IOTWeek

Dublin — June 20-23, 2022

# IoT and Edge Computing Standardisation Challenges and Beyond session

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GLOBAL VISION:

IoT TODAY AND BEYOND

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# Scope of the session

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The expansion of the IoT and edge computing landscape has brought opportunities but also new challenges. Standards have an essential role in the IoT and edge computing systems development and uptake.

This session discusses the status of the IoT and edge computing standardisation challenges and of the key SDO specification activities focusing on solving these challenges, as well as what is coming next.

**Key Themes:**

Discussion of EC policies and regulations that will impact the IoT and Edge computing standardisation

Discussion on the up to date IoT and edge computing standardisation challenges and what is coming next

Discussion of the key SDO specification activities focusing on solving IoT and Edge computing challenges

**Target results of the session**

Provide recommendation to research projects, such as EU funded research projects, on solving open IoT and edge computing standardisation challenges

Support SDOs to define next steps in IoT and/or edge computing standardisation activities

What are the recommendations for synchronization between SDOs on IoT and edge computing activities

# IoT and Edge Computing Landscapes

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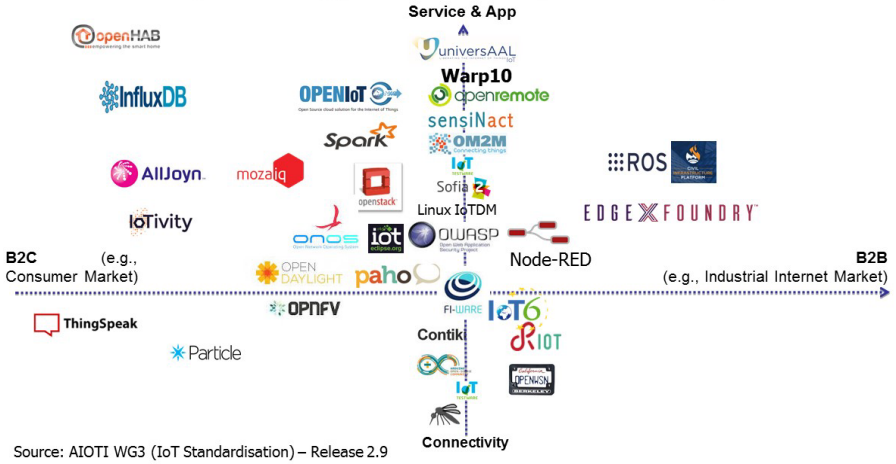
## IoT SDOs and Alliances Landscape (Technology and Marketing Dimensions)

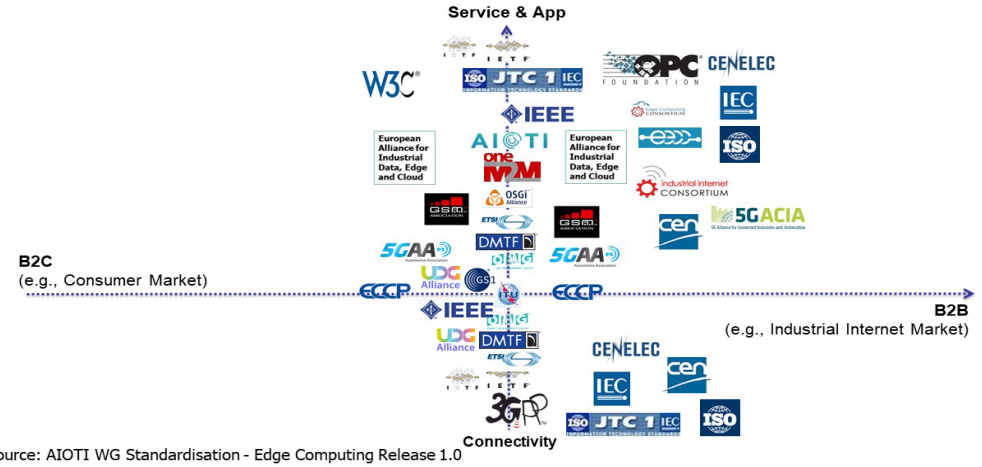

Source: AIOTI WG3 (IoT Standardisation) – Release 2.9

## IoT Open Source Initiatives Landscape (Technology and Marketing Dimensions)



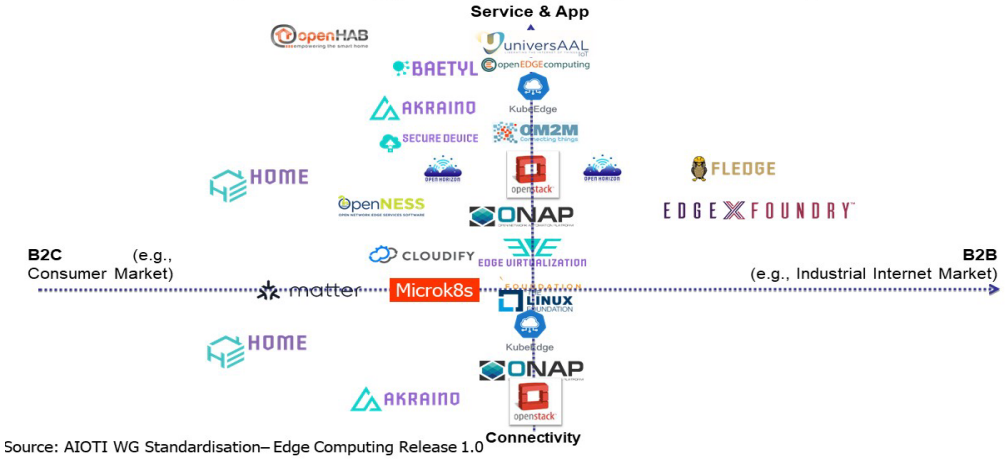

Source: AIOTI WG3 (IoT Standardisation) – Release 2.9

## Edge Computing SDOs and Alliances Landscape (Technology and Marketing Dimensions)




Source: AIOTI WG Standardisation - Edge Computing Release 1.0

## Edge Computing Open Source Initiatives Landscape (Technology and Marketing Dimensions)




Source: AIOTI WG Standardisation– Edge Computing Release 1.0

# IoT Standardisation Challenges ("IoT Gap Analysis and Recommendations" report)

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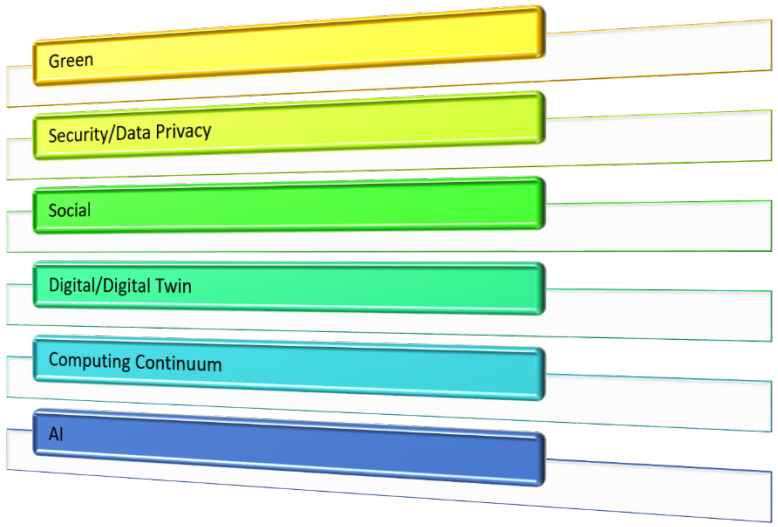
= Well addressed and no gap anymore
= In the process of solving the gaps, in the right direction
= In the process of solving the gaps, but much work to be done
= Still an open gap

| Nb | Short name | Nature of the standardisation gap | Domain |
|---|---|---|---|
| 1 | Applications to Span Multiple Ecosystems | APIs that decouple applications from the details of specific IoT ecosystems as a means to enable open markets of services (e.g., W3C –WoT, addresses well the standardisation gap for decoupling applications from the details of specific IoT ecosystems). | Service and applications |
| 2 | Safety | Safety standards (refer to safety standards of the relevant targeted domain, e.g., ISO 26262 or ISO 21448 for road vehicle) to be taken into account | Deployment |
| 3 | (Cyber-)Security | Risk Management Framework and Methodology. | Security / Privacy |
| 4 | Data management | Data rights management: ownership, storage, sharing, selling, liability, etc. | Security / Privacy |
| 5 | Harmonized identification | Harmonized reference for unique and secured naming mechanisms. | Applications Management |
| 6 | Semantic interoperability | Standards to interpret and process the sensor data in an identical manner across heterogeneous platforms. Need of a global and neutral data model. | Service and applications |
| 7 | Platform interoperability | Multiplicity and fragmentation of IoT HLAs, platforms and discovery mechanisms. | Integration / Interoperability / IoT Architecture |
| 8 | Connectivity interoperability | Competing communications and networking technologies. | Connectivity |
| 9 | Ethics and trustworthiness | Ethics. Transparency and choice for citizens. | Service and applications<br>Security / Privacy<br>Societal |
| 10 | Open Markets of Digital Services | Standards needed to enable open markets of services. | Business |
| 11 | Device certification | Certification mechanisms defining "classes of devices" and ensuring quality of the devices. | Device-sensor technology |
| 12 | Solution deployment and maintenance tools | Tools to enable ease of installation, configuration, maintenance, operation of devices, technologies, and platforms. Standardized methods to distribute software components to devices across a network | Deployment |
| 13 | Scalable device deployment | Unified model/tools for deployment and management of large-scale distributed networks of devices. | Deployment/ Device-sensor technology |
| 14 | Green technologies | Green technologies. | IoT Architecture / Societal |
| 15 | Usability | Easy accessibility and usage to a large non-technical public. | Applications Management |

# Edge Computing Standardisation Challenges ("Edge Computing Gap Analysis and Recommendations" report) - Categories of standardisation challenges






| Challenges presented in detail in | Green | Security/ Data Privacy | Social | Digital/Digital Twin | Computing Continuum | AI |
|---|---|---|---|---|---|---|
| Section 2.1 | | intelligent approaches | | | interoperability, orchestration | |
| Section 2.2 | energy costs balance | distributed security | | | federation, cross-platform | network optimization |
| Section 2.3 | | users trust, fault tolerance | agile pricing | | systems' collaboration | |
| Section 2.4 | energy /$CO_2$ footprint | solutions evaluation | | massive IoT applications | | green AI |
| Section 2.5 | energy /$CO_2$ footprint | solutions evaluation | | | | |
| Section 2.6 | environmental impact score | GDPR compliance | ESG monitoring | metrics collection | | performance acceleration |
| Section 2.7 | | | | | | explainable AI, common sense |
| Section 2.8 | | confidentiality, non-repudiation | | digital twins, physics realism | | explainable AI, interpretability |
| Section 2.9 | | digital attestations | | digital twins, data spaces | | federated learning |
| Section 2.10 | | | | new solutions certification | | |
| Section 2.11 | | | | | MEC, connectivity | |
| Section 2.12 | | | | | MEC hosts, interoperability | |
| Section 2.13 | | access, share, store, threats | human-centric | | microservices, scaling, planes | distributed AI, fed. learning |
| Section 2.14 | environmental meta-model | | societal context, buy-sell | model coherency | interoperability, internet space | |
| Section 2.15.1 | | | | | interoperability, ecosystems | |
| Section 2.15.2 | | | | | coexistence rules | |
| Section 2.15.3 | | | | devices/systems certification | | |
| Section 2.15.4 | | trustworthiness, dependability | | non-functional properties | | |
| Section 2.15.5 | | | | digital service transformation | | |
| Section 2.15.6 | | security/privacy models | | | interoperability, coexistence | |
| Section 2.15.7 | | | | | | cognitive digital services |
| Section 2.15.8 | | | socio-economic impact | service discovery | end-to-end interoperability | |
| Section 2.15.9 | | service security, security models | | | | |
| Section 2.15.10 | | services authentication | micropayments | | | |
| Section 2.15.11 | policy descriptions | | policy descriptions | | | |
| Section 2.15.12 | | | | novel models/ languages | | |
| Section 2.15.13 | | | | distributed devices | reorganization, reassignment | |
| Section 2.15.14 | | | | | responsive connectivity | AI on the edge |
| Section 2.15.15 | | | | | X-continuum paradigm | |
| Section 2.15.16 | | | | | granularity, interoperability | |
| Section 2.15.17 | | | | | swarm systems | intelligence clustering |
| Section 2.15.18 | | | | distribution, decentralisation | | cognition |
| Section 2.15.19 | | | | | | fed. learning, AI for edge |
| Section 2.15.20 | | | | virtualisation, automation | | |
| Section 2.15.21 | | | | | systems integration | AI-based edge applications |
| Section 2.15.22 | | federated AAA[9] | | digital twin, IoT certification | infrastructures merging | |
| Section 2.15.23 | | | | | interoperability, merging | |
| Section 2.15.24 | | distributed/ ledger security | | digital twin | | distributed AI |



