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Continuation & integration of HGI Smart Home activities
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Foreword

This Technical Report (TR) has been produced by ETSI Partnership Project oneM2M (oneM2M).

1 Scope

The present document is a study of the continuation and integration of some HGI Smart Home activities into oneM2M, following the (PT2) HGI announcement of its closure by June 2016. It includes the description of HGI SH deliverables versus the appropriate oneM2M deliverables for the integration of these HGI achievements.

It intends to be used as a liaison working document with HGI about the status progress of this continuation and integration and is expected to be useful for both HGI and oneM2M to check that all technical items from HGI SH Task Force expected to be integrated are appropriately handled by oneM2M.

2 References

2.1 Normative 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 referenced document (including any amendments) applies.

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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] oneM2M Drafting Rules.

NOTE: Available at http://www.onem2m.org/images/files/oneM2M-Drafting-Rules.pdf.

[i.2] ETSI TS 118 11 oneM2M TS-0011: "Common Terminology".

[i.3] ETSI TR 118 517: "Home Domain Abstract Information Model".

[i.4] ETSI TR 118 507: "Abstraction and Semantics Capability Enablement".

[i.5] ETSI TS 118 123: "Home Appliances Information Model and Mapping".

[i.6] ETSI TS 118 101: "Functional Architecture".

[i.7] Home Gateway Initiative HGI-RD036: "Smart Home architecture and system requirements".

NOTE: Available at http://www.homegatewayinitiative.org/userfiles/file/downloads/RD036Publication.pdf.

[i.8] Smart (Home) Device Template (SDT).

NOTE: Available at https://github.com/Homegateway/SmartDeviceTemplate/.

[i.9] Home Gateway Initiative HGI RD039: "Requirements for Wireless Home Area Networks (WHANs) Supporting Smart Home Services".

NOTE: Available at http://www.homegatewayinitiative.org/userfiles/file/downloads/RD039-Req-for-Wireless-home-area-networks.pdf.

[i.10] Home Gateway Initiative HGI-RD048: "HG Requirements For HGI Open Platform 2.1".

NOTE: Available at http://www.homegatewayinitiative.org/userfiles/file/downloads/HGI-RD048-HG_Requirements_for_HGI_Open_Platform_2_0_published_text.pdf.

[i.11] ECHONET Consortium

NOTE: Available at https://github.com/Homegateway/ECHONET-SDT-Contribution.

[i.12] OSGi Alliance.

NOTE: Available at http://www.osgi.org.

[i.13] Eclipse Vorto Project.

NOTE: Available at http://eclipse.org/vorto.

[i.14] ETSI TS 118 104: "oneM2M; Service Layer Core Protocol Specification (oneM2M TS-0004)".

[i.15] ETSI TS 118 112: "oneM2M; Base Ontology (oneM2M TS-0012)".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI TS 118 111 [i.2] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI TS 118 111 [i.2] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 118 111 [i.2] and the following apply:

CWMP	CPE (Customer Premises Equipment) WAN (Wide Area Network) Management Protocol
DAL	Device Abstraction Layer
HGI	Home Gateway Initiative
RMS	Remote Management System
SHGW	Smart Home Gateway
SHTF	Smart Home Task Force
WHAN	Wireless Home Area Network
WI	Work Item

4 Conventions

The key words "Shall", "Shall not", "May", "Need not", "Should", "Should not" in the present document are to be interpreted as described in the oneM2M Drafting Rules [i.1].

5 Technical description of HGI Smart Home activities in a generic IoT context

5.1 General Introduction to HGI SmartHome concepts and motivation of integration to oneM2M

The HGI Smart Home Task Force global objective was to defragment the Smart Home market and propose unified concepts identified as of prime importance around the Smart Home Gateway (SHGW) in order to facilitate the adoption and the use of such a product and related services in homes.

These concepts can be categorized into three main trends:

- modularity of the SHGW middleware to allow for flexible evolution of the services offered to the user;
- abstraction of the (possibly various) underlying connectivity technologies of the devices connected to the SHGW;
- identification of reference points that need to be standardized to forster open exposure to mutualized functions at the SHGW level as enablers for local or remote services.

