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Machine-to-Machine communications (M2M); OMA DM compatible Management Objects for ETSI M2M



Reference

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Machine-to-Machine communications (M2M).

1 Scope

The present document contains OMA DM [2] compatible management objects for three ETSI M2M mgmtObj instances: etsiScI Mo M2M-TS 102 690 [4], etsiAreaNwkInfo M2M-TS 102 690 [4] and etsiAreaNwkDeviceInfo M2M-TS 102 690 [4].

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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2.1 Normative references

The following referenced documents are necessary for the application of the present document.

- [1] OMA-WP-AC-MO-20090127-A: "White Paper on Provisioning Objects", January 2009.
- [2] OMA-TS-DM_Protocol-V1_3-20121009-C: "OMA Device Management Protocol", October 2012.

NOTE: Available at http://member.openmobilealliance.org/ftp/public_documents/dm/DM-DM13/Permanent_documents/OMA-TS-DM_Protocol-V1_3-20121009-C.zip

- [3] OMA-TS-DM_TND-V1_3-20121009-C: "OMA Device Management Tree and Description", October 2012.

NOTE: Available at http://member.openmobilealliance.org/ftp/public_documents/dm/DM-DM13/Permanent_documents/OMA-TS-DM_TND-V1_3-20121009-C.zip

- [4] ETSI TS 102 690: "Machine-to-Machine communications (M2M); Functional architecture".
- [5] ETSI TS 102 921: "Machine-to-Machine communications (M2M); mIa, dIa and mId interfaces".
- [6] Void.
- [7] ISO/IEC/IEEE 9945:2009: "Information technology -- Portable Operating System Interface (POSIX®) Base Specifications, Issue 7".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI TR 102 725: "Machine to Machine Communications (M2M); M2M definitions".

NOTE: Explanations on the acronyms and abbreviations used in the present document can be found in TR 102 725.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 102 725 [i.1] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in TR 102 725 [i.1] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 102 725 [i.1] and the following apply:

DM	Device Management
MANDMO	M2M Area Network Device Management Object
MANMO	M2M Area Network Management Object
MO	Management Object
MSCLMO	M2M Service Capability Layer Management Object
OMA	Open Mobile Alliance

4 General Principles

In the present document, the following three OMA DM compliant MOs are developed for ETSI M2M:

- MSCLMO for ETSI M2M etsiScI Mo
- MANMO for ETSI M2M etsiAreaNwkInfo
- MANDMO for ETSI M2M etsiAreaNwkDeviceInfo

Based on OMA DM specification on designing a new MO [1], [3], the following rules are followed in the present document:

- MO Identifiers:
 - MO identifier for MSCLMO is urn:oma:mo:ext-etsi-msclmo:1.0;
 - MO identifier for MANMO is urn:oma:mo:ext-etsi-manmo:1.0;
 - MO identifier for MANDMO is urn:oma:mo:ext-etsi-mandmo:1.0.
- Special Handling of resource/attributes in etsiScI Mo/etsiAreaNwkInfo/etsiAreaNwkDeviceInfo:
 - Subscriptions resource in etsiScI Mo/etsiAreaNwkInfo/etsiAreaNwkDeviceInfo will not be modelled in MSCLMO/MANMO/MANDMO;
 - Several common attributes of a M2M resource in etsiScI Mo/etsiAreaNwkInfo/etsiAreaNwkDeviceInfo including expirationTime, accessRightID, searchStrings, creationTime, lastModifiedTime, moID, originalMO, description, does not occur in MSCLMO/MANMO/MANDMO;
 - Collection instances in etsiScI Mo/etsiAreaNwkInfo/etsiAreaNwkDeviceInfo are modelled as an unnamed node (i.e. <x>) in MSCLMO/MANMO/MANDMO.

