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SmartM2M;
Strategic/technical approach on how to achieve interoperability/interworking of existing standardized IoT Platforms

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Smart Machine-to-Machine communications (SmartM2M).

Modal verbs terminology

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Introduction

The initial project of Machine-to-Machine (M2M) communications was addressing the possibility for a device to interact with other devices (point-to-point or via gateways). This project has been handled at the very start by a variety of specialized (often sector-specific) platforms and solutions. Soon, it has been clear that this approach was bearing a strong risk of fragmentation with great difficulty in ensuring interoperability of such platforms when required. The Standard Development Organizations (SDOs) and Standard Setting Organizations (SSOs) have started to address the question of the M2M communications and have developed a number of approaches focusing on interoperability, in particular at the network level. Amongst the standards developed, some have addressed the possibility to serve as a basis for the development of platforms that could use these standards to deal with interoperability in a generic manner, across a variety of business sectors, with a variety of possible implementations. Such "standardized platforms" are relying on reference architectures, interoperability stacks addressing different layers, generic protocol adaptors, etc.

Gradually, the focus of the industry has shifted to the design and development of IoT systems with the purpose to offer full-fledge systems dealing with a vast number of devices (with various computing and interaction capabilities) and potentially integrating these devices into larger systems implementing often complex business processes. This has been enabled by the emergence of IoT devices with higher computing capacity and the possibility of producing massive amounts of data that will be collected, transformed, stored and managed by larger (non IoT specific) information systems which transform it into qualitative information to trigger useful actions.

This incorporation of IoT with Big Data is one new challenge for IoT platforms, a significant one but not the only one. Another example is the use of Virtualization technologies coming from Cloud Computing that wants to get the benefits of Cloud in terms of flexibility and cost effectiveness. In the case of Big Data or Virtualization, the role of standards is challenged by new approaches based on the usage of Open Source Software (OSS) components. The "standardized IoT platforms" will have to address the challenges and probably not all of the existing ones will be able to make it.

An important business sector for the validation of the approach of generic standardized platforms is Industrial IoT. The need for the Industry to have a holistic approach to the use of Information Technologies to foster innovation and competitiveness has been addressed by a variety of initiatives coming from business sectors (such as Industrie 4.0 in Germany and similar national initiatives) or from the European Commission (such as Digitizing European Industry - DEI). The approaches taken will have to combine the benefits of existing technology solutions (including established standards) with the flexibility offered by new approaches such as Big Data, Virtualization, or Semantic Interoperability.

Two main challenges have to be addressed by IoT standardization (organizations) and by the "standardized" platforms (an example is oneM2M, see ETSI TS 118 101 [i.13] that some of these organizations are developing:

- The "advanced technology" challenge posed by e.g. the incorporation of Big Data or Virtualization.
- The "business sector" challenge with the question of which level of genericity can be provided in support of the development of large IoT systems for Smart Cities, Intelligent Transport or Industrial IoT.
- The "standards" challenge posed by the role of emerging approaches such as Open Source.

The example of Industrial IoT is addressed in detail, based on considerations and questions such as the following:

- Considering that Industrial IoT is a business sector in which the Return on Investment (RoI) of IoT is expected to be positive in the short/medium period, how is it possible to foster the adoption of IoT standards and standardized IoT platforms in this particular sector.
- The adoption of standards and platforms for interoperability should benefit not only to the technology providers but, first and foremost, to those who purchase and use these solutions, in particular the SMEs who do not always have the technical knowledge and the leverage available to large businesses.

The present document addresses these questions first by carefully outlining the nature, the role of IoT platforms and proposing elements for the identification of the most relevant ones. It also addresses detailed examples such as Industrial IoT to outline the challenges posed to generic IoT platforms.

1 Scope

1.1 Context for the present document

The design, development and deployment of - potentially large - IoT systems require to address a number of topics - such as security, interoperability or privacy - that are related and should be treated in a concerted manner. In this context, several Technical Reports have been developed that each address a specific facet of IoT systems.

In order to provide a global a coherent view of all the topics addressed, a common approach has been outlined across the Technical Reports concerned with the objective to ensure that the requirements and specificities of the IoT systems are properly addressed and that the overall results are coherent and complementary.

