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REST APIs for Mobius-Yellow Turtle Release2 V1.0.0

APIs Guide document v1.0.0

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Update History

Version Number	Update Date	Note
V1.0.0	July 07 2017	Comply to oneM2M Release 2

1. Mobius OPEN REST APIs

1.1. REST APIs

This user manual provides guide for users who use REST APIs of Mobius Yellow Turtle (short for Mobius) IoT server platform for their own purposes.

The Mobius REST APIs is used to upload data generated by embedded IoT devices to Mobius platform as well as data retrieve services. The Mobius REST APIs are developed for handling CRUDN (Create, Retrieve, Update, Delete and Notification) operations for oneM2M resources specified in oneM2M standard.

The Mobius REST APIs cover guide for functionalities of devices(AE) registration, data management for the registered AE, device management, resources CRUD management, subscription/notification, data and device discovery etc. The current APIs will be maintained to reflect updates to existing and new oneM2M Common Service Functions (CSFs) functionalities in oneM2M Release1.

The Mobius REST APIs are initially developed for supporting HTTP and MQTT protocol binding. In current user manual, we only provide guide for HTTP protocol binding as an example while guide for MQTT protocol binding will be provided in the future. oneM2M standard is specified to use short name to represent oneM2M resource and attribute primitives while protocol-dependent message transported on wire can be represented in serializations such as XML, JSON or CBOR etc.

In previous version of Mobius user manual, we use XML as content type of HTTP body while in current version of Mobius user manual, we prefer to use JSON serialization for HTTP message representations.

For more preferences, please go to clause 2.2.1.

1.2. Common HTTP Header Field Settings

A group of HTTP headers are defined in oneM2M HTTP binding specification with specific field value. These headers are specified to be used in HTTP requests for CRUD operations as following:

- X-M2M-Origin: The `X-M2M-Origin` header is mapped to the field value of ***From*** attribute of request and response primitive and vice versa, if applicable, and it is assigned by the Originator of the request (e.g. AE or CSE), that is, assigned with the entity ID (AE-ID or CSE-ID) of http request originator. In case that AE has no assigned entity ID before registration, a temporary* field value is used to send HTTP requests, and once the entity is registered successfully to Mobius, the entity will receive a formal entity ID which is used for request originator authentication for accessing specific resources following defined access control rules.

  The format of entity ID is specified in oneM2M standard in the way as following:

  - In CSE case, the entity ID i.e. SP-relative CSE-ID starts with a slash '/' while
  - In AE case, the entity ID i.e. AE-ID staring with an uppercase letter 'S' or 'C' and followed by any combination of number and English letters, indicating the entity ID is assigned by service-provider or CSE, respectively.

  Examples:

#AE registration case:
```
X-M2M-Origin: S
X-M2M-Origin;: S0.2.481.1.1.232466
X-M2M-Origin: S20170705065326333aZtE
X-M2M-Origin: C
X-M2M-Origin: C0.2.481.1.1.232466
```

#CSE registration case:
```
X-M2M-Origin: /4akkeakjdfq423
X-M2M-Origin: S6dkr308jtls
```

- X-M2M-RI: The M2M-Request-ID tracks a request initiated by an AE over the Mca reference point, or a CSE over the Mcc reference point, if applicable, end to end. It is also included in the response to indicate the corresponding request. A unique value has to be set to X-M2M-RI header.
  Examples:
  `X-M2M-RI: req12345`

- Accept: The Originator may use the Accept header to indicate in which media type (i.e. content type parameter) the originator prefers to receive the response. The latest version of Mobius supports both XML and JSON content type.
  Examples:
  `Accept: application/xml`
  `Accept: application/json`

- Content-Type: Any HTTP request or response containing message-body has to include *Content-type* header which has to be set to either "`application/xml`", "`application/json`", "`application/vnd.onem2m-res+xml`", or "`application/vnd.onem2m-res+json`".

  The Hosting CSE will send response body message which is represented in media type specified in the Content-Type header field included in the request message if any. The Content-Type header has to be included both in Create and Update of HTTP request.

The Resource-Type (short for *rt*) primitive parameter is only present in Create request and the value of Resource-Type has to be appended to the Content-type header value of the corresponding request message in the form `ty=RESOURCE-TYPE_VALUE`, separated by a semicolon character (`;`). A valid Content-Type header in this case looks e.g. as follows:

Examples:
For AE Create request case: `Content-Type: application/vnd.onem2m-res+xml; ty=2`
For Container Create request case: `Content-Type: application/vnd.onem2m-res+xml; ty=3`
For any resource Update request case: `Content-Type: application/vnd.onem2m-res+xml`

1.3. oneM2M Data Types Reference

Table 1.3-1 oneM2M Simple Data Types

XSD type name	Type Name	Examples	Description
m2m:ID	Generic ID	//globalm2m.org	Used to represent generic IDs generated and used within oneM2M (M2M-SP-ID)
		//globalm2m.org/C190XX7T	(CSE-ID)
		//globalm2m.org/CSE1/123A38ZZY	(AE-ID)
m2m:nodeID	Node ID	urn:gsma:imei:90420156-025763-0;svn=42	Used for Node IDs. The constraints on this type are different from those on Generic IDs (IMEI as node ID)
m2m:deviceID	Device ID	urn:dev:ops:012345-Set%2DTop%2DBox-0123456789	A Device ID identifies a device using a Universally Unique IDentifier (UUID). A valid hex digit character string of UUID and the format of the URN is one of OPS URN, OS URN, IMEI URN, ESN URN, or MEID URN.
m2m:externalID	M2M-EXT-ID	u rn:gsma:imei:90420156-025763-0;vers=0	The External Identifier allows the Underlying Network to identify the M2M Device (e.g. ASN, MN) associated with the CSE-ID.In 3GPP case, the accessID is mapped to External Identifier as specified in TS 23.003.
m2m:requestID	Request ID	ab3f124a, CSE1/98821	Used for Request IDs. This type may include the ID of the target CSE as well as a part that varies for each ID
m2m:nhURI	Non Hierarchical Identifier	/CSE090112/C190XX7T	Used where a resourceID is required to be non-hierarchical
m2m:acpType	List of ACP Resource IDs	//IN-CSEID.m2m.myoperator.org/93405	Used to represent a list of AccessControlPolicy identifiers.
m2m:labels	list of xs:token	printers networkwifi1 home_energy	A list of tokens used as keys for discovering resources (searching wifi connected printer from vendor 1)
m2m:triggerRecipientID	Trigger Recipient Identifier	3010	Used when device triggering services are requested from the Underlying Network, to identify an instance of an ASN/MN-CSE on an execution environment, to which the trigger is routed. Defined as port number in the range 0 to 65535.
m2m:listOfM2MID	List of M2M identifiers		xs:list of elements of data type m2m:ID
m2m:listOfMinMax	List of Time Limits	10 2560	xs:list of two xs:long values defining min and max limits of time intervals in units of milliseconds (value -1 representing infinite time)
m2m:backOffParameters	List of Backoff Parameters	100 100 2000	Ordered sequence of 3 values of data type xs:nonNegativeInteger representing backoffTime, backoffTimeIncrement, maximumBackoffTime (in units of milliseconds)
m2m:ipv4	IPv4 address string with optional CIDR suffix	10.125.0.0/16,122.77.12.1	Used in m2m:accessControlRules
m2m:ipv6	IPv6 address string with optional CIDR suffix	::/0, Fadf:ddd0::/32, abcd:ffff:abb0:aaaa::/64	Used in m2m:accessControlRules
m2m:countryCode	Country Code	KR	2-

XSD type name	Type Name	Examples	Description
			character country code as defined by ISO-3166
m2m:poaList	List of PointOfAccess strings	http://172.25.0.10:8080, coap://m2m.sp.com	list of xs:string. Each pointOfAccess entry in list is represented as a string containing the underlying transport protocol as well as the IP address and port (or an FQDN).
m2m:timestamp	Time stamp string	20141003T112032	DateTime string of 'Basic Format' specified in ISO8601 [27]. Time zone shall be interpreted as UTC timezone.
m2m:absRelTimestamp	absolute or relative time stamp string	20141003T112032 (absolute time),or 3600000 (relative time)	defined as xs:union of m2m:timestamp and xs:duration data types
m2m:typeOfContent	Type of Content	application/xml	The media type shall be an IANA registered Media Types name, or an experimental Media Type (See [26]) ':'
m2m:contentInfo	Content Information	application/xml:2	A string consisting of a media type optionally followed by a m2m:encoding separated by ':' character. See Note-1.
m2m:eventCat	Event Category	2	Either One of the values from m2m:stdEventCats or A user-defined category in the range 100-999
m2m:eventCatWithDef	Event Category with default	0	Either A value from m2m:eventCat , or The value 0 which has the special meaning "default"
m2m:listOfEventCat	List of (applicable) Event Categories	1 101	xs:list of elements of data type m2m:eventCat
m2m:listOfEventCatWithDef	List of m2m:eventCatWithDef	0 1 101	
m2m:scheduleEntry	Schedule Entry	* 0-5 2,6,10 * * * *	The string is used to describe a duration of enablement.
m2m:attributeList	List of xs:NCName	poa rr	Used for the Content parameter of Retrieve request primitives and in m2m:eventNotificationCriteria. Attributes represented with their short names.
m2m:serviceRoles	List of SRole-IDs	"01-001" (see note 2) NOTE: This is an enumeration of String value)	Used to represent a list of SRole-IDs.
Note-1: the encoding in m2m:contentInfo may be omitted when the value was "0 (plain)". But since default value of encoding is not allowed in future releases, it is recommended not to omit the encoding.			

1.4. Result Content reference

Table 1.4-1 Interpretation of ResultContent

Value	Interpretation	Note
0	nothing	
1	attributes	Default value
2	hierarchical address	
3	hierarchical address and attributes	
4	attributes and child resources	
5	attributes and child resource references	
6	child resource references	
7	original resource	
NOTE: See clause TS-0004 6.4.1 clause "Request message parameter data types"		

1.5. Short name representation

1.5.1. Resource and specialization type short name

Table 2.2.10. 1 shows short names for corresponding resource and specialization type defined in oneM2M standard. Parts of short names are referred to be used in the current API.

Table 1.5-1 Resource and specialization type short names

Resource Type Name	Short Name
accessControlPolicy	***acp***
accessControlPolicyAnnc	***acpA***
AE	***ae***
AEAnnc	***aeA***
container	***cnt***
containerAnnc	***cntA***
latest	***la***
oldest	***ol***
contentInstance	***cin***
contentInstanceAnnc	***cinA***
CSEBase	***cb***
delivery	***dlv***
eventConfig	***evcg***
execInstance	***exin***
fanOutPoint	***fopt***
group	***grp***
groupAnnc	***grpA***
locationPolicy	***lcp***
locationPolicyAnnc	***lcpA***
m2mServiceSubscriptionProfile	***mssp***
mgmtCmd	***mgc***
mgmtObj	***mgo***
mgmtObjAnnc	***mgoA***
node	***nod***
nodeAnnc	***nodA***
pollingChannel	***pch***
pollingChannelURI	***pcu***
remoteCSE	***csr***
remoteCSEAnnc	***csrA***
request	***req***
schedule	***sch***
scheduleAnnc	***schA***
serviceSubscribedAppRule	***asar***
serviceSubscribedNode	***svsn***
statsCollect	***stcl***
statsConfig	***stcg***
subscription	***sub***
firmware	***fwr***
firmwareAnnc	***fwrA***
software	***swr***
softwareAnnc	***swrA***
memory	***mem***
memoryAnnc	***memA***
areaNwkInfo	***ani***
areaNwkInfoAnnc	***aniA***
areaNwkDeviceInfo	***andi***
areaNwkDeviceInfoAnnc	***andiA***
battery	***bat***
batteryAnnc	***batA***

Resource Type Name	Short Name
deviceInfo	***dvi***
deviceInfoAnnc	***dviA***
deviceCapability	***dvc***
deviceCapabilityAnnc	***dvcA***
reboot	***rbo ****
rebootAnnc	***rboA***
eventLog	***evl***
eventLogAnnc	***evlA***
cmdhPolicy	***cmp***
activeCmdhPolicy	***acmp***
cmdhDefaults	***cmdf***
cmdhDefEcValue	***cmdv***
cmdhEcDefParamValues	***cmpv***
cmdhLimits	***cml***
cmdhNetworkAccessRules	***cmnr***
cmdhNwAccessRule	***cmwr***
cmdhBuffer	***cmbf***
notificationTargetMgmtPolicyRef	**ntpr**
notificationTargetPolicy	**ntp**
policyDeletionRules	**pdr**
notificationTargetSelfReference	**ntsr**
dynamicAuthorizationConsultation	**dac**

1.5.2. Resource attribute short names

In protocol bindings resource attributes names have to be translated into short names as shown in **Table 1.5-2**.

Table 1.5-2 Resource attribute short names

Attribute Name	Occurs in	Short Name
accessControlPolicyIDs	All except accessControlPolicy, contentInstance	***acpi***
announcedAttribute	accessControlPolicy, AE, container, contentInstance, group, locationPolicy, mgmtObj, node, remoteCSE, schedule	***aa***
announceTo	accessControlPolicy, AE, container, contentInstance, group, locationPolicy, mgmtObj, node, remoteCSE, schedule	***at***
creationTime	All	***ct***
expirationTime	All except contentInstance, CSEBase	***et***
labels	All (optional)	***lb***l
lastModifiedTime	All	***lt***
Link	All	***lnk***
parentID	All	***pi***
resourceID	All	***ri***
resourceType	All	***ty****
resourceName	All	***rn***
privileges	accessControlPolicy	***pv***
selfPrivileges	accessControlPolicy	***pvs***
App-ID	AE	***api***
AE-ID	AE	***aei***
appName	AE	***apn***
pointOfAccess	AE, CSEBase, remoteCSE	***poa***
ontologyRef	AE, container, contentInstance	***or***
nodeLink	AE, CSEBase, remoteCSE	***nl***
contentSerialization	AE	***csz***
creator	container, contentInstance, eventConfig, group, pollingChannel, statsCollect, statsConfig, subscription	***cr***
maxNrOfInstances	container	***mni***

Attribute Name	Occurs in	Short Name
maxByteSize	container	***mbs***
maxInstanceAge	container	***mia***
currentNrOfInstances	container	***cni***
currentByteSize	container	***cbs***
locationID	container	***li***
contentInfo	contentInstance	***cnf***
contentSize	contentInstance	***cs***
primitiveContent	request	***pc****
content	contentInstance	***con***
cseType	CSEBase, remoteCSE	***cst***
CSE-ID	CSEBase, remoteCSE, service SubscribedNode	***csi***
supportedResourceType	CSEBase	***srt***
notificationCongestionPolicy	CSEBase	***ncp***
source	delivery	***sr***
target	delivery, request	***tg***
lifespan	delivery	***ls***
eventCat	delivery	***ec****
deliveryMetaData	delivery	***dmd***
aggregatedRequest	delivery	***arq***
eventID	eventConfig, statsCollect	***evi***
eventType	eventConfig	***evt***
evenStart	eventConfig	***evs***
eventEnd	eventConfig	***eve***
operationType	eventConfig	***opt***
dataSize	eventConfig	***ds***
execStatus	execInstance	***exs***
execResult	execInstance	***exr***
execDisable	execInstance	***exd***
execTarget	execInstance, mgmtCmd	***ext***
execMode	execInstance, mgmtCmd	***exm***
execFrequency	execInstance, mgmtCmd	***exf***
execDelay	execInstance, mgmtCmd	***exy***
execNumber	execInstance, mgmtCmd	***exn***
execReqArgs	execInstance, mgmtCmd	***exra***
execEnable	mgmtCmd	***exe***
memberType	group	***mt***
currentNrOfMembers	group	***cnm***
maxNrOfMembers	group	***mnm***
memberIDs	group	***mid***
membersAccessControlPolicyIDs	group	***macp***
memberTypeValidated	group	***mtv***
consistencyStrategy	group	***csy***
groupName	group, subscription	***gn***
locationSource	locationPolicy	***los***
locationUpdatePeriod	locationPolicy	***lou***
locationTargetId	locationPolicy	***lot***
locationServer	locationPolicy	***lor***
locationContainerID	locationPolicy	***loi***
locationContainerName	locationPolicy	***lon***
locationStatus	locationPolicy	***lost***
serviceRoles	m2mServiceSubscriptionProfile	***svr***
description	mgmtCmd, mgmtObj, all management resources from firmware	***dc***
cmdType	mgmtCmd	***cmt***
mgmtDefinition	mgmtObj, all management resources from firmware	***mgd***
objectIDs	mgmtObj	***obis***
objectPaths	mgmtObj	***obps***
nodeID	node	***ni***
hostedCSELink	node	***hcl***
CSEBase	remoteCSE	***cb***
M2M-Ext-ID	remoteCSE	***mei***

Attribute Name	Occurs in	Short Name
Trigger-Recipient-ID	remoteCSE	***tri***
requestReachability	remoteCSE	***rr***
originator	request	***og***
metaInformation	request	***mi***
requestStatus	request	***rs***
operationResult	request	***ol***
operation	request	***opn***
requestID	request	***rid***
scheduleElement	schedule	***se***
deviceIdentifier	serviceSubscribedNode	***di***
ruleLinks	serviceSubscribedNode	***rlk***
statsCollectID	statsCollect	***sci***
collectingEntityID	statsCollect	***cei***
collectedEntityID	statsCollect	***cdi***
devStatus	areaNwkDeviceInfo	***ss***
statsRuleStatus	statsCollect	***srs***
statModel	statsCollect	***sm***
collectPeriod	statsCollect	***cp***
eventNotificationCriteria	subscription	***enc***
expirationCounter	subscription	***exc***
notificationURI	subscription	***nu***
groupID	subscription	***gpi***
notificationForwardingURI	subscription	***nfu***
batchNotify	subscription	***bn***
rateLimit	subscription	***rl***
preSubscriptionNotify	subscription	***psn***
pendingNotification	subscription	***pn***
notificationStoragePriority	subscription	***nsp***
latestNotify	subscription	***ln***
notificationContentType	subscription	***nct***
notificationEventCat	subscription	***nec***
subscriberURI	subscription	***su***
version	firmware, software	***vr***
URL	firmware, software	***url***
update	firmware	***ud***
updateStatus	firmware	***uds***
install	software	***in***
uninstall	software	***un***
installStatus	software	***ins***
activate	software	***act***
deactivate	software	***dea***
activeStatus	software, areaNwkInfo	***acts***
memAvailable	memory	***mma***
memTotal	memory	***mmt***
areaNwkType	areaNwkInfo	***ant***
listOfDevices	areaNwkInfo	***ldv***
devId	areaNwkDeviceInfo	***dvd***
devType	areaNwkDeviceInfo	***dvt***
areaNwkId	areaNwkDeviceInfo	***awi***
sleepInterval	areaNwkDeviceInfo	***sli***
sleepDuration	areaNwkDeviceInfo	***sld***
listOfNeighbors	areaNwkDeviceInfo	***lnh***
batteryLevel	battery	***btl***
batteryStatus	battery	***bts***
deviceLabel	deviceInfo	***dlb***
manufacturer	deviceInfo	***man***
model	deviceInfo	***mod***
deviceType	deviceInfo	***dty***
fwVersion	deviceInfo	***fwv***
swVersion	deviceInfo	***swv***
hwVersion	deviceInfo	***hwv***

Attribute Name	Occurs in	Short Name
capabilityName	deviceCapability	***can***
attached	deviceCapability	***att***
capabilityActionStatus	deviceCapability	***cas***
enable	deviceCapability	***ena***
disable	deviceCapability	***dis***
currentState	deviceCapability	***cus***
reboot	reboot	***rbo***
factoryReset	reboot	***far***
logTypeId	eventLog	***lgt***
logData	eventLog	***lgd***
logActionStatus	eventLog	***lgs***
logStatus	eventLog	***lgst***
logStart	eventLog	***lga***
logStop	eventLog	***lgo***
firmwareName	firmware	***fwnnam***
softwareName	software	***swn***
cmdhPolicyName	cmdhPolicy	***cpn***
mgmtLink	cmdhPolicy, activeCmdhPolicy, cmdhDefaults, cmdhNetworkAccessRules, cmdhNwAccessRule	***cmlk***
activeCmdhPolicyLink	activeCmdhPolicy	***acmlk***
order	cmdhDefEcValue, cmdhLimits	***od***
defEcValue	cmdhDefEcValue	***dev***
requestOrigin	cmdhDefEcValue, cmdhLimits	***ror***
requestContext	cmdhDefEcValue, cmdhLimits	***rct***
requestContextNotification	cmdhDefEcValue, cmdhLimits	***rcn***
requestCharacteristics	cmdhDefEcValue, cmdhLimits	***rch***
applicableEventCategories	cmdhNetworkAccessRules	***aecs***
applicableEventCategory	cmdhEcDefParamValues, cmdhBuffer	***aec***
defaultRequestExpTime	cmdhEcDefParamValues	***dqet***
defaultResultExpTime	cmdhEcDefParamValues	***dset***
defaultOpExecTime	cmdhEcDefParamValues	***doet***
defaultRespPersistence	cmdhEcDefParamValues	***drp***
defaultDelAggregation	cmdhEcDefParamValues	***dda***
limitsEventCategory	cmdhLimits	***lec***
limitsRequestExpTime	cmdhLimits	***lqet***
limitsResultExpTime	cmdhLimits	***lset***
limitsOpExecTime	cmdhLimits	***loet***
limitsRespPersistence	cmdhLimits	***lrp***
limitsDelAggregation	cmdhLimits	***lda***
targetNetwork	cmdhNwAccessRule	***ttn***
minReqVolume	cmdhNwAccessRule	***mrv***
backOffParameters	cmdhNwAccessRule	***bop***
otherConditions	cmdhNwAccessRule	***ohc***
maxBufferSize	cmdhBuffer	***mbfs***
storagePriority	cmdhBuffer	***sgp***
applicableCredIDs	serviceSubscribedAppRule	***apci***
allowedApp-IDs	serviceSubscribedAppRule	***aai***
allowedAEs	serviceSubscribedAppRule	***aae***

1.5.3. Primitive parameter short names

Table 1.5-3 shows short names for primitive parameters used for request and response primitives.

Table 1.5-3 Primitive parameter short names

Parameter Name	XSD long name	Occurs in	Short Name
Operation	operation	Request	*op*
To	to	Request, Response	*to*
From	from	Request, Response	*fr*

Request Identifier	requestIdentifier	Request, Response	*rqi*
Resource Type	resourceType	Request	*ty*
Content	primitiveContent	Request, Response	*pc*
Role	role	Request	*rol*
Originating Timestamp	originatingTimestamp	Request, Response	*ot*
Request Expiration Timestamp	requestExpirationTimestamp	Request	*rqet*
Result Expiration Timestamp	resultExpirationTimestamp	Request, Response	*rset*
Operation Execution Time	operationExecutionTime	Request	*oet*
Response Type	responseType	Request	*rt*
Result Persistence	resultPersistence	Request	*rp*
Result Content	resultContent	Request	*rcn*
Event Category	eventCategory	Request, Response	*ec*
Delivery Aggregation	deliveryAggregation	Request	*da*
Group Request Identifier	groupRequestIdentifier	Request	*gid*
Filter Criteria	filterCriteria	Request	*fc*
Discovery Result Type	discoveryResultType	Request	*drt*
Response Status Code	responseStatusCode	Response	*rsc*

1.5.4. Complex data types members

Table 1.5-4 shows short names for parameters used for filter criteria and eventNotificationCriteria primitives.

Table 1.5-4 Complex data type member short names

Member Name	Occurs in	Short Name
createdBefore	filterCriteria, eventNotificationCriteria	***crb***
createdAfter	filterCriteria, eventNotificationCriteria	***cra***
modifiedSince	filterCriteria, eventNotificationCriteria	***ms***
unmodifiedSince	filterCriteria, eventNotificationCriteria	***us***
stateTagSmaller	filterCriteria, eventNotificationCriteria	***sts***
stateTagBigger	filterCriteria, eventNotificationCriteria	***stb***
expireBefore	filterCriteria, eventNotificationCriteria	***exb***
expireAfter	filterCriteria, eventNotificationCriteria	***exa***
labels	filterCriteria, eventNotificationCriteria	***lbl****
resourceType	filterCriteria	***ty****
sizeAbove	filterCriteria, eventNotificationCriteria	***sza***
sizeBelow	filterCriteria, eventNotificationCriteriay	***szb***
contentType	filterCriteria	***cty***
limit	filterCriteria	***lim***

2. OPEN APIs

2.1. Introduction

Mobius APIs implements a suite of interfaces between oneM2M entity originator and CSE receiver.

Each interface is identified with a unique Identifier following the format of **API/<RESOURCE_TYPE>/<OPERATION_TYPE>/<NUMBER>_<PERMUTATION>**,

Where PERMUTATION field is to indicate additional variable(s) that are used in a oneM2M request primitive, e.g. API/CSR/CRE/001_RCN/2

Table 2.1-1 Interface Id Notation for Mobius API

Name	Value
API/<RESOURCE_TYPE>/<OPERATION_TYPE>/<NUMBER>_<PERMUTATION>	
<RESOURCE_TYPE>	AE (<AE>)
	CNT(<container>)
	CIN (<contentInstance>)
	CSR(<remoteCSE>)
	GRP(<group>)
	SUB(<subscription>)
	SMD(<semanticDescriptor>)
	TS(<timeSeries>)
	TSI(<timeSeriesInstance>)
	MGO(<mgmtObj>)
	_(underscore: indicating any resource type)
<OPERATION_TYPE>	CRE(CREATE)
	UPD(UPDATE)
	DEL(DELETE)
	NOTIF(NOTIFY)
	DIS(DISCOVERY)
<NUMBER>	001 - 999
<PERMUTATION>	Variables that can be attribute name, enumerated variable with associated value etc. In case multiple variables are represented in the <PERMUTATION>, slash "/" is used to separate them. E.g. resultContent with its value can be represented as a <PERMUTATION> like - RCN/1, - LBL/CRB (e.g. retrieve *label* and *createBefore* attribute)

2.2. Outline of API

The interfaces are defined following the interface Id format, and they are summarized into **Table .2.1-2**. ResultContent parameter is involved into some of interface to demonstrate how the responce se varies with associated resultContent value so that users can learn how to user resultContent parameter in their request to achieve different requirement, e.g. to reduce the response message size by avoiding receiving payload of the response.

Table 2.1-3 A summary of Mobius open APIs

Interface ID	Interface Category	Interface Description
API/CB/RET/001_RCN/1	<CSEBase> RETRIEVE	Retrieve CSEBase with resultContent set to 1 (attributes)
API/CB/RET/001_RCN/4	<CSEBase> RETRIEVE	Retrieve CSEBase with Result Content set to 4 (attributes+childResources)
API/CSR/CRE/001_RCN/0	<remoteCSE> CREATE	Create remoteCSE with resultContent set to 0 (nothing)
API/CSR/CRE/001_RCN/1	<remoteCSE> CREATE	Create remoteCSE with resultContent set to 1 (attributes)
API/CSR/CRE/001_RCN/2	<remoteCSE> CREATE	Create remoteCSE with resultContent set to 2 (hierarchial-address)
API/CSR/CRE/001_RCN/3	<remoteCSE> CREATE	Create remoteCSE with resultContent set to 3 (hierarchical-address&attributes)
API/CSR/RET/002_RCN/1	<remoteCSE> RETRIEVE	Retrieve remoteCSE with resultContent set to 1 (attributes)
API/CSR/UPD/003_RCN/0	<remoteCSE> UPDATE	Update remoteCSE with resultContent set to 0 (nothing)
API/CSR/UPD/003_RCN/1	<remoteCSE> UPDATE	Update remoteCSE with resultContent set to 1 (attributes)
API/CSR/DEL/004_RCN/0	<remoteCSE> DELETE	Delete remoteCSE with resultContent set to 0 (nothing)
API/AE/CRE/001_RCN/0	<AE> CREATE	Create AE with resultContent set to 0 (nothing)
API/AE/CRE/001_RCN/1	<AE> CREATE	Create AE with resultContent set to 1 (attributes)
API/AE/CRE/001_RCN/2	<AE> CREATE	Create AE with resultContent set to 2 (hierarchial-address)
API/AE/CRE/001_RCN/3	<AE> CREATE	Create AE with resultContent set to 3 (hierarchical-address &attributes)
API/AE/RET/002_RCN/1	<AE> RETRIEVE	Retrieve AE with resultContent set to 1 (attributes)
API/AE/RET/002_RCN/4	<AE> RETRIEVE	Retrieve AE with resultContent set to 4 (attributes+childResources)
API/AE/UPD/003_RCN/0	<AE> UPDATE	Update AE with resultContent set to 0 (nothing)
API/AE/DEL/004_RCN/0	<AE> DELETE	Delete AE with ResultContent set to 0 (nothing)
API/CNT/CRE/001_RCN/0	<container> CREATE	Create container with resultContent set to 0 (nothing)
API/CNT/CRE/001_RCN/1	<container> CREATE	Create container with resultContent set to 1 (attributes)
API/CNT/CRE/001_RCN/2	<container> CREATE	Create container with resultContent set to 2 (hierarchicalAaddress)
API/CNT/CRE/001_RCN/3	<container> CREATE	Create container with resultContent set to 3(hierarchicalAaddress+attributes)
API/CNT/RET/002_RCN/1	<container> RETRIEVE	Retrieve container with resultContent set to 1 (attributes)
API/CNT/RET/002_RCN/4	<container> RETRIEVE	Retrieve container with resultContent set to 4 (attributes+childResources)
API/CNT/UPD/003_RCN/0	<container> UPDATE	Update container with resultContent set to 0 (nothing)
API/CNT/DEL/004_RCN/0	<container> DELETE	Delete container with resultContent set to 0 (nothing)
API/CIN/CRE/001_RCN/0	<contentInstance> CREATE	Create contentInstance with resultContent set to 0 (nothing)
API/CIN/CRE/001_RCN/1	<contentInstance> CREATE	Create contentInstance with resultContent set to 1 (attributes)
API/CIN/CRE/001_RCN/2	<contentInstance> CREATE	Create contentInstance with resultContent set to 2
API/CIN/CRE/001_RCN/3	<contentInstance> CREATE	Create contentInstance with resultContent set to 3
API/CIN/RET/002_LA	<contentInstance> RETRIEVE	Retrieve a latest contentInstance resource
API/CIN/RET/002_OL	<contentInstance> RETRIEVE	Retrieve an oldest contentInstance resource
API/CIN/DEL/003_RCN/0	<contentInstance> DELETE	Delete a contentInstance with resultContent set to 0 (nothing)

Interface ID	Interface Category	Interface Description
API/SMD/CRE/001_RCN/1	<semanticDescriptor> CREATE	Create semanticDescriptor with resultContent set to 1
API/SMD/CRE/001_RCN/3	<semanticDescriptor> CREATE	Create semanticDescriptor with resultContent set to 3
API/SMD/RET/002_RCN/1	<semanticDescriptor> RETRIEVE	Retrieve semanticDescriptor with resultContent set to 1 (attributes)
API/SMD/UPD/003_RCN/0	<semanticDescriptor> UPDATE	Update semanticDescriptor with resultContent set to 0 (nothing)
API/SMD/DEL/004_RCN/0	<semanticDescriptor> DELETE	Delete semanticDescriptor with resultContent set to 0 (nothing)
API/_/DIS/001_TY	Discovery with one single filter	Discovery with resourceType filter criteria
API/_/DIS/001_LBL	Discovery with one single filter	Discovery with labels filter criteria
API/_/DIS/001_LIM	Discovery with one single filter	Discovery with limit filter criteria
API/_/DIS/001_OFST	Discovery with one single filter	Discovery with Offset filter criteria
API/_/DIS/001_LVL	Discovery with one single filter	Discovery with Level filter criteria
API/_/DIS/002_STB/STS	Discovery with multiple filters	Discovery with stateTagBigger, and stateTagSmaller filter conditions
API/_/DIS/002_CRA/CRB	Discovery with multiple filters	Discovery with createdAfter, and createdBefore filter conditions
API/_/DIS/002_SZA/SZB	Discovery with multiple filters	Discovery with sizeBelow, and sizeAbove filter conditions
API/_/DIS/002_US/MS/LIM	Discovery with multiple filters	Discovery with modifiedSince, and unmodifiedSince, and limit filter conditions
API/_/DIS/002_EXB/EXA/LIM	Discovery with multiple filters	Discovery with expiredBefore, expiredAfter and limit filter conditions
API/SUB/CRE/001_RCN/0	<subscription> CREATE	Create subscription with resultContent set to 0 (nothing)
API/SUB/RET/002_RCN/1	<subscription> RETRIEVE	Retrieve subscription with resultContent set to 1 (attributes)
API/SUB/UPD/003_RCN/0	<subscription> UPDATE	Update subscription with resultContent set to 0 (nothing)
API/SUB/DEL/004_RCN/0	<subscription> DELETE	Delete subscription with resultContent set to 0 (nothing)
API/GRP/CRE/001_RCN/0	<group> CREATE	Create group with resultContent set to 0 (nothing)
API/GRP/RET/002_RCN/1	<group> RETRIEVE	Retrieve group with resultContent set to 1(attributes)
API/GRP/UPD/003_RCN/0	<group> UPDATE	Update group with resultContent set to 0 (nothing)
API/GRP/DEL/004_RCN/0	<group> DELETE	Delete group with resultContent set to 0 (nothing)
API/TS/CRE/001_RCN/0	<timeSeries> CREATE	Create timeSeries with resultContent set to 0 (nothing)
API/TS/RET/002_RCN/1	<timeSeries> RETRIEVE	Retrieve timeSeries with resultContent set to 1 (attributes)
API/TS/UPD/003_RCN/0	<timeSeries> UPDATE	Update timeSeries with resultContent set to 0 (nothing)
API/TS/DEL/004_RCN/0	<timeSeries> DELETE	Delete timeSeries with resultContent set to 0 (nothing)
API/TSI/CRE/001_RCN/0	<timeSeriesInstance> CREATE	Create timeSeriesInstance with resultContent set to 0 (nothing)
API/TSI/RET/002_RCN/1	<timeSeriesInstance> RETRIEVE	Retrieve timeSeriesInstance with resultContent set to 1 (attributes)
API/TSI/DEL/003_RCN/0	<timeSeriesInstance> DELETE	Delete timeSeriesInstance with resultContent set to 0 (nothing)

2.3. API Details

2.3.1. Abbreviations and Preferences

1) Abbreviations

NP (Not Present): NP mark indicates attributes that don't necessarily be present in the resource representation for the corresponding request via API.

M (Mandatory): M mark indicates attributes shall be present in the resource representation either for the corresponding request via API or the responses provided by the specific IoT platform.

O (Optional): O mark indicates attributes that are allowed to be present in the resource representation for the corresponding request for API but will not affect the request result if absent.

2) Preferences

APreferences applied through the current API are listed as following:

A *resultContent* attribute is used as a query string to manage user preference on the type of response content. If the *reultContent* is absent in the request URL, the default value 1(attributes) is applied to indicate the response for a corresponding request is composed of attributes of the requested resource. More about resultContent parameter is listed on clause 0.

All resources and attributes present in the request API are represented by their corresponding short name, which is defined by oneM2M TS-0004. More details for the short names, please refer to clause 2.2.10.

2.3.2. <CSEBase> Resource

A <*CSEBase*> resource represents a CSE and it is the root for all resources that are residing in the CSE. The <*CSEBase*>resource doesn't support the creation, update, and delete operations via API but only supports retrieve operation.

1) API/CB/CRE

The <*CSEBase*>resource is not permitted to be created via API.

2) API/CB/RET

The <*CSEBase*>resource supports retrieve operation via API following generic procedures specified in oneM2M TS-0001.

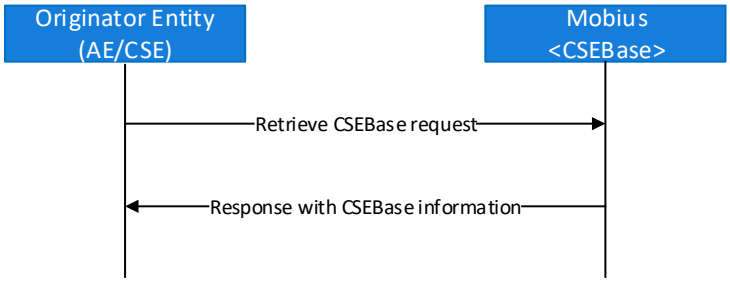
Interface ID	API/CB/RET/001_RCN/1 API/CB/RET/001_RCN/4
Interface Name	CSEBase RETRIEVE with resultContent parameter
Target Resource	Requested <CSEBase> resource
Interface	The interface is used to send a <CSEBase> resource RETRIEVE request to Mobius, and

Description

receive response from Mobius. The RETRIEVE request is initialized with an associated ***result content*** **(RCN)** parameter to in order to get preferred response from Mobius as following:

- RCN = 1 : Retrieve attributes of <CSEBase> resource of Mobius. Note that this is default response option of oneM2M RETRIEVE operation.
- RCN = 4 : Retrieve both attributes and child resources (if any) of <CSEBase> resource of Mobius. This option will use to list all child resources under the <CSEBase> resource.

① Call Flow



② Resource URL Information

```
GET /Mobius?rcn=<VALUE>
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	Entity ID of request originator

④ Examples

API/CB/RET/001_RCN/1

Request

```
GET /Mobius?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 1hkkhkj2345
X-M2M-Origin: S20170717074825768bp21
```

Response

```
HTTP/1.1 200 OK
X-M2M-RI: 1hkkhkj2345
X-M2M-RSC: 2000

Content-Length: 278
Content-Type: application/json

{
    "m2m:cb": {
        "ty": 5,
        "ct": "20170713T161614",
        "ri": "SJDRnzBBZ",
        "rn": "Mobius",
        "lt": "20170713T161614",
        "et": "20270713T161614",
```

```
        "lbl": [
            "Mobius"
        ],
        "mni": 3153600000,
        "cst": 1,
        "csi": "/Mobius",
        "srt": [
            "1",
            "2",
            "3",
            "4",
            "9",
            "10",
            "16",
            "17",
            "23",
            "24",
            "29",
            "30"
        ],
        "poa": [
            "http://yt.iotmobius.com:7579"
        ]
    }
}
```


API/CB/RET/001_RCN/4

Request

```
GET /Mobius?rcn=4 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 454hkkhkj25
X-M2M-Origin: S20170717074825768bp21
```

Response

```
HTTP/1.1 200 OK
X-M2M-RI: 454hkkhkj25
X-M2M-RSC: 2000

Content-Length: 1278
Content-Type: application/json
```


```
{
    "m2m:acp": [
        {
            "ri": "ByW7eOgcBW",
            "pv": {
                "acr": [
                    {
                        "acor": [
                            "ByW7eOgcBW",
                            "S20170717074825768bp21",
                            "guest_groupA",
                            "guest_groupB",
                            "student_eduA",
                            "student_eduB"
                        ],
                        "acop": 63
                    }
                ]
            },
            "pvs": {
                "acr": [
                    {
```

```
                    "acor": [
                        "S20170705065326333aZtE",
                        "S20170717074825768bp2l",
                        "ryeubi",
                        "ByW7eOgcBW"
                    ],
                    "acop": 63
                }
            ]
        },
        "pi": "SJDRnzBBZ",
        "ty": 1,
        "ct": "20170717T084010",
        "rn": "admin_acp",
        "lt": "20170717T094921",
        "et": "20190717T084010"
    }
],
"m2m:ae": [
    {
        "ri": "S20170717074825768bp2l",
        "api": "0.2.481.2.0001.001.000111",
        "aei": "S20170717074825768bp2l",
        "rr": true,
        "pi": "SJDRnzBBZ",
        "ty": 2,
        "ct": "20170717T074825",
        "rn": "ae_test",
        "lt": "20170717T074825",
        "et": "20190717T074825",
        "lbl": [
            "key1",
            "key2"
        ]
    }
],
"m2m:cnt": [
    {
        "ri": "ByGTx8-5BZ",
        "cr": "S20170717074825768bp2l",
        "mni": 4,
        "mbs": 3153600000,
        "mia": 31536000,
        "cni": 4,
        "cbs": 8,
        "pi": "S20170717074825768bp2l",
        "ty": 3,
        "ct": "20170717T094005",
        "rn": "cnt_test",
        "lt": "20170717T094048",
        "et": "20190717T094005",
        "lbl": [
            "heartbeat1"
        ],
        "st": 5
    }
],
"m2m:cin": [
    {
        "ri": "Bkz7b9k9Hb",
        "cr": "/S20170713193946542YSqa",
        "cs": 1,
        "con": "3",
        "pi": "SyMsYrXSHb",
        "ty": 4,
        "ct": "20170717T074042",
```

```
            "rn": "4-20170717074042886dNPy",
            "lt": "20170717T074042",
            "et": "20190717T074042",
            "st": 7
        },
        {
            "ri": "S1z80F15rb",
            "cr": "S20170713165320930fkUi",
            "cs": 4,
            "con": "1178",
            "pi": "ryGoKHmSrb",
            "ty": 4,
            "ct": "20170717T073958",
            "rn": "4-20170717073958064rWAI",
            "lt": "20170717T073958",
            "et": "20190717T073958",
            "st": 31
        }
    ],
    "m2m:csr": [
        {
            "ri": "BkZJUExqSZ",
            "cst": 1,
            "poa": [
               "http://203.254.173.104:7580/notification",
               "mqtt://203.253.128.151/:rosemary"
            ],
            "cb": "//yt.rosemary.com/nCube",
            "csi": "/nCube",
            "rr": true,
            "pi": "SJDRnzBBZ",
            "ty": 16,
            "ct": "20170717T082438",
            "rn": "nCube",
            "lt": "20170717T082759",
            "et": "20190717T082438"
        }
    ],
    "m2m:ts": [
        {
            "ri": "SJMOVwW5HW",
            "cr": "S20170717074825768bp2l",
            "mni": 3153600000,
            "mbs": 3153600000,
            "mia": 31536000,
            "cni": 0,
            "cbs": 0,
            "pei": 1,
            "mdd": true,
            "mdn": 1000,
            "mdc": 0,
            "mdt": 2,
            "pi": "S20170717074825768bp2l",
            "ty": 29,
            "ct": "20170717T094520",
            "rn": "ts1",
            "lt": "20170717T094701",
            "et": "20190717T094520",
            "lbl": [
               "timeSeries_label",
               "heartbeat1"
            ],
            "st": 1
        }
    ]
}
```

3) API/CB/UPD

The <*CSEBase*> resource is not permitted to be updated via API.

4) API/CB/DEL

The <*CSEBase*> resource is not permitted to be deleted via API.

2.3.3. <remoteCSE> Resource

The <remoteCSE> resource represents a Registree CSE that is registered into a Registrar CSE, and <remoteCSE> locates directly under the <CSEBase> of the Registrar CSE. Similarly, one <remoteCSE> resource will also be created under the <CSEBase> of the Registree CSE to represent the Registrar CSE when the Registree CSE is successfully registered into the Registrar CSE.

For example, when CSE1 (Registree CSE) registers with CSE2 (Registrar CSE), there will be two <remoteCSE> resources created: one in CSE1: <CSEBase1>/<remoteCSE2> and one in CSE2: <CSEBase2>/<remoteCSE1>. Note that the creation of two <remoteCSE> resources located in <CSEBase1> and <CSEBase2>, respectively, does not imply mutual registration (i.e., <CSEBase1>/<remoteCSE2> does not mean CSE2 registered with CSE1).

The <remoteCSE> resource contains a group of universal attributes applied for all oneM2M resource primitives and a group of specific resources applied for only <remoteCSE> resource itself, shown as Table 2.2.3- 1 and Table 2.2.3-2. Table 2.2.3-2 also shows mandatory attributes (with *M* mark) required to be present while using API, as well as optional attributes (with *O* mark) that are not necessarily present and those attributes (with *NP* mark) that should not be present in resource request representation.

Taking a remote light control scenario at home as an example, the home gateway can be modelled as a MN-CSE registered as a <remoteCSE> to enable the communication of local light bulbs with outside of home network. Any light bulb to be connected to the home gateway can be registered as <AE> as a child resource of <remoteCSE>.

In this document, one gateway called ***nCube*** is modelled as a MN-CSE, and a cloud server called ***Mobius*** is modelled as a IN-CSE. From oneM2M perspective view, the nCube and Mobius is identified by following information:

- **Mobius (IN-CSE)**
  - CSE-ID**: /Mobius**
  - Resource ID**: SJDRnzBBZ**
- **nCube (MN-CSE)**
  - CSE-ID**: /nCube**
  - Resource ID: **r1WDkRlsra**

-

Table 2.2.3- 1 Universal Attributes of <remoteCSE> resource

Attribute Name	Request Optionality	
	Create	Update
@resourceName	NP	NP
resourceType	NP	NP
resourceID	NP	NP
parentID	NP	NP
accessControlPolicyIDs	O	O
creationTime	NP	NP
expirationTime	O	O
lastModifiedTime	NP	NP
labels	O	O
announceTo	O	O
announcedAttribute	O	O

Table 2.2.3- 2 Resource Specific Attributes of <remoteCSE> resource

Attribute Name	Request Optionality		Data Type	Default Value and Constraints
	Create	Update		
cseType	O	NP	m2m:cseTypeID	No default
pointOfAccess	O	O	m2m:poaList	No default
CSEBase	M	NP	xs:anyURI	No default
CSE-ID	M	NP	m2m:ID	No default
M2M-Ext-ID	O	O	m2m:externalID	No default
Trigger-Recipient-ID	O	O	m2m:triggerRecipientID	No default
requestReachability	M	O	xs:boolean	No default
nodeLink	O	O	xs:anyURI	No default

1) API/CSR/CRE

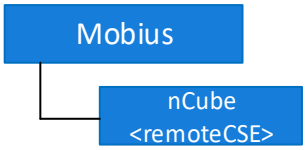
Interface IDs	API/CSR/CRE/001_RCN/0 API/CSR/CRE/001_RCN/1 API/CSR/CRE/001_RCN/2 API/CSR/CRE/001_RCN/3
Interface Name	remoteCSE CREATE with resultContent parameter
Target Resource	<CSEBase> resource as parent resource of the being created <remoteCSE> resource
Interface Description	The interface is used by a CSE Registree (nCube) to send a <remoteCSE> Create request attached with resultContent to a Registrar CSE (Mobius), and the Registree CSE will receive a successful <remoteCSE> Create response. The response message varies according to the resultContent (hereafter ***rcn***) parameter that is used by the CSE Registree. • When **resultContent** is set to 0 (zero): The response contains the ***response status code*** ONLY with no information of the created <remoteCSE> resource. • When **resultContent** is set to 1 (one): The response contains a **response status code** as well as the <remoteCSE> resource information (***attributes***) that represents the nCube. • When **resultContent** is set to 2 (two): The response contains a ***response status code*** as well as the ***hierarchical address*** of the created <remoteCSE> resource information. • When **resultContent** is set to 3 (three): The response contains a ***response status code***, the ***hierarchical address***, and ***attributes*** of the created <remotecSE>

resource that represent the nCube.

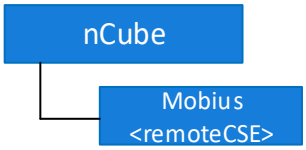
When the CSE Registree receives a successful <remoteCSE> Create response, the CSE Registree creates a <remoteCSE> resource for the Registrar CSE locally to represent the Registrar CSE.

Note that mandatory attributes for creation of the <remoteCSE> are highlighted in create request.

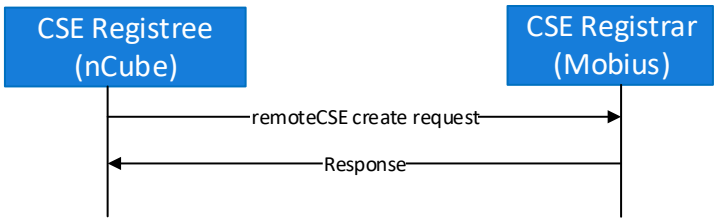
① Resource Structure will look like as below when the <remoteCSE> resource is created successfully under Mobius:



Respectively, the CSE Registree will also create a <remoteCSE> resource for the Registrar Mobius. The resource structure looks as below:



② Call Flow between a CSE Registree and the Registrar CSE is shown as below:



③ Resource URL Information

```
POST /Mobius?rcn=<INTEGER_VALUE>
```

④ Http Header Information

Header	Value
Accept	*application/json*
X-M2M-RI	Request ID
X-M2M-Origin	CSE-ID of CSE Registree
Content-Type	*application/vnd.onem2m-res+json; ty=16*

⑤ Examples

API/CSR/CRE/001_RCN/1

Request

```
POST /Mobius?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: fdferer232
X-M2M-Origin: /nCube
```

```
Content-Type: application/vnd.onem2m-res+json;ty=16

{
  "m2m:csr" : {
      "rn" : "nCube",
      "csi": "/nCube",
      "poa": ["http://yt.rosemary.com"],
      "rr" : true,
      "cb" :"//yt.rosemary.com/nCube"
    }
}
```

Response

```
HTTP/1.1 201 Created

X-M2M-RI: fdferer232
X-M2M-RSC: 2001

Content-Location: /Mobius/r1WDkRlsra
Content-Type: application/json
Content-Length: 243

{
    "m2m:csr": {
        "rn": "nCube ",
        "ty": 16,
        "pi": "SJDRnzBBZ",
        "ri": "r1WDkRlsra",
        "ct": "20170718T031751",
        "et": "20190718T031751",
        "lt": "20170718T031751",
        "cb": "//yt.rosemary.com/nCube",
        "csi": "/nCube",
        "rr": true,
        "cst": 1,
        "poa": [
            "http://yt.rosemary.com"
        ]
    }
}
```

API/CSR/CRE/001_RCN/0

Request

```
POST /Mobius?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req1RTRW2345
X-M2M-Origin: /nCube
Content-Type: application/vnd.onem2m-res+json;ty=16
{
  "m2m:csr" : {
      "rn" : "nCube",
      "csi": "/nCube",
      "poa": ["http://yt.rosemary.com"],
      "rr" : true,
      "cb" :"//yt.rosemary.com/nCube"
    }
}
```

Response

```
HTTP/1.1 201 Created

X-M2M-RI: req1RTRW2345
```

```
X-M2M-RSC: 2001

Content-Location: /Mobius/r1WDkRlsra
Content-Type: application/json
Content-Length: 0
```

API/CSR/CRE/001_RCN/2

Request

```
POST /Mobius?rcn=2 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req343GFG12345
X-M2M-Origin: /nCube
Content-Type: application/vnd.onem2m-res+json;ty=16

{
  "m2m:csr" : {
      "rn" : "nCube",
      "csi": "/nCube",
      "poa": ["http://yt.rosemary.com"],
      "rr" : true,
      "cb" :"//yt.rosemary.com/nCube"
    }
}
```

Response

```
HTTP/1.1 201 Created

X-M2M-RI: req343GFG12345
X-M2M-RSC: 2001

Content-Location: /Mobius/r1WDkRlsra
Content-Type: application/json
Content-Length: 27

{
    "m2m:uri": "Mobius/nCube"
}
```

API/CSR/CRE/001_RCN/3

Request

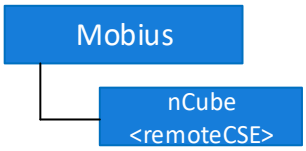
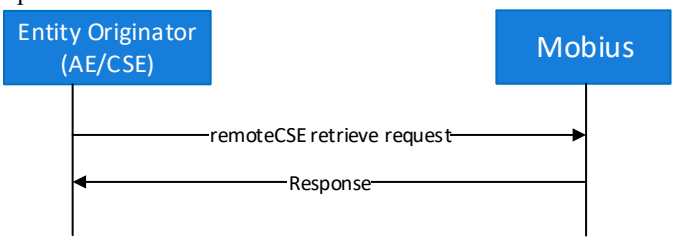
```
POST /Mobius?rcn=3 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: dfafd3423
X-M2M-Origin: /nCube
Content-Type: application/vnd.onem2m-res+json;ty=16

{
  "m2m:csr" : {
      "rn" : "nCube",
      "csi": "/nCube",
      "poa": ["http://yt.rosemary.com"],
      "rr" : true,
      "cb" :"//yt.rosemary.com/nCube"
    }
}
```

Response

```
HTTP/1.1 201 Created
```

```
X-M2M-RI: dfafd3423
X-M2M-RSC: 2001

Content-Length: 275
Content-Location: /Mobius/r1WDkRlsra
Content-Type: application/json

{
    "m2m:rce": {
        "uri": "Mobius/nCube",
        "m2m:csr": {
            "rn": "nCube",
            "ty": 16,
            "pi": "SJDRnzBBZ",
            "ri": "rkW2zyWoHZ",
            "ct": "20170718T031751",
            "et": "20190718T031751",
            "lt": "20170718T031751",
            "cb": "//yt.rosemary.com/nCube",
            "csi": "/nCube",
            "rr": true,
            "cst": 1,
            "poa": [
                "http://192.168.0.105:7579"
            ]
        }
    }
}
```


2) API/CSR/RET

Interface ID	API/CSR/RET/002_RCN/1
Interface Name	remoteCSE RETRIEVE with resultContent set to 1 (attributes)
Target Resource	The <remoteCSE> resource located under <CSEBase> of Mobius
Interface Description	The interface is used to send a <remoteCSE> RETRIEVE request attached with resultContent to a hosting CSE (Mobius), and the hosting CSE will send back a response containing attributes of the requested <remoteCSE> resource. ① Resource Structure  ② Call Flow between an originator and its hosting CSE is shown as below: Note that the external entity can be a CSE or an AE which has access control right to access to the requested <remoteCSE> resource.  ③ Resource URL Information

```
GET /Mobius/ncube?rcn=1
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	Entity ID (AE or CSE-ID) of the request originator

⑤ Example

API/CSR/RET/002_RCN/1

Request

```
GET /Mobius/ncube?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: reqdf12346
X-M2M-Origin: /nCube
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 238
Content-Type: application/json
X-M2M-RI: reqdf12346
X-M2M-RSC: 2000

{
    "m2m:csr": {
        "pi": "SJDRnzBBZ",
        "ty": 16,
        "ct": "20170718T032300",
        "ri": "rkW2zyWoHZ",
        "rn": "nCube",
        "lt": "20170718T032300",
        "et": "20190718T032300",
        "cst": 1,
        "poa": [
            "http://192.168.0.105:7579"
        ],
        "cb": "//yt.rosemary.com/nCube",
        "csi": "/nCube",
        "rr": true
    }
}
```

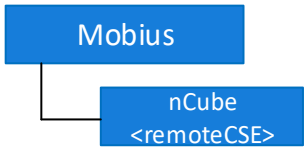
3) API/CSR/UPD

Interface ID	API/CSR/UPD/003_RCN/0 API/CSR/UPD/003_RCN/1
Interface Name	RemoteCSE UPDATE with resultContent parameter
Target Resource	The <remoteCSE> resource located under <CSEBase> of Mobius
Interface Description	The interface is used to send a <remoteCSE> UPDATE request attached with resultContent to a hosting CSE (Mobius), and the hosting CSE will send back a response according to the configured resultContent value as following: • When **resultContent** is set to 0 (zero): The response contains the ***response***

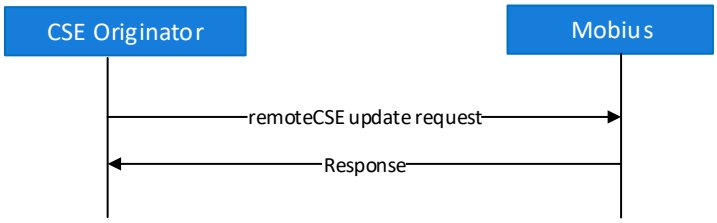
status code ONLY with no information of the requested <remoteCSE> resource.

- When **resultContent** is set to 1 (one): The response contains a **response status code** as well as the <remoteCSE> resource information (***attributes***) that represents the nCube.

- Resource Structure



- Call Flow between a CSE originator and the hosting CSE of requested <remoteCSE> is shown as below: Note that the external entity can only be a CSE.



- Resource URL Information

```
PUT /Mobius/ncube?rcn=<VALUE>
```

- Http Header Information

Header	Value
Accept	*application/json*
X-M2M-RI	Request ID
X-M2M-Origin	CSE-ID of request originator
Content-Type	application/vnd.onem2m-res+json

- Example: Demonstrate the update of the <pointOfAccess> attribute of <remoteCSE> resource.