- Node Properties in MSCLMO/MANMO/MANDMO management tree:
 - The Occurrence of a node in MSCLMO/MANMO/MANDMO management tree can be:
 - ZeroOrOne, ZeroOrMore, ZeroOrN, One, OneOrN, OneOrMore for unnamed node.
 - Named node can only have ZeroOrOne, or One occurrence since OMA-DM needs each node in a management tree shall have a unique URI.
 - Character Meaning:
 - + 1 ore more occurrences
 - * 0 or more occurrences
 - ? 0 or 1 occurrence
 - Each node in MSCLMO/MANMO/MANDMO can have one or more of following access types as specified and supported by OMA-DM [2]:
 - Get, Replace, Exec, Add, Delete, Copy.
 - A RO (sub-) resource or an attribute is modelled as a node with Get access type.
 - A RW (sub-) resource or an attribute is modelled as a node with Get and Replace access type.
 - An attribute standing for an action is modelled as a node with Get and Exec access type.
 - The DFFormat of a node in MSCLMO/MANMO/MANDMO management tree can be:
 - b64, bin, bool, chr, int, node, null, xml, date, time, float:
 - for the leaf node of type 'chr' which is defined as comma separated list: when a comma is contained in an item of such a list, the comma shall be escaped by using '\,'.
 - an interior node shall have "node" as its DFFormat value.
 - The Status of each node in MSCLMO/MANMO/MANDMO can be "Required" or "Optional":
 - An Optional (sub-)resource or attribute is modelled as an Optional node.
 - A Mandatory (sub-)resource or attribute is modelled as a Required node.
- A node with the name "Ext" is introduced in MSCLMO/MANMO/MANDMO for vendor-specific extension.

5 M2M Service Capabilities MO

5.1 MO Description

The M2M SCL MO (MSCLMO) resides in the Management Tree of the any M2M Device or M2M Gateway which supports the M2M service capabilities (e.g. DM enablers). This MO corresponds to the etsiScI MO which is an mgmtObj resource instance as specified in ETSI M2M functional architecture M2M-TS 102 690 [4]. This MO maintains information regarding the management of the M2M service capabilities in M2M Devices and M2M Gateways.

Figure 1 gives the pictorial description of the MSCLMO. The description of the various nodes within this MO is given below.

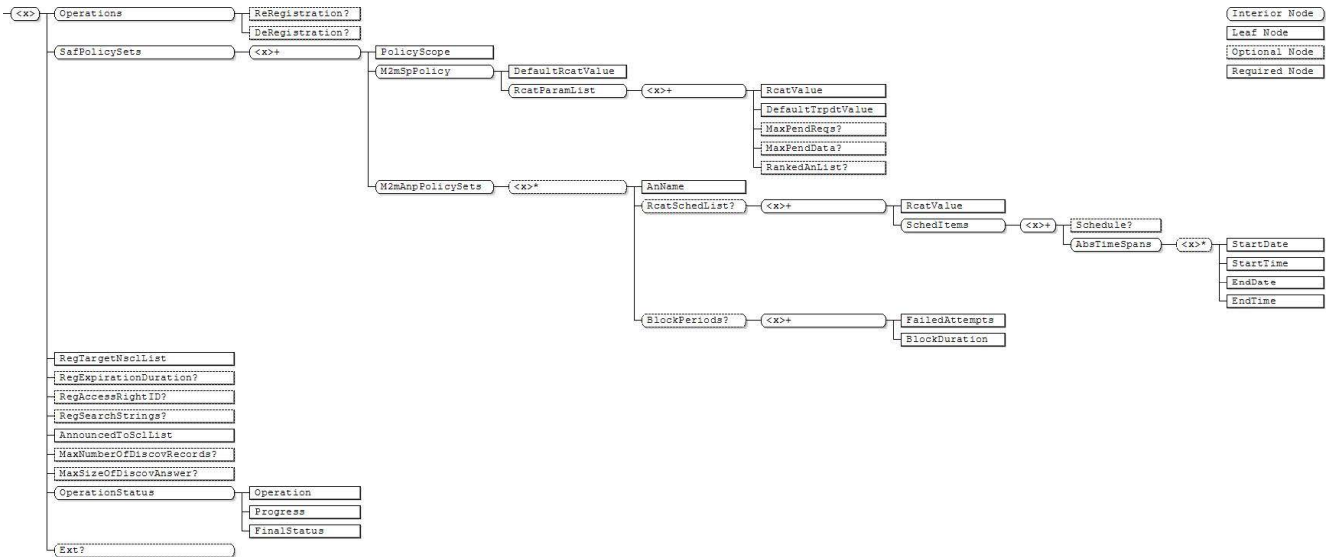


Figure 1: OMA-DM Compatible SCL MO (MSCLMO)

In what follows the term "time zero" is used to refer to the time of first instantiation of the management object.

