OPENADE 1.0 SERVICE DEFINITION - REST EXTENSION

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Contents

69

70

List of Figures

76

77

List of Tables

79

80

81

1 INTRODUCTION

This document contains only the extensions necessary to the OpenADE Common specification to build an AtomPub resource representation syndication server. It is based heavily on GData, an open specification of AtomPub extensions required for general-purpose data synchronization.

These extensions define a collection of resource feeds as a discoverable, stateless data service, using HTTPS to send and receive requests and information in AtomPub XML. This resource-oriented architecture is proposed, similar to efforts elsewhere, such as web / internet of things, GData, and OData. This architecture provides secure access to scalable methods and data resources hosted by the provider, while maintaining concurrency and integrity. All data is secured at the user level, so that access to individual operations can be provided or revoked to external services, and other users' data will still be protected.

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1.1.2 CIM OBJECT MODELS

The recommendations herein build on work owned by the IEC. Required extensions identified in this recommendation will be submitted to the IEC, and will be tracked for inclusion in the model.

Information on the management of rights and governance can be found at the page below.
http://www.iec.ch/tctools/patent-guidelines.htm

1.1.3 SERVICE RESOURCE DEFINITIONS

If necessary, UCAIug is willing to work with standards development organizations to incorporate additional aspects of this recommendation into standards, including the specification of how to use profiled (restricted) CIM objects within a RESTful HTTP environment, and possibly the resource definitions themselves.

1.2 REFERENCED SPECIFICATIONS

- [1] OpenADE B&UR 1.0 - http://osgug.ucaiug.org/sgsystems/OpenADE/Shared%20Documents/Forms/AllItems.aspx?RootFolder=%2fsgsystems%2fOpenADE%2fShared%20Documents%2fBusiness%20and%20User%20Requirements
- [2] OpenADE SRS 1.0 - http://osgug.ucaiug.org/sgsystems/OpenADE/Shared%20Documents/Forms/AllItems.aspx?RootFolder=%2fsgsystems%2fOpenADE%2fShared%20Documents%2fSRS
- [3] IEC CIM (TC 57 61968/61970) - http://tc57.iec.ch
- [4] OAuth - http://tools.ietf.org/html/draft-hammer-oauth-10
- [5] HTTP(S) – IETF RFC 2616 - http://www.ietf.org/rfc/rfc2616.txt
- [6] GData - http://code.google.com/apis/gdata/docs/2.0/reference.html
- [7] OData - http://www.odata.org/docs/[MC-APDSU].htm
- [8] PubSubHubbub - http://code.google.com/p/pubsubhubbub/
- [9] Atom Publishing Protocol (RFC 5023) – http://tools.ietf.org/html/rfc5023
- [10] OpenSG OpenADE SD – Common http://osgug.ucaiug.org/sgsystems/OpenADE/Shared%20Documents/Forms/AllItems.aspx?RootFolder=%2fsgsystems%2fOpenADE%2fShared%20Documents%2fService%20Definition%2fOpenADE%201%2e0%20Service%20Definition

1.3 REFERENCED GUIDANCE

- [G1] 3PDA – Security Profile for Third Party Data Access (ASAP-SG) http://osgug.ucaiug.org/utilisec/Shared%20Documents/Forms/AllItems.aspx?RootFolder=%2futilisec%2fShared%20Documents%2fThird%20Party%20Data%20Access%20Security%20Profile

1.4 NAMESPACES

This document does not define any namespaces. Namespaces defined in referenced specifications shall be used as defined.

2 RESOURCES

Resource Oriented Architecture is nothing new; in fact the web we are all familiar with today provides restful (browser) access to internet resources. When you specify the Address URL of a page, you are providing the address of that resource that you requested. This architecture provides similar operations for external data consumer applications to request data and methods. Generally, data is made available as a feed, which is an agreement about how to query, create, update, request, and delete entries (individual object records, which have a defined schema according to their type).

