Expert Group on

Internet of Things (IoT) / Cyber-physical Systems (CPS)

Chair: **Sebastian Engell**
TU Dortmund (TUDO), Germany

Co-Chair: **Tariq Samad**
Technological Leadership Institute, University of Minnesota, US (previously: Honeywell, USA)

EG Management: **Christian Sonntag**
TU Dortmund (TUDO), Germany

Sebastian Engell, TUDO

**ICT Policy, Research and Innovation
for a Smart Society**

www.picasso-project.eu

PICASSO: Objectives and Activities

Enhancing Cooperation focusing on pre-competitive R&I

> Analyse industrial drivers, societal needs and barriers to exploitation

> Promote mutual funding opportunities and develop the "ICT Industry Toolkit"

> Develop and promote success stories/ good practices

> Outline and provide all collaboration opportunities, especially for the industrial sector.

Contribute the EU-US policy dialogue

> Discuss policy-gaps or overregulation targeting core policy issues: Standards; Privacy; Cyber Security.

> Prepare Policy Brief and propose ways forward

> Analyse the areas with the highest potential for EU-US ICT collaboration

Outline new avenues and develop strategic initiatives

> Investigate, put forward and promote strategic initiatives for EU-US ICT collaboration

> Start the implementation of selected strategic and agreed initiatives, e.g. on regulation /de-regulation needs, standardization...

> Explore options and propose and promote topics for exclusive EU-US collaboration under joint or coordinated schemes and in the field of core ICT technological areas and societal challenges.

Expert Groups

3 Technology Groups
On strategic ICT technology areas in relation to societal challenges

1 Horizontal Group
On ICT Policy

Synergies between policy and technology groups

5G Networks

Big Data

IoT/CPS

Policy issues:
Privacy and data protection | Cybersecurity | Standards and Interoperability | Ethics …

25+ Experts in total across all groups

PICASSO
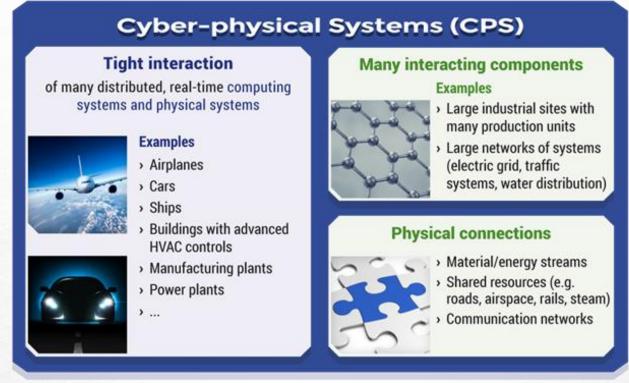EU-US ICT collaboration

Internet of Things (IoT)

> Internet of Things (IoT) – Paradigm based on the convergence of:

- Low-cost sensing and computation
- Ubiquitous connectivity and mobile apps
- Cloud analytics and big data

> IoT annual global economic potential: Between **$1.4 trillion** to **$14.4 trillion** by 2020 – big hype

> IoT initiatives, alliances, and clusters

- **US:** Several alliances with international membership
- **European IoT Research and Innovation Cluster** with over 40 European projects
- **Alliance for Internet of Things Innovation (AIOTI**)

Cyber-physical Systems (CPS)

> An area of European strength

- € 410 billion market
- 4 million jobs worldwide, of which one quarter are in Europe

Convergence of IoT and CPS

> Focus of current research and development in IoT

- Low-cost sensors / computing
- Provision of connectivity, middleware
- Enormous amounts of data can be collected

> Making it useful (and a business) is sometimes not so clear

- What benefits can be gained from the data
- Challenge: From sensing to actuation, closing the loop

→ **IoT is an enabling technology for CPS**

> Cyber-physical systems are often embedded in large systems consisting of many coupled components with partical autonomy
  → Cyber-physical Systems of Systems (CPSoS)

> **CPS + IoT => CPSoS**

Expert Group on IoT/CPS

> **Scope** of the Expert Group: **The intersection of IoT and CPS**

> **IoT related to applications that involve physical systems**

- Smart Cities
- Smart Energy
- Smart Transport
- Smart Production

> Beyond connectivity:

