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oneM2M – LwM2M interworking

Recommendation ITU-T Y.4500.14



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Recommendation ITU-T Y.4500.14

oneM2M – LwM2M interworking

Summary

Recommendation ITU-T Y.4500.14 specifies the interworking capabilities of the machine to machine (M2M) service layer between application service node/infrastructure node/middle node (ASN/IN/MN) common services entities (CSEs) and lightweight machine to machine (LWM2M) endpoints.

History

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NOTE – This Recommendation departs slightly from the usual editorial style of ITU-T Recommendations to preserve existing cross-referencing from external documents.

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Recommendation ITU-T Y.4500.14

oneM2M – LwM2M interworking

1 Scope

This Recommendation specifies the interworking capabilities of the machine to machine (M2M) service layer between application service node/infrastructure node/middle node (ASN/IN/MN) common services entities (CSEs) and lightweight machine to machine (LWM2M) endpoints using the architecture identified in Annex VI of oneM2M TS-0001 [ITU-T Y.4500.1] for the following interworking scenarios:

- Interworking for transparent transport of encoded LWM2M objects and commands in content sharing resources between LWM2M endpoints and M2M applications.
- Interworking with full mapping of LWM2M objects in LWM2M endpoints to semantically enabled content sharing resources that are utilized by M2M applications.

NOTE – The present Recommendation limits content sharing resources to <container> and <contentInstance> resources.

The Recommendation contains oneM2M Release 2 specification oneM2M LWM2M Interworking V2.0.0 and is equivalent to standards of oneM2M partners including ARIB, ATIS [b-ATIS.oneM2M.TS0014], CCSA [b-CCSA M2M-TS-0014], ETSI [b-ETSI TS 118 114], TTA, TSDSI [b-TSDSI STD T1.oneM2M TS-0014], TTA [b-TTAT.MM-TS.0014] and TTC [b-TTC TS-M2M-0014].

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- | | |
|-------------------|--|
| [ITU-T Y.4500.1] | Recommendation ITU-T Y.4500.1 (2018), <i>one M2M - Functional architecture</i> . |
| [ITU-T Y.4500.11] | Recommendation ITU-T Y.4500.11 (2018), <i>one M2M - Common terminology</i> . |
| [ETSI TS 118 103] | ETSI TS 118 103 (2016), <i>one M2M; Security solutions (oneM2M TS-0003 version 2.4.1 Release 2)</i> . |
| [OMA TS LwM2M] | OMA-TS-LightweightM2M-V1-0-20150318-D, <i>Lightweight Machine to Machine Technical Specification, March 2015, Open Mobile Alliance</i> . |

3 Definitions

For the purposes of the present Recommendation, the terms and definitions given in oneM2M TS-0011 [ITU-T Y.4500.11] and oneM2M TS-0001 [ITU-T Y.4500.1] apply.

3.1 Terms defined elsewhere

This Recommendation uses the following term(s) defined elsewhere:

3.1.1 application entity [ITU-T Y.4500.11]: Represents an instantiation of application logic for end-to-end M2M solutions.

3.1.2 common services entity (CSE) [ITU-T Y.4500.11]: Represents an instantiation of a set of common service functions of the M2M environments. Such service functions are exposed to other entities through reference points.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

For the purposes of the present Recommendation, the abbreviations given in oneM2M TS-0011 [ITU-T Y.4500.11] and the following apply:

AE	Application Entity
ASN	Application Service Node
CoAP	Constrained Application Protocol
CSE	Common Services Entity
DTLS	Datagram, Transport Layer Security
IPE	Interworking Proxy application Entity
IN	Infrastructure Node
JSON	JavaScript Object Notation
LWM2M	Lightweight Machine to Machine
M2M	Machine to Machine
MCU	Multipoint Control Unit
MN	Middle Node
OMA	Open Mobile Alliance
RAM	Random Access Memory
SMS	Short Message Service
UDP	User Datagram Protocol

5 Conventions

The keywords "shall", "shall not", "should", "should not", "may", "need not" in the present Recommendation are to be interpreted as described:

Shall/Shall not:

Requirements

- 1) Effect on Standard: Standard needs to describe the required feature (i.e., specify a technical solution for the Requirement);
- 2) Effect on products: every implementation (M2M Solution that complies to this Standard) must support it;
- 3) Effect on deployments: every deployment (M2M Service based on this Standard) must use the Standardized feature where applicable – otherwise e.g., interoperability problems with other services could arise.