Since this document is the first to define the general-purpose conventions, several resources were identified to allow consumers to gain access to the resources they want. These extensions are listed below.

- **Resource** – To discover provided resources
- **Subscribe** – To register for notifications

In addition, addressable resources are defined for the following objects, defined in [10] OpenADE SD - Common.

- **MeterReading** – Represents a collection of readings associated with a specific ReadingType
- **IntervalReading** – A durational measurement
- **Reading** – An instantaneous measurement
- **CustomerAuthorisation** – Represents the agreement to share data with the 3rd Party

2.1 URI FORMAT / SYNTAX

The URIs of the resources defined in OpenADE take the general form below. The <baseURL> does not need to be the same across different implementations, since resource addresses include the entire string.

```
http://<baseURL>/<resource>?<query>
```

Resource requests require inputs of user, key, and resource object. Additional path elements may be required for some resources. Resources return a list (feed) or an individual entry.

Requests for protected resources require https, and require authorization token in HTTP header.

The query section contains additional inputs that can be specified to affect processing, passed as a list of `name=value` pairs.

2.2 MESSAGE DOCUMENT FORMAT

Message documents shall use the extended version of the Atom Publishing Protocol ([9] AtomPub, which extends the Atom Syndication Protocol) defined in [6] GData for the elements described in this document, to fulfill this need.

In addition to the recommended format, it is possible to support additional representations. An input can be accepted to provide RSS or other formats, but these additional formats are all optional, and will only be considered for this specification if needed.

2.3 PAYLOAD ENTITIES

Payload entities will be specializations (subclasses) of the message document “entry”. They will therefore inherit all elements defined in the message document entry, as well as implement an XML schema representation of a CIM class defining additional schema elements.

Feed payloads will contain a list of references to resource entries that match the request query criteria.

The batch payload defined in the Common document allows a number of documents or resource requests to be included in a single request.

2.3.1 RESOURCES

Domain data objects build on the IEC CIM model. In general, resources will be named using the CIM class as the resource part of the URI. Collections are returned if no specific entry ID is specified in the resource. For listings of fields, see the details for each resource, defined in Section 10.

Some examples are shown below.

/MeterReading/fj2ofj8

```
<?xml version="1.0" encoding="UTF-8"?>
<entry xmlns="http://www.w3.org/2005/Atom"
    xmlns:m="http://osgug.ucaiug.org/ns/2010/06/oade">
    <category scheme="http://osgug.ucaiug.org/ns/2010/06/oade"
            term="http://osgug.ucaiug.org/ns/2010/06/oade#MeterReading"/>
    <id>https://data.utility.com/rs/MeterReading/fj2ofj8</id>
    <m:mRID>fj2ofj8</m:mRID>
    <m:ReadingType>
        <m:mRID>7.6.7.1.0.12.0.0.0.3.72'</m:mRID>
    </m:ReadingType>
    <m:ServiceDeliveryPoint>
        <m:aliasName>My House</m:aliasName>
        <m:mRID>98374</m:mRID>
        <m:MeterAsset>
            <m:aliasName>Premise Meter</m:aliasName>
            <m:mRID>10298374</m:mRID>
        </m:MeterAsset>
        <m:ServiceCategory>
            <m:kind>electricty</m:kind>
        </m:ServiceCategory>
    </m:ServiceDeliveryPoint>
</entry>
```

/MeterReading/fj2ofj8/IntervalReading/2001-12-17T09_30_47Z

```
<?xml version="1.0" encoding="UTF-8"?>
<entry xmlns="http://www.w3.org/2005/Atom"
    xmlns:m="http://osgug.ucaiug.org/ns/2010/06/oade">
    <category scheme="http://osgug.ucaiug.org/ns/2010/06/oade"
            term="http://osgug.ucaiug.org/ns/2010/06/oade#IntervalReading"/>
    <id>https://data.utility.com/rs/MeterReading/fj2ofj8/IntervalReading/2001-12-17T09_30_47Z</id>
    <m:timeStamp>2001-12-17T09:30:47Z</m:timeStamp>
    <m:endTimeStamp>2001-12-17T10:30:47Z</m:endTimeStamp>
    <m:value>3.1</m:value>
</entry>
```

