ATIS OS-IoT Manual

February 12th, 2018

Iain Sharp,

Principal Technologist, ATIS

Table of Contents

1. Introduction

ATIS OS-IoT is an open source toolkit to simplify the development of IoT clients that are compatible with the oneM2M standard. OS-IoT provides functions to allow clients to implement a oneM2M Application Entity (AE) which can interact with a oneM2M server (CSE). Various open source and proprietary CSEs are available.

The OS-IoT package contains C++ functions and definitions which support the sending and receipt of oneM2M compatible messages. These functions support an API which allows applications to interact with the CSE at the level of oneM2M resource objects. This package can be used as a library to build IoT applications. The package also contains a demo command line application 'osiotcmd which can be used to test CSEs and as a reference to see how to use the library functions.

OS-IoT is implemented using C++11 and is intended to be portable to a wide variety of platforms. During development, the package was tested on a PC/x64 running Ubuntu 16.04 LTS and a Dragonboard DB410c (ARM) running Linaro Debian Stretch.

1.1. Obtaining and Building OS-IoT

The OS-IoT package is available on Git. See the 'download', 'Build and Install' and 'Testing with a CSE' pages at www.os-iot.org

1.2. Dependencies

- CodeSynthesis XSD tree
  (To build from the XSD files requires the full installation of CodeSynthesis XSD tree. If you just want to build from the C++ source files in the package then only the headers from CodeSynthesis XSD are needed).
- Apache XERCES
- Libcurl installed in default include path and default lib path for gcc
- OpenSSL in a version compatible with the linked Libcurl
- Jsoncpp - Amalgamated source files are included in this distribution. This does not need to be installed separately.
- Eidheim Simple Web Server - The header library is included in this distribution. This does not need to be installed separately.
- ASIO stand-alone library - The header library is included in this distribution. This does not need to be installed separately.

1.3. License

See the README file in the package for licensing and contribution information.

1.4. Reference for osiotcmd Application

The OS-IoT package contains an example command line application ('osiotcmd'). The source code demonstrates how to use the library and the application itself may be used for testing purposes.

The application takes options of two types:

- Command options that control the actions of the command, and
- Configuration options that configure settings for the command.

Note that because this application is only created for demo and testing purposes it performs very minimal validation on options. Options with invalid content will lead to undefined results.

1.4.1. Command Options

The options in this section act as commands to instruct the program what functions to perform. Commands may be chained in the same call by adding multiple options in order, e.g.:

```
$ ./osiotcmd -r -c
```

Option	**Name**	**Effect**
-c	Create	Creates: - An AE named 'MY_SENSOR' at <base addr> - A container named 'DESCRIPTOR' at <base addr>/MY_SENSOR - A contentInstance at <base addr>/MY_SENSOR/DESCRIPTOR
-d	Delete	Delete the resource at <base addr>/MY_SENSOR
-u	Update	Update the resource at <base addr>/MY_SENSOR
-s	Subscribe	Create a subscription named 'MY_SUBSCRIPTION' at <base addr>/MY_SENSOR/DESCRIPTOR Uses the POA in the AE resource as the notification destination.
-su	Subscribe with explicit URL	As above, but includes a URL directly in the subscription resource
-p	PollingChannel	Create a PollingChannel named 'MY_POLLING_CHANNEL' at <base addr>/MY_SENSOR
--acp	AccessControlPolicy	Create an AccessControlPolicy named 'MY_ACP' at <base addr>/MY_SENSOR
-r	Retrieve	Retrieve the resource at <base addr>
-ci	ContentInstance	Creates a contentInstance at <base addr>/MY_SENSOR/DESCRIPTOR

Option	Name	Effect
-l	Listen on polling channel	Poll a polling channel at: <base addr>/MY_SENSOR/ MY_POLLING_CHANNEL/pcu **NOTE:** Currently this is a blocking, never-ending polling option which will require the operation to be force-quit, e.g. with ^c or 'kill -9' **NOTE:** In the current version, the response from the polling channel is displayed if debug is enabled, but not decoded.
-L	Listen on HTTP Server	Will setup an HTTP server listening on port 18888, on any address with root /om2m, for notification requests. This server will be in a new thread from the main program. If the main program terminates the server thread will also terminate. Use with '-W' to force the server to stay open. e.g. `$ ./osiotcmd -L -W` will create a server to listen and then wait for server activity.
-W	Wait	Stops further execution of the program except for the HTTP server, if it is running. Any commands after -W are not processed. NOTE: This will create a never-ending wait-loop which will require the operation to be force-quit, e.g. with ^c or 'kill -9'

