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CROSS FERTILISATION THROUGH ALIGNMENT, SYNCHRONISATION AND EXCHANGES FOR IoT

H2020 – CREATE-IoT Project

Deliverable 01.09

Public-Private Partnerships collaborative event

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Dissemination level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Summary					
No and name	**D01.09 Public-Private Partnerships collaborative event**				
Status	< Released>	**Due**	m26	**Date**	28-02-2019
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Editor	R. Armitt Little (ATOS)				
DoW	This deliverable is carried out under the umbrella of task T01.01 - IoT Focus Area coordination and road mapping. Its stated is aim is to arrange a collaborative event with invited IoT LSP projects and PPPs representatives to present to the former the outcomes of interactions of CREATE-IoT with PPPs in alignment with coordination goals of task T01.01.				
Comments					

Document history			
Rev.	**Date**	**Author**	**Description**
0.00	19-10-2018	SINTEF	Template/Initial version.
0.01	03-01-2019	SINTEF	General information and proposal for document structure.
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0.06	23-05-2019	SINTEF, ATOS	Refinement report
1.00	29-05-2019	SINTEF	Final release.

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1. EXECUTIVE SUMMARY

1.1 Publishable summary

Developing and enlarging the European IoT ecosystems requires collaboration and coordination among various European Partnerships and strong links between communities of IoT users and providers, to discuss, align and plan research and innovation agendas for development and deployment of IoT technologies and applications across various industrial sectors as part of the next Framework Programme for research and Innovation.

The aim of the workshop:

- Present the state-of-play and developments of European research and innovation landscape related to IoT
- Present the IoT Large-Scale Pilots Programme projects outcomes, the value proposition, the gaps identified and highlight the next steps for sustainability and scaling up the results
- Discuss and provide recommendations for the future strategic directions for EU Research and Innovation from across the different European partnerships
- Explore the role of European partnerships with industry in the future and analyse the concept for future European partnerships under the "Horizon Europe" EU Framework Programme for Research and Innovation (2021-2027)
- Focus on European industry-driven priorities for converging technologies such as IoT/IIoT, 5G, AI, DLTs, edge computing in manufacturing, processing, construction, ICT and automotive.

The event was organised in six sessions that covered the following topics:

Research and Innovation context – including an overview of the IoT/IIoT research and innovation activities in Europe and the EC plans.

IoT Large-Scale Pilots Programme session included IoT Large-Scale Pilots Programme projects presentations covering achievements, future work, potential for sustainability and scaling-up.

European partnerships strategic directions and research priorities in a global context session involved different European partnership initiatives that presented their positions on specific themes focusing on specific activities, research, innovation and deployment priorities and future plans.

Panel 1 focused on future research, innovation and deployment agenda with the panel speakers analysing, and discussing the strategic directions, the research priorities, the gaps while presenting their expectations for future research and innovation.

Panel 2 focused on industry-driven priorities for converging technologies such as IoT/IIoT, 5G, AI, DLTs, edge computing and the impact of new European partnerships. Strategic Value Chain on Industrial Internet of Things (IIoT) discussions focused on the SWOT analysis that will generate clear recommendations to boost European research, innovation, deployment and investments in intelligent infrastructure that will have a significant impact on the European industry, job creation and jobs.

The final part included a wrap-up session and the presentation of a short overview future activities from the Horizon Europe perspective and considering IoT/IIoT as part of the Next Generation Internet.

The collaborative CREATE-IoT event with IoT LSPs and PPP is a follow-up to interviews carried out by CREATE-IoT and PPP representatives during 2017 and 2018 with the scope to link with PPPs to identify areas of potential collaboration and discuss the areas that the PPPs

Strategic Research and Innovation Agenda (**SRIA**) relate to IoT, and for CREATE-IoT to provide feedback from a common sector-neutral IoT specific view.

The collaborative event is organised to offer a direct interaction between the PPPs and the LSPs with the main aim for the PPPs to discuss their roadmaps with the shop-floor LSP pilots. The spirit of the event fosters a collaborative atmosphere where the LSPs fully engaged to give their perspective and feedback to the PPPs and provide input on what innovations and research should be prioritised in PPP SRIAs based on solid piloting experience / results.

The event collocates with the ARTEMIS Technology Conference 2019 in Amsterdam held on the 16-17th April 2019.

1.2 Non-publishable information

None, the document is public.

2. INTRODUCTION

2.1 Purpose and target group

The overall aim of the event is to better align IoT LSPs and PPPs and other EU initiatives in relation to their research strategy in terms of the IoT FA, and common vision looking forward to Horizon Europe.

The event´s primary goals related to the IoT European Large-Scale Pilots Programme are for:

- PPPs/EU Initiatives to engage with IoT LSPs and present directly to the IoT "shop-floor" their strategy in areas relevant to the IoT FA and vision looking forward to Horizon Europe.
- Giving LSPs the opportunity to present highlights of their piloting experiences, gaps encountered, and recommendations for future innovations and research.
- Enabling CREATE-IoT to analyse and promote common strategic research and innovation goals.

2.2 Contributions of partners

ATOS provide overall coordination and execution of the event, agenda proposal and invites.
SINTEF provide logistics in identifying and securing the event location and sending invites.
GRAD contribute to the organization of the event and sending invites.
ISMB contribute to the organization of the event and sending invites.

For the different PPPs the CREATE-IoT partners were engaged to make the link. Cooperation with U4IoT in organising the event.

- EURobotics (SINTEF/NUIG)
- 5G IA (SINTEF/LINK/ISMB)
- ECSEL- AENEAS, ARTEMIS-IA, EPoSS (SINTEF)
- ECSO (ATOS)
- BDVA (ATOS/GRAD/SINTEF)
- AIOTI (SINTEF/NUIG/GRAD /ETSI)
- EIP-SCC (ISMB)
- EFFRA/FoF (GRAD)
- ETP4HPC (SINTEF)
- Industry 4.0 (ANYSOL)
- Standardisation (SINTEF)

Contact with the LSPs made through the activity groups in this case AG01.

- ACTIVEAGE (NUIG)
- AUTOPILOT (SINTEF)
- MONICA (ISMB)
- SYNCHRONICITY (ATOS)
- IoF2020 (SINTEF)

EC through DG CONNECT was co-organising the event.

2.3 Relations to other activities in the project

This event is organized within the framework of activities of CREATE-IoT project falling under WP01 on Coordination and Support to the IoT Focus Area.

This workshop continues the work started in deliverable D04.03 "EU research and innovation activities overall plan", during which CREATE-IoT analysed the Strategic Research and Innovation Agendas (SRIAs) or equivalent documents of coming from relevant entities or associations linked to the PPPs, JTIs, EIPs and other industrial associations involved in defining, implementing or supporting research and innovation that involve IoT. D04.03 provided an initial mapping of the IoT footprint across the objectives and priorities in each of those SRIAs.

D01.09 will provide valuable input for future deliverables of the project:

- D01.11 EU research and innovation activities overall plan – Evaluation (m36)
- D01.12 EU IoT value chain integration framework (m36)

3. WORKSHOP OBJECTIVES

3.1 Workshop description

The increased demand for the IoT/IIoT technologies and applications requires a coordinated effort in Europe to accelerate the development and deployment of intelligent devices, create "systems of systems" by connecting the edge of IoT/IIoT solutions to distributed data processing and storage systems (edge, fog, cloud, etc.), and enable end-to-end trust, privacy, security, processing, analytics to fully benefit from the IoT/IIoT capabilities.

End-to-end strategies create intelligent "system of systems" using heterogeneous devices with various levels of intelligence, as well as context-based security to reliably filter and process data locally. These, in turn, allow the IoT/IIoT devices and applications to seamlessly interact with each other and with new devices and infrastructure.

Figure 1: Set the scene - Ovidiu Vermesan, SINTEF, Karl Andersson, LTU, Dolores Ordóñez, AnySolution

In order achieve this it is essential to stimulate collaboration between IoT/IIoT initiatives, foster the take up of IoT/IIoT in Europe and support the development and growth of IoT/IIoT ecosystems based on open technologies and platforms.

This requires strategic and operational synchronisation and alignment through frequent, multi-directional exchanges between the various European partnerships to foster links between communities of technologies users and providers, as well as with Member States' initiatives.

In this context, the event is organised by the CREATE-IoT as part of the IoT Large-Scale Pilots Programme with support from DG Connect and several European partnerships to present the research and innovation strategic agendas, ensure coherent exchanges of best practices between the various European partnerships, and cross fertilisation of the various activities for technological and validation issues of common interest across the various European partnerships.

The speakers invited from industry, research and academia are representing different European partnership initiatives, the IoT Large-Scale Pilots Programme projects and the EC.

4. RESEARCH AND INNOVATION CONTEXT

4.1 Overview of the context

Goal: Networking and align expectations, making the bridge and look at synergies.

Overview of the context

- IoT in key vertical sectors: Create cross sector platform and look at sharing good practices from one sector to others.
- Platform building and making systems work.
- Identifying interoperability issues.
- Growing standards are key.

Focus Area Digitisation & Transformation

- Large scale pilots. Piloting is meant to bring evidence for Policy making (e.g. Standards validation).
- Ecosystem development, Not technology integration push.
- Platforms.
- See standards being adopted and maturing.
- Look at cross-sector elements like policy, technology, bottlenecks, and Key issues governance and security.

