Welcome to the World of Standards

SPECIALIST TASK FORCE 505
IOT STANDARDS LANDSCAPING & IOT LSP GAP ANALYSIS

IoT Landscape Status and Results
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TR 103 375 analysing the standards landscape provides a list of existing standardised technology suggested to be reused by the LSPs
Structure of TR 103 375

- Enterprise View of IoT Framework

- Overview of Knowledge Areas:
  - Communication and Connectivity
  - Integration/Interoperability
  - Application
  - Infrastructure
  - IoT Architecture
  - Devices and Sensor Technology
  - Security and Privacy

- Common standards across vertical domains (LSPs)

- Standards specific to vertical domain
  - Smart Cities, Smart Living, Smart Farming, Smart Wearables, Smart Mobility, Smart Environment, Smart Manufacturing

- Conclusion and Recommendation

- List of SDOs and SSOs involved in IoT standardisation
Scope and Objectives of TR 103 375

The scope of the report is to provide an overview of the IoT standards landscape: requirements, architecture, protocols, tests etc. to provide the roadmaps of the IoT standards, when they are available.

The essential objectives are:

• To analyse the status of current IoT standardisation;
• To assess the degree of industry and vertical market fragmentation;
• To point towards actions that can increase the effectiveness of IoT standardisation, improve interoperability, and to allow for the building of IoT ecosystems.
Many elements make up an IoT LSP. It’s more than just the technology. The initial concept was to present a view of the IoT framework as an enterprise architecture made of many parts that make the framework:

- To show how complex all the elements that are needed for an IoT LSP and
- To present a view that helps to put the entire element in context for the reader and users that are considering using the information in this TR for LSP operation

Next step was to start with the AIOTI WG3 report on “IoT LSP Standard Framework Concepts”. This provided several ways of visualising the landscape in order to simplify and facilitate the usage of the information in various IoT application domains.

TR 103 375 then expands on the AIOTI work by reviewing the scope of each of the relevant standards within the SDOs, those suggested by AIOTI, and often more
Contents of the Enterprise View

- **Architecture Reference Model** consists of an IoT architecture integrating all components that make up an IoT system.
- **IoT domain** holds the view of what make up an IoT.
- **Standards Information Database (SIB)** holds any relevant standards that can be used and with which new enterprise architectures shall comply with. It is the main study of TR 103375.
- **Reference Library** holds any re-useable information that can be used across the pilots.
- **Governance Repository** houses any policies, regulations that applies to any LSP.

**Complexity with IoT** comes from the fact that IoT intends to support a number of different applications covering a wide array of disciplines, that are not all part of the ICT domain.
A proposed Enterprise view of the IoT Framework can be used by a Large Scale Pilot (LSP) to conceptualise their pilot study.

The proposal of how this framework would be useful will be for example to think of an LSP provider that has a vision of the IoT domain it wants to operate in.

The LSP chooses its Architecture based on the standards that are available in the SIB (i.e. information in this TR).

The choice of the standards to use will be influenced by the governance aspects such as regulation of the area of operation.

The choice will also need to make reference to any existing model available, which will be in reference library.

The Structure of the SIB into the Knowledge areas will hopefully make this easier for the LSPs.
Communication and Connectivity knowledge area:
Covers mainly specification of communication protocol layers, including PHY, MAC, NWK, Transport, Application layer, and their types, e.g. Wireless/Radio and Wire line

Integration/Interoperability knowledge area:
Covers mainly specification of common IoT features required to provide integration and interoperability

Applications knowledge area:
Covers the support of the applications lifecycle including development tools/models, deployment and management; including analytics, application supporting tools and application domain specific activities
AIOTI Knowledge Area 2/2

Infrastructure knowledge area:
Covers aspects related to the design, deployment, and management of computational platforms tailored to support IoT-based applications.

IoT Architecture knowledge area:
Covers integrated/complete IoT specification solutions, including architecture descriptions.

Devices and sensor technology knowledge area:
Covers mainly device/sensor lifecycles, including operating systems, platforms, configuration management, sensor/actuators virtualization etc.

Security and Privacy knowledge area:
Covers security and privacy topics.
### Snap shot of Common Standards Across Vertical Domains – Connectivity KA

<table>
<thead>
<tr>
<th>SDO</th>
<th>Standards</th>
<th>Description/Analysis</th>
<th>SC</th>
<th>SL</th>
<th>SF</th>
<th>SW</th>
<th>SMo</th>
<th>SE</th>
<th>SMA</th>
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<tbody>
<tr>
<td>3GPP multi-purpose</td>
<td>TS 23.002 (network architecture) TS 23.401 (Packet Radio Service) TS 36.300 (Radio Access Overall description)</td>
<td>The 3GPP standards cover Radio, Core Network, and Service Architecture for cellular mobile networks. The different versions are named: GSM, GPRS (2G), EDGE, UMTS (3G), HSPA, LTE (or 4G), LTE-Advanced. The specifications cover all aspect of a radio telecommunication system. LTE is significantly more spectrally-efficient than 2G or 3G, hence transporting data over a 4G network can be done at a much lower cost per bit. The LTE-ADVANCED standard version is still evolving. New networks are being rolled out, and leading-edge features are being added to 4G to satisfy the market need for ever-increasing data rates. <a href="http://www.3gpp.org/specifications/specifications">http://www.3gpp.org/specifications/specifications</a></td>
<td>X</td>
<td>X</td>
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<tr>
<td>IETF 6lo</td>
<td>Definition of Managed Objects for 6LoWPANs (RFC 7388) 6LoWPAN-GHC (RFC 7400) Transmission of IPv6 Packets over ITU-T G.9959 Networks (RFC 7428) Ipv6 over BLUETOOTH® Low Energy (RFC 7668)</td>
<td>The IETF WG 6lo targets IPv6 over low power area networks, i.e. over networks of resource-constrained nodes in terms of memory, processing resources and bandwidth.</td>
<td>X</td>
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<td>X</td>
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**Vertical domains**

SC: Smart Cities  
SL: Smart Living  
SF: Smart Farming  
SW: Smart Wearables  
SMo: Smart Mobility  
SE: Smart Environment  
SMA: Smart Manufacturing  

SDO: Standards Developing Organisation
### SDO Standards Description Analysis

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<tbody>
<tr>
<td>3GPP V2X</td>
<td>TR 22.885 (Study on LTE Support for Vehicle to Everything (V2X) Services) ; TS 22.185 (Service requirements for V2X services; Stage 1); TR 22.891 (3GPP; Technical Specification Group Services and System Aspects; Feasibility Study on New Services and Markets Technology Enablers; Stage 1) for Smarter</td>
<td>3GPP has recently started working on C-ITS for LTE-Advanced and 5G (known as Smarter).</td>
<td>These documents identify the main use cases where LTE could be used for V2X scenarios and the corresponding requirements. <a href="">ftp://ftp.3gpp.org/Specs/archive/22_series</a></td>
</tr>
<tr>
<td>AVNU Alliance</td>
<td>Profile for automotive use and certification tests from the automotive Certification Test Subgroup (CDS)</td>
<td>The AVNU Alliance is an industry forum dedicated to the advancement of professional-quality audio video transport by promoting the adoption of the IEEE 802.1 Audio Video Bridging (AVB), and the related IEEE 1722 and IEEE 1733, standards over various networking link-layers.</td>
<td>The AVNU Alliance enables deterministic networking via certification of compliance and interoperability for devices using open IEEE standards. The AVNU certification program ensures interoperability of networked devices in a broad range of applications including professional AV, automotive, industrial control and consumer. A fully networked car according to AVNU alliance allows access to all sensors and cross-domain communication. <a href="http://avnu.org/automotive/">http://avnu.org/automotive/</a></td>
</tr>
</tbody>
</table>
329 standards in total allocated to
- 7 vertical IoT Domains (LSPs) and
- 7 Knowledge Areas

150 Common standards

179 vertical specific standards mostly identified in the IoT domains
- Smart Mobility
- Smart Living
- Smart Manufacturing
More than 70% of the standards allocated to

- Communication and Connectivity
- Integration/Interoperability
- IoT Architecture

Most of the common standards identified in the Knowledge Areas

- Communication and Connectivity
- Integration/Interoperability
- Devices and Sensor Technology
- Infrastructure
A number of the standards apply across verticals, some of them apply to specific vertical domains.

There are many connectivity and interoperability standards and specifications that are not IoT-specific.

Make the choice for one solution (notably architecture) across verticals that allows for cross domain interoperability.

Recommendations to the LSPs:

- Select the architecture for the pilots based on the standards that are listed in the TR 103375 (Enterprise Framework: Standards Information Base SIB).
- Use as much of the standards which are listed as “Common Standards across vertical domains”.
Some Recommendations (2)

**IoT (standardization) landscape is currently fragmented**

- **Encourage the large SDOs/SSOs to strengthen collaboration and cooperation**
  The potential of standards, which are identified as “Common Standards across vertical domains” will only materialize if the development of IoT standards in vertical domains is making effective use of those standards rather than reinventing similar but not complaint ones, thus increasing the fragmentation of the IoT standards landscape

- **Organize "progress report" events regularly to advertise the progress made with IoT standards, specifications and Open Source towards the IoT Service Customers (in cooperation with the LSPs and CSAs)**
## Snapshot of Annex: Summary of the SDOs and SSOs identified in the TR

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Name</th>
<th>Mission</th>
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<tbody>
<tr>
<td>3GPP</td>
<td>Third Generation Partnership Project</td>
<td>The 3rd Generation Partnership Project (3GPP) unites [Seven] telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), known as “Organizational Partners” and provides their members with a stable environment to produce the Reports and Specifications that define 3GPP technologies. The 3GPP standards are organized into four Technical Specification Groups (TSG): Radio Access Networks (RAN), Services &amp; Systems Aspects (SA), Core Network &amp; Terminals (CT)</td>
</tr>
<tr>
<td>ACEA</td>
<td>European Automobile Manufacturers Association</td>
<td>The European Automobile Manufacturers' Association (ACEA) represents the 15 Europe-based car, van, truck and bus manufacturers. It defines and advocates the common interests, policies and positions of the European automobile industry.</td>
</tr>
<tr>
<td>AIOTI</td>
<td>Alliance for IoT Innovation</td>
<td>The Alliance for Internet of Things Innovation (AIOTI) was initiated by the European Commission in order to develop and support the dialogue and interaction among the Internet of Things (IoT) various players in Europe. The overall goal of the AIOTI is the creation of a dynamic European IoT ecosystem to unleash the potentials of the IoT.</td>
</tr>
</tbody>
</table>

- **SDO**: Standards Developing Organisation
- **SSO**: Standards Setting Organisation
Lesson Learned from TR Creation Project

- Vast amount of very useful research out there so it was challenging to know when to actually stop.
- Not all standards enable interoperability
- Some good industry adapted proprietary “good practice” out there but not all were approved Standards hence there was a debate as to whether to include or exclude them.
- Only standards included in TR, no proprietary solution
- We had some useful feedback when the TR was sent for public review however it was challenging knowing when to put a cut off on the feedback as some organisations still kept sending useful feedback even after cut of date!
- As soon as the TR was released we realised that we need another version as some new standards began to emerge...
Thank you for your attention!

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