AIOTI

# Edge computing standardisation gaps

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| Section | Standards | Section | Standards | Section | Standards | Section | Standards |
|---|---|---|---|---|---|---|---|
| 2.1 | 26 | 2.11 | 30 | 2.15.7 | 1 | 2.15.17 | 0 |
| 2.2 | 41 | 2.12 | 15 | 2.15.8 | 3 | 2.15.18 | 5 |
| 2.3 | 12 | 2.13 | 9 | 2.15.9 | 2 | 2.15.19 | 1 |
| 2.4 | 1 | 2.14 | 3 | 2.15.10 | 7 | 2.15.20 | 3 |
| 2.5 | 1 | 2.15.1 | 7 | 2.15.11 | 1 | 2.15.21 | 2 |
| 2.6 | 2 | 2.15.2 | 6 | 2.15.12 | 0 | 2.15.22 | 4 |
| 2.7 | 1 | 2.15.3 | 6 | 2.15.13 | 0 | 2.15.23 | 4 |
| 2.8 | 7 | 2.15.4 | 6 | 2.15.14 | 14 | 2.15.24 | 6 |
| 2.9 | 1 | 2.15.5 | 4 | 2.15.15 | 2 | 2.15.25 | 2 |
| 2.10 | 6 | 2.15.6 | 4 | 2.15.16 | 3 | | |

= **Less priority gap, more standardisation work ongoing**

= **High priority gap, some standardisation work ongoing**

= **Considerably high priority gap**



- Considerable (high priority) standardisation gaps related to AIOTI identified edge computing challenges of (red color):
  - Digital Twins (Sections 2.4, 2.5, 2.9);
  - ICT/IoT and policies description and languages supporting the Environmental, Social and Governance (ESG) monitoring (Sections 2.6, 2.15.11, 2.15.12);
  - Federated Learning and AI (Sections 2.7, 2.15.7, 2.15.19);
  - Devices and IoT swarm systems management (Sections 2.15.13, 2.15.17).
- Activities could be initiated for creation of standardization specifications covering challenges of (brown color):
  - IoT and edge computing coexistence/integration/interoperability and continuum across several sectors and platforms (Sections 2.14, 2.15.6, 2.15.5, 2.15.6, 2.15.15, 2.15.16, 2.15.20, 2.15.21, 2.15.22, 2.15.23);
  - Services discovery and authentication – in the context of multiple edges (Sections 2.15.8, 2.15.9).

# Questions



1. Which key EC policies and regulations will impact the IoT and Edge computing standardisation? List and motivate at least 3 of them?

2. Which are the key IoT and Edge computing Standardisation challenges that need to be handled by SDOs with high priority?

3. What are the activities done by your SDO/Alliance to solve IoT and Edge computing standardisation challenges?

4. What you see as next step on supporting of the IoT and edge computing open standardisation challenges/activities in (1) SDOs and (2) research projects, such as European projects

5. How could your SDO synchronise with other SDOs on IoT and Edge computing standardisation activities?

    o) Are there possible minimal interoperability mechanisms (MIMs) for emerging areas of IoT/Edge computing that can be agreed by SDOs?

6. Provide an answer to any other question that you would like to address

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# Thank you!

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