As similar concepts are handled by oneM2M at the Sercice Layer level for the IoT domain in general, some technical achievements from HGI SHTF can be merged into some of the oneM2M deliverables, which is a supplementary path towards more de-fragmentation of the IoT domain. The remaining subsections of this section 5 summarizes these HGI SHTF achievements to be considered.

5.2 Smart Home Architecture and requirements for Reference Points, HGI-RD036

HGI-RD036 [i.7] deliverable presents the HGI reference architecture for the Smart Home Gateway (SHGW) and identifies the reference points that are at stake to deliver the smart home services, be it locally or remotely.

Figure 5.2-1 shows this reference architecture, which is driven by the requirements of modularity and device abstraction allowed by the SHGW.

The Reference Points between the appliances (devices) and the SHGW and between the SHGW and the Cloud are designated by "RPx" on figure 5.2-1.

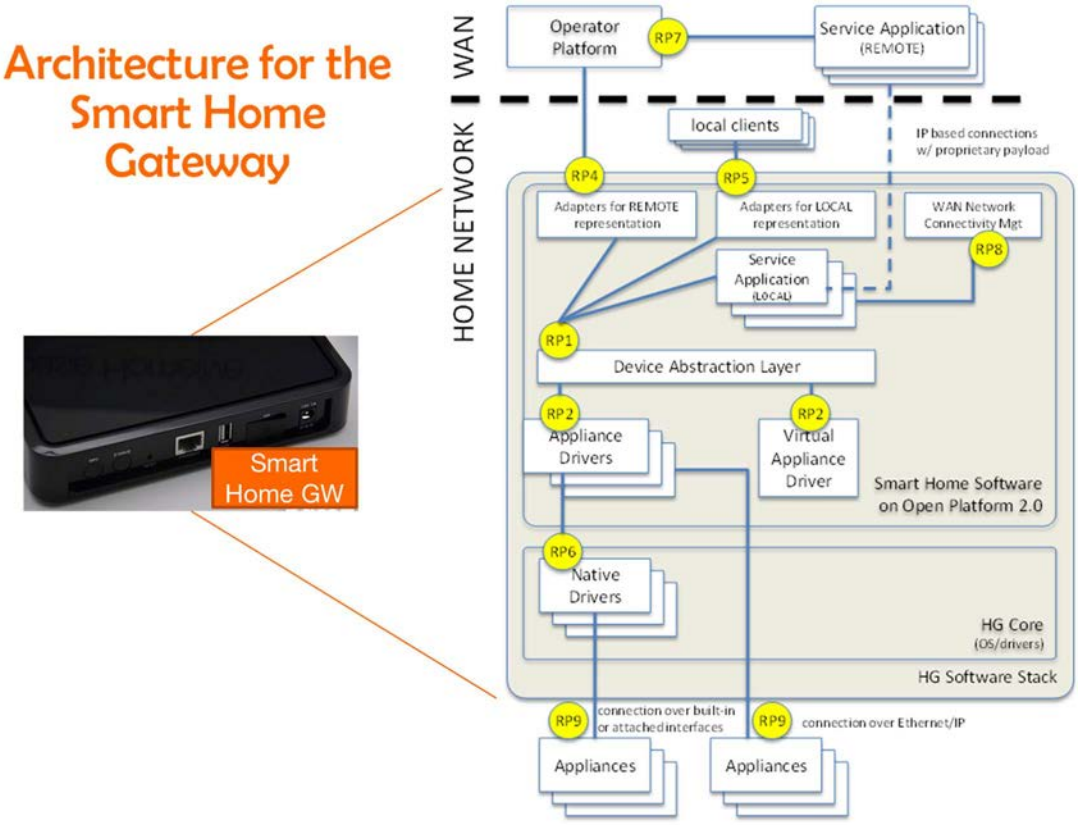

Figure 5.2-1: SHGW reference architecture and Reference Points

When comparing this architecture with the oneM2M architecture ETSI TS 118 101 [i.6], the following points can be examined:

- the SHGW as a oneM2M Middle Node;
- RP4 as an example of oneM2M Mcc reference point;
- RP7 as an example of Mca reference point; and
- RP8 as an example of Mcn reference point.

This comparison is further detailed under clause 6.

As for the Device Abstraction Layer, this is further focused on figure 5.2-2, which points out the disctinction between:

- the "south" part of the DAL where the goal is to abstract the various device-connectivity technologies; and
- the "north" part of the DAL where the goal is to decouple the applicative-specific i.e.various applicative domains, with their specific ontologies, and unify the meaning of commands from the application side.

The purpose of device abstraction is indeed to allow creators of applications on SHGWs and/or in the Cloud to discover, identify, read, configure and manipulate devices, without needing to modify the software for each and every manufacturer model or type of wireless access, etc.

Figure 5.2-2 also shows the SDT (Smart Device Template) as part of this Device Abstraction process. This SDT is explained in more details under clause 5.3.

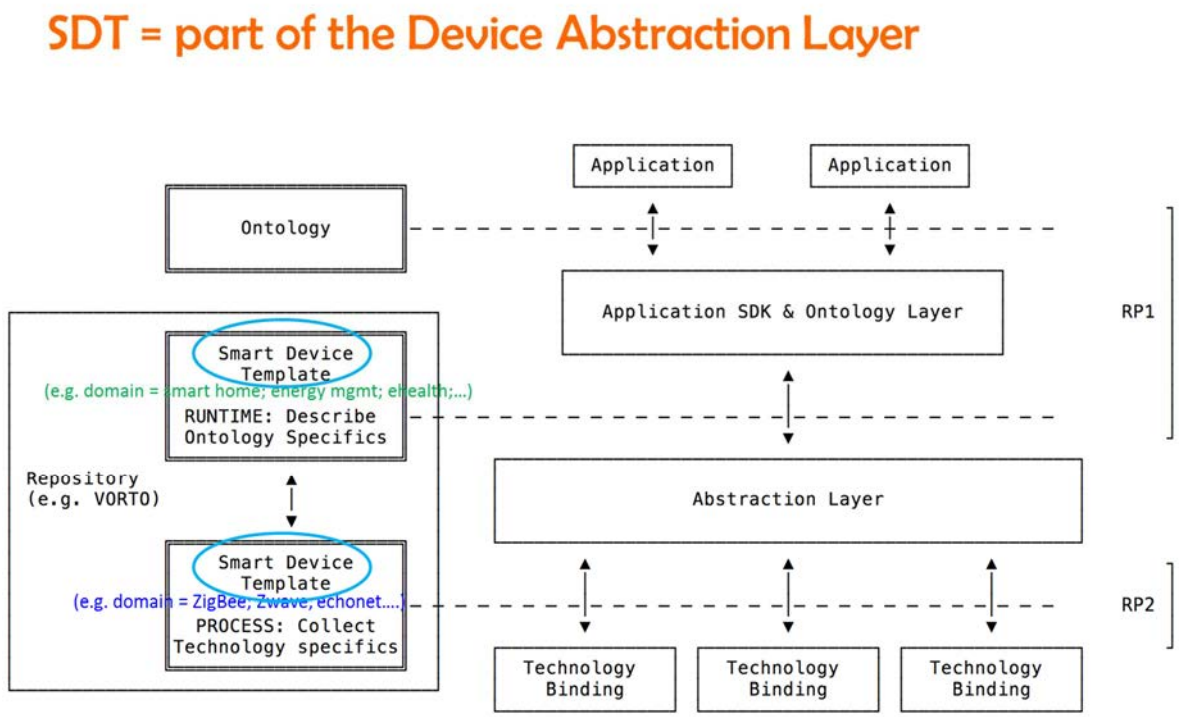

Figure 5.2-2: SDT place in the Device Abstraction process

5.3 Smart Device Template

The SDT (Smart Device Template [i.8]) is an initiative from HGI to find consensus amongst various SDOs and industry alliances to derive a common approach for device modelling. HGI and partners have the approach to agree on a set of automation commands, following a common syntax, which are sufficient to model most home appliance functions.

Every software developed for home gateways or internet-of-things gateways needs to be capable of using various different protocols (DECT ULE,EchonetLite, UpnP, ZigBee®, etc.) to interact with a range of devices designed for the home environment. This adds extreme overheads in integrating, checking and updating code. The purpose of SDT is to describe devices and device services in a way which is independent of the LAN technology, in a format which is convenient and reliable for integration in modern code (Java, C/C++, etc.).