CustomerAuthorisation/23049857203

```
<?xml version="1.0" encoding="UTF-8"?>
<entry xmlns="http://www.w3.org/2005/Atom"
    xmlns:m="http://osgug.ucaiug.org/ns/2010/06/oade">
    <category scheme="http://osgug.ucaiug.org/ns/2010/06/oade"
            term="http://osgug.ucaiug.org/ns/2010/06/oade#CustomerAuthorisation"/>
    <id>https://data.utility.com/rs/CustomerAuthorisation/23049857203</id>
    <m:mRID>23049857203</m:mRID>
    <m:validityInterval>
        <m:end>2002-11-17T09:30:47Z</m:end>
        <m:start>2000-11-17T09:30:47Z</m:start>
    </m:validityInterval>
```

```
</entry>
```

3 PATTERNS

This section contains guidance and decisions on how message exchanges flow for the general scenarios below. In general, the constructs and operations defined in [9] AtomPub shall be used, including requests for Services, Workspaces, Collections, Members, Categories, and Media Types. Extensions are generally refined subsets of the full specifications detailed in [6] GData, and full implementations should not break clients who only implement these recommendations.

3.1 CREATING, UPDATING, DELETING

The POST method is to be used for creation of new entries, PUT is to be used for updates to existing entries, and DELETE is to be used to delete an entry.

3.2 QUERY, REQUEST AND RESPONSE (RETRIEVE) FORMATS

This section specifies the input parameters that can be passed to GET method operations for format, category, reference expansion, sorting, filtering, and iteration through list items.

3.2.1 FORMAT

The default, and only required format, will be CIM-extended AtomPub feed / entry XML.

3.2.2 CATEGORY

Specification of the category of entries is accomplished using the Atom element “term”, and if needed could be supported as a qualifier in queries by accepting category terms as inputs. In general, each CIM object class will become a category of entry, so that the representations of entries can be specified with a schema.

3.2.3 REFERENCE EXPANSION

By default, feed queries will return a list of resource links. If the reference expansion flag is set, entries returned will be expanded to contain their full representation.

(Need to determine if nested expansion is necessary / possible, and if so, how to specify to what level)

[7] OData uses an `m:inline` extension to the `atom:link` element for this purpose.

3.2.4 SORTING

Ability to specify the sort order of resulting query / request entries is not necessary - subsequent processing of received data can display or rearrange data however desired. However, ordering of entries shall remain consistent across requests, so that an iterator can be used to page through results.

3.2.5 FILTERING

Filtering requires inputs that allow the specification of the resource name and/or path, as well as a range of publication or update date/times. Properties of the entry element (defined by its category type) could be defined to be acceptable by default as filter terms for the associated resource. Need to determine if it is feasible to implement all, or if identification is necessary of only the filter terms required for specific use cases. Possibly usage patterns could determine the need for indexing, etc.

If a specific entry ID is specified, that entry is returned.

3.2.6 ITERATION

Iteration inputs allow consumers to request a subset of entries or references at a time, and then page through them for processing. Inputs include the starting entry index, and number of entries per page.

Query results shall include the additional openSearch terms as defined in [6] GData for iteration.

3.2.7 CONDITIONAL RETRIEVAL

If-None-Match in HTTP header shall be used to retrieve entries only if they have changed as defined in both [7] OData and [6] GData.

3.3 EVENT NOTIFICATION (PUB/SUB)

The publish / subscribe pattern is incredibly useful, and is specified mostly in [9] AtomPub. However, there is no mechanism defined in AtomPub to notify subscribers of new feed entries. This requires them to “poll” for new data, and while this is sufficient in many cases, some business processes require ability to notify in order to achieve reduced latency in client updates.

[8] PubSubHubbub defines a mechanism for this purpose, and may be implemented for this purpose.

3.4 BATCH TRANSFERS

If desired, a feed for each data service consumer could be provided through which all subscribed content would be returned in a single request (or series of large chunks). This mechanism should allow any resource type to be included within a single feed. The regular synchronization behavior shall be implemented as a regular feed request or subscription notification with reference expansion specified, as defined in [6] GData.

4 DISCOVERY

Discovery of available resources shall utilize the [9] AtomPub constructs defining services, workspaces, and collections. This is accomplished with a client request to GET the definition of all collections, followed by enrollment / authorization, and finally subscription to the appropriate feeds.

5 METADATA

A “Resource” resource shall allow retrieval of the representation of all available resources, and the currently implemented version of each.

[9] AtomPub defines a “workspace collection” for this, as in the example below.

```
<?xml version="1.0" encoding='utf-8'?>
   <service xmlns="http://www.w3.org/2007/app"
            xmlns:atom="http://www.w3.org/2005/Atom">
     <workspace>
       <atom:title>Main Site</atom:title>
       <collection
           href="http://example.org/blog/main" >
         <atom:title>My Blog Entries</atom:title>
         <categories
            href="http://example.com/cats/forMain.cats" />
       </collection>
       <collection
           href="http://example.org/blog/pic" >
         <atom:title>Pictures</atom:title>
         <accept>image/png</accept>
         <accept>image/jpeg</accept>
         <accept>image/gif</accept>
       </collection>
     </workspace>
```

6 EXTENSIBILITY

[9] AtomPub is specified to be extensible, and implementations should be able to function even with different versions of client or server. In addition, section 6.2 in AtomPub provides recommended behavior.

Extensions to the CIM objects will be associated with specific versions of the namespace, specified in the version attribute of the schema element.

7 VERSIONING

As additional capabilities are added to the interface definition, a specification of the version of the definition will be needed to help in service discovery negotiation. This should not change the namespace of any definitions.

8 CONCURRENCY

In order to ensure data integrity, clients may only update resources if they are updating the current version of the resource. If an update request fails due to conflict (not current version), the client must request the latest version, apply changes to that representation, and retry the update.

[6] GData and [7] OData both use ETags for versioning / concurrency management, and are largely compatible. Additional details will be specified as identified during initial implementations.

See GData Resource Versioning http://code.google.com/apis/gdata/docs/2.0/reference.html#ResourceVersioning for more information.

9 FUNCTIONAL AREAS

9.1 COMMON

The flows in this section represent general-purpose functions that are needed for all protected resource publications.

9.1.1 **DISCOVER** RESOURCE- (SEQUENCE DIAGRAM)

