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Architecture for Scalable, Self-human-centric, Intelligent, Secure, and Tactile next generation IoT

D2.9 – Advisory Board Minutes – Second Meeting

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Work Package	WP2		

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Authors

Name	Partner	e-mail
Ignacio Lacalle	P01 UPV	iglaub@upv.es
Carlos E. Palau	P01 UPV	cpalau@dcom.upv.es

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Executive Summary

This Advisory Board Meeting Minutes report is written in the framework of WP2 of the H2020-funded project ASSIST-IoT (Grant No. 958257). This deliverable constitutes the second out of three deliverables aiming at describing feedback from AB. D2.8 directs this document, which will continue by D2.10.

The content of this deliverable orbits around the organisation of the 2nd formal meeting with the Advisory Board of ASSIST-IoT (a set of 7 people expert in different fields such as 5G, standardisation, edge computing, maritime ports and overall Industry digitalisation or Next Generation IoT) with the partners of the Consortium.

The document relates the preparatory actions that have been performed by the partners to face the meeting in an optimal situation, namely: (i) establishment of a set of questions key to be answered by the AB members, (ii) performance of diverse tasks in a continuous basis to gather impactful feedback from AB's side and (iii) actually organising the meeting in an all-encompassing way.

The core of the document described the debates that took place during the meeting, which was structured in three different sessions (Digital Transformation and standards for IoT, Edge-Cloud Computing Continuum and Resilience and Security-Privacy) and which all AB members participated, altogether with project staff.

The meeting and the previous actions redounded in a set of recommendations and results that have already had an impact in the project. According to this document, a total of 9 new recommendations were drawn (separated into 1 global management consideration, 1 global research direction, 3 technical additions, 2 exploitation points, 1 communication suggestion and 1 standardisation note), as well as 2 new risks, 2 influenced "global" requirements, 4 influenced "stakeholders requirements" and 2 new KPIs.

This document also includes an update of the plan (that is originally feeding on deliverable D2.8), including the tentative arrangement of a physical meeting AB-ASSIST-IoT by March 2023.

The deliverable can be considered closed and complete as it also embeds a rounded-up conclusion accompanied by a set of next actions to be performed.

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List of acronyms

Acronym	Explanation
AB	Advisory Board
ABECI	Advisory Board Expected Contributions Indicators
AI	Artificial Intelligence
CSA	Coordination and Support Action
CTO	Chief Technology Officer
Dx.y	Deliverable No. x of Work Package y
FPGA	Field Programmable Gate Array
HPC	High Performance Computing
IoB	Internet of Bodies
IoT	Internet of Things
KPI	Key Performance Indicator
MEC	Mobile Edge Computing
NDA	Non-Disclosure Agreement
NFV	Network Function Virtualization
NGIoT	Next Generation IoT
P2P	Peer-to-Peer
SD-WAN	Software Defined Wide Area Network
SDN	Software Defined Network
WP	Work Package

1. About this document

This document is the second of a series of three deliverables associated to the interaction of ASSIST-IoT Consortium with the selected Advisory Members. This second version, following the plan set out in deliverable D2.8, reports about the advance in the interactions between the Advisory Board and the ASSIST-IoT Consortium, focusing on the results of the 2nd Meeting with the AB (which unfortunately, due to still-applying COVID-19 associated restrictions, was conducted in a virtual fashion).

1.1. Deliverable context

Table 1. Deliverable context

Keywords	Lead Editor
Objectives	Directly linked with Objective O8, specifically towards achieving KVIs of the communities joined and professional attracted, together with innovative business models delivered. Although not directly related to other objectives, the recommendations provided by AB members are expected to enhance the overall quality of ASSIST-IoT research.
Exploitable results	N/A. Although not directly generating any KER, the recommendations provided by AB members are expected to enhance the quality and impact of those.
Work plan	This deliverable is directly linked to task T2.5 – Advisory Board Management, serving both as guidelines/plan and as an execution report. Indirectly, this deliverable is linked with tasks T2.1, T2.2, T9.2, T9.3 and T9.4, as the interaction/contribution with/from AB members is expected to have considerable influence on the global management of the project and its associated dissemination impacts.
Milestones	N/A
Deliverables	This deliverable constitutes the second out of three deliverables aiming at describing feedback from AB. D2.8 directs this document, which will continue by D2.10.
Risks	Risk#2.5 – Advisory Board members are not able to conduct satisfactorily the required assessment and/or advisory roles. This deliverable describes the actions and results from the interaction with AB members, which should contribute to minimise that risk.

1.2. The rationale behind the structure

The content of the deliverable is organized into seven main sections:

- **Section 2** describes the actions that have been performed by ASSIST-IoT partners in preparation for the 2nd meeting with the AB group. It reports indeed the work performed in T2.5 from M6 to M18.
- **Section 3** depicts the actual minutes of the 2nd AB meeting, indicating the agenda that was followed, the participants and the interventions.
- **Section 4** summarises the outcomes obtained from the interaction with the AB, including recommendations and other results like feedback for risks or requirements of the project.
- **Section 5** updates the original plan, indicating the current timepoint, while **Section 6** lists the actions ahead towards D2.10 (3rd Meeting).
- Finally, **Section 7** concludes the document by reflecting on the advances obtained so far.

2. Preparation towards the meeting

The period between 1st and 2nd AB meetings has been characterised by technical progress of the project (see 2.1). The interaction with the AB has been slightly reduced in comparison with the first 6 months (where their perspective was crucial to address the technical developments). In this regard, the following actions have been performed:

- Creation of a summary of project advances to share the current status to the AB members
- Explanation of different documentation sources that can be consulted to understand the progress of ASSIST-IoT
- Indirect (or even direct) creation of requirements that have been depicted in D3.3.
- Indirect (or even direct) creation of risks that have been depicted in D2.6.
- Peer-to-peer contacts to gain knowledge in several areas (especially regarding 5G and Standardisation)
- Preparation of the 2nd meeting, creating a series of questions and aspects that could be supported/clarified by the AB members.
- Prospective analysis of opportunities for the future months

2.1. Summary of relevant advances and documentation

This sub-section aims at documenting the summary of the project advances that was forwarded to AB members before they were summoned to the 2nd AB meeting. It is interesting as it served the team for writing down the achievements so far, as well as set the foundations for the documentation of the platforms (and all enablers) for deliverable D6.5.

