

# Standardizing the Internet of Things: ETSI and AIOTI

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## **Abstract:**

Where to start in order to learn how standards are being drafted and set for the Internet of Things (IoT)? and why the European Telecommunications Standards Institute (ETSI) presides the standardization group in AIOTI (Alliance for Internet of Things Innovation)? A key factor has been 3GPP/ETSI TC MSG (mobile networks) et oneM2M/ETSI TC SmartM2M (M2M/IoT) and their links to AIOTI. These standardization projects, which sought to solve problems of cybersecurity and interoperability on the IoT, had close ties with R&D programs funded by the European Union. This introduction with its short, up-to-date bibliography will hopefully stimulate the reader to take a closer look at ETSI and AIOTI...

The IoT European Research Cluster's (IERC) definition of the Internet of things (IoT) nearly amounts to the Internet of everything: *"A dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual 'things' have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network."*<sup>1</sup>

Since 2010, the programs of research and innovation on the IoT funded by the European Union are grouped in the IERC. The IoT literally took off in Europe in 2015. With the support of the European Commission and of parties active in research, innovation and industry in this field, the IERC became an informal alliance and, in 2016, an official organization: the Alliance for IoT Innovation (AIOTI).<sup>2</sup>

AIOTI seeks to bolster the dialog and interactions among the parties involved in the IoT in Europe and thus contribute to creating a dynamic European system for accelerating the IoT's adoption. It makes recommendations for cooperation on programs of IoT research and innovation. The European Union funds, in particular, Large Scale Pilots, programs that work closely with the IERC and AIOTI. AIOTI is striving to be recognized as a major player in the interoperability, security, confidentiality and safety of IoT systems and applications worldwide. It seeks to build up confidence in IoT solutions through its recommendations (handbooks, codes of good practices, benchmark solutions, standards, etc.) to developers and users.

The European Telecommunications Standards Institute (ETSI) is part of AIOTI since its foundation in 2015. With active support from the European Commission, this alliance has released reports on IoT policies and standards, and ETSI has been a catalyst for cooperation. Within AIOTI, the working group "IoT Standardization" (WG03), chaired by ETSI, has pointed out standardization problems related to interoperability, security and the lack (or duplication) of standards. To reach a consensus, the WG03 works on recommendations (based on participation and contribution to the working group) for improving existing standards, analyzing shortcomings and drafting joint strategies.

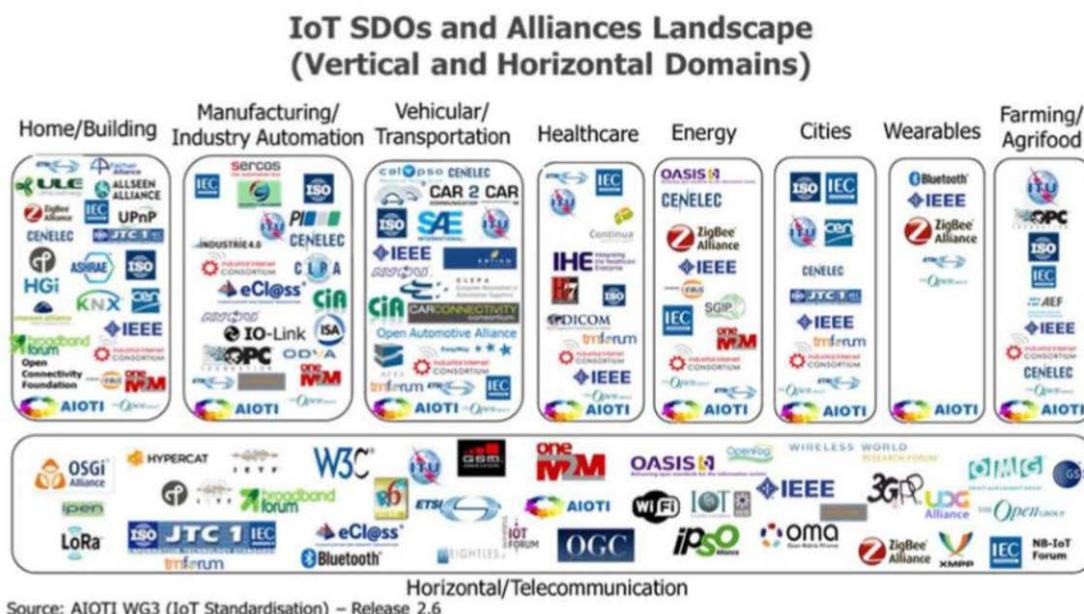
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<sup>1</sup> Quotation from [http://www.internet-of-things-research.eu/about\\_iot.htm](http://www.internet-of-things-research.eu/about_iot.htm).

This article has been translated from French by Noal Mellott (Omaha Beach, France). All websites have been consulted in April 2019.

<sup>2</sup> <http://www.aioti.eu>

However AIOTI's WG03 does not draft standards. ETSI has a key role in making the WG03 a partner of the European Commission for boosting cooperation on IoT standardization, research and innovation. The WG03 has become a place of collaboration where information is exchanged about standards, their implementation and IoT innovation.<sup>3</sup>



## IoT standardization at ETSI

ETSI has drafted and backs the global standards oneM2M and 3GPP for the service and radio layers of the IoT.<sup>4</sup> Under its partnership agreements, ETSI states that it will not develop rival service and radio standards. The objective is to harmonize the standardization of mobile networks and IoT machine-to-machine (M2M) connections. Thanks to this, the worldwide mobile network has grown into what we now have and is moving toward 5G. The “one” in oneM2M has full meaning for IoT: no rival standards are to be developed within ETSI.

### The Third Generation Partnership Project (3GPP)

The Third Generation Partnership Project (3GPP) sees to the standards for mobile networks (GSM, GPRS, EDGE, UMTS, LTE and LTE Advanced) and to IoT specifications (NB-IoT, eMTC and EC-GSM). This project of international cooperation is an ETSI Partnership Project (EPP) with organizations of regional standardization in telecommunications: ARIB (Japan), ATIS (USA), CCSA (China), ETSI (Europe), TSDSI (India), TTA (South Korea) and TTC (Japan).<sup>5</sup> 3GPP oversees the maintenance of the mobile broadband standards PRS and EDGE (included in GSM 2G and 2.5G),

<sup>3</sup> <https://aioti.eu/collaborations/>

<sup>4</sup> Respectively <http://www.onem2m.org/about-onem2m/why-onem2m> and <http://www.3gpp.org/about-3gpp/about-3gpp>.

<sup>5</sup> <http://www.3gpp.org/about-3gpp/partners>

UMTS with HSPA (included in GSM 3G) and LTE Advanced and Advanced Pro (included in GSM 4G). 3GPP's IoT specifications (NB-IoT, eMTC and EC-GSM-IoT) exist since Release 13.<sup>6</sup>

3GPP's standing support team is the Mobile Competence Center (MCC), with headquarters at ETSI, which is located in Sophia-Antipolis (France).

3GPP works with AIOTI's WG03 on the "IoT relation and impact on 5G". AIOTI has published and updates a report that lists use cases for 3GPP SA1 — Release 16.<sup>7</sup>

### *Machine-to-machine standards and the Internet of Things: OneM2M*

OneM2M is, like 3GPP, an ETSI Partnership Project (EPP), but with slightly different partners: type 1 — ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC (also partners in 3GPP) plus TIA (USA) — and type 2 (Global Platform and OMA).<sup>8</sup>

OneM2M seeks to develop the technical specifications for a common machine-to-machine service layer that can be easily integrated in hardware and software. We must also be able to count on this layer to connect a multitude of peripheral devices with servers using M2M applications worldwide. OneM2M's main objective is to attract and actively involve organizations in M2M/IoT, such as firms in information and communications technology (ICT) and smart systems transportation, health, public services, industrial robotics, home automation, etc.

OneM2M cooperates with AIOTI since it plays an active part in the WG03 on High Level Architecture (HLA)<sup>9</sup> and SemIoP/IoT Semantic Interoperability. It has boosted AIOTI to make better known its unique offer (already available to the service layer) of interoperability in collaboration with AIOTI's active members: standards development organizations, alliances and open-source projects as well as research and industrial programs.

OneM2M's basic ontology<sup>10</sup> has served for the Smart Appliances Reference (SAREF) ontology developed initially in ETSI TC SmartM2M. OneM2M provides the grounds for "extension mapping" (the instantiation of SAREF) in the fields of smart technology for energy, the environment, buildings, cities, industry, farming, transportation, health, the water supply, etc. It sets up a common framework for communicating information to SAREF.

OneM2M's basic IoT ontology is the core of the global offer of semantic interoperability (SemIoP). It has been enlarged with the activities of AIOTI's WG03 on IoT SemIoP.

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<sup>6</sup> [http://www.3gpp.org/news-events/3gpp-news/1785-nb\\_10t\\_complete](http://www.3gpp.org/news-events/3gpp-news/1785-nb_10t_complete)

<sup>7</sup> Report available at <https://aioti.eu/aioti-report-on-10t-relation-and-impact-on-5g/>

<sup>8</sup> <http://www.onem2m.org/about-onem2m/partners>

<sup>9</sup> <https://aioti.eu/wp-content/uploads/2018/06/AIOTI-HLA-R4.0.7.1-Final.pdf>

<sup>10</sup> <http://www.onem2m.org/technical/published-drafts>

## ETSI's M2M/IoT technical committees

### The Mobile Standards Group for 3GPP

The Mobile Standards Group (TC MSG) is ETSI's technical committee for supporting 3GPP. Its terms of reference<sup>11</sup> list the following responsibilities:

- perform work in activities as mandated by the European Commission and in support of European regulations;
- identify regulatory requirements;
- develop harmonized standards under Article 3.2 of the Radio Equipment Directive (2014/53/EU) while maintaining close ties with 3GPP, 3GPP2, IEEE and WiMAX Forum and related ETSI groups; and
- avoid duplication of work (in particular with 3GPP).

### SmartM2M for oneM2M

SmartM2M is ETSI's technical committee for supporting oneM2M. Its assignments are to:<sup>12</sup>

- support EU policies and regulatory requirements in M2M technology for the IoT (smart electricity meters and grids, etc.);
- identify in EU policies and regulatory requirements the M2M IoT services and applications (GDPR, ePrivacy Directive, etc.) to be developed by SmartM2M and convert oneM2M specifications into ETSI standards.

This technical committee has used oneM2M to demonstrate for the first time interconnections between cars (ITS) and farm vehicles (AEF, ISOBUS).<sup>13</sup>

As part of the H2020 program, the European Commission intends to support an environment capable of delivering IoT. Actions will, for example, validate IoT techniques and procedures through the IoT Large Scale Pilots and identify the standards required for worldwide deployment and interoperability of Large-Scale Pilot projects. The workshop "IoT Standards Landscaping and Gap Analysis" identified security, confidentiality, semantic interoperability and the interoperability of IoT platforms as key items.

Specialized Task Force 547 has provided support to certain EU IoT policies.<sup>14</sup> Its major objectives are to identify available standards and best practices, build a bridge between the parties who design or implement IoT systems, and support their work by providing comprehensive information and teaching materials for practical uses and in view of implementation.

In fact, all standardization groups — the Internet of everything! — are taking part in setting standards for the IoT at ETSI! Rather than being restricted to the ETSI Technology Cluster "Connecting Things", the IoT encompasses all forms of technology at ETSI.<sup>15</sup> To describe IoT standardization at ETSI, I have taken as starting point the technical committee SmartM2M in relation with oneM2M (and 3GPP).

<sup>11</sup> <https://portal.etsi.org/TBSiteMap/MSG/MSGToR>

<sup>12</sup> <https://portal.etsi.org/TBSiteMap/SmartM2M/SmartM2MToR.aspx>

<sup>13</sup> A live demonstration was conducted from 22 to 26 October 2018 during "ETSI IoT Week": <https://www.etsi.org/etsi-iot-week-2018>.

<sup>14</sup> <https://portal.etsi.org/STF/stfs/STFHomePages/STF547>

<sup>15</sup> <https://www.etsi.org/technologies-clusters/technologies> & <https://www.etsi.org/technologies-clusters/technologies/internet-of-things>

## **Conclusion**

In 2018, the IoT for industry (robotics, cobots,<sup>16</sup> drones and driverless vehicles) tended toward a “tactile IoT” (augmented reality, digital twins, virtual assistants) that encompasses both human-machine and machine-machine interactions: autonomous, smart and hyperconnected. This holds the promise of an IoT based on real-time interactive systems with a slue of new applications for industry, society and business. The IoT/IIoT is continually evolving with new techniques and applications, as it integrates, for example, hyperconnectivity (5G and 5G+), breakthrough computer technology (sensors and “actuators”), blockchains (distributed registers) and artificial intelligence (neural networks, machine learning). The convergence toward a single Internet (of everything) will take time and entail collaboration and standardization.

The maturation of the IoT market will lead to integrating new technological trends, those under way and those to come (GUILLEMIN 2018a). In the long run, since prototypes and simulators of quantum computers already exist (for generating random numbers and distributing quantum keys), advances in computational power and quantum cryptography might push us into a new ICT age by 2030 (or earlier). In a longer run, when the ICT becomes NBIC (Nano-Bio-Cognitive-ICT), thus covering transhumanism in an era that might lie beyond the “singularity” (under condition of quantum computing and algorithms), then computers (the machine, system, Internet) could outman humanity (technological singularity) and become the major source of innovation and R&D. People would then be nothing more than the orchestrators, users and, we hope, beneficiaries.

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<sup>16</sup> A “cobot” is a robot designed to interact directly with a human operator in a shared workspace (PESHKIN & COLGATE 1999).

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