



**Publicly Available Specification (PAS);
Smart Machine-to-Machine communications (SmartM2M)
Home Gateway Initiative RD036-Smart Home architecture and
system requirements**

CAUTION

The present document has been submitted to ETSI as a PAS produced by HGI and approved by the ETSI Technical Committee Smart Machine-to-Machine communications (SmartM2M).

HGI was owner of the copyright of the document (RD036) and/or had all relevant rights and had assigned said rights to ETSI on an "as is basis". Consequently, to the fullest extent permitted by law, ETSI disclaims all warranties whether express, implied, statutory or otherwise including but not limited to merchantability, non-infringement of any intellectual property rights of third parties. No warranty is given about the accuracy and the completeness of the content of the present document.

ReferenceDTS/smartM2M-103424

Keywords

gateway, home gateway, intelligent home & buildings

ETSI650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:
<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2016.
All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.
3GPP™ and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.
GSM® and the GSM logo are Trade Marks registered and owned by the GSM Association.

Contents

Foreword.....	4
Modal verbs terminology.....	4
1 Scope	5
2 References	5
2.1 Normative references	5
2.2 Informative references.....	5
3 Definitions, symbols and abbreviations	6
3.1 Definitions.....	6
3.2 Abbreviations	7
3.3 Relationship with other HGI Specifications	7
4 Business requirements and Use Cases.....	8
5 Architecture.....	8
6 Overview	8
6.1 High-level view of smart home architecture	9
7 HG with specific software execution environment (Open Platform 2.0).....	12
7.1 Detailed HG software stack architecture	13
7.2 Access Control and Policies	14
7.3 Appliance States	15
7.4 Grouping of Appliances	16
8 Functional requirements	17
8.1 Requirements for RP1 Device Abstraction Layer.....	17
8.2 Requirements for RP1 Access Control.....	18
8.3 Requirements for DAL.....	18
8.4 Requirements for RP2 Appliance Driver Interface.....	18
8.5 Requirements for RP4 Remote Representation.....	19
8.6 Requirements for RP5 Local representation of appliances.....	20
8.7 Requirements for RP6 Native Driver Interface	20
8.8 Requirements for RP7 Reference point in the cloud	20
8.9 Requirements for RP8 WAN Network Connectivity Interface	20
History	21

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Smart Machine-to-Machine communications (SmartM2M), as result of the PAS process for document HGI-RD036 developed by the Home Gateway Initiative.

The Home Gateway Initiative, a non-profit organization closed on June 2016, produced guidelines, requirements documents, white papers, vision papers, test plans and other documents concerning broadband equipment and services which are deployed in the home.

HGI worked on Specifications for home connectivity and Services enablement, in particular to encompass a delivery framework for Smart Home services. The defined architecture includes support for a standard, general purpose software execution environment in the HG (for third party applications), API definitions, device abstraction and interfacing with Cloud based platforms.

The HGI's methodology ensured that projects undertaken reflected items of strong interest to the Broadband Service Providers (BSPs), as well as brought in opportunities at every stage for vendor input, suggestions and participation.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

1 Scope

The rapid increase in the number of smart devices in the home, from entertainment systems to appliances and medical devices and the now near ubiquitous broadband connectivity have created a significant new potential market for service providers. However, in order to exploit this market and provide an integrated customer experience there is a central component which is still missing - a set of standards for the home gateway which will enable interoperability between smart home entities.

Defining smart home related standards for the home gateway can benefit the market in several ways:

- Avoiding duplication of hardware and software and the associated costs of having several disparate systems.
- Providing opportunities for new 'blended' services based on combining data from different HANs and appliances.
- Enabling automated, intelligent reaction to the environment - e.g. demand-side energy management.

The present document defines a smart home system architecture and derives requirements for the Home Gateway.

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.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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

Not applicable.

2.2 Informative 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.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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 TS 103 426 (11-2016): "Publicly Available Specification (PAS); Smart Machine-to-Machine communications (SmartM2M) Home Gateway Initiative RD048-HG Requirements For HGI Open Platform 2.1".
- [i.2] ETSI TS 103 425 (11-2016): "Publicly Available Specification (PAS); Smart Machine-to-Machine communications (SmartM2M) Home Gateway Initiative RD039-Requirements for Wireless Home Area Networks (WHANs) Supporting Smart Home Services".

- [i.3] HGI GD-017-R3 (August 2011): "Use Cases and Architecture for a Home Energy Management Service".
- NOTE: http://www.homegatewayinitiative.org/userfiles/file/downloads/GD-017-R3_use-cases-and-architecture-for-home-energy-Management-service.pdf.
- [i.4] HGI-GWD035: "Smart Home Use Cases".
- NOTE: www.homegateway.org
- [i.5] ISO/IEC FDIS 15067-3: "Home Electronic System (HES) application model - Part 3: Model of a demand-response energy management system for HES".
- NOTE: <http://www.iso.org>
- [i.6] HGI-RD044 Home Gateway Base Requirements: "Residential Profile 2".
- NOTE: http://www.homegatewayinitiative.org/userfiles/file/downloads/P_HGI02723R11.pdf
- [i.7] Void.
- [i.8] "OSGi Service Platform Core Specification", Release 4, Version 4.2 or later.
- NOTE: www.osgi.org
- [i.9] HGI-RWD016-R3 (April, 2013): "HG and Home Network Diagnostics Module Requirements".
- NOTE: http://www.homegatewayinitiative.org/userfiles/file/downloads/HGI-RD016_HG-Home-Network-Diag-Modul-Req.pdf.
- [i.10] "Echonet Lite".
- NOTE: https://echonet.jp/spec_v112_lite_en
- [i.11] "Zigbee™".
- NOTE: <http://www.zigbee.org/zigbee-for-developers/applicationstandards/zigbeehomeautomation/>.
- [i.12] "EnOcean".
- NOTE: http://www.enocean-alliance.org/en/enocean_standard/.
- [i.13] "DECT Ultra-Low-Energy (ULE)".
- NOTE: <http://www.ulealliance.org/specifications>.
- [i.14] Void.
- [i.15] Void.
- [i.16] IEEE 802.11™: "Wireless LANs".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in Open Platform 2.0 [i.1] and the following apply:

action: A function that can be executed by an appliance.

appliance: A domestic electrical/mechanical machine which accomplishes some function used in smart home services.

data point: A property of an appliance, which can change while the appliance is in operation.

Home Gateway (HG): Device connecting the HAN to the Internet, Operator Platform and Service Platforms.

Smart Home Functions: Hardware/software implementing smart home functionality, which is typically part of the HG but could in some cases be implemented in a separate piece of hardware.

virtual appliance: An appliance implemented purely in software.

reference point: A point of interaction between two entities, which may be subject to standardization e.g. in the form of an API or protocol.

module: A Service Module (or just module) is a downloadable, packaged collection of resources and/or code needed to provide a specific function.

Service Application: Is a set of software modules and configurations that collectively implement a specific function or set of functions, possibly across several distributed platforms.

Service Provider: Is a business entity. The Service Provider supplies the necessary means to provide the business related support of a specific Service Application.

Network Provider: Provides and manages wide area network connectivity between the Service Platform and other parties, which include the Gateway Operator and other Service Providers. In the case where the Service Platform is connected via the Internet, the Network Provider also supplies the Internet Service Provider (ISP) functionality.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AAL Ambient Assisted Living

NOTE: Home automation to assist aged/infirm persons.

API Application Program Interface

CPE Consumer Premises Equipment

CWMP CPE WAN Management Protocol

DAL Device Abstraction Layer

HAN Home Area Network

HG Home Gateway

HGI Home Gateway Initiative

IP Internet Protocol

IPR Intellectual Property Rights

ISP Internet Service Provider

LAN Local Area Network

NTP Network Time Protocol

OS Operating System

OSGi OSGi Alliance

RP Reference Point

SDT Smart Device Template

NOTE: A HGI term related to appliance function modelling.

ULE Ultra Low Energy

WAN Wide Area Network

3.3 Relationship with other HGI Specifications

The present document contains requirements over and above those in the HGI Residential Profile [i.6], Open Platform 2.0 [i.5] and Wireless HAN Services [i.2]. All the requirements of those documents still apply, except that support of Open Platform 2.0 is only mandatory with regard to clause 5.3 "HG with specific Software Execution Environment (Open Platform 2.0)".

Note that the Energy Gateway mentioned in Figure 7 of the HGI Energy Management document [i.3] is one of the possible appliances in the home network

4 Business requirements and Use Cases

The business requirements and use cases used as the basis for the architecture described in the present document are described in [i.4].

