# Service Layer API for oneM2M

Final Draft

97 Pages

## Abstract

oneM2M is a global standard organization ~~and~~that specifies ~~middleware~~a common M2M Service Layer for IoT, called Common Services Entities (CSE). An application can discover and access functionalities~~y~~ in a CSE with RESTful operations, which are Create, Retrieve, Update, Delete and Notify. oneM2M specifies a ~~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 a high level API for oneM2M RESTful operations hiding the difference of the 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 |

| Revision | Date | Comments |
|---|---|---|
| 0.0.2 | *April 17 2018* | Update based on discussion in Washington meeting.<br>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.<br>Organize DTOs: Added AttributeDTO, LocalIdTokenIdAssigmentDTO, and DasInfoDTO and remove DynAuthLocalIdAssignmentsDTO and DynAuthReqInfoDTO<br>Introduce OperationIF interface as a super interface of ProtocolBinding interface and CSE interface for enabling concise application code. This replaces former simple.Client.<br>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'<br>Update Javadoc with more explanations. (moved old classes to org.osgi.service.onem2m.old package for preparing deletion.)<br>Add description to Security Consideration section.<br>Add oneM2M R3 specs and XSD to references. |
| 0.0.5 | *Jun 27 2018* | Modified after discussion in Washington DC F2F.<br>Restructure service interfaces; now 2 interface is remaining. For receiving notification, dedicated interface is prepared. Remove Introspection interfaces.<br>Reduce service properties by removing ones for informative purpose.<br>Add example flow to control devices.<br>Modify security consideration in section 9.2. |
| 0.06 | *Jun 29 2018* | Add examples, with code snipets.<br>Add 'Data Modification in Protocol Binding' section.<br>Add discovery() method with additional parameter. |
| 0.07 | *Sep 17 2018* | Remove all service properties. Add some reasons to considered alternative section. |
| 0.0.8 | *May 22 2019* | Add configuration chapter.(5.4)<br>Fix API parameter. |

| Revision | Date | Comments |
|---|---|---|
| 0.1 | *Feb 04 2020* | Remove configuration chapter (introduce 0.0.8)<br>Fix Figure, typo.<br>Add GenericDTO<br>Remove Instruction(in red text) |
| 0.2 | *Feb 18 2020* | Reflect comments from Andreas Kraft.<br>Add two DTOs (NotificationEventDTO, IPEDiscoveryRequestDTO) |

# 1 Introduction

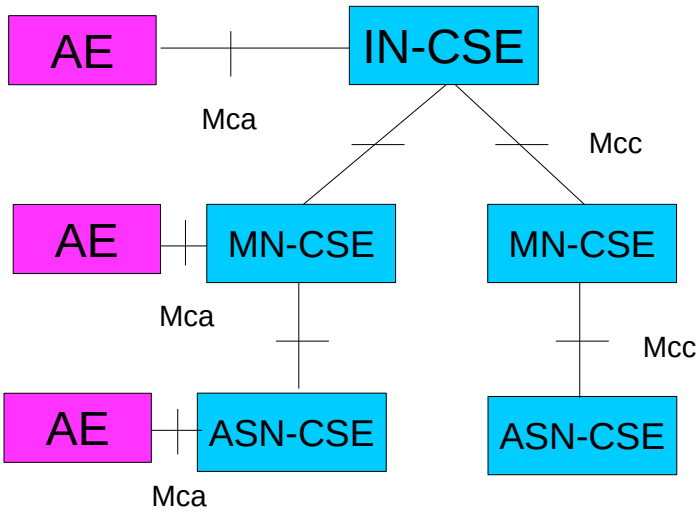
oneM2M is a global standard organization ~~and~~that specifies ~~middleware~~a common M2M Service Layer for the Internet of Things (IoT), called Common Services Entities (CSE). An application~~s~~ can discover and access ~~CSE's~~ functionalities in a CSE~~y~~ with RESTful operations, which are Create, Retrieve, Update, Delete and Notify. TS-0001 [2] defines more than 40 resource types to expose CSE's functionalities. oneM2M ~~allows~~specifies a variety of communication methods, a combination of 4 protocol bindings (HTTP, MQTT, CoAP, Websocket) and 3 serializations (XML, JSON, CBOR).

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

# 2 Application Domain

## 2.1 IoT Application configuration using oneM2M

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

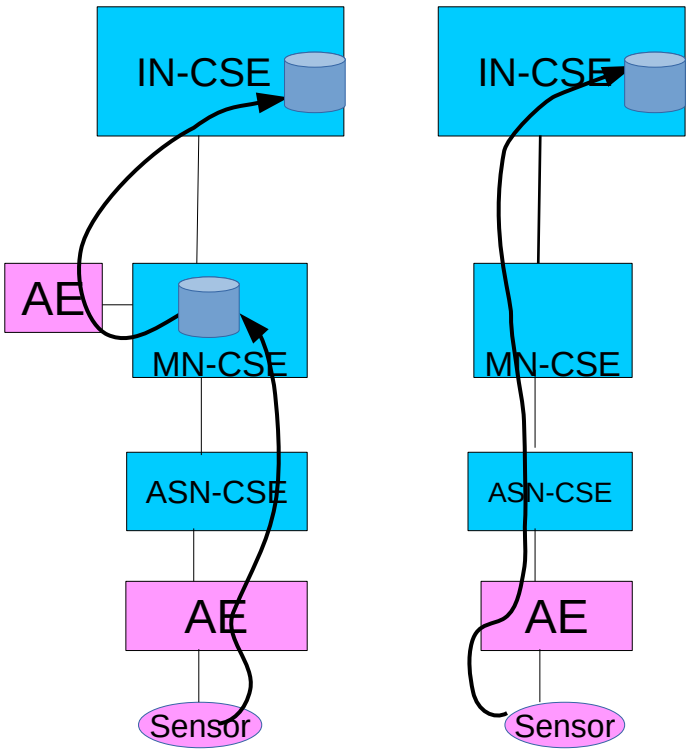



oneM2M's applications, called Application Entitys (AE), connects to one of the CSEs. After a AE is connected to the CSE, the AE can access to all other CSEs, by retargeting function requests (similar to routing) to CSEs.

An AE accesses a CSE's functionality through a RESTful API, which consists of Create, Retrieve, Update, Delete and Notify in targeting more than 40 types of resources. For examples, a typical resource types are <*contentInstance*> that expresses IoT data, and <*container*> that holds a set of <*contentInstance*>s. An AE can create or retrieve the resources of type <contentInstance> on any CSE by the retargeting functionality, as far as permission is allowed. The interface between CSEs is called *Mcc* and interface between CSE and AE is called Mca. Both interfaces look almost the same, but the functionalities vary.

It is possible to develop a variety of types of distributed applications using thise architecture. For example, for IoT data aggregation applications, it is possible to develop gradual aggregation application types or direct aggregation application types. In gradual aggregation application type, an AE connected to an ASN-CSE creates <*conentInstance*>s in the ASN-CSE, and intermediate applications calculate statistics and put the result on IN-CSE as a <*contentInstance*>, while, in direct aggregation application type, an AE connected to an ASN-CSE creates <*contentInstance*>s in the IN-CSE directly.

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




## 2.2 Communication methods used in oneM2M

oneM2M allows a variety of communication methods, a combination of 4 protocol bindings (HTTP, MQTT, CoAP, Websocket) and 3 serializations (XML, JSON, CBOR). Morelt might be added in the future. oneM2M specifiesprovides specifications onin different levels.

Firstly, TS-0001 [2] specifies the high level resource definitions, it defines more than 40 resource types, such as <contentInstance> for storing IoT data and, <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 such as JSON 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. A ~~l~~long name is human friendly string and specifications mainly use this notation, while the short name is ~~short~~an abbreviated unique string consist of typically 2 or 3 characters (but not limited and sometimes longer) ~~and~~that is used in communications ~~protocol use this notation~~. In most cases, the initial characters of long name are assigned as short name, for examples, **ct** for the CreationTime attribute and **at** for the AnnounceTo attribute.

# 3 Problem Description

oneM2M specifies protocol based interfaces, but doesn't specify a programing level API. As previously mentioned oneM2M allows a 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 a standardized API, application program tends to depend on the communication method initially intend to use and it will became hard to ~~run~~operate in another environment in which ~~uses~~ another communication method is used. (For example, an application designed for XML/HTTP, tend to run on environment use JSON/Websocket)

The s~~S~~econd problem is the latency of the communication between CSE and application. Even if CSE and application is located in the same ~~box~~physical environment, 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.

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

# 4 Requirements

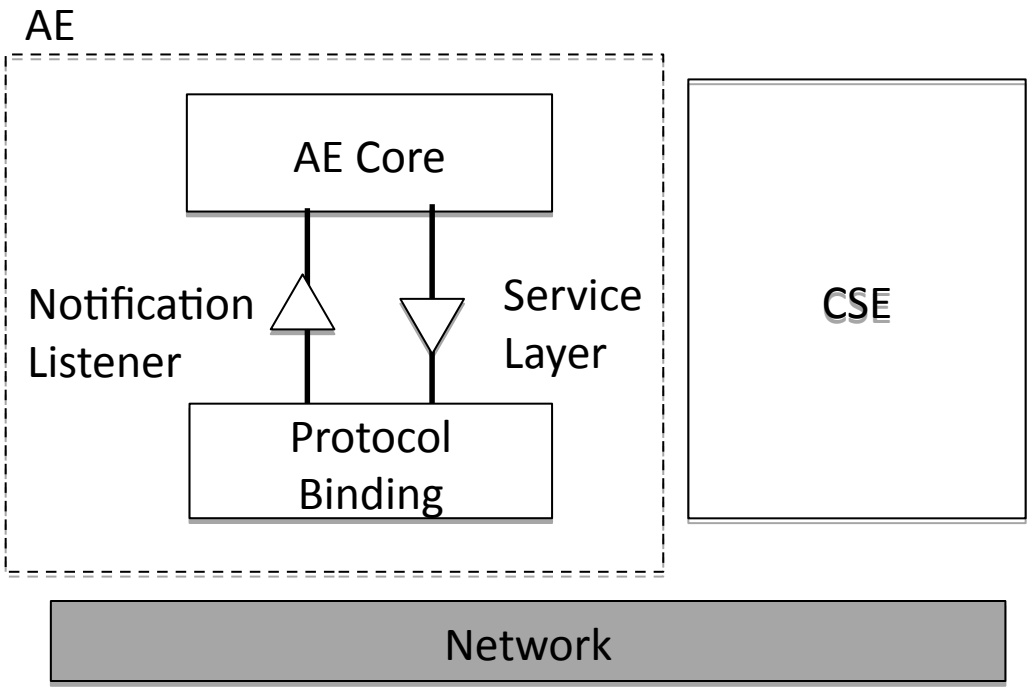
- R0010 – The solution MUST provide means to access an externally hosted~~outer~~ CSE from an application.