Should/Should not:

Recommendation

- 1) Effect on Standard: Standard needs to describe a solution that allows the presence and the absence of the feature;
- 2) Effect on products: an implementation may or may not support it, however support is recommended;
- 3) Effect on deployments: a deployment may or may not use it, however usage is recommended.

May/Need not:

Permission/Option

- 1) Effect on Standard: Standard needs to describe a solution that allows the presence and the absence of the required feature;
- 2) Effect on products: an implementation may or may not support it;
- 3) Effect on deployments: A deployment may or may not use it.

6 Architecture model

6.1 Introduction

The architecture model followed in the present Recommendation is based on the architecture model in Annex VI of oneM2M TS-0001 [ITU-T Y.4500.1] that describes how interworking between CSEs and non-oneM2M solutions and protocol using specialized interworking proxy application entities (IPEs). The present Recommendation describes the LWM2M IPE that supports the interworking scenarios depicted in Figure 6.1-1.

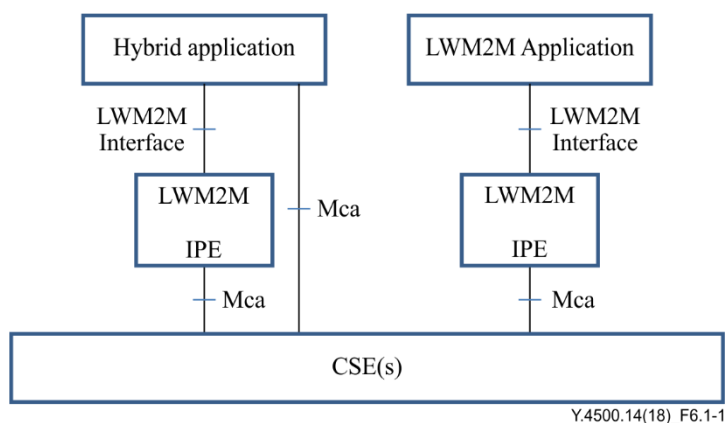
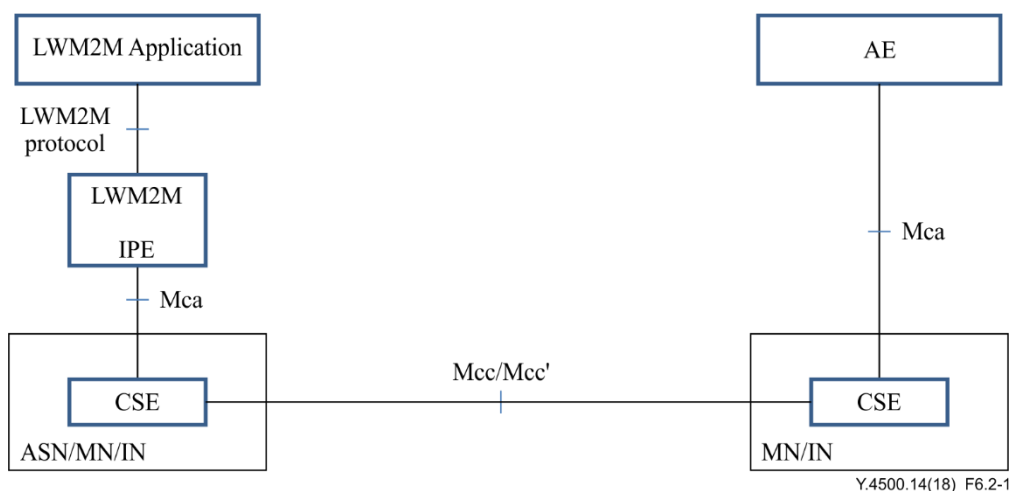


Figure 6.1-1 – LWM2M interworking scenarios

In the scenarios depicted in Figure 6.1-1, the hybrid and LWM2M applications represent applications that implement the LWM2M client role defined in the LWM2M protocol [OMA TS LwM2M].