<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This placeholder node is the root node for the MSCLMO. The parent node of this node defines the location of this MO in the Management Tree.

The Management Object Identifier for the MSCLMO shall be: "urn:oma:mo:ext-etsi-msclmo:1.0".

<x>/Operations

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the root node for operations allowed to operate on the MSCLMO.

<x>/Operations/ReRegistration

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	null	Get, Exec

This leaf node is used to trigger a re-registration action.

<x>/Operations/DeRegistration

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	null	Get, Exec

This leaf node is used to trigger a de-registration action.

<x>/SafPolicySets

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the parent node for all policies related to store-and-forward (SAF).

<x>/SafPolicySets/<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	OneOrMore	node	Get

This interior node is the parent node for a specific store-and-forward (SAF) policy set. At time zero one node of this type is present which contains the default policies. The value for the "PolicyScope" leaf node (see next paragraph) has to be set to "default". More nodes of this type are possible to define policies that are specific to a given request issuer (DA or GA).

<x>/SafPolicySets/<x>/PolicyScope

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for the scope of an SAF policy set <x>. The value of this leaf node defines the scope of the policies contained in the parent node <x> for a specific SAF policy set.

In case of the default SAF policy set which shall exist at time zero, the value of the PolicyScope leaf node shall be the string "default".

For other SAF policy sets, the value of the PolicyScope leaf node can be set to a list of Application IDs, in which case the policies contained in the respective parent SAF policy set node are applicable to requests coming from any of the listed applications.

<x>/SafPolicySets/<x>/M2mSpPolicy

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the parent node for all information related to an SAF policy set controlled by the M2M service provider.

<x>/SafPolicySets/<x>/M2mSpPolicy/DefaultRcatValue

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node is the default value for a request category (Rcat) to be used for requests to remotely hosted resources during SAF-handling when no RCAT value was specified in the request. In case of the default SAF policy set, this leaf node shall be set to the value "RCAT_0" at time zero.

<x>/SafPolicySets/<x>/M2mSpPolicy/RcatParamList

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node stands for a list of interior nodes that contain definitions of parameters to be used in SAF handling for requests of a given RCAT value.

<x>/SafPolicySets/<x>/M2mSpPolicy/RcatParamList/<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	OneOrMore	node	Get

This interior node stands for a set of parameters that are associated with a given RCAT value.

The different leaves of this interior node consist of one RCAT value and associated values for default TRPDT value, the maximum number of pending requests, the maximum size of buffered data, and a ranked list of access network names. See details below. At most one interior node <x>/SafPolicySets/<x>/M2mSpPolicy/RcatParameters/<x> can exist that contains a leaf node <x>/SafPolicySets/<x>/M2mSpPolicy/RcatParameters/<x>/RcatValue with a given RCAT value. At time zero exactly one <x>/SafPolicySets/<x>/M2MSpPolicy rcatParameters/<x> shall exist for each of the possible RCAT values (i.e. one for each on "RCAT_0", "RCAT_1", up to "RCAT_N"; N = 8 in the present document).

<x>/SafPolicySets/<x>/M2mSpPolicy/RcatParamList/<x>/RcatValue

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node contains the RCAT value with which to associate a set of SAF handling parameters. The RCAT value is a string for expressing the Request Category to which the other SAF parameters under the same interior node apply. At most one interior node <x>/SafPolicySets/<x>/M2mSpPolicy/RcatParameters/<x> can exist that contains a leaf node <x>/SafPolicySets/<x>/M2mSpPolicy/RcatParameters/<x>/RcatValue with a given RCAT value. In case of the default SAF policy set, the leaf nodes of the N (= number of possible RCAT values) interior nodes <x>/SafPolicySets/<x>/M2mSpPolicy/RcatParameters/<x> that exists at time zero shall be set to different value "RCAT_0", "RCAT_1", up to "RCAT_N", so that each possible RCAT value is represented exactly once.