The key goals of the SDT are:

1) keep it simple, especially for manufacturers to contribute device information;

2) modularity for functions and device types;

3) make it easy for developers to create unified APIs;

4) be independent of underlying home-area network technologies;

5) enable extendibility of the system in place without service interruption;

6) allow a pass-through mechanism to enable use of proprietary or technology-specific functions.

The SDT approach is to define re-usable basic functions (or services), labelled "ModuleClass", which can represent the typical functions found in many home automation systems, such as "on/off", "dim a lamp", "receive events from binary sensor", "read data from sensor", etc. Each ModuleClass is composed of a (small) number of actions, datapoint read/write operations, or asynchronous events. For example, an "on/off" ModuleClass would consist perhaps of just one Action, but a "ReadKeypad" Action might have a number of possible events, each with some data value and (usually) a sequence-ID or timestamp start/stop to indicate when and how long each key was pressed.

More details about SDT can now be found in ETSI TR 118 517 [i.3], clause 5.1.3.

Also the ECHONET Consortium provided the mapping of the ECHONET-LITE technology in the SDT format [i.11].

It should be noted that the HGI work on SDT is closely aligned with the work of OSGi Alliance [i.12] on Device Abstraction Layer (DAL). The OSGi Residential Specification Release 6 defines such a DAL that acts as an intermediate between technology-specifics of connected devices and embedded applications.

OSGi Alliance already specified technologies binding for various connecting technologies such as enOcean, UpnP, USB, ZB, Zwave, etc.

The next step on top of DAL within the OSGi Alliance is to specify further support for device abstraction using SDT. This is expected to be done in collaboration with oneM2M, based on ETSI TS 118 123 [i.5], through the new Work Item on technical axis of collaboration between OSGi Alliance and oneM2M.

Furthermore, SDT-related discussions happened with a part of the Eclipse Foundation, in particular the Eclipse Vorto Project [i.13]. Vorto is an open source tool that allows to create and manage technology agnostic, abstract device descriptions, so called information models. Vorto and SDT information models are closely aligned in order to be able to exchange device descriptions in an interoperable way.

5.4 Wireless Home Area Networks consideration, HGI-RD039

HGI-RD039 [i.9] provides guidance on WHAN technologies used for smart home services. This lists generic requirements expected for these technologies to enable functions such as bidirectional communication and pairing of devices with WHAN coordinators.

In particular, the following sections of this HGI deliverable may be referenced in device management related oneM2M Work Items such as the Work Item on oneM2M Abstraction and Semantics Capability Enablement and the one on M2M Application & Field Domain Component Configuration:

- clause 6.2.2 "Management, Configuration and Maintenance";
- clause 7.1 "Installation and configuration of devices";
- clause 7.3 "Management and maintenance of devices";
- clause 7.4 "Connectivity management".

5.5 Home gateway Open platform, HGI-RD048

HGI-RD048 [i.10] specifies the requirements regarding modular software deployments on home gateway with an open platform. These modular software applications must run in a dedicated virtual execution environment to enable software flexibility. In particular, software modules and module configuration data can be kept across the complete firmware updates, avoiding the overhead of maintaining different versions of firmware for several HG models. The solution of such an execution environment is defined as open platform.

The open platform 2.1 [i.10] enabled home gateway consists of several functional entities, including core functions (HG_Core), HG Execution Environment (HG_EE), HG Application Programming Interface (HG_API) and Management Agent (MA), as demonstrated in figure 5.5-1.