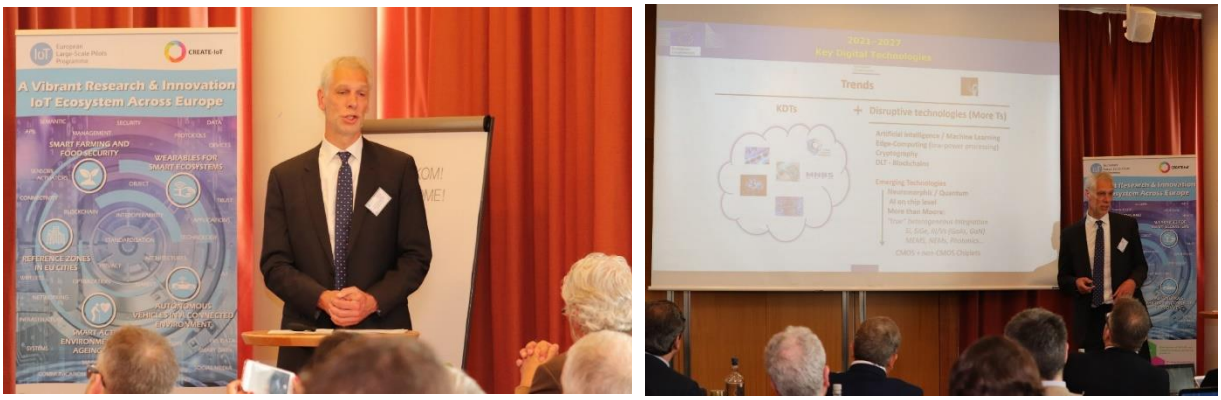

Figure 2: Overview presentation - Rolf Riemenschneider, EC, Belgium

Strategy 2020

- Key Digital Technologies 2021-2027.
- Next Generation Internet - Data, Analytics, Transactions.

Research and Development Drivers for Next Generation IoT

- Moving from the cloud to mesh where we have device-to-device interaction.
- Processing data at the edge lowers attack surface.
- Data is the New Oil – looking for monetization strategies.
- Note most spending in IoT domain is on consumer applications.
- RAMI model – possible linkage with semantic interoperability, ETSI, oneM2M and W3C.
- Interoperability issues key – looking for contributions to standards.
- Digital Industry and Space area allocated around 15BEuros.
- Emerging Technology – Neuromorphic and quantum, AI, the new oil is data, trust level and security of data of interest.
- NGI – Technological (r)evolution.
- 3 different levels - AI (top – backend large data), Intelligent digital twins (middle – metamodels, prediction) and mesh communications (lower @the edge).

- The Industrial IIoT swot analysis was noted.
- Key changes: 5G, Mesh Architectures, Digital Twins.
- Future of 5G. IoT partnership -> IoT challenge to increase speed, real-time and low latency → massive M2M device communication.

Value chain approach: Smart networks and services

- Shift from pure mobile network services towards functions (device2device/ device2edge) and mobile application services. The edge can provide ad hoc computing and intelligence, whilst guaranteeing more security and increase the trust of people. 5G to enrich low latency for both mobile and network infrastructure.
- Shared governance at the edge between mobile network operators and smart system integrators -> Use case Autonomous Vehicle, Vehicle2Infrastructure communication (Quality of Service, Infrastructure Services) -> Monetise 5G services.

Evolution of Partnerships

- Partnership Area 2.
- Digital-centric partnerships: a shift in the value chain to get physical buyers linked.
- Specific Challenges: Next generation Architectures, Tactile interaction, Interop DLT contract agreements.
- No decision taken yet --> Consultation (June 2019→ online consultation for the evolution of PPPs).
- Policy event for presentation R&I days event 24-26 September.

Expectations for the workshop

- Networking.
- Digital industrial platforms.
- Global view and competition.
- Changes in value chains.
- Converging technologies AI, cloud, big data, IoT/IIoT.
- Impact of industrial testbeds, initiatives, lighthouse projects.

5. IoT Large-Scale Pilots Programme

In this section we give some short presentation notes from for the participating LSP projects. For further information we refer to the presentations available at European Large-Scale Pilots Programme web site (European Industry Partnerships Collaborative Event) [1].

5.1 ACTIVAGE

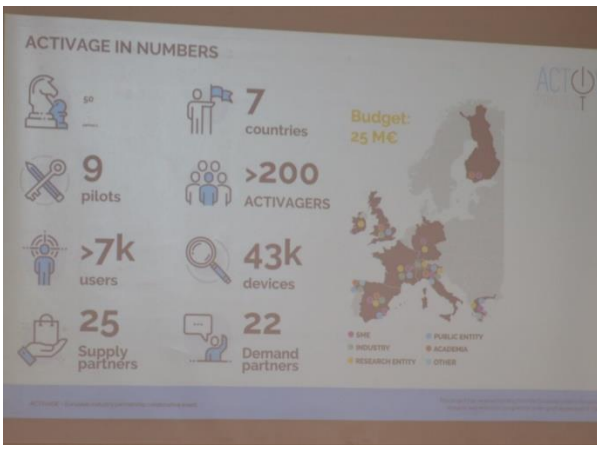

Figure 3: ACTIVAGE - Sergio Guillén, mySphera, Spain [3]

- New ecosystem based on IoT to enable the AHA market (nowadays fragmented small islands but with huge potential). There are 100M+ 65-year olds in Europe and the figure is rising.
- IoT is the enabler to facilitate scaling up and replicate beyond the islands. Improve replicability meaning to get more people engaged. Foster "multiplicability" among verticals.
- The difficulties to scale up and replicate solutions are due to closed architectures, to be tackled within the interoperability layer.
- Open calls are meant in this sense to foster replicability, using the interoperability layer as the reference (SAREF extended).
- Follows the smart living architecture with fixed and mobile edge comprising Data lake, plugins, marketplace making it easy to add, deploy and scale up new services.
- Future focus: IoT, extending the applications to the medical sector, data marketplaces, big data.

5.2 SYNCHRONICITY

Figure 4: SYNCHRONICITY - Nuria de Lama, ATOS, Spain, Rick Schager, Eindhoven City Council, Netherlands [4]

- Outcomes for Europe and beyond and is influencing global standards.

- Smart cities still subject to many silos.
- Technical baseline foundation in the reference zones (pilots).
- WIN -> Use Minimal Interoperability Mechanisms (MIMs) to port services across cities and be interoperable.
- Atomic city agnostic services.
- Standards based innovation.
- Access to products and data via marketplace.
- Interoperability and portability – MIMs (Minimum Interoperability Mechanisms) - basically API with shared data models.
- Reference architecture for IoT Embedded Smart Cities D2.1.
- Validated thanks to the project in the Reference Zones included in SYNCHRONICITY and soon extended to 130 cities that have already approved MIMs (including Mexico and Asia), as part of the Sustainability Plan.
- Scalability is needed for business creation and should be tackled not only with technological advancements but also with the right legal framework, notably adaptation of public procurement processes.
- Main umbrella for sustainability operations: Open & Agile Smart Cities (OASC) [5].

5.3 MONICA

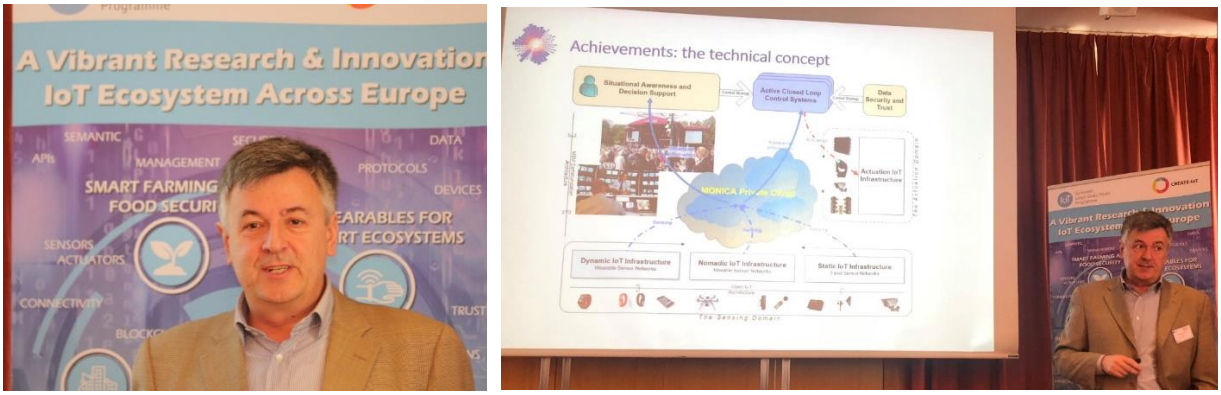

Figure 5: Roberto Gavazzi, Telecom Italia, Italy

- Massive scale operations (<10.000 simultaneous users).
- Open IoT Platform AIOTI Standard.
- Edge computing 1-2ms closed loop response time needed. Not able to get this performance in the cloud!
- Enable 3rd party services by making the data available.
- Innovative real time surveillance.
- Replication and evolution to 5G are key!
- Scalability Question: Cannot meet 2ms closed loop for bigger events! The 5G use case for a stadium is needed to better meet this capability.
- Security and safety in public spaces.
- Avoid sound pollution and ensure safety.
- Deployed at a number of events, e.g. Yorkshire Country Cricket stadium Heddingly for cricket and Rugby matches.
- Targeting 10,000 simultaneous users.
- Noted that 1 million connections per square km cannot be done with 4G, but this is possible with 5G.

5.4 IoF2020

Figure 6: George Beers, Wageningen University, Netherlands

- IoF2020 has published an IoT catalogue of reusable components based mostly on standards pushed by FIWARE and common Information Models to ease interoperability.
- Data publication and marketplace platforms based on open standards.
- Sustainability based on i) technology ii) business iii) demos.
- IoF2020 intend to give support to Digital Innovation Hubs with their results.
- DIH will offer support to farmers.
- 116 partners, 28 countries, 5 trials and 33 use cases. Links to ETSI, FIWARE and AgGateway.
- Have created catalogue of reusable components.
- Standardisation – noted no dominant player in sector. Looking at common information models, map to RAMI 4.0 and open standards.
- Route to sustainability is via SmartAgriHubs to prove reusable services.
- Noted that there is a need to hone demonstration skills as vineyard demo was disappointing.
- Poor broadband coverage in rural areas is an issue.

GAPS:

- Data marketplaces.
- Data sharing in the ecosystem from the Farmer through to food chain.

5.5 AUTOPILOT

Not present due to coinciding project meeting in Versailles. However, the project covers a number of applications (automated driving, shuttle services to airports, valet parking, platooning etc.).

5.6 Discussions and conclusions

Cross-Platform Connections:

- Noted that there are horizontal activity groups covering interoperability standardisation (WG2).
- There are linkages with AIOTI and 5G IA.
- EIP Agri – highlighted governance important for data.
- Data ownership is a hot topic.
- Data rights – the user should give rights to use data, and they should also benefit from this.
- Producers of the data - these may indeed be users of technology – such as farmers with a GPS system on their tractors or sensors in their crops or soils.