- R0011 – The solution MUST provide means to access ~~outer~~an externally hosted CSE from a 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 client CSE to accept requests ~~form~~from ~~outer~~an externally hosted CSE.
- R0020 – The solution MUST provide means for client CSE to accept requests ~~form~~from ~~outer~~an externally hosted application.
- R0030 – The solution MUST provide means to communicate through a Java interface between a CSE and an 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

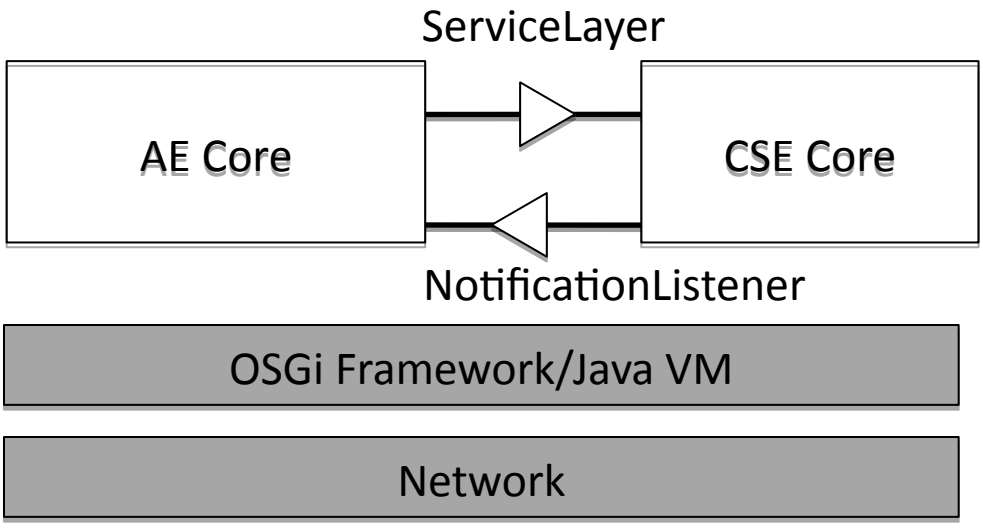
## 5.1 Overview for the solution

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

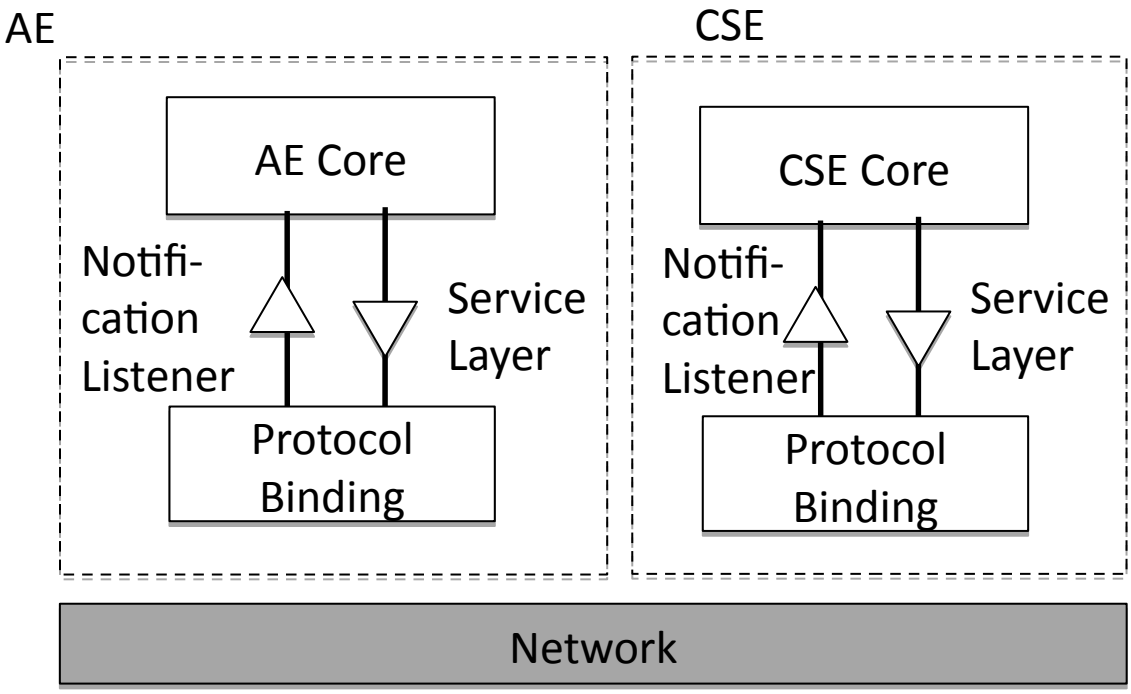



In the above figure, the term of Core is introduced for AE Core and CSE Core. This is for specifying parts which does not contain ProtocolBinding of AE and CSE.

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 the ServiceLayer API, without inter-mediating ProtocolBinding Services. Fthe following figure depicts the 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.



The fFollowing 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

The Service Layer Interface is for allowing an AE to send requesst and getreceive responses.

request() method allows –very raw data type access and it enables all possible message exchanges among oneM2M entities. This is called the low level API.,

```
Promise<ResponseDTO> request(RequestDTO request);
```

Here as a return type, org.osgi.util.promise.Promise is used for realizing both synchronous and asynchronous type of invocation.

Meanwhile, the low level APIit can be redundant to application developers, because they need to write composition of requestPrimitive and decomposition of responsePrimitive. This interface is provided for application developer allowing less application codes. It provides methods with higher level of abstraction; operation level of resource such as create, retrieve, update, delete and so on. They do not cover all of possible messages exchangeof oneM2M but do typical ones. Implementation of these methods automatically inserts 'requestID' and 'from' parameter to RequestDTO for the.

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

The create() method is a method to create new resource under specified uri. The second argument resource is expression of resource to be generated. The resourceType field of the resourceDTO must be assigned. For other fields depends on resource type. Section 7.4 of TS-00004 specifies the optionalities of the fields.

The retrieve() methods are methods to retrieve resource on URI specified by uri argument. There are two variations of retrieve methods, one has 'targetAttributes' argument and the other doesn't have. The arguments are for specifying attributes to be retrieved. The retrieve method without 'targetAttributes' arguments behaves as all of attributes are specified.

The update() method is a method to update resource on the URI specified by uri argument. The resource argument holds attributes to be updated. Attributes not to be updated shall not included in the argument.

The delete() method is a method to delete resouce on the URI specified by uri argument.

The discovery() methods are methods to find resources under URI specified by uri argument with condition specified by fc arguments. There are two variations of the methods, one has additional 'drt' argument which specifies the expression of returned URIs. The possible parameter can be structured or unstructured. The method with 'drt' argument behaves as structured is specified.
The notify() method is a method to send notification to URI specified by uri argument. The notification argument expresses notification to be sent.

```
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.
	 */
	public Promise<ResponsePrimitiveDTO> request(RequestPrimitiveDTO request);

	/**
	 * 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);

	/**
	 * 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);

		/**
	 * find resources
```

```
     *
     * @param uri URI for top of search
     * @param fc filter criteria
     * @param drt Discovery Result Type (structured/unstructured)
     * @return list of URIs matching the condition specified in fc
     */
    public Promise<List<String>> discovery(String uri, FilterCriteriaDTO
fc, RequestPrimitiveDTO.DiscoveryResultType drt);

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

}
```

## 5.3 Notification Listener Interface

The NotificationListener interface is a interface for receiving notifications. The bundles that receives notifications must implement this interface and register the service object to the OSGi service registry. In case of the multiple application are running on the OSGi framework, multiple instances of the service object of NotificationListner iare registered in the OSGi service registry. The implementation of the protocol binding must look for the proper instance by checking its registering bundle.

```
public interface NotificationListener {
    /**
     * receive notification.
     *
     * @param request request
     */
    public void notified(RequestPrimitiveDTO request);

}
```

## 5.4 Service Property for Interfaces

No service properties are defined for ServiceLayer interface and NotificagtionListener interface.

## 5.5 Service Binding

Proper instance of ServiceLayer sService must be bound to proper AE Core. Implementation of ServiceLayer should created by ServiceFactory to provide a proper service instance depending on calling AE Core.

## 5.6 Data Modification in ServiceLayer Service

Usually ServiceLayer service –doesn't change any logical information on passing data, but as an exception ServiceLayer service modifies the passing data by adding pointOfAccess information on following case.

1. create() for <AE> resource

2. update() for <AE> only when pointOfAccess'is specified.

3. request() when content is equivalent to above.

This is because AE Core entity ~~doesn't~~may not know the pointOfAccess information and processing show above simply solve the problem.