<x>/SafPolicySets/<x>/M2mSpPolicy/ RcatParamList /<x>/DefaultTrpdtValue

Status	Tree Occurrence	Format	Min. Access Types
Required	One	int	Get

This leaf node represents the default duration in seconds that is tolerable for pending of an issued request of the associated RCAT value when no specific tolerable delay was specified with the request. In case of the default SAF policy set, all N leaf nodes

<x>/SafPolicySets/<x>/M2mSpPolicy/RcatParameters/<x>/DefaultTrpdtValue that exist at time zero shall be set to the value "315360000" (representing 10 years) or larger.

<x>/SafPolicySets/<x>/M2mSpPolicy/ RcatParamList /<x>/MaxPendReqs

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	int	Get

This leaf node represents a threshold for triggering establishment of connectivity by D/GSCL defining the maximum number of pending requests in SAF-handling with a request category equal to the associated RCAT value. According to the description in M2M-TS 102 690 [4], the D/GSCL shall be allowed to trigger establishment of connectivity when more requests have been stored than the configured maximum number of pending requests for a given RCAT value. In case of the default SAF policy set, no leaf node of this type shall exist at time zero.

<x>/SafPolicySets/<x>/M2mSpPolicy/ RcatParamList /<x>/MaxPendData

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	chr	Get

This leaf node represents a threshold for triggering establishment of connectivity by D/GSCL defining the maximum amount of data used by pending requests in SAF-handling with a request category equal to the associated RCAT value. According to the description in M2M-TS 102 690 [4], the D/GSCL shall be allowed to trigger establishment of connectivity when more data has been used to buffer requests of a given RCAT value than the configured limit for the maximum amount of pending data. This leaf node's format is a token comprising of an integer with an appended memory unit (B - Bytes, K - 1 024 Bytes, M - 1 048 576 Bytes, G - 1 073 741 824 Bytes) to be associated with the given RCAT value.

In case of the default SAF policy set, no leaf node of this type shall exist at time zero.

<x>/SafPolicySets/<x>/M2mSpPolicy/ RcatParamList /<x>/RankedAnList

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	chr	Get

This leaf node represents a ranked list of preferred access networks tokens to be associated with the given RCAT value. All tokens in this list are comma separated and each token identifies a specific access network. The list governs selection of a preferred access network for processing requests of the associated RCAT value that are pending in SAF-handling. The ranked list consists of items containing access network names in line with the "anName" attributes of <anpPolicy> resources in descending order of preference for the given RCAT value.

In case of the default SAF policy set, no leaf node of this type shall exist at time zero.

<x>/SafPolicySets/<x>/M2mAnpPolicySets

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the parent node for all information related to SAF-handling policies which are controlled by the access network provider.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrMore	node	Get

This interior node is the parent node for all information related to a specific set of SAF-handling policies which is controlled by the associated access network provider. In case <x>/SafPolicySets/<x> represents the default SAF policy set, no interior node of this type shall exist at time zero.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/AnName

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for an access network name that is used by the managed D/GSCL to determine for which access network the policies defined in this <x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/ interior node shall apply. When trying to setup connectivity, the D/GSCL needs to be able to use that name internally to establish connectivity via the associated access network.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	node	Get

This interior node stands for a list of RCAT schedule policy items for defining when it is appropriate to use the access network associated with "AnName" for processing requests of specific RCAT values. Each item contains one RCAT values and a list of allowed time-spans, where the time spans can be defined by a combination of AbsTimeSpans and Schedule time spans. Details of the format for RCAT schedule policy items are specified in M2M-TS 102 921 [5].

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	OneOrMore	node	Get

This interior node is the parent node for all information about an association between a number of allowed time spans and an associated RCAT value. At most one interior node <x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x> can exist that contains a leaf node <x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/RcatValue with a given RCAT value.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/RcatValue

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node contains the RCAT value with which to associate a set of allowed time spans. The RCAT value is a string for expressing the Request Category to which the time span parameters under the same interior node apply. At most one interior node <x>/SafPolicySets/<x>/M2mSpPolicy/RcatParameters/<x> can exist that contains a leaf node <x>/SafPolicySets/<x>/M2mSpPolicy/RcatParameters/<x>/ RcatValue with a given RCAT value.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the parent node for a set of interior nodes that contain schedule items that define allowed time spans for the associated RCAT value. Each node under SchedItems defines allowed time spans for the associated RCAT value that result from the combination of absolute time spans defined under the AbsTimeSpans node along with reoccurring time spans defined in the Schedules node.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems/<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	OneOrMore	node	Get

This interior node contains one schedule item that defines allowed time spans for the associated RCAT value. Under this parent node, at least one of following nodes:

- leaf node "Schedules" as defined below; or
- interior node "AbsTimeSpans/<x>",

needs to be populated with information on allowed time spans.