- A summary of the advance with the enablers (including its description) was provided.
- The documentation of advance of transversal enablers was made available by uploading the deliverable D5.1 and the deliverable D5.2 to ASSIST-IoT's public website.
- An explanation of the basic concepts of the architecture deployment and enablers principles was provided (note that an extended reference of this material is available at the end of the Guide for Open Call applicants guide):

The horizontal Planes represent collections of functions that can be logically layered on top of one another. For example, observation data originating from a sensor must pass through the Smart Network and Control plane and be processed on the Data Management plane, before being presented to an end-user in a GUI application on the Applications and Services plane. Verticals, on the other hand, represent functions targeting NGIoT properties that exist either independently on different planes or require the cooperation of elements from multiple planes.

Microservices

ASSIST-IoT architecture proposes to **follow a microservice software architecture**, which pursues building applications as suites of services. The goal of the microservice architecture of ASSIST-IoT is to allow the inclusion of small applications (called **enablers)** that are each responsible for executing one function autonomous, independent, and self-contained.

Enablers encapsulation

The project introduces the abstraction term "enablers", which will consist of a group of microservices, each of them served over a container, acting towards a single goal (i.e., to provide a specific functionality). Each enabler provides a single point of entry (interface) to communicate with it, without exposing the internal communication mechanisms between its components, thus having an **"encapsulation"** of microservices. In essence, an enabler is a collection of software (and possibly hardware) components - running on nodes - that work together to deliver a specific functionality of a system.

Containerisation, Kubernetes and Helm charts

ASSIST-IoT proposes to employ a *containerised* approach that will allow developers to create each microservice over the most fitting OS and language. As all components on the edge appliance will be containerised, it will allow to search and infer which equipment can handle which containers, and enables applications to be dynamically deployed and moved, and their resource utilisation to be monitored.

In ASSIST-IoT, **Kubernetes**[1] (k8s) has been selected as the main technology for containers orchestration, and, therefore, for enablers orchestration. In addition, the modified distributions of Kubernetes that target constrain devices must be used in specific cases: microk8s, k3s and k0s.

In particular, deployment of enablers in ASSIST-IoT are expected to be as follows:

- Enabler components must be put together and be containerised as pieces of software – enablers (using Docker)
- Enablers must have "standardised" interfaces following ASSIST-IoT guidelines.
- Enablers -to be deployed- must include enough networking features and other specifications, needing to be annotated as Helm charts.

- To accompany the previous, the deliverable D3.6 (2nd iteration of architecture) was already made public on ASSIST-IoT's website.
- In addition, a series of remarks related to specific technical aspects of the project were communicated to the members (in order to be prepared to answer the questions that are described in Section 2.2):
  - Clustered node implementation without master component
  - The Edge Data Broker enablers' rule-based features are using Lua Scripts (data can be analysed to cause alert events, directed to specific sinks depending on pre-defined conditions, or be blocked from further transmission)
  - The selected technology for the Edge Data Broker is a modified version of the open-source VerneMQ
  - Detailed purpose and objectives of DevSecOps practices and principles were communicated, highlighting the selection of elemental software tools, such as source code repository and version control and the guidelines to be used in ASSIST-IoT.
- The following contributions to SDOs were signalled:
  - AIOTI: Edge Computing Standard Framework Concepts Release 1.0
  - AIOTI: IoT and Edge Computing impact on Beyond 5G: enabling technologies and challenges Release 1.0
  - AIOTI Edge Computing Gap analysis – architecture and functionalities, under preparation
  - AIOTI Computing Continuum Requirements on IoT/Edge Computing & Optical Communication – use cases and requirements, under preparation
  - AIOTI Data space position paper, under preparation
  - BDVA position paper data spaces and interoperability, under preparation
  - EU-IoT White Paper, „A Vision on Smart, Decentralised Edge Computing Research Directions", common publication, 20th September

[1] https://kubernetes.io/

2.2. Relevant questions circulated to AB members

One of the main actions performed during the period between the first two AB meetings was the preparation of a series of questions for the AB members to reflect on and provide feedback upon. The rationale behind this action was to prepare some feed for though for AM members in advance so that discussions within the meeting could be optimised in terms of efficiency.

For doing so, the technical teams (while advancing in their developments in WP3, WP4, WP5, WP7 and WP9, mostly), started identifying a series of aspects that (although being experts/knowers of) would appreciate external advice to be tackled. In particular, technical staff considered that some challenging questions that appeared in front of them would be worth consultation with the Advisory Board. This exercise was tackled all across the board of tasks execution between M6 and M18.

The result of such activities was a list with a series of questions/hypotheses. With the purpose of addressing the proper questions to the fittest AB member (although all of them had the opportunity to intervene and provide feedback over every question), a "categorisation" of the items on the list was performed.

Afterwards, those "questions" were compiled, put together and structured in a homogenised, divided into three clear blocks: (i) relevant challenging points of ASSIST-IoT in that specific area, (ii) questions to understand the perspective of AB members in those regards and (iii) other suggested potential points to discuss in the meeting and in the future related to that field.

The sub-sections below gather the material generated. It is presented as tables to facilitate the read.

2.2.1.Edge-Cloud computing continuum

- Addressed to Prof. Pawel Gepner–

Table 2. Relevant questions for 2nd AB meeting related to Edge-Cloud computing continuum

Relevant challenging points of ASSIST-IoT work in Edge-Cloud computing continuum
• Dealing with decentralisation: is it really possible a system that will not rely somehow in a centralised node (does not need to be cloud, but centralised – e.g., high tier edge node). • How to use package services to be distributed among nodes? • K8s, K3s, K0s in various machines: dealing with them as separated clusters or considering them as nodes joining a bigger cluster mastered by a central node? • Have you found exceptions to the "packaging" of software and hardware whenever creating a distributed edge-to-cloud platform? (our example: MR HoloLens equipment). • Do you think that every use-case needs a so different solution among them that it is really difficult to create a one-size-fits-all architecture?
Perspective from AB members about the topic
• How do you think we should move forward in this sense? • Which is your experience on proposing Edge-to-Cloud architectures? • Which are the baseline technologies that you would recommend? • What about orchestration of services? Docker Swarm? K8s? Other approaches? • Are there any preferred material we should stick to?
Suggested discussion points
1. Edge-to-Cloud orchestration: your experience **2.** Dealing with centralisation-decentralisation – is there the mandatory need of a central node to a certain set of features? (e.g., long-term storage, authentication…).

2.2.1.Standardisation

- Addressed to Konstantinos Karachalios–

Table 3. Relevant questions for 2nd AB meeting related to Standardisation

Relevant challenging points of ASSIST-IoT work in Standardisation
• Gap analysis and matching the project subjects with standardisation work (broad range of initiatives). • Rules for contributions in different SDO, need to be the member, external contributions? Possible cooperation with SDO's vs project results and resources. • Preparation of the contribution: How can we prepare our architecture deliverable to be compliant with pre-normative formats? • How to start new standardisation subject?
Perspective from AB members about the topic
• How do you think we should move forward in the standardisation work? • Which are the best strategies to be followed supported by the Industry? • Are there any preferred material we should stick to? • In case of IEEE SA: o How the working groups are organised and which is best way to contribute in selected subjects? What are currently most active groups in terms of our selected subjects? o What are best practices in the working groups?
Suggested discussion points
1. Gap analysis in standardisation – current most interesting subjects. 2. Most active SDO's and initiatives in the IoT domain. **3.** Best practices for IEEE SA cooperation – participation in the working groups or external contribution.

2.2.1.Data brokering

- Addressed to Dr. Harilaos Koumaras–

Table 4. Relevant questions for 2nd AB meeting related to Data brokering

Relevant challenging points of ASSIST-IoT work in Data Brokering
• Is there any recommended approach for delivering an "isolated" edge data broker enabler? Our current proposal: clustered VerneMQ Data Broker • Should we consider any safety barrier during the deployment of the clustered VerneMQ data broker?
Perspective from AB members about the topic
• Which are the best strategies to be followed supported by the Industry? • Any challenges met during the implementation of clustered broker nodes in other projects?
Suggested discussion points
1. Built-in solutions 2. Experience in other project 3. Communication between the Pods **4.** Security issues due to the clustered nodes

2.2.1.Cybersecurity / DevSecOps

- Addressed to Prof. Jari Collin–

Table 5. Relevant questions for 2nd AB meeting related to Cybersecurity / DevSecOps

Relevant challenging points of ASSIST-IoT work in Cybersercurity / DevSecOps
• How to ensure that all departments in a large industrial company will comply with security principles? → Culture and training and Security Standards ISO 2700X, NIST 800-series and others could be the answer, are there any others? Other approaches do not cover all the possibilities but describe what to do when an incident will happen. • Cybersecurity scope in IoT is broad, due to architectural layer deployment on edge-fog-cloud, is it possible to simplify the scope to guarantee the coverage of cybersecurity objectives to Authentication, Authorization, Availability, Integrity, Confidentiality and Auditing? • DevSecOps is intended to be a cycle in continuous movement from development to operation. IoT deployments at the edge may require build processes for edge computing in a different OS type for a different number of targets and this complicates deployments on all target devices → ASSIST-IoT approach on this is an enabler approach
Perspective from AB members about the topic
• How do you think we should move forward in this sense? • Which are the best strategies to be followed supported by the industry? • Is there any preferred material we should stick to?
Suggested discussion points
1. Focus on cyber scenarios associated with attacks and defence techniques as a way to prove cybersecurity monitoring mechanisms. **2.** Security architecture vs security design. Implementing a broad scope of security functions on the architecture could be out of the scope of ASSIST-IoT i.e. Network segmentation policies, Networks security devices, or dedicated Kubernetes security policies

2.2.1.Digitalisation in Maritime ports (and other verticals)

- Addressed to Mr. José García de la Guía–

Table 6. Relevant questions for 2nd AB meeting related to Digitalisation in Maritime Ports

Relevant challenging points of ASSIST-IoT work in Digitalisation in Maritime ports
• The project aims at demonstrating the capabilities of wireless technologies in the port environment e.g., remote operation of cranes. How to tackle the heterogeneity of wireless networks (FluidMesh, WiFi, 4G&5G…)? Is there a one-fits-all solution in the market? • The project will make use of different technological systems deployed in ports (PCS, PDS, TOS…) How to tackle the heterogeneity of data formats and systems coming from different providers and vendors? • How to alleviate the negative impressions from port staff concerning the introduction of new digitalization solutions? Will the technology replace my job? • How to efficiently reach the port authorities and/or terminal operators IT departments and be responsible to allow access to the source truth? • How to mitigate the fear of sharing information between customers and providers, as well as between competitive providers systems? • The project will make use of cartography, but there are different format already in place (map, .dwg, etc.) How to promote the standardisation of ports digital processes?