## 5.7 Example: Registration

This section explains how application registers to its hosting CSE. In order to interact with the oneM2M system the bundle obtains a reference to the `ServiceLayer` service from the service registry

```
@Component
public class MyLightSwitchComponent {
@Reference
ServiceLayer client
}
```

After getting client, it starts registration by creating <AE> resource.<AE> resource creation requires App-ID, AE-ID, requestReachability attributes. In the following code, "C" is passed for AE-ID, this means asking CSE for assigning the value. Assigned value is is included in returned resource

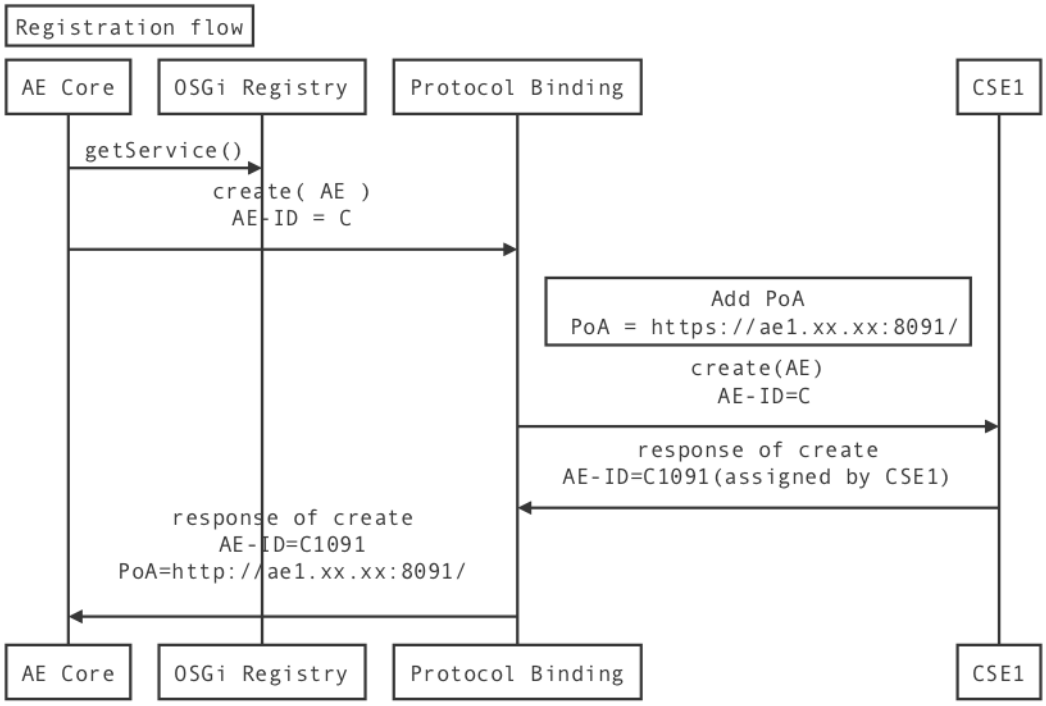
The information of pointOfAccess is kept in ServiceLayer Service, it is assigned by ServiceLayer Service. before sending the request message to network. The value is also returned in response.

After success response of <AE> resource, it registers NotificationListener with returned AE-ID and pointOfAccess as the service property

```
@Component
public class RegistrationExample implements NotificationListener {
      @Reference
      ServiceLayer client;

      BundleContext context;
       @Activate
       void start(BundleContext context) {
```

```
            this.context = context;

            // create AE: This means registration.
            ResourceDTO dto = new ResourceDTO();
            dto.resourceType = ResourceType.AE.getValue();
            dto.attribute.put("App-ID", "01.com.company.lightApp1<");
            dto.attribute.put("AE-ID", "C");
            dto.attribute.put("requestReachability", Boolean.TRUE);
            final Promise<ResourceDTO> ret = client.create("/CSE1/csebase-", dto);
            // "-" in here "/CSE1/-" means address of resource, the root resource (csebase is the name of <CSEBase> resource, which are the root of CSE resource tree.
            med CSE1.  CSE na//

            ret.onResolve(new Runnable() {
                  public void run() {
                        ResourceDTO ae = null;
                       try {
                             ae = ret.getValue();
                       } catch (Exception e) {
                             e.printStackTrace();
                             return;
                       }
                        Dictionary prop = new Properties();
                        prop.put("AE-ID",ae.attribute.get("AE-ID"));
                        prop.put("PoA",ae.attribute.get("pointOfAccess");
                        context.registerService(new String[] {"org.osgi.service.onem2m.
NotificationListener"}, this, prop);
                  }
            });
      }

     @Override
     public void notified(RequestPrimitiveDTO request) {
           //....
     }
```

Following figure shows sequence diagram of the registration flow.




## 5.8 Example: Turning Light ON

This section explains how application turns on the lights located on remote site. There are mainly two ways to represent devices in oneM2M.

First way uses <flecContainer> resource type for representing device, its status, and so on. The resource type is introduced in oneM2M release 2 and it allows having custom attributes in it. Based on the resource, variety of the data model for devices, especially of home domain, are specified in TS-0023. With this way application can use standardized data model and operate device status in commonly used manner.

Second way uses <container> and <contentInstance> resource types for representing device and its status. These resource types are introduced very beginning of oneM2M and this approach is well explained in developer guide (TR-0025 [TODO ref. WEB] ) Meanwhile, the resource type is not primarily designed for this purpose, but for storing data, so that how to operate device could be different from usual manner. To change state, new <contentInstance> is created with new status in its content attribute. <container> usually has multiple <contentInstance>s underneath and the latest one is supposed to be the latest status.

### 5.8.1 Example (Using <flexContainer>

In this example a simple bundle wishes to swtich light devices on when the bundle is started, and switch them off again when the bundle is stopped. Here it is assumed that registration process described in the previous section is done.

1. When the bundle has obtained a reference to the ServiceLayer then it can use the `discover` method to find all of the lightbulbs in the system

```
public class MyLightSwitchComponent {
@Reference
ServiceLayer client;

Promise<List<String>> discoveredLightbulbs;

@Activate
void start() {
  discoveredLightbulbs = findLightBulbs();
}

private Promise<List<String>> findLightBulbs() {
    String baseURI = "/homegateway/-csebase/"; // -csebase  is name for means -<CSE-Base> resource and it is the root of -( -kaid of top directoryRoot -toof the CSE resource tree )

    FilterCriteriaDTO filter = new FilterCriteriaDTO();
    filter.resourceType = Collections.singletonList(
      ResourceType.flexContainer.getValue());
    AttributeDTO attr = new AttributeDTO();
    attr.name = "contentDefinition";
    attr.value = "org.onem2m.home.device.light";
    filter.attribute = Collections.singletonList(attr);
    filter.filterOperation = FilterCriteriaDTO.FilterOperation.AND;

    return client.discovery(baseURI, filter);
}
}
```

2. Once the lightbulbs are discovered then the bundle can switch on the bulbs by creating a content instance using the `update` method

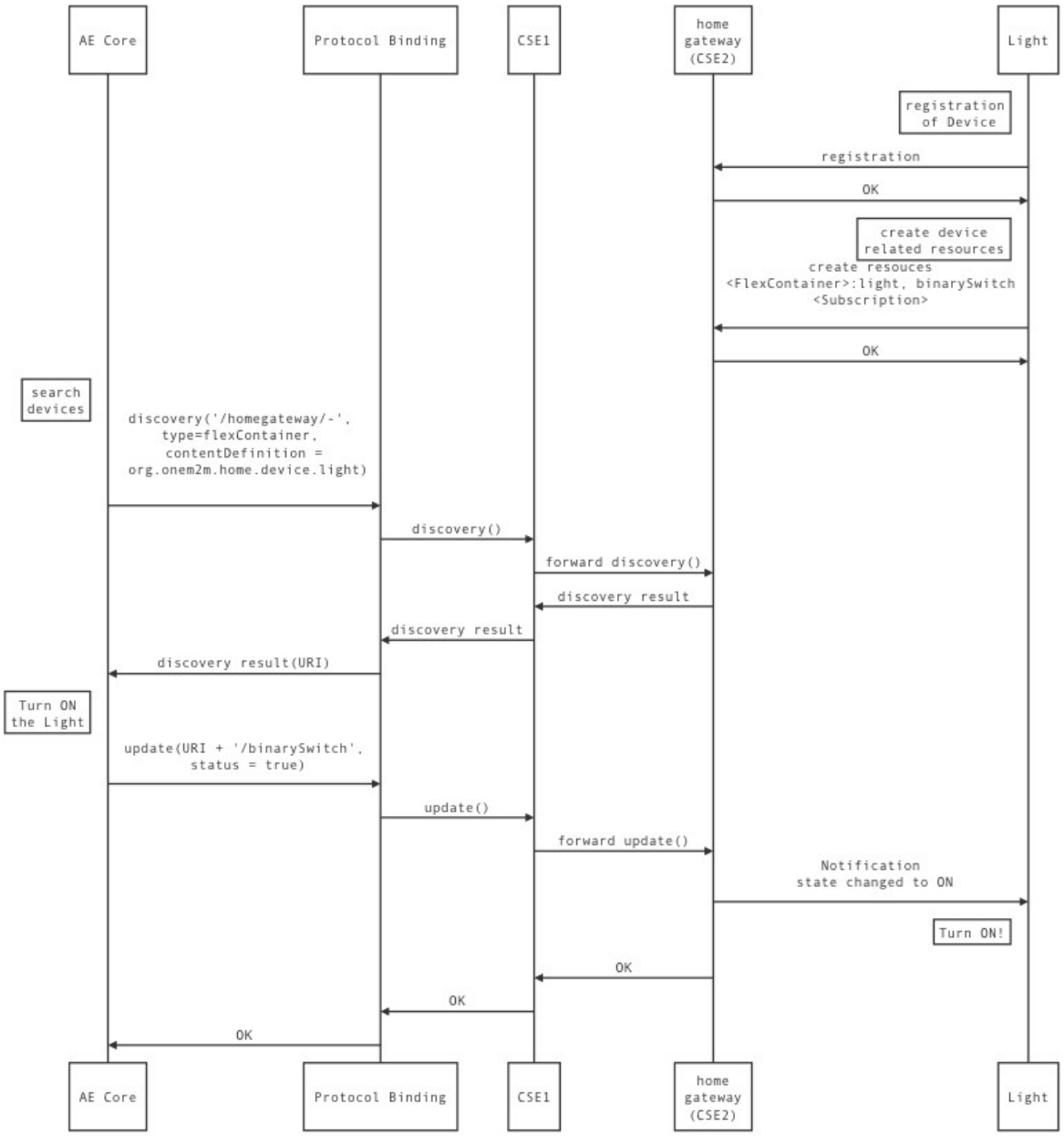
```
public class MyLightSwitchComponent {
@Reference
ServiceLayer client;
Promise<List<ResourceDTO> allTurnedOn;
```

```
@Activate
void start() {
  allTurnedOn = findLightBulbs().
        flatMap(l -> Promises.all(
             l.stream()
                .map(this::turnOn)
                .collect(toList())));
}

private Promise<ResourceDTO> turnOn(String bulbUri) {
  ResourceDTO dto = new ResourceDTO();
  dto.attribute.put("powerStatus", Boolean.TRUE);
  return client.update(bulbUri + "/binarySwitch", dto );
}
}
```

3. Finally, the bulbs can be turned off again when the bundle is stopped.

```
public class MyLightSwitchComponent {
@Reference
ServiceLayer client;
Promise<List<ResourceDTO> allTurnedOn;

@Deactivate
void stop() {
    findLightBulbs().flatMap(l -> Promises.all(
        l.stream()
           .map(this::turnOff)
     .collect(toList())));
}
}
```

Following figure shows the example showing how application turn on the light device on the remote.