How to pass from pilots to business that scales across Europe?

- Regulatory drivers e.g. Smart cities need for clean air, Demographic change.
- Open, work and share ed strategy with Industry.
- Connect Europe Facility for best infrastructure.

Conclusions (Rolf Riemenschneider, DGCNECT, EC):

- Work with standards to facilitate uptake.
- ALL to lower the barriers for up-scaling.

6. EUROPEAN PARTNERSHIPS STRATEGIC DIRECTIONS AND RESEARCH PRIORITIES IN A GLOBAL CONTEXT

In this section we give short presentation notes from for the participating associations. For further information we refer to the presentations available at European Large-Scale Pilots Programme web site (European Industry Partnerships Collaborative Event) [1].

6.1 ARTEMIS-IA

Figure 7: Jan Lohstroh, ARTEMIS-IA, Netherlands [10]

- Over 200 members.
- Noted that there are several associations with overlap.
- Fragmented funding is an issue in H2020 also with member states (ECSEL), Eureka and National Funding.
- Associations need to cooperate to compile the SRA's for the various domains.
- Lighthouse projects in ECSEL have the intention of breaking silos.
- ECS-SRA and Advancy report highlighted (both downloadable from ARTEMIS Industry Association [8]) - US and Chinese competition an issue.
- EC has visibility of H2020 and ECSEL, but member states have visibility of ECSEL, Eureka and National Projects.
- Lighthouse projects bring together projects via the Liaise Group (who have the role of identifying relevant projects/synergies).
- Three Lighthouses: Industry4.E, Mobility.E and Health.E, all supported by ECSEL-CSAs.

Lighthouse Initiative to break the siloes. Aim is to find synergies between various application areas. Download the ECS-SRA covering the whole value chain, (see ECSEL Joint Undertaking [9]).

ARTEMIS-IA has 6 domains (including IoT and Systems of Systems) and its members are active in many projects, but not all fully aware of each other to break down the silos (especially w.r.t. EUREKA and national projects).

Establish a LIASE Group to bring together Lighthouse cornerstone projects from all programmes and sectors. Find the missing elements and gaps and make the EU competitive.

ARTEMIS-IA promoted, within the ECSEL JU, three Lighthouses based on ECSEL cornerstone projects:

- Industry4.E.
- Mobility.E.
- Health.E.

6.2 5G PPP IA / Networld2020

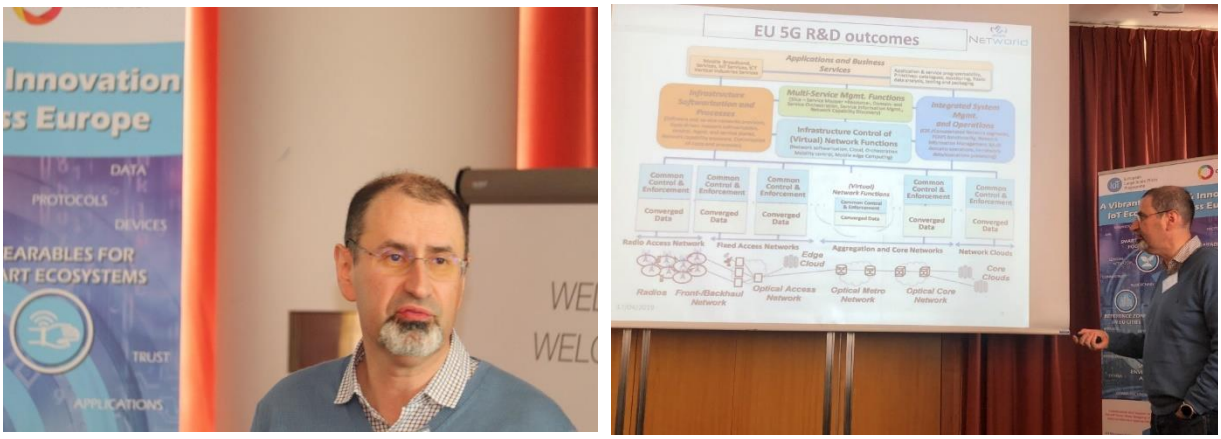

Figure 8: Rui Aguiar, Aveiro University, Portugal [11]

- Structures itself towards the technical challenges.
- Not designing networks for single verticals.
- Reduce cost in providing an architecture that serves all sectors, not just one sector!
- Future network with mMTC everywhere supporting distributed computing.
- Horizon Europe -> CEF -> Digital Europe Program.
- Data and virtualization issues.
- Challenges: how to push bits at lower (energy) cost; centimetre level localization.
- 1000 members.
- Main link is with ITU.
- Have been working on 5G for 8 years – lots of pre-planning which has resulted in many different supporting projects.
- Challenges are to provide low cost, low energy interfaces.
- Smart Networks and Services is the main priority in the domain – want more of everything: bandwidth, latency reduction, security, accuracy, massive machine type communications and energy efficiency.

Question:

- How do you see the value chain in the edge?

Answer:

- Multi-tenant is a critical aspect. Not at the stage to separate sectors and business models.
- Able to develop systems that can support all.
- Spectrum split by regulators has a big impact on the use cases.

For the local 5G networks there is a need for shared governance principles, investment in infrastructure. and a faster rollout for the industry for industrial sites which are not in the city but outside the city.

In addition, the local networks are connected and embedded in the global networks. For IIoT it is needed to build the 5G infrastructure, platforms, components in Europe and for Europe and not relying totally on suppliers outside Europe.

6.3 AIOTI

Figure 9: AIOTI - Luis Perez Freire, Gradiant, Spain and Ovidiu Vermesan, SINTEF, Norway [12]

AIOTI comprising a large variety of members, organised in sector-specific WGs but avoiding silo approaches through Cross-Domain Integration and horizontal working groups.

Challenge: increase acceptance; IoT nowadays is released on certain value chains. The challenge would be to go from siloed value chains to a Distributed Value Network:

- Sharing data across sectors with interoperability at all levels (devices, semantic, etc.).
- Enabled by smart networks (including 5G), highly flexible and adaptable to specific applications and services.
- With applications and services powered by AI, supported by edge computing.
- With a high level of trust provided by DLTs.
- WG on IoT standardisation, also research, and policy.
- Noted that data is shared between applications supported by networks.
- Address the convergence of technologies IoT and IIoT integration with 5G, AI, edge computing, services, developments.
- Strategic Research and Innovation Agenda – can be downloaded.
- SRA covers configuration, orchestration and open device drivers, edge computing, IoT platforms, distributed and federated architectures, 5G and AI, digital twins, tactile internet, methods and ethics, security and trust.
- Have a collaboration strategy via MoU and joint vision with 5G.

Synergies between AIOTI and 5G for Horizon Europe. SRIA being developed and addressing Consumer, Industry and Business.

A strategic discussion about the future of IoT/IIoT - 5G smart networks intelligent connectivity partnership is necessary. The IIoT developments in the industrial space and the requirements for 5G bring a unique opportunity.

For a possible future IIoT, 5G partnership is important to identify what are the critical value chains for that matter of road mapping to them to achieve the vision for the future.

Reference documents:

- Research and Innovation Priorities for IoT - Industrial, Business and Consumer Solutions, August 2018 [13].
- Advancing EU IoT Research and Innovation - AIOTI's position on Horizon Europe and Digital Europe, August 2018 [14].
- AIOTI Report on IoT Relation and Impact on 5G [15].
- Joint 5GIA-AIOTI Vision on Future Networks, Services and Applications – High societal and economic impact potentials for a collaborative approach in the Horizon Europe Programme, March 2019 [16].

6.4 ECSEL

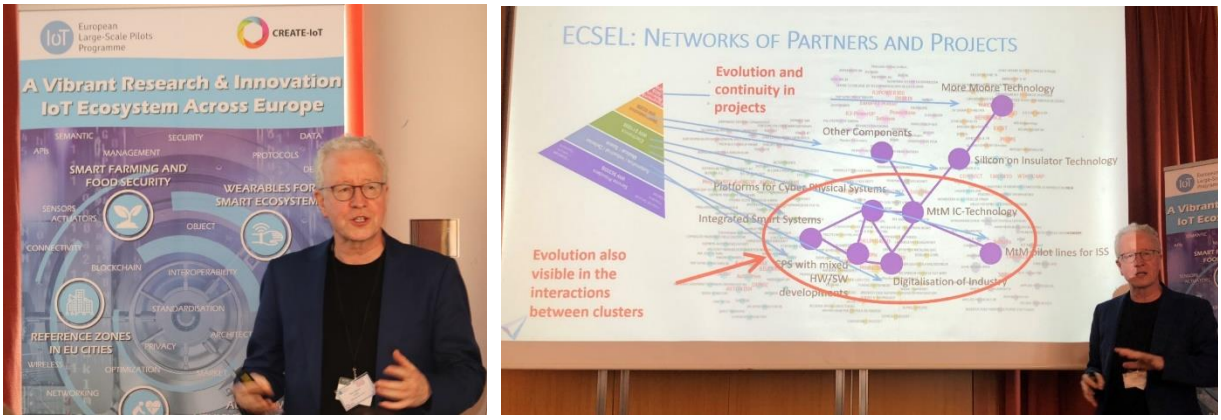

Figure 10: Yves Gigase, ECSEL Belgium [17]

ECSEL is a unique partnership fostered by DG Connect and supported by 27 participating states and three industry associations (AENEAS, EPOSS and ARTEMIS-IA). It is a tri-partite with 64 projects from 2014 to 2018, counting 2160 beneficiaries, 3.4 Bn Euros in total investment partially funded by the EU and the ECSEL participating states for an amount of 1.6Bn Euros. The workplan for ECSEL is based on the Strategic Research Agenda common to the 3 associations and shared with others such as the Eureka cluster Penta.

The challenge is how to achieve more? A few possibilities implemented in ECSEL projects are value chain integration, innovation through the use of results from past projects coming from different programmes, supporting projects that answer ECS-development needs defined in other programmes, etc.

A few examples were given how the projects of call 2018 achieve this: by tuning the objectives with the needs of another JU like SESAR JU; by developing standards, by linking with priority areas from other European roadmaps; by integrating the full value chain in one project with aspects of chip manufacturing, embedded software and smart system integration technology aspects; by integrating existing vertical supply chains with stakeholders from different horizons: health, mobility, communication, sensors, etc.; by working on system of systems technologies, by integrating new technologies such as big data, neuromorphic computing, artificial intelligence in industrially relevant applications and environments exposing a large set of partners to those new technologies. In this context it was remarked that some fuzziness and overlapping among different initiatives and partnerships is important to keep as it encourages both collaboration and competition.

A new instrument developed by ECSEL are the Lighthouse Initiatives that create synergies between activities in different programmes to push things like standardisation, community building above and beyond projects, gap analysis in roadmaps, tuning of developments, etc. One of the ECSEL Lighthouse Initiatives Mobility.E was presented as an example https://www.ecsel.eu/mobilitye This lighthouse initiative pointed to 6 priorities and identified a number of gaps. Lighthouse initiatives shall hopefully be continued within the ECSEL successor in the Horizon Europe framework programme.

6.5 NEREID

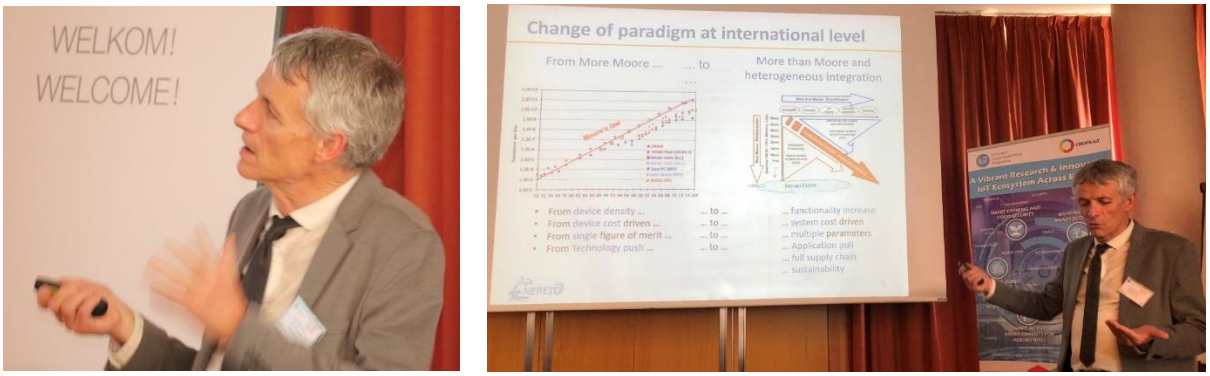

Figure 11: Francis Balestra, IMEP-LHAC, France [18]

NEREID (H2020 ICT-CSA) collaborates with ECS and IRDS.

Next Steps:

- EU would benefit from long term research program with clusters of projects covering a wide range of TRLS (TRL 1 – 7).
- Use end user & technology application expert to get joint vision in the roadmap proposal.
- NEREID feed-in the long-term vision in ECSEL.

Activities:

- More than Moore is an EU strength– heterogenous integration to get functionality increase.
- Complementary roadmap to ECSEL strategy -feeds the longer-term agenda of ECSEL.
- NEREID covers More Moore, Beyond CMOS, functional diversification (Smart sensors, Smart energy, Energy harvesting for autonomous systems), heterogeneous integration and system design, and equipment and manufacturing science amongst others.
- Advisory Committee from Europe, USA and Asia (12 people).
- Have used a top down and bottom up approach for road mapping.
- Future technologies with FoMs considering availability versus time.
- Identification of gaps in research.
- Focus on medium term 5+ years, long term 10 + years.
- Looks at the semiconductor technologies and beyond to be used in IoT/IIoT applications.
- Looking at up to 2033.
- Roadmap available on NEREID website.

Question:

- How do they move their results in innovation in Europe stakeholders?

Answer:

- System design is application driven so they already have the link for supporting many applications.

iPhone 1 had 70% of EU components, but sometimes innovation comes from technology like lower power high performance processing.

6.6 ETP4HPC

Figure 12: Michael Malms, IBM Research, Switzerland [19]

Since Oct 2018: New organisation: EuroHPC Joint Undertaking, covering activities in HPC research and innovation, infrastructure and deployment.

HPC+ BDVA are part of the Research and Innovation Advisory Group (RIAG) within the Joint Undertaking EuroHPC, providing advice on the roadmaps.
ETP4HPC collaborates with AIOTI, BDVA and HiPEAC.

New challenges for HPC:

- Increasing interplay of simulation, AI, IoT and analytics -> WP2019 focuses on projects mixed workloads on simulation, AI and Data Analytics.
- Heterogeneous design accelerators combined into one cohesive environment.
- Covering HPC - Cloud – Edge.

For the next SRA (to be delivered in Dec; 2019):

- Topics driven by industrial uses cases (from energy, aviation, automotive, manufacturing and pharmaceuticals) and scientific use cases (energy, life sciences, weather and climate, fundamental science).
- Organised along top 10 research cluster priorities, derived from the use cases.
- HPC+ the edge will promote the value for Digital Twins.
- Would be good to collaborate more with IoT LSPs for simulation.
- Neuromorphic computing for AI.
- Technical Research priorities 2021 – 2024.
    - Priorities per domains – high level view.
    - Examples of relevant use cases.
    - Research clusters.
    - Upstream Technologies – focus for 2021 – 2024.
    - Gen. recommendations for workprogramme 2021-2022 (focus calls, large scale pilots, collaborative aspects, etc.).

Question:

- How does ETP4HPC contribute to the standardisation?

Answer:

- As of today, not within the focus of ETP4HPC's activities; this is more done by the technology providers themselves.

6.7 BDVA

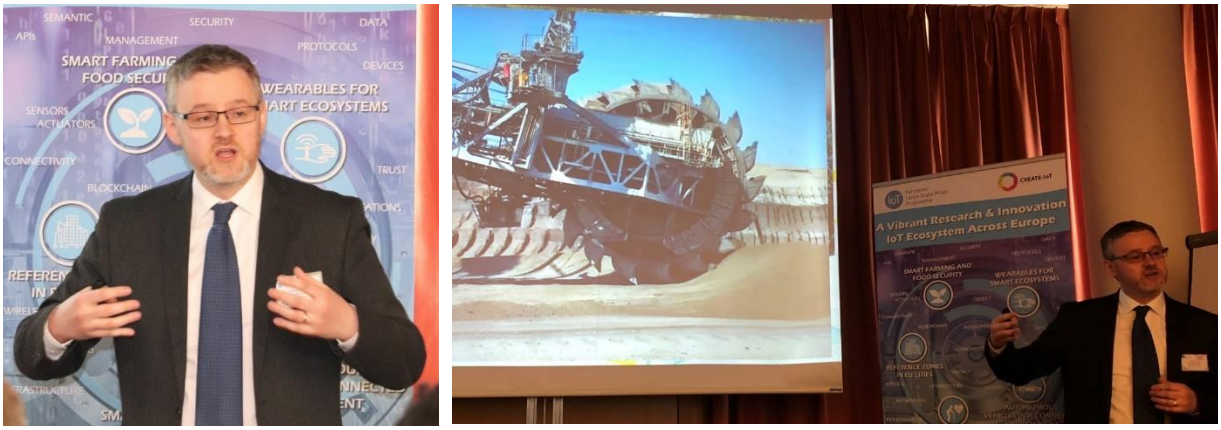

Figure 13: Edward Curry, The Insight Centre, Ireland [20]

Barrier to AI in Europe is the access to data as the platforms don´t exist in Europe. Four Lighthouse projects – Data driven AI. Refer to BDVA Position Paper (Towards a European data sharing space - Enabling data exchange and unlocking AI potential) [21].

Data is key enabler – Reference Architecture is structured in three layers:

- Data generation.
- Platforms (access and portability).
- AI and decision platform.

Next generation platforms/marketplace, example projects:

- Skywise - Unleashing the potential of data (AIRBUS) [22].
- Waternomics (EU) [23].

Investing in raw or pre-processed data can add value. One of the challenges for BDVA is to achieve a common Data sharing platform. The point is to share data but not necessarily to have open data sets.

Technical Challenges:

- Respecting Data Ownership.
- How to monetise it.
- Lack of EU wide position.

There is a need for AI Partnership and promoting with EU Robotics. See Joint Vision Paper for an Artificial Intelligence Public Private Partnership (AI PPP) [24].

- Data is the new oil.
- Concerns over data silos and US monopolies.
- There is no significant European data aggregator (argued that this is not a bad thing).
- Data is a key enabler – SMEs and public sector level.
- 4 lighthouse projects BOOST4.0, Transportation, BIG Medication and DataBio.
- DataBio - 26 pilots 0.4-3.7% improvements in forestry/fishery applications.
- Transport - 13 pilots 13% improvement in operational efficiency.
- Raw data is converted to insights.
- Processing raw data is expensive - who will invest in this?
- Data needs to be sieved to get useful data.
- European Data Space is required to give scale of data necessary.
- Moving towards a European Data Sharing Space.
- Skywise – Airbus data platform for aviation across the full value chain.
- Waternomics – share information on energy and water usage.
- Opportunity for governance – evidence-based policy making and compliance.

- Respecting data ownership.
- Another challenge is trust.
- There is a need for an AI partnership, e.g. with euRobotics.

Question:

- Position on silos like Google, Facebook?

Answer:

- Big data aggregators & EU should avoid this and support decentralisation of management of data in a distributed approach. The German approach on International Data Space promotes standards connectors for the federation of data spaces.

Question:

- How to get access to real data? How to expect people to let others access their data?

Answer:

- Always has to be a value e.g. research benefit, monetary exchange. Also share my data with your data to get mutual benefit. Not all data will be open data.

6.8 ECSO

Figure 14: Roberto Cascella, ECSO, Belgium [25]

- Mission to build a resilient EU ecosystem over trusted technologies to address challenges of digitalisation of society and industry.
- Lessons learned -> SRIA 2.0 (2027).
- Three papers on AI, Blockchain and IoT.
- Highlight security challenges on Digital Twins and quantum computing.
- The transversal nature of ECSO see it collaborating with other PPPs such as HPC and Robotics on SRIAs.