1.4.2. Configuration Options

The following options can change the configuration of the program. Where an option takes a value it should follow the option, e.g.

```
$ ./osiotcmd -h 127.0.0.1:9999 -x
```

Option	Effect	Default Value
-h	Host name – sets the host name and port to use	127.0.0.1:8080
-a	Address – sets the <base addr>	/in-cse/in-name

-f	From – sets the 'From' parameter	admin:admin
-x	Encode as XML	
-j	Encode as JSON	Default protocol is JSON
-q	Quiet: suppress debug output	Debug output is on
--https	Use certificate based HTTPS Note that security parameters should be specified if this option is used.	Off (use HTTP)
--httpsPsk	Use PSK based HTTPS As a side effect, this option will set the cipherList to "PSK". Note that security parameters should be specified if this option is used.	Off (use HTTP)
--noVerifyPeer	Use in conjunction with –https. Disable verification of the server's certificate	Peer verify On
--noVerifyHost	Use in conjunction with --https. Disable verification that the server's identify in its certificate matches the address used to contact it.	Host verify On
--caPath	Use in conjunction with –https. Specify path to the CA directory	None
--caInfo	Use in conjunction with –https. Specify CA file	None
--sslCert	Use in conjunction with –https. Specify file to use as client certificate	None
--sslKey	Use in conjunction with –https. Specify file containing the key for the client certificate.	None
--sslPasswd	Use in conjunction with –https. Specify password used to decode the file specified in –sslKey	None
--subjectANA	Use in conjunction with –https. Specify the allowed value for the server's subjectAltName	None

--cipherList	Use in conjection with –https and –httpsPsk Specify the list of allowed ciphers (in openSSL format). For example, to use the oneM2M TS0003 specified certificate cipher set to "ECDHE-ECDSA-AES128-SHA256". The ciphers specified should be compatible with the transport mode specified (certificate based Vs PSK security). If PSK security is to be used this must be set to "PSK" or a list of PSK ciphers. If –httpsPsk option is used this will overwrite any previously set value of the cipherList to "PSK".	Default openSSL ciphers or "PSK" if –httpsPsk was previously specified.
--pskIdentity	Use in conjunction with –httpsPsk Specify the PSK identity	None
--pskKey	Use in conjunction with –httpsPsk Specify the PSK key as a hex string. To use an ASCII string use --pskKeyAscii	None
--pskKeyAscii	Use in conjunction with –httpsPsk Specify the PSK key as an ASCII string. To use a hex string use --pskKey	None
--passResCodes	Comma separated list of OS-IoT Result codes that are "pass" results during a test. If the results of all operations are contained in this list then the command will return 0, else it will return non-zero Primarily useful as part of automated test scripts.	200,201,202
--printTestRes	Include to print "### TEST PASS ###" or "=== TEST FAIL ===" based on match of passResCode on termination.	Off
--poaPort	Set the port number to use for the HTTP notification server. Used for -c, --su and -L commands.	18888
--poaAddr	Sets the host name or IP address to indicate to the CSE as the Point of Access to send notifications to the client. Used for -c and –su commands.	localhost

2. Technical Feature Overview

2.1. Supported Features

OS-IoT supports oneM2M compliant AE implementations including the following features:

- HTTP network transport
- PSK or Certificate based HTTPS transport when acting as an HTTP client
- XML or JSON serialization
- AE, CSE-Base, Container, Content Instance, Subscription, Polling Channel and Access Control Policy resources
- Create/Update/Retrieve/Delete operations for resources on a remote CSE for the supported resource types
- Request Reachable support for subscriptions including use of an HTTP server on the AE