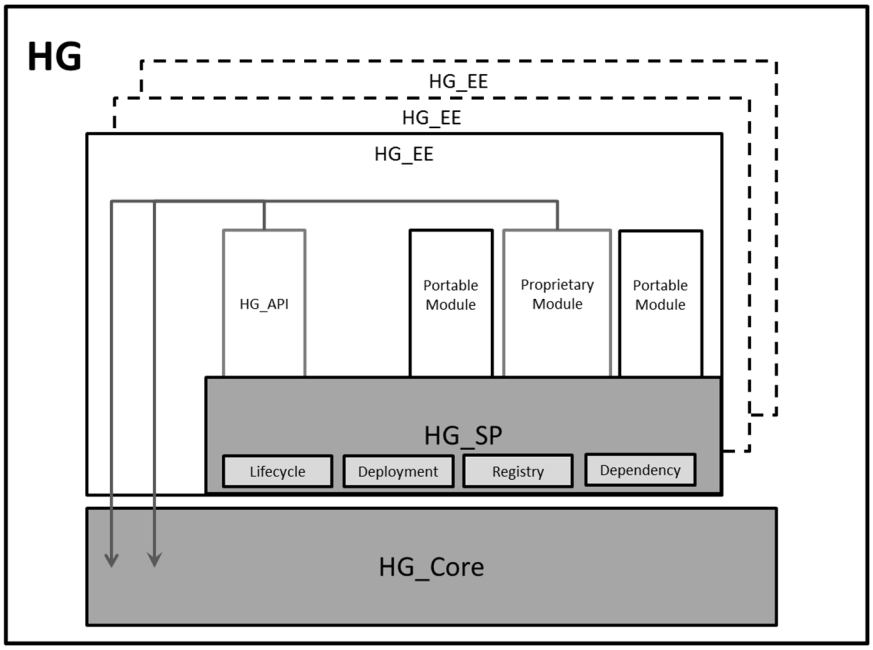

Figure 5.5-1: Home gateway architecture model

HG_Core utilize an operation system, on which HG_Core runs the HG native softwares. Running on top of the HG_Core, HG_EE includes the HG_SP providing software lifecycle management and acting as a container for flexible application software modules, which can use HG_API to access to residential gateway functions. Moreover, CWMP protocol is used by MA, a piece of software running on the HG, to handle the management commands from RMS.

In addition, besides the general requirements, HGI-RD048 [i.10] also specifies the technology-specific requirements for OSGI technology. This OSGI service platform is a Java based HG_SP with the addition of a comprehensive component model. Other technology-specific requirements could be developed in the same ways as the OSGI requirements, in conjunction with the generic requirements.

6 Integration of HGI SH items into oneM2M work items

6.1 Update of oneM2M WIs already including some HGI SH inputs

As introduced in clause 5, the main HGI Smart Home technical achievements of interest for oneM2M include:

- HGI-RD036 [i.7] deliverable, defining the Smart Home Architecture, published in Q4-2015.
- SDT3.0 Smart Device Template [i.8], which is the meta-data model defined for modelling devices.

The abstraction layer explicitely defined by these HGI deliverables can indeed be mapped to the oneM2M abstraction Common Services Entity at the Middle Node (MN-CSE), as illustrated in figure 6.1-1 derived from figure 5.2-1.