Digitalization in industry require cybersecure operations for data where an end to end security must be guaranteed (challenge is to promote discussion between stakeholders). Definition of SGAM based architectures. for data but either an end to end security must be guaranteed (challenge is to promote discussion between stakeholders).

- Security by design
- Awareness (now it is seen as a cost)
- Foster collaboration
- Cyber security strategy ENISA.
- Next multi framework programme, Digital Europe and Horizon Europe.
- Threats increasing a lot due to Digitalisation.
- Convergence of IT and OT (operational technology).
- Security to protect systems.

- 500 MEuros put in leveraging 18000 MEuros.
- Important to boost SMEs.
- 250 organisations engaged of which 25% are SMEs.
- Also have public administration as partners.
- Aim to produce resilient and trusted technologies.
- Technical areas include AI, IoT and blockchain.
- Have identified a list of areas
- Finance and Energy are the big areas as well as e-government.
- Industries 4.0 is also important.
- Plan to look at AgriFood in the future – not a priority at the moment.

Question:

- There is a need to not just have strong cyber security solutions but also at operational level. EC always pushes cybersecurity but what can be done to improve it?

Answer:

- Yes, we are strong in theory, but cybersecurity is mainly linked to data as a patch. Even if Security by design is stressed in all calls it seems like it is added on later as an afterthought.

It is needed to:

- Have the 5G approach to have secure e2e design by all stakeholders.
- Be seen as an insurance by CEOs rather than an overhead.
- Go beyond traditional paradigms but go for comprehensive e2e solutions.
- Raise the bar above the data security competence centre.

Question:

- Why is AGRI Food not on the ECSO slides?

Answer:

- Yes, it should be added. AGRI Food is on the list and will be added in the future. However, ECSO focused on initial priorities Energy is massive priority with many calls on cybersecurity, likewise eGov & Industry.

Question:

- How to ensure transversality rather than silos coming from architecture?

Answer:

- ECSO is pushing a sector agnostic approach but also looking at sector priorities with their vertical WG e.g. Industry 4.0 can have specific data protection issues, but they push transversal reuse of solutions, processes and best practices across sectors.

6.9 EFFRA / FoF

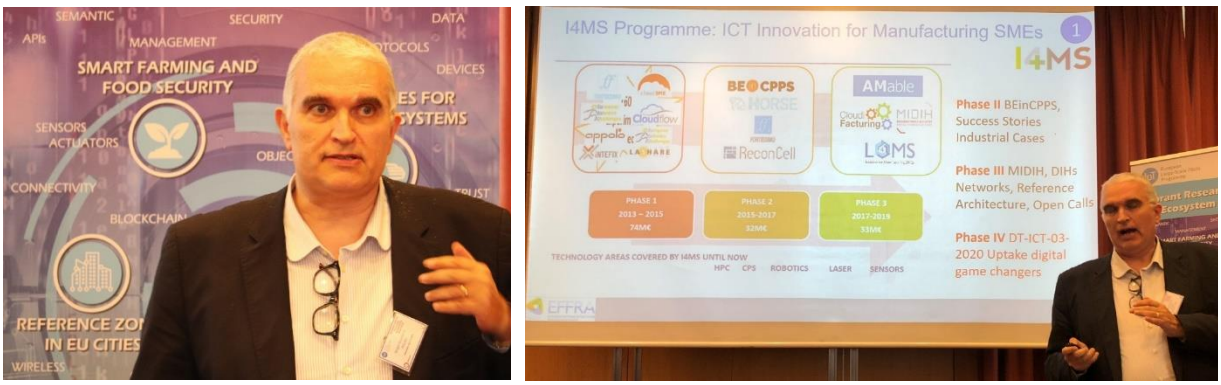

Figure 15: Sergio Gusmeroli, Politecnico de Milano, Italy [26]

Open DEI – Aligning reference architecture RAMI. Let us consider data providers and data consumers instead of data owners. Analytical approach to drive innovation:

- FIWARE (for industrial application; RAMI 4.0 as reference architecture).
- Apache.
- EFFRA is the private part of Factories of the Future representing 2000 organisations.
- Has run 280 projects.
- Link to BDVA and BOOST4.0.
- Considering things like agile value networks, excellence in manufacturing, human factors, interoperable digital manufacturing, platforms, etc.
- Other projects mentioned I4MS, BEinCPPS and MIDIH.
- Phase 4 DT-ICT-03-2020 addressing uptake "digital game is changing".
- Smart mould example for production of plastics based on FIWARE.
- Whirlpool producing smart testing station for zero defect quality in production.
- MIDIH Analytics framework – FIWARE Implementation with Apache.
- eFactory – marketplace for agile value networks.
- QU4LITY project (Zero Defect).
- OPEN-DEI CSA will start June 1st covering RAMI, IDS, FIWARE and IIRA.
- Connected Factories – coordinated via EFFRA.
- BDVA – have identified 26 innovation challenges in manufacturing.
- Four main topics - smart factories, low environmental footprint, parallel product and, human driven innovation (i.e. collaborative intelligence).

Question:

- Joint paper on Smart Manufacturing has 56 challenges! How to have an agile approach to drive innovation where Europe wants to go?

Answer:

- Last year several workshops produced this, and this year there will be a synthesis of them.

Most important is the community on data sharing industry data space. Now international data space. Reference Architecture 3.0. WG on sharing data B-to-B, don´t discuss data owner but focus on data providers and data consumers.

6.10 EIP-AGRI

Figure 16: Willemine Brinkman, EIP-AGRI, Netherlands

Cost benefit to farmers are key to uptake/sustainability. It is needed to enable farmers with digital awareness & skills. The innovation approaches promoted EU-wide through Horizon 2020 and the Rural Development policy may be useful for other domains. Interactive innovation, involving

the users of innovation, right from the start and all along the process, is being taken up actively in all EU MSs. Reuse and re-boiling of solutions is a positive strength.

- Operational groups in different regions – all over Europe (funded by rural development programmes).
- Multi-actor projects.
- Example of Operational Group: Controlled Traffic Farming – project in Belgium.
- Goal is to ensure productive and sustainable EU agriculture and forestry now and, in the future, – maintaining a good environment for our grandchildren; producing more with less.
- Improve uptake and create impact.
- Examples of relevant work:
  - Precision farming focus group 2014 [28], and Benchmarking Focus Group 2016 [29].
  - Workshop on data sharing [30], and Seminar on Digital Innovation Hubs [31].
  - Access to all EIP-AGRI work on digitisation via website – digitisation toolbox [32].
- Digitising agriculture is not just about large fields being cultivated by robot tractors – examples:
  - Drones to monitor reindeer flocks.
  - Sheep to eat weeds in vineyards (IoT used to prevent them eating vines).
- DIHs - challenges quite often not technological, but social and governance related.
- Farmers at the core of everything.
- Have a multilevel strategy for digitising agriculture and rural areas [33].
- CAP is a big driver.
- Would be good to invite to each other's events, worth the effort, even if it may be difficult sometimes.

Important to get different stakeholders together at events to get a clash of ideas that generates innovation. EIP AGRI and IOF2020 address this and additional work using this approach is still needed.

Question:

- Sustainability issue is how to better spread ideas across other sectors. What could help this?

Answer:

- DG AGRI call next year but other sectors e.g. health must be considered in a cross-sector approach. The challenge is to get the different actors together and take the first step.

Question:

- Valuable experience engaging users from the beginning?

Answer:

- Yes, the EIP-AGRI experience has proven that this is indeed very valuable, and will lead to better uptake and use of innovations.

Question:

- Replicability?

Answer:

- The fact that the interactive innovation approach and the Operational Group projects are proving so popular and are spreading all over Europe indicates that this approach is replicable, and worth the effort.

6.11 Standards Synchronization

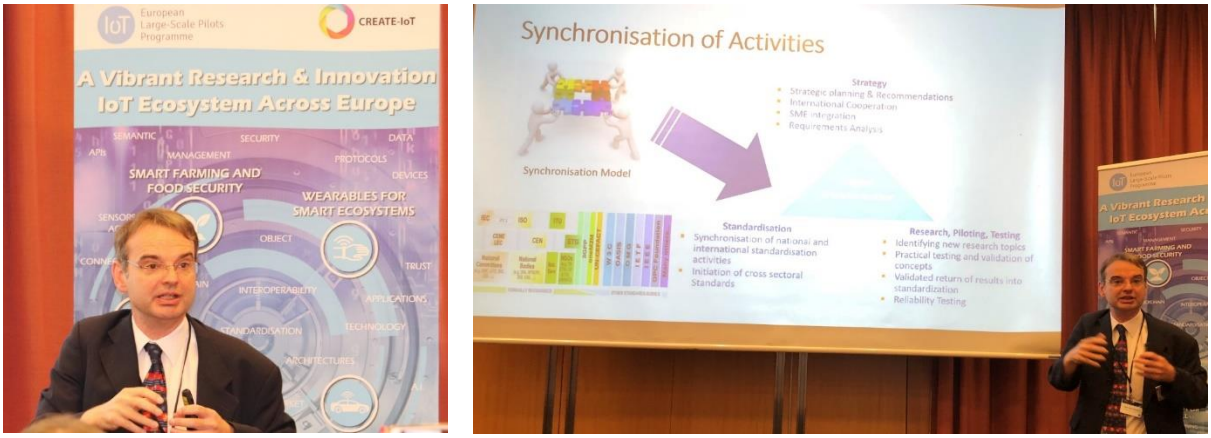

Figure 17: Haydn Thompson, THHINK Wireless Technologies Ltd, UK [34]

There is currently some disconnect between standardisation bodies and pilot standardisation activities. There is thus a need to:

- Foster cooperation and synchronisation.
- Increase visibility of standardisation activities going on.

A pragmatic approach is required:

- Low cost.
- Sustainable.
- Add value to ecosystem.

Networking platform proposed to provide glue, look at the gaps and push standards. The proposed synchronisation platform will provide an overview of the current status across various stakeholder bodies and EU initiatives.

- Want to synchronise activities to get better visibility of standardisation activities in SDOs and projects and promote standardisation for competitive benefit.
- Have developed proposed model for this which is being supported by the EC (new CSAs, etc.).

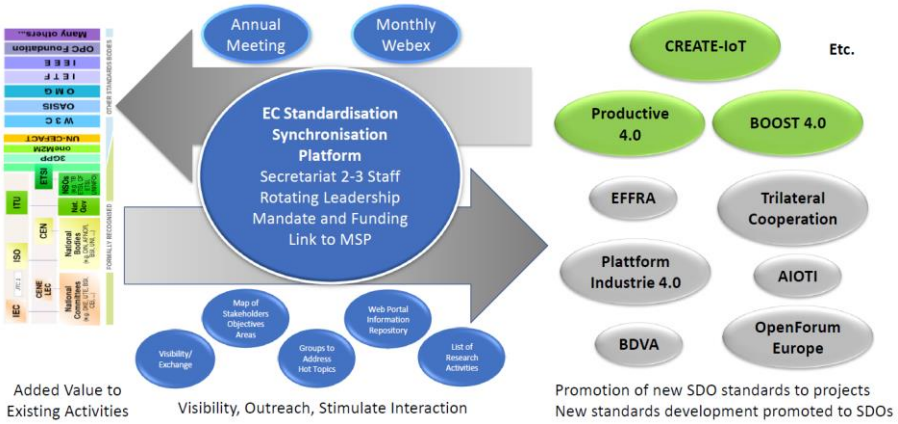

Figure 18: How synchronisation platform might work [34]

- Benefits - Visibility of what is going on and timescales, connection to ecosystem, promotion of developing standards, influencing standards.
- Looking for: Interest in participation from SDOs and projects, contributions in terms of inputs and outreach, ideas for standards that can be trialled.

Question:

- What is the plan and how much is in the area of IoT?

Answer:

- The key objective is to provide an overview of what is going on which is useful for SDOs, MS, industry and projects A key target area is manufacturing and here IoT is having a big impact.

Question:

- When is it a good idea to standardise something?

Answer:

- Not everything needs to be standardised. Quite often solutions are not standardised and are kept secret as a competitive advantage. They become a de facto standard.

Question:

- Why does EC not push / propose standards in calls and it is left for projects to do this work? Noting that there are more and more standards and bodies to keep track of.

Answer:

- One activity for the synchronisation platform would be outreached to promote standards to projects. A key challenge is the diversity of SDOs and other actors in the standards domain. The synchronisation platform aims to bring all of this information together in one place.
- EC does push for interoperability and standardisation (both adoption and contribution to) in its R&D&I work programmes, but project level is not always the right granularity, mora can be achieved at cluster level and even better when consolidated at partnership level (cf. AIOTI WG03).

7. FUTURE RESEARCH, INNOVATION AND DEPLOYMENT AGENDA - CONTRIBUTIONS FROM EUROPEAN PARTNERSHIPS AND FUTURE DEVELOPMENTS

7.1 Panel

Figure 19: Panel discussions

Moderation: Franck Boissière, EC, Belgium

Panel:

- Ju Liu, Huawei, Belgium
- Maike Gilliot, ETP4HPC, France
- Oltion Xhezo, Vodafone, UK
- Roberto Cascella, ECSO, Belgium
- Roberto Gavazzi, Telecom Italia Mobile, Italy
- Yves Gigase, ECSEL, Belgium
- Omar Elloumi, Nokia, France

Introduction: New partnership landscape is being debated: less partnerships, more impact, more proactivity. But one big one would not achieve anything.

7.2 Discussions and Conclusions

Question 1: Need to cluster things that are being addressed by different actors. From your experience what do you see going beyond the boundaries going forward?

Statements:

- Huawei (responsible for 3GPP Ecosystems):
  - Stresses the need to put all common requirements into 3GPP. Stage 1 system requirements are to be frozen this year, but still no clear requirements on Machine-to-Machine communications.
  - Data requirements are very valuable to capture in 3GPP.
- ETP4HPC:
  - Need to reach out other partnerships.
  - We were very happy in the past with isolated big machines. These “traditional” applications will of course continue to play an important role in HPC, but in addition, we

now face a new era with boundaries coming down with integrated applications, HPC is just one brick to be connected with other PPPs. HPC strongly depends on collaboration to integrate aspects coming from AI, Data Analytics and the IoT domains.
  - Need to address new issues standards, process, workflow, governance and organisation issues.

- Vodafone:
  - More discussions need it on connectivity. Do we take it for granted? It's a concern to overlook the connectivity enablers in such an ecosystem because important challenges are ahead for the hyperconnected future.
  - As industry moves toward digitisation, there is an increasing convergence between vertical sectors and the communications sector. IoT and other disruptive technologies have driven this convergence and it will be further intensified by 5G.
  - Vodafone is proactivity identifying vertical policy areas (Healthcare, Automotive, Smart Buildings, Logistics, Insurance and Agriculture) and engaging with sector specific policymakers much earlier in the process.
  - Sector specific regulators are increasingly setting sector-specific policy that has an impact on digital and the future of connecting/enabling technologies. It is key to ensure that vertical industries realise the benefits of 5G. We need to engage quickly and ensure this cross-sectoral approach is endorsed more widely from stakeholders.
  - Lines have blurred between different actors /roles in the value chain, and we are getting more involved and expanding vertically in the value chain, through either M&A or partnerships. Examples include:
    - Vodafone Automotive - is the new name for 'Cobra' following Vodafone's acquisition of the Cobra Group in August 2014. This combines Cobra's expertise in vehicle security and telematics, with Vodafone's reputation as a world leading telecoms brand.
    - Integration with ARM to provide IoT narrowband propositions See: "Arm and Vodafone commit to work together to simplify Internet of Things (IoT) deployment" [35].
    - Founding member of AIOTI particularly active in the Smart Energy and Farming WG, and previously chair of the Policy WG.
- ECSO:
  - Industry along with SMEs, & Academic institutions needs to have a role in future partnerships, since their engagement is necessary to maximise investments in technology and solutions and ensure market impact. To create an ecosystem that engages all actors.
  - It is observed that some technologies are converging following the evolution of the market like IoT+5G with edge computing, IA+Robotics.
  - Robotics depends on opportunities. What will be the main drivers? Or will there be a sector that will drive the economies?
  - Clustering will be needed indeed, but how clustering is done should follow market signals.
  - Cybersecurity is transversal, and clustering enables to work with all and at same time recognise sector specific elements.

- TIM:
  - 3GPP standardisation is best approach for connectivity platform with the telecom approach always aiming at being transversal and open.
  - The example of 3gpp is a very good example of a standard agreed among all players in the value chain, which has allowed the development of ecosystem and the market up to unprecedented size (Apple's iPhone, a number of powerful manufacturers worldwide, etc.).
  - The 3GPP ecosystem standard for any phone to work in any platform.

    - Port this approach to IoT to derive a transversal platform approach and this PPP can help a lot to avoid closed silo approaches (usually linked to vertical markets).
    - Even if horizontal approach is adopted each vertical has to be considered. Difficult but compromise must be found between horizontal approaches and vertical needs to enable these new ecosystems to work.
    - A common language needs to be found amongst verticals and 3GPP can bring this. All stakeholders need to understand that they must approach each other and leave out vertical specific language.
- ECSEL:
  - To develop (as example) IoT some clear technological hurdles need to be overcome:
    - Need for low power electronics to fulfil the computational needs and other that are required for IoT systems.
    - Need for reliable systems.
    - Need for standards and legislation to solve things like validation and certification of new technologies (like AI).
  - Therefore, need for partnerships that brings knowledgeable companies and RTOs together. Value chain integration is important in every partnership.
  - But 1. no partnership can do it alone and 2. the group of stakeholders to fulfil those needs is larger than the traditional partners like companies and academics.
  - On 1. It is important to create partnerships in different domains but careful not to cloud the visibility on who does what. Also, it is important to create the tools to make the collaboration between partnerships possible.
  - On 2. Multiple issues to be tackled by those partnerships can only be tackled if different actors participate: Member States, EC, companies, academic world, citizen organizations, etc. This should be reflected in the partnerships, allowing for concerted global approaches, including the perspectives of business and citizen in doing so.
- Nokia:
  - Is a member of AIOTI.
  - Impressive meeting today. Scope of partnerships has real substance.
  - 5G: a lot of enablers have been developed under the umbrella of 5G to conform what is regarded today as the next generation of connectivity; this is an inspiring example of for what needs to happen at a higher level among AI, Big Data, IoT, etc.
  - Enables the backbone to come together with big data and security. The 5G backbone enabler for all new services like automotive.
  - Synergy between IoT & 5G is very clear but big questions on security.
  - Regarding the clustering / overlap: competition is good, it drives innovation.
  - Digital transformation can be achieved coupling Big Data and security. 5G shall be intended as the backbone for digital transformation.

Conclusions (Franck Boissière, EC, Belgium):

- Almost only technology providers and not enough user in the strategic partnerships. This is bad for IoT.
- Need to move up the application.
- Careful with partnerships as can do good but can go very wrong.
- Important that industry gets involved.
- Expert top down approach to research has a limit like in 5G where operators traditionally dominating the telecom approach in the past with only 1 or 2 operators per country, but now more in a situation where many more device manufacturers, as well as vertical end users could be providing much more input if really involved in early trials and pilots.

Question 2: In defining future partnerships what makes us sure we are not falling on the wrong side that the few important members in PPPs aren´t enforcing their own ideas?

Potential problem with Partnerships. Define in advance all the research & innovation that needs to be done according to what the industry decides in advance. When defining future partnerships, how can the EC be sure that it does not miss the shot by paying attention to some demands versus others that may remain unheard?

- ECSO:
  - ECSO welcomes the engagement of Member States. This is very needed in the cybersec field.
  - Answer to Q2: it is not only about industry but building a community beyond the partners and reach out to actors and verticals that are outside the association. This is very important for ECSO to engage in dialogue and look at gaps.
  - Regarding the need of having the view from the "industry", ECSO understand this word not only as large industry (that provide long term vision) but also as SMEs (that provide innovation) and RTOs/universities (for SOTA research) and the citizens/consumers always needs to be considered. ECSO has followed this approach when defining their priorities for Horizon Europe.
- Nokia:
  - Regarding the discussion about data ownership and the California model, Europe can be different and is well positioned for this as we own our cars, house, manufacturing, and operational technology, and there won´t be any one dominant player.
  - The starting point for confidence in success is to build on the current stack where 5G is just another stack for IoT.
- ECSEL:
  - ECSEL benefits from Lighthouse initiatives and evolution of clusters, and new topics introduced as part of the evolution. Regarding complex partnerships like ECSEL there are:
    - Weak points:
      - Decision processes can be slow, as there are conflicting interests.
      - Lack of representation of end users/citizens/public.
    - Strong points:
      - Consensus does create stability and longer-term certainty.
      - Much stronger impact translated in further commitments of the partners for continued actions.