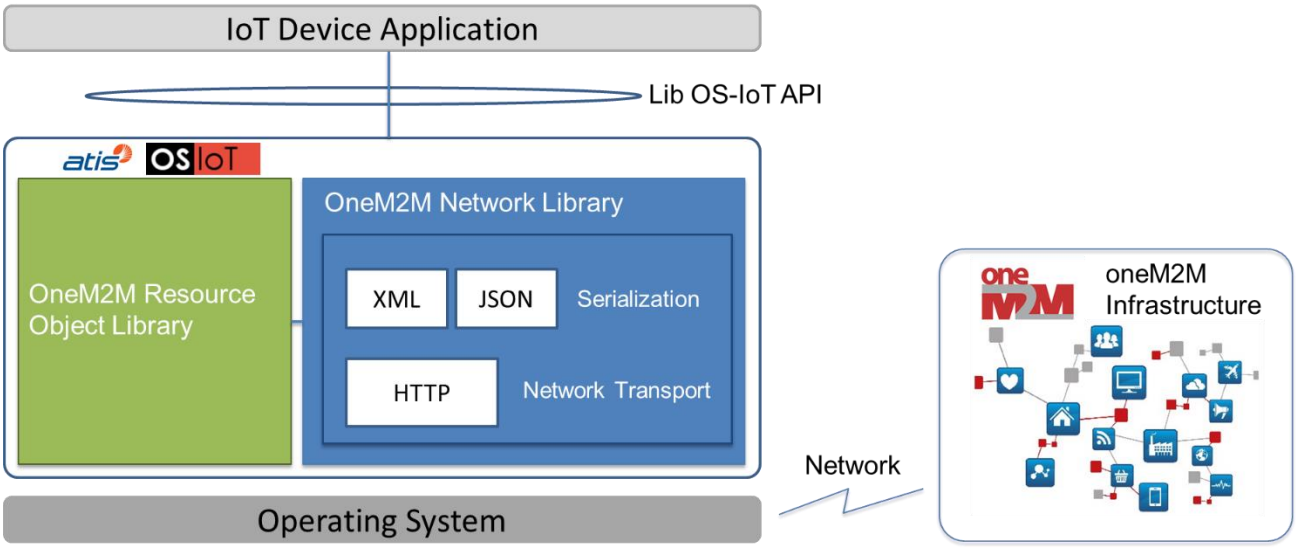
For details of the features supported please see subsequent sections.

2.2. Conceptual Model

The figure below shows a high-level view of the OS-IoT library. The library is intended to run on an IoT device and provide the embedded application with a simple method of reading and writing resources on a oneM2M compliant CSE.

The library contains two main aspects:

- A resource object library of oneM2M compliant resources instantiated as C++ objects
- Network communication procedures to allow these resources to be written to and read from a CSE.



Simplified Model of the OS-IoT Library

A developer who wishes to program a oneM2M compatible client device can link the library as part of their application. The application can then perform actions such as creating a local oneM2M resource to represent the data that it wishes to write to the network and then using the network library to send this to a local CSE. For details on the library API please see subsequent sections.

3. API Specification

The formal specification of the programming API for the library is available at:

http://os-iot.org/apireference/

3.1. Network Function API

The API for network functions consists of functions defined in the onem2m namespace. See “Library Usage” at the above link or the example applications to see how to use them.

3.2. Resource Object Library API

The resource object library API is a set of C++ headers and class implementations automatically generated from oneM2M standard XSD files using Codesynthesis XSD Tree. The API specification available at the link above defines the usage. Further information which may be useful may be obtained from:

- The C++ header files contained in the project’s ‘cdt’ directory
- The modified oneM2M XSD files contained in the same project directory
- The Codesynthesis XSD Tree documentation, in particular the “C++/Tree Mapping User Manual”

For the key oneM2M objects and parameters inspection of the example application included in the package should illustrate how to create and read the most important fields from objects.

Note that the object naming in the API follows the “long names” defined by oneM2M. The long names are automatically mapped to and from the corresponding short names as part of the serialization functions of the library.

3.2.1. General Guidance

When manipulating oneM2M resource objects please keep the following points in mind:

- The OS-IoT library does not enforce presence of mandatory parameters in objects or ensure that objects comply to restrictions like ranges or naming conventions specified by oneM2M.
- When an object is to be sent, it is the responsibility of the application to ensure that the object is populated with all parameters that are mandatory, according to the onem2M specifications, in that context. For example, when creating an AE object, the application should ensure that the “requestReachable” parameter is set appropriately.
- When objects are received the OS-IoT library will map all supported parameters that it can interpret according to the correct type to the resource object passed to the application. All parameters (and sub parameters) in this object are treated as optional, regardless of their status in the oneM2M standard. Applications should check received objects according to their particular requirements. Note that the objects in the API encode attributes differently depending on their optionality and multiplicity. This is explained in the API specification. Make sure you use the appropriate access method for the parameter and check for presence of optional parameters before attempting to read them. Failure to do this will cause memory errors if parameters are not present.