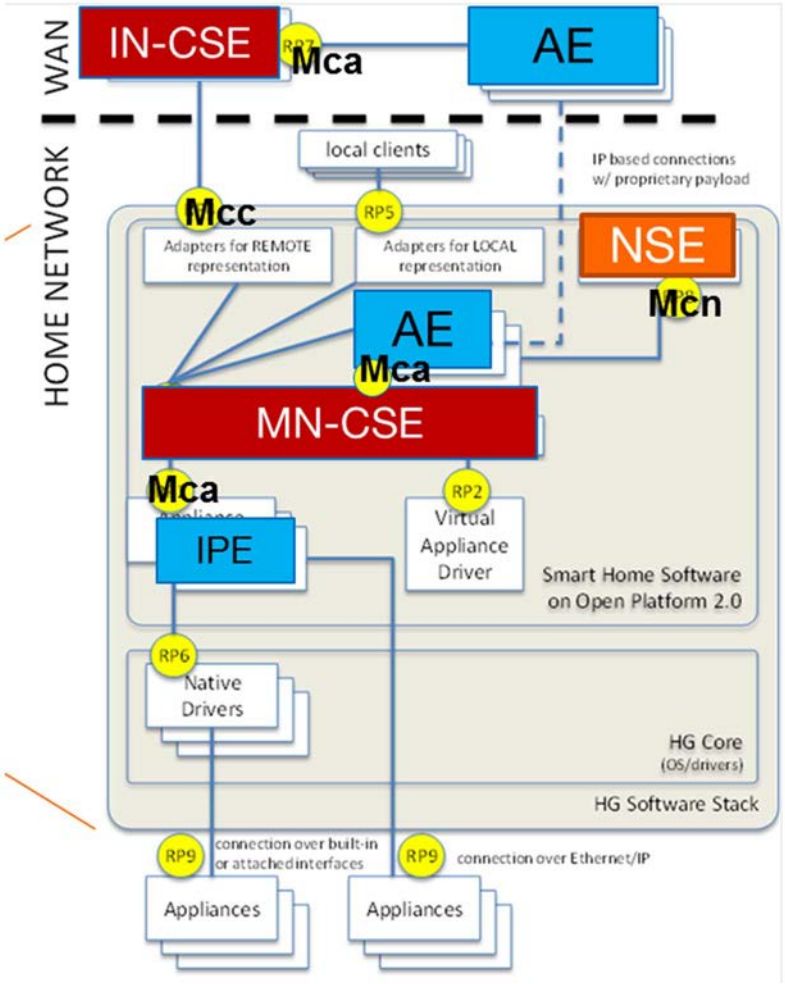

Figure 6.1-1: Mapping HGI SH architecture to oneM2M entities

The HGI Abstraction Layer concept is already mentioned in ETSI TR 118 507 [i.4] clause 6.2.2, and the updated SDT3.0 is described into details in ETSI TR 118 517 [i.3] clause 5.1.3. From the latter, the SDT3.0 appears to be particularly relevant to be the oneM2M reference for the normative Home Information Model deliverable ETSI TS 118 123 [i.5] (dealt by the same work item on Home Domain Enablement).

From figure 5.2-2, the SDT is shown as a modelling template that can be used to:

- model devices in a unified way, be they modelling-based or modelling-based; for this part the SDT can be exposed to the appliances through a oneM2M IPE (Interworking Proxy Entity) via a oneM2M Mca instantiation that should meet the HGI requirements for RP1 Device Abstraction Layer (see figure 5.2-1) as copied in table 6.2-1 (under clause 6.2);
- provide a unified template for modelling devices for any applicative domain, thus facilitating cross-domain semantic interoperability; for this part, the SDT can be seen as the converging model to which various appliances data models from the industry can be mapped to. It is indeed used as the basis for ETSI TS 118 123 [i.5].

6.2 other oneM2M WIs to be involved

The mapping of the SDT to oneM2M MN-CSE involves mapping of SDT elements into some oneM2M resource types of ETSI TS 118 101 [i.6] Release 2 (Generic Interworking) e.g. <flexContainer>, as detailed in ETSI TS 118 123 [i.5].

It is important to assure that the mapping of SDT-based Home information model allows for command and control of smart home devices; this involves taking into account stage 3 aspects, in a coherent way with ETSI TS 118 104 [i.14] Release 2. These aspects are also detailed in ETSI TS 118 123 [i.5].

6.3 Potential need for (a) new oneM2M WI(s)

In clause 5.2, the HGI RP8 was compared to oneM2M Mcn, as a possible mean to re-use relevant functions from the fixed internet connection. Yet, currently the oneM2M Mcn is defined in relation with the mobile network, i.e. for the 3GPP triggering function. There may be a need to create a new oneM2M WI to describe Mcn in relation with fixed networks; such a new WI could be worked in close relation with e.g. BBF.

Clause 5.3 mentions the OSGi work on top of DAL, which is expected to be done in collaboration with oneM2M. This has just been taken into account by creating the new oneM2M Work Item on OSGi interworking. The targeted TR is expected to handle the alignment of OSGi IoT work with ETSI TS 118 123 [i.5] (HGI SDT-based) home information model.

This new Work Item should also take into account HGI-RD048 [i.10] which contains requirements regarding modular software deployments on the home gateway and includes technology-specific requirements for OSGi technology.

HGI Requirements listed in HGI-RD036 [i.7] for Smart Home systems (see clause 5.2) and in HGI-RD039 [i.9] for Wireless Home Area Networks (see clause 5.4) are being reviewed against oneM2M specifications; if gaps are identified a new WI for CRs to ETSI TS 118 112 [i.15], and possibly other TSs may be created that would fit in oneM2M Release 3.

History

Document history		
V2.0.0	September 2016	Publication