The Schedules node defines a recurrence of allowed time spans (see below) and the interior node AbsTimeSpans contains definitions of absolute time spans (see below), that, if present, place constraints on the schedule recurrence. If no Schedules node is present and at least one absolute time span is defined in the AbsTimeSpans node, the sum of all time spans defined by AbsTimeSpans shall be applied for that instance of SchedItems/<x>. If no absolute time span is defined under AbsTimeSpans, the reoccurring time spans in Schedules are not constraint. All definitions of absolute time spans under the AbsTimeSpans node shall use the same time zone. If AbsTimeSpans does not contain any entries or does not define a specific time zone, UTC shall be assumed for all time spans defined in that instance of SchedItems/<x>. The sum of all time spans defined by all nodes under SchedItems defines the times when it is appropriate to use the access network for processing requests with a request category equal to the associated RCAT value.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems/<x>/Schedule

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	chr	Get

This leaf node is the comma-separated list of a set of schedule strings. A schedule string is a string formatted according to the CRONTAB input file definition in (ISO/IEC/IEEE 9945:2009 [7]). The schedule that is defined by the Schedule string is the sum of all absolute time spans (in one minute granularity) that match with the given CRONTAB string. Example of CRONTAB string: "*" 0-6 * * 1-6" would mean the period from 0:00 h to 6:00 h (inclusive) on any week day (Monday through Friday) "*" 22-23,0-4 * * 1-6" would mean the period from 22:00 h to 04:00 h on any week day (Monday through Friday). The reoccurring time spans are the sum of all time spans defined by the list of schedule strings. The reoccurring time spans defined in this leaf node are constraint by any absolute time spans defined in

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems/<x>/AbsTimeSpans/<x>, if present.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems/<x>/AbsTimeSpans

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node stands for a list of allowed absolute time spans to be associated with the given RCAT value.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems/<x>/AbsTimeSpans/<x>

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrMore	node	Get

This interior node is the parent node for all information about a single absolute time span.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems/<x>/AbsTimeSpans/<x>/StartDate

Status	Tree Occurrence	Format	Min. Access Types
Required	One	date	Get

This leaf node stands for the start date of a single absolute time span in absolute date as defined by OMA DM.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems/<x>/AbsTimeSpans/<x>/StartTime

Status	Tree Occurrence	Format	Min. Access Types
Required	One	time	Get

This leaf node stands for the start time of a single absolute time span in absolute time as defined by OMA DM.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems/<x>/AbsTimeSpans/<x>/EndDate

Status	Tree Occurrence	Format	Min. Access Types
Required	One	date	Get

This leaf node stands for the end date of a single absolute time span in absolute date as defined by OMA DM.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/RcatSchedList/<x>/SchedItems/<x>/AbsTimeSpans/<x>/EndTime

Status	Tree Occurrence	Format	Min. Access Types
Required	One	time	Get

This leaf node stands for the end time of a single absolute time span in absolute time as defined by OMA DM.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/BlockPeriods

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	node	Get

This interior node stands for a list of block period policy items for defining how long an D/GSCL shall wait before re-trying to establish connectivity via the access network associated with "AnName" after the previous attempt has failed. Each item consists of a number of consecutive failed attempts and a duration. The number of consecutive failed attempts defines how many consecutive attempts for establishing connectivity need to have failed in order to apply this block policy item and the duration defines how long the next attempt shall be blocked. The D/GSCL shall always apply the block policy item with the largest number of consecutive failed attempts that is smaller or equal to the actual number of consecutive failed attempts. Details of the format for block period policy items are specified in M2M-TS 102 921 [5].

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/BlockPeriods/<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	OneOrMore	node	Get

This interior node is the parent node for all information about a number of consecutively failed access attempts and a duration that should be used to block the next access attempt.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/BlockPeriods/<x>/FailedAttempts

Status	Tree Occurrence	Format	Min. Access Types
Required	One	int	Get

This leaf node stands for the number of consecutively failed access attempts.