3.3. Threading

Except for the HTTP server (see below), all OS-IoT procedures run in the same thread as the calling code. All procedures are blocking until a result is returned or they time-out. The OS-IoT library does not support multithreaded operation.

The HTTP server used to support listening for notifications runs in its own thread which is created and managed by the OS-IoT library.

3.4. Error and Exception Handling

OS-IoT attempts to avoid generating errors based on received data by interpreting as much data as it can understand and silently ignoring data that is not supported or not compliant to oneM2M standards. In normal operation, OS-IoT should not throw exceptions.

In error situations OS-IoT does not attempt to perform error recovery itself. Exceptions thrown by the library or by its dependencies are not handled in the library and will be passed back to the calling application. Applications should define their own error processing procedures.

A different exception handling behaviour is applied for the HTTP server thread. Exceptions that occur during the establishment of the HTTP server are reported in the result of the startHttpServer() function. Exceptions that occur after this are caught (and should be logged to std::out) by the OS-IoT library and execution of the server thread stopped without the exception being rethrown. The calling application can check the status of the HTTP server thread using the getHttpServerRunning() function.

Correct handling of errors, particularly those caused by receipt of malicious data, is important to protect the security of networked IoT devices. Application designers are recommended to give careful attention to the design and testing of this aspect.

4. Protocol Compliance Statement

This section shows the level of support for oneM2M protocol elements in OS-IoT. It first shows the general parameters of the Request Primitive and Response Primitive. It then shows the support for protocol fields in the contents of the Request Primitive and Response Primitive.

4.1. Request Primitive

Request operations are sent by OS-IoT. The following table shows the status of parameters.

Primitive Parameter	Multiplicity	Support in HTTP Transport	Note
Operation	1	Supported	
To	1	Supported	Treated as oneM2M address
From	0..1	Supported	
Request Identifier	1	Supported	
Resource Type	0..1	Supported	Must match resource contained in Content
Content	0..1	Supported	See section 3 for details
Role IDs	0..1	Not supported	
Originating Timestamp	0..1	Not supported	
Request Expiration Timestamp	0..1	Not supported	
Result Expiration Timestamp	0..1	Not supported	
Operation Execution Time	0..1	Not supported	
Response Type	0..1	Not supported	
Result Persistence	0..1	Not supported	
Result Content	0..1	Not supported	
Event Category	0..1	Not supported	
Delivery Aggregation	0..1	Not supported	
Group Request Identifier	0..1	Not supported	

Primitive Parameter	Multiplicity	Support in HTTP Transport	Note
Filter Criteria	0..1	Not supported	
Discovery Result Type	0..1	Not supported	
Tokens	0..1	Not supported	
Token IDs	0..1	Not supported	
LocalTokenIDs	0..1	Not supported	
Token Request Indicator	0..1	Not supported	
Group Request Target Members	0..1	Not supported	
Authorization Signature Indicator	0..1	Not supported	
Authorization Signatures	0..1	Not supported	
Authorization Relationship Indicator	0..1	Not supported	

4.2. Primitive Response

Primitive responses are received by OS-IoT. The following table shows the status of support.

Primitive Parameter	Multiplicity	Support in HTTP Transport	Note
Response Status Code	1	Supported	Response code is handled at the level of the HTTP response code. The X-M2M-RSC header is not supported.
Request Identifier	1	Ignored	
Content	0..1	Supported	See section 4 for details

Primitive Parameter	Multiplicity	Support in HTTP Transport	Note
To	0..1	Ignored	
From	0..1	Ignored	
Originating Timestamp	0..1	Ignored	
Result Expiration Timestamp	0..1	Ignored	
Event Category	0..1	Ignored	
Content Status	0..1	Ignored	
Content Offset	0..1	Ignored	
Assigned Token Identifiers	0..1	Ignored	
Token Request Information	0..1	Ignored	
Authorization Signature Request Information	0..1	Ignored	

4.3. Resources in Request Primitive Content

The following resources are supported by OS-IoT when sending a Request Primitive.

"Not tested" means that it is possible that the correct serialization may be generated but that this hasn't been tested and support should not be assumed.

4.3.1. Universal/Common Attributes

Attribute Name	Request Optionality		Support in XML	Support in JSON
	Create	Update		
@resourceName	O	NP	Supported	Supported
resourceType	NP	NP		
resourceID	NP	NP		
parentID	NP	NP		
accessControlPolicyIDs	O	O	Supported	Supported

Attribute Name	Request Optionality		Support in XML	Support in JSON
	Create	Update		
creationTime	NP	NP		
expirationTime	O	O	Not tested	Not tested
lastModifiedTime	NP	NP		
labels	O	O	Supported	Supported
announceTo	O	O	Not tested	Not tested
announcedAttribute	O	O	Not tested	Not tested
dynamicAuthorizationConsultationIDs	O	O	Not tested	Not tested

4.3.2. AE

Resource Specific attributes

Attribute Name	Request Optionality		Support in XML	Support in JSON
	Create	Update		
appName	O	O	Not tested	Not tested
App-ID	M	NP	Supported	Supported
AE-ID	NP	NP		
pointOfAccess	O	O	Supported	Supported
ontologyRef	O	O	Not tested	Not tested
nodeLink	O	O	Not tested	Not tested
requestReachability	M	O	Supported	Supported
contentSerialization	O	O	Supported (Note 1)	Supported (Note 1)
e2eSecInfo	O	O	Not tested	Not tested

Note 1: The contentSerialization paremter is supported by OS-IoT. However, support for this parameter seems to be inconsistent on servers. IoTDM appears to reject values specified by current versions of the oneM2M specifications. Eclipse OM2M seems to ignore the parameter.

4.3.3. Container

Resource Specific attributes

Attribute Name	Request Optionality		Support in XML	Support in JSON
	Create	Update		
maxNrOfInstances	O	O	Not tested	Not tested
maxByteSize	O	O	Not tested	Not tested
maxInstanceAge	O	O	Not tested	Not tested
currentNrOfInstances	NP	NP		
currentByteSize	NP	NP		
locationID	O	O	Not tested	Not tested
ontologyRef	O	O	Not tested	Not tested
disableRetrieval	O	NP	Not tested	Not tested

4.3.4. Content Instance

Resource Specific attributes

Attribute Name	Request Optionality	Support in XML	Support in JSON
	Create		
contentInfo	O	Supported	Supported
contentSize	NP		
contentRef	O	Not tested	Not tested
ontologyRef	O	Not tested	Not tested
content	M	Supported (treated as type xs:string)	Supported (treated as string)

4.3.4. Subscription

Resource Specific Attributes

Attribute Name	Request Optionality		Support in XML	Support in JSON
	Create	Update		
eventNotificationCriteria	O	O	Supported (Note 1)	Supported (Note 1)
expirationCounter	O	O	Supported	Supported
notificationURI	M	O	Supported	Supported
groupID	O	O	Not tested	Not tested
notificationForwardingURI	O	O	Not tested	Not tested
batchNotify	O	O	Not supported	Not supported
rateLimit	O	O	Not supported	Not supported
preSubscriptionNotify	O	NP	Not supported	Not supported
pendingNotification	O	O	Not supported	Not supported
notificationStoragePriority	O	O	Not supported	Not supported
latestNotify	O	O	Not tested	Not tested
notificationContentType	O	O	Not supported	Not supported
notificationEventCat	O	O	Not supported	Not supported
subscriberURI	O	NP	Not supported	Not supported

NOTE 1: For the eventNotificationCriteria only the 'notificationEventType' parameter is supported.

4.3.5. Polling Channel

Note: Polling Channel is not supported by IoTDM at the time of writing.

4.3.6. Access Control Policy

The following tables indicate the supported attributes.

Attribute Name	Support in XML	Support in JSON
Privileges	Supported	Supported
selfPrivileges	Supported	Supported

The following table shows the support of the object m2m:accessControlRule.

Attribute Name	Support in XML	Support in JSON
accessControlOriginators	Supported	Supported
accessControlOperations	Supported	Supported
accessControlContexts	Supported (Note 1)	Supported (Note 1)
accessControlContexts/accessControlWindow	Supported	Supported
accessControlContexts/accessControlIpAddresses	Supported	Supported
accessControlContexts/accessControlIpAddresses/ipv4Addresses	Supported	Supported
accessControlContexts/accessControlIpAddresses/ipv6Addresses	Supported	Supported
accessControlContexts/accessControlLocationRegions	Supported (Note 2)	Supported (Note 2)
accessControlAuthenticationFlag	Supported (Note 1)	Supported (Note 1)
accessControlObjectDetails	Not supported	Not supported
accessControlObjectDetails/resourceType	Not supported	Not supported
accessControlObjectDetails/specializationID	Not supported	Not supported
accessControlObjectDetails/childResourceType	Not supported	Not supported

Note 1: Support for these attributes is inconsistent in CSEs. For maximum compatibility with different CSEs it is recommended that they are not populated in request messages.

Note 2: Only supported at the level of a list of countries.

4.4. Resources in Response Primitive Content

The following resources are supported by OS-IoT when receiving a Response Primitive.

"Not tested" means that it is possible that the correct output may be generated but that this hasn't been tested and support should not be assumed. In general, "not tested" parameters will be ignored, but this is not guaranteed behaviour.

"Not tested*" means that support is included in the code, but the correct mapping has not, yet, been verified.

4.4.1. Universal/Common Attributes

Attribute Name	Support in XML	Support in JSON
@resourceName	Supported	Supported
resourceType	Supported	Supported
resourceID	Supported	Supported
parentID	Supported	Not tested*

Attribute Name	Support in XML	Support in JSON
accessControlPolicyIDs	Supported	Supported
creationTime	Supported	Not tested*
expirationTime	Supported	Not tested*
lastModifiedTime	Supported	Not tested*
labels	Supported	Supported
announceTo	Not tested	Ignored
announcedAttribute	Not tested	Ignored
dynamicAuthorizationConsultationIDs	Not tested	Ignored

4.4.2. AE

Resource Specific attributes

Attribute Name	Support in XML	Support in JSON
appName	Not tested	Ignored
App-ID	Supported	Ignored
AE-ID	Supported	Supported
pointOfAccess	Not tested	Ignored
ontologyRef	Not tested	Ignored
nodeLink	Not tested	Ignored
requestReachability	Not tested	Supported
contentSerialization	Not tested	Ignored
e2eSecInfo	Not tested	Ignored

4.4.3. Container

Resource Specific attributes

Attribute Name	Support in XML	Support in JSON
maxNrOfInstances	Not tested	Ignored
maxByteSize	Not tested	Ignored
maxInstanceAge	Not tested	Ignored
currentNrOfInstances	Not tested	Ignored
currentByteSize	Not tested	Ignored
locationID	Not tested	Ignored
ontologyRef	Not tested	Ignored
disableRetrieval	Not tested	Ignored
stateTag	Supported	Not tested*

4.4.4. Content Instance

Resource Specific attributes

Attribute Name	Support in XML	Support in JSON
contentInfo	Supported	Not tested*
contentSize	Supported	Not tested*
contentRef	Not tested	Ignored
ontologyRef	Not tested	Ignored
content	Supported (treated as type xs:string)	Supported (treated as string)

Attribute Name	Support in XML	Support in JSON
stateTag	Not tested	Ignored

4.4.5. CSE Base

Data Type	Attribute Name	Support in XML	Support in JSON
m2m:cseTypeID	*cseType*	Not tested	Ignored
m2m:ID	*CSE-ID*	Not tested	Ignored
list of m2m:resourceType	*supportedResourceType*	Supported	Supported
m2m:poaList	*pointOfAccess*	Not tested	Ignored
xs:anyURI	*nodeLink*	Not tested	Ignored
list of xs:anyURI	*dynamicAuthorizationConsultationIDs*	Not tested	Ignored
m2m:e2eSecInfo	*e2eSecInfo*	Not tested	Ignored

4.4.6. Subscription

Resource Specific Attributes

Attribute Name	Support in XML	Support in JSON
eventNotificationCriteria	Not tested	Ignored
expirationCounter	Not tested	Ignored
notificationURI	Not tested	Ignored
groupID	Not tested	Ignored
notificationForwardingURI	Not tested	Ignored
batchNotify	Not supported	Ignored

rateLimit	Not supported	Ignored
preSubscriptionNotify	Not supported	Ignored
pendingNotification	Not supported	Ignored
notificationStoragePriority	Not supported	Ignored
latestNotify	Not tested	Ignored
notificationContentType	Not supported	Ignored
notificationEventCat	Not supported	Ignored
subscriberURI	Not supported	Ignored

4.4.7. Polling Channel

No Resource Specific Attributes

4.4.8. AccessControlPolicy

The following tables indicate the supported attributes.