API/CSR/UPD/003_RCN/0

Request

```
PUT /Mobius/ncube?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req21fgsdg345
X-M2M-Origin: /nCube
Content-Type: application/vnd.onem2m-res+json
{
  "m2m:csr": {
    "poa": "http://0.2.481.1.0001.001.000111"
  }
}
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 0
Content-Type: application/vnd.onem2m-res+json
X-M2M-RI: req21fgsdg345
X-M2M-RSC: 2004
```

API/CSR/UPD/003_RCN/1

Request

```
PUT /Mobius/ncube?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: reqgfh21345
X-M2M-Origin: /csencube
Content-Type: application/vnd.onem2m-res+json
{
  "m2m:csr": {
       "poa": [
         "http://yt.rosemary.com:7580/notification”,
         "yt.rosemary.com/:rosemary"
     ]
  }
}
```

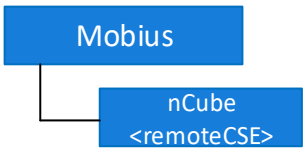
Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 288
Content-Type: application/vnd.onem2m-res+json
X-M2M-RI: reqgfh21345
X-M2M-RSC: 2004
{
    "m2m:csr": {
        "pi": "SJDRnzBBZ",
        "ty": 16,
        "ct": "20170718T032300",
        "ri": "rkW2zyWoHZ",
        "rn": "nCube",
        "lt": "20170718T052735",
        "et": "20190718T032300",
        "cst": 1,
        "poa": [
            "http://yt.rosemary.com:7580/notification",
            "mqtt://yt.rosemary.com/:rosemary"
        ],
        "cb": "//yt.rosemary.com/nCube",
        "csi": "/nCube",
        "rr": true
    }
}
```

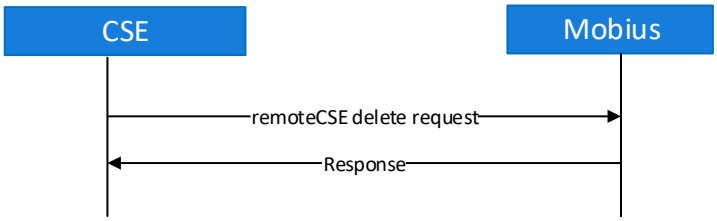
4) API/CSR/DEL

Interface ID	API/CSR/DEL/004_RCN/0
Interface Name	RemoteCSE DELETE with resultContent set to 0 (nothing)
Target Resource	The <remoteCSE> resource located under <CSEBase> of Mobius
Interface Description	The interface is used to send a <remoteCSE>DELETE request attached with resultContent set to 0 to the hosting CSE, and the hosting CSE will delete the <remoteCSE> resource and send back a response containing the response status code of the DELETE operation.

① Resource Structure



② Call Flow between an originator and its hosting CSE is shown as below: Note that the external entity can only be a CSE.



③ Resource URL Information

```
DELETE /Mobius/ncube?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/json*
X-M2M-RI	Request ID
X-M2M-Origin	CSE-ID of the request originator

⑤ Example

API/CSR/DEL/004_RCN/0

Request

```
DELETE /Mobius/ncube?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: reasdfsdafq125
X-M2M-Origin: /nCube
```

Response

```
HTTP/1.1 200 OK
Content-Length: 0
Content-Type: application/json
X-M2M-RI: reasdfsdafq125
X-M2M-RSC: 2002
```

2.3.4. <AE> Resource

The <AE> resource represents information about an Application Entity that is registered to a CSE. The originator of a <AE> create request is and only can be an AE. A CSE is not allowed to initiate a <AE> create request.

The <AE> resource contains a group of universal attributes which are defined to be potentially applicable for all oneM2M resource primitives and a group of specific resources applied for only <AE>

resource itself, shown as Table 2.2.4. 1 and Table 2.2.4.2. Table 2.2.4.2 also shows mandatory attributes (with *M* mark) required to be included in the request message using REST API, as well as optional attributes (with *O* mark) that are not necessarily present and those attributes (with *NP* mark) that should not be present in resource request representation.

The <AE> resource which resides in different kind of nodes such as Application Dedicated Node, Middle Node, Infrastructure Node etc. An Application Dedicated Node could reside in a constrained M2M device, while a Middle Node could reside in an M2M gateway and an Infrastructure Node could reside in an M2M Service Infrastructure. For example, in smart home scenario, light bulbs are modelled as Application Dedicated Node which communicate with home gateway which is modelled as a Middle Node and in resource registration phase, light bulbs can be registered as an <AE> resource.

Table 2.2.4. 1 Universal Attributes of <AE> resource

Attribute Name	Request Optionality	
	Create	Update
@resourceName	O	NP
resourceType	NP	NP
resourceID	NP	NP
parentID	NP	NP
accessControlPolicyIDs	O	O
creationTime	NP	NP
expirationTime	O	O
lastModifiedTime	NP	NP
labels	O	O
announceTo	O	O
announcedAttribute	O	O

Table 2.2.4. 2 Resource Specific Attributes of <AE> resource

Attribute Name	Request Optionality		Data Type	Default Value and Constraints
	Create	Update		
appName	O	O	xs:string	No default
App-ID	M	NP	xs:string	No default
AE-ID	NP	NP	m2m:ID	No default
pointOfAccess	O	O	m2m:poaList	No default
ontologyRef	O	O	xs:anyURI	No default
nodeLink	NP	NP	xs:anyURI	No default
requestReachability	M	O	xs:boolean	No default
contentSerialization	O	O	m2m:serializations	No default

1) API/AE/CRE

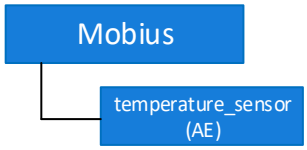
Interface ID	API/AE/CRE/001_RCN/0 API/AE/CRE/001_RCN/1 API/AE/CRE/001_RCN/2 API/AE/CRE/001_RCN/3
Interface Name	AE CREATE with resultContent parameter
Target Resource	<CSEBase> resource of the requested <AE> resource
Interface Description	The interface is used by a AE Registree to send a <AE> CREATE request attached with resultContent to a Registrar CSE (Mobius), and the Registrar CSE creates a <AE> resource and sends back a response to the AE Registree according to the configured resultContent parameter. • When **resultContent** is set to 0 (zero): The response contains the ***response status code*** ONLY with no information of the created <AE> resource. • When **resultContent** is set to 1 (one): The response contains a **response status**

code as well as the <AE> resource information (***attributes***) that represents the nCube.

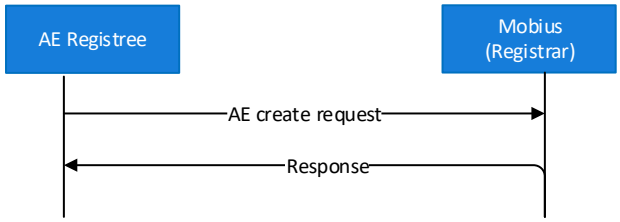
- When **resultContent** is set to 2 (two): The response contains a ***response status code*** as well as the ***hierarchical address*** of the created <AE> resource information.
- When **resultContent** is set to 3 (three): The response contains a ***response status code***, the ***hierarchical address***, and ***attributes*** of the created <AE> resource that represent the Registree entity.

Note that mandatory attributes for creation of the <AE> are highlighted in create request. A temperature sensor is registered to Mobius platform by sending a <AE> registration request to the Mobius CSEBase.

① Resource Structure



② Call Flow between the AE Registree and the Registrar CSE is shown as below:



③ Resource URL Information

POST /Mobius?rcn=<VALUE>

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=2*

⑤ Example

API/AE/CRE/001_RCN/0

Request

```
POST /Mobius?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: sdafdger325
X-M2M-Origin: S
Content-Type: application/vnd.onem2m-res+json;ty=2

{
    "m2m:ae": {
        "rn": "temp_sensor",
        "api": "0.2.481.2.0001.001.000111",
        "lbl": ["indoor_temp", "room_1"],
        "rr": true
```

```
}
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 0
Content-Location: /Mobius/S20170718063914261 9Wni
Content-Type: application/json
X-M2M-RI: sdafdger325
X-M2M-RSC: 2001
```

API/AE/CRE/001_RCN/1

Request

```
POST /Mobius?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 156545dagdasf
X-M2M-Origin: S
Content-Type: application/vnd.onem2m-res+json;ty=2

{
    "m2m:ae": {
        "rn": "temp_sensor",
        "api": "0.2.481.2.0001.001.000111",
        "lbl": ["indoor_temp", "room_1"],
        "rr": true
}
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 247
Content-Location: /Mobius/S20170718064315893ezjk
Content-Type: application/json
X-M2M-RI: 156545dagdasf
X-M2M-RSC: 2001

{
    "m2m:ae": {
        "rn": "temp_sensor",
        "ty": 2,
        "pi": "SJDRnzBBZ",
        "ri": "S20170718064315893ezjk",
        "ct": "20170718T064315",
        "et": "20190718T064315",
        "lt": "20170718T064315",
        "api": "0.2.481.2.0001.001.000111",
        "lbl": [
            "indoor_temp",
            "room_1"
        ],
        "rr": true,
        "aei": "S20170718064315893ezjk"
    }
}
```

API/AE/CRE/001_RCN/2

Request

```
POST /Mobius?rcn=2 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 45hghfg6757
X-M2M-Origin: S
Content-Type: application/vnd.onem2m-res+json;ty=2

{
    "m2m:ae": {
        "rn": "temp_sensor",
        "api": "0.2.481.2.0001.001.000111",
        "lbl": ["indoor_temp", "room_1"],
        "rr": true
    }
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 27
Content-Location: /Mobius/S20170718064315893ezjk
Content-Type: application/json
X-M2M-RI: 45hghfg6757
X-M2M-RSC: 2001

{
    "m2m:uri": "Mobius/temp_sensor"
}
```

API/AE/CRE/001_RCN/3

Request

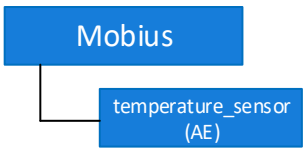
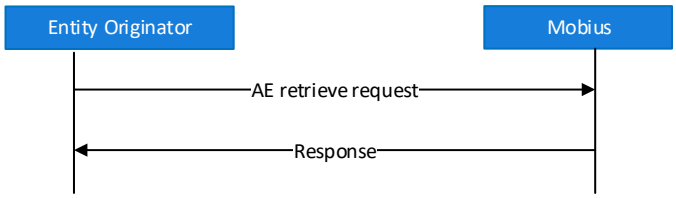
```
POST /Mobius?rcn=3 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: dsaf456763
X-M2M-Origin: S
Content-Type: application/vnd.onem2m-res+json;ty=2

{
    "m2m:ae": {
        "rn": "temp_sensor",
        "api": "0.2.481.2.0001.001.000111",
        "lbl": ["indoor_temp", "room_1"],
        "rr": true
    }
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 282
Content-Location: /Mobius/S20170718064315893ezjk
Content-Type: application/json
X-M2M-RI: dsaf456763
X-M2M-RSC: 2001

{
    "m2m:rce": {
        "uri": "Mobius/temp_sensor",
        "m2m:ae": {
```

```
            "rn": "temp_sensor",
            "ty": 2,
            "pi": "SJDRnzBBZ",
            "ri": "S20170718064315893ezjk",
            "ct": "20170718T064935",
            "et": "20190718T064935",
            "lt": "20170718T064935",
            "api": "0.2.481.2.0001.001.000111",
            "lbl": [
                "indoor_temp",
                "room_1"
            ],
            "rr": true,
            "aei": "S20170718064315893ezjk"
        }
    }
}
```


2) API/AE/RET

Interface ID	API/AE/RET/002_RCN/1 API/AE/RET/002_RCN/4
Interface Name	AE RETRIEVE with resultContent parameter
Target Resource	The <AE> resource located under <CSEBase> of Mobius
Interface Description	The interface is used to send a <AE> RETRIEVE request attached with resultContent to the <AE> resource located under the <CSEBase> of the Mobius, and the hosting CSE (Mobius) will send back a response according to the configured resultContent. • When ***resultContent*** is set to 1: The response contains the attributes information of the requested <AE> resource. • When ***resultContent*** is set to 4: The response contains both the attributes and child resources (if any) of the requested <AE> resource. This option is usuallt used to retrieve all child resources under a <AE> resource. ① Resource Structure  ② Call Flow between the request originator and the hosting CSE is shown as below:  ③ Resource URL Information

```
GET /Mobius/temp_sensor?rcn=<VALUE>
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	Entity ID of request originator

⑤ Example

API/AE/RET/002_RCN/1

Request

```
GET /Mobius/temp_sensor?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: reqadsf45321
X-M2M-Origin: S20170718064315893ezjk
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 247
X-M2M-RI: reqadsf45321
X-M2M-RSC: 2000

{
    "m2m:ae": {
        "pi": "SJDRnzBBZ",
        "ty": 2,
        "ct": "20170718T063914",
        "ri": "S20170718064315893ezjk",
        "rn": "temp_sensor",
        "lt": "20170718T063914",
        "et": "20190718T063914",
        "lbl": [
            "indoor_temp",
            "room_1"
        ],
        "api": "0.2.481.2.0001.001.000111",
        "aei": "S20170718064315893ezjk",
        "rr": true
    }
}
```

API/AE/RET/002_RCN/4

Request

```
GET /Mobius/temp_sensor?rcn=4 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: asdf4546343
X-M2M-Origin: S20170718064315893ezjk
```

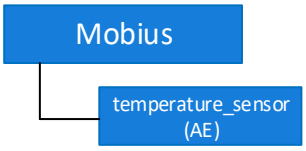
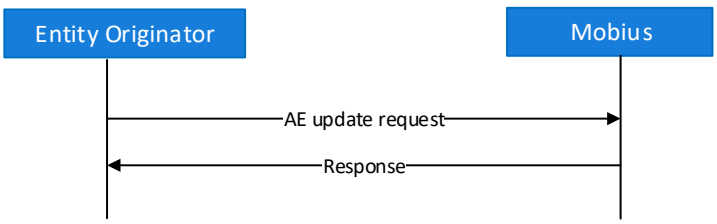
Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 1267
X-M2M-RI: asdf4546343
X-M2M-RSC: 2000
```

```
{
    "m2m:ae": [
        {
            "ri": "S20170718064315893ezjk",
            "api": "0.2.481.2.0001.001.000111",
            "aei": "S20170718064315893ezjk",
            "rr": true,
            "pi": "SJDRnzBBZ",
            "ty": 2,
            "ct": "20170718T064935",
            "rn": "temp_sensor",
            "lt": "20170718T064935",
            "et": "20190718T064935",
            "lbl": [
                "indoor_temp",
                "room_1"
            ]
        }
    ],
    "m2m:cnt": [
        {
            "ri": "SJfPKzNjrZ",
            "cr": "S20170718064315893ezjk",
            "mni": 3153600000,
            "mbs": 3153600000,
            "mia": 31536000,
            "cni": 2,
            "cbs": 4,
            "pi": "S20170718064315893ezjk",
            "ty": 3,
            "ct": "20170718T070223",
            "rn": "cnt_test",
            "lt": "20170718T070231",
            "et": "20190718T070223",
            "lbl": [
                "API"
            ],
            "st": 2
        }
    ],
    "m2m:cin": [
        {
            "ri": "S1GCtGNorb",
            "cr": "S20170718064315893ezjk",
            "cs": 2,
            "con": "on",
            "pi": "SJfPKzNjrZ",
            "ty": 4,
            "ct": "20170718T070230",
            "rn": "4-20170718070230465dEOt",
            "lt": "20170718T070230",
            "et": "20190718T070230",
            "st": 1
        },
        {
            "ri": "rkG19zEsrb",
            "cr": "S20170718064315893ezjk",
            "cs": 2,
            "con": "on",
            "pi": "SJfPKzNjrZ",
            "ty": 4,
            "ct": "20170718T070231",
            "rn": "4-20170718070231099M0sB",
            "lt": "20170718T070231",
            "et": "20190718T070231",
            "st": 2
```

```
        }
    ],
    "m2m:grp": [
        {
            "ri": "BkGyjG4iSZ",
            "cr": "S20170718064315893ezjk",
            "mt": 0,
            "cnm": 2,
            "mnm": "10",
            "mid": [
                "Mobius/temp_sensor/cnt_test/4-
20170717101658000xxvX",
                "Mobius/temp_sensor/cnt_test/4-
20170717101657318 4FnI"
            ],
            "mtv": false,
            "csy": 1,
            "pi": "S20170718064315893ezjk",
            "ty": 9,
            "ct": "20170718T070246",
            "rn": "grp1",
            "lt": "20170718T070246",
            "et": "20190718T070246"
        }
    ]
}
```


3) API/AE/UPD

Interface ID	API/AE/UPD/003_RCN/0
Interface Name	AE UPDATE with resultContent set to 0
Target Resource	The <AE> resource located under <CSEBase> resource of Mobius
Interface Description	The interface is used to send a <AE> UPDATE request attached with resultContent set to 0 to the target <AE> resource under Mobius, and the hosting CSE will send back a response only containing the response status code indicating the request processing status. ① Resource Structure  ② Call Flow  ③ Resource URL Information `PUT /Mobius/temp_sensor?rcn=0` ④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	Entity ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

⑤ Example

API/AE/UPD/003_RCN/0

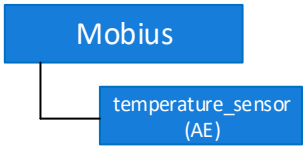
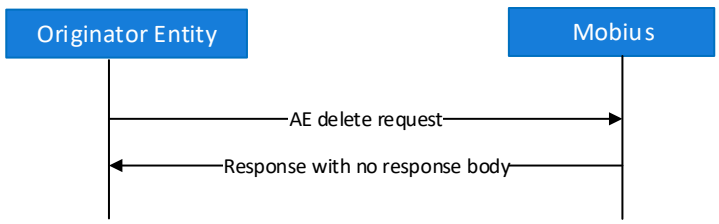
Request

```
PUT /Mobius/temp_sensor?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: ere56534543
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json

{
  "m2m:ae":
  {
        "poa": ["http://ae.temp.com:9090"]
  }
}
```

Response

```
HTTP/1.1 200 OK
Content-Length: 0
Content-Type: application/json
X-M2M-RI: ere56534543
X-M2M-RSC: 2004
```

4) API/AE/DEL

Interface ID	API/AE/DEL/004_RCN/0
Interface Name	AE DELETE with resultContent set to 0
Target Resource	The <AE> resource located under <CSEBase> of Mobius
Interface Description	The interface is used to send a <AE> DELETE request attached with resultContent set to 0 to the hosting CSE (Mobius), and the hosting CSE will delete the <AE> and send back a response containing a response status code indicating the DELETE request status. ① Resource Structure  ② Call Flow 

③ Resource URL Information

```
DELETE /Mobius/temp_sensor?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	Entity ID of request originator

⑤ Example

API/AE/DEL/004_RCN/0

Request

```
DELETE /Mobius/temp_sensor?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: rdsfsdfeq63456
X-M2M-Origin: S20170718064315893ezjk
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 0
Content-type: application/json
X-M2M-RI: rdsfsdfeq63456
X-M2M-RSC: 2002
```

2.3.5. <container> Resource

The <container> resource represents a container for data instances. It is used to share information with other entities and potentially to track the data. A *<container>* resource has no associated content. It has only attributes and child resources.

The <container> resource contains a group of universal attributes applied for all oneM2M resource primitives and a group of specific resources applied for only <container> resource itself, shown as Table 2.2.5. 1 and Table 2.2.5.2. Table 2.2.5.2 only shows optional attributes (with *O* mark) that are not necessarily present and those attributes (with *NP* mark) that should not be present in resource request representation. There are no mandatory attributes required to be present when sending a create <container> resource request, all the attributes of <container> resources will be automatically assigned by registrar CSE during handling create <container> request.

The <container> resource can be seen as a container of a group of data instances with same characteristics, for example, sensor measurement of temperature, humidity, illumination, CO2 etc. For example, when a temperature sensor is modelled as application dedicated node and registered with an <AE> resource, a <container> resource can be created under the created <AE> as its child resource to contain temperature measurements. Note that <container> resource has no associated content and the real data is contained in a child resource of container called <contentInstance> which will be introduced in section 2.2.6.

Table 2.2.5. 1 Universal Attributes of <container> resource

Attribute Name	Request Optionality	
	Create	Update
@resourceName	O	NP
resourceType	NP	NP
resourceID	NP	NP
parentID	NP	NP
accessControlPolicyIDs	O	O
creationTime	NP	NP
expirationTime	O	O
lastModifiedTime	NP	NP
stateTag	NP	NP
labels	O	O
announceTo	O	O
announcedAttribute	O	O

Table 2.2.5. 2: Resource Specific Attributes of <container> resource

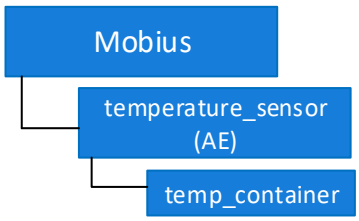
Attribute Name	Request Optionality		Data Type	Default Value and Constraints
	Create	Update		
creator	O	NP	m2m:ID	No default
maxNrOfInstances	O	O	xs:nonNegativeInteger	No default
maxByteSize	O	O	xs:nonNegativeInteger	No default
maxInstanceAge	O	O	xs:nonNegativeInteger	No default
currentNrOfInstances	NP	NP	xs:nonNegativeInteger	No default (This is generated by the hosting CSE and limited by the maxNrOfInstances)
currentByteSize	NP	NP	xs:nonNegativeInteger	No default (This is generated by the hosting CSE and limited by the maxByteSize)
locationID	O	O	xs:anyURI	No default
ontologyRef	O	O	xs:anyURI	No default

1) API/CNT/CRE

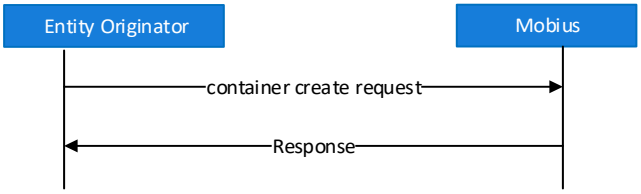
Interface ID	API/CNT/CRE/001_RCN/0 API/CNT/CRE/001_RCN/1 API/CNT/CRE/001_RCN/2 API/CNT/CRE/001_RCN/3
Interface Name	container CREATE with resultContent parameter
Target Resource	<AE> resource as a parent resource of the requested <container> resource
Interface Description	The interface is used to send a <container> CREATE request attached with resultContent under the <AE> resource located in the <CSEBase> of Mobius, the hosting CSE (Mobius) will create the <container> resource under the <AE>, and send back a response according to the configured resultContent. • When **resultContent** is set to 0: The response contains the ***response status code*** ONLY with no information of the created <container> resource. • When **resultContent** is set to 1 (one): The response contains a **response status code** as well as the <container> resource information (***attributes***) that represents the nCube. • When **resultContent** is set to 2: The response contains a ***response status code*** as well as the ***hierarchical address*** of the created <container> resource information. • When **resultContent** is set to 3: The response contains a ***response status code***, the ***hierarchical address***, and ***attributes*** of the created <container> resource that

represent the Registree entity.

① Resource Structure



② Call Flow



③ Resource URL Information

```
POST /Mobius/temp_sensor?rcn=<VALUE>
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	Entity ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=3*

⑤ Example

API/CNT/CRE/001_RCN/0

Request

```
POST /Mobius/temp_sensor?rcn=0  HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: asdfasdf3443
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=3

{
   "m2m:cnt":
  {
    "rn": "temp_container"
  }
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 0
Content-Location: /Mobius/SJfALihnHW
Content-Type: application/json
X-M2M-RI: asdfasdf3443
```

```
X-M2M-RSC: 2001
```

API/CNT/CRE/001_RCN/1

Request

```
POST /Mobius/temp_sensor?rcn=1  HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 123436fggdf5
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=3

{
   "m2m:cnt":
  {
    "rn": "temp_container"
  }
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 269
Content-Location: /Mobius/SJfALihnHW
Content-Type: application/json
X-M2M-RI: 123436fggdf5
X-M2M-RSC: 2001

{
    "m2m:cnt": {
        "rn": "temp_container",
        "ty": 3,
        "pi": "S20170719105818456181B",
        "ri": "SJfALihnHW",
        "ct": "20170719T105829",
        "et": "20200719T105829",
        "lt": "20170719T105829",
        "st": 0,
        "mni": 3153600000,
        "lbl": [
            "API"
        ],
        "mbs": 3153600000,
        "mia": 31536000,
        "cr": "S20170717074825768bp21",
        "cni": 0,
        "cbs": 0
    }
}
```

API/CNT/CRE/001_RCN/2

Request

```
POST /Mobius/temp_sensor?rcn=2  HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: as45f56fg
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=3

{
   "m2m:cnt":
  {
    "rn": "temp_container"
```

```
  }
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 38
Content-Location: /Mobius/SJfALihnHW
Content-Type: application/json
X-M2M-RI: as45f56fg
X-M2M-RSC: 2001

{
    "m2m:uri": "/Mobius/temp_sensor/temp_container"
}
```

API/CNT/CRE/001_RCN/3

Request

```
POST /Mobius/temp_sensor?rcn=3  HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 12145435ghrs
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=3

{
   "m2m:cnt":
  {
    "rn": "temp_container"
  }
}
```

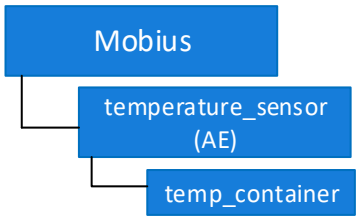
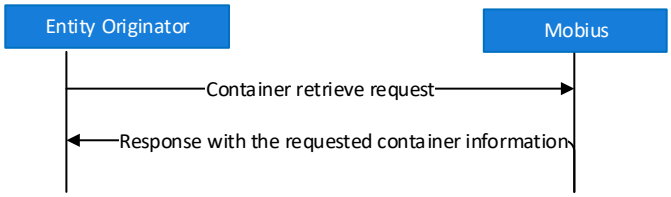
Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 313
Content-Location: /Mobius/SJfALihnHW
Content-Type: application/json
X-M2M-RI: 12145435ghrs
X-M2M-RSC: 2001

{
    "m2m:rce": {
        "uri": "Mobius/temp_sensor/temp_container",
        "m2m:cnt": {
            "rn": "temp_container",
            "ty": 3,
            "pi": "S20170719105818456181B",
            "ri": "SJfALihnHW",
            "ct": "20170719T110403",
            "et": "20200719T110403",
            "lt": "20170719T110403",
            "st": 0,
            "mni": 3153600000,
            "lbl": [
                "API"
            ],
            "mbs": 3153600000,
            "mia": 31536000,
            "cr": "S20170717074825768bp2l",
            "cni": 0,
            "cbs": 0
        }
```

```
    }
}
```

2) API/CNT/RET

Interface ID	API/CNT/RET/002_RCN/1 API/CNT/RET/002_RCN/4
Interface Name	container RETRIEVE with resultContent parameter
Target Resource	Requested <container> resource

Interface Description	The interface is used to send a <container> RETRIEVE request attached with resultContent to the <container> resource located in the <CSEBase> of Mobius, the hosting CSE (Mobius) will send back a response according to the configured resultContent.
	• When ***resultContent*** is set to 1: The response contains the attributes information of the requested <container> resource.
	• When ***resultContent*** is set to 4: The response contains both the attributes and child resources (if any) of the requested <container> resource. This option is usuallt used to retrieve all child resources under a <container> resource.
	① Resource Structure
	 
	
	② Call Flow
	 
	
	③ Resource URL Information
	`GET /Mobius/temp_sensor/temp_container?rcn=<INTEGER_VALUE>`
	④ Http Header Information
	Header / **Value**
	Accept / *application/ json*
	X-M2M-RI / Request ID
	X-M2M-Origin / AE-ID of request originator
	⑤ Example
	API/CNT/RET/002_RCN/1
	Request
	`GET /Mobius/temp_sensor/temp_container?rcn=1 HTTP/1.1`
	`Host: yt.iotmobius.com:7579`

```
Accept: application/json
X-M2M-RI: asdfs435454
X-M2M-Origin: S20170718064315893ezjk
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 269
Content-Type: application/json
X-M2M-RI: asdfs435454
X-M2M-RSC: 2000

{
    "m2m:cnt": {
        "rn": "temp_container",
        "ty": 3,
        "pi": "S20170719105818456181B",
        "ri": "SJfALihnHW",
        "ct": "20170719T105829",
        "et": "20200719T105829",
        "lt": "20170719T105829",
        "st": 0,
        "mni": 3153600000,
        "lbl": [
            "API"
        ],
        "mbs": 3153600000,
        "mia": 31536000,
        "cr": "S20170717074825768bp2l",
        "cni": 0,
        "cbs": 0
    }
}
```

API/CNT/RET/002_RCN/4

Request

```
GET /Mobius/temp_sensor/temp_container?rcn=4 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 23432fghfsd65
X-M2M-Origin: S20170718064315893ezjk
```

Response

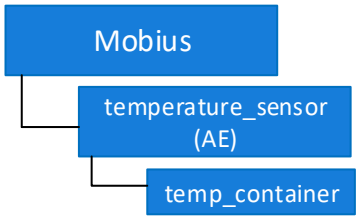
```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 883
Content-Type: application/json
X-M2M-RI: 23432fghfsd65
X-M2M-RSC: 2000

{
    "m2m:cnt": [
        {
            "ri": "SJfALihnHW",
            "cr": "S20170717074825768bp2l",
            "mni": 3153600000,
            "mbs": 3153600000,
            "mia": 31536000,
            "cni": 3,
            "cbs": 6,
            "pi": "S20170719105818456181B",
            "ty": 3,
```

```
            "ct": "20170719T105829",
            "rn": "temp_container",
            "lt": "20170719T124549",
            "et": "20200719T110403",
            "lbl": [
               "API"
            ],
            "st": 3
        }
    ],
    "m2m:cin": [
        {
            "ri": "BkM4KVR3BW",
            "cr": "S20170717074825768bp2l",
            "cs": 2,
            "con": "on",
            "pi": "SJfALihnHW",
            "ty": 4,
            "ct": "20170719T124547",
            "rn": "4-20170719124547923wKrZ",
            "lt": "20170719T124547",
            "et": "20200719T124547",
            "st": 1
        },
        {
            "ri": "SJGHtV0hrW",
            "cr": "S20170717074825768bp2l",
            "cs": 2,
            "con": "on",
            "pi": "SJfALihnHW",
            "ty": 4,
            "ct": "20170719T124548",
            "rn": "4-201707191245487O479Am",
            "lt": "20170719T124548",
            "et": "20200719T124548",
            "st": 2
        },
        {
            "ri": "SyMIF4R2HW",
            "cr": "S20170717074825768bp2l",
            "cs": 2,
            "con": "on",
            "pi": "SJfALihnHW",
            "ty": 4,
            "ct": "20170719T124549",
            "rn": "4-20170719124549580WZMC",
            "lt": "20170719T124549",
            "et": "20200719T124549",
            "st": 3
        }
    ]
}
```

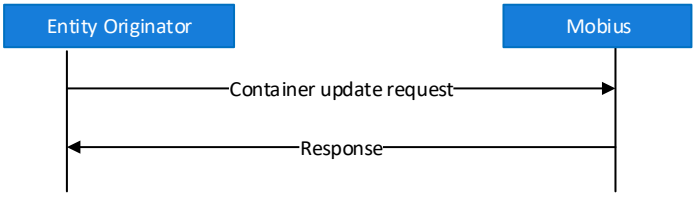
3) API/CNT/UPD

Interface ID	API/CNT/UPD/003_RCN/0
Interface Name	container UPDATE with resultContent set to 0 (nothing)
Target Resource	Requested <container> resource
Interface Description	The interface is used to send a <container> UPDATE request attached with resultContent set to 0 to the target <container> resource located under the Mobius, and the hosting CSE (Mobius) will respond with only the response status code to indicate the UPDATE operation status.

① Resource Structure



② Call Flow



③ Resource URL Information

```
PUT /Mobius/temp_sensor/temp_container?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

⑤ Example of Request Message

API/CNT/UPD/003_RCN/0

Request

```
PUT /Mobius/temp_sensor/temp_container?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: fdgf435465
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json

{
  "m2m:cnt":
  {
        "mni": 10000,
        "lbl": ["indoor_temp"]
  }
}
```

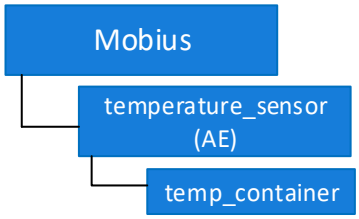
Response

```
HTTP/1.1 200 OK
Content-Length: 0
Content-Type: application/json
X-M2M-RI: fdgf435465
X-M2M-RSC: 2004
```

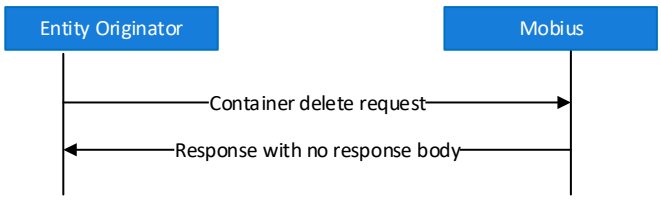
4) API/CNT/DEL

Interface ID	API/CNT/DEL/004_RCN/0
Interface Name	container DELETE with resultContent set to 0 (nothing)
Target Resource	Requested <container> resource
Interface Description	The interface is used to send a <container> DELETE request attached with resultContent set to 0 to a target <container> resource located under the Mobius, and the hosting CSE (Mobius) will respond with only response status code to indicate the DELETE operation status.

1) Resource Structure



2) Call Flow



3) Resource URL Information

DELETE /Mobius/temp_sensor/temp_container?rcn=0

4) Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID

5) Example

API/CNT/DEL/004_RCN/0

Request

```
DELETE /Mobius/temp_sensor/temp_container?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: asdf45345234
```

	X-M2M-Origin: S20170718064315893ezjk **Response** HTTP/1.1 200 OK Accept: application/json Content-Length: 0 X-M2M-RI: asdf45345234 X-M2M-RSC: 2002

2.3.6. <contentInstance> Resource

The <contentInstance> resource represents a data instance stored in the <container> resource. Taking a temperature sensor device as an example, the temperature sensor is designed to collect temperature data of environment and in this case, the real temperature data is modelled as a <contentInstance> resource. In details, we assume both the temperature sensor is registered with <AE> resource and a <container> resource is created under the <AE> to store temperature instances, under this consumption, whenever the temperature data is uploaded into a central server, the temperature data has to be denoted as a value of *content* attribute of <contentInstance> resource.

The <contentInstance> resource cannot be modified once created, and is able to be deleted explicitly by an AE or may be deleted by the platform based on specific policies. If the platform has policies to manage the <contentInstance> resource, these policies are represented by attributes *axByteSize*, *maxNrOfInstances* and/or *maxInstanceAge* attributes in their parent <container> resource.

The <contentInstance> resource inheritances the same access control policies of its parent <*container*> resource, and does not have its own *accessControlPolicyIDs* attribute.

Table 2.2.6. 1 Universal Attributes of <contentInstance> resource

Attribute Name	Request Optionality
	Create
@resourceName	O
resourceType	NP
resourceID	NP
parentID	NP
expirationTime	O
creationTime	NP
lastModifiedTime	NP
stateTag	NP
labels	O
announceTo	O
announcedAttribute	O

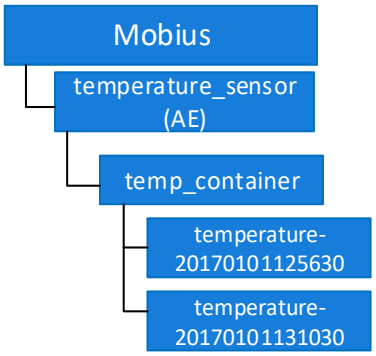
Table 2.2.6. 2 Resource Specific Attributes of <contentInstance> resource

Attribute Name	Request Optionality	Data Type	Default Value and Constraints
	Create		
creator	O	m2m:ID	
contentInfo	O	m2m:contentInfo	No default
contentSize	NP	xs:nonNegativeInteger	No default
ontologyRef	O	xs:anyURI	No default
content	M	xs:anySimpleType	No default (Transfer encoding may be applied, and indicated applied encoding as part of the *contentInfo* attribute)

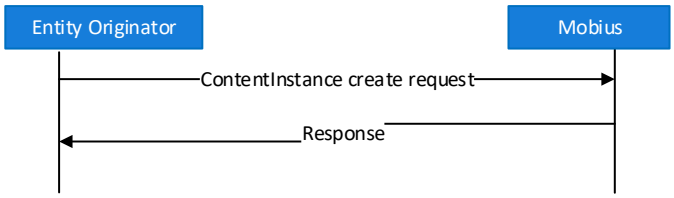
1) API/CIN/CRE

Interface ID	API/CIN/CRE/001_RCN/0 API/CIN/CRE/001_RCN/1 API/CIN/CRE/001_RCN/2 API/CIN/CRE/001_RCN/3
Interface Name	contentInstance CREATE with resultContent parameter
Target Resource	The <container> resource as a parent resource of being created <contentInstance> resource
Interface Description	The interface is used to send a <contentInstance> CREATE request attached with resultContent to the target <container> resource located under the Mobius, and the hosting CSE (Mobius) will create a new <contentInstance> under the requested <container>, and send back a response containing only the reponse status code to indicate the CREATE operation status. • When **resultContent** is set to 0: The response contains the ***response status code*** ONLY with no information of the created <contentInstance> resource. • When **resultContent** is set to 1: The response contains a **response status code** as well as the <contentInstance> resource information. • When **resultContent** is set to 2: The response contains a ***response status code*** as well as the ***hierarchical address*** of the created <contentInstance> resource information. • When **resultContent** is set to 3: The response contains a ***response status code***, the ***hierarchical address***, and ***attributes*** of the created <contentInstance> resource.

① Resource Structure



② Call Flow



③ Resource URL Information

```
POST
/Mobius/temp_sensor/temp_container?rcn=<INTEGER_VALUE>
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=4*

⑤ Example

API/CIN/CRE/001_RCN/0

Request

```
POST /Mobius/temp_sensor/temp_container?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: asdgdsa4rt32
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=4

{
   "m2m:cin":
  {
    "con": "20"
  }
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 0
Content-Location:
/Mobius/temp_sensor/temp_container/temperature-20170101125630
X-M2M-RI: asdgdsa4rt32
X-M2M-RSC: 2001
```

API/CIN/CRE/001_RCN/1

Request

```
POST /Mobius/temp_sensor/temp_container?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: cfgfdsg76765
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=4

{
   "m2m:cin":
  {
    "con": "20"
  }
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 211
Content-Location: /Mobius/SyMIF4R2HW
X-M2M-RI: cfgfdsg76765
X-M2M-RSC: 2001

{
    "m2m:cin": {
        "pi": "SJfALihnHW",
        "ty": 4,
        "ct": "20170719T124549",
        "ri": "SyMIF4R2HW",
        "rn": "4-20170719124549580WZMC",
        "lt": "20170719T124549",
        "et": "20200719T124549",
        "st": 3,
        "cs": 2,
        "cr": "S20170717074825768bp21",
        "con": "on"
    }
}
```

API/CIN/CRE/001_RCN/2

Request

```
POST /Mobius/temp_sensor/temp_container?rcn=2 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 2yase457hgfd5
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=4

{
   "m2m:cin":
  {
    "con": "20"
```

```
  }
}
```

Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 62
Content-Location: /Mobius/SyMIF4R2HW
X-M2M-RI: 2yase457hgfd5
X-M2M-RSC: 2001

{
    "m2m:uri":
    "/Mobius/temp_sensor/temp_container/4-
20170719134926901 4jCM"
}
```

API/CIN/CRE/001_RCN/3

Request

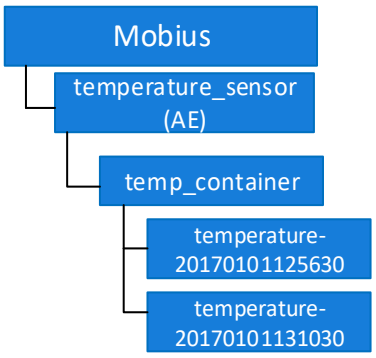
```
POST /Mobius/temp_sensor/temp_container?rcn=3 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 544g56kmgsa
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=4

{
   "m2m:cin":
  {
    "con": "20"
  }
}
```

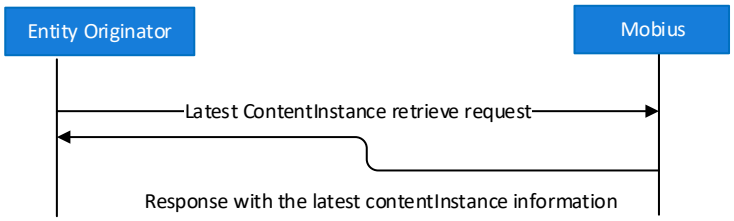
Response

```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 279
Content-Location: /Mobius/SyMIF4R2HW
X-M2M-RI: 544g56kmgsa
X-M2M-RSC: 2001


{
    "m2m:rce": {
        "uri":"Mobius/temp_sensor/temp_container/4-
20170719134926901 4jCM",
        "m2m:cin": {
          "pi": "SJfALihnHW",
          "ty": 4,
          "ct": "20170719T124549",
          "ri": "SyMIF4R2HW",
          "rn": "4-20170719124549580WZMC",
          "lt": "20170719T124549",
          "et": "20200719T124549",
          "st": 3,
          "cs": 2,
          "cr": "S20170717074825768bp2l",
          "con": "on"
      }
    }
}
```

2) API/CIN/RET

<table>
<tr><td>Interface ID</td><td>API/CIN/RET/002_LA
API/CIN/RET/002_OL</td></tr>
<tr><td>Interface Name</td><td>Latest contentInstance RETRIEVE</td></tr>
<tr><td>Target Resource</td><td><latest> virtual resource of the requested <container> resource</td></tr>
<tr><td>Interface Description</td><td>
The interface is used to send a latest (or oldest) <contentInstance> RETRIEVE request to the Mobius, and the hosting CSE (Mobius) sends back the most recently created(or the oldest) <contentInstance> information to the originator.

① Resource Structure


② Call Flow


③ Resource URL Information
GET /Mobius/temp_sensor/temp_container/latest

④ Http Header Information
<table>
<tr><th>Header</th><th>Value</th></tr>
<tr><td>Accept</td><td>application/ json</td></tr>
<tr><td>X-M2M-RI</td><td>Request ID</td></tr>
<tr><td>X-M2M-Origin</td><td>AE-ID of request originator</td></tr>
</table>
⑤ Example of Request Message
API/CIN/RET/002_LA

Request

GET /Mobius/temp_sensor/temp_container/latest HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: sdag34545t
X-M2M-Origin: S20170718064315893ezjk

Response
</td></tr>
</table>

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 271
Content-Type: application/json
X-M2M-RI: sdag34545t
X-M2M-RSC: 2000

{
    "m2m:cin": {
          "pi": "SJfALihnHW",
          "ty": 4,
          "ct": "20170719T124549",
          "ri": "SyMIF4R2HW",
          "rn": "4-20170719124549580WZMC",
          "lt": "20170719T124549",
          "et": "20200719T124549",
          "st": 3,
          "cs": 2,
          "cr": "S20170717074825768bp2l",
          "con": "on"
      }
}
```

API/CIN/RET/002_OL

Request

```
GET /Mobius/temp_sensor/temp_container/oldest HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: hgh45422df
X-M2M-Origin: S20170718064315893ezjk
```

Response

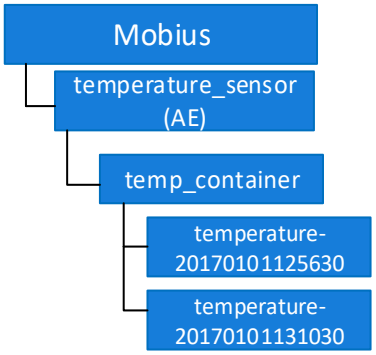
```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 271
Content-Type: application/json
X-M2M-RI: hgh45422df
X-M2M-RSC: 2000

{
    "m2m:cin": {
        "pi": "r1Mss3h3Bb",
        "ty": 4,
        "ct": "20170719T124547",
        "ri": "BkM4KVR3BW",
        "rn": "4-20170719124547923wKrZ",
        "lt": "20170719T124547",
        "et": "20200719T124547",
        "st": 1,
        "cs": 2,
        "cr": "S20170717074825768bp21",
        "con": "on"
    }
}
```

3) API/CIN/DEL

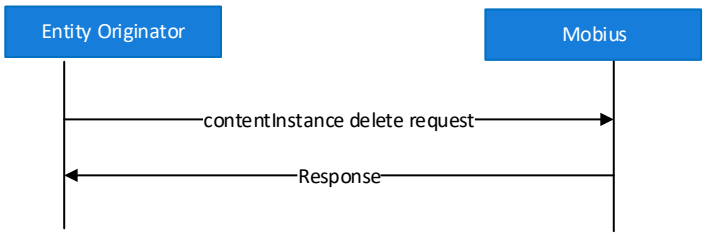
Interface ID	API/CIN/DEL/003_LA/RCN/0
Interface Name	contentInstance DELETE with resultContent set to 0 (nothing)
Target Resource	<latest> virtual resource of requested <container> resource
Interface Description	The interface is used to send a <container> DELETE request attached with resultContent to the Mobius, and the hosting CSE (Mobius) will delete the <contentInstance>, and send

back a response containing the response status code to indicate the status of the DELETE operation.

① Resource Structure



② Call Flow



③ Resource URL Information

```
DELETE /Mobius/temp_sensor/temp_container/latest?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

⑤ Example

API/CIN/DEL/003_LA/RCN/0

Request

```
DELETE /Mobius/temp_sensor/temp_container/latest?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: sadf32445
X-M2M-Origin: S20170718064315893ezjk
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 0
X-M2M-RI: sadf32445
X-M2M-RSC: 2002
```

2.3.7. <semanticDecriptor> Resource

The <semanticDescriptor> resource is used to store a semantic description pertaining to a resource and potentially sub-resources. Such a description may be provided according to ontologies. The semantic information is used by the semantic functionalities of the oneM2M system and is also available to applications or CSEs.

The < semanticDescriptor > resource contains a group of universal attributes applied for all oneM2M resource primitives and a group of specific resources applied for only < semanticDescriptor > resource itself, shown as Table 2.2.7. 1 and Table 2.2.7.2. Table 2.2.7.2 also shows mandatory attributes (with *M* mark) required to be present while using API, as well as optional attributes (with *O* mark) that are not necessarily present and those attributes (with *NP* mark) that should not be present in resource request representation.

Table 2.2.7. 1 Universal Attributes of <semanticDescriptor> resource

Attribute Name	Request Optionality	
	Create	Update
@resourceName	O	NP
resourceType	NP	NP
resourceID	NP	NP
parentID	NP	NP
expirationTime	O	O
accessControlPolicyIDs	O	O
creationTime	NP	NP
lastModifiedTime	NP	NP
labels	O	O

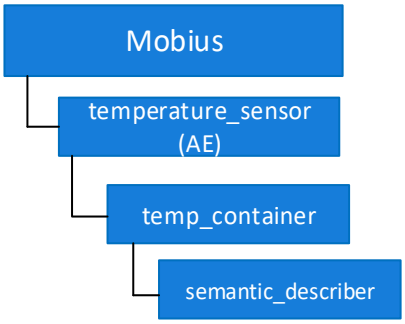
Table 2.2.7. 2 Resource Specific Attributes of <semanticDescriptor> resource

Attribute Name	Request Optionality		Data Type	Default Value and Constraints
	Create	Update		
creator	O	NP	m2m:ID	No default
descriptorRepresenation	M	O	m2m:descriptorRepresentation	application/rdf+xml:1
semanticOpExec	NP	O	m2m:sparql	No default
descriptor	M	O	xs:base64Binary	No default
ontologyRef	O	O	xs:anyURI	No default
relatedSemantics	O	O	List of xs:anyURI	No default

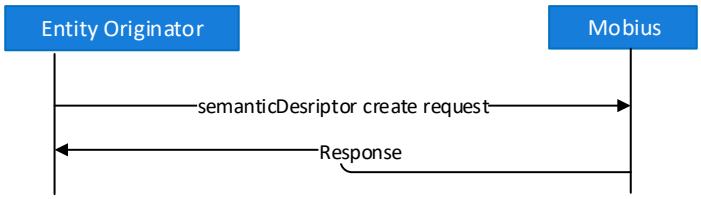
1) API/SMD/CRE

Interface ID	API/SMD/CRE/001_RCN/1 API/SMD/CRE/001_RCN/3
Interface Name	SemanticDescriptor CREATE with resultContent parameter
Target Resource	<container> resource as the parent resource of the requested <semanticDescriptor> resource
Interface Description	The interface is used to send a <semanticDescriptor> CREATE request attached with resultContent to the Mobius, and the hosting CSE (Mobius) creates a <semanticDescriptor> resource and send back a response according to the configured resultContent. • When **resultContent** is set to 1: The response contains a **response status code** as well as the <semanticDescriptor> resource information. • When **resultContent** is set to 3: The response contains a ***response status code***, the ***hierarchical address***, and ***attributes*** of the created <semanticDescriptor> resource.

① Resource Structure



② Call Flow



③ Resource URL Information

```
POST /Mobius/temp_sensor/temp_container?rcn=<INTEGER_VALUE>
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=24*

⑤ Example of Request Message

API/SMD/CRE/001_RCN/1

Request

```
POST /Mobius/temp_sensor/temp_container?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: gfdg43534fd
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=24

{
    "m2m:smd" : {
        "dcrp"   : "application/rdf+json:1",
        "rn"     : "semantic_describer01",
        "dsr":
"PHJkZjpSREYNCPHJkZjpSREYNCPHJkZjpSREYNCPHJkZjpSREYNC4="
    }
}
```

Response

```
HTTP/1.1 201 Created
```

```
Accept: application/json
Content-Length: 224
Content-Location: /Mobius/rkfVrWlpSb
Content-Type: application/vnd.onem2m-res+json
X-M2M-RI: gfdg43534fd
X-M2M-RSC: 2001

{
    "m2m:smd": {
        "rn": "semantic_describer01",
        "ty": 24,
        "pi": "SJfALihnHW",
        "ri": "rkfVrWlpSb",
        "ct": "20170719T144828",
        "et": "20200719T144828",
        "lt": "20170719T144828",
        "st": 0,
        "mni": 3153600000,
        "dcrp": "application/rdf+json:1",
        "cr": "S20170718064315893ezjk"
    }
}
```

API/SMD/CRE/001_RCN/3

Request

```
POST /Mobius/temp_sensor/temp_container?rcn=3 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: 435435thdgd
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=24

{
    "m2m:smd" : {
        "dcrp"   : "application/rdf+json:1",
        "rn"     : "semantic_describer01",
        "dsr":
"PHJkZjpSREYNCPHJkZjpSREYNCPHJkZjpSREYNCPHJkZjpSREYNC4="
    }
}
```

Response

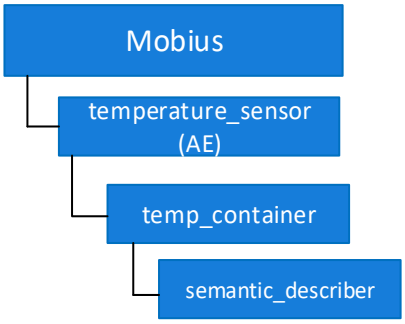
```
HTTP/1.1 201 Created
Accept: application/json
Content-Length: 273
Content-Location: /Mobius/rkfVrWlpSb
Content-Type: application/vnd.onem2m-res+json
X-M2M-RI: 435435thdgd
X-M2M-RSC: 2001


{
    "m2m:rce": {
        "uri":
"Mobius/temp_sensor/temp_container/semantic_describer01",
        "m2m:smd": {
            "rn": "semantic_describer01",
            "ty": 24,
            "pi": "SJfALihnHW",
            "ri": "rkfVrWlpSb",
            "ct": "20170719T145612",
            "et": "20200719T145612",
            "lt": "20170719T145612",
            "st": 0,
```

```
            "mni": 3153600000,
            "dcrp": "application/rdf+json:1",
            "cr": "S20170718064315893ezjk"
        }
    }
}
```

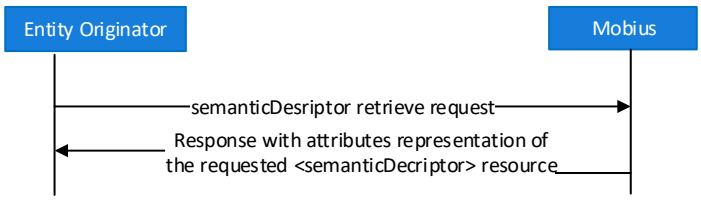

2) API/SMD/RET

Interface ID	API/SMD/RET/002_RCN/1
Interface Name	SemanticDescriptor RETRIEVE with resultContent set to 1 (attributes)
Target Resource	Requested <semanticDescriptor> resource
Interface Description	The interface is used to send a <semanticDescriptor> RETRIEVE request attached with resultContent to the Mobius, and the hosting CSE sends back a response containing the response status code and the attributes information of the requested <semanticDescriptor> resource.

① Resource Structure



② Call Flow



③ Resource URL Information

```
GET /Mobius/temp_sensor/temp_container/semantic_describer?rcn=1
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

⑤ Example

API/SMD/RET/002_RCN/1

Request

```
GET
/Mobius/temp_sensor/temp_container/semantic_describer01?rcn=1
HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: sadgdsag123
X-M2M-Origin: S20170718064315893ezjk
```

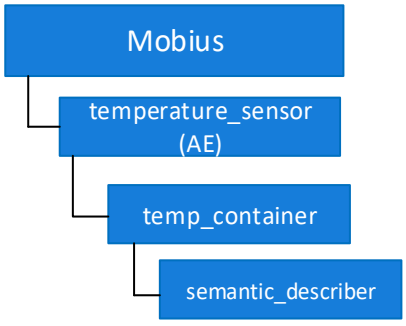
Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 224
X-M2M-RI: sadgdsag123
X-M2M-RSC: 2000

{
    "m2m:smd": {
        "rn": "semantic_describer01",
        "ty": 24,
        "pi": "SJfALihnHW",
        "ri": "rkfVrWlpSb",
        "ct": "20170719T144828",
        "et": "20200719T144828",
        "lt": "20170719T144828",
        "st": 0,
        "mni": 3153600000,
        "dcrp": "application/rdf+json:1",
        "cr": "S20170718064315893ezjk"
    }
}
```

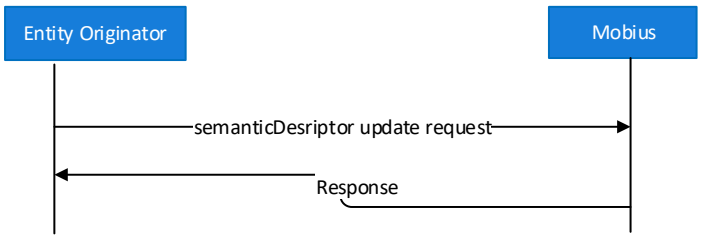
3) API/SMD/UPD

Interface ID	API/SMD/UPD/003_RCN/0
Interface Name	SemanticDescriptor UPDATE with resultContent set to 0 (nothing)
Target Resource	Requested <semanticDescriptor> resource
Interface Description	The interface is used to send a <semanticDescriptor> UPDATE request attached with resultContent to the Mobius, and the hosting CSE (Mobius) updates the <semanticDescriptor> and sends back a response containing the response status code to indicate the UPDATE operation status.

① Resource Structure



② Call Flow



③ Resource URL Information

PUT

/Mobius/temp_sensor/temp_container/semantic_describer01?rcn=0

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

⑤ Example

API/SMD/UPD/003_RCN/0

Request

```
PUT /Mobius/temp_sensor/temp_container/semantic_describer01?rcn=0
HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: fdgfd435435
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json

{
   "m2m:smd":
  {
    "or": "ontology.ref.com/semantics"
  }
}
```

Response

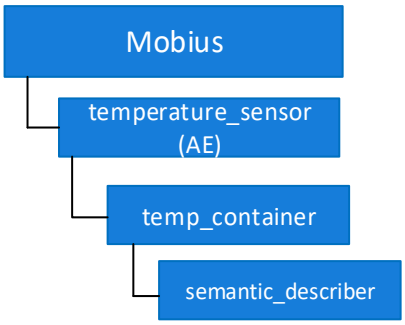
```
HTTP/1.1 200 OK
Content-Length: 0
Content-Type: application/json
X-M2M-RI: fdgfd435435
X-M2M-RSC: 2004
```

4) API/SMD/DEL

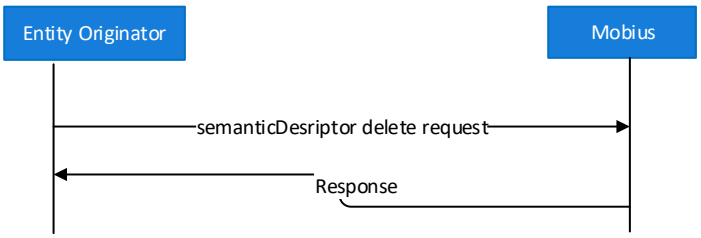
Interface ID	API/SMD/DEL/004_RCN/0
Interface Name	SemanticDescriptor DELETE with resultContent set to 0 (nothing)
Target	Requested <semanticDescriptor> resource

Resource	
Interface Description	The interface is used to send a <semanticDescriptor> DELETE request attached with resultContent to the Mobius, and the hosting CSE (Mobius) deletes the requested <semanticDescriptor> resource, and sends back a response containing a response status code to indicate the DELETE operation status.

1) Resource Structure



2) Call Flow



3) Resource URL Information

```
DELETE
/Mobius/temp_sensor/temp_container/semantic_describer01?rcn=0
```

4) Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

5) Example

API/SMD/DEL/004_RCN/0

Request

```
DELETE
/Mobius/temp_sensor/temp_container/semantic_describer01?rcn=0
HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: fds3435fgfd
X-M2M-Origin: S20170718064315893ezjk
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
```

	Content-Length: 0 X-M2M-RI: fds3435fgfd X-M2M-RSC: 2002

2.3.8. Resource Discovery

The Discovery CSF (DIS) searches information about applications and services as contained in attributes and resources.

The result of a discovery request from an Originator depends upon the filter criteria (e.g. a combination of keywords, identifiers, location and semantic information) that can limit the scope of information returned to the Originator and is subject to access control policy allowed by M2M Service Subscription. An Originator could be an AE or another CSE. The scope of the search could be within one CSE, or in more than one CSE.

The discovery request indicates the address of the resource where the discovery is to be performed. Upon receiving such request, the DIS CSF discovers, identifies, and returns the matching information regarding discovered resources according to the filter criteria. A successful response includes the discovered information in the representation of <aggregatedResponse>resource.

The ***filterUsage*** element of the ***Filter Criteria*** parameter does not represent a filter condition. It indicates how the ***Filter Criteria*** parameter shall be used. If this parameter is not provided, the Retrieve request primitive which includes this element triggers a generic retrieve operation as shown in Table 2.2.8-1, which means when a discovery request is preferred, the *filterUsage* (short for `fu`) has to be present and set to either '1' or '2' as a query string, e.g. `/Mobius?fu=1&ty=2`, together with other ***Filter Criteria*** parameters, e.g. the resource type (short for *ty)*.

The difference between setting *filterUsage* to '1' and '2' reflects in the representation of discovery response, if any. When *filterUsage* sets to '1', the response of discovery request is represented with format of the URIList (short for *uril*) and all URIs of discovered resources will be listed in the response. There is no limitation to the number of URIs of discovered resources to be returned.

While when *filterUsage* sets to '2', the response is represented as the *responsePrimitive (*short for *rsp*) containing attributes of the resources that match with presented filter criteria conditions. In case that the amount of matched resources is more than the maximum number of resources that a hosting CSE could return, the filter criteria *limit* is preferred to use to limit the number of resources to be returned. In addition, filter criteria *resourceType* (short for *ty)*, *label* (short for *lbl*), *createdAfter* (short for *cra*), *createdBefore* (short for *crb*), and *limit* (short for *lim*) are supported to be used as the filter condition for conditional resource retrieve operation.

The value of *createdAfter* and *createdBefore* filter criteria has to be DateTime string using 'Basic Format' specified in ISO8601 and the timezone is interpretated as UTC timezone. More filter criteria parameters are listed at Table 2.2.8-2.

Table 2.2.8-1 Interpretation of filterUsage

Value	Interpretation	Note
1	Discovery Criteria	
2	Conditional Retrieval	This is the default value when the ***filterUsage*** condition is not present in a Retrieve request.
3	IPE On-demand Discovery	

Table 2.2.8-2 Type definition of m2m:filterCriteria

Element Path	Multiplicity	Element Data Type	Target Resource Attribute
createdBefore	0..1	m2m:timestamp	creationTime
createdAfter	0..1	m2m:timestamp	
modifiedSince	0..1	m2m:timestamp	lastModifiedTime
unmodifiedSince	0..1	m2m:timestamp	
stateTagSmaller	0..1	xs:positiveInteger	stateTag
stateTagBigger	0..1	xs:nonNegativeInteger	
expireBefore	0..1	m2m:timestamp	expirationTime
expireAfter	0..1	m2m:timestamp	
sizeBelow	0..1	xs:positiveInteger	contentSize
sizeAbove	0..1	xs:nonNegativeInteger	
resourceType	0..1	list of m2m:resourceType	resourceType
contentType	0..n	m2m:typeOfContent	contentType
attribute	0..n	m2m:attribute	-
filterUsage	0..1	m2m:filterUsage	-
limit	0..1	xs:nonNegativeInteger	-
level	0..1	xs:positiveInteger	-
offset	0..1	xs:positiveInteger	-
labels	0..1	m2m:labels	labels

A group of resources shown as below are created with different label values for demonstration of discovery operations.

Table 2.2.8-3 Example of Resources

Resource Type	Resource Name	Resource attributes representation in JSON

2 (AE)	"temp_sensor"	{
		"m2m:ae": {
		"pi": "SJDRnzBBZ",
		"ty": 2,
		"ct": "20170103T092533",
		"ri": "S20170718064315893ezjk",
		"rn": "temp_sensor",
		"lbl": [
		"temp_sensor",
		"sensor",
		"indoor"
		],
		"lt": "20170104T030832",
		"et": "20180103T092533",
		"api": "A01.com.company.temptApp1",
		"aei": "S20170718064315893ezjk",
		"rr": true
		}
		}

2 (AE)	"temp_sensor02"	{
		"m2m:ae": {
		"pi": "SJDRnzBBZ",
		"ty": 2,
		"ct": "20170104T030802",
		"ri": "S20170718063914261 9Wni",

		"rn": "temp_sensor02", "lbl": ["temp_sensor", "sensor", "outdoor"], "lt": "20170104T030802", "et": "20180104T030802", "api": "A01.com.company.temptApp2", "aei": "S201707180639142619Wni", "rr": true } }

2(AE)	"temp_sensor03"	{
		"m2m:ae": {
		"pi": "SJDRnzBBZ",
		"ty": 2,
		"ct": "20170104T031337",
		"ri": "S20170748064315893exvc",
		"rn": "temp_sensor03",
		"lbl": [
		"temp_sensor",
		"sensor",
		"farm_indoor"
		],
		"lt": "20170104T031337",
		"et": "20180104T031337",
		"api": "A01.com.company.temptApp3",
		"aei": "S20170748064315893exvc",
		"rr": true
		}
		}

3(container)	"temp_container"	{
		"m2m:cnt": {
		"pi": "S20170718064315893ezjk",
		"ty": 3,
		"ct": "20170103T092549",
		"ri": "SJfALihnHW",
		"rn": "temp_container",
		"lbl": [
		"temperature_repo",
		"temp",
		"indoor"
		],
		"lt": "20170104T060156",
		"et": "20180103T092549",
		"st": 9,
		"mni": 10000,
		"cni": 1,
		"cbs": 2
		}
		}

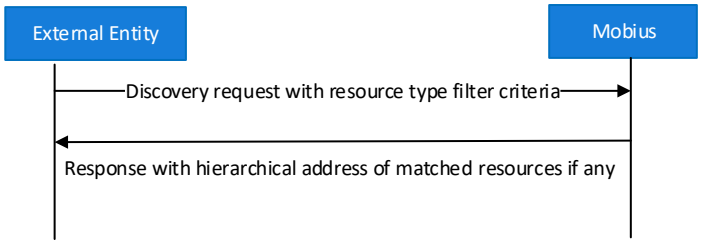
3(container)	"temp_container02"	{
		"m2m:cnt": {
		"pi": "S20170718064315893ezjk",
		"ty": 3,
		"ct": "20170104T060227",
		"ri": "SKfALihnasdf",
		"rn": "temp_container02",
		"lbl": [
		"temperature_repo",
		"temp",
		"outdoor"
		],
		"lt": "20170104T060227",
		"et": "20180104T060227",
		"st": 0,
		"mni": 9007199254740991,
		"cni": 0,
		"cbs": 0
		}
		}

3(container)	"temp_controller"	{
		"m2m:cnt": {
		"pi": "S20170718064315893ezjk",

		<pre>"ty": 3,
		"ct": "20170104T060527",
		"ri": "SMNLihnHWJS",
		"rn": "temp_controller",
		"lbl": [
		"sensor control",
		"controller"
		],
		"lt": "20170104T060527",
		"et": "20180104T060527",
		"st": 0,
		"mni": 1000,
		"cni": 0,
		"cbs": 0
		}
		}</pre>

1) API/_/DIS/001_TY

Interface ID	API/_/DIS/001_TY
Interface Name	Discovery with resourceType filter criteria condition
Target Resource	Any oneM2M resource primitives that are supported by Mobius

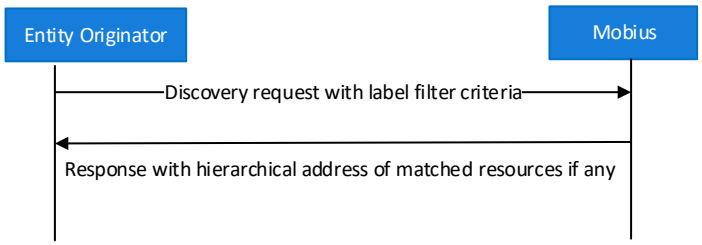
Interface Description	The interface is used to discovery resources that match with the specific resource type value. If found, the hosting CSE sends back the hierarchical address of the matched resources.
	
	We demonstrate to discovery <AE> and <container> resources that stored in the Mobius CSEBase resource only. For other resource types, users can try it by yourselves.
	
	① Call Flow
	 
	
	② Resource URL Information
	`GET /Mobius?fu=1&ty=<RESOURCE_TYPE_VALUE>`
	
	③ Http Header Information
	Header / **Value**
	Accept / *application/ json*
	X-M2M-RI / Request ID
	X-M2M-Origin / AE-ID of request originator
	
	④ Example
	Request
	`GET /Mobius?fu=1&ty=2 HTTP/1.1`
	`Host: yt.iotmobius.com:7579`
	`Accept: application/json`
	`X-M2M-RI: req55312`
	`X-M2M-Origin: S20170718064315893ezjk`
	
	Response
	`HTTP/1.1 200 OK`

```
Accept: application/json
Content-Length: 87
X-M2M-RI: 12345
X-M2M-RSC: 2000

{
  "m2m:uril":
     "Mobius/temp_sensor
     Mobius/temp_sensor02
     Mobius/temp_sensor03"
}
```

2) API/_/DIS/001_LBL

Interface ID	API/_/DIS/001_LBL
Interface Name	Discovery with label filter criteria condition
Target Resource	Any oneM2M Resource Primitive that contains a label attribute
Interface Description	The interface is used to discovery resources that match with the specific *label* value. If found, the hosting CSE sends back the hierarchical address of the matched resources.

① Call Flow



② Resource URL Information

```
GET /Mobius?fu=1&lbl=<LABEL_VALUE>
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

④ Example

```
Request

GET /Mobius?fu=1&lbl=sensor HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req9988123
X-M2M-Origin: S20170718064315893ezjk

Response

HTTP/1.1 200 OK
Accept: application/json
Content-Length: 87
X-M2M-RI: req9988123
X-M2M-RSC: 2000

{
  "m2m:uril":
```

```
    "Mobius/temp_sensor
    Mobius/temp_sensor02
    Mobius/temp_sensor03"
}
```

Request

```
GET /Mobius?fu=1&lbl=indoor HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req9988124
X-M2M-Origin: S20170718064315893ezjk
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 75
X-M2M-RI: req9988124
X-M2M-RSC: 2000

{
  "m2m:uril":
    "Mobius/temp_sensor/temp_container
     Mobius/temp_sensor"
}
```

Request

```
GET /Mobius?fu=1&lbl=outdoor HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req9988125
X-M2M-Origin: S20170718064315893ezjk
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 79
X-M2M-RI: req9988125
X-M2M-RSC: 2000

{
  "m2m:uril":
    "Mobius/temp_sensor/temp_container02
     Mobius/temp_sensor02"
}
```

Request

```
GET /Mobius?fu=1&lbl=temp HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req9988126
X-M2M-Origin: S20170718064315893ezjk
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 92
X-M2M-RI: req9988126
X-M2M-RSC: 2000

{
```

```
  "m2m:uril":
     "Mobius/temp_sensor/temp_container02
      Mobius/temp_sensor/temp_container"
}
```

Request

```
GET /Mobius?fu=1&lbl=indoor&ty=2 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req9988124
X-M2M-Origin: S20170718064315893ezjk
```

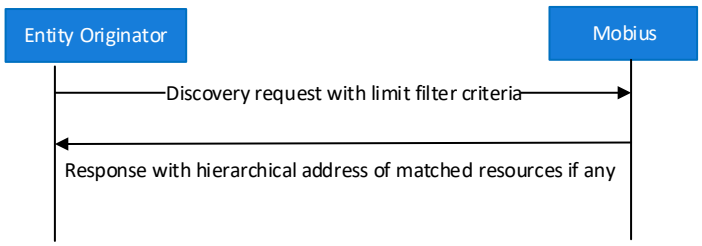
Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 75
X-M2M-RI: req9988124
X-M2M-RSC: 2000

{
  "m2m:uril":
     "Mobius/temp_sensor"
}
```

3) API/_/DIS/001_LIM

Interface ID	API/_/DIS/001_LIM
Interface Name	Discovery with limit filter criteria condition
Target Resource	Any oneM2M resource primitives that are supported by Mobius
Interface Description	The interface is used to limit the number of resources to be returned as a result of discovery operation by specifying a filter criteria parameter *limit* as a query string of the request URL. Note that the parameter *limit* is usually used with other filter criteria parameters together, such as *label, resource type, createAfter,* and *createBefore* etc.

① Call Flow



② Resource URL Information

```
GET /Mobius?fu=1&lim=<INTEGER_VALUE>
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

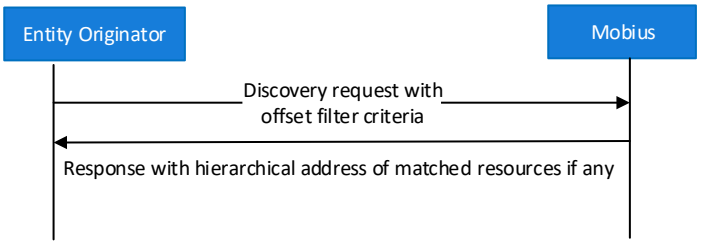
④ Exmaple

Request

```
GET /Mobius/temp_sensor?fu=1&lim=2 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req123343
X-M2M-Origin: S20170718064315893ezjk

Response

HTTP/1.1 200 OK
Accept: application/json
Content-Length: 90
X-M2M-RI: req123343
X-M2M-RSC: 2000

{
  "m2m:uril":
     "Mobius/temp_sensor/time_series_02
      Mobius/temp_sensor/time_series_01"
}
```

4) API/_/DIS/001_OFST

Interface ID	API/_/DIS/001_OFST
Interface Name	Discovery with offset filter criteria condition
Target Resource	Any oneM2M Resource primitive that contains at least one direct child level subresource(s)

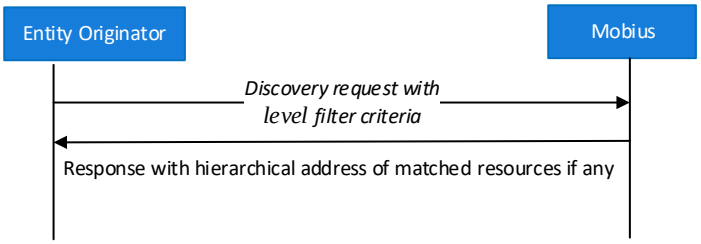
Interface Description	The interface is used to discovery child resources under a specific resource and return a list of the child resources (if any) by excluding a number of child resource whose amount is indicated by offset field value.
	
	The parameter *offset* is usually used with other filter criteria parameters together, such as *label, resource type,* and *limit* etc.
	
	1) Call Flow
	 
	
	2) Resource URL Information
	`GET /Mobius?fu=1&ofst=<INTEGER_VALUE>`
	
	3) Http Header Information
	Header / **Value**
	Accept / *application/ json*
	X-M2M-RI / Request ID
	X-M2M-Origin / AE-ID of request originator
	
	4) Example
	Request
	
	`GET /Mobius?fu=1&ofst=3 HTTP/1.1`
	`Host: yt.iotmobius.com:7579`
	`Accept: application/json`

```
X-M2M-RI: req16666
X-M2M-Origin: S20170718064315893ezjk

Response

HTTP/1.1 200 OK
Accept: application/json
Content-Length: 146
X-M2M-RI: req16666
X-M2M-RSC: 2000
{
  "m2m:uril":
    "Mobius/temp_sensor/temp_group02
     Mobius/temp_sensor/temp_group
     Mobius/temp_sensor/temp_container/4-20170104072347771tn55"
}
```

5) API/_/DIS/001_LVL

Interface ID	API/_/DIS/001_LVL
Interface Name	Discovery with level filter criteria condition
Target Resource	Any oneM2M resource primitives that has at least one child level of sub-resource(s)
Interface Description	The interface is used to discovery all child resources under a target parent resource with constraint on the specific level in the resource tree and return a list of children resources if found. For example, level field value 2 indicates the discovery request will discovery the direct children resources of the target resource at maximum; level value set to 3 indicates discovery until the grand-chilren resources of the target resource at maximum. The parameter *level* is usually used with other filter criteria parameters together, suich as *label, resource type, offset* and *limit* etc.

1) Call Flow



2) Resource URL Information

```
GET /Mobius?fu=1&lvl=<INTEGER_VALUE>
```

3) Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

4) Example

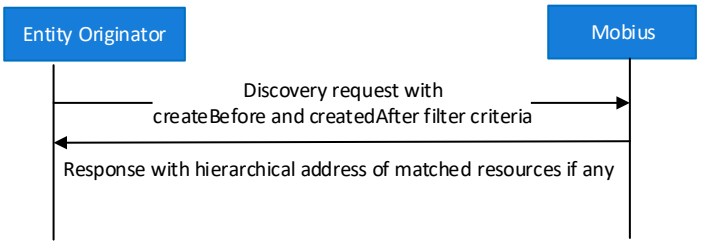
```
Request

GET /Mobius?fu=1&lvl=3 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req16676
```

```
X-M2M-Origin: S20170718064315893ezjk

Response
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 416
X-M2M-RI: req16676
X-M2M-RSC: 2000

{
  "m2m:uril":
    "Mobius/temp_sensor/time_series_02
     Mobius/temp_sensor/time_series_01
     Mobius/temp_sensor/temp_container02
     Mobius/temp_sensor/temp_container
     Mobius/temp_sensor/temp_container/4-20170106072400523Qi0b
     Mobius/temp_sensor/temp_container/4-20170106072357569iSEg
     Mobius/temp_sensor/temp_container/4-20170106072352694gA9G"
}
```

6) API/_/DIS/002_CRA/CRB

Interface ID	API/_/DIS/002_CRA/CRB
Interface Name	Discovery with createdBefore and createdAfter filter criteria conditions
Target Resource	Any oneM2M Resource primitives that are supported by Mobius
Interface Description	The interface is used to discovery resources that match with the period of creation time specified by the filter criteria parameter *createdBefore* and *createdAfter*. If found, the hosting CSE sends back the hierarchical address of the matched resources. Note that the parameter *createAfter* and *createBefore* are usually used with other filter criteria parameters together, such as *label, resource type,* and *limit* etc.

1) Call Flow



2) Resource URL Information

```
GET /Mobius?fu=1&crb=<TIMESTAMP_1>&cra=<TIMESTAMP_2>
```

3) Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

4) Example

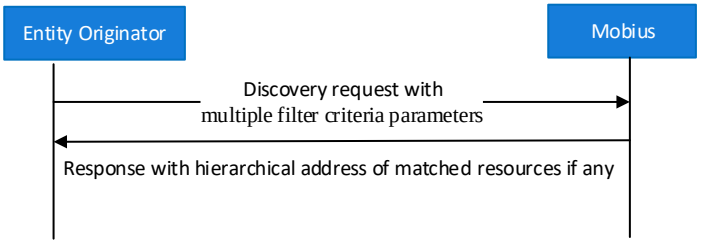
```
Request

GET /Mobius?fu=1&crb=20170108T072322&cra=20170101T072322
HTTP/1.1
Host: yt.iotmobius.com:7579
```

```
Accept: application/json
X-M2M-RI: req16664
X-M2M-Origin: S20170718064315893ezjk

Response

HTTP/1.1 200 OK
Accept: application/json
Content-Length: 416
X-M2M-RI: req16664
X-M2M-RSC: 2000

{
  "m2m:uril":
    "Mobius/temp_sensor/time_series_02
     Mobius/temp_sensor/time_series_01
     Mobius/temp_sensor/temp_container02
     Mobius/temp_sensor/temp_container
     Mobius/temp_sensor/temp_container/4-20170106072400523Qi0b
     Mobius/temp_sensor/temp_container/4-20170106072358694qMc
     Mobius/temp_sensor/temp_container/4-20170106072357569iSEg
     Mobius/temp_sensor/temp_container/4-20170106072352694gA9G"
}
```

7) API/_/DIS/002_STB/STS

Interface ID	API/_/DIS/002_STB/STS
Interface Name	Discovery with stateTagBigger and stateTagSmaller filter criteria conditions
Target Resource	Any oneM2M resource primitives that have stateTag attribute e.g. container
Interface Description	The interface is used to discovery resources that match with multiple filter criteria parameters. If found, the hosting CSE sends back the hierarchical address of the matched resources.

1) Call Flow



2) Resource URL Information

```
GET
/Mobius?fu=1&sts=<STATE_TAG_INTEGER_VALUE_1>&stb=<STATE_TAG_INTEGE
R_VALUE_2>
```

3) Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

4) Example

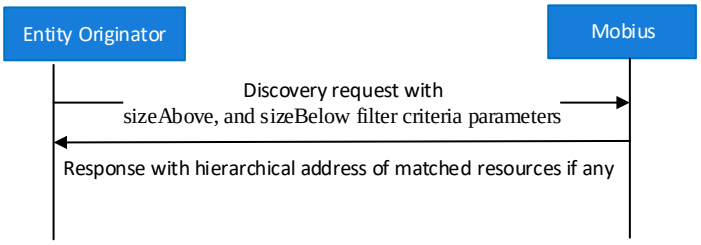
```
Request

GET /Mobius/temp_sensor?fu=1&stb=0&sts=5 HTTP/1.1
```

```
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req19676
X-M2M-Origin: S20170718064315893ezjk
Response

HTTP/1.1 200 OK
Accept: application/json
Content-Length: 52
X-M2M-RI: req19676
X-M2M-RSC: 2000

{
  "m2m:uril": "Mobius/temp_sensor/temp_container"
}
```

8) API/_/DIS/002_SZB/SZA/LIM

Interface ID	API/_/DIS/002_SZB/SZA/LIM
Interface Name	Discovery with sizeBelow, sizeAbove and limit filter criteria conditions
Target Resource	Any oneM2M resource primitives that have contentSize attribute
Interface Description	The interface is used to discovery resources that have contentSize attribute value meet the [sizeAbove, sizeBelow] threshold, and the hosting CSE (Mobius) will return all resources that meet this filter condition.

1) Call Flow



2) Resource URL Information

```
GET
/Mobius?fu=1&sza=<CONTENT_SIZE_VALUE_1>&szb=<CONTENT_SIZE_VALUE_2>
&lim=<INTEGER_VALUE>
```

3) Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

4) Example

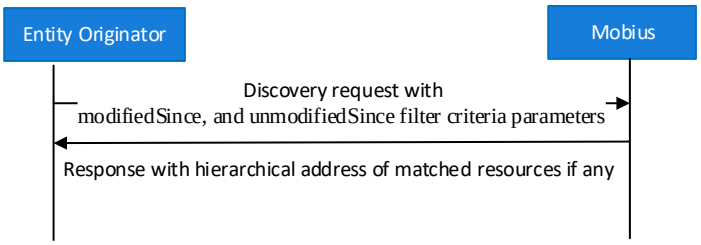
```
Request

GET /Mobius/temp_sensor? fu=1&sza=2&szb=100&lim=20 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req19676
X-M2M-Origin: S20170718064315893ezjk

Response
```

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 52
X-M2M-RI: req19676
X-M2M-RSC: 2000

{
  "m2m:uril": "Mobius/temp_sensor/temp_container/4-
20170719124549580WZMC"
}
```

9) API/_/DIS/002_US/MS/LIM

Interface ID	API/_/DIS/002_US/MS/LIM
Interface Name	Discovery with modifiedSince, unmodifiedSince, and limit filter conditions
Target Resource	Any oneM2M resource primitives that have lastModifiedTime attribute meets the filter criteria conditions
Interface Description	The interface is used to discovery resources that have lastModifiedTime attribute value meet the [modifiedSince, unmodifiedSince] threshold, and the hosting CSE (Mobius) will return all resources that meet this filter condition.

1) Call Flow



2) Resource URL Information

```
GET
/Mobius?fu=1&us=<TIMESTAMP_1>&ms=<TIMESTAMP_2>&lim=<INTEGER_VALUE>
```

3) Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

4) Example

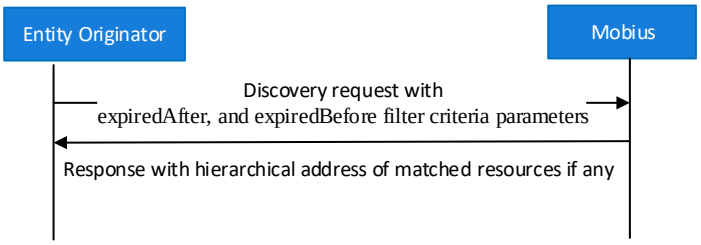
```
Request

GET /Mobius/temp_sensor?
fu=1&us=20270105T072322&ms=20170201T072322&lim=20 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req19676
X-M2M-Origin: S20170718064315893ezjk

Response

HTTP/1.1 200 OK
Accept: application/json
```

```
Content-Length: 52
X-M2M-RI: req19676
X-M2M-RSC: 2000

{
  "m2m:uril":
       "Mobius/temp_sensor/temp_container/4-
20170719124549580WZMC"
}
```

10) API/_/DIS/002_EXB/EXA/LIM

Interface ID	API/_/DIS/002_EXB/EXA/LIM
Interface Name	Discovery with expiredBefore, expiredAfter, and limit filter conditions
Target Resource	Any oneM2M resource primitives that have expirationTime attribute meets the filter criteria conditions
Interface Description	The interface is used to discovery resources that have expirationTime attribute value meet the [expiredAfter, expiredBefore] threshold, and the hosting CSE (Mobius) will return all resources that meet this filter condition.

5) Call Flow



6) Resource URL Information

```
GET
/Mobius?fu=1&exb=<TIMESTAMP_1>&exa=<TIMESTAMP_2>&lim=<INTEGER_VALU
E>
```

7) Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

8) Example

```
Request

GET /Mobius/temp_sensor?
fu=1&exb=20200105T072322&exa=20170701T072322&lim=5 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req19676
X-M2M-Origin: S20170718064315893ezjk

Response

HTTP/1.1 200 OK
Accept: application/json
Content-Length: 52
```

	X-M2M-RI: req19676
	X-M2M-RSC: 2000
	
	{
	"m2m:uril":
	"Mobius/temp_sensor/temp_container/4-
	20170719124549580WZMC"
	}

2.3.9. <subscription> Resource

2.2.9.1 Introduction

The <subscription> resource contains subscription information for its subscribed-to resource. The subscription resource is represented as a resource subscription in the CSE resource structure as a direct child of the subscribed-to resource.

The <subscription> resource contains a group of universal attributes applied for all oneM2M resource primitives and a group of specific resources applied for only <container> resource itself, shown as Table 2.2.9-1 and Table 2.2.9-2. Table 2.2.9-2 shows one mandatory attribute (with *M* mark) needs to be present in a create <subscription> resource request, and optional attributes (with *O* mark) that are not necessarily present in a create <subscription> resource request, as well as those attributes (with *NP* mark) that should not be present in resource request representation.

The Subscription and Notification (SUB) CSF provides notifications related to a subscription that is used to track event changes on resource, i.e. update or deletion of a resource. The scope of a resource subscription includes tracking changes of attribute(s), direct child resource(s) as well as tracking operations on attribute(s) and direct child resource(s), but not include tracking neither changes nor operations on attribute(s) and direct child resource(s).

A subscription to a resource is initialized by an AE or a CSE and is granted by the Hosting CSE with access control policies. Each subscription may include notification policies that specify which, when, and how the notifications are sent, e.g. directly to subscriber by HTTP URL or indirectly to subscriber via MQTT broker. Subscription resource subscriber may subscribe to a single resource via a single subscription request, or via a single subscription subscribe to multiple resources which are grouped and represented as a single resource. Note that subscriptions to a group is made only if the subscriber is interested in all members of the group. If a subscription to a group is made, the Group Management Group CSF aggregates the notifications from the group members, and notifies the subscriber with the aggregated notifications.

When AE sends a subscription request to a resource for tracking event changes on it, the subscription request has to include information of

- The Subscription resource subscriber ID i.e. AE-ID or CSE-ID.
- The hosting CSE-ID where the subscribed-to resource is existed.
- The address of subscribed-to resource i.e. the URI of subscribed-to resource.
- Notification URL to which notifications will be sent whenever modifications to the subscribed-to resource are tracked.

2.2.9.2 Notification Working Principle

oneM2M specification defines an attribute *notificationEventType* to indicate the event type that trigger notifications as shown in Table 2.2.9-3. For the moment, Mobius implements three notification event types mapped to *notificationEventType* field value 1, 3, and 4, respectively for tracking the notification events as following:

- Update to attributes of the subscribed-to resource,
- Creation of a direct child resource of the subscribed-to resource,
- Deletion of a direct child resource of the subscribed-to resource, and

Notification Procedures for modified resources case are specified as following:

When a change track event is generated, the hosting CSE (notification originator) will check the *eventNotificationCriteria* attribute and its sub-attribute *notificationEventType* of the <subscription> resource associated with the modified resource.

The *eventNotificationCriteria* and *notificationEventType* defines the track event types following which the corresponding notifications are sent to the resource subscriber, as shown in Table 2.2.9-3. While n*otificationContentType* as shown in Table 2.2.9-4 defines the type of notification content to be contained in the notification. If n*otificationContentType* is set to '2' indicating 'Modified Attributes', the notification will only include the modified attribute while set to '3' indicating 'ResourceID', the notification will include the resourceID of the subscribed-to resource, and if n*otificationContentType* set to either '1' or not present indicating the default setting of "All Attributes", the notification will include all attributes of the subscribed-to resource.

The *notificationEventCat* attribute (notification policy) indicates an event category of the subscription that shall be included in the notification request to be able for the Notification Target to correctly handle the notification. If the *notificationEventCat* attribute is set, the Notify request primitive will employ the ***Event Category*** parameter as given in the *notificationEventCat* attribute. If the *latestNotify* attribute is set, the subscription resource hosting CSE will assign ***Event Category*** parameter of value 'latest' of the notifications generated pertaining to the subscription created.

If the <subscription> resource associated with the modified resource includes a <*notificationSchedule*> child resource, the hosting CSE will check the time periods given in the the *scheduleElement* attribute of the <*notificationSchedule*> child resource. Also, the hosting CSE has to check the reachability schedule associated with the Receiver by exploring its <schedule> resource. If reachability schedules are not present in a node, then that Entity is considered to be always reachable.

Regarding the *pendingNotification* attribute, if it is set to 'sendLatest', the subscription resource hosting CSE will cache the most recent Notify request and set the ***Event Category*** to value of 'latest' and send the latest notification to the resource subscriber following notification schedules, while if it is set to 'sendAllPending', the subscription resource hosting CSE will cache all the Notify request. If *pendingNotification* attribute is not present, the hosting CSE will discard the corresponding Notify requests.

oneM2M specification defines rules for the notification URL format as following:

The *notificationURI* attribute is defined as a list of URIs representing entities that is reachable by a CSE (the Hosting CSE) to send notifications to them. The URI needs to be formulated to either one of the following formats:

- oneM2M compliant Resource-ID: The resource-ID can be represented in structured/unstructured CSE-relative-resource-ID, structured/unstructured SP-Relative-Resource-ID, or structured/unstructured Absolute-Resource-ID. e.g. Structured SP-relative-AE-ID: http://<IP>:<port>/CSE-ID/CSE-Name/AE-ID
    - Identifier compliant with a oneM2M supported protocol binding such as HTTP and MQTT. For example, MQTT defines URI format to be used in the attribute *pointOfAccess* as mqtt://<authority> or mqtts://<authority> (when TLS is applied). Note that oneM2M MQTT binding protocol specification still has no definition on the structure of the notification URL. Mobius implements the notification URL in MQTT in this way mqtt://<MQTT-broker-IP>:<port>/<AE-ID-of-TAGET-DEVICE> e.g. the notificationURL attribute with field value look like `"nu":["mqtt://iot.ocean.org/mbroker/S0.2.481.1.20160326004729784"]` where the MQTT port is omitted because MQTT default port (1883) is implicitly used. In case if non-default MQTT port (1883) is used, the port has to be explicitly specified.

Besides receiving notifications through the accessible information defined in attributes such as *pointOfAccess*, *notificationURI*, the subscriber can also use polling method by creating <*pollingChannel*> resource under the subscribed-to resource to receive the notification information. In case the subscriber is not reachable, attribute *requestReachability* has to set to Boolean *FALSE* to indicate it is not reachablility by other entities.

For a group-related subscription, the group hosting CSE needs to configure the *notificationForwardingURI* of a fanout subscription request with the configured *notificationURI* of the original subscription request. The group hosting CSE also has to configure the *notificationURI* of the fanout subscription request with a Resource-ID specified by the group Hosting CSE.

Notification pattern in protocol level is defined as following:

Regarding the format of notification URI through which the subscribed-to resource hosting CSE is able to send notifications to the resource subscriber directly or indirectly, the Mobius platform supports two formats of notification URI compliant to HTTP and MQTT protocol, respectively.

In HTTP case, the subscribed-to hosting CSE sends directly notifications to the resource subscriber (e.g AE or CSE) using the *notificationURI* attribute value with assumption that the resource subscriber sets *requestReachability* attribute to BOOLEAN value *TRUE* to indicate its reachability by other entities.

While MQTT protocol is based on the principle of publishing messages and subscribing to Topics to implement the indirect notification to Topics subscribers. MQTT supports multiple clients can connect to a same MQTT broker and subscribe to Topics which they are interested in. Each client is able to connect to the MQTT broker and publish messages associated with a topic to the MQTT broker then the MQTT broker delivers (publishes) the published message to corresponding clients that have subscribed to that topic. In other words, different clients can subscribe to one same topic and in this case, when there is any (authenticated) client publishes messages to that topic, other clients which have subscribed to this topic can receive notifications from the MQTT broker.

Entities that implement MQTT client libraries can communicate with each other through MQTT protocol. In fact, the request and response are done by using SUBSCRIBE and PUBLISH method associated with specific Topics. OneM2M MQTT protocol binding defines the format of Topics for requestPrimitives and responsePrimitives, respectively as following:

`/oneM2M/req/<originator>/<receiver>/<serialization-type>` and

`/oneM2M/resp/<originator>/<receiver>/<serialization-type>`

Where <originator> and <receiver> indicate the entity ID of the request originator and the correspoinding request receiver, e.g. in <container> resource creation request case, the originator can be a AE while the receiver is the hosting CSE. Both the <originator> and <receiver> need to be formulated as SP-relative-AE-ID or SP-relative-CSE-ID with omitting any leading slash "/" character. In case the entity ID is AE case, any slash "/" character embedded in the AE-ID has to be replaced with ":" character. The <serialization-type> field indicates the serialization type that is used for the request and response, i.e. JSON, XML or CBOR etc.

For any entity using MQTT protocol, they have to subscribe to Topics stored in MQTT server in order receive any requests target to themselves as well as receive responses for the requests that are initialized by themselves. Therefore, any entities (AE and CSE) have to subscribe to two Topics after connecting with MQTT server as following:

`/oneM2M/req/+/<SP-relative-AE-ID>/#` and

`/oneM2M/resp/<SP-relative-AE-ID>/+/#`

Or

`/oneM2M/req/+/<SP-relative-CSE-ID>/#` and

`/oneM2M/resp/<SP-relative-CSE-ID>/+/#`

Where the "+" character in the Topics is wildcard to indicate the current entity can receive any message coming from any entity with target to the current entity and "#" character indicates any serialization type such as XML, JSON, or CBOR etc.

After subscribe to Topics, the entity can publish any message associated with a Topic specifying the originator and receiver to the MQTT server then MQTT server will distribute the message according to the Topic included in the message to entites that has subscribed to that Topic.

For a complete requestPrimitive using MQTT protocol, the requestPrimitive has to contain mandatory request parameters such as *operation, from, to, primtiveContent* (for CREATE and UPDATE operation) etc. All information is included in the MQTT request payload. For details, please refer to oenM2M MQTT protocol binding specification.

Table 2.2.9-1 Universal Attributes of <subscription> resource

Attribute Name	Request Optionality	
	Create	Update
@resourceName	O	NP
resourceType	NP	NP
resourceID	NP	NP
parentID	NP	NP
accessControlPolicyIDs	O	O
creationTime	NP	NP
expirationTime	O	O
lastModifiedTime	NP	NP
labels	O	O

Table 2.2.9-2 Resource Specific Attributes of <subscription> resource

Attribute Name	Request Optionality		Data Type	Default Value and Constraints
	Create	Update		
eventNotificationCriteria	O	O	m2m:eventNotificationCriteria	Default behaviour is notification on Update_of_Resource
expirationCounter	O	O	xs:positiveInteger	No default
notificationURI	M	O	list of xs:anyURI	No default
groupID	O	O	xs:anyURI	No default
notificationForwardingURI	O	O	xs:anyURI	No default
batchNotify	O	O	m2m:batchNotify	No default
rateLimit	O	O	m2m:rateLimit	No default
preSubscriptionNotify	O	NP	xs:positiveInteger	No default
pendingNotification	O	O	m2m:pendingNotification	No default
notificationStoragePriority	O	O	xs:positiveInteger	No default
latestNotify	O	O	xs:boolean	No default
notificationContentType	O	O	m2m:notificationContentType	No default
notificationEventCat	O	O	m2m:eventCat	No default
creator	O	NP	m2m:ID	No default
subscriberURI	O	NP	xs:anyURI	No default

Table 2.2.9-3 Interpretation of notificationEventType

Value	Interpretation	Note
1	Update_of_Resource	Default value
2	Delete_of_Resource	
3	Create_of_Direct_Child_Resource	
4	Delete_of_Direct_Child_Resource	
5	Retrieve_of_Container_Resource_With_No_Child_Resource	Context : a RETRIEVE request targets a subscribed-to <container> resource with the Result Content parameter set to either “child-resources” or “attributes+child-resources”. A notification is initiated if the child resource is obsolete or not present in the targeted parent resource.

Table 2.2.9-4 Interpretation of notificationContentType

Value	Interpretation	Note
1	All Attributes	Default value
2	Modified Attributes	
3	ResourceID	

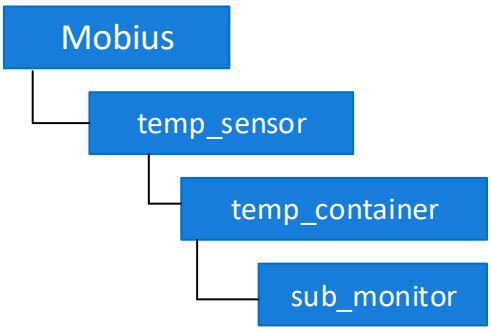
Table 2.2.9-5 Interpretation of pendingNotification

Value	Interpretation	Note
1	sendLatest	
2	sendAllPending	

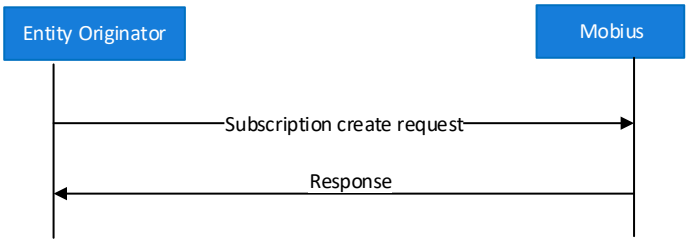
2.2.9.3 Subscription CRUD API

1) API/SUB/CRE for Application Monitoring case

Interface ID	API/SUB/CRE/001_RCN/0
Interface Name	Subscription CREATE with resultContent set to 0 (nothing)
Target Resource	<container> resource as parent resource of the requested <subscription> resource
Interface Description	The interface is used to send a <subscription> CREATE request attached with resultContent set to 0 to the Mobius, and the hosting CSE (Mobius) creates a <subscription> resource and sends back a response containing a response status code to indicate the CREATE operation status. ① Resource Structure



② Call Flow



③ Resource URL Information

```
POST /Mobius/temp_sensor/temp_container?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=23*

⑤ Assumption

In this example, when AE sends a <subsription> create request under the <container> resource, the *notificationEventType* (short for *net*) is set to a set of value {1, 3, 4} indicating whenever there are changes to either the update to the attribtues of subscribed-to <container> resource, or create/delete of a direct child of the subscribed-to <container> resource. Note that Mobius only implements the track on these three event types.

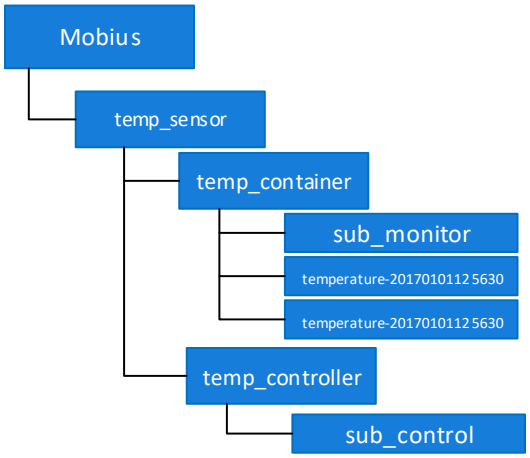
In addition, attribute *notificationContentType* (short for *nct*) is set to value 2 indicating only modified attributes will be contained in the notification request message. Attribute *pendingNotification* is set to value 1 indicating only sending latest pending notifications to the subscriber.

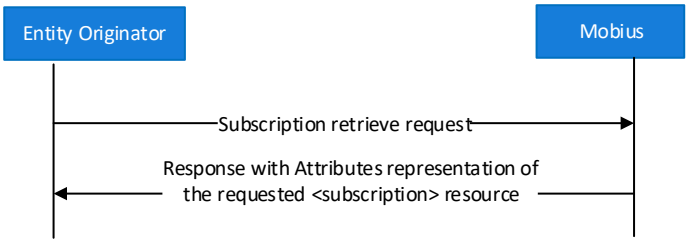
Example:

```
Request

POST /Mobius/temp_sensor/temp_container?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: fdf43543543
X-M2M-Origin: S20170718064315893ezjk
```

```
Content-Type: application/vnd.onem2m-res+json;ty=23

{
  "m2m:sub":
  {
    "rn": "sub_monitor",
    "enc": {
        "net": [1, 3, 4]
    },
    "nu":["mqtt://iot.broker.org/S0.2.481.1.20160326004729784"],
    "nct": 2,
    "pn": 1
  }
}

Response

HTTP/1.1 201 Created
Content-Length: 0
Content-Location: /Mobius/temp_sensor/temp_container/sub_monitor
Content-Type: application/json
X-M2M-RI: fdf43543543
X-M2M-RSC: 2001
```

2) API/SUB/RET for Application Monitoring case

Interface ID	API/SUB/RET/001_RCN/1
Interface Name	Subscription retrieve for application monitoring with resultContent set to 1 (attributes)
Target Resource	<subscription> resource
Interface Description	The interface is used to retrieve the <subscription> resource *sub_monitor* in <container> *cont_status* and respond the request originator with the requested <subscription> resource information. The originator can be any authenticated AE or CSE who has access control right to retrieve <subscription> resource *sub_monitor* from <container> *cont_status*. ① Resource Structure  ② Call Flow



③ Resource URL Information

```
GET /Mobius/temp_sensor/temp_container/sub_monitor?rcn=1
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

⑤ Example

Request

```
GET /Mobius/temp_sensor/temp_container/sub_monitor?rcn=1
HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req11115
X-M2M-Origin: S20170718064315893ezjk
```

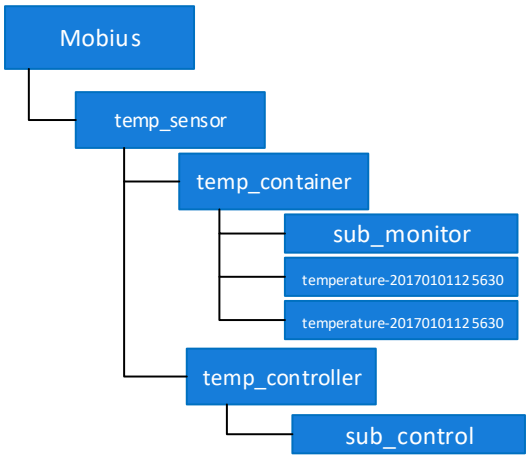
Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 318
X-M2M-RI: req11115
X-M2M-RSC: 2000

{
    "m2m:sub": {
        "rn": "sub_monitor",
        "ty": 23,
        "pi": "SyMIF4R2HW",
        "ri": "HkMmRhb6rZ",
        "ct": "20170719T164602",
        "et": "20200719T164602",
        "lt": "20170719T164602",
        "nu": [
            "mqtt://localhost/0.2.481.1.7579"
        ],
        "enc": {
            "net": [
                1, 3, 4
            ]
        },
        "bn": {
            "num": 0,
            "dur": "10"
        },
        "nct": 2,
        "cr": "S20170718064315893ezjk"
    }
}
```

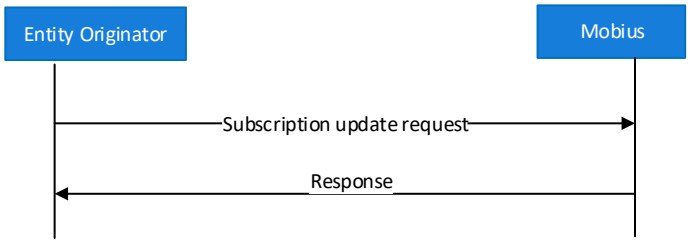
3) API/SUB/UPD for Application Monitoring case

Interface ID	API/SUB/UPD/001_RCN/0
Interface Name	Subscription UPDATE for application monitoring with resultContent set to 0 (nothing)
Target Resource	<subscription> resource
Interface Description	The interface is used to update the attribute(s) of <subscription> resource *sub_monitor* under <container>resource *cont_status* and respond the request originator with the updated <subscription> resource information. The originator can be any authenticated AE or CSE who has access control right to update <subscription> resource *sub_monitor.*

① Resource Structure



② Call Flow



③ Resource URL Information

```
PUT /Mobius/temp_sensor/temp_container/sub_monitor?rcn=0
```

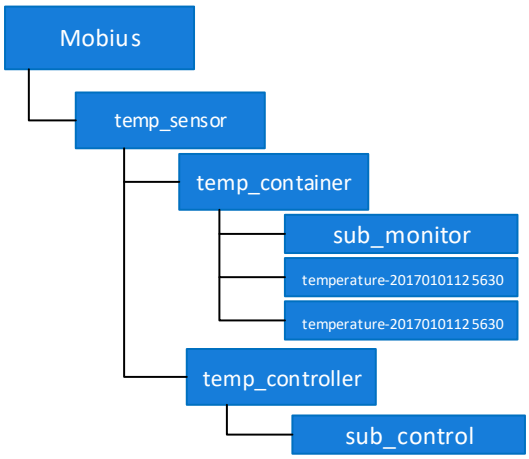
④ Http Header Information

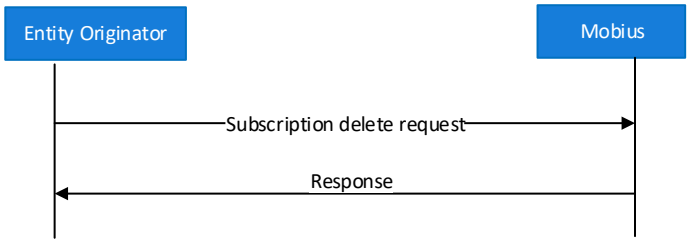
Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

⑤ Example: In this example, we try to update attributes of the <subscription> resource *sub_monitor* including attribute *pendingNotification* is update with new field value of 2 indicating all pending notifications will be send to the subscriber.

	Request
	
	`PUT /Mobius/temp_sensor/temp_container/sub_monitor?rcn=0`
	`HTTP/1.1`
	`Host: yt.iotmobius.com:7579`
	`Accept: application/json`
	`X-M2M-RI: req109239`
	`X-M2M-Origin: S20170718064315893ezjk`
	`Content-Type: application/vnd.onem2m-res+json`
	
	`{`
	`"m2m:sub":`
	`{`
	`"pn": 2`
	`}`
	`}`
	
	Response
	
	`HTTP/1.1 200 OK`
	`Content-Length: 0`
	`Content-Type: application/json`
	`X-M2M-RI: req109239`
	`X-M2M-RSC: 2004`

4) API/SUB/DEL for Application Monitoring case

Interface ID	API/SUB/DEL/001_RCN/0
Interface Name	Subscription DELETE for application monitoring with resultContent set to 0 (nothing)
Target Resource	<subscription> resource
Interface Description	The interface is used to send a <subscription> *sub_monitor* delete request with the resultContent set to 0 to the target <container>resource *temp_container* and receive a notification request containing the deleted <subscription> resource information. The originator can be any authenticated AE or CSE who has access control right to delete <subscription> resource *sub_monitor.* ① Resource Structure  ② Call Flow



③ Resource URL Information

```
DELETE /Mobius/temp_sensor/temp_container/sub_monitor?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

⑤ Example

Request

```
DELETE /Mobius/temp_sensor/temp_container/sub_monitor?rcn=0
HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req9992125
X-M2M-Origin: S20170718064315893ezjk
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 0
X-M2M-RI: req9992125
X-M2M-RSC: 2002
```

2.2.9.4 Use cases: Application of subscription and notification mechanism

In this section, we introduce two use cases that apply subscription and notification mechanism, resource monitoring and devices control use case. oneM2M AE resource primitive allows to create two direct children <container> resources to store the status information and control information, named *temp_container* and *temp_controller,* respectively, as depicted in figure 2.2.9.4-1. The device and application which both are modelled as AE can implement the controlling and monitoring purpose through creation of <subscription> resource under corresponding <container> resource *temp_controller* and *temp_container*, respectively.

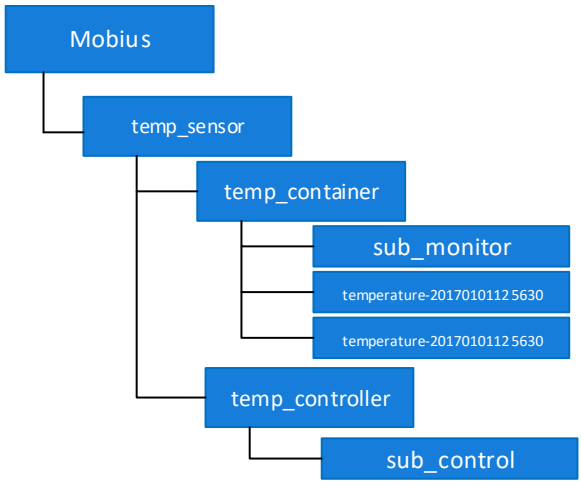


Figure 2.2.9.4-1 Resource structure of Mobius for controlling and monitoring

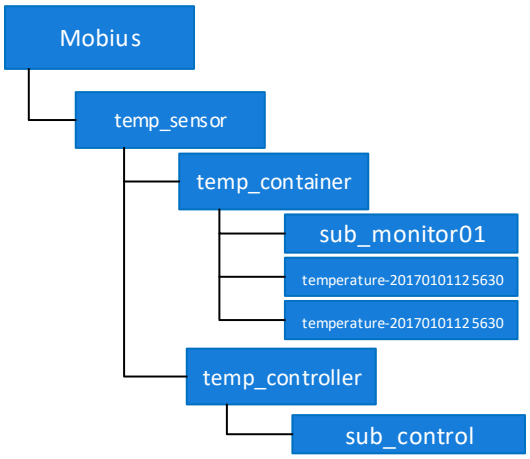
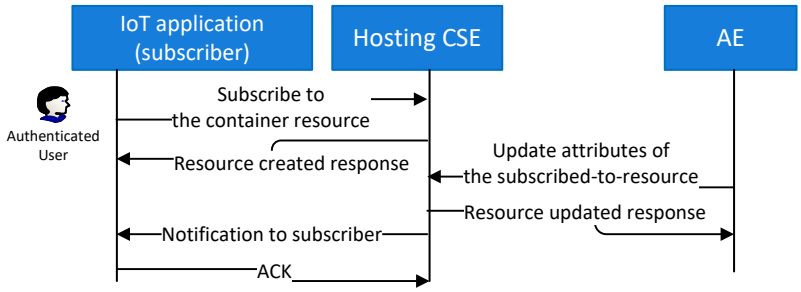
In device controlling use case, when the authenticated user sends a control command to the target device through sending a creation request of a <contentInstance> resource to the <container> *temp_controller* with control command value included in *primitiveContent* attribute, the <container> subscriber (i.e. the target device) will receive notification from the subscribed-to <container> resource hosting CSE and then be actuated.

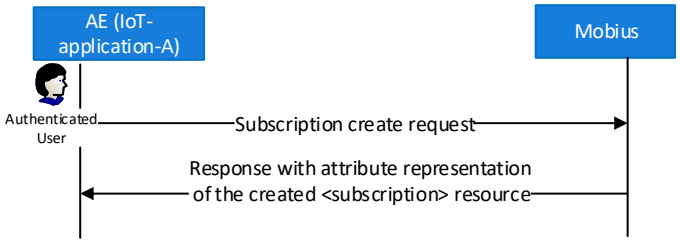
While in device monitoring use case, any authenticated user subscribes to <container> *temp_container* through a smart application and when there are any <contentInstance> resource created under <container> *temp_container,* the authenticated user will get notified with the created direct child resource through the smart application.

Each use case introduces the tracking notification events when either the subscribe-to-resource is updated, the child resource of the subscribed-to-resource is created, or the child resource of the subscribed-to-resource is deleted.

Use Case I: Subscription and notification for smart application monitoring

Secenario I: Notification for update_of_subscribed-to-resource

Scenario Name	Notification for update_of_subscribed-to-resource
Description	① Resource Structure  ② Call Flow  We assume there is three entities, an AE (an IoT application-A) that initiates a <subscription> resource *sub_monitor* create request to the target <container> *temp_container*, an AE (IoT application-B) that has access right to update the <container> resource *temp_container*, the hosting CSE. Call flows among these three entities are as following: - The AE (IoT-application-A) sends a a <subscription> resource *sub_monitor* create request to the target <container> *temp_container;* - The AE (IoT-application-B) sends a subscribed-to-resource (<container>) update request; - The hosting CSE sends a notification to the subscriber and the subscriber sends back an acknowledgement.
Procedures	**a. <u>IoT-Application-A subscribe to <container> resource</u>** ① Call flow



② Resource URL Information

```
POST /Mobius/temp_sensor/temp_container?rcn=0
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=23*

④ Assumption

In the <subsription> create request, attribute *notificationEventType* (short for *net*) is set to a value {1} indicating whenever there are update to the subscribed-to <container> resource, a notification will be triggered. Attribute *notificationURL* is set to field value of `"mqtt://iot.ocean.org/mbroker/S0.2.481.1.20160326004729784"` where broker IP `iot.ocean.org/mbroker` and AE-ID `S0.2.481.1.20160326004729784` is used.

In addition, attribute *notificationContentType* (short for *nct*) is set to value 2 indicating only modified attributes will be contained in the notification request message. Attribute *pendingNotification* is set to value 1 indicating only sending latest pending notifications to the subscriber.

Example:

Request

```
POST /Mobius/temp_sensor/temp_container?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req14335
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=23

{
  "m2m:sub":
  {
    "rn": "sub_monitor01",
    "enc": {
        "net": [1]
    },
    "nu":["mqtt://iot.ocean.org/mbroker/S0.2.481.1.20160326004729
784"],
    "nct": 2,
    "pn": 1
  }
}
```

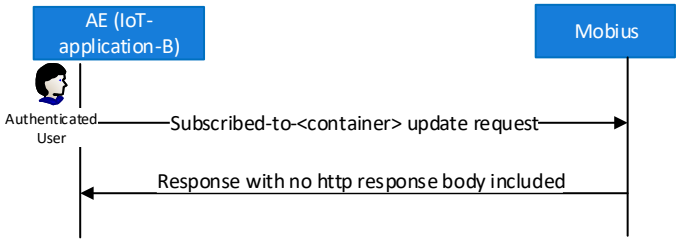
Response

```
HTTP/1.1 201 Created
```

```
Content-Length: 0
Content-Location:
/Mobius/temp_sensor/temp_container/sub_monitor01
Content-Type: application/json
X-M2M-RI: req14335
X-M2M-RSC: 2001

{
  "m2m:sub": {
    "pi": "/Mobius/temp_sensor/temp_container",
    "ty": 23,
    "ct": "20170105T025047",
    "ri": "/Mobius/temp_sensor/temp_container/sub_monitor01",
    "rn": "sub_monitor01",
    "lt": "20170105T025047",
    "et": "20180105T025047",
    "st": 0,
    "enc": {
      "net": [1]
    },
    "nu": [
      "mqtt://iot.ocean.org/mbroker/S0.2.481.1.20160326004729784"
    ],
    "pn": 1,
    "nct": 2
  }
}
```

b. IoT-Application-B updates the subscribed-to-<container>

① Call flow



② Resource URL Information

```
PUT /Mobius/temp_sensor/temp_container?rcn=0
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

④ Example: The update attributes of the <container> resource *temp_container* including attribute *maxNumberofInstance* is update with new field value of **200000** as well as new *labels* field value.

Example:

```
Request

PUT /Mobius/temp_sensor/temp_container?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
```

```
Accept: application/json
X-M2M-RI: req109239
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json

{
  "m2m:cnt":
  {
    "mni": 200000,
    "lbl": ["resource-monitoring"]
  }
}
```

Response

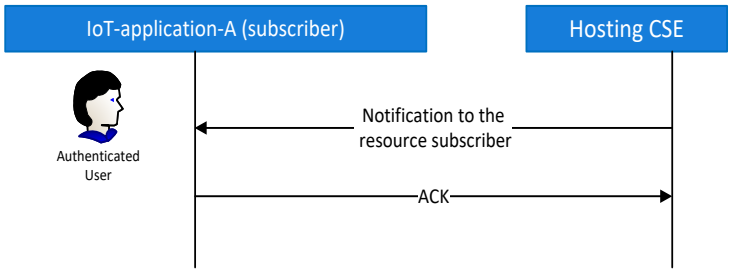
```
HTTP/1.1 200 OK
Content-Length: 0
Content-Type: application/json
X-M2M-RI: req109239
X-M2M-RSC: 2004
```

c. Hosting CSE sends notification to subscriber

The hosting CSE sends notification request to the subscriber and the notification request message is formulated to MQTT request packet sent from entity (originator) `Mobius` to entity (receiver) `S0.2.481.1.20160326004729784.` When the entity `S0.2.481.1.20160326004729784` succesfully receives the notification message, it will respond with an acknowledgement.

We assume the entity (`Mobius`) has subscribed to Topic `/oneM2M/resp/Mobius/+` in order to receive notification acknowledgement while the entity has subscribed to Topic `/oneM2M/req/+/S0.2.481.1.20160326004729784` in order to receive notification request from any entity.

① Call flow



② Resource URL information
The hosting CSE `PUBLISH` **notification request** associated with Topic `/oneM2M/req/Mobius/S0.2.481.1.20160326004729784/json`

③ HTTP Header information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

④ Example
Request message

The hosting CSE `PUBLISH` the notification request message in the payload associated with Topic `/oneM2M/req/Mobius/S0.2.481.1.20160326004729784/json`

```
{
  "m2m:sgn":
  {
```

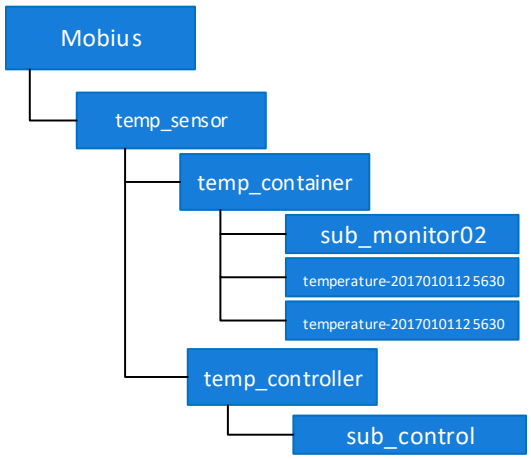
```
      "nev":
      {
          "rep":
          {
          "m2m:cnt":
          {
            "mni": 200000,
            "lbl": ["resource-monitoring"],
            "lt": "20170104T072540",
            "st": 5
          }
        }
       },
       "sur":"S0.2.481.1.20160326004729784"
     }
}
```

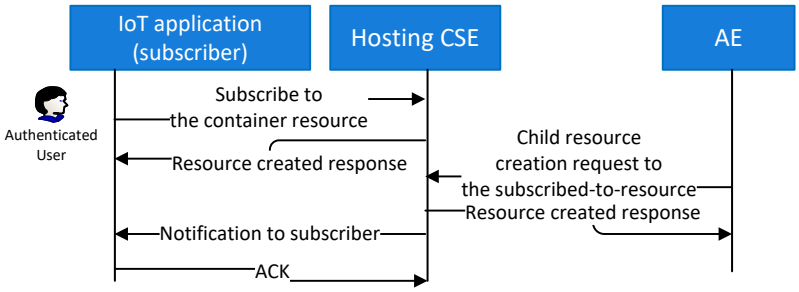

Response message

Entity `S0.2.481.1.20160326004729784` PUBLISH a response message associated with the Topic (as below) which specifies the target entity `Mobius`:
`/oneM2M/resp/Mobius/S0.2.481.1.20160326004729784/json`


```
{
    "m2m:rsp":
    {
       "rsc":2000,
       "fr": "S0.2.481.1.20160326004729784",
       "rqi":"rqi-20160414063014594jn3d"
    }
}
```


Secenario II: Notification for child creationof-subscribed-to-resource

Scenario Name	Notification-for-child-create-of-subscribed-to-resource
Description	① Resource Structure  ② Call Flow



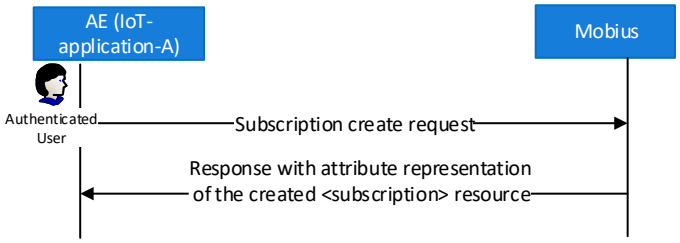
We assume there is three entities, an AE (an IoT application-A) that initiates a <subscription> resource *sub_monitor* create request to the target <container> *temp_container*, an AE (IoT application-B) that has access right to create any child resource under the <container> resource *temp_container*, the hosting CSE.
Call flows among these three entities are as following:

- The AE (IoT-application-A) sends a a <subscription> resource *sub_monitor* create request to the target <container> *temp_container;*
- The AE (IoT-application-B) sends a <contentInstance> create request to the subscribed-to-resource (<container>);
- The hosting CSE sends a notification to the subscriber and the subscriber sends back an acknowledgement.

Procedures

a. <u>IoT-Application-A subscribe to <container> resource</u>

① Call flow



② Resource URL Information

```
POST /Mobius/temp_sensor/temp_container?rcn=1
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=23*

④ Assumption

In the <subsription> create request, attribute *notificationEventType* (short for *net*) is set to a value {3} indicating whenever there is any child resource got created under the subscribed-to <container> resource, a notification will be triggered. Attribute *notificationURL* is set to field value of `"mqtt://iot.ocean.org/mbroker/S0.2.481.1.20160326004729795"` where broker IP `iot.ocean.org/mbroker` and AE-ID `S0.2.481.1.20160326004729795` is used.

In addition, attribute *notificationContentType* (short for *nct*) is set to value 2 indicating only modified attributes will be contained in the notification request message. Attribute *pendingNotification* is set to value 1 indicating only sending latest pending notifications to

the subscriber.

Example:

Request

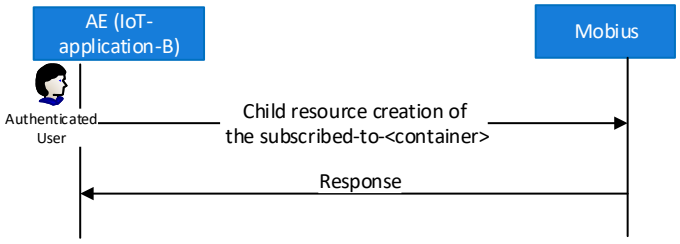
```
POST /Mobius/temp_sensor/temp_container?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req14335
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=23

{
  "m2m:sub":
  {
    "rn": "sub_monitor02",
    "enc": {
        "net": [3]
    },

   "nu":["mqtt://iot.ocean.org/mbroker/S0.2.481.1.201603260047297
   95"],
    "nct": 2,
    "pn": 1
  }
}
```

Response

```
HTTP/1.1 201 Created
Content-Length: 261
Content-Location: /Mobius/HkMmRhb6rZ
Content-Type: application/json
X-M2M-RI: req14335
X-M2M-RSC: 2001

{
  "m2m:sub": {
    "pi": "SyMIF4R2HW",
    "ty": 23,
    "ct": "20170105T025047",
    "ri": "HkMmRhb6rZ",
    "rn": "sub_monitor02",
    "lt": "20170105T025047",
    "et": "20180105T025047",
    "st": 0,
    "enc": {
      "net": [3]
    },
    "nu": [
      "mqtt://iot.ocean.org/mbroker/S0.2.481.1.20160326004729795"
    ],
    "pn": 1,
    "nct": 2
  }
}
```

b. Creation of child resource of the subscribed-to-<container>

① Call flow



② Resource URL Information
`POST /Mobius/temp_sensor/temp_container?rcn=0`

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json?ty=4*

④ Example: Create a new contentInstance under the <container> resource *temp_container*.

Request

```
POST /Mobius/temp_sensor/temp_container?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req109233
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json?ty=4

{
  "m2m:cin":
  {
    "con":"35"
  }
}
```

Response

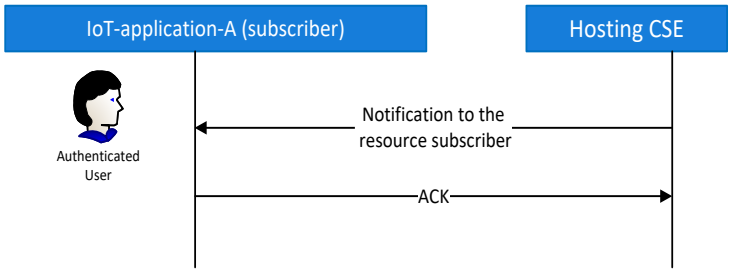
```
HTTP/1.1 201 CREATED
Content-Length: 0
Content-Type: application/json
Content-Location: /Mobius/B1f94ff6SW
X-M2M-RI: req109233
X-M2M-RSC: 2001
```

c. Hosting CSE sends notification to subscriber

The hosting CSE sends notification request to the subscriber and the notification request message is formulated to MQTT request packet sent from entity (originator) `Mobius` to entity (receiver) `S0.2.481.1.20160326004729795.` When the entity `S0.2.481.1.20160326004729795` succesfully receives the notification message, it will respond with an acknowledgement.

We assume the entity (`Mobius`) has subscribed to Topic `/oneM2M/resp/Mobius/+` in order to receive notification acknowledgement while the entity has subscribed to Topic `/oneM2M/req/+/S0.2.481.1.20160326004729795` in order to receive notification request from any entity.

⑤ Call flow



⑥ Resource URL information
The hosting CSE `PUBLISH` **notification request** associated with Topic
`/oneM2M/req/Mobius/S0.2.481.1.20160326004729795/json`

⑦ HTTP Header information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

⑧ Example
Request message

Request

The hosting CSE `PUBLISH` the notification request message in the payload associated with Topic
`/oneM2M/req/Mobius/S0.2.481.1.20160326004729795/json`

```
{
"m2m:sgn":
   {
     "nev":
     {
         "rep":
         {
          "m2m:cin":
          {
            "con":"35"
          }
         }
      },
      "sur":"S0.2.481.1.20160326004729795"
    }
}
```

Response

Entity `S0.2.481.1.20160326004729795` PUBLISH a response message associated with the Topic (as below) which specifies the target entity `Mobius`:
`/oneM2M/resp/Mobius/S0.2.481.1.20160326004729795/json`

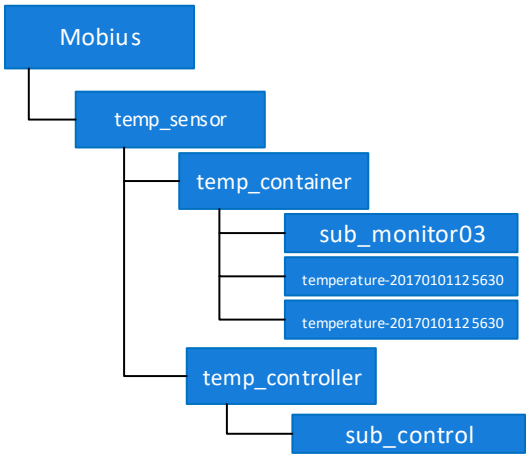
```
{
 "m2m:rsp":
 {
  "rsc":2000,
  "fr": "S0.2.481.1.20160326004729795",
  "rqi":"rqi-20160414063014594jn3d"
 }
}
```

Secenario III: Notification for child_delete_of_subscribed-to-resource

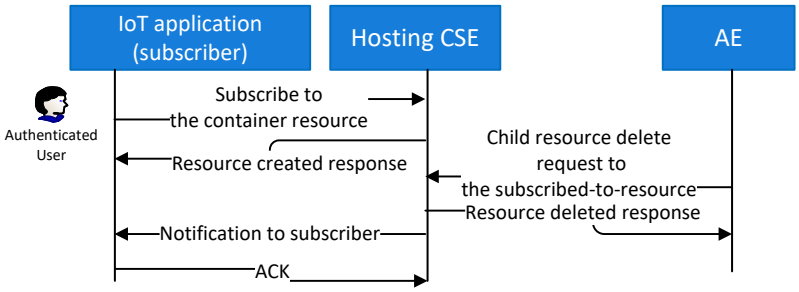
Scenario Name	Notification for child_delete_of_subscribed-to-resource

Description

① Resource Structure



② Call Flow



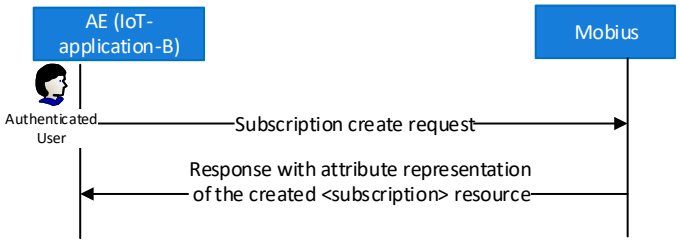
We assume there is three entities, an AE (an IoT application-A) that initiates a <subscription> resource *sub_monitor* create request to the target <container> *temp_container*, an AE (IoT application-B) that has access right to delete any child resource under the <container> resource *temp_container*, the hosting CSE.
Call flows among these three entities are as following:

- The AE (IoT-application-A) sends a a <subscription> resource *sub_monitor* create request to the target <container> *temp_container;*
- The AE (IoT-application-B) sends a <contentInstance> delete request to the subscribed-to-resource (<container>);
- The hosting CSE sends a notification to the subscriber and the subscriber sends back an acknowledgement.

Procedures

a. <u>IoT-Application-A subscribe to <container> resource</u>

① Call flow



② Resource URL Information

```
POST /Mobius/temp_sensor/temp_container?rcn=1
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=23*

④ Assumption

In the <subsription> create request, attribute *notificationEventType* (short for *net*) is set to a value {4} indicating whenever there is any child resource got deleted under the subscribed-to <container> resource, a notification will be triggered. Attribute *notificationURL* is set to field value of `"mqtt://iot.ocean.org/mbroker/S0.2.481.1.20160326004729982"` where broker IP `iot.ocean.org/mbroker` and AE-ID `S0.2.481.1.20160326004729982` is used.

In addition, attribute *notificationContentType* (short for *nct*) is set to value 2 indicating only modified attributes will be contained in the notification request message. Attribute *pendingNotification* is set to value 1 indicating only sending latest pending notifications to the subscriber.

Example:

Request

```
POST /Mobius/temp_sensor/temp_container?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req14335
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=23

{
  "m2m:sub":
  {
    "rn": "sub_monitor03",
    "enc": {
        "net": [4]
    },

   "nu":["mqtt://iot.ocean.org/mbroker/S0.2.481.1.201603260047299
   82"],
    "nct": 2,
    "pn": 1
  }
}
```

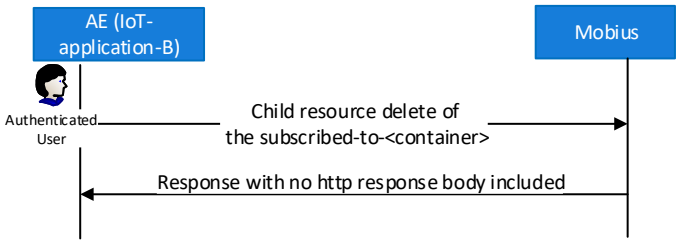
Response

```
HTTP/1.1 201 Created
Content-Length: 262
Content-Location: /Mobius/S1z_AMGpBb
Content-Type: application/json
X-M2M-RI: req14335
X-M2M-RSC: 2001

{
  "m2m:sub": {
    "pi": "SyMIF4R2HW",
    "ty": 23,
    "ct": "20170105T025047",
    "ri": "S1z_AMGpBb",
    "rn": "sub_monitor03",
```

```
    "lt": "20170105T025047",
    "et": "20180105T025047",
    "st": 0,
    "enc": {
      "net": [4]
    },
    "nu": [
      "mqtt://iot.ocean.org/mbroker/S0.2.481.1.20160326004729982"
    ],
    "pn": 1,
    "nct": 2
  }
}
```

b. Creation of child resource of the subscribed-to-<container>

① Call flow



② Resource URL Information
Delete an oldest <contentInstance> resource from the <container> *temp_container:*

```
DELETE /Mobius/temp_sensor/temp_container/oldest?rcn=0
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

④ Example: Delete an oldest <contentInstance> resource from the <container> *temp_container:*

Request message:

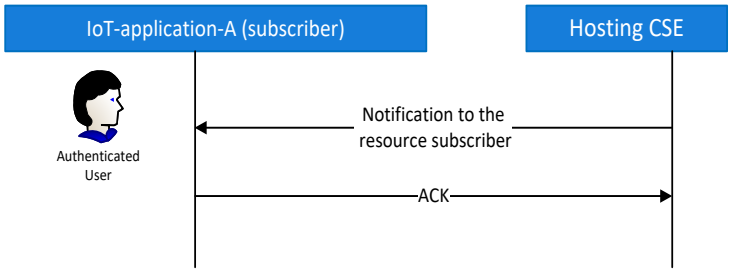
```
Request

DELETE /Mobius/temp_sensor/temp_container/oldest?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req109233
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json

Response

HTTP/1.1 200 OK
Content-Length: 0
Content-Type: application/json
X-M2M-RI: req109233
X-M2M-RSC: 2002
```

c. Hosting CSE sends notification to subscriber

The hosting CSE sends notification request to the subscriber and the notification request message is formulated to MQTT request packet sent from entity (originator) `Mobius` to entity (receiver) `S0.2.481.1.20160326004729982.` When the entity `S0.2.481.1.20160326004729982` succesfully receives the notification message, it will respond with an acknowledgement.

We assume the entity (`Mobius`) has subscribed to Topic `/oneM2M/resp/Mobius/+` in order to receive notification acknowledgement while the entity has subscribed to Topic `/oneM2M/req/+/S0.2.481.1.20160326004729982` in order to receive notification request from any entity.

① Call flow



② Resource URL information
The hosting CSE `PUBLISH` **notification request** associated with Topic `/oneM2M/req/Mobius/S0.2.481.1.20160326004729982/json`

③ HTTP Header information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

④ Example
Request message

Request

The hosting CSE `PUBLISH` the notification request message in the payload associated with Topic `/oneM2M/req/Mobius/S0.2.481.1.20160326004729982/json`

```
{
"m2m:sgn":
   {
     "nev":
     {
        "rep":
        {
         {
           "m2m:cin":
           {
             "pi": "/Mobius/temp_sensor/temp_container",
             "ty": 4,
             "ct": "20170106T072352",
             "ri": "/Mobius/temp_sensor/temp_container/4-
20170106072352694gA9G",
             "rn": "4-20170106072352694gA9G",
             "lt": "20170106T072352",
             "et": "20180106T072352",
             "st": 1,
             "mni": 10000,
             "cs": 2
          }
```

```
          }
        }
       },
       "sur":"S0.2.481.1.20160326004729982"
     }
}
```

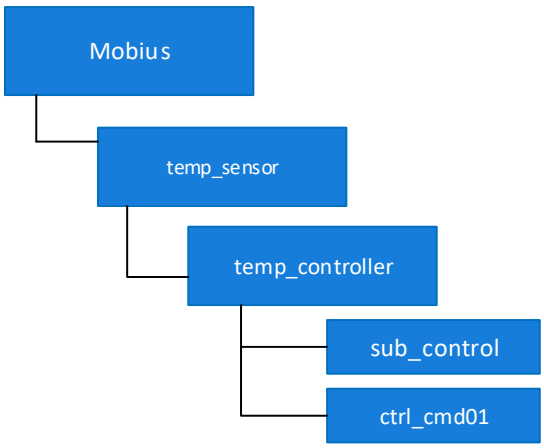
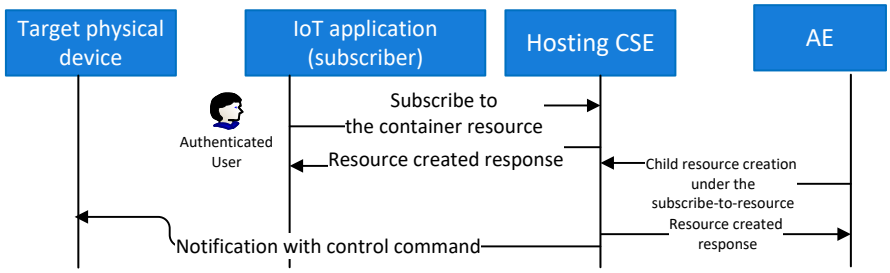
Response

Entity `S0.2.481.1.20160326004729982` PUBLISH a response message associated with the Topic (as below) which specifies the target entity `Mobius`:
`/oneM2M/resp/Mobius/S0.2.481.1.20160326004729982/json`

```
{
 "m2m:rsp":
 {
  "rsc":2000,
  "fr": "S0.2.481.1.20160326004729982",
  "rqi":"rqi-20160414063014594jn3d"
 }
}
```

Use Case II: Subscription and notification for device control

Secenario I: Notification for device control

Scenario Name	Notification for child_create_of_subscribed-to-resource
Description	③ Resource Structure  ④ Call Flow  We assume there is three entities, - an AE (an IoT application-A) that initiates a <subscription> resource *sub_monitor*

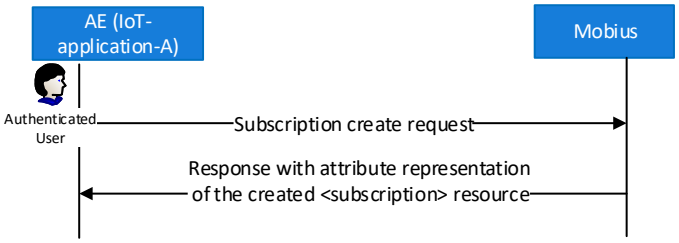
create request to the target <container> *temp_controller*; the request contains configured *notificationURL* which is set to a public access URL of a physical device;
- an AE (IoT application-B) that has access right to create a <contentInstance> resource under the <container> resource *temp_controller*;
- the hosting CSE.

Call flows among these three entities are as following:
- The AE (IoT-application-A) sends a a <subscription> resource *sub_control* create request to the target <container> *temp_controller;*
- The AE (IoT-application-B) sends a <contentInstance> create request to the subscribed-to-resource (<container>) containing the device controlling command;
- The hosting CSE sends a notification to the target physical device for controlling.

Procedures

d. IoT-Application-A subscribe to <container> resource

① Call flow



② Resource URL Information

```
POST /Mobius/temp_sensor/temp_controller?rcn=1
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=23*

④ Assumption

In the <subsription> create request, attribute *notificationEventType* (short for *net*) is set to a value {1, 3, 4 } indicating whenever there is any child resource got created/deleted under the subscribed-to <container> resource, or any successful update to the subscribed-to-<container>, a notification will be triggered.
Attribute *notificationURL* is set to field value of `"mqtt://iot.ocean.org/mbroker/S1.352.7.0.20170111014729892"` where broker IP `iot.ocean.org/mbroker` and AE-ID of the target physical device `S1.352.7.0.20170111014729892` is used.

In addition, attribute *notificationContentType* (short for *nct*) is set to value 2 indicating only modified attributes will be contained in the notification request message. Attribute *pendingNotification* is set to value 1 indicating only sending latest pending notifications to the subscriber.

Example:

```
Request

POST /Mobius/temp_sensor/temp_controller?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
```

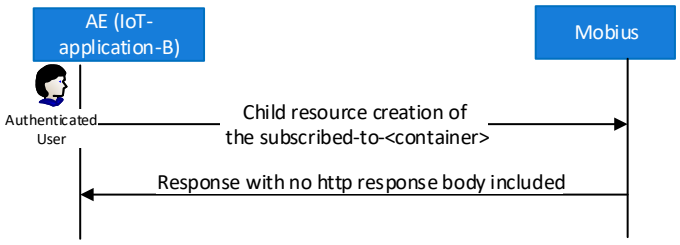
```
Accept: application/json
X-M2M-RI: req14335
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=23

{
  "m2m:sub":
  {
    "rn": "sub_control",
    "enc": {
        "net": [1,3,4]
    },

   "nu":["mqtt://iot.ocean.org/mbroker/S1.352.7.0.201701110147298
   92"],
    "nct": 2,
    "pn": 1
  }
}
```

Response

```
HTTP/1.1 201 Created
Content-Length: 261
Content-Location: /Mobius/rJMTPQG6Sb
Content-Type: application/json
X-M2M-RI: req14335
X-M2M-RSC: 2001

{
  "m2m:sub": {
    "pi": "SyMIF4R2HW",
    "ty": 23,
    "ct": "20170106T025047",
    "ri": "rJMTPQG6Sb",
    "rn": "sub_control",
    "lt": "20170106T025047",
    "et": "20180106T025047",
    "st": 0,
    "enc": {
      "net": [1,3,4]
    },
    "nu": [
      "mqtt://iot.ocean.org/mbroker/S1.352.7.0.20170111014729892"
    ],
    "pn": 1,
    "nct": 2
  }
}
```

e. Creation of child resource of the subscribed-to-<container>

① Call flow



② Resource URL Information

```
POST /Mobius/temp_sensor/temp_controller?rcn=0
```

③ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json?ty=4*

④ Example: Create a new <contentInstance> resource under the <container> resource *temp_container*. The control command for the device control is contained as a content of attribute *content*.

Request message:

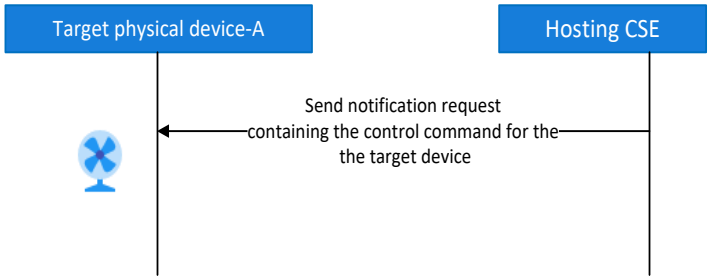
```
Request

POST /Mobius/temp_sensor/temp_controller?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req109223
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json?ty=4

{
  "m2m:cin":
  {
    "con":"onStart"
  }
}

Response

HTTP/1.1 201 CREATED
Content-Length: 0
Content-Type: application/json
Content-Location: /Mobius/HyfbANG6SZ
X-M2M-RI: req109223
X-M2M-RSC: 2001
```

f. Hosting CSE sends notification to subscriber

The hosting CSE sends notification request to the subscriber and the notification request message is formulated to MQTT request packet sent from entity (originator) `Mobius` to entity (receiver) `S1.352.7.0.20170111014729892.` When the entity `S1.352.7.0.20170111014729892` succesfully receives the notification message, it will respond with an acknowledgement.

We assume the entity (`Mobius`) has subscribed to Topic `/oneM2M/resp/Mobius/+` in order to receive notification acknowledgement while the entity has subscribed to Topic `/oneM2M/req/+/ S1.352.7.0.20170111014729892` in order to receive notification request from any entity.

① Call flow



② Resource URL information
The hosting CSE `PUBLISH` **notification request** associated with Topic
`/oneM2M/req/Mobius/S1.352.7.0.20170111014729892/json`

③ HTTP Header information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

④ Example
Request message

The hosting CSE `PUBLISH` the notification request message in the payload associated with Topic
`/oneM2M/req/Mobius/S1.352.7.0.20170111014729892/json`

```
{
"m2m:sgn":
   {
     "nev":
     {
        "rep":
        {
         "m2m:cin":
         {
            "pi": "/Mobius/temp_sensor/temp_controller",
            "ty": 4,
            "ct": "20170111T100118",
            "ri": "HyfbANG6SZ",
            "rn": "ctr_cmd01",
            "lt": "20170111T100118",
            "et": "20180111T100118",
            "st": 1,
            "mni": 10000,
            "cs": 2,
            "con":"onStart"
         }
        }
     },
     "sur":"S1.352.7.0.20170111014729892"
   }
}
```

2.3.10. <group> Resource

The <group> resource is defined in the oneM2M specifications for management of a group of resources with same or different (mixed) type(s). Attribute *memberType* is defined to specify the type of resources as the group members. The *memberType* attribute can be either set to the value of resource type of group member when all the group members have same resource type or to “MIXED” as a default value indicating the group members have different resource types. In addition, a mandatory attribute *memberID* is defined to identify group members, which can be set to the *resourceID* of the group members. Also a mandatory attribute *maxNrOfMembers* is defined to limit the maximum number of

group members in a group resource. The originator of <group> resource creation request may also set the value of attribute *consistencyStrategy* to either ABANDON_GROUP, SET_MIXED, or default ABANDON_MEMBER to indicate the preference of the originator for handle the <group> resource creation by hosting CSE when the validation of *memberType* by hosting CSE is unsuccessful.

In order to enable the management (including update and retrieve) of a group of resources through a simple operation e.g. HTTP Post operation, oneM2M specifications also defines a virtual child resource <fanOutPoint> to manupulate operations against group members, i.e. whenever the request is sent to the <fanOutPoint> resource under its parent <group> resource, the request is fanned out to each member of the <group> resource, which are indicated by the *memberIDs* attribute in the <group> resource, and the corresponding responses are aggregated from each member and responded to the Originator.

For example, if a group resource containing two container resources, a <fanOutPoint> request to create a contentInstance will result in the creation of the contentInstance resource under all the container resources in the addressed group resource. In practice, this example can be used for remote lights control scenario by creating a contentInstance with *content* attribute set to *OFF* (or *ON)* to change the light status of a group of lights one time. Another example of using <fanOutPoint> resource is to create <subscription> resource to group members e.g. containers. Once the <subscription> resources are created under all group members, the Originator is able to retrieve and aggregate notifications from those subscriptions. Note that attribute *notificationForwardingURI* should be contained in the <subscription> fanOutPoint request.

The <group> resource also support to contain sub-group resources. The creation procedures for the sub-group resources are same with its parent <group> resource.

The fanOut request to the members of sub-group resource can be implemented by specifying the request URI to `<URI of parent group resource>/fanOutPoint/fanOutPoint`. Additional relative address can also be appended to the request URI of `<URI of parent group resource>/fanOutPoint/fanOutPoint`, then it would look like `<URI of parent group resource>/fanOutPoint/fanOutPoint/<relative address>`.

The universal attributes of <group> resource is shown in Table 2.2.10.1 while the group resource-specific attributes are defined in Table 2.2.10.2 as below.

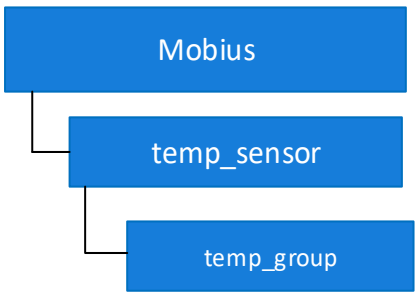
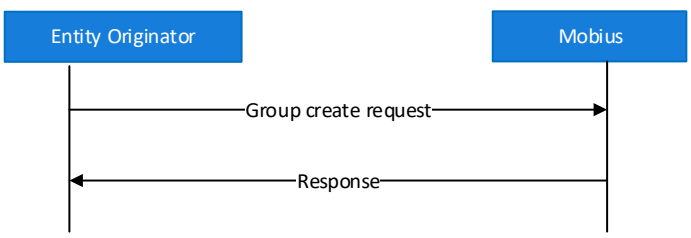
Table 2.2.10. 1 Universal Attributes of <group> resource

Attribute Name	Request Optionality	
	Create	Update
@resourceName	O	NP
resourceType	NP	NP
resourceID	NP	NP
parentID	NP	NP
accessControlPolicyIDs	O	O
creationTime	NP	NP
expirationTime	O	O
lastModifiedTime	NP	NP
labels	O	O
announceTo	O	O
announcedAttribute	O	O
dynamicAuthorizationConsultationIDs	O	O

Table 2.2.10. 2 Resource Specific Attributes of <group> resource

Attribute Name	Request Optionality		Data Type	Default Value and Constraints
	Create	Update		
creator	O	NP	m2m:ID	
memberType	O	NP	m2m:memberType	Default value is set to 'MIXED'
currentNrOfMembers	NP	NP	xs:positiveInteger	No default (This is generated by the hosting CSE and limited by the *maxNrOfMembers* attribute of the <group> resource)
maxNrOfMembers	M	O	xs:positiveInteger	No default
memberIDs	M	O	list of xs:anyURI	No default
membersAccessControlPolicyIDs	O	O	list of xs:anyURI	No default
memberTypeValidated	NP	NP	xs:boolean	No default (This is generated by the hosting CSE)
consistencyStrategy	O	NP	m2m:consistencyStrategy	Default value is set to 'ABANDON_MEMBER'
groupName	O	O	xs:string	No default

1) API/GRP/CRE

Interface ID	API/GRP/CRE_RCN/0
Interface Name	Group CREATE with resultContent set to 0 (nothing)
Target Resource	Parent resource <AE> of the requested <group> resource
Interface Description	The interface is used to send a <group> CREATE request attached with resultContent set to 0 to the Mobius, and the hosting CSE creates a <AE> resource, and sends back a response containing a response status code to indicate the CREATE operation status. ① Resource Structure  ② Call Flow 

③ Resource URL Information