### 5.8.2 Example (Using <container> and <contentInstance>

In this example, device is expressed as <container> resource type in remote CSE (Home Gateway). Discovery is changed as follows. Here it assumes that all <container>s representing lightbulb have label of “lightBulb”.

```
private Promise<List<String>> findLightBulbs() {
```

```
        String baseURI = "/homegateway/csebase-/"; Root of the CSE resource tree// - mean
s CSEBase ( kind of top directory )


        FilterCriteriaDTO filter = new FilterCriteriaDTO();
        filter.resourceType = Collections.singletonList(
            ResourceType.container.getValue());
        filter.labels = Collections.singletonList("lightBulb");
        filter.filterOperation = FilterCriteriaDTO.FilterOperation.AND;
        return client.discovery(baseURI, filter);
}
```

Light can be controlled by creating new <contentInstance> resource as follows.

```
    private Promise<ResourceDTO> turnOn(String bulbUri) {
        ResourceDTO dto = new ResourceDTO();
        dto.resourceType = ResourceType.container.getValue();
        dto.attribute.put("content", "ON");
        return client.create(bulbUri , dto );
     }
```

# 6 Data Transfer Objects

## 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 one of a types ~~that is~~ allowed for OSGi DTO.

In figure, followed 'DTO' of DTO class name is committed.

## 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 {

	public Operation operation;

	public String to;
	public String from;

	public String requestIdentifier;

	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;

	public ResultContent resultContent;
	public String eventCategory;

	public Boolean deliveryAggregation;
	public String groupRequestIdentifier;
	public FilterCriteriaDTO filterCriteria;

	public DiscoveryResultType discoveryResultType;
```

```
	public String tokens;
	public List<String> tokenIDs;
	public List<String> localTokenIDs;

	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);
		// methos are 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{

	public Integer responseStatusCode;

	public String requestIdentifier;
	public PrimitiveContentDTO content;
	public String to;
	public String from;
	public String originatingTimestamp;
	public String resultExpirationTimestamp;
	public String eventCategory;

	public ContentStatus contentStatus;

	public Integer contentOffset;
	public List<LocalTokenIdAssignmentDTO> assignedTokenIdentifiers;
	public List<DasInfoDTO> tokenReqInfo;

	// 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 {

	public java.lang.Integer responseTypeValue;

	public List<java.lang.String> notificationURI;

	public static enum ResponseType {
		nonBlockingRequestSynch(1), nonBlockingRequestAsynch(2),
blockingRequest(3), flexBlocking(4);
		// methos are 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;
	public Integer stateTagSmaller;
	public Integer stateTagBigger;
	public String expireBefore;
	public String expireAfter;
	public List<String> labels;
	public List<Integer> resourceType;

	public Integer sizeAbove;

	public Integer sizeBelow;
	public List<String> contentType;
	public AttributeDTO attribute;

	public FilterUsage filterUsage;

	public Integer limit;
	public String semanticsFilter;

	public FilterOperation filterOperation;

	public Integer contentFilterSyntax;
	public String contentFilterQuery;

	public Integer level;

	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);
		// methos are omitted...
	}

	public static enum FilterUsage {
		DiscoveryCriteria(1), ConditionalRetrival(2), IPEOndemandDiscovery(3);
		// methos are 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.

	public Integer resourceType;

	public String resourceID;

	public String parentID;

	public String creationTime;

	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 NotificationEventDTO Map<String,Object>
notificationEvent;//NotificationEventDTO

	public Boolean verificationRequest;

	public Boolean subscriptionDeletion;
	public String subscriptionReference;
	public String creator;
	public String notificationForwardingURI;
	

	public IPEDiscoveryRequestDTOMap<String,Object>
ipeDiscoveryRequest;//IPEDiscoveryRequestDTO

	IPEDiscoveryRequestDTO
	public String notificationTarget;
	public Boolean targetRemovalRequest;
	public Boolean targetRemovalAllowance;
	public Boolean aeRegistrationPointChange;
	public Boolean aeReferenceIDChange;
	public String trackingID1;
	public String trackingID2;
	
}
```

## 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 long_name version and short_name version. The long name ~~version~~ should be ~~referred~~used.

| 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:string,xs:token,xs:anyURI~~, **m2m:ID**~~, | String | |
| m2m:timestamp (based on xs:string) | 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.<br><br>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

# OSGi Javadoc

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| Package Summary | | Page |
|---|---|---|
| org.osgi.service.onem2m | - | 32 |
| org.osgi.service.onem2m.dto | - | 38 |

# Package org.osgi.service.onem2m

| Interface Summary | | Page |
|---|---|---|
| NotificationListener | Primary Interface for an oneM2M entity to send request and get response to/from other oneM2M entity. | 33 |
| ServiceLayer | Primary Interface for an oneM2M entity to send request and get response to/from other oneM2M entity. | 35 |

| Exception Summary | | Page |
|---|---|---|
| OneM2MException | General Exception for oneM2M. | 34 |

# Interface NotificationListener

***org.osgi.service.onem2m***

---

`public interface` **`NotificationListener`**

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

---

| Method Summary | | Page |
|---|---|---|
| `void` | **`notified`**`(RequestPrimitiveDTO request)`<br>receive notification. | 33 |

## Method Detail

### notified

`void` **`notified`**`(RequestPrimitiveDTO request)`

receive notification.

**Parameters:**

`request` - request primitive

# Class OneM2MException

*org.osgi.service.onem2m*

java.lang.Object
  └ java.lang.Throwable
    └ java.lang.Exception
      └ java.io.IOException
        └ **org.osgi.service.onem2m.OneM2MException**

**All Implemented Interfaces:**

Serializable

---

public class **OneM2MException**
extends IOException

General Exception for oneM2M.

---

| Field Summary | | Page |
|---|---|---|
| - | **cause**<br>Cause of Exception | 34 |
| - | **errorCode**<br>Error Code | 34 |

| Constructor Summary | Page |
|---|---|
| **OneM2MException()** | 34 |

## Field Detail

### errorCode

public **errorCode**

Error Code

### cause

public **cause**

Cause of Exception

## Constructor Detail

### OneM2MException

public **OneM2MException()**

# Interface ServiceLayer

***org.osgi.service.onem2m***

---

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 | **create**(String uri, ResourceDTO resource)<br>create resource | 35 |
| org.osgi.util.promise.Promise | **delete**(String uri)<br>delete resource | 36 |
| org.osgi.util.promise.Promise | **discovery**(String uri, FilterCriteriaDTO fc)<br>find resources. | 36 |
| org.osgi.util.promise.Promise | **discovery**(String uri, FilterCriteriaDTO fc, RequestPrimitiveDTO.DiscoveryResultType drt)<br>find resources | 37 |
| org.osgi.util.promise.Promise | **notify**(String uri, NotificationDTO notification)<br>send notification | 37 |
| org.osgi.util.promise.Promise | **request**(RequestPrimitiveDTO request)<br>send a request. | 35 |
| org.osgi.util.promise.Promise | **retrieve**(String uri)<br>retrieve resource | 36 |
| org.osgi.util.promise.Promise | **retrieve**(String uri, List targetAttributes)<br>retrieve subset of attributes. | 36 |
| org.osgi.util.promise.Promise | **update**(String uri, ResourceDTO resource)<br>update resource | 36 |

## Method Detail

### request

org.osgi.util.promise.Promise **request**(RequestPrimitiveDTO request)

send a request.

**Parameters:**
request - request primitive
**Returns:**
promise of ResponseDTO.

---

### create

org.osgi.util.promise.Promise **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 retrieve(String uri)
```

retrieve resource

**Parameters:**

uri - URI for retrieving resource

**Returns:**

retrieved resource data

---

## retrieve

```
org.osgi.util.promise.Promise retrieve(String uri,
                                       List 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 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 delete(String uri)
```

delete resource

**Parameters:**

uri - target URI for deleting resource

---

## discovery

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

find resources. Discovery Result Type is kept as blank and default value of target CSE is used for the parameter.

**Parameters:**

`uri` - URI for top of search
`fc` - filter criteria

**Returns:**

list of URIs matching the condition specified in fc

---

## discovery

```
org.osgi.util.promise.Promise discovery(String uri,
                                        FilterCriteriaDTO fc,
                                        RequestPrimitiveDTO.DiscoveryResultType drt)
```

find resources

**Parameters:**

`uri` - URI for top of search
`fc` - filter criteria
`drt` - Discovery Result Type (structured/unstructured)

**Returns:**

list of URIs matching the condition specified in fc

---

## notify

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

send notification

# Package org.osgi.service.onem2m.dto

| Class Summary | | Page |
|---|---|---|
| AttributeDTO | DTO expresses Attribute. | 40 |
| ChildResourceRefDTO | DTO expressing ChildResourceRef. | 41 |
| DasInfoDTO | DTO expressing DasInfo. | 43 |
| FilterCriteriaDTO | DTO expressing FilterCriteria. | 45 |
| FilterCriteriaDTO.FilterOperation | Enum FilterOperation | 50 |
| FilterCriteriaDTO.FilterUsage | Enum FilterUsage | 52 |
| GenericDTO | GenericDTO expresses miscellaneous data structures. | 54 |
| IPEDiscoveryRequestDTO | IPEDiscoveryRequestDTO is an element of NotificationEventDTO | 55 |
| LocalTokenIdAssignmentDTO | DTO expressing LocalTokenIdAssignment. | 56 |
| NotificationDTO | DTO expressing Notification. | 57 |
| NotificationEventDTO | NotificationEventDTO This data structure is held in NotificationDTO. | 59 |
| NotificationEventDTO.NotificationEventType | NotificationEventType | 61 |
| PrimitiveContentDTO | DTO expressing Primitive Content. | 63 |
| ReleaseVersion | Enum expressing oneM2M specification version. | 66 |
| RequestPrimitiveDTO | DTO expresses Request Primitive. | 68 |
| RequestPrimitiveDTO.DiscoveryResultType | - | 73 |
| RequestPrimitiveDTO.Operation | enum type for Operation | 75 |
| RequestPrimitiveDTO.ResultContent | enum type for Result Content | 77 |
| ResourceDTO | DTO expressing Resource. | 80 |
| ResourceWrapperDTO | DTO expressing ResourceWrapper. | 82 |
| ResponsePrimitiveDTO | DTO expressing Response Primitive. | 83 |
| ResponsePrimitiveDTO.ContentStatus | Enum ContentStatus | 86 |

# 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 for expressing matching condition.

---

| Field Summary | | Page |
|---|---|---|
| - | **name**<br>Attribute name | 40 |
| - | **value**<br>Supposed value of the attribute | 40 |

| Constructor Summary | Page |
|---|---|
| **AttributeDTO()** | 40 |

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

## Field Detail

### name

```
public name
```

Attribute name

### value

```
public value
```

Supposed value of the attribute

## 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 |
|---|---|---|
| - | **name**<br>name of the child resource pointed to by the URI | 41 |
| - | **specializationID**<br>resource type specialization of the child resource pointed to by the URI in case @type represents a flexContainer. | 42 |
| - | **type**<br>resourceType of the child resource pointed to by the URI | 41 |
| - | **uri**<br>URI to the child resource. | 41 |

| Constructor Summary | Page |
|---|---|
| **ChildResourceRefDTO**() | 42 |

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

## Field Detail

### uri

public **uri**

URI to the child resource.