• The project will access to the TOS, but it could happen that the latter should be updated affecting to our project developments due to incompatibilities. How to efficiently manage this type of integration and deployment of different digital systems?
Perspective from AB members about the topic
• How do you think we should move forward in this sense in the previously identified blockages? • Which are the best strategies to be followed supported by the Industry? • Are there any preferred SDO we should stick to? • In this pandemic crisis, in which travelling is not widespread, which are the top maritime events that someone should attend in order to be aware of the latest industry trends and developments?
Suggested discussion points
• Interoperability blockages on data formats and systems for digitalization • Strategies for smooth cooperation between different competitors • Security / Fear of exposing data outside port communities (either to public clouds or to external actors) • Security / Fear from port staff with respect to the introduction of new digital systems in their daily jobs (cameras, AGVs, GPSs, etc)

2.2.1.Reliability

- Addressed to Prof. Joydeep Mitra–

Table 7. Relevant questions for 2nd AB meeting related to Edge computing

Relevant challenging points of ASSIST-IoT work in Edge Computing
• We are handling pilots with low number of connected sites and elements connected to the same network. Are there ways to better/worse extrapolate to the behaviour in a largest connected network? • How to introduce reliability considerations into the architecture?
Perspective from AB members about the topic
• How do you think we should move forward in this sense? • Taking into account what we have prepared so far, what are the most important resilience challenges in each of the pilots and in the approach as a whole? • Where are the dangers that we may not see from the inside -- when what we do is approached form the outside…

3. Second Advisory Board Meeting

3.1. Agenda

This time (2nd AB meeting), instead of arranging a series of "individual" sessions interviewing and discussing with each AB member separately, the meeting was organised (**that took place on February 1st 2022 and lasted 1h45'**) co-located with an ASSIST-IoT Plenary Meeting. Therefore, all partners had the opportunity to interact with the Advisory Board, ensuring a successful collaboration.

Drawing from the categorisation set out in Section 2.2. and the expertise declaration informed via deliverable D2.8 (see Figure 1), the following simplifications towards building the agenda were done (see also how the categories were defined):

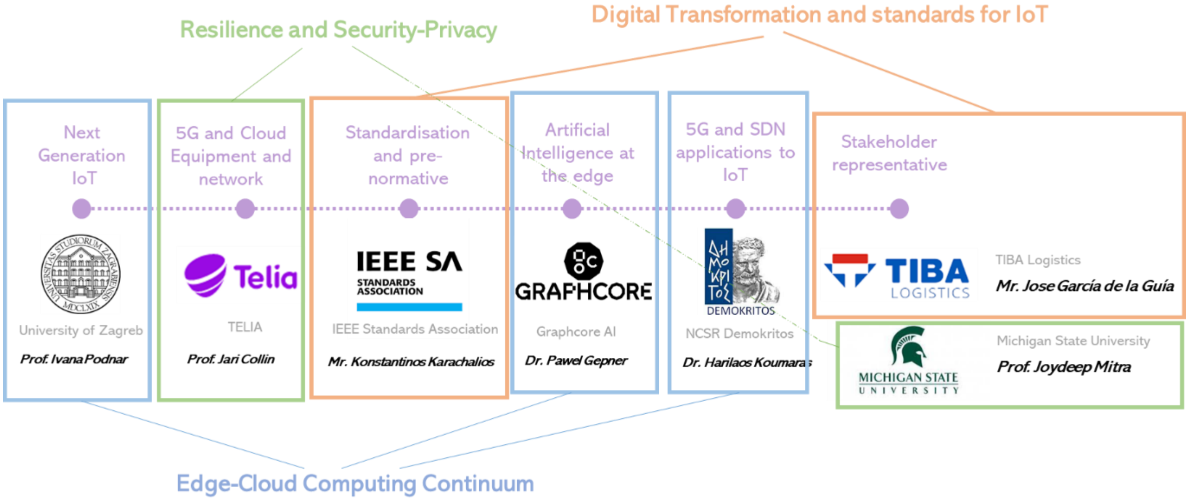
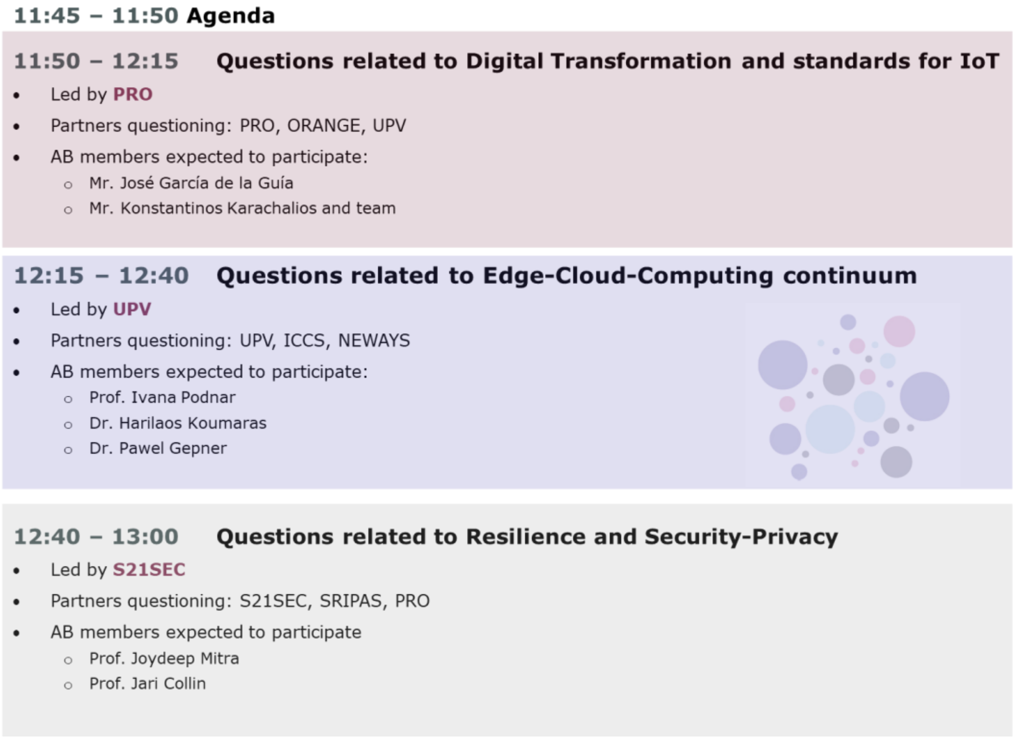

Resilience and Security-Privacy
Digital Transformation and standards for IoT
Next Generation IoT
5G and Cloud Equipment and network
Standardisation and pre-normative
Artificial Intelligence at the edge
5G and SDN applications to IoT
Stakeholder representative
University of Zagreb
Prof. Ivana Podnar
Telia
TELIA
Prof. Jari Collin
IEEE SA
STANDARDS ASSOCIATION
IEEE Standards Association
Mr. Konstantinos Karachalios
GRAPHCORE
Graphcore AI
Dr. Pawel Gepner
DEMOKRITOS
NCSR Demokritos
Dr. Harilaos Koumaras
TIBA LOGISTICS
TIBA Logistics
Mr. Jose García de la Guía
MICHIGAN STATE UNIVERSITY
Michigan State University
Prof. Joydeep Mitra
Edge-Cloud Computing Continuum

Figure 1. Topic and AB member categorisation for AB meeting agenda

Considering the previous, the agenda was defined as follows:



11:45 – 11:50 Agenda

11:50 – 12:15 Questions related to Digital Transformation and standards for IoT

- Led by **PRO**
- Partners questioning: PRO, ORANGE, UPV
- AB members expected to participate:
  - Mr. José García de la Guía
  - Mr. Konstantinos Karachalios and team

12:15 – 12:40 Questions related to Edge-Cloud-Computing continuum

- Led by **UPV**
- Partners questioning: UPV, ICCS, NEWAYS
- AB members expected to participate:
  - Prof. Ivana Podnar
  - Dr. Harilaos Koumaras
  - Dr. Pawel Gepner

12:40 – 13:00 Questions related to Resilience and Security-Privacy

- Led by **S21SEC**
- Partners questioning: S21SEC, SRIPAS, PRO
- AB members expected to participate
  - Prof. Joydeep Mitra
  - Prof. Jari Collin

Figure 2. 2nd AB meeting agenda

3.2. Minutes

The Project Coordinator (UPV – Professor Carlos E. Palau) presented the three blocks of the agenda.

Block #1: Digital Transformation and standards for IoT

Q1: Is digital transformation open to all businesses? Small companies, big enterprises, all type of verticals?

Mr. Jose García: depends on how one defines the digital transformation. Everyone wants to say that they are doing digital transformation just installing devices, but the truth is that the actual transformation is to **change the business**, change the processes and orbit them around digitalization. From TIBA's company, 2 spin-offs have been generated to deliver digital services. Internal businesses still adapting to digital tools. It is a long run.

Q2: What should drive digital transformation? Migration, on-premises equipment, adapt to be able to compete?

Dr. Harilaos Koumaras: For ASSIST-IoT it is important to think about how IoT (collecting data and actuation) can change business analysis, meaning how the business is performing. Nodes are becoming more intelligent and the application that a company now offers is moving to the actual source of the data. It is now a matter of shifting the mindset to expand their services in order to include the programmability of IoT nodes completely.

Q3: How could we merge heterogeneous data? Interoperability? How can this be tackled? How to mitigate the heterogeneity of data?

Prof. Ivana Podnar: whether the raw data is going to be shared or just some sub-set of processed data needs to be stored is a relevant question here. How models are built and shared is also an important point to be considered.

Q4: What about the fear of sharing the data?

Mr. Jose García: There is data that must be shared and others that not. It is more comfortable (and people in ports are more willing to) share data if the platform transparently guarantees security, anonymisation and encryption of data. In addition, the fact of including blockchain for integrity and auditing of transactions endorsed by smart contracts is also a differential component.

Q5: How could we promote standardization of the things we are developing?

Mr. Alpesh Shah (on behalf of Mr. Karachalios): When it comes to formats in IoT: There is a lot of data that is difficult to: (i) sift useful data, (ii) too dependent on use-cases, (iii) not very ready for cybersecurity, (iv) GDPR issues, (v) data formats are at this point so wide it is difficult to grasp the future.

When it comes to the imprint of AI algorithms in the edge, there is a lot of unstructured (not all useful) data. What IEEE is seeing is that this is an aspect to be further studied w.r.t standards: how to sift which data is useful depending on the application cases. In addition, the formulation of data ontologies per "application field/sector" should also a prominent matter to be tackled by standardization in the months/years to come.

Mr. Sri Chandra (on behalf of Mr. Karachalios): Federated Learning is the hottest topic now in IEEE standards. Privacy/Cybersecurity of data is also a trend, in terms of building trustable systems. Actually, trust in the system is a more relevant topic than data heterogeneity from certain standpoints.

Q6: How has the pandemic changed the industry in terms of the digital transformation/IoT/operations/work?

Mr. Jose García: Enormous increase in cost. Difficulties hiring people. Expensive to deliver software, to perform research. Everything is harder and more expensive. Inflation of prices is a large problem. The unavailability of devices and components is a huge real problem.

Block #2: ECC continuum

Q1: Which is your experience in proposing these edge-cloud computing architectures? Should we change our paradigm?

Dr. Harilaos Koumaras: The ECC is a challenge that is currently under investigation, the use-case driven architecture is still something that is there. Creating one common architecture that fits all is still not a reality. Even though EC has identified this challenge, it becomes a discussion that is entering the 5G realm where the programmable-APIs have their role. ETSI and other initiatives are supporting this API programmability as the key for tackling all sectors. Independently of the underlying technology selected (k8s, OSM, etc.), the more relevant thing is the usage of the nodes, in terms of using them under exposed APIs that must be dynamic and programmable.

Dr. Pawel Gepner: Two aspects: (i) standardization of APIs and interfaces, which leads to the usage of containers is very extended, k8s is OK but also vendor technologies like Vodafone or GSK have their place on how the Industrial companies are tackling the edge-cloud deployment. (ii) moving the computing part to the edge instead of relying too much on the cloud. Specially, AI on the edge is being reinforced. GraphCore is adding graph algorithms in the edge so that the response is as quick as possible as it is closer to the data source. Containerisation helps interact between layers and move performance to the edge. The bad news is that this world is still moved by private vendors.

Prof. Ivana Podnar: IMHO the architecture is quite general as it is hierarchical. The decentralization is very well achieved with the horizontal interaction between nodes within the same tier. This is a very good approach. ASSIST-IoT should stress the links that bring decentralization to the picture.

Have you considered only k8s or have proposed the use of others?