Addresses OpenSG OpenADE 1.0 SRS 3.2.1, bullet 1.2, 1.3

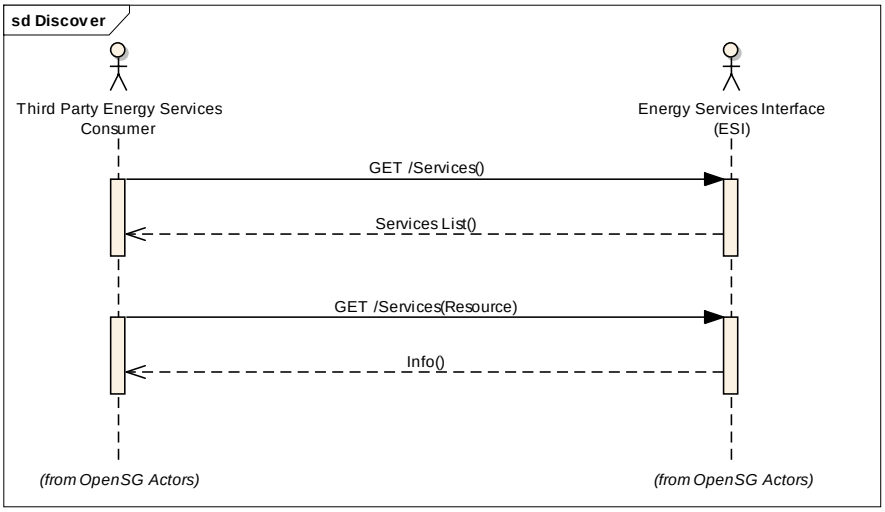


Figure 1: Discover Service Resources Sequence Diagram

9.2 METERING CONSUMPTION

9.2.1 **CONSUMPTION REQUEST** - *(SEQUENCE DIAGRAM)*

Addresses OpenSG OpenADE 1.0 SRS 3.2.1, bullet 3.1, 3.2

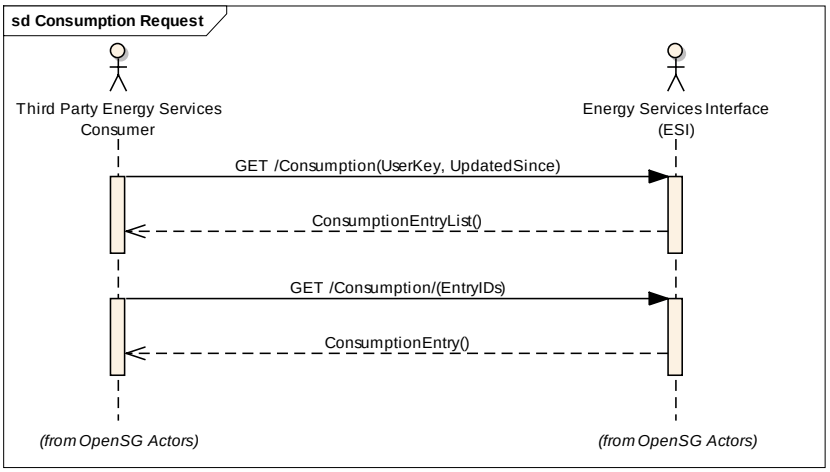


Figure 2: MeterReading Request Sequence Diagram

9.2.2 CONSUMPTION SUBSCRIBE - (SEQUENCE DIAGRAM)

Addresses OpenSG OpenADE 1.0 SRS 3.2.1, bullet 3.1

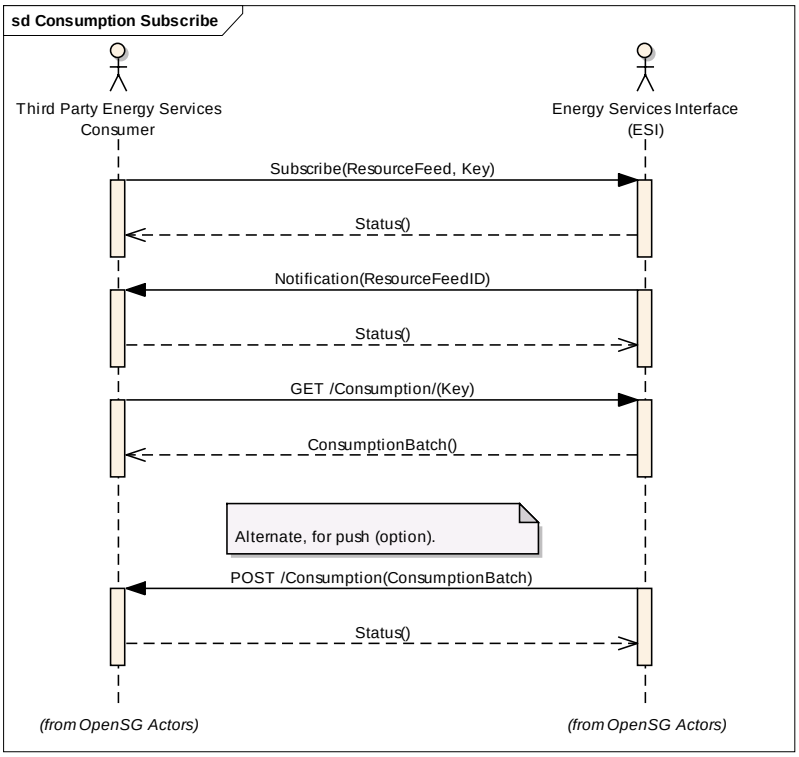


Figure 3: Subscribe Sequence Diagram

10 RESOURCE DEFINITIONS

The following diagram provides an overview of the service resources defined. Of course, the service consumer also has to implement client requests for required interfaces, in order to access the resources provided by the provider. The <Key> shown below may be an access token associated with a specific user, or with a group.