### name

public **name**

name of the child resource pointed to by the URI

### type

public **type**

resourceType of the child resource pointed to by the URI

---

## specializationID

public **specializationID**

resource type specialization of the child resource pointed to by the URI in case @type represents a flexContainer. This is an optional field.

# 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 |
|---|---|---|
| - | **dasRequest**<br>Information to send to the Dynamic Authorization Server | 43 |
| - | **securedDasRequest**<br>Secured Information to send to the Dynamic Authorization Server. | 43 |
| - | **uri**<br>Dynamic Authorization Server URI | 43 |

| Constructor Summary | Page |
|---|---|
| **DasInfoDTO()** | 44 |

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

## Field Detail

### uri

public **uri**

Dynamic Authorization Server URI

### dasRequest

public **dasRequest**

Information to send to the Dynamic Authorization Server

### securedDasRequest

public **securedDasRequest**

Secured Information to send to the Dynamic Authorization Server. JWS or JWE is assigned to this field.

## 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 |
|---|---|---|
| final static class | **FilterCriteriaDTO.FilterOperation**<br>Enum FilterOperation | 50 |
| final static class | **FilterCriteriaDTO.FilterUsage**<br>Enum FilterUsage | 52 |

| Field Summary | | Page |
|---|---|---|
| - | **applyRelativePath**<br>Apply Relative Path | 49 |
| - | **attribute**<br>Attribute | 48 |
| - | **childAttribute**<br>Child Attribute | 49 |
| - | **childLabels**<br>Child Labels | 49 |
| - | **childResourceType**<br>Child Resource Type | 49 |
| - | **contentFilterQuery**<br>Content Filter Query | 48 |
| - | **contentFilterSyntax**<br>Content Filter Syntax | 48 |
| - | **contentType**<br>Content Type | 48 |
| - | **createdAfter**<br>Created After | 46 |
| - | **createdBefore**<br>Created Before | 46 |
| - | **expireAfter**<br>Expire After | 47 |
| - | **expireBefore**<br>Expire Before | 47 |
| - | **filterOperation**<br>Filter Operation | 48 |
| - | **filterUsage**<br>Filter Usage | 48 |

| | | |
|---|---|---|
| - | **labels**<br>Labels | 47 |
| - | **labelsQuery**<br>Label Query | 49 |
| - | **level**<br>Level | 48 |
| - | **limit**<br>Limit number of Answers | 48 |
| - | **modifiedSince**<br>Modified Since | 47 |
| - | **offset**<br>Offset | 48 |
| - | **parentAttribute**<br>Parent Attribute | 49 |
| - | **parentLabels**<br>Parent Labels | 49 |
| - | **parentResourceType**<br>Parent Resource Type | 49 |
| - | **resourceType**<br>Resource Type | 47 |
| - | **semanticsFilter**<br>Semantic Filter | 48 |
| - | **sizeAbove**<br>Size Above | 47 |
| - | **sizeBelow**<br>Size Below | 47 |
| - | **stateTagBigger**<br>State Tag Bigger | 47 |
| - | **stateTagSmaller**<br>State Tag Smaller | 47 |
| - | **unmodifiedSince**<br>Unmodified Since | 47 |

| Constructor Summary | Page |
|---|---|
| **FilterCriteriaDTO**() | 49 |

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

## Field Detail

### createdBefore

public **createdBefore**

Created Before

### createdAfter

public **createdAfter**

Created After

### modifiedSince

public **modifiedSince**

Modified Since

### unmodifiedSince

public **unmodifiedSince**

Unmodified Since

### stateTagSmaller

public **stateTagSmaller**

State Tag Smaller

### stateTagBigger

public **stateTagBigger**

State Tag Bigger

### expireBefore

public **expireBefore**

Expire Before

### expireAfter

public **expireAfter**

Expire After

### labels

public **labels**

Labels

### resourceType

public **resourceType**

Resource Type

### sizeAbove

public **sizeAbove**

Size Above

### sizeBelow

public **sizeBelow**

Size Below

### contentType

public **contentType**

Content Type

### attribute

public **attribute**

Attribute

### filterUsage

public **filterUsage**

Filter Usage

### limit

public **limit**

Limit number of Answers

### semanticsFilter

public **semanticsFilter**

Semantic Filter

### filterOperation

public **filterOperation**

Filter Operation

### contentFilterSyntax

public **contentFilterSyntax**

Content Filter Syntax

### contentFilterQuery

public **contentFilterQuery**

Content Filter Query

### level

public **level**

Level

### offset

public **offset**

Offset

### childLabels

public **childLabels**

Child Labels

### parentLabels

public **parentLabels**

Parent Labels

### labelsQuery

public **labelsQuery**

Label Query

### childResourceType

public **childResourceType**

Child Resource Type

### parentResourceType

public **parentResourceType**

Parent Resource Type

### childAttribute

public **childAttribute**

Child Attribute

### parentAttribute

public **parentAttribute**

Parent Attribute

### applyRelativePath

public **applyRelativePath**

Apply Relative Path

**See Also:**
TS-0004 7.3.3.17.17

## Constructor Detail

### FilterCriteriaDTO

public **FilterCriteriaDTO**()

# Class FilterCriteriaDTO.FilterOperation

org.osgi.service.onem2m.dto

java.lang.Object
  └ java.lang.Enum
    └ **org.osgi.service.onem2m.dto.FilterCriteriaDTO.FilterOperation**

**All Implemented Interfaces:**
Comparable, Serializable

**Enclosing class:**
FilterCriteriaDTO

---

```
final public static class FilterCriteriaDTO.FilterOperation
extends Enum
```

Enum FilterOperation

**See Also:**
TS-0004 6.3.4.2.34

---

| Field Summary | | Page |
|---|---|---|
| static | **AND**<br>Logical AND | 50 |
| static | **OR**<br>Logical OR | 50 |

| Method Summary | | Page |
|---|---|---|
| int | **getValue**()<br>get assigned value | 51 |
| static FilterCriteriaDTO.FilterOperation | **valueOf**(String name) | 51 |
| static FilterCriteriaDTO.FilterOperation[] | **values**() | 51 |

## Field Detail

### AND

```
public static final AND
```

Logical AND

### OR

```
public static final OR
```

Logical OR

## Method Detail

### values

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

### ~~valueOf~~

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

### ~~getValue~~

```
public int getValue()
```

get assigned value

**Returns:**
assigned integer value

# Class FilterCriteriaDTO.FilterUsage

org.osgi.service.onem2m.dto

java.lang.Object
└ java.lang.Enum
└ **org.osgi.service.onem2m.dto.FilterCriteriaDTO.FilterUsage**

**All Implemented Interfaces:**
Comparable, Serializable

**Enclosing class:**
FilterCriteriaDTO

---

final public static class **FilterCriteriaDTO.FilterUsage**
extends Enum

Enum FilterUsage

**See Also:**
TS-0004 6.3.4.2.31

---

| Field Summary | | Page |
|---|---|---|
| static | **ConditionalRetrival**<br>Conditional Retrieve | 52 |
| static | **DiscoveryCriteria**<br>Discovery Criteria | 52 |
| static | **IPEOndemandDiscovery**<br>IPE on Demand Discovery | 53 |

| Method Summary | | Page |
|---|---|---|
| int | **getValue**()<br>get assigned integer value | 53 |
| static FilterCriteriaDTO.FilterUsage | **valueOf**(String name) | 53 |
| static FilterCriteriaDTO.FilterUsage[] | **values**() | 53 |

## Field Detail

### DiscoveryCriteria

public static final **DiscoveryCriteria**

Discovery Criteria

### ~~ConditionalRetrival~~

public static final **ConditionalRetrival**

Conditional Retrieve

### ~~IPEOndemandDiscovery~~

`public static final IPEOndemandDiscovery`

IPE on Demand Discovery

## Method Detail

### values

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

### ~~valueOf~~

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

### ~~getValue~~

`public int getValue()`

get assigned integer value

**Returns:**
assigned integer value

# Class GenericDTO

org.osgi.service.onem2m.dto

java.lang.Object
└ org.osgi.dto.DTO
└ **org.osgi.service.onem2m.dto.GenericDTO**

---

public class **GenericDTO**
extends org.osgi.dto.DTO

GenericDTO expresses miscellaneous data structures.

---

| Field Summary | | Page |
|---|---|---|
| - | **element**<br>Substructure of DTO. | 54 |
| - | **type**<br>type of data structure, which is represented by this DTO. | 54 |

| Constructor Summary | Page |
|---|---|
| **GenericDTO**() | 54 |

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

## Field Detail

### type

public **type**

type of data structure, which is represented by this DTO. This is optional field. The creator of the DTO may use the field for clarification purpose. Receiver should not rely on this information to analyze data structure, since this information may not provided.

### element

public **element**

Substructure of DTO. Type of the value part should be one of types allowed as OSGi DTO.

## Constructor Detail

### GenericDTO

public **GenericDTO**()

# Class IPEDiscoveryRequestDTO

***org.osgi.service.onem2m.dto***

java.lang.Object
  └ org.osgi.dto.DTO
    └ **org.osgi.service.onem2m.dto.IPEDiscoveryRequestDTO**

---

public class **IPEDiscoveryRequestDTO**
extends org.osgi.dto.DTO

IPEDiscoveryRequestDTO is an element of NotificationEventDTO

**See Also:**
TS-0004 6.3.5.13

---

| Field Summary | | Page |
|---|---|---|
| - | **filterCriteria**<br>FilterCriteria | 55 |
| - | **originator**<br>originator | 55 |

| Constructor Summary | Page |
|---|---|
| **IPEDiscoveryRequestDTO()** | 55 |

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

## Field Detail

### originator

public **originator**

originator

### filterCriteria

public **filterCriteria**

FilterCriteria

**See Also:**
TS-0004 6.3.5.8

## Constructor Detail

### IPEDiscoveryRequestDTO

public **IPEDiscoveryRequestDTO()**

# 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 |
|---|---|---|
| - | **localTokenID**<br>local token ID | 56 |
| - | **tokenID**<br>token ID | 56 |

| Constructor Summary | Page |
|---|---|
| **LocalTokenIdAssignmentDTO()** | 56 |

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

## Field Detail

### localTokenID

public **localTokenID**

local token ID

### ~~tokenID~~

public **tokenID**

token ID

## 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 |
|---|---|---|
| - | **creator**<br>creator | 58 |
| - | **ipeDiscoveryRequest**<br>IPE Discovery Request. | 58 |
| - | **notificationEvent**<br>Notification Event | 57 |
| - | **notificationForwardingURI**<br>URI for notification target | 58 |
| - | **subscriptionDeletion**<br>Flag showing subscription deletion This field is optional. | 58 |
| - | **subscriptionReference**<br>URI referring subscription resource. | 58 |
| - | **verificationRequest**<br>Flag showing verification request. | 57 |

| Constructor Summary | Page |
|---|---|
| **NotificationDTO**() | 58 |

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

## Field Detail

### notificationEvent

```
public notificationEvent
```

Notification Event

### verificationRequest

```
public verificationRequest
```

Flag showing verification request. This field is optional.

---

### subscriptionDeletion

`public` **`subscriptionDeletion`**

Flag showing subscription deletion This field is optional.

### subscriptionReference

`public` **`subscriptionReference`**

URI referring subscription resource.

### creator

`public` **`creator`**

creator

### notificationForwardingURI

`public` **`notificationForwardingURI`**

URI for notification target

### ipeDiscoveryRequest

`public` **`ipeDiscoveryRequest`**

IPE Discovery Request.

## Constructor Detail

### NotificationDTO

`public` **`NotificationDTO`**`()`

# Class NotificationEventDTO

org.osgi.service.onem2m.dto

java.lang.Object
└ org.osgi.service.onem2m.dto.NotificationEventDTO

---

public class **NotificationEventDTO**
extends Object

NotificationEventDTO This data structure is held in NotificationDTO.

**See Also:**
TS-0004 6.3.5.13

---

| Nested Class Summary | | Page |
|---|---|---|
| final static class | **NotificationEventDTO.NotificationEventType**<br>NotificationEventType | 61 |

| Field Summary | | Page |
|---|---|---|
| - | **notificationEventType**<br>notificationEventType | 60 |
| - | **operationMonitor**<br>operationMonitor | 59 |
| - | **representation**<br>m2m:representation | 59 |

| Constructor Summary | Page |
|---|---|
| **NotificationEventDTO()** | 60 |

## Field Detail

### representation

public **representation**

m2m:representation

**See Also:**
TS-0004 6.3.5.62

---

### operationMonitor

public **operationMonitor**

operationMonitor

**See Also:**
TS-0004 6.3.5.57

## notificationEventType

public **notificationEventType**

notificationEventType

**See Also:**
TS-0004_6.3.4.2.19

# Constructor Detail

## NotificationEventDTO

public **NotificationEventDTO**()

# Class NotificationEventDTO.NotificationEventType

***org.osgi.service.onem2m.dto***

```
java.lang.Object
  └ java.lang.Enum
      └ org.osgi.service.onem2m.dto.NotificationEventDTO.NotificationEventType
```

**All Implemented Interfaces:**

Comparable, Serializable

**Enclosing class:**

NotificationEventDTO

---

```
final public static class NotificationEventDTO.NotificationEventType
extends Enum
```

NotificationEventType

**See Also:**

TS-0004 6.3.4.2.19

---

| Field Summary | | Page |
|---|---|---|
| static | **create_of_direct_child_resource**<br>create_of_direct_child_resource | 62 |
| static | **delete_of_direct_child_resouce**<br>create_of_direct_child_resouce | 62 |
| static | **delete_of_resource**<br>delete_of_resource | 62 |
| static | **retrieve_of_container_resource_with_no_child_resource**<br>retrieve_of_container_resource_with_no_child_resource | 62 |
| static | **updagte_of_resource**<br>updagte_of_resouce. | 61 |

| Method Summary | | Page |
|---|---|---|
| int | **getValue**() | 62 |
| static NotificationEventDTO.NotificationEventType | **valueOf**(String name) | 62 |
| static NotificationEventDTO.NotificationEventType[] | **values**() | 62 |

## Field Detail

### updagte_of_resource

```
public static final updagte_of_resource
```

updagte_of_resouce. This is the default value.

### delete_of_resource

```
public static final delete_of_resource
```

delete_of_resource

### create_of_direct_child_resource

```
public static final create_of_direct_child_resource
```

create_of_direct_child_resource

### delete_of_direct_child_resouce

```
public static final delete_of_direct_child_resouce
```

create_of_direct_child_resouce

### retrieve_of_container_resource_with_no_child_resource

```
public static final retrieve_of_container_resource_with_no_child_resource
```

retrieve_of_container_resource_with_no_child_resource

## Method Detail

### values

```
public static NotificationEventDTO.NotificationEventType[] values()
```

### valueOf

```
public static NotificationEventDTO.NotificationEventType valueOf(String name)
```

### getValue

```
public int getValue()
```

# 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 used as union. Only one field MUST have a value, the others MUST be null.

---

| **Field Summary** | | ***Page*** |
|---|---|---|
| - | **aggregatedNotification**<br>Aggregated Notification | 64 |
| - | **aggregatedResponse**<br>Aggregated Response | 64 |
| - | **attributeList**<br>Attribute List | 65 |
| - | **childResourceRefList**<br>Child Resource RefList | 65 |
| - | **debugInfo**<br>Debug Info | 64 |
| - | **listOfURIs**<br>List Of URIs | 64 |
| - | **notification**<br>Notification | 65 |
| - | **queryResult**<br>Query Result | 65 |
| - | **requestPrimitive**<br>Request Primitive | 65 |
| - | **resource**<br>Resource | 64 |
| - | **resourceWrapper**<br>Resource Wrapper | 64 |
| - | **responsePrimitive**<br>Response Primitive | 64 |
| - | **securityInfo**<br>Security Info | 64 |
| - | **uri**<br>URI | 64 |

| **Constructor Summary** | ***Page*** |
|---|---|
| **PrimitiveContentDTO()** | 65 |

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

toString

## Field Detail

### resource

public **resource**

Resource

### resourceWrapper

public **resourceWrapper**

Resource Wrapper

### aggregatedNotification

public **aggregatedNotification**

Aggregated Notification

### securityInfo

public **securityInfo**

Security Info

### responsePrimitive

public **responsePrimitive**

Response Primitive

### debugInfo

public **debugInfo**

Debug Info

### listOfURIs

public **listOfURIs**

List Of URIs

### uri

public **uri**

URI

### aggregatedResponse

public **aggregatedResponse**

Aggregated Response

### childResourceRefList

public **childResourceRefList**

Child Resource RefList

### notification

public **notification**

Notification

### attributeList

public **attributeList**

Attribute List

### requestPrimitive

public **requestPrimitive**

Request Primitive

### queryResult

public **queryResult**

Query Result

## Constructor Detail

### PrimitiveContentDTO

public **PrimitiveContentDTO**()

# Class ReleaseVersion

***org.osgi.service.onem2m.dto***

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

**All Implemented Interfaces:**

Comparable, Serializable

---

```
final public class ReleaseVersion
extends Enum
```

Enum expressing oneM2M specification version. This information is introduced after Release 2.0 and oneM2M uses only R2A,R3_0 (as 2a and 3).

---

| Field Summary | | Page |
|---|---|---|
| static | **R1_0**<br>Release 1 | 66 |
| static | **R1_1**<br>Release 1.1 | 66 |
| static | **R2_0**<br>Release 2 | 67 |
| static | **R2A**<br>Release 2A | 67 |
| static | **R3_0**<br>Release 3 | 67 |

| Method Summary | | Page |
|---|---|---|
| static ReleaseVersion | **valueOf**(String name) | 67 |
| static ReleaseVersion[] | **values**() | 67 |

## Field Detail

### R1_0

```
public static final R1_0
```

Release 1

### R1_1

```
public static final R1_1
```

Release 1.1

---

### R2_0

```
public static final R2_0
```

Release 2

### R2A

```
public static final R2A
```

Release 2A

### R3_0

```
public static final R3_0
```

Release 3

## 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 |
|---|---|---|
| final static class | **RequestPrimitiveDTO.DiscoveryResultType** | 73 |
| final static class | **RequestPrimitiveDTO.Operation**<br>enum type for Operation | 75 |
| final static class | **RequestPrimitiveDTO.ResultContent**<br>enum type for Result Content | 77 |

| Field Summary | | Page |
|---|---|---|
| - | **authorRelIndicator**<br>Author Relation Indicator | 72 |
| - | **authorSignIndicator**<br>Author Sign Indicator | 72 |
| - | **authorSigns**<br>Author Signs | 72 |
| - | **content**<br>Primitive Content | 70 |
| - | **deliveryAggregation**<br>Delivery Aggregation | 71 |
| - | **discoveryResultType**<br>Discovery Result Type | 71 |
| - | **eventCategory**<br>Event Category | 71 |
| - | **filterCriteria**<br>Filter Criteria | 71 |
| - | **from**<br>From Parameter. | 70 |
| - | **groupRequestIdentifier**<br>Group Request Identifier | 71 |
| - | **groupRequestTargetMembers**<br>Group Request Target Members | 72 |
| - | **localTokenIDs**<br>Local Token Identifiers | 72 |
| - | **operation**<br>Operation | 69 |

| | | |
|---|---|---|
| - | **operationExecutionTime**<br>Operation Execution Time | 70 |
| - | **originatingTimestamp**<br>Originating Timestamp | 70 |
| - | **releaseVersionIndicator**<br>Release Version | 72 |
| - | **requestExpirationTimestamp**<br>Request Expiration Timestamp | 70 |
| - | **requestIdentifier**<br>Request Identifier | 70 |
| - | **resourceType**<br>Resource Type | 70 |
| - | **responseType**<br>Response Type Info | 71 |
| - | **resultContent**<br>Result Content | 71 |
| - | **resultExpirationTimestamp**<br>Result Expiration Timestamp | 70 |
| - | **resultPersistence**<br>Result Persistence | 71 |
| - | **roleIDs**<br>Role IDs | 70 |
| - | **semanticQueryIndicator**<br>Semantic Query Indicator | 72 |
| - | **to**<br>To Parameter | 70 |
| - | **tokenIDs**<br>Token Identifiers | 71 |
| - | **tokenRequestIndicator**<br>Token Request Indicator | 72 |
| - | **tokens**<br>tokens | 71 |
| - | **vendorInformation**<br>Vendor Information | 72 |

| Constructor Summary | Page |
|---|---|
| **RequestPrimitiveDTO()** | 72 |

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

## Field Detail

### operation

public **operation**

Operation

### to

public to

To Parameter

### from

public from

From Parameter. In other word, originator of request is stored.