5 Architecture

The architecture is described first in terms of the entities and interfaces of the smart home eco-system and then in terms of the software execution environment within the HG. There is a particular focus on the Device Abstraction Layer (DAL) which mediates between high-level applications and the specific local area network protocols and technologies in the home network.

The following reference points in the architecture are explained in more detail in the following sections, but brief definitions are given in table 1 for convenience.

Table 1: Overview of Reference Points

RP Number	Reference Point Description
RP1	A common representation of and unified APIs to control and query, home appliances (in the software execution environment)
RP2	The reference point between the appliance drivers for various HAN technologies and the device abstraction layer
RP3	(RP3 is a reference point which no longer features in this architecture, but the notation is retained for historical reasons)
RP4	A common representation of and control over home appliances in the local network for access by the Operator Platform via a remote-access protocol
RP5	Support for local clients to communicate with the HG to access home appliances
RP6	The reference point for the native drivers towards the smart home software
RP7	Reference point in the cloud between an Operator Platform and Cloud Service Applications
RP8	A description of the WAN connection(s) on the HG is available at this Reference Point
RP9	The Home Area Network (HAN) physical interface to appliances

6 Overview

In the HGI context, the Home Gateway is considered to be the heart of the smart home - it connects and controls the home appliances and serves as the main entry point for communication with the operators, service providers and utilities in the cloud. The end user has access to their services in the home either via the cloud or through a direct connection to the HG. This is illustrated in Figure 1.

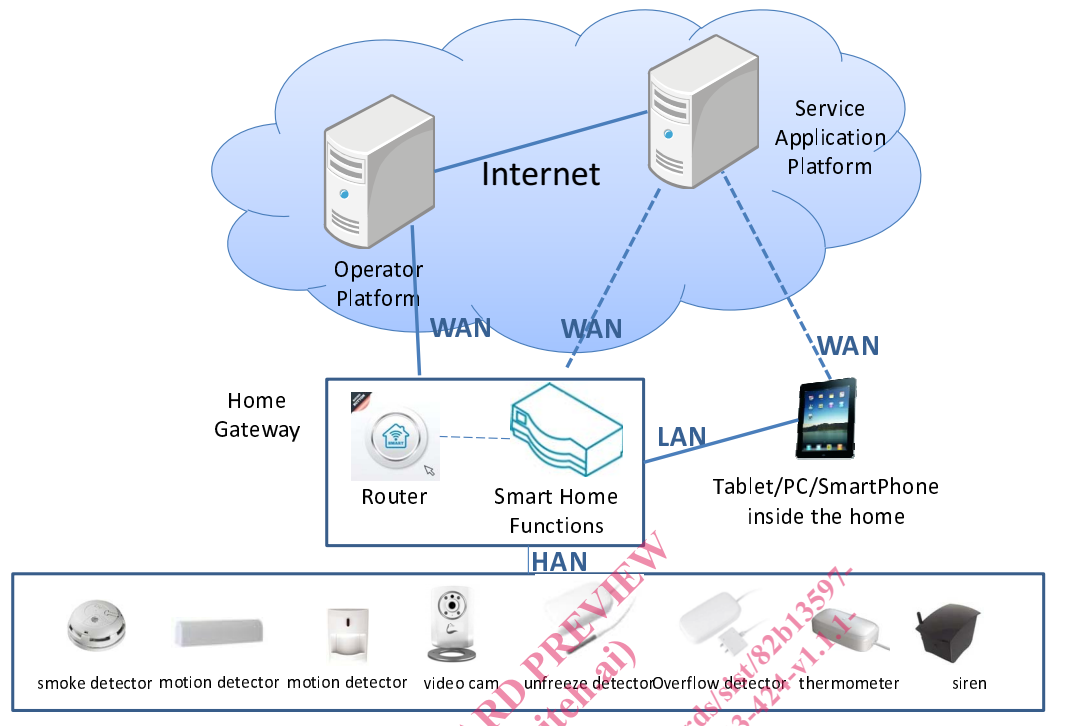


Figure 1: HGI smart home architecture

The present document does not specify functionality to support direct connections between the Service Application Platform and the HG or home PCs/tablets (shown by dotted lines in figure 1) for appliance access, but such connections are not precluded.

Note that figure 1 indicates that the Home Gateway itself may be implemented in more than one software and/or hardware entity, for example in a router and in a separate piece of equipment containing the smart home software functionality described within the present document.

6.1 High-level view of smart home architecture

Figure 2 shows a schematic view of the high level entities and reference points of the HGI smart home architecture. This Figure depicts the smart home functions as a black box, deferring the discussion of the way in which remote requests from WAN or LAN side clients are translated to actions on smart home appliances. Only the external reference points are shown in Figure 2.

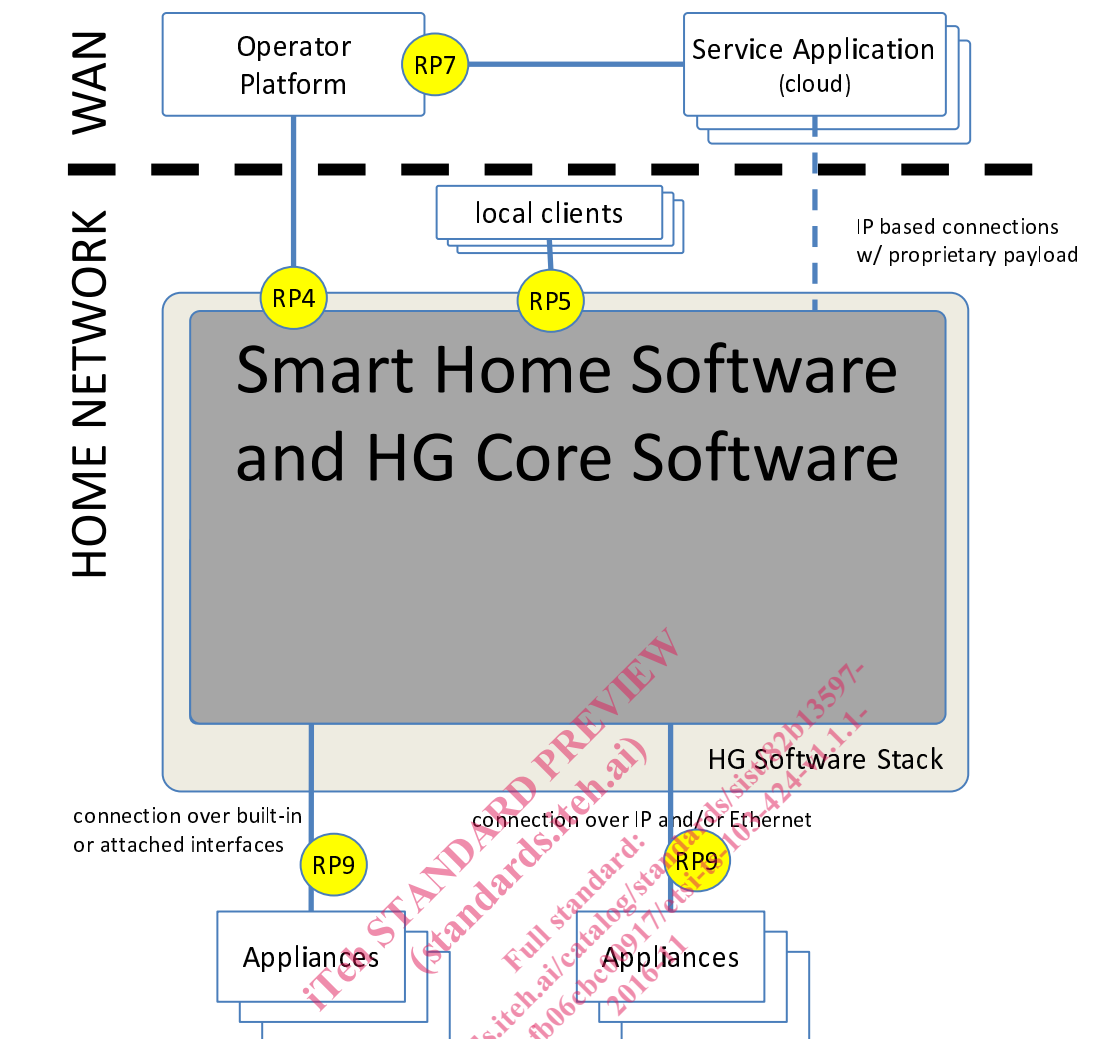


Figure 2: Reference points between the HG software and software in the Cloud or local client software