Attribute Name	Support in XML	Support in JSON
Privileges	Supported	Supported
selfPrivileges	Supported	Supported

The following table shows the support of the object m2m:accessControlRule.

Attribute Name	Support in XML	Support in JSON
accessControlOriginators	Supported	Supported
accessControlOperations	Supported	Supported
accessControlContexts	Not tested	Ignored
accessControlContexts/accessControlWindow	Not tested	Ignored
accessControlContexts/accessControlIpAddresses	Not tested	Ignored
accessControlContexts/accessControlIpAddresses/ipv4Addresses	Not tested	Ignored
accessControlContexts/accessControlIpAddresses/ipv6Addresses	Not tested	Ignored
accessControlContexts/accessControlLocationRegions	Not tested	Ignored
accessControlAuthenticationFlag	Not tested	Ignored
accessControlObjectDetails	Not supported	Ignored
accessControlObjectDetails/resourceType	Not supported	Ignored
accessControlObjectDetails/specializationID	Not supported	Ignored
accessControlObjectDetails/childResourceType	Not supported	Ignored

4.5. Notification

The following table shows parameter support for receipt of notification primitives.

Aggregated notifications are not supported.

Parameter	Support in XML	Support in JSON
notificationEvent	Supported	Supported
representation	Supported for object type contentInstance only	Supported
operationMonitor	Not tested	Ignored
notificationEventType	Supported	Supported
verificationRequest	Supported	Supported
subscriptionDeletion	Supported	Supported
subscriptionReference	Supported	Supported
creator	Not tested	Ignored
notificationForwardingURI	Not tested	Ignored
IPEDDiscoveryResult	Not supported	Ignored

4.6. listOfURIs

This listOfURIs object can be sent in the response to a discovery request. This is supported for both XML and JSON.

Appendix A – Additional References

Architecture Presentation

An overview presentation of the library architecture is available here:

http://access.atis.org/apps/org/workgroup/os-iot/download.php/35503/latest

Appendix B – Compatibility Notes with CSE Implementations

B.1. Eclipse OM2M

The following areas limit compatibility with OS-IoT:

- In the notification primitive, OM2M sends a parameter tagged “rss” as part of the notificationEvent (“nev”) structure. This tag is not defined in oneM2M. It may be an alternative encoding of the notificationEventType (“net”).
- If the parameter org.eclipse.om2m.notification.mmt is set to “application/json” to configure OM2M to send notifications encoded in JSON format (see OM2M bug ID 507443) then OM2M will encode the notification in JSON, but may not use the correct value of the “Content-Type” header. In testing, the verification event was sent with the correct Content-Type, but a notification for due to a subscription was sent with Content-Type = application/xml. To work around this, keep the default (XML) setting for org.eclipse.om2m.notification.mmt.
- PollingChannel functionality is not supported. Though a pollingChannel resource can be created, an attempt to send a GET operation to the pollingChannelURI creates an error.

Further areas to note are:

- The default ‘admin:admin’ logon in the From Parameter does not conform to the requirements of TS0001. OS-IoT does not enforce conformance to TS0001 and permits the use of this parameter.
- The parameter “contentSerialization” in the AE resource seems to be ignored – rather the serialization for notifications is based on a local configuration (see OM2M bug ID 507443).
- When creating a pollingChannel resource an ACPI is added to the resource even though this is not defined as part of the pollingChannel resource in the oneM2M specifications (see TS0001 s9.6.21). Also, a parameter tagged ‘pcu’ (pollingChannelURI perhaps) is added to the response. This parameter is not defined in oneM2M specifications. OS-IoT ignores these additional parameters.