ASSIST-IoT partners Already k3s and microk8s have been tested and are suitable and accepted for ASSIST-IoT architecture. The idea is to allow the usage also of k0s and other assimilable technologies to be part of clusters.

This was agreed as a very strong point that ASSIST-IoT must stress out.

Q2: How to approach the custom gateway? What to use? Dedicated AI processors, FPGA?

Dr. Pawel Gepner: From experience in INTEL. IoT gateway based on INTEL accelerator and to be included in the GPU. Therefore, the debate is whether to use FPGA or GPGPU (including AI programmability). ATOS is using GPGPU as an intelligent unit inside and to use the rest of the components under a low-voltage scenario.

Conclusion: recommended: GPGPU and low-voltage SOC and design the components around this paradigm and purpose. The biggest challenge for implementation and usability is to make the interfaces as much universal as possible (standard APIs, mature components, etc.).

Block #3: Resilience and Security-Privacy

Prof. Joydeep Mitra: Privacy/security must be separated out from resilience.

When we try to implement data security, we need to make sure that we have the most secure channels. Certain channels of communication may be less secure than others but we should consider having them to implement redundancy. Redundancy must be looked for. Sometimes this is overlooked. Secure channel + redundancy. Should we dismiss less secure channels? To solve this question this must be decoupled into: (i) readiness and (ii) reliability.

With regards to. resilience. How do we guarantee that the system retains its minimal functionality in the presence of compromises? Can we break down the resilience strategy into tiers? If this breaks, how do we ensure that minimal functionalities are retained?... Breaking this down into multiple tiers might be a proper strategy. Adding interconnection between layers is also relevant, including how to bounce back from one to another. This also allows to isolate functionalities and add redundancy.

Q1: How to tackle the reluctance of companies/workers to accept and adopt new technologies? Or what is the same… how to ensure sustainability of technological solutions?

Dr. Pawel Gepner:

Security is key. Something for something. Nothing for nothing. In the AI market, people are very open to sell data as long as it is not very connected to their profits. Whatever is related to customers or their model (sensitive data), this is impossible to achieve. Academia is much more ready to share data and to adopt technological solutions.

Mr. José García: It is a question of which value are you bringing to the business? In the end, companies are not owners of most information (customers are the actual owners). The most important point is to know who the owner of the data is, and then have their permission. Logistics industry is reluctant to share their info. But now the power is not having the data (no longer), but WHAT you are doing with that data. If the processes over that data can be directly linked to the cash flow, benefits, less consumption of resources, improving the quality of the data for making informed decisions, making things happening before, anticipating problems that might be extremely costly to the company, etc. then there is where everything starts to be opened and then reluctance disappears. Conclusion: If you want to do business with data, add value directly linked to benefits (or things that lead to the best benefits rate).

Dr. Harilaos Koumaras: (from the academic perspective).

Academia needs the tools that facilitate interaction with the private sector. The tight collaboration the beyond duration of projects must happen rooted in long-term relations such as technology transfer contracts. DIHs must play a key role in have this happen. Innovation cannot be kept just in projects, collaboration beyond projects (based on data sharing, common exploitation of results, usage in production environments after the project…) is a crucial point that must be looked for in order to foster sustainability of technological solutions.

Prof. Joydeep Mitra:

Industries are very protective of their data. However, it is also a duty of the technology providers to express that very often the technology does not need very revealing data, it is enough to decide “must have” data or even anonymized data to perform analysis that can provide benefits to the companies. Curation of the data and education of stakeholders to those coordinates is also key. Transparency is a value that must be enforced.

4. Feedback and outcomes

4.1. Recommendations

Drawing from the discussions taking place in the second meeting (sew 3.2), the T2.5 team of the task made a synthesis and interpretation effort to translate the observations from AB members into recommendations fitted to ASSIST-IoT workplan. The objective of this action was to come up with a set of actionable indications that should drive (or fine-tune) the execution of the project. The results of this activity were the following:

Table 8. Recommendations from AB second meeting to be considered in ASSIST-IoT workplan

Topic	Recommendation	Potential impact in the workplan
Global management considerations	The inflation of prices and the unavailability of devices and components is a huge real problem.	This recommendation has directly compelled ASSIST-IoT to generate a specifically-devoted risk in the Risk Management strategy.
Global research directions	The resilience of the system is paramount and should be tackled in ASSIST-IoT drilled down in diverse tiers	This aspect, which was till now undermined, will be included as part of the next iteration of the architecture design document (D3.7).
Technical additions	How models are built and shared is also an important point to be considered	Federated Learning task is taking this comment into consideration in the implementation of T5.2 enablers, including explainability and no repudiation in the mix of features.
	Conclusion: recommended: GPGPU and low-voltage SOC and design the components around this paradigm and purpose	The design of the GWEN (edge gateway of ASSIST-IoT) has considered this and does not include a FPGA but a SOC and a GPU.
	The redundancy of network connections is an aspect that is normally overlooked.	The multi-link enabler of ASSIST-IoT (T4.2) has been moved up in the priority list (aims at allowing multi-link connections in case one goes down).
Exploitation	We must focus on transmitting the idea to stakeholders that the actual transformation is to improve the business, being ASSIST-IoT the vehicular tool for achieving that goal.	For aligning this perspective with ASSIST-IoT deliveries, T9.4 proposed (and has performed) a series of actions framed within a spin-in agile methodology with project stakeholders.