<x>/SafPolicySets/<x>/M2mAnpPolicySets/<x>/BlockPeriods/<x>/BlockDuration

Status	Tree Occurrence	Format	Min. Access Types
Required	One	int	Get

This leaf node stands for the duration in seconds for which to block further access attempts.

<x>/RegTargetNsclList

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for a list of NSCLs that the D/G-SCL may use in order to perform a new registration (after reboot or not). All values are comma separated and each value stands for a specific NSCL.

<x>/RegExpirationDuration

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	int	Get

This leaf node stands for the duration of the next registration in seconds. The value shall not be set to zero. Any negative value stands for infinite duration.

<x>/RegAccessRightID

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	chr	Get

This leaf node stands for the default accessRightID to be allocated to the <scl> when the <scl> is created in the hosting NSCL during the registration procedure of the corresponding D/GSCL.

<x>/RegSearchStrings

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	chr	Get

This leaf node provides an approach to modify the criteria for discovery of D/G-SCL. It stands for a list of search strings, which are comma separated.

<x>/AnnouncedToSclList

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node is used to set default announcedTo-SCL list for D/G-SCL to announce local resources to remote SCLs (especially when the application doesn't specify the announceTo attribute when creating resources). All values are comma separated and each value stands for a specific announcedTo-SCL.

<x>/MaxNumberOfDiscovRecords

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	int	Get

This leaf node stands for the maximum number of resource URIs contained in a discovery result.

<x>/MaxSizeOfDiscovAnswer

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	int	Get

This leaf node stands for the maximum size of the discovery answer. This value is expressed in bytes and is useful for very constrained devices.

<x>/OperationStatus

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the parent node for all information about the status of the operation "ReRegistration" (including a progress indicator, a final state and a reminder of the requested action).

<x>/OperationStatus/Operation

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for the link to the operation whose status is represented by "OperationStatus".

<x>/OperationStatus/Progress

Status	Tree Occurrence	Format	Min. Access Types
Required	One	int	Get

This leaf node stands for the progress of the operation in percentage. The range shall be between 0 to 100.

<x>/OperationStatus/FinalStatus

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for the final status of the operation. The predefined values are "SUCCESS" or "FAILURE".

<x>/Ext

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	node	Get

This interior node is used for vendor-specific extensions to MSCLMO.

6 M2M Area Network MO

6.1 MO Description

The M2M Area Network MO (MANMO) resides in the Management Tree of the DM Gateway, which could function as an M2M Gateway or an M2M Device with M2M service capabilities (e.g. DM enablers) according to ETSI M2M functional architecture M2M-TS 102 690 [4]. This MO corresponds to the etsiAreaNwkInfo which is an mgmtObj resource instance as specified in M2M-TS 102 690 [4]. This MO maintains information regarding the handling of one or multiple M2M Area Networks through the DM Gateway. An M2M Area Network may be any type of local area (or short range) networks of different technologies (e.g. ZigBee™, m-Bus, WiFi).

Figure 2 gives the pictorial description of the MANMO. The description of the various nodes within this MO is given below.

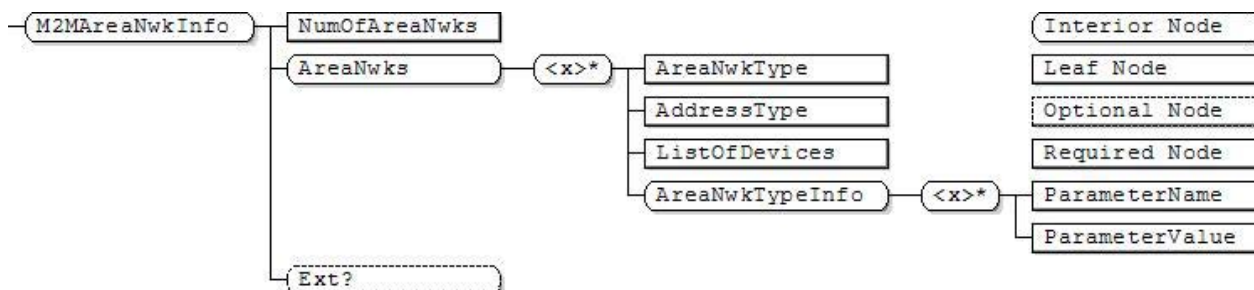


Figure 2: OMA-DM Compatible M2M Area Network MO (MANMO)

M2MAreaNwkInfo

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the root node for the MANMO. The parent node of this node defines the location of this MO in the Management Tree. This node and its child nodes contain the information for managing an M2M Area Network.