### requestIdentifier

public requestIdentifier

Request Identifier

### resourceType

public resourceType

Resource Type

### content

public content

Primitive Content

### roleIDs

public roleIDs

Role IDs

### originatingTimestamp

public originatingTimestamp

Originating Timestamp

### requestExpirationTimestamp

public requestExpirationTimestamp

Request Expiration Timestamp

### resultExpirationTimestamp

public resultExpirationTimestamp

Result Expiration Timestamp

### operationExecutionTime

public operationExecutionTime

Operation Execution Time

### responseType

`public responseType`

Response Type Info

### resultPersistence

`public resultPersistence`

Result Persistence

### resultContent

`public resultContent`

Result Content

### eventCategory

`public eventCategory`

Event Category

### deliveryAggregation

`public deliveryAggregation`

Delivery Aggregation

### groupRequestIdentifier

`public groupRequestIdentifier`

Group Request Identifier

### filterCriteria

`public filterCriteria`

Filter Criteria

### discoveryResultType

`public discoveryResultType`

Discovery Result Type

### tokens

`public tokens`

tokens

### tokenIDs

`public tokenIDs`

Token Identifiers

### localTokenIDs

public **localTokenIDs**

Local Token Identifiers

### tokenRequestIndicator

public **tokenRequestIndicator**

Token Request Indicator

### groupRequestTargetMembers

public **groupRequestTargetMembers**

Group Request Target Members

### authorSignIndicator

public **authorSignIndicator**

Author Sign Indicator

### authorSigns

public **authorSigns**

Author Signs

### authorRelIndicator

public **authorRelIndicator**

Author Relation Indicator

### semanticQueryIndicator

public **semanticQueryIndicator**

Semantic Query Indicator

### releaseVersionIndicator

public **releaseVersionIndicator**

Release Version

### vendorInformation

public **vendorInformation**

Vendor Information

## Constructor Detail

### RequestPrimitiveDTO

public **RequestPrimitiveDTO**()

# Class RequestPrimitiveDTO.DiscoveryResultType

*org.osgi.service.onem2m.dto*

java.lang.Object
  └ java.lang.Enum
    └ **org.osgi.service.onem2m.dto.RequestPrimitiveDTO.DiscoveryResultType**

**All Implemented Interfaces:**
Comparable, Serializable

**Enclosing class:**
RequestPrimitiveDTO

---

final public static class **RequestPrimitiveDTO.DiscoveryResultType**
extends Enum

---

| Field Summary | | Page |
|---|---|---|
| static | **structured**<br>structured | 73 |
| static | **unstructured**<br>unstructured | 73 |

| Method Summary | | Page |
|---|---|---|
| int | **getValue**() | 74 |
| static RequestPrimitiveDTO.DiscoveryResultType | **valueOf**(String name) | 74 |
| static RequestPrimitiveDTO.DiscoveryResultType[] | **values**() | 74 |

## Field Detail

### structured

public static final **structured**

structured

### unstructured

public static final **unstructured**

unstructured

## Method Detail

### values

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

### ~~valueOf~~

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

### ~~getValue~~

```
public int getValue()
```

# Class RequestPrimitiveDTO.Operation

org.osgi.service.onem2m.dto

java.lang.Object
  └ java.lang.Enum
    └ **org.osgi.service.onem2m.dto.RequestPrimitiveDTO.Operation**

**All Implemented Interfaces:**
Comparable, Serializable

**Enclosing class:**
RequestPrimitiveDTO

---

```
final public static class RequestPrimitiveDTO.Operation
extends Enum
```

enum type for Operation

---

| Field Summary | | Page |
|---|---|---|
| static | **Create**<br>Create | 75 |
| static | **Delete**<br>Delete | 76 |
| static | **Notify**<br>Notify | 76 |
| static | **Retrieve**<br>Retrieve | 76 |
| static | **Update**<br>Update | 76 |

| Method Summary | | Page |
|---|---|---|
| int | **getValue**()<br>get assigned integer value | 76 |
| static RequestPrimitiveDTO.Operation | **valueOf**(String name) | 76 |
| static RequestPrimitiveDTO.Operation[] | **values**() | 76 |

## Field Detail

### Create

```
public static final Create
```

Create

---

### Retrieve

```
public static final Retrieve
```

Retrieve

### Update

```
public static final Update
```

Update

### Delete

```
public static final Delete
```

Delete

### Notify

```
public static final Notify
```

Notify

## Method Detail

### values

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

### valueOf

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

### getValue

```
public int getValue()
```

get assigned integer value

**Returns:**
assigned integer value

# Class RequestPrimitiveDTO.ResultContent

org.osgi.service.onem2m.dto

java.lang.Object
└ java.lang.Enum
└ org.osgi.service.onem2m.dto.RequestPrimitiveDTO.ResultContent

**All Implemented Interfaces:**
Comparable, Serializable

**Enclosing class:**
RequestPrimitiveDTO

---

final public static class **RequestPrimitiveDTO.ResultContent**
extends Enum

enum type for Result Content

---

| Field Summary | | Page |
|---|---|---|
| static | **attributes**<br>attributes | 78 |
| static | **attributesAndChildResourceReferences**<br>attributesAndChildResourceReferences | 78 |
| static | **attributesAndChildResources**<br>attributesAndChildResources | 78 |
| static | **childResourceReferences**<br>childResourceReferences | 78 |
| static | **childResources**<br>childResources | 78 |
| static | **hierarchicalAddress**<br>hierarchicalAddress | 78 |
| static | **hierarchicalAddressAndAttributes**<br>hierarchicalAddressAndAttributes | 78 |
| static | **nothing**<br>nothing | 78 |
| static | **originalResource**<br>originalResource | 78 |

| Method Summary | | Page |
|---|---|---|
| int | **getValue**()<br>get assigned integer value | 79 |
| static RequestPrimitiveDTO.ResultContent | **valueOf**(String name) | 79 |
| static RequestPrimitiveDTO.ResultContent[] | **values**() | 79 |

## Field Detail

### nothing

`public static final nothing`

nothing

### attributes

`public static final attributes`

attributes

### hierarchicalAddress

`public static final hierarchicalAddress`

hierarchicalAddress

### hierarchicalAddressAndAttributes

`public static final hierarchicalAddressAndAttributes`

hierarchicalAddressAndAttributes

### attributesAndChildResources

`public static final attributesAndChildResources`

attributesAndChildResources

### attributesAndChildResourceReferences

`public static final attributesAndChildResourceReferences`

attributesAndChildResourceReferences

### childResourceReferences

`public static final childResourceReferences`

childResourceReferences

### originalResource

`public static final originalResource`

originalResource

### childResources

`public static final childResources`

childResources

## Method Detail

### values

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

### ~~valueOf~~

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

### ~~getValue~~

```
public int getValue()
```

get assigned integer value

**Returns:**

assigned integer value

# 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 |
|---|---|---|
| - | **attribute**<br>Non Universal Attribute. | 81 |
| - | **creationTime**<br>Creation time | 81 |
| - | **labels**<br>Labels This field is optional. | 81 |
| - | **lastModifiedTime**<br>last modified time | 81 |
| - | **parentID**<br>Parent ID Resource ID of parent resource. | 81 |
| - | **resourceID**<br>Resource ID | 80 |
| - | **resourceName**<br>Resource name | 81 |
| - | **resourceType**<br>Resource Type | 80 |

| Constructor Summary | Page |
|---|---|
| **ResourceDTO()** | 81 |

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

## Field Detail

### resourceType

```
public resourceType
```

Resource Type

### ~~resourceID~~

```
public resourceID
```

Resource ID

### parentID

`public parentID`

Parent ID Resource ID of parent resource.

### creationTime

`public creationTime`

Creation time

### lastModifiedTime

`public lastModifiedTime`

last modified time

### resourceName

`public resourceName`

Resource name

### labels

`public labels`

Labels This field is optional.

### attribute

`public 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 |
|---|---|---|
| - | **resource**<br>Resource | 82 |
| - | **uri**<br>URI for the resource | 82 |

| Constructor Summary | Page |
|---|---|
| **ResourceWrapperDTO()** | 82 |

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

## Field Detail

### uri

public **uri**

URI for the resource

### resource

public **resource**

Resource

## 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 |
|---|---|---|
| final static class | **ResponsePrimitiveDTO.ContentStatus**<br>Enum ContentStatus | 86 |

| Field Summary | | Page |
|---|---|---|
| - | **assignedTokenIdentifiers**<br>Assigned Token Identifiers | 85 |
| - | **AuthSignatureReqInfo**<br>AuthSignatureReqInfo | 85 |
| - | **content**<br>Primitive Content | 84 |
| - | **contentOffset**<br>Content Offset | 85 |
| - | **contentStatus**<br>Content Status | 85 |
| - | **eventCategory**<br>Event Category | 84 |
| - | **from**<br>From Parameter | 84 |
| - | **originatingTimestamp**<br>Originating Timestamp | 84 |
| - | **releaseVersionIndicator**<br>Release Version Indicator | 85 |
| - | **requestIdentifier**<br>Request Identifier | 84 |
| - | **responseStatusCode**<br>Response Status Code | 84 |
| - | **resultExpirationTimestamp**<br>ResultExpiration Timestamp | 84 |
| - | **to**<br>To Parameter | 84 |
| - | **tokenReqInfo**<br>Token Request Info | 85 |
| - | **vendorInformation**<br>Vendor Information | 85 |

| Constructor Summary | Page |
|---|---|
| ResponsePrimitiveDTO() | 85 |

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

## Field Detail

### responseStatusCode

public responseStatusCode

Response Status Code

### requestIdentifier

public requestIdentifier

Request Identifier

### content

public content

Primitive Content

### to

public to

To Parameter

### from

public from

From Parameter

### originatingTimestamp

public originatingTimestamp

Originating Timestamp

### resultExpirationTimestamp

public resultExpirationTimestamp

ResultExpiration Timestamp

### eventCategory

public eventCategory

Event Category

### contentStatus

public **contentStatus**

Content Status

### contentOffset

public **contentOffset**

Content Offset

### assignedTokenIdentifiers

public **assignedTokenIdentifiers**

Assigned Token Identifiers

### tokenReqInfo

public **tokenReqInfo**

Token Request Info

### AuthSignatureReqInfo

public **AuthSignatureReqInfo**

AuthSignatureReqInfo

### releaseVersionIndicator

public **releaseVersionIndicator**

Release Version Indicator

### vendorInformation

public **vendorInformation**

Vendor Information

## Constructor Detail

### ResponsePrimitiveDTO

public **ResponsePrimitiveDTO()**

# Class ResponsePrimitiveDTO.ContentStatus

*org.osgi.service.onem2m.dto*

java.lang.Object
  └ java.lang.Enum
    └ **org.osgi.service.onem2m.dto.ResponsePrimitiveDTO.ContentStatus**