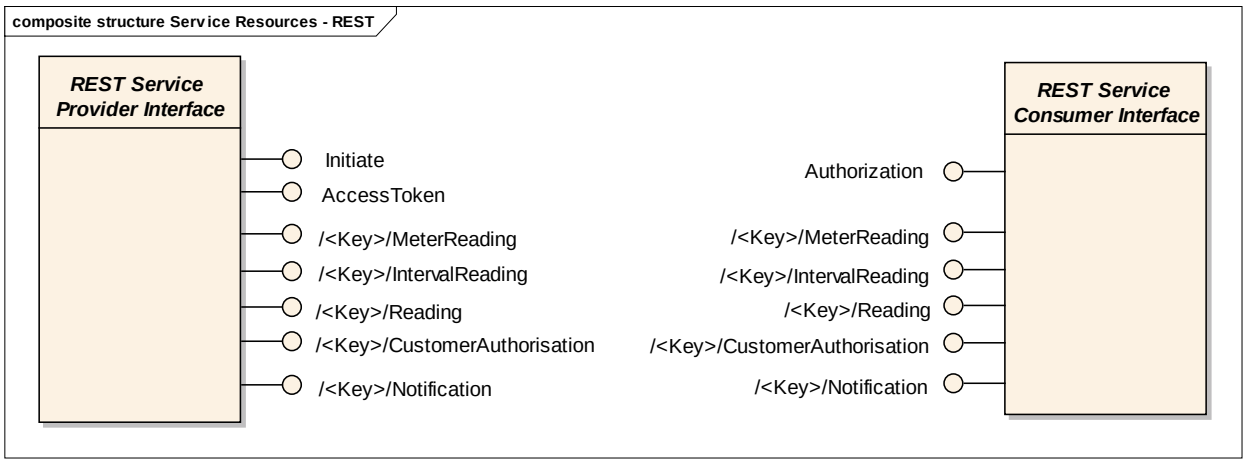


Figure 4: Service Resource Interfaces

359 The following table lists the resources defined for OpenADE.

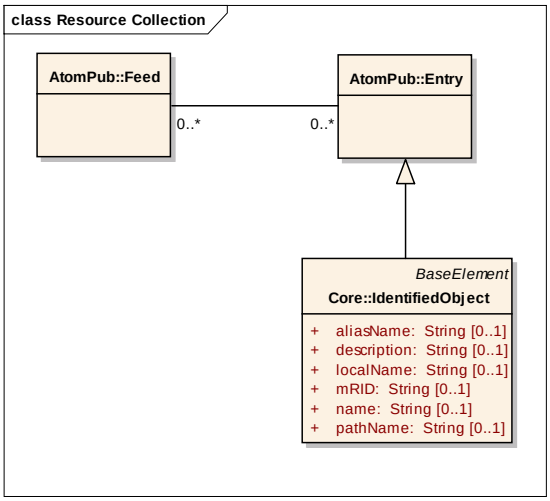
Logical Resource Name	Consumer Operation	Implementer	Description
Resource	GET /rs/Resource	Utility	Get supported service resources and extensions
Meter Reading	GET /rs/<Key>/MeterReading	Utility	Get meter readings – may be interval or instantaneous
IntervalReading	GET /rs/<Key>/IntervalReading	Utility	Get individual interval readings within a MeterReading stream
Reading	GET /rs/<Key>/Reading	Utility	Get meter reading types defining readings units and lengths
CustomerAuthorisation	GET /rs/<Key>/ CustomerAuthorisation	Utility	Get meter reading types defining readings units and lengths
Notification	POST /rs/<Key>/Notification	Both	Get notifications such as user modified authorization

360 Table 1: Resource Operations

361 10.1 RESOURCE DEFINITION

362 All resources with beginning with /rs/ support the patterns in Section 3, returning a (possibly expanded) collection
363 of data resource stream entries. Individual entries can be managed using POST, UPDATE, and DELETE. Permissions
364 may be set according to policy, but guidance is provided regarding the typical configuration in resource details
365 following this table.

366 The UML diagram below shows a proposed method of linking CIM object types to a syndication collection
367 container such as AtomPub.



368

Figure 5: Use of CIM objects within feeds

IdentifiedObject is the top-most generalization (superclass) of most CIM classes. By generalizing this with the feed "Entry" element, all CIM IdentifiedObjects become valid Entry elements. In addition to the use of IdentifiedObject as a specialization of an Entry, CIM classes used as resources shall also have category terms defined for them within service workspace collections, so that entries can use the term element to denote their type and link to schema.

10.2 RESOURCE DETAILS

Many of the resources below are necessary to support initial setup and authorization. Implementations shall conform to referenced specifications for details on these interfaces. Clarifications and refinements made to support these service resources are denoted where necessary.

All resources are to be implemented as collections, with the elements listed in the sections below. Additional allowed values may be specified, and will be included here as necessary.

10.2.1 COLLECTION (FEED)

Collections consist of feeds, and exhibit behavior as defined in [9] AtomPub.

10.2.2 CATEGORY

Categories shall be specified for CIM identifiedObject entry classes using the atom constructs shown in the example below.

```
<?xml version="1.0"?>
<app:categories
    xmlns:app="http://www.w3.org/2007/app"
    xmlns:atom="http://www.w3.org/2005/Atom" fixed="yes"
    scheme="http://http://osgug.ucaiug.org/ns/2010/06/oade">
    <atom:category term="MeterReading"/>
    <atom:category term="Reading"/>
    <atom:category term="IntervalReading"/>
    <atom:category term="ReadingType"/>
    <atom:category term="CustomerAuthorisation"/>
    <atom:category term="ServiceSupplier"/>
    <atom:category term="ServiceDeliveryPoint"/>
</app:categories>
```

10.2.3 RESOURCES

Resource is used to discover service resources available via the addressed endpoint.

Schema	Use	Element
Resource	GET Output	ResourceURI
Resource	GET Output	Name
Resource	GET Output	Version
Resource	GET Output	Categories
Resource	GET Output	Acceptable Types

10.2.4 AUTHORIZATION

This resource is used to post the signed authorization for the associated token to the 3rd Party.

Schema	Use	Element
Authorization	Input	oauth_token
Authorization	Input	oauth_verifier

10.2.5 ACCESS TOKEN

This resource allows the 3rd Party to get the authorized request token. A different key is created for each authorized resource, so in the case of Meter Readings, individual service point channels would have separate keys.

Schema	Use	Element
AccessToken	Output	realm
AccessToken	Output	oauth_consumer_key
AccessToken	Output	oauth_token
AccessToken	Output	oauth_signature_method
AccessToken	Output	oauth_timestamp
AccessToken	Output	oauth_nonce
AccessToken	Output	oauth_verifier
AccessToken	Output	oauth_signature

10.2.6 NOTIFICATION

Notifications are to be used to announce the creation or modification of resources. Based on the design pattern chosen for each information exchange, notification may or may not be required.

Schema	Use	Element
Notification	GET Output	Resource List