B.2. IoTDM

The following areas limit compatibility with OS-IoT:

- PollingChannel resource type is not supported
- Notifications are sent without the notification (“sgn”) JSON tag which should be included. This tag must be inferred by the receiver. The Content-Type header is “application/vnd.onem2m-ntfy+json”. **NOTE:** OS-IoT includes a work-around for this case – if the first attempt to decode the notification according to oneM2M specifications fails, and if the Content-Type matches the value used by IoTDM then the missing tag will be inserted and a second attempt to decode the notification will be performed.

- The parameter contentSerialization in the AE resource does not support the values specified by oneM2M. The values supported are the strings “json” and “xml” (case insensitive). See IoTDM bug 9002. By default IoTDM will use JSON.

B.3. Ocean IoT Mobius V2.0.0

- Notifications to the AE PoA in the AE resource are not supported. The AE must specify a URL in the individual Subscription resource.

B.4 Interdigital oneMPOWER

- Some versions only accept result code 201 (one2mHttpCREATED) and not 200 (onem2mHttpOK) as a successful acknowledgement of a notification validation operation.
- AccessControlContexts (acco) is only supported if sent as a single object in JSON. The XSD defines this as having multiplicity therefore the correct JSON encoding (used by OS-IoT) is an array containing one or more objects. Do not populate the AccessControlContext if sending an AccessControlPolicy to oneMPOWER. Even for an acco encoded how oneMPOWER expects, populating an accessControlLocationRegion or an accessControlAuthenticationFlag in an accessControlPolicy can generate an error.
- In a JSON encoded notification request the “representation” (rep) element may be sent as a string containing a JSON object rather than as a JSON object directly. The OS-IoT library accepts both encodings.

Appendix C – Resource Support Reported by Tested CSEs

Performing a GET on the CSE generates a list of supported resource types. The following table shows the resource types self-reported as supported by the CSEs listed.

ID	Resource Name	OM2M V1.0.0	IoTDM Carbon	oneMPower	Mobius V2.0.0 Commit 35405b1
1	accessControlPolicy	Yes	Yes	Yes	Yes
2	AE	Yes	Yes	Yes	Yes
3	container	Yes	Yes	Yes	Yes
4	contentInstance	Yes	Yes	Yes	Yes
5	CSEBase	Yes	Yes	Yes	
6	delivery				
7	eventConfig			Yes	
8	execInstance				
9	group	Yes	Yes	Yes	Yes
10	locationPolicy				Yes
11	m2mServiceSubscriptionProfile			Yes	
12	mgmtCmd			Yes	
13	mgmtObj			Yes	
14	node	Yes	Yes	Yes	
15	pollingChannel	Yes		Yes	
16	remoteCSE	Yes		Yes	Yes
17	request	Yes		Yes	Yes
18	schedule			Yes	
19	serviceSubscribedAppRule			Yes	
20	serviceSubscribedNode			Yes	
21	statsCollect			Yes	
22	statsConfig				
23	subscription	Yes	Yes	Yes	Yes

ID	Resource Name	OM2M V1.0.0	IoTDM Carbon	oneMPower	Mobius V2.0.0 Commit 35405b1
24	semanticDescriptor			Yes	Yes
25	notificationTargetMgmtPolicyRef				
26	notificationTargetPolicy				
27	policyDeletionRules				
28	flexContainer			Yes	
29	timeSeries				Yes
30	timeSeriesInstance				Yes
31	role				
32	token				
33	trafficPattern				
34	dynamicAuthorizationConsultation				
10001	accessControlPolicyAnnc			Yes	
10002	AEAnnc			Yes	
10003	containerAnnc			Yes	
10004	contentInstanceAnnc			Yes	
10009	groupAnnc			Yes	
10010	locationPolicyAnnc				
10013	mgmtObjAnnc			Yes	
10014	nodeAnnc			Yes	
10016	remoteCSEAnnc			Yes	
10018	scheduleAnnc			Yes	
10024	semanticDescriptorAnnc				
10028	flexContainerAnnc				
10029	timeSeriesAnnc				
10030	timeSeriesInstanceAnnc				

ID	Resource Name	OM2M V1.0.0	IoTDM Carbon	oneMPower	Mobius V2.0.0 Commit 35405b1
10033	trafficPatternAnnc				
10034	dynamicAuthorizationConsultationAnnc				
	Additional (proprietory?)			2100	