Conclusions (Franck Boissière, EC, Belgium):

- Several elements emerging like lighthouse concept as a process to open up the partnerships.
- Some partnerships are closed to members whereas openness and engagement builds up ecosystems and the partnership.
- There is the building of partnerships but also building / believing in the sense of community.
- Almost all mentioned the automotive sector but how would an automotive company know which PPP best suited their interests? A, B or C is a major challenge, especially for smaller actors.
- Stability can be provided by definition in fixed agendas / what the EC propose in a programme.

Question 3: What do you see in the Horizon Europe proposal the structure and elements that brings cohesion in a longer-term view among partnerships and their interests?

- TIM:
  - This has already happened in the past (FI-PPP and other). We have a board which many projects refer to. This board shall direct and give guidelines to projects to avoid duplication and provide guidance to technical direction.

- Vodafone:
  - A new and specific IoT policy approach from the EC would be really welcome, as it can lead toward: a) sustained growth of IoT growth b) opening up of new markets, e.g. new verticals and unlocking of 5G potential and non-personal IoT data sharing, c) true economies of scale for all IoT applications (business and consumer) across the EU.
  - For example, there is substantial potential behind AI, but it needs sustainable IoT to progress (they say AI and IoT is a marriage in data). We can do much more with data. but do we have rules and consensus in Europe to take full advantage of all data that is being generated?
  - The new IoT Framework will need to address four main areas:
  - Ensure proportionate regulation 'designed for IoT' - regulatory rules relate to actual risk of harm based on IoT use-cases, as opposed to rules designed for 'traditional' voice/data services.
  - Increase harmonisation - ensure that IoT achieves true economies of scale across Europe, without having to adapt service to different regulatory regimes across the EU28 Member States.
  - Promote Technology Neutrality - ensure a level playing field between Cellular and Non-Cellular IoT connectivity providers; avoid the arbitrary imposition of vertical standards that favour non-cellular technology, including in our priority IoT verticals as above mentioned.
  - Some policies or regulations are being set without a harmonised, neutral regulatory approach in mind.
  - Europe needs a technology and service-neutral approach so industry regulators are not pre-selecting "winners and losers" in their sector, for example through a mandate that devices in that sector must be connected in unlicensed spectrum (V2X, drone-control regulations).
  - Enhance European competitiveness and ensure that the EU retains its ability to compete with the Americas and APAC (China) by maximising the benefits of IoT, and IoT data, in a secure manner. A Deloitte study has demonstrated that the economic benefits of sharing machine data across the industrial IoT supply chain are clear (1.4trn to EU GDP by 2035).
  - Pan European solutions are Key!
- Nokia:
  - In full agreement with Vfe observations.
  - AI is evolving towards an AIaaS model.
  - Reaching the stage that future 5G services are being driven top down by IoT and including AI.
- IoF2020:
  - Partnerships need to be more inclusive and maybe less "excellent". There is a risk of future partnerships to run very far away and leave many actors/people behind.
  - Human-centric means that skills/education should be considered.
  - Inclusiveness is also about providing skills and training not just membership.
- Nokia:
  - Inclusiveness is indeed extremely important.
- ECSEL:
  - Human-centricity has always been around as a concept from the start of H2020 but has not been really implemented/developed in many areas. Not an easy task.
- ARTEMIS-IA:
  - Raised the idea of mission for MSs to share their ideas to create structures to respond to their missions, and as a way to organize Horizon Europe.
  - Rolf (EC) indicates a board will be setup to manage mission in 2021 to 2022 for first missions where it's still to be decided priorities and implementations, but first the clusters.

- ECSO:
  - Skills and training are core to ECSO's priorities. There is a recognized gap in terms of skills and awareness in the field of cybersecurity, not only at citizen levels, but also as C level in companies.
  - Security & privacy for citizens is also a high concern in ECSO: this can be tackled by improving awareness or by policy making (example: GDPR).
  - Future in Horizon with a new pillar on Citizen impact.
- ETP4HPC:
  - In our case, 40% of the funding of our projects has gone to non-member entities. But can be a pitfall if not focused enough and can end up with too much overlap between projects.
  - In order to generate impact, you need to focus on specific, agreed priorities so that research results can be taken to the market.
  - Include the citizen -> Bring HPC topics to university courses.

Conclusion (Franck Boissière, EC, Belgium):

- Interesting ideas regarding representativeness, openness.
- Need to have more comprehensive value chain approach.
- So far, the model was one partnership=one unit in the EC. This model is changing now, and silos needs to be broken down, new partnerships build with strategic technology and policy in mind, embedding from the outset an engagement approach.
- We will need to consolidate partnership around consolidated value chains in light of global competition (5G- Components-IoT, or AI-Big data - HPC) , while at the same time thinking about building bridges cutting across the new partnerships for common thematic across verticals (dataspaces, common vertical lighthouses, et.)

8. INDUSTRY-DRIVEN PRIORITIES FOR CONVERGING TECHNOLOGIES SUCH AS IOT/IIOT, 5G, AI, DLTS, EDGE COMPUTING – IMPACT OF NEW EUROPEAN PARTNERSHIPS

8.1 Panel

Figure 20: Panel discussions

Moderation: Rolf Riemenschneider, EC, Belgium

Panel:

- Willemine Brinkman, EIP AGRI SP, Netherlands
- Rui Aguiar, Aveiro University, Portugal
- Francis Balestra, IMEP-LAHC, CNRS/Grenoble INP, France
- David Langley, TNO, Netherlands
- Sergio Gusmeroli, Politecnico di Milano, Italy
- Natalie Samovich, Enercoutim, Portugal
- Edward Curry, The Insight Centre, Ireland

SWOT analysis - Strategic Value Chain for Industrial Internet of Things (IIoT) developed by DG GROW:

In the context of the Renewed EU Industrial Policy Strategy, the European Commission has set up the Strategic Forum for Important Projects of Common European Interest to foster a proactive cooperation with Member States and industry on the key Strategic Value Chains for Europe that use advanced technologies. Until summer 2019, the Strategic Forum is working to develop the recommendations for actions in selected key Strategic Value Chains (SVC) for the EU, Member States, regions, industry and other stakeholders involved. IIoT has been identified as one of several key Strategic Value Chains and key stakeholders are involved to support the development of the recommendations for IIoT that have to be addressed in Horizon Europe, Digital Europe and CEF. The recommendations are important to be passed as a package to the new commission to support the Strategic Value Chain on IIoT. The discussions focused on the SWAT analysis and discussed the critical paths of IIoT value chain in Europe.

8.2 Discussions and Summary

- EIP-AGRI:
  - Many elements in this SWOT are well known to the agri community (connectivity, lack of awareness of a growing and complex offer).
  - Key message: you need to listen to and involve the people that will be using the technology, they have specific needs.
  - There are big opportunities in agriculture for technology suppliers (IoT and others), including SMEs that can come up with innovative/imaginative tailored solutions. (Data) Interoperability between different manufacturers/vendors
  - Huge diversity in agriculture and IoT applications and it's not a one size fits all, and needs tailored solutions to fit farmers specifics.
    - Question: What´s the best approach: top-down or bottom-up approach?
    - Answer: Mixed top-down and bottom-up.
- 5G/NetWorld2020:
  - We have a strong technology bias. We discovered that we needed to explain the society the added value.
    - Question: What is the best approach: define a top-down deployment strategy? Or let the market deploy and then intervene.
    - Answer (TIM): In Italy, 5G frequencies have already been bought by the industry (2.6 bn euros). There is a cost already paid upfront.
    - Answer (Rui): Contradictory approach from the EC: they require the help from the 5G players to help develop the industrial potential but at the same time, they are requiring the same industry to pay for spectrum or technology licenses.
- NEREID:
  - The nanoelectronics case is special, as they need to cover the whole TRL scale from 1 to 6-7.
  - They see a top-down orchestrated approach as more efficient than a bottom-up approach, but the 2nd one is also important to develop disruptive applications.
  - The NEREID roadmap proposes plans for some specific technologies and applications where Europe is strong.
  - Connectivity, "More than Moore", very low power More Moore technologies are some of the important elements for the nanoelectronics community, with large medium to long term impacts. In their case a long-term programme is needed to reach the final stages of the TRL scale.
  - Need cluster projects with ten-year programme to provide greater integration and efficiency for the main European technologies and applications.
  - Very wide collaboration with industry and academic and end user (that maybe was not so much addressed in the past).
- TNO:
  - Lack of uptake of IoT technologies by SMEs and other players, especially in some European regions --> Solution: DIHs focused on IoT. Need to combine exploitation of existing technology (high TRLs, what DIHs are for) with exploration (raising lower TRLs through research). Both dimensions need to be combined.
  - Innovation perspective and make clear what value organisations can create e.g. reduce waste, efficiency, human value, knowledge, etc.

    The Digital Ecosystem must lead to the perception of Value creation.
    - Member States often question the EC on their choice of Large-Scale initiatives. Regional hubs/competence centres are an important piece of the puzzle.
- EFFRA:
  - Manufacturing industry is not just about production of physical goods. Business model is progressively changing towards service production rather than production of goods (e.g. not selling the car but the KMs). Also, the sharing economy and the circular economy is

shaping the manufacturing industry (up to end of life and recycling). IIoT should be understood as "IoT for manufacturing industry" instead.

- Digital transformation: manufacturing industry must transform itself to avoid the danger of disappearing. For this several approaches exist, but each approach works good in some cases but not others:
  - Top-down: digital maturity analysis. From "as is" to "to be". Not working for more mature companies that also need the bottom-up approach.
  - Bottom-up: In Italy they have set up fiscal incentives for companies that want to undergo digital transformation.
- DIHs are key to raise awareness, accelerate and elevate the level of digital transformation.
  - Question: Is top down (public infrastructure) needed or bottom-up (industry led) approach needed?
  - Answer: Both needed: Top down for EU wide incentive and Bottom-up are regional-local levels.
  - Question: Where to put the money?
  - Answer: Training and Skills development.

- Enercoutim:
  - Perspective from the energy sector (2020-2050 vision to carbon neutrality).
  - Opportunity for the IoT supply sector to impact the transformation of the energy sector.
  - Top down and bottom up drivers.
  - Technologies:
    - How to get there fast.
    - Create a blue growth economy.
    - Deploy in packetized technologies (smart objects, DLT, AI, Cloud, IoT, connectivity, governance, etc.).
    - Decentralised, Decarbonised, Deregulated.
    - Digital Twin for whole energy sector in Europe.
    - Paper available on marketplaces deregulation governance and ethics released recently.
    - Marketplace for energy driven solutions.
    - Digital grid for grid strengthening (non-feasible to replace the whole grid, retrofitting actions to be pursued).
    - Trust in AI must be achieved: data quality, semantic, integration.
    - Question: Do you see that Member States are willing to progress on a common infrastructure and to facilitate cross border market?
    - Answer: Cross border interconnectivity is already committed between Spain and Portugal and will be market-driven (auctions). Grid renovation will not be as simple, but will progress, possibly linked to "blue growth".
- BDVA:
  - Challenges on data ownership! Leave to market o or needs public intervention?
  - How far should public intervention go?
  - The ultimate goal/driver should be public interest and European competitiveness.
  - Data ownership and governance needs tackled and cleaned up!
  - Now regarding data, the current discussion on AI about fairness, expandability, ethics, etc, it boils down to the availability of quality data and the use that is done with it.
  - Data quality and semantics to support/drive data ethics.
  - Europe could become a world leader here, if done properly (differentiating ourselves from Facebooks & co.). Shared top-down with bottom-up.
  - Support public shared data space. Massive intervention from Top down to create such a huge infrastructure is still open.

Summary by Rolf Riemenschneider, EC, Belgium

- The potential scope and need of a bold and coordinated investment with member states on Industrial IoT (IIoT) has been discussed (having presented the conclusion of the IIoT Value Chain workshop). The panel unanimously concluded that an EC coordinated initiative would be beneficial in combination with a bottom up approach with the demand side – however, prioritisation was given to capacity building and deployment rather than large public intervention, e.g. an IPCEI. Mix of top-down and bottom-up policy mix seems to be the way to go ahead.
- Try to keep current PPPs open and reactive to new technological and economic challenges.
- In the future, the SRA would have to be more reactive across different Commission policy streams, which would require complementary and swift actions.
- Keep an eye on the deployment and value created at regional level.
- Impact on SMEs must be monitored.

The research and innovation priorities are important to be presented it as a package including IIoT, 5G, edge computing, AI, knowledge ecosystems and intelligent infrastructure for industrial sectors. This will have traction from several countries.

The follow up of the European Industry Partnerships Collaborative Event will be in September/October 2019. Most probably another workshop then.

In September will be the bilateral strategic meetings with different groups for preparing the future European partnerships.

Organising team: Ross Little Armitt, ATOS, Spain, Ovidiu Vermesan, SINTEF, Norway, Karl Andersson, LTU, Sweden, Dolores Ordóñez, AnySolution, Stefano Fava, LINKS Foundation, Italy, Marcos Álvarez, GRADIANT, Spain.

9. CONCLUSIONS

Wrap-up and what next. Horizon Europe perspective – IoT/IIoT as part of the Next Generation Internet.

Closing remarks (Rolf Riemenschneider, EC, Belgium)

- This workshop is the first of its kind by bringing so many stakeholders on the table.
- Almost all and every PPP acknowledges the need to link up to vertical and extend its strategy to cross vertical applications and laterally scaled ecosystems - a concept that is strongly built in into the design of the Focus Area IoT and DT under H2020.
- EC is interested in finding the right measures to be delivered across different policy streams but also to tailor its measure to deployment and up-scaling as well as securing investment in digital infrastructure.
- EC is interested in finding evidence of the impact of Large-Scale Piloting efforts being done by the EC.
    - Some of the impact comes in the form of recommendations for policy making beyond 2020.
    - Others to promote digital architecture and standards across so far siloed application domains.
    - Support convergences of platforms and standards.
    - The strategy of the IoT focus area with its open engagement model (with industry, supply and demand side), its visibility and extension to regional initiatives and its open ecosystem support with direct interaction with SMEs, has been commendable and identified as a success factor also for other PPPs.
- What are the deployment infrastructure needs? Who puts in the data infrastructure for sharing data, for data analytics, for taking up advances on AI and data valorisation?
- The changes in new value chains in a global context is something of high interest to the EC and needs to consider the global economic trends and new partnerships. This requires current PPP to analyse their key stakeholders in a global context and highlight converging application and market trends.
- Trend analysis is a good starting point but needs a deeper insight, highlighting the cross-cutting challenges across the portfolio of current partnerships and re-focus on new global challenges.
- Agreements on how to share investment costs need to be made in fields like 5G, Shared Data Spaces.
    - Who pays in the end for a shared infrastructure?
    - Are public investments needed to ensure open and scalable data infrastructure?
    - Business model and agreement on investment needed.
- Many open questions remain yet to be solved.
    - Huge investments in sectors and who makes the first move?
    - Pilot initiatives and use cases need more analysis as to provide evidence for policymaking
    - Europe’s challenge for a modern digital society is to deliver on a modern policy framework that cuts across today’s silos of domain specific organisation charts.
- New future Partnerships:
    - Policy-driven e.g. clean climate as driver, reducing Greenhouse Gas Emissions, mobility and demographic change.

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11. APPENDIX - EUROPEAN INDUSTRY PARTNERSHIPS COLLABORATIVE EVENT PROGRAM

08:30-09:00	**Registration – Hotel Lobby - Steigenberger Airport Hotel Amsterdam**
Meeting Room: Lime-Olive, Steigenberger Airport Hotel Amsterdam, The Netherlands	
European State of Play: Achievements, Research Gaps and Future Priorities	
09:00-09:05	***Set the scene*** **-** Ovidiu Vermesan, SINTEF, Norway, Karl Andersson, Luleå *University of Technology, Sweden*, Dolores Ordóñez, AnySolution, Spain, Ross Little, Atos, Spain, Stefano Fava, Links Foundation, Italy
09:05-09:15	***Research and Innovation Context*** Rolf Riemenschneider, EC, Belgium
09:15-10:20	***IoT Large-Scale Pilots Programme – highlights, achievements, sustainability, scale-up, cooperation with regional/national initiatives, value proposition, identified gaps and next steps.*** • ACTIVAGE - Sergio Guillén, mySphera, Spain • IoF2020 - George Beers, WUR University, Netherlands • SYNCHRONICITY - Nuria de Lama, Atos, Spain / Rick Schager, Eindhoven Council, Netherlands • MONICA – Roberto Gavazzi, Telecomitalia, Italy **Moderator**: Rolf Riemenschneider, EC Belgium
10:20-11:00	***European partnerships strategic directions and research priorities in a global context.*** • ARTEMISI-IA: Jan Lohstroh, Netherlands • 5G PPP IA /NetWorld2020 – Rui L. Aguiar, Aveiro University, Portugal/Karl Andersson, Luleå *University of Technology, Sweden* • AIOTI – Luis Perez-Freire Gradiant, Spain/Ovidiu Vermesan, SINTEF, Norway **Moderator**: Rolf Riemenschneider, EC Belgium
11:00-11:20	**Coffee/Tea Break**
11:20-13:15	***European partnerships strategic directions and research priorities in a global context. Digital autonomy. Future standardisation and regulatory landscape.*** • ECSEL - Yves Gigase, ECSEL, Belgium • NEREID- Nanoelectronics Roadmap for Europe – Francis Balestra, IMEP-LAHC, France • ETP4HPC - Michael Malms, IBM Research, Switzerland • BDVA – Edward Curry, The Insight Centre, Ireland • ECSO – Roberto Cascella, ECSO Secretariat, Belgium • EFFRA / FoF - Sergio Gusmeroli, Politecnico di Milano, Italy • EIP-AGRI - Willemine Brinkman, Netherlands • Synchronisation Model for Standardisation Activities in Europe - Haydn Thompson, THHINK Wireless Technologies Ltd, UK **Moderator**: Franck Boissière, EC Belgium
13:15-14:00	**Buffet Lunch Break and Networking**
Meeting Room: Lime-Olive, Steigenberger Airport Hotel Amsterdam, The Netherlands	
Future technologies, impact for society -The horizon landscape in Europe	
14:00-15:15	***Future research, innovation and deployment agenda. Contributions from European partnerships and future developments. Priority themes. Key takeaways.*** Panellists: Yves Gigase, ECSEL, Oltion Xhezo, Vodafone, Ju Liu, Huawei, Omar Elloumi, Nokia, Maike Gilliot, ETP4HPC, Roberto Cascella, ECSO, Roberto Gavazzi, Telecomitalia **Moderator:** Franck Boissière, EC Belgium
15:15-15:30	**Coffee/Tea Break**
15:30-16:30	***Industry-driven priorities for converging technologies such as IoT/IIoT, 5G, AI, DLTs, edge computing in manufacturing, processing, construction, ICT and automotive – Impact of new European partnerships. New value chains.*** Panellists: (as starting point): Francis Balestra, IMEP-LAHC, Rui L. Aguiar, Aveiro University, Willemine Brinkman, EIP-AGRI, Derrick Pisani, Connectivity Alliance, Edward Curry, The Insight Centre, Natalie Samovich, Enercoutim, David Langley, TNO, Sergio Gusmeroli, POLITO **Moderator:** Rolf Riemenschneider, EC Belgium
16:30-17:00	***Wrap-up and what next. Horizon Europe perspective*** – IoT/IIoT as part of the Next Generation Internet, Connectivity and Intelligence at the Edge. ***Concluding remarks*** **-** Rolf Riemenschneider, EC Belgium
17:00	**Closing**