The Management Object Identifier for the MANMO shall be:

"urn:oma:mo:ext-etsi--manmo:1.0".

M2MAreaNwkInfo/NumOfAreaNwks

Status	Tree Occurrence	Format	Min. Access Types
Required	One	int	Get

This leaf node stands for the total number of M2M Area Networks behind an M2M Gateway.

M2MAreaNwkInfo/AreaNwks

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the parent node for all information about all M2M Area Networks connecting to the same M2M Gateway.

M2MAreaNwkInfo/AreaNwks/<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	ZeroOrMore	node	Get

This interior node is the parent node for information about a specific M2M Area Networks connecting to the same M2M Gateway.

M2MAreaNwkInfo/AreaNwks/<x>/AreaNwkType

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for the type of the M2M Area Network. The following enumeration-type strings are defined in M2M-TS 102 921 [5]: 6LOWPAN, 6LOWPAN-BLUETOOTH, 6LOWPAN-WIFI, 6LOWPAN-PLC, IPV4-WPAN, IPV4-BLUETOOTH, IPV4-WIFI, IPV4-PLC, ZIGBEE. Note that other types of area networks may be added in the future.

M2MAreaNwkInfo/AreaNwks/<x>/AddressType

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for the address type of the M2M Area Network.

M2MAreaNwkInfo/AreaNwks/<x>/ListOfDevices

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This interior node contains a list of pointers to all devices in this M2M Area Network. All values in this list are comma separated. Each value stands for a reference to a specific device (i.e. the root node <x> of MANDMO as defined in clause 7.1).

M2MAreaNwkInfo/AreaNwks/<x>/AreaNwkTypeInfo

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the placeholder for containing parameters specific to a type of M2M Area Networks, as denoted by the "AreaNwkType".

M2MAreaNwkInfo/AreaNwks/<x>/AreaNwkTypeInfo/<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	ZeroOrMore	node	Get

This interior node stands for a specific parameter.

M2MAreaNwkInfo/AreaNwks/<x>/AreaNwkTypeInfo/<x>/ParameterName

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for the name of the parameter.

M2MAreaNwkInfo/AreaNwks/<x>/AreaNwkTypeInfo/<x>/ParameterValue

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for the value of the parameter.

M2MAreaNwkInfo/Ext

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	node	Get

This interior node is used for vendor-specific extensions to MANMO.

7 M2M Area Network Device MO

7.1 MO Description

The M2M Area Network Device MO (MANDMO) resides in the Management Tree of the DM Gateway, which could function as an M2M Gateway or an M2M Device with M2M service capabilities (e.g. DM enablers) according to ETSI M2M functional architecture M2M-TS 102 690 [4]. This MO corresponds to the etsiAreaNwkDeviceInfo which is an mgmtObj resource instance as specified in M2M-TS 102 690 [4]. This MO maintains information regarding the handling of an M2M Area Network device through the DM Gateway. An M2M Area Network device may be a legacy device or a constrained device without M2M service capabilities. Each MANDMO maintains the device information pertaining to one or multiple M2M Area Networks that a device is associated with, including both the device characteristics and its neighbouring relationship.

Figure 3 gives the pictorial description of the Device Inventory MO. The description of the various nodes within this MO is given below.