- How can the data be transformed into useful knowledge and actions?
- Large scale systems (CPSoS) with multiple / multiscale feedback loops, local autonomy
- Strong involvement of humans
- But also strong need for support of humans ("Cognitive Systems")

Expert Group Members

Name	Organization Position	Background
Sebastian Engell (Chair)	TU Dortmund, Germany Professor	Automation and Control / Systems Management / CPS
Tariq Samad (Co-chair)	Technological Leadership Institute (TLI), University of Minnesota, US Professor	Industrial Automation
Massoud Amin	TLI, University of Minnesota, US Director / Professor	Infrastructures / Smart Grid
Chris Greer	NIST, US Associate Director for Programs	Computing / CPS
Paul Nielsen	Software Engineering Institute, CMU, US Director / CEO	Software development / CPS / Cyber-security
Haydn Thompson	THHINK, UK Director	Wireless sensors / Transportation / Manufacturing / Smart Cities
Hubertus Tummescheit	Modelon CEO	Modeling / Simulation
O. Sinan Tumer	SAP Co-Innovation Lab, US Senior Director	Co-Innovation / Research Commercialization
Ovidiu Vermesan	SINTEF ICT, Norway Chief Scientist, Chair WG01 AIOTI	Internet of Things

Objectives of the Expert Group

› Identify **gaps, (technical and societal) needs, drivers, and opportunities** in research, innovation, and policy at the intersection of IoT and CPS

› Analyze the **potential and the challenges for EU-US collaboration** in IoT/CPS research, innovation, and policies

› **Propose new avenues for EU-US ICT collaboration** and **pave the way** to strategic initiatives and actions in the domain of IoT/CPS

› **Support links** between EU and US networks (PPPs, ETPs, H2020 projects, associations) and contribute to PICASSO **outreach**.

› **Distribute information on cross-Atlantic funding opportunities**

Main Task for the Coming 9 Months: Opportunity Report

> **Highlight similarities and differences** between EU and US R&I policies and **possibilities for synergies**

> Identify **gaps, challenges, and open issues** in research and innovation in IoT/CPS

> Outline **opportunities for collaboration**, involving the industrial sector

> Propose EU-US **strategic initiatives** including **academia-industry collaborations**

> Propose **policy initiatives**

> Serve as a basis for future discussions in PICASSO

Opportunity Report

> **Start from "Panorama Report"**

> **Analytical work by the Expert Group**
>
> - Investigate current research priorities and the focus of on-going projects
> - Analyse gaps and new opportunities

> **Interviews** with leading representatives of industry and academia on challenges, opportunities, and technology and policy gaps

> **Discussions** with funding bodies (e.g. NSF, EU)

> **Synthesis:** Key challenges, proposals for strategic initiatives

> Posting and discussion → **Next meeting in May 2017**

The Opportunity Report: Structure

> ## Overview and Motivation

- Summary of current "panorama" in important sectors, motivation for closer EU-US cooperation (gains by synergy etc.)

> ## Opportunities

- Overview of the EG domain

- Research and innovation priorities including similarities and differences between EU and US

- Analysis of gaps and opportunities

- Collaboration opportunities

- Suggestions of policy initiatives

> ## Summary: Major Recommendations

The Opportunity Report: Timeline

> **June 2016:** Skeleton and template

> **Sept. 2016**: Draft of current R&I priorities part circulated to EG
- Feedback from EG members (and others)

> **Sept. - Oct. 2016:**
- Interviews and discussions on gaps and opportunities
- Inputs from EG members
- TelCo for screening of topics

> **Nov. 2016:** Input by EG members and consolidation

> **Dec. 2016 – Jan. 2017**: Collection of feedback from EG members and discussions with stakeholders

> **Feb. 2017**: Final version

Policy Discussion

> The Expert Group on IoT/CPS is asked to provide input to the Policy Expert Group

- **Goals:** Get a clear overview of the priority policy issues in ICT collaboration, and insight how these issues can be addressed

> (Candidate) policy issues for discussion

- **Privacy and data protection (topic of today)**

- Global societal challenges (human rights, climate change, sustainability)

- Trust and confