European IoT Standardisation: Progressing EU-China Common Views

Georgios Karagiannis / Huawei and AIOTI WG03 vice-chair

Contributors on AIOTI WG03 activities: H. Barthel, M. Bauer, M. Carugi, E. Darmois, L. Daniele, P. Guillemin, M. J. Heiles, O. Elloumi

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www.euchina-iot5g.eu

EU-China IoT Cooperation Activities

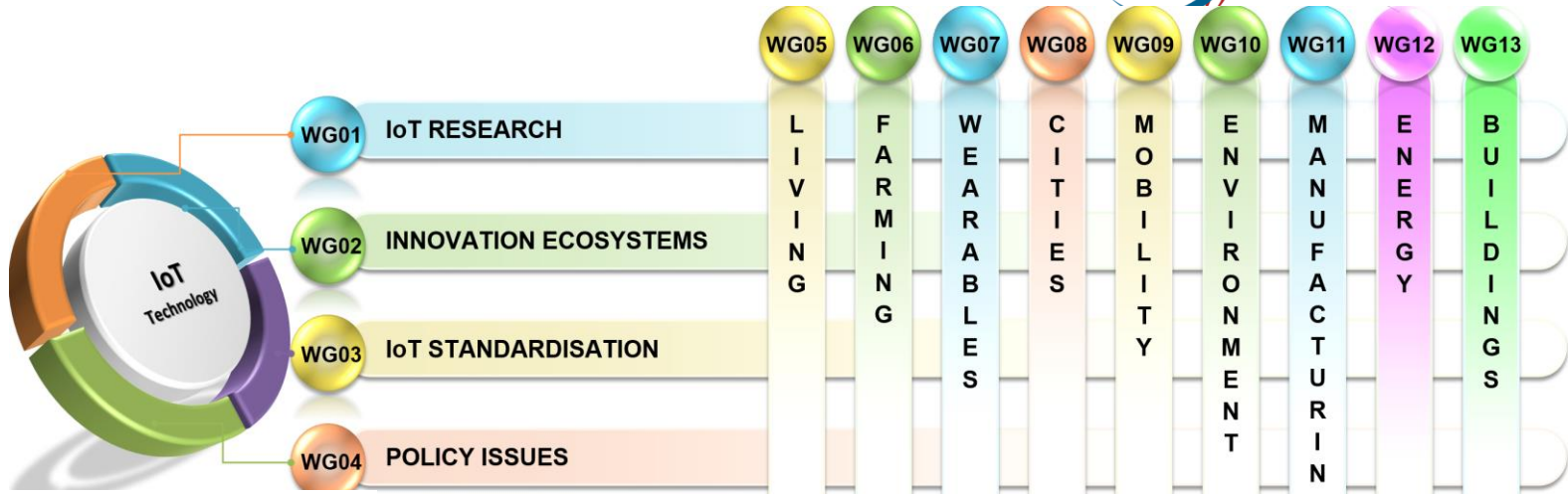
- Europe and China are at forefront of technological advances in areas related to the Future Internet
- While both parties share common technological objectives, there is still room for improvement in what concerns bilateral co-operation
- To foster collaboration specifically in the domain of the IoT, both parties established the EU-China IoT Advisory Group in 2011, which published among others:
  - Peter Friess and Jun Li, "EU-China Joint White Paper on the Internet of Things", EU DG CONNECT and CAICT, January 2016
  - EU-China IoT Advisory Group, "EU-China Position Paper on IoT Architecture", EU DG Connect and CAICT, 23/10/2014
  - EU-China IoT Advisory Group, "EU-China Joint White Paper on Internet-of-Things Identification", EU DG Connect and CAICT, 30/09/2014
  - EU-China IoT Advisory Group, "EU-China Joint White Paper on IoT Semantic Interoperability", EU DG Connect and CAICT, 20/08/2015

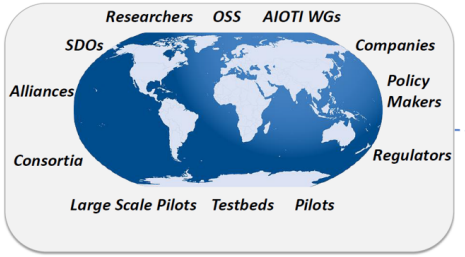
International and EU IoT Standardisation Activities

- Main International IoT initiatives:
  - oneM2M, a global initiative aiming to ensure efficient deployment of Machine-to-Machine (M2M) communications systems and the IoT:
    - develops technical specifications for a common M2M Service Layer that can be embedded within various hardware and software to connect the wide range of devices worldwide with M2M application servers
  - Other major initiatives such as 3GPP, BBF, ETSI, IEEE, ITU-T, ISO, IEC, OPC Foundation focus on IoT standardisation
  - Examples of consortia focussing on IoT: IIC, IoT Forum, OSGi Alliance and OCF
- Main IoT related initiatives in Europe:
  - ETSI's Technical Committee SmartM2M, develops specifications for requirements, functional architecture, and interface descriptions for a standardised M2M platform
  - Platform Industrie 4.0
  - CEN / CENELEC
  - Alliance for Internet of Things Innovation (AIOTI) was initiated by the European Commission in 2015 as a result of European and global IoT technology and market developments.
    - address the challenges of IoT technology and applications deployment, which include standardisation, interoperability and policy issues

Alliance for IoT Innovation (AIOTI)

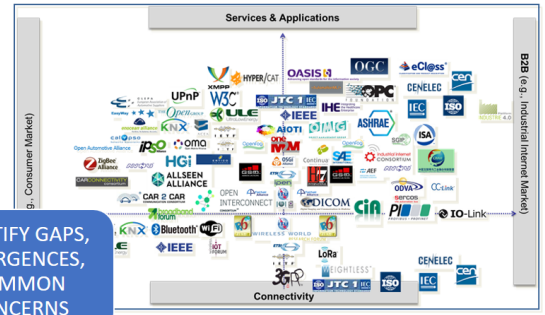
AIOTI





WG03 support to AIOTI in

- **Digital Single Market**
- **Digitising European Industry**
- **H2020 Large Scale Pilots**



ANALYZE LANDSCAPE

IDENTIFY GAPS, DIVERGENCES, COMMON CONCERNS

TASK SUB-TEAMS TO ADDRESS THEMES

- *High Level Architecture - HLA*
- *Semantic Interoperability - SemIoP*
- *Privacy & Security &WG04*
- *Identifiers, 5G and IoT*

PUBLISH GUIDANCE AND RECOMMEND ATIONS

ENGAGE, DISSEMINATE AND INFLUENCE

AIOTI WG03

AIOTI WG03 IoT Standardization engagement model

April 2018

- **AIOTI > 190 members**
- **21 Founding members**
  400 active people in AIOTI
- **190 active people in AIOTI WG0**

PHILIPS Lighting, vodafone, BOSCH, SIEMENS, SAMSUNG, NOKIA, Schneider Electric, HUAWEI, Telit, Infineon, ARTEMIS, ENGINEERING, CATAPULT Digital, Gradiant, life.augmented, IBM, ARTHUR'S LEGAL, CNH INDUSTRIAL, BT, Atos, JOHN DEERE

AIOTI WG03 Activities

- **IoT Landscape** georgios.karagiannis@huawei.com
  - IoT Landscape maintenance is key to keep the liaisons alive and maintain dialogue on how to foster collaboration to improve interoperability & security
  - Gap Analysis and recommendations + IoT-LSP (and IoT-EPI) (emmanuel.darmois@commledge.com)
    - STF 505, CREATE-IoT => report under review to be published in May 2018
  - Cooperation with SDOs/Alliances to foster co-creation and interworking (georgios.karagiannis@huawei.com, Patrick.Guillemin@etsi.org)
    - Signed MoU with Brazil Camarade IoT, Signed MoU with ITAC of Japan, Preparing MoU with AII China
  - IoT relation and impact on 5G thomas.klein@de.ibm.com ; georgios.karagiannis@huawei.com
- **HLA / High Level Architecture** marco.carugi@gmail.com ; omar.elloumi@nokia.com
  - IoT Reference Architecture and its mapping with existing IoT Reference Architectures new R4 under construction
  - IoT identifiers juergen.heiles@siemens.com ; henri.barthel@gs1.org
- **SemIoP IoT Semantic Interoperability** Martin.Bauer@neclab.eu ; Laura.Daniele@tno.nl
  - new White Paper under construction
- **IoT Privacy (with WG04)** vanderwees@arthurslegal.com Serie of AIOTI webinars, Nuance of Trust event
  - IoT Platform, experimentation, LSPs need concrete standard framework & references to enable ”IoT Trust” and IoT “Privacy by design” + STF 547
- **IoT Security (with WG04)** vanderwees@arthurslegal.com, jacques.kruse-brandao@nxp.com, harm.arendshorst@ilabs.ai
  - IoT Security Architecture for Trusted IoT Devices; Baseline Requirements for Security & Privacy up to segment requirements; experimentation, LSPs need concrete standard framework & references to enable ”IoT Trust” based on IoT “Security by design

Examples of AIOTI WG03 Ongoing Activities: Gaps

Domain	Gaps
IoT Architecture	• Multiplicity of IoT HLAs, platforms and discovery mechanisms
Connectivity	• Fragmentation of the standardization landscape • Large number of heterogeneous & competing communications and networking technologies
Integration / Interoperability	• Global-level standards (international vs. regional level) • Fragmentation due to competitive platforms and standards
Device /Sensor Technology	• Quality assurance and certification • Device modularity
Service and applications	• Data interoperability: lack of easy translation mechanisms between different specific models. Need of a global and neutral data model. Seamless inter-working between data systems • Interoperable processing rules: lack of definition for advanced analysis and processing of sensor events and data to interpret the sensor data in an identical manner across heterogeneous platforms • APIs to support application portability among devices/terminals • Specific solutions at Service Layer to enable communications between the platforms (e.g., plugins to oneM2M platform)
Applications Management	• Usability • Applications tailored to individual needs: evolution, flexibility of the components • Harmonized Identification • Interoperability between IoT HLAs, platforms and discovery mechanisms
Security / Privacy	• Privacy and security issues can be a blocking factor for user's acceptance and prevent large scale deployments. Security and privacy are addressed on an isolated basis for part of the applications • Lack of highly secure and trusted environments • Liability for data privacy
Deployment	• Safety • Deployment tools
Regulation	• Regulations for frequency harmonization and usage
Business	• Collaboration between vertical domains, siloed applications • Lack of a reference for business cases and value chain model to guide choices for deployment • Lack of knowledge about potentialities of IoT among decision makers, users
Societal	• Green Technologies • Ethics. Transparency and choice for citizens

Source: AIOTI WG03 and ETSI STF 505

Examples of AIOTI WG03 Ongoing Activities: High Level Architecture - Status

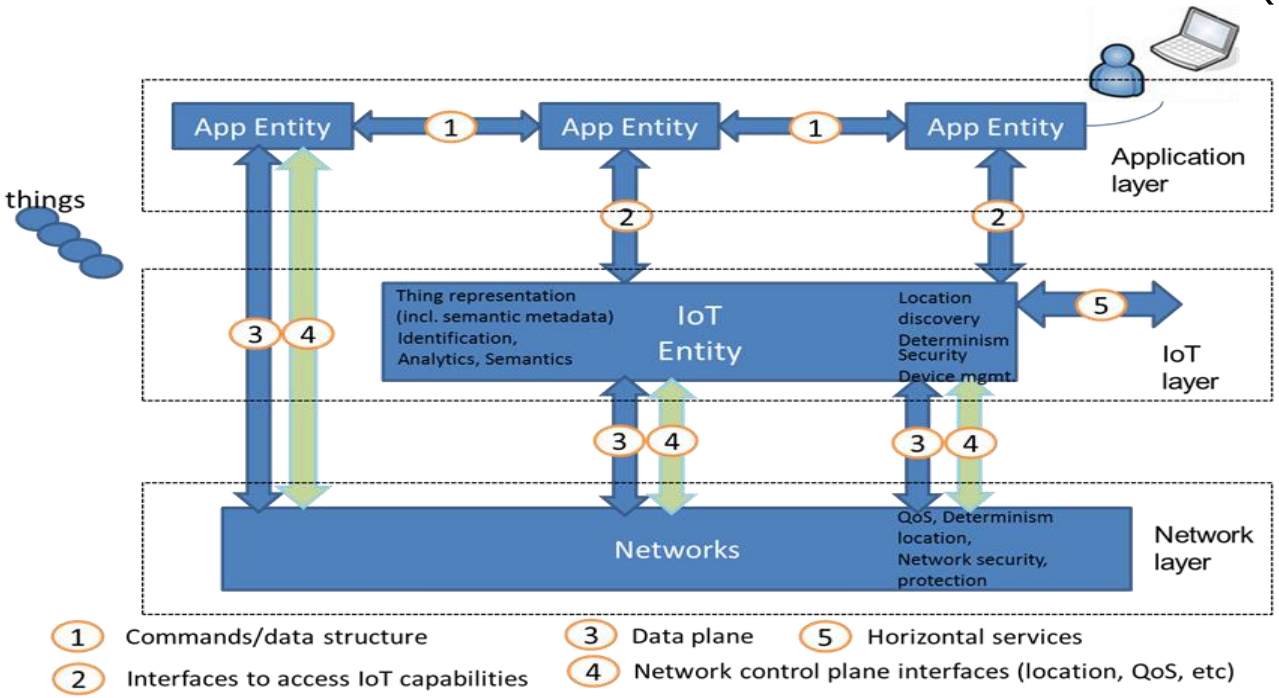
- **AIOTI WG3 has developed a High Level Architecture (HLA) for IoT**

  HLA takes into account architecture specifications of existing SDOs and alliances

  Current HLA Release: https://aioti.eu/wp-content/uploads/2017/06/AIOTI-HLA-R3-June-2017.pdf

- **ISO/IEC/IEEE 42010 is recommended to capture views and supporting models**
- **While the HLA document body is consistent with ISO/IEC/IEEE 42010, it doesn't provide a complete IoT architecture description conforming to the standard**

  HLA focuses on the Domain and Functional models (other models possibly in future)



High level AIOTI functional model, referred to as the "AIOTI HLA functional model"

The HLA document also details mappings of relevant SDOs' specifications to this functional model (ITU-T, oneM2M, IIC, RAMI4.0)

Examples of AIOTI WG03 Ongoing Activities: High Level Architecture - Future Work

- **The HLA team is working on the following tasks (HLA Rel.4.0 and beyond)**
  - Identifiers for IoT (TASK ALREADY COMPLETED)
    - Analysis conducted by specific Task Force – V1.0 dedicated paper published Feb 18
  - Big Data and HLA enhanced by Big Data supporting capabilities
    - Initial content in Rel.3.0: based on ITU-T Y.4114, NIST Big Data framework, other
    - Relevant Big Data standardization initiatives and related architectural mapping to HLA functional model (where applicable): BDVA, ISO/IEC JTC1 WG9, others TBD
    - Framework of IoT-Big Data integrated architecture (starting with the approach for integration) – some relevant information sources: BDVA, JTC1 WG9, ITU-T (SG20, SG13, FG-DPM)
  - Virtualization in the context of IoT and related impact on HLA
    - Different approaches under discussion (ETSI ISG NFV based, ETSI STF 535 (microservices) based)
  - Artificial Intelligence and related impact on HLA
    - AI enabled by Big Data, AI for IoT in general
    - HLA enhanced by AI supporting capabilities (incl. mapping of future AI Ref. Arch. to HLA)

Examples of AIOTI WG03 Ongoing Activities: High Level Architecture - Future Work

- **The HLA team has identified the following additional topics - their development has not been started yet (beyond HLA Rel.4.0)**
  - Data protection and privacy requirements (see EU GDPR) and related impact on HLA
  - Autonomous systems and IoT and related impact on HLA
  - Platform-to-platform interconnection (cloud based APIs) and related impact on HLA - the context of this study requires further elaboration
  - Impact on HLA of the "Digitizing the European Industry (DEI)" initiative's developments (e.g. joint MSP/DEI WG on standardization in support to DEI)
- **In line with AIOTI objectives, the HLA developments are expected to be used also to support discussion and promote convergence on related matters in the standardization arena (including SDOs, Alliances, For and Associations)**

Examples of AIOTI WG03 Ongoing Activities: Semantic Interoperability

- ***Semantics*** is the study of meaning – in our context the meaning of the data being exchanged
- Traditionally, the **semantics of data being exchanged** is encoded in the producers and consumers of the data, i.e. it is **implicit**ly given as part of the implementation of producers and consumers
- Situation in IoT
  - IoT systems can be huge and dynamic, i.e. there is a large number of changing producers and consumers
  - Producers and consumers do not a-priori know each other
  - Increased value in IoT in case information can be (re-)used for completely new purposes
  - ➢ Implicit encoding of semantics not flexible enough + discovery has to be enabled
- ➢ **Make semantics explicit**, i.e. attach the meaning to the data
- It is about the **agreement on uniquely identified concepts**
- The communicated data are **instantiations** of the concepts
- Concepts, properties and relationships can be **formalized as ontologies**
- **Semantic Interoperability is about exchanging information on the basis of agreed, formalized and explicit semantics**

Examples of AIOTI WG03 Ongoing Activities: Semantic Interoperability - Status and Future Work

- SemIoP is working on the following tasks
  - Gap analysis concerning interoperability standards
  - Semantic Interoperability in European Projects, in particular IoT Large Scale Pilots
    - Support interactions on semantic interoperability
    - Analyze approaches and provide guidance
  - Support discussion and promote convergence across different standardization activities
    - Published **joint whitepaper with oneM2M, W3C Web of Things, IEEE P2413** in August 2016: ***Semantic Interoperability for the Web of Things*** https://www.researchgate.net/publication/307122744_Semantic_Interoperability_for_the_Web_of_Things
    - Ongoing work on **new whitepaper(s) targeting**
      - Developers & system architects: Show how to implement semantic solutions and to achieve semantic interoperability
      - Standardization Engineers / Bodies: Towards best practice in semantic interoperability
  - Promote use of common ontologies and best practices
    - SAREF, oneM2M Base Ontology, SSN, …

Examples of AIOTI WG03 Ongoing Activities: Identifiers for IoT - Analysis

- Identification plays an important role for IoT; In addition to the identification of the Things itself identification is used for several other purposes; Various identification schemes already exist, are standardized and deployed
- AIOTI WG3 has performed a thorough analysis of the identification needs and related standardization for IoT:
  - Evaluated identification needs for IoT and related requirements
  - Classified different identification needs
  - Categorized identifier requirements
  - Provided examples of existing Identifier Standards
  - Considered and discussed
    - Allocation, Registration and Resolution of Identifiers
    - Security, Privacy and Personal Data Protection
    - Interoperability of Identifiers
- Input provided by survey in the international IoT standardization and research community
- Results available at https://aioti.eu/wp-content/uploads/2018/03/AIOTI-Identifiers_in_IoT-1_0.pdf.pdf

Examples of AIOTI WG03 Ongoing Activities: Identifiers for IoT – General Considerations

- No single identification scheme fits all needs
- Various identifiers schemes already exist, are in use and standardized. They are often application or domain specific, but also generic identifier schemes that cover wider application area exist
- Some identifiers (i.e. communication identifiers) are bound to a specific technology and cannot be selected independently

➢ Clearly identify the different identification needs and related use cases during system design

➢ Take into account that IoT systems might be used in a wider context as originally foreseen and have to interact with other IoT systems in the future:

  ➢ Consider existing identification schemes that can handle this wider context or can be easily extended

➢ Security and privacy are important for identifiers:

  ➢ Specific requirements strongly depend on the use case and identified entity

➢ As part of a security and privacy threat and risk analysis, also the specific requirements related to the identifiers have to be identified and relevant legal and regulatory frameworks have to be taken into account

Conclusions and Next Steps

- IoT Standardisation coordination and harmonisation between EU and China, but also globally, need to continue, on topics such as: security and privacy, semantic interoperability, Identifiers for IoT, IoT Reference Architectures and radio spectrum allocations
- To further increase the level of harmonisation of standards between Europe and China an open and transparent exchange of information through mutual participation in research and standardisation activities would be beneficial
- Several key IoT challenges and gaps identified by AIOTI and ETSI can be used to progress the EU-China common views by cooperating and solving several of these key IoT challenges and gaps

Thank you for your attention

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