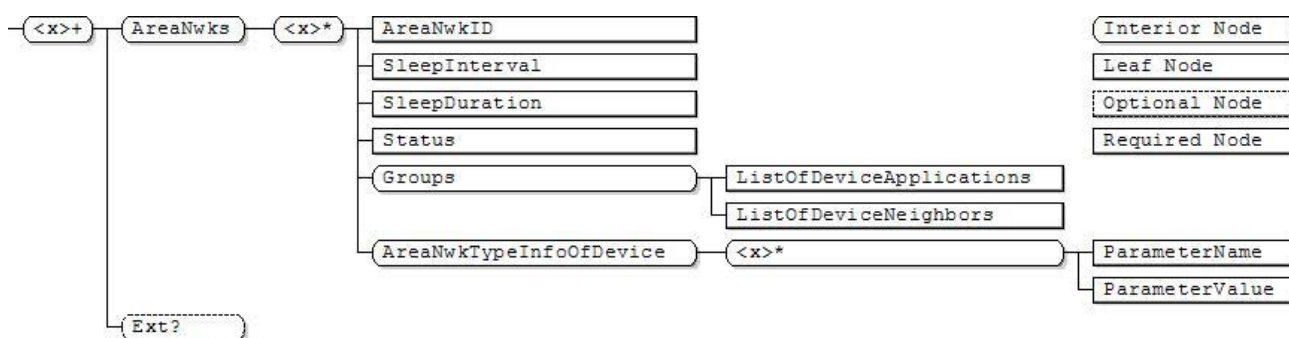


Figure 3: OMA-DM Compatible M2M Area Network Device MO (MANDMO)

<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	OneOrMore	node	Get

This interior node is the root node for the MANDMO. The parent node of this node defines the location of this MO in the Management Tree. This node and its child nodes contain the information for managing an M2M Area Network device, which is associated with one or multiple M2M Area Networks. Each device behind M2M GW should have a corresponding MANDMO. The Management Object Identifier for the MANDMO shall be: "urn:oma:mo:ext-etsi-mandmo:1.0".

<x>/AreaNwks

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the parent node for all information related to all M2M Area Network that the device is associated with.

<x>/AreaNwks/<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	ZeroOrMore	node	Get

This interior node contains information related to a specific M2M Area Network that the device is associated with.

<x>/AreaNwks/<x>/AreaNwkID

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for the M2M Area Network ID that the device <x> belongs to.

<x>/AreaNwks/<x>/SleepInterval

Status	Tree Occurrence	Format	Min. Access Types
Required	One	int	Get

This leaf node stands for the sleep interval of the device <x> in seconds.

<x>/AreaNwks/<x>/SleepDuration

Status	Tree Occurrence	Format	Min. Access Types
Required	One	int	Get

This leaf node stands for the sleep duration of the device <x> in seconds.

<x>/AreaNwks/<x>/Status

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for the status of the device <x>. It can be ASLEEP or AWAKE.

<x>/AreaNwks/<x>/Groups

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is used to contain two lists: a list of applications on the device <x> and a list of neighbours of the device <x>.

<x>/AreaNwks/<x>/Groups/ListOfDeviceApplications

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for a list of applications running on the device <x>. All values are comma separated and each value stands for a reference to a specific application running on the device <x>.

<x>/AreaNwks/<x>/Groups/ListOfDeviceNeighbors

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node stands for a list of neighbours of the device <x>. All values are comma separated and each value stands for a reference to a specific neighbour device.

<x>/AreaNwks/<x>/AreaNwkTypeInfoOfDevice

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node is the placeholder for containing parameters of the device <x> specific to a type of M2M Area Network.

<x>/AreaNwks/<x>/AreaNwkTypeInfoOfDevice/<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	ZeroOrMore	node	Get

This interior node contains a specific parameter.

<x>/AreaNwks/<x>/AreaNwkTypeInfoOfDevice/<x>/ParameterName

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node contains the name of a specific parameter.

<x>/AreaNwks/<x>/AreaNwkTypeInfoOfDevice/<x>/ParameterValue

Status	Tree Occurrence	Format	Min. Access Types
Required	One	chr	Get

This leaf node contains the value of a specific parameter.

<x>/Ext

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	node	Get

This interior node is used for vendor-specific extensions to MANDMO.

Annex A (informative): Bibliography

OMA-TS-GwMO-V1-0: "Gateway Management Object Technical Specification", Version 1.0, Open Mobile Alliance™.

NOTE: Available at URL: <http://www.openmobilealliance.org/>

ISO 8601:2000: "Data elements and interchange formats -- Information interchange -- Representation of dates and times".

NOTE: Available at URL: http://member.openmobilealliance.org/ftp/Public_documents/DM/DM-GWMO/Permanent_documents/OMA-TS-GwMO-V1_0-20120306-C.zip

ISO 8601:2004: "Data elements and interchange formats -- Information interchange -- Representation of dates and times".

NOTE: Available at <http://www.iso.ch/>.

History

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