**All Implemented Interfaces:**
Comparable, Serializable

**Enclosing class:**
ResponsePrimitiveDTO

---

final public static class **ResponsePrimitiveDTO.ContentStatus**
extends Enum

Enum ContentStatus

---

| Field Summary | | Page |
|---|---|---|
| static | **FULL_CONTENT**<br>FULL_CONTENT | 86 |
| static | **PARTIAL_CONTENT**<br>PARTIAL_CONTENT | 86 |

| Method Summary | | Page |
|---|---|---|
| static ResponsePrimitiveDTO.ContentStatus | **valueOf**(String name) | 87 |
| static ResponsePrimitiveDTO.ContentStatus[] | **values**() | 87 |

## Field Detail

### PARTIAL_CONTENT

public static final **PARTIAL_CONTENT**

PARTIAL_CONTENT

### FULL_CONTENT

public static final **FULL_CONTENT**

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 |
|---|---|---|
| final static class | **ResponseTypeInfoDTO.ResponseType**<br>enum ResponseType | 89 |

| Field Summary | | Page |
|---|---|---|
| - | **notificationURI**<br>Notification URI | 88 |
| - | **responseTypeValue**<br>Response Type Value | 88 |

| Constructor Summary | Page |
|---|---|
| **ResponseTypeInfoDTO()** | 88 |

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

## Field Detail

### responseTypeValue

```
public responseTypeValue
```

Response Type Value

### notificationURI

```
public notificationURI
```

Notification URI

## Constructor Detail

### ResponseTypeInfoDTO

```
public ResponseTypeInfoDTO()
```

# Class ResponseTypeInfoDTO.ResponseType

*org.osgi.service.onem2m.dto*

java.lang.Object
  └ java.lang.Enum
    └ **org.osgi.service.onem2m.dto.ResponseTypeInfoDTO.ResponseType**

**All Implemented Interfaces:**
Comparable, Serializable

**Enclosing class:**
ResponseTypeInfoDTO

---

final public static class **ResponseTypeInfoDTO.ResponseType**
extends Enum

enum ResponseType

---

| Field Summary | | Page |
|---|---|---|
| static | **blockingRequest**<br>blockingRequest | 90 |
| static | **flexBlocking**<br>flexBlocking | 90 |
| static | **nonBlockingRequestAsynch**<br>nonBlockingRequestAsynch | 89 |
| static | **nonBlockingRequestSynch**<br>nonBlockingRequestSynch | 89 |

| Method Summary | | Page |
|---|---|---|
| int | **getValue**()<br>get assigned value | 90 |
| static ResponseTypeInfoDTO.ResponseType | **valueOf**(String name) | 90 |
| static ResponseTypeInfoDTO.ResponseType[] | **values**() | 90 |

## Field Detail

### nonBlockingRequestSynch

public static final **nonBlockingRequestSynch**

nonBlockingRequestSynch

### nonBlockingRequestAsynch

public static final **nonBlockingRequestAsynch**

nonBlockingRequestAsynch

### blockingRequest

```
public static final blockingRequest
```

blockingRequest

### flexBlocking

```
public static final flexBlocking
```

flexBlocking

## Method Detail

### values

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

### valueOf

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

### getValue

```
public int getValue()
```

get assigned value

**Returns:**

assigned integer value.

# 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.

---

| Nested Class Summary | | Page |
|---|---|---|
| final static class | **SecurityInfoDTO.SecurityInfoType**<br>Enum SecurityInfoType | 93 |

| Field Summary | | Page |
|---|---|---|
| - | **dasRequest**<br>Das Request | 91 |
| - | **dasResponse**<br>Das Response | 92 |
| - | **escertkeMessage**<br>Escertke Message | 92 |
| - | **esprimObject**<br>Esprim Object | 92 |
| - | **esprimRandObject**<br>Esprim Rand Objecgt | 92 |
| - | **securityInfoType**<br>Security Info Type | 91 |

| Constructor Summary | Page |
|---|---|
| **SecurityInfoDTO**() | 92 |

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

## Field Detail

### securityInfoType

public **securityInfoType**

Security Info Type

### dasRequest

public **dasRequest**

Das Request

### dasResponse

`public` **`dasResponse`**

Das Response

### esprimRandObject

`public` **`esprimRandObject`**

Esprim Rand Objecgt

### esprimObject

`public` **`esprimObject`**

Esprim Object

### escertkeMessage

`public` **`escertkeMessage`**

Escertke Message

## Constructor Detail

### SecurityInfoDTO

`public` **`SecurityInfoDTO`**`()`

# Class SecurityInfoDTO.SecurityInfoType

*org.osgi.service.onem2m.dto*

java.lang.Object
  └ java.lang.Enum
    └ **org.osgi.service.onem2m.dto.SecurityInfoDTO.SecurityInfoType**

**All Implemented Interfaces:**
Comparable, Serializable

**Enclosing class:**
SecurityInfoDTO

---

final public static class **SecurityInfoDTO.SecurityInfoType**
extends Enum

Enum SecurityInfoType

---

| Field Summary | | Page |
|---|---|---|
| static | **DynamicAuthorizationRelationshipMappingRequest**<br>DynamicAuthorizationRelationshipMappingRequest | 94 |
| static | **DynamicAuthorizationRelationshipMappingResponse**<br>DynamicAuthorizationRelationshipMappingResponse | 94 |
| static | **DynamicAuthorizationRequest**<br>DynamicAuthorizationRequest | 94 |
| static | **DynamicAuthorizationResponse**<br>DynamicAuthorizationResponse | 94 |
| static | **ESCertKEMessage**<br>ESCertKEMessage | 94 |
| static | **ESPrimObject**<br>ESPrimObject | 94 |
| static | **ReceiverESPrimRandObjectRequest**<br>ReceiverESPrimRandObjectRequest | 94 |
| static | **ReceiverESPrimRandObjectResponse**<br>ReceiverESPrimRandObjectResponse | 94 |

| Method Summary | | Page |
|---|---|---|
| int | **getValue**()<br>Get assigned value. | 95 |
| static SecurityInfoDTO.SecurityInfoType | **valueOf**(String name) | 94 |
| static SecurityInfoDTO.SecurityInfoType[] | **values**() | 94 |

## Field Detail

### DynamicAuthorizationRequest

```
public static final DynamicAuthorizationRequest
```

DynamicAuthorizationRequest

### DynamicAuthorizationResponse

```
public static final DynamicAuthorizationResponse
```

DynamicAuthorizationResponse

### ReceiverESPrimRandObjectRequest

```
public static final ReceiverESPrimRandObjectRequest
```

ReceiverESPrimRandObjectRequest

### ReceiverESPrimRandObjectResponse

```
public static final ReceiverESPrimRandObjectResponse
```

ReceiverESPrimRandObjectResponse

### ESPrimObject

```
public static final ESPrimObject
```

ESPrimObject

### ESCertKEMessage

```
public static final ESCertKEMessage
```

ESCertKEMessage

### DynamicAuthorizationRelationshipMappingRequest

```
public static final DynamicAuthorizationRelationshipMappingRequest
```

DynamicAuthorizationRelationshipMappingRequest

### DynamicAuthorizationRelationshipMappingResponse

```
public static final DynamicAuthorizationRelationshipMappingResponse
```

DynamicAuthorizationRelationshipMappingResponse

## Method Detail

### values

```
public static SecurityInfoDTO.SecurityInfoType[] values()
```

### valueOf

```
public static SecurityInfoDTO.SecurityInfoType valueOf(String name)
```

### getValue

public int **getValue**()

Get assigned value.

**Returns:**
assigned value



# 8 Considered Alternatives

## 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: ~~6Currently665~~ XSD files are defined in XSD v3.2.0 of~~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 JAXB tool(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.

## 8.4 Service Property for Service Layer Interface

In previous version, property named as PoAforAE is supposed to attach to Service Layer Interface. The way application need to search dedicated service for the AE, however, is not easy for developers nor OSGi way. The property has been removed and matching will be done by using Service Factory and mapping of bundle location and appropriate PoA is known by the service implementation.

## 8.5 Service Property for Notification Listener Interface

In previous version, property named as PoA and AE-ID are supposed to attach to Notification Listener Interface.

To attache AE-ID, application need to check result of <AE> resource creation and know modified AE-ID by CSE, and attach it as a property. This is complicated procedure and it is not a good design choice requiring all applications to implement this manner. Regarding PoA, the design that AE does not need to care of PoA was chosen.

Implementation of Service Layer Interface should manage both information by monitoring method request for creating <AE> resource and modifying the response. [This part need to be confirmed by reference implementation.]

# 9 Security Considerations

## 9.1 ServiceLayer Service with secure protocol configuration

In case that ServiceLayer 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, so that AE core MUST be bound to the right protocol service binding. It is implementation's responsibility of protocol binding, it SHOULD utilize Service Factory to determine calling entity.

# 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?)

## 10.2 Author's Address



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## 10.3 Acronyms and Abbreviations

CSE: Common Services Entity

AE: Application Entity

CBOR: Concise Binary Object Representation

DTO: Data Transfer Object

JAXB: The Java Architecture for XML Binding

XSD: XML Schema Definition Language

## 10.4 End of Document