6.2 Reference model

The LWM2M interworking reference model, shown in Figure 6.2-1, utilizes the functional architecture's reference model in oneM2M TS-0001 [ITU-T Y.4500.1]; augmenting the oneM2M TS-0001 [ITU-T Y.4500.1] reference model with capabilities provided by the LWM2M IPE.



NOTE – The application entity (AE) in the reference model could be registered with the same CSE as the LWM2M IPE.

Figure 6.2-1 – LWM2M reference model

6.3 Types of interworking

LWM2M IPEs provide the following types of interworking:

- 1) Interworking using the content sharing resource for transparent transport of encoded LWM2M objects that are available to application entities (AEs) as depicted in Figure 6.3-1.
- 2) Interworking with full mapping of the semantics of LWM2M objects to semantically enabled resources that are available to AEs as depicted in Figure 6.3-2.
- 3) While depicted outside the hosting CSE, the content sharing resources are hosted in a CSE (e.g., CSE1).

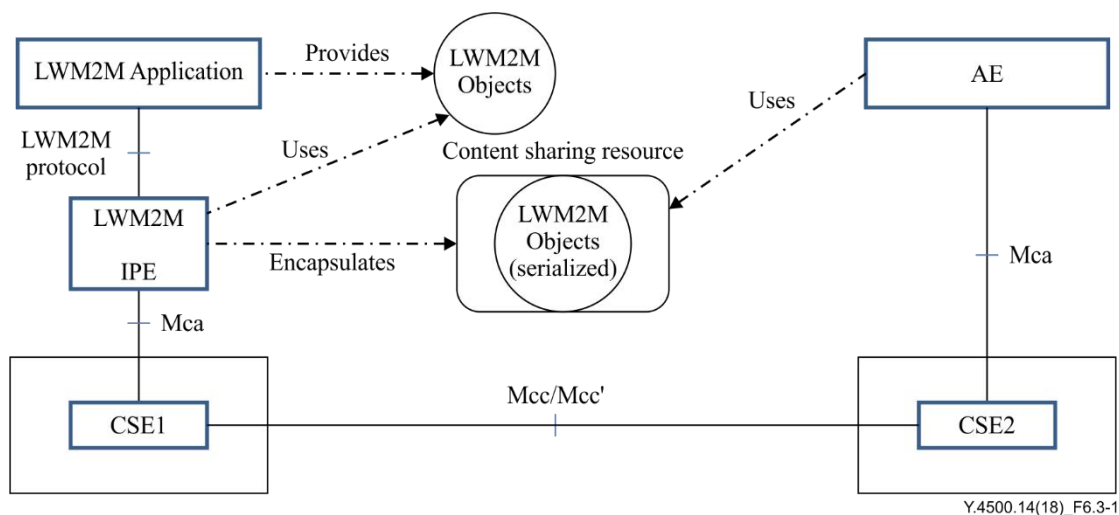


Figure 6.3-1 – LWM2M transparent interworking function

In Figure 6.3-1, the LWM2M objects are provided by the LWM2M application to the LWM2M IPE using the LWM2M protocol. The LWM2M IPE then encapsulates the LWM2M objects in content sharing resources and then hosts the content sharing resources in a CSE using the Mca reference points for use by AEs. The AE accesses the content sharing resource from the CSE that hosts the resource using the Mca reference point. Once the AE receives the content sharing resource, the AE extracts the LWM2M object from the content sharing resource for the AE's purpose. Clause 7 describes this type of interworking in greater detail.