	It is key to transmit to stakeholders interested in ASSIST-IoT that a crucial perspective is to change the mindset toward edge-IoT nodes computation and programmability.	The abovementioned spin-in agile action included, to cover this recommendation, the creation of MVP feature sets to let stakeholders know early how the traits of ASSIST-IoT technology in this regard (edge nodes) can directly benefit their businesses.
Standardisation	Data sifting based on rules per application case and the use of specialized ontologies should be a prominent matter in standardization.	The interaction between T9.3 and T4.3 (semantics, ontologies, data aggregation, annotation, etc.) has been increased. Participation in standardization groups related to data sifting and ontologies has been boosted.
Communication	Long-term relations with other projects, with DIHs and achievement of technology transfer contracts must play a key role.	WP9 has created specific KPIs to ensure coverage of these aspects (see deliverables D9.2 and D9.5)

4.2. Other results

As indicated in the introduction of Section 2, several activities (apart from the meeting) took place with the AB members that led the Consortium to consider the following as tangible results:

Identified risks coming from AB members included in deliverable D2.6 (2):

1) **Risk. Name**: Encapsulation exceptions; **Risk. Description**: Some enablers (due to the underlying technologies/libraries that they use) cannot follow the encapsulation rules set out for ASSIST-IoT enablers (k8s, Helm charts...).; **Rationale from AB comment to risk introduction**: Comments from Prof. Podnar made the team realise that in case some enabler would not be able to stick to the well achieved encapsulation+k8s approach, this could be considered as a serious shortcoming.
2) **Risk. Name**: Global chip shortage; **Risk. Description**: The Global Chip Shortage will probably affect the delivery of procured equipment needed to: (i) produce the GWEN, (ii) carry out on-premise pilots; **Rationale from AB comment to risk introduction**: Direct introduction coming from Mr. García's comment about inflation and devices unavailability (and the impression that this will be sustained during foreseeable future).

Requirements (technological) coming from AB members included in ASSIST-IoT (2)

1) **Req. Number**: R-C-6 ; **Req. Name**: Data Persistence and Trust; **Rationale**: Comments from Mrs. Alpesh and Mr. Karachalios about the relevance of trust and data representation (including sifting) have made the partners in WP3 to enhance the description of this risk (that was already existing in the first version of requirements identification).
2) **Req. Number**: R-C-7; **Req. Name**: Edge-oriented deployment; **Rationale**: Comments from Dr. Koumaras made partners realise that the edge-orientation of the platform must be considered not only as a byproduct of allowing smart orchestration on edge nodes and the creation of the GWEN, but also a "philosophy and mindset change" that must be fostered throughout all technical and impact actions of the project.

Requirements (stakeholders') coming from AB members included in ASSIST-IoT (4)

1) **Req. Number**: R-P1-12; **Req. Name**: CHE authentication; **Rationale**: Feedback was received about the emergent need of the machine-to-machine communications in Industrial environments to also be authenticated, authorized, etc. (space that was usually reserved to human-machine interactions).
2) **Req. Number**: R-P1-18; **Req. Name**: Industrial and Safety protocols support; **Rationale**: Similar to KPI5.2.1, in order to boost safety, thus trust, thus confidence, thus willingness from workers to accept and adopt modern digital technologies.
3) **Req. Number**: R-P1-21; **Req. Name**: Remote reliability capabilities ; **Rationale**: Related to the multi-link and resilience/redundancy observation.

4) **Req. Number**: R-P2-9; **Req. Name**: Assessment of personal exposure to UV radiation; **Rationale**: Same as R-P1-18.

(*Bonus track – not planned as an outcome from AB-ASSIST-IoT partners interaction*): Addition of KPIs coming from AB input included in D8.1 (2):

1) **KPI Number**: KPI4.3.1. **KPI Name:** Streaming annotation latency. **Rationale:** Drawing from the comment that semantic interoperability is inserted in processes, as well as the relevance of these techniques for standardization.
2) **KPI Number**: KPI5.2.1. **KPI Name:** Work time- time saving for workers. **Rationale:** Drawing from the comments by Mr. García about the reluctance of staff in the Industry to accept new IoT (or other new digital) technologies that could be understood to substitute their role, and also link with the need to share data for improving their processes (the time they devote to certain tasks), a KPI has been created to assess ASSIST-IoT capacity to tackle these points.

4.3. ABECI Analysis

Paying attention to the directives created in D2.8, the ASSIST-IoT managing team created a set of specific KPIs to formalise the goals and expectations related to the Advisory Board participation in the project. The so-called Advisory Board Expected Contributions Indicators (ABECIs) are used to track and monitor the influence (and level of support) that the project is receiving from its AB members. This is also conceived as a tool for improving the relationship with the members, as it is a live asset being enhanced during the project. The evolution of those KPIs after the 1st half of the project is:

Table 9. Advisory Board Expected Contributions Indicator

Advisory Board Expected Contributions Indicator (ABECI)	After 1st Meeting (M6)	After 2nd Meeting (M18)	Expected (final) value
Risks identified from AB members and added to ASSIST-IoT risk mgmt. procedure.	0	2	4 risks
Pre-normative doc. of ASSIST-IoT outcome following standardisation template	0	0	1 doc.
Participation in standardisation working groups introduced by AB member	0	1 (AIOTI)	2 contributions
Recommendations of AB members becoming actions in ASSIST-IoT workplan	8	17	20 recommendations
Requirements (technological) coming from AB members included in ASSIST-IoT	0	3	4 requirements
Requirements (stakeholders') coming from AB members included in ASSIST-IoT	0	4	10 requirements
Liaison actions with external projects driven by AB-ASSIST-IoT interaction	0	0	4 actions
Attendance to events driven/guided/conducted by AB members	0	0	3 events

Reflecting about the numbers above, the interaction with AB members is meeting the expectations but much work is still needed to be performed with regards to leveraging their networks/knowledge/expertise/experience in both research and commercial projects with the goal of enlarging ASSIST-IoT presence (in events, standardization fora, other actions). Whereas their early (in M6), and more consolidated (in M18) feedback is already influencing several parts of ASSIST-IoT workplan, this consequence is expected to be increased further during the second half of the project.

5. Meetings plan update

As it was set out in the Grant Agreement, **two formal physical AB meetings** were planned to be conducted during the action, with other additional two feedbacks to be requested in key moments of the action. Apart from those, it is planned that continuous mutual feedback will be conducted via scheduled teleconferences and P2P meetings.

However, up to M18 (the moment where this deliverable is being generated) the restrictions (associated to COVID-19) have still applied across Europe, preventing physical meetings to be organised. It is only now that in-person sessions are being resumed for research projects, so the original plan could start being re-taken from this point on (not precluding further pandemic outbreaks that could revert the situation back again).

Considering the previous, the "updated planning" (by M18) slightly complements the one designed in M6 as follows (in blue the updated plan – D2.8 schedule is maintained in black for reference):

- Virtual meetings: Teleconference calls will be (are being) properly scheduled to keep track of advances and to get feedback and other contribution from AB members. Planned dates for these meetings are:
  - Initial: first contact. Individually with each member (done before M6).
  - General assembly with all Advisory Board members and several representatives of ASSIST-IoT Consortium (done after M6).
  - Globally, each 3/4 months, in order to keep continuous feedback with enough time to steer direction of research/impact (done via email mostly).
  - Coinciding with key moments of the project: e.g., launch of Open Calls, before/after project review, before/after pilot demonstrations… (AB members were informed about the Open Call opening).
- Face-to-face meetings: ASSIST-IoT partners plan to have two physical meetings with the Advisory Board, coinciding with Plenary/Technical Meetings of the project. Planned dates for these meetings are:
  - ASSIST-IoT Technical Meeting – M16 – February 2022 (Done in M16 – virtually – 2nd AB meeting)
  - ASSIST-IoT Plenary Meeting – M29 – March 2023 (the idea is to hold this one in a physical fashion, restrictions allowing)

This plan will be updated at in D2.10, adjusting to the timeline and advances of the project.

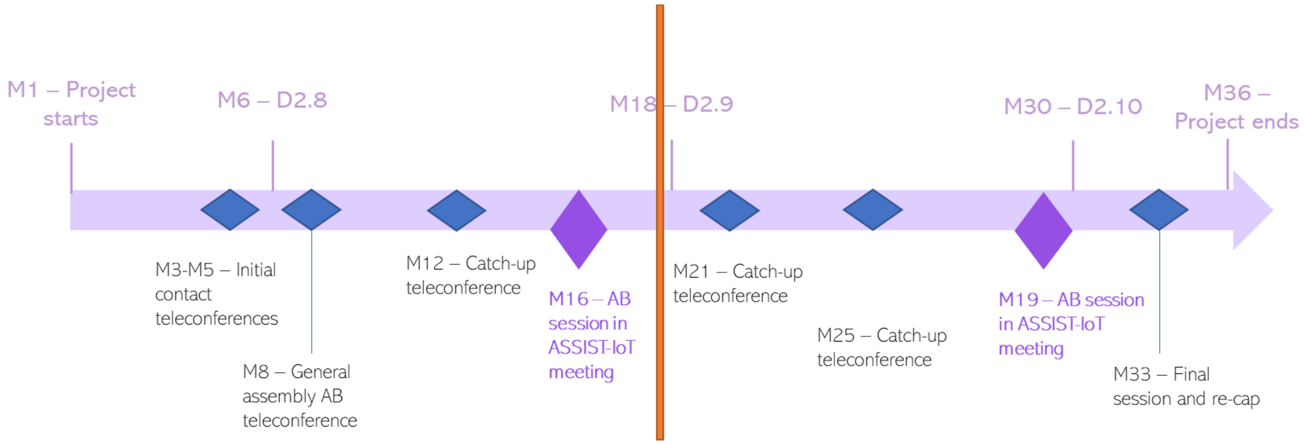

M1 – Project starts
M6 – D2.8
M18 – D2.9
M30 – D2.10
M36 – Project ends
M3-M5 – Initial contact teleconferences
M8 – General assembly AB teleconference
M12 – Catch-up teleconference
M16 – AB session in ASSIST-IoT meeting
M21 – Catch-up teleconference
M25 – Catch-up teleconference
M19 – AB session in ASSIST-IoT meeting
M33 – Final session and re-cap

Figure 3. Advisory Board Meetings plan

As it can be seen, the plan is being followed despite the difficulties, and the Consortium is committed to enhancing its interaction with AB members, as their inputs are proving to be useful to maximise outcomes of the project and good evolution of technical developments.

6. Next actions

According to the plan and the recommendations provided in the second meeting(s), and following the original plan and committed activities, the most immediate actions are the following:

- To share the next round of technical deliverables (being completed in M18, at the same time as this document).
- To share the next round of impact deliverables (being completed in M18, at the same time as this document).
- To share the conclusions out of the 4th Plenary Meeting of the Project (physical, Valencia, May 2022) and also the results of the mid-term review that will take place on June 30th, 2022.
- To keep virtual communications with them in order to enlarge/enhance requirements, KPIs and workplan of the project.
- To arrange a general assembly (with all AB members and ASSIST-IoT representatives) for March 2023 (M29 of the project).
- To prepare documentation, next actions and update of the plan settled in this document towards the catch-up meetings (virtual) in M21 and M25.
- To apply recommendations in Table 3 in the different points of the workplan. These hints must be shared by the Project Coordination with all WP leaders to ensure proper addressing across parallel tasks.
- To apply conclusions realised after Table 4 to improve the settled ABECIs.
- To keep continuous communication with AB members in case of potential joint-collaboration opportunities (e.g., dissemination events, EU-IoT organised calls, etc.).
- Elaborate over the suggested discussion points that were not deepened enough during the meeting and aftermath actions (see Section 2.2).

7. Conclusions

After half of the project has been conducted, it could be said that the interaction with Advisory Board members has been fruitful so far. A total of 17 recommendations that have translated into actual additions to the project work plan have been counted, as well as their influence on different actions like risk identification, requirement elicitation and KPI definition. In addition, two “official meetings” have already been conducted (unfortunately, virtual), where valuable feedback has been obtained, ensuring technical developments and innovative approach of ASSIST-IoT to be kept sound also from an external set of eyes. In addition, some relevant conclusions have been extracted on how to move forward, generating a reasonably healthy list of actions to be tackled during the next months. These conclusions will help the Consortium to prepare ahead of the 3rd AB meeting (in March 2023), which will hopefully be conducted physically.

The Consortium expects to keep up with the good work in this regard and perform a successful, mutually beneficial interchange with AB members throughout the project duration.