The present document has been built with this common approach also applied in all of the other documents listed below:

- ETSI TR 103 533 [i.1].
- ETSI TR 103 534 [i.2].
- ETSI TR 103 535 [i.3].
- ETSI TR 103 537 [i.4].
- ETSI TR 103 591 [i.5].

1.2 Scope of the present document

The present document is addressing the issues related to the interoperability and interworking of IoT platforms, in particular standardized IoT platforms, and how the way they are handled can foster their adoption by the IoT community. The following points are discussed:

- What is a platform and what are the relevant ones for IoT?
- What are the main requirements of Interoperability and Interworking?
- How these requirements are taken into account by typical platforms.
- How those elements are taken into account in specific sectors such as Industrial IoT.
- Which recommendations can be made for an effective selection and usage?

2 References

2.1 Normative references

Normative references are not applicable in the present document.

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 TR 103 533 (V1.1.1): "SmartM2M; Security; Standards Landscape and best practices".

[i.2] ETSI TR 103 534 (Parts 1 and 2) (V1.1.1): "SmartM2M; Teaching material".

[i.3] ETSI TR 103 535 (V1.1.1): "SmartM2M; Guidelines for using semantic interoperability in the industry".

[i.4] ETSI TR 103 537 (V1.1.1): "SmartM2M; PlugtestsTM preparation on Semantic Interoperability".

[i.5] ETSI TR 103 591 (V1.1.1): "SmartM2M; Privacy study report; Standards Landscape and best practices".

[i.6] White Paper: "IoT Platforms Interoperability Approaches", IoT-EPI Platform Interoperability Task Force, 2017.

[i.7] AIOTI: "IoT LSP Standards Framework Concepts", Release 2.8, White Paper, 2017.

[i.8] AIOTI: "High Level Architecture (HLA)", Release 4.0, June 2018.

[i.9] "Semantic Interoperability", Release 2.0, AIOTI, 2015.

NOTE: Two new AIOTI Joint White Papers on Semantic Interoperability have been issued by AIOTI on 22 October 2019. See https://aioti.eu/aioti-iso-iec-jtc1-etsi-onem2m-and-w3c-collaborate-on-two-joint-white-papers-on-semantic-interoperability-targeting-developers-and-standardization-engineers/.

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NOTE: Available at http://www.internet-of-things-research.eu/pdf/D03_01_WP03_H2020_UNIFY-IoT_Final.pdf.

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[i.13] ETSI TS 118 101 (V2.10.0): "Functional Architecture (oneM2M TS-0001 version 2.10.0 Release 2)".

[i.14] ETSI TS 118 102 (V2.7.1): "oneM2M Requirements (oneM2M TS-0002 version 2.7.1 Release 2)".

[i.15] oneM2M TS-0012 (2018): "Base Ontology".

[i.16] oneM2M TS-0023 (2018): "Home Appliances Information Model and Mapping".

[i.17] ETSI TS 118 121 (V2.0.0): "oneM2M; oneM2M and AllJoyn® Interworking (oneM2M TS-0021 version 2.0.0 Release 2)".

[i.18] oneM2M TS-0014 (2017): "LWM2M Interworking".

[i.19] oneM2M TS-0024 (2017): "OIC Interworking".

[i.20] oneM2M TS-0033 (2017): "Interworking Framework".

[i.21] ETSI TR 103 527 (V1.1.1):"SmartM2M; Virtualized IoT Architectures with Cloud Back-ends".

[i.22] ETSI TR 103 528 (V1.1.1): "SmartM2M; Landscape for open source and standards for cloud native software applicable for a Virtualized IoT service layer".

[i.23] ETSI TR 103 529 (V1.1.1): "SmartM2M; IoT over Cloud back-ends: A Proof of Concept".

[i.24] ETSI TS 103 378 (V1.1.1): "Smart Body Area Networks (SmartBAN) Unified data representation formats, semantic and open data model".

[i.25] ACTIVAGE Deliverable D3.1: "Report on IoT European Platforms". .

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[i.26] T. Berners-Lee, J. Hendler and O. Lassila: "The Semantic Web" Scientific American, 2001, vol. 284, no 5, p. 28-37.

[i.27] Recommendation ITU-T Y.2063: "Framework of the web of things".

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[i.31] Linked Open Vocabularies for Internet of Things (LOV4IoT).

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[i.32] ETSI TS 103 264 (V1.1.1): "SmartM2M; Smart Appliances; Reference Ontology and oneM2M Mapping".

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