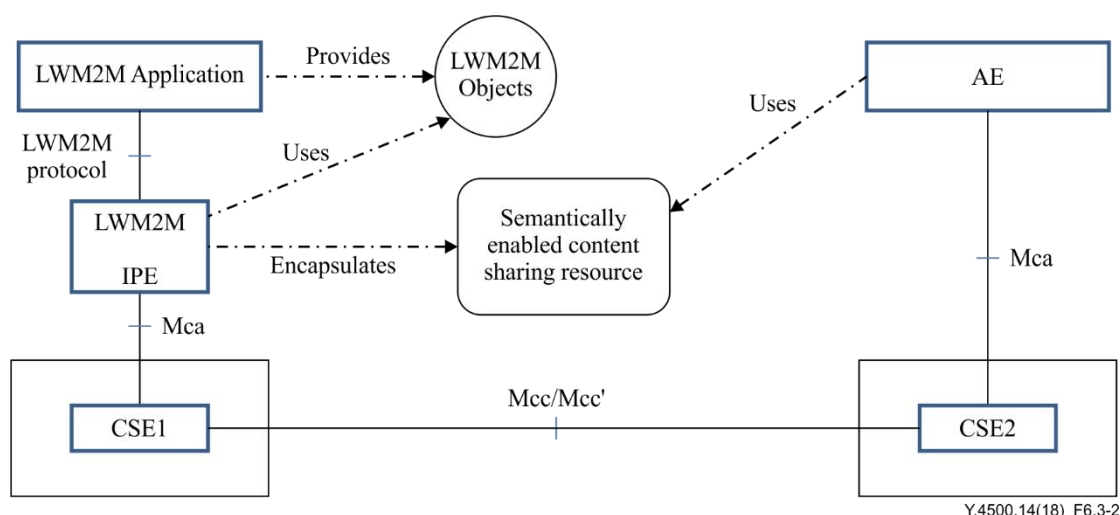


Figure 6.3-2 – LWM2M semantically enabled interworking function

In Figure 6.3-2, the LWM2M objects are provided by the LWM2M Application to the LWM2M IPE using the LWM2M Protocol. The LWM2M IPE then interworks the LWM2M objects into content sharing resources. The content sharing resources are based on the oneM2M defined Semantic Ontology. The LWM2M IPE hosts the content sharing resource in a CSE across the Mca reference for use by other AEs. The AE accesses the content sharing resource from the CSE that hosts the resource using the Mca reference point. Once the AE receives the content sharing resource, the AE encodes the information using the Semantic Ontology for the AE's purpose. Clause 9 describes this type of interworking in greater detail.

An instance of a LWM2M IPE shall provide the capability for transparent transport of encapsulated LWM2M objects as content sharing resources and/or translation of LWM2M objects as oneM2M semantically enabled content sharing resources.

6.4 Composition of the interworking proxy entity

The LWM2M IPE participation in the LWM2M protocol as described in clause 5 does so in the role of a LWM2M server to which LWM2M applications (LWM2M clients) interact. For each LWM2M client (endpoint) that is maintained by the LWM2M server in the LWM2M IPE, the LWM2M IPE shall instantiate and maintains an instance of a resource of type <AE>. Figure 6.4-1 shows LWM2M IPE architecture.

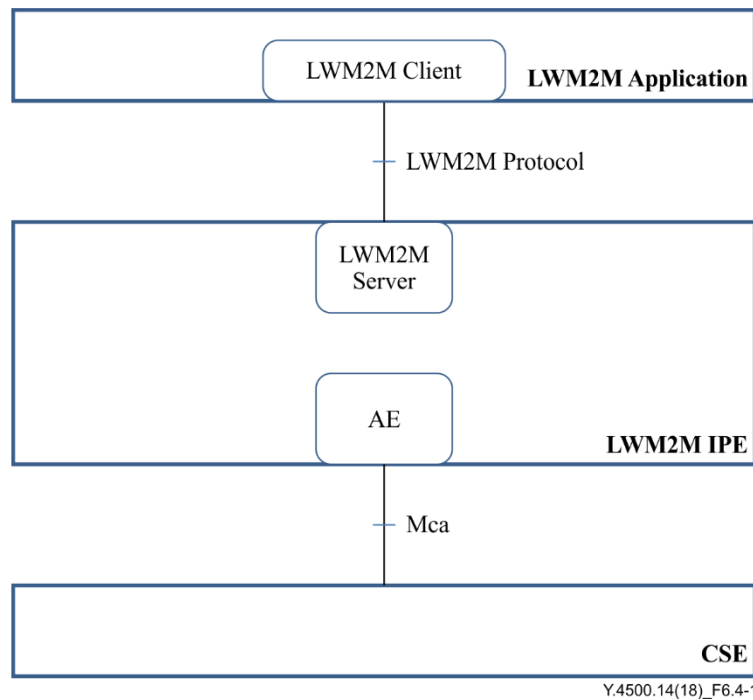


Figure 6.4-1 – LWM2M IPE architecture

7 Architecture aspects

7.1 Introduction

The LWM2M IPE participation in the LWM2M protocol as described in clause 5 does so in the role of a LWM2M server with which LWM2M applications (LWM2M clients) interact. As a LWM2M server, the IPE provides the following architecture aspects based on the LWM2M protocol aspects described in clause I.2:

- LWM2M device and endpoint lifecycle (client registration).
- LWM2M object discovery (client registration, device management and service enablement).
- LWM2M object transport and interworking (device management and service enablement).
- LWM2M object subscription and notification (information reporting).
- LWM2M interworking proxy entity administration.
- LWM2M client provisioning (bootstrap).
- LWM2M object security (device management and service enablement).

7.2 LWM2M device and endpoint lifecycle

7.2.1 Introduction

As the LWM2M IPE discovers LWM2M endpoints when the LWM2M IPE interacts with the LWM2M client over the LWM2M protocol's bootstrap and client registration interfaces, the LWM2M IPE shall maintain the associated resources in the CSE that represents the LWM2M device and endpoint.

7.2.2 LWM2M device and endpoint resource representation

7.2.2.1 Introduction

LWM2M endpoint provides the management and control functions for an M2M application on a device. As such, the CSE that hosts the M2M application shall represent the LWM2M endpoint as a

<AE> resource (LWM2M endpoint <AE> resource). The LWM2M Device that hosts the LWM2M endpoint shall be represented as a <node> resource.

7.2.2.2 LWM2M device and endpoint resource identification

LWM2M endpoints are identified by their endpoint client name described in clause 7.2.1 of the LWM2M Technical Specification [OMA TS LwM2M]. The endpoint client name URN without the "urn:" sequence is used as the AE-ID of the associated <AE> resource that represents the LWM2M client.

In most deployment scenarios, LWM2M devices host one (1) LWM2M endpoint. In this scenario the LWM2M device's <node> resource's M2M-Node-ID should be the same as the LWM2M endpoint client name URN without the "urn:" sequence. When a LWM2M device hosts more than one (>1) LWM2M endpoint, the determination of the <node> resource's M2M-Node-ID is implementation specific. In all deployment scenarios, the <AE> resource is linked with the <node> resource as described in oneM2M TS-0001 [ITU-T Y.4500.1].

As the LWM2M endpoint is represented as an <AE> resource and a LWM2M object is represented as a content sharing resource in the M2M service layer, a reference shall be made between the <AE> resource that represents the LWM2M endpoint and the content sharing resources which represents the list of LWM2M objects and object instances available in that LWM2M client.

In order to identify interworked entities hosted in a CSE for the LWM2M technology described in this present Recommendation, the <AE> resource that represents the LWM2M endpoint and the content sharing resources which represent the list of LWM2M objects and object instances available in that LWM2M client, shall have a *Iwked_Technology labels* attribute set to LWM2M.

In addition the <AE> resource uses the hierarchical and non-hierarchical mechanisms for resource addressing as defined in clause 9.3.1 of oneM2M TS-0001 [ITU-T Y.4500.1] where the *resourceName* attribute of the <AE> resource shall be an endpoint client name URN without the "urn:" sequence.

7.2.2.3 LWM2M endpoint lifecycle

LWM2M endpoint's are discovered when the LWM2M client is successfully registers with the LWM2M server using the LWM2M Register operation. In addition to the LWM2M register operation, the LWM2M client can periodically refresh the LWM2M client's registration with the LWM2M IPE using the LWM2M Update operation. Finally a LWM2M client can deregister when the LWM2M client issues a de-register operation to the LWM2M IPE or the LWM2M client's registration lifetime expires.

The LWM2M client registration interface's operations and the registration lifetime expiration event maps to the following operations on the <AE> and <node> resources.