```
POST /Mobius/temp_sensor?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=9*

⑤ Example

Request

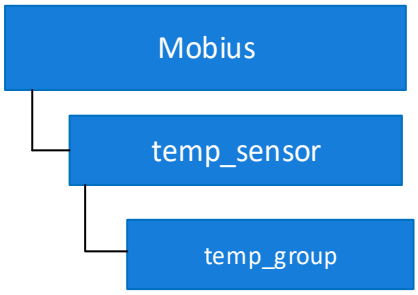
```
POST /Mobius/temp_sensor?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req15999
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=9

{
   "m2m:grp" : {
      "mid": [
         "/Mobius/temp_sensor/temp_container",
         "/Mobius/temp_sensor/temp_container02"
      ],
      "mnm": 50,
      "mt":  3,
      "rn": "temp_group"
   }
}
```

Response

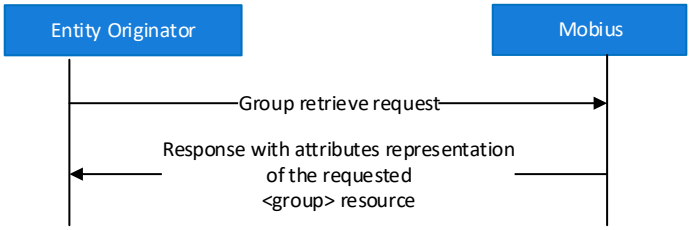
```
HTTP/1.1 201 Created
Content-Length: 0
Content-Location: /Mobius/temp_sensor/temp_group
Content-Type: application/json
X-M2M-RI: req15999
X-M2M-RSC: 2001
```

2) API/GRP/RET

Interface ID	API/GRP/RET_RCN/1
Interface Name	Group RETRIEVE with resultContent set to 1 (attributes)
Target Resource	Requested <group> resource
Interface Description	The interface is used to send a <group> RETRIEVE request attached with resultContent set to 1 to the Mobius, and the hosting CSE sends back a retrieved <group> resource. ① Resource Structure



② Call Flow



⑥ Resource URL Information

```
GET /Mobius/temp_sensor/temp_group?rcn=1
```

⑦ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

⑧ Example

Request

```
GET /Mobius/temp_sensor/temp_group?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req333325
X-M2M-Origin: S20170718064315893ezjk
```

Response

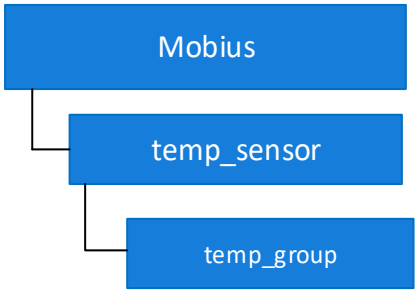
```
HTTP/1.1 200 OK
Content-Length: 322
Content-Type: application/json
X-M2M-RI: req333325
X-M2M-RSC: 2000

{
  "m2m:grp": {
    "rn": "temp_group02",
    "ty": 9,
    "pi": "SyMIF4R2HW",
    "ri": " HJfuAnf6sf",
    "ct": "20170105T071432",
    "et": "20180105T071432",
    "lt": "20170105T071432",
    "st": 0,
    "mnm": 50,
    "mid": [
```

```
      "/Mobius/temp_sensor/temp_container",
      "/Mobius/temp_sensor/temp_container02"
    ],
    "mt": 3,
    "csy": 1,
    "cnm": 2,
    "mtv": true
  }
}
```

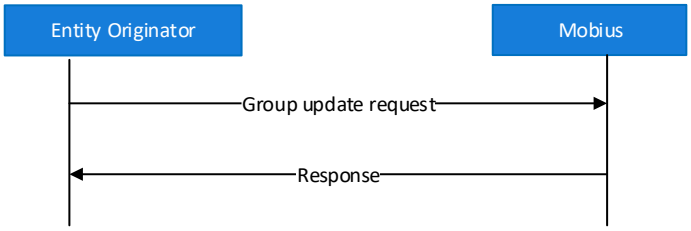
3) API/GRP/UPD

Interface ID	API/GRP/UPD_RCN/0
Interface Name	Group UPDATE with resultContent set to 0 (nothing)
Target Resource	Requested <group> resource
Interface Description	The interface is used to send a <group> UPDATE request attached with resultContent set to 0 to the Mobius, and the hosting CSE (Mobius) updates the requested <group> resource and sends back a response containing a response status code to indicate UPDATE operation status.

① Resource Structure



② Call Flow



③ Resource URL Information

```
PUT /Mobius/temp_sensor/temp_group?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

⑤ Example

```
Request

PUT /Mobius/temp_sensor/temp_group?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
```

```
Accept: application/json
X-M2M-RI: req999932
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json

{
   "m2m:grp" : {
      "mnm": 100,
      "lbl": ["containers_group"]
   }
}
```

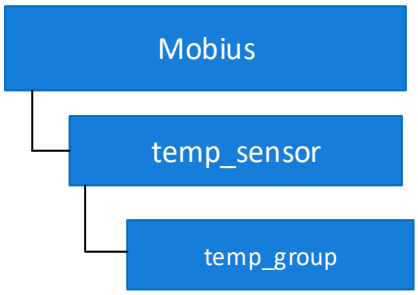
Response

```
HTTP/1.1 200 OK
Content-Length: 0
Content-Type: application/json
X-M2M-RI: req999932
X-M2M-RSC: 2004
```

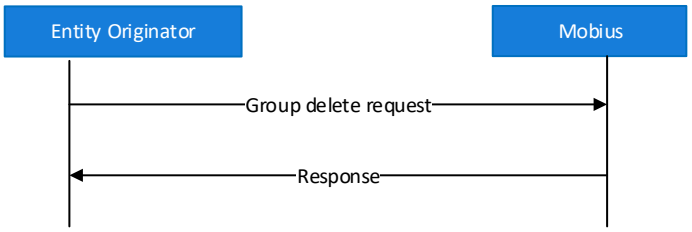
4) API/GRP/DEL

Interface ID	API/GRP/DEL_RCN/0
Interface Name	Group DELETE with resultContent set to 0 (nothing)
Target Resource	Requested <group> resource
Interface Description	The interface is used to send a <group> DELETE request attached with resultContent set to 0 to the Mobius, and the hosting CSE (Mobius) deletes the requested <group> resource, and sends back a response containing a response status code to indicate DELETE operation status.

① Resource Structure



② Call Flow



① Resource URL Information

```
DELETE /Mobius/temp_sensor/temp_group?rcn=0
```

② Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

③ Example

```
Request

DELETE /Mobius/temp_sensor/temp_group?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
X-M2M-RI: req999332
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json

Response

HTTP/1.1 200 OK
Accept: application/json
Content-Length: 0
X-M2M-RI: req999332
X-M2M-RSC: 2002
```

2.3.11. <timeSeries> Resource

The <timeSeries> resource represents a container for Time Series Data instances. It is used to share information with other entities and potentially to track, detect and report the missing data in Time Series. A <timeSeries> resource has no associated content. It has only attributes and child resources.

The <TimeSeries> resource can be understood as similar with <container> resource in such aspect:

- Both are represented as a container for data instances and have no associated content and have only attributes and child resources,
- Both have a group of attributes representating the limitation on the data container, such as *maxNrOfInstances, maxByteSize, maxInstanceAge* as well as *currentNrOfInstances* and *currentByteSize* etc.
- The *accessControlPolicyID* and *stateTag* also applied to <TimeSeries> resource.

but it still has some differences as following:

- Mainly designed for storing time series data instances;
- defines a group of resource-specific attributes representing features of time series data, such as periodicInterval indicating the time period that the time series data is collected, missingDataCurrentNr indicating the current number of time series data that has been missed by the data receiver etc.\
- <timeSeries> resource doesn't have virtual resource <latest> and <oldest> which are defined to retrieve the most recent created and the most oldest <contentInstances> as defined in <container> resource.

A group of universal attributes defined for <timeSeries> resource is listed at Table 2.2.11-1 and resource-specific attributes is listed at Table 2.2.11-2.

Table 2.2.11-1 Universal/Common Attributes of <timeSeries> resource

Attribute Name	Request Optionality	
	Create	Update
@resourceName	O	NP
resourceType	NP	NP
resourceID	NP	NP
parentID	NP	NP
accessControlPolicyIDs	O	O
creationTime	NP	NP
expirationTime	O	O
lastModifiedTime	NP	NP
stateTag	NP	NP
labels	O	O
announceTo	O	O
announcedAttribute	O	O
creator	O	NP

Table 2.2.11-2 Resource Specific Attributes of <timeSeries> resource

Attribute Name	Request Optionality		Data Type	Default Value and Constraints
	Create	Update		
maxNrOfInstances	O	O	xs:nonNegativeInteger	No default
maxByteSize	O	O	xs:nonNegativeInteger	No default
maxInstanceAge	O	O	xs:nonNegativeInteger	No default
currentNrOfInstances	NP	NP	xs:nonNegativeInteger	No default (This is generated by the Hosting CSE and limited by the maxNrOfInstances)
currentByteSize	NP	NP	xs:nonNegativeInteger	No default (This is generated by the Hosting CSE and limited by the maxByteSize)
periodicInterval	O	O	xs:nonNegativeInteger	No default
missingDataDetect	O	O	xs:boolean	No default
missingDataMaxNr	O	O	xs:nonNegativeInteger	No default
missingDataList	NP	NP	m2m:missingDataList	No default
missingDataCurrentNr	NP	NP	xs:nonNegativeInteger	No default (This is generated by the Hosting CSE and limited by the missingDataMaxNr)
missingDataDetectTimer	O	O	xs:nonNegativeInteger	No default (This is in units of milliseconds.)
ontologyRef	O	O	xs:anyURI	No default

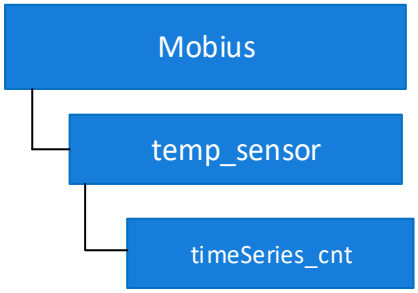
Table 2.2.11-3 Child Resources of <timeSeries> resource

Child Resource Type	Child Resource Name	Multiplicity
<timeSeriesInstance>	[variable]	0…n
<subscription>	[variable]	0…n
<semanticDescriptor>	[variable]	0...n

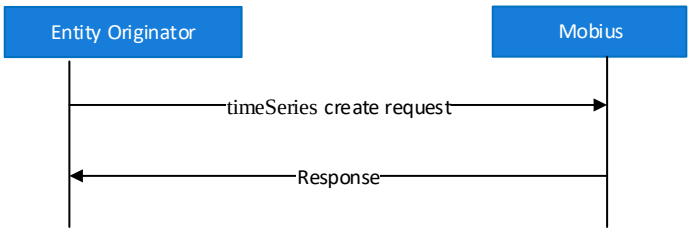
1) API/TS/CRE

Interface ID	API/TS/CRE
Interface Name	timeSeries CREATE with resultContent set to 0 (nothing)
Target Resource	Parent resource <AE> of the requested <timeSeries> resource
Interface Description	The interface is used to send a <timeSeries> CREATE request attached with resultContent set to 0 to the Mobius, and the hosting CSE creates a <AE> resource and sends back a response containing a response status code to indicate the CREATE operation status.

① Resource Structure



② Call Flow



③ Resource URL Information

```
POST /Mobius/temp_sensor?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=29*

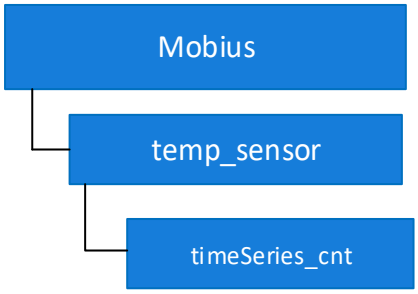
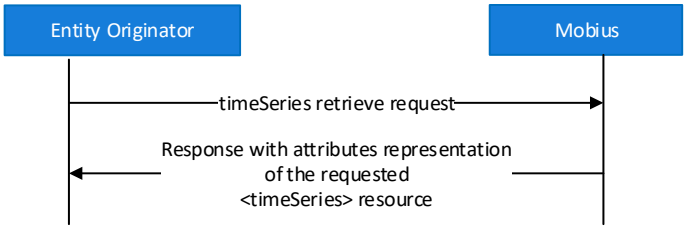
⑤ Example of Request Message

Request

```
POST /Mobius/temp_sensor?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req98999
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=29

{
 "m2m:ts":
 {
    "rn": "timeSeries_cnt",
    "pei": 1000,
```

	<pre>"mdd": true,
	"mdt": 200
	}
	}
	
	Response
	HTTP/1.1 201 Created
	Content-Length: 0
	Content-Location: /Mobius/BkfKH17TSW
	Content-Type: application/json
	X-M2M-RI: req98999
	X-M2M-RSC: 2001</pre>

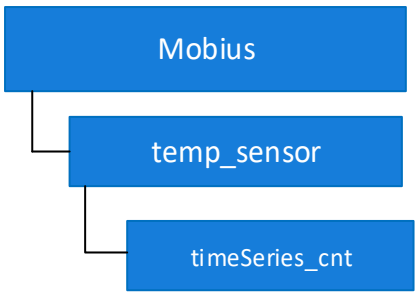
2) API/TS/RET

Interface ID	API/TS/RET_RCN/1
Interface Name	timeSeries RETRIEVE with resultContent set to 1 (attributes)
Target Resource	Requested <timeSeries> resource
Interface Description	The interface is used to send a <timeSeries>RETRIEVE request attached with resultContent set to 0 to the Mobius, the hosting CSE (Mobius) sends back a response containing the attributes information of <timeSeries> resource. ① Resource Structure  ② Call Flow  ⑨ Resource URL Information `GET /Mobius/temp_sensor/timeSeries_cnt?rcn=1` ⑩ Http Header Information **Header** / **Value** **Accept** / *application/ json* **X-M2M-RI** / Request ID **X-M2M-Origin** / AE-ID of request originator

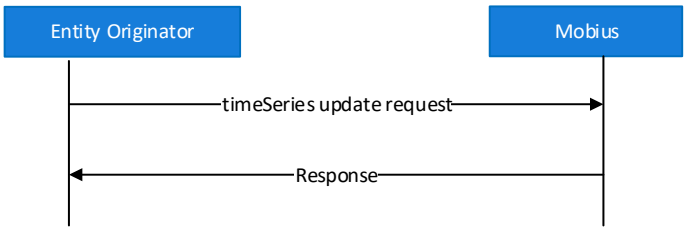
⑪ Example of Request Message

```
Request

GET /Mobius/temp_sensor/timeSeries_cnt?rcn=1 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req399325
X-M2M-Origin: S20170718064315893ezjk

Response

HTTP/1.1 200 OK
Content-Length: 279
Content-Type: application/json
X-M2M-RI: req399325
X-M2M-RSC: 2000

{
  "m2m:ts": {
    "rn": "timeSeries_cnt",
    "ty": 29,
    "pi": "S20170718064315893ezjk",
    "ri": "BkfKH17TSW",
    "ct": "20170109T053451",
    "et": "20180109T053451",
    "lt": "20170109T053451",
    "st": 0,
    "mni": 9007199254740991,
    "pei": 1000,
    "mdd": true,
    "mdn": 1000,
    "mdc": 0,
    "mdt": 200,
    "cni": 0,
    "cbs": 0
  }
}
```

3) API/TS/UPD

Interface ID	API/TS/UPD_RCN/0
Interface Name	timeSeries update with resultContent set to 0 (nothing)
Target Resource	Requested <timeSeries> resource
Interface Description	The interface is used to send a <timeSeries> UPDATE request attached with resultContent set to 0 to the Mobius, and the hosting CSE (Mobius) updates the requested <timeSeriesInstance> resource, and sends back a response containing a response status code to indicate the UPDATE operation status. ① Resource Structure 

② Call Flow



③ Resource URL Information

```
PUT /Mobius/temp_sensor/timeSeries_cnt?rcn=0
```

④ Http Header Information

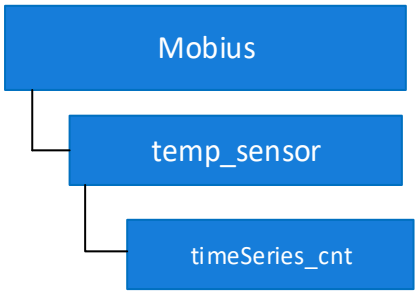
Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

⑤ Example

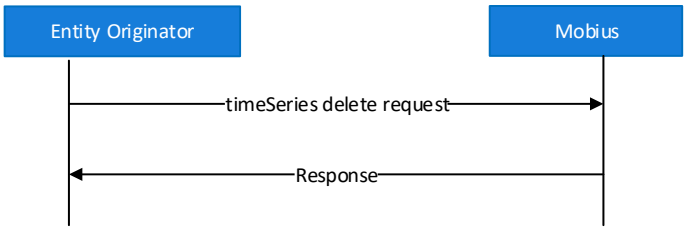
```
Request

PUT /Mobius/temp_sensor/timeSeries_cnt?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req990932
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json

{
 "m2m:ts":
 {
    "mdn":200
 }
}

Response HTTP/1.1 200 OK
Content-Length: 0
Content-Type: application/json
X-M2M-RI: req990932
X-M2M-RSC: 2004
```

4) API/TS/DEL

Interface ID	API/TS/DEL_RCN/0
Interface Name	timeSeries delete with resultContent set to 0 (nothing)
Target Resource	Requested <timeSeries> resource
Interface Description	The interface is used to send a <timeSeries> DELETE request attached with resultContent set to 0 to the Mobius, and the hosting CSE (Mobius) deletes the requested <timeSeries> resource, and sends back a response containing a response status code to indicate the DELETE operation status. ① Resource Structure



② Call Flow



④ Resource URL Information

```
DELETE /Mobius/temp_sensor/timeSeries_cnt?rcn=0
```

⑤ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

⑥ Example of Request Message

Request

```
DELETE /Mobius/temp_sensor/timeSeries_cnt?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
X-M2M-RI: req999332
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 0
X-M2M-RI: req999332
X-M2M-RSC: 2002
```

2.3.12. <timeSeriesInstance> Resource

The <timeSeriesInstance> resource represents a data instance of the <timeSeries> resource. It shares the similar concept with <contentInstance> and both cannot be modified once created. The creation of the <timeSeriesInstance> are limited by the policies that applied to it parent <timeSeries> resource in terms of *maxByteSize, maxNrOfInstances, maxInstanceAge* attribute etc. The <timeSeriesInstance> resource cannot apply its own *accessControlPolicID* but can ineritate the the *accessControlPolicyID* of its parent resource. Similar rule of *stateTag* as <contentInstance> resource applies to <timeSeriesInstance>.

A group of universal attributes defined for <timeSeriesInstance> resource is listed at Table 2.2.12-1 and resource-specific attributes is listed at Table 2.2.12- 2.

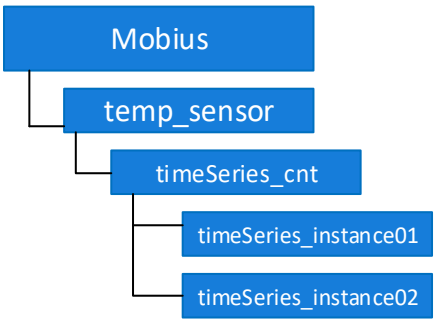
Table 2.2.12-1 Universal/Common Attributes of <timeSeriesInstance> resource

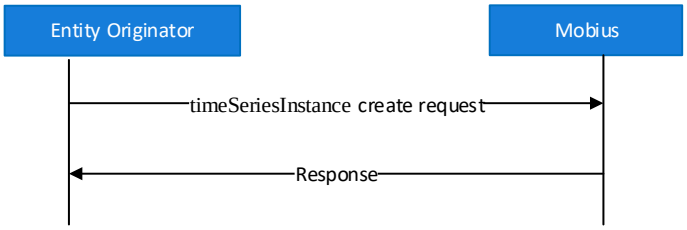
Attribute Name	Request Optionality
	Create
@resourceName	O
resourceType	NP
resourceID	NP
parentID	NP
creationTime	NP
expirationTime	O
lastModifiedTime	NP
labels	O
announceTo	O
announcedAttribute	O

Table 2.2.12- 2 Resource Specific Attributes of <timeSeriesInstance> resource

Attribute Name	Request Optionality	Data Type	Default Value and Constraints
	Create		
dataGenerationTime	M	m2m:absRelTimestamp	No default
content	M	xs:anySimpleType	No default
sequenceNr	O	xs:nonNegativeInteger	No default

1) API/TSI/CRE

Interface ID	API/TSI/CRE_RCN/0
Interface Name	timeSeries create with resultContent set to 0 (nothing)
Target Resource	Parent resource <timeSeries> of the requested <timeSeriesInstance> resource
Interface Description	The interface is used to send a <timeSeriesInstance> create request attached with resultContent set to 0 to the target <timeSeries> resource and receive a successful <timeSeriesInstance> creation response with no http response body included. ① Resource Structure  ② Call Flow



③ Resource URL Information

```
POST /Mobius/temp_sensor?timeSeries_cnt?rcn=0
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json; ty=30*

⑤ Example of Request Message

Request

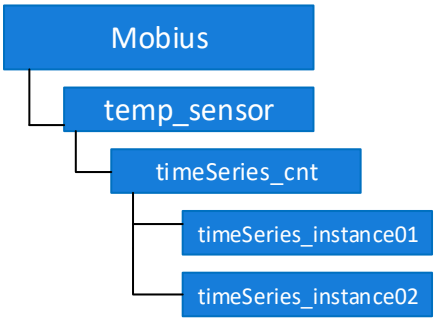
```
POST /Mobius/temp_sensor/timeSeries_cnt?rcn=0 HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req108999
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json;ty=30

{
 "m2m:tsi":
 {
    "rn": "timeSeries_instance01",
    "dgt": "20170106T152424",
    "con": "30"
 }
}
```

Response

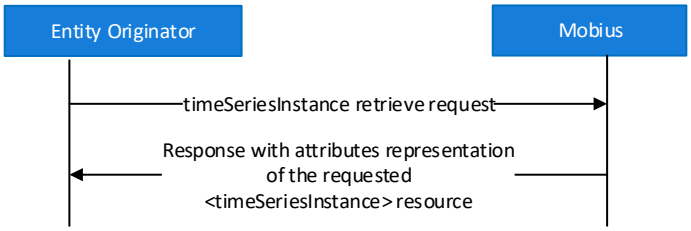
```
HTTP/1.1 201 Created
Content-Length: 0
Content-Location: /Mobius/HyMZFGQ6HW
Content-Type: application/json
X-M2M-RI: req108999
X-M2M-RSC: 2001
```

2) API/TSI/RET

Interface ID	API/TSI/RET_RCN/1
Interface Name	timeSeriesInstance retrieve with resultContent set to 1 (attributes)
Target Resource	Requested <timeSeriesInstance> resource
Interface Description	The interface is used to send a <timeSeriesInstance> create request attached with resultContent set to 0 to the target <timeSeriesInstance> resource and receive a successful <timeSeriesInstance> creation response with no http response body included. ① Resource Structure



② Call Flow



③ Resource URL Information

```
GET
/Mobius/temp_sensor/timeSeries_cnt/timeSeries_instance01?rcn=1
```

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator

⑤ Example of Request Message

Request

```
GET
/Mobius/temp_sensor/timeSeries_cnt/timeSeries_instance01?rcn=1
HTTP/1.1
Host: yt.iotmobius.com:7579
Accept: application/json
X-M2M-RI: req309325
X-M2M-Origin: S20170718064315893ezjk
```

Response

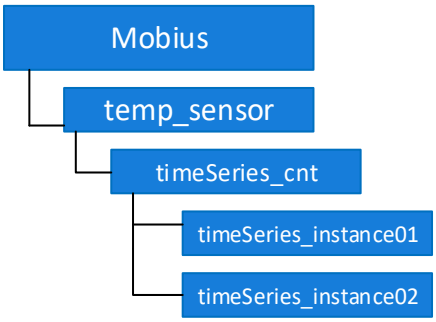
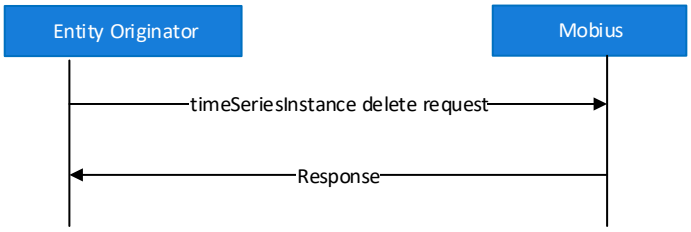
```
HTTP/1.1 200 OK
Content-Length: 264
Content-Type: application/json
X-M2M-RI: req309325
X-M2M-RSC: 2000

{
  "m2m:tsi": {
    "rn": "timeSeries_instance01",
    "ty": 30,
    "pi": "BkfKH17TSW",
    "ri": "HyMZFGQ6HW",
    "ct": "20170109T022828",
    "et": "20180109T022828",
```

	<pre>"lt": "20170109T022828",
	"st": 3,
	"cs": 2,
	"con": "30",
	"dgt": "20170106T152424"
	}
	}</pre>

3) API/TSI/UPD

Interface ID	API/TSI/UPD_RCN/0
Interface Name	timeSeries update with resultContent set to 0 (nothing)
Target Resource	Requested <timeSeriesInstance> resource
Interface Description	Update operation is not allowed to <timeSeriesInstance> resource.

4) API/TSI/DEL

Interface ID	API/TSI/DEL_RCN/0
Interface Name	timeSeriesInstance DELETE with resultContent set to 0 (nothing)
Target Resource	Requested <timeSeriesInstance> resource
Interface Description	The interface is used to send a <timeSeriesInstance> DELETE request attached with resultContent set to 0 to the Mobius, and the hosting CSE (Mobius) deletes the requested <timeSeriesInstance> resource, and sends back a response containing a response status code to indicate the DELETE operation status. ① Resource Structure  ② Call Flow  ③ Resource URL Information DELETE /Mobius/temp_sensor/timeSeries_cnt/timeSeries_instance01?rcn=0

④ Http Header Information

Header	Value
Accept	*application/ json*
X-M2M-RI	Request ID
X-M2M-Origin	AE-ID of request originator
Content-Type	*application/vnd.onem2m-res+json*

⑤ Example

Request

```
DELETE
/Mobius/temp_sensor/timeSeries_cnt/timeSeries_instance01?rcn=0
HTTP/1.1
Host: yt.iotmobius.com:7579
X-M2M-RI: req979332
X-M2M-Origin: S20170718064315893ezjk
Content-Type: application/vnd.onem2m-res+json
```

Response

```
HTTP/1.1 200 OK
Accept: application/json
Content-Length: 0
X-M2M-RI: req979332
X-M2M-RSC: 2002
```

References:

oneM2M Specifications:

- TS-0001_Functional_Architecture
- TS-0004_Service_Layer_Core_Protocol
- TS-0009_HTTP_Protocol_Binding
- TS-0010-MQTT_protocol_binding
- TR-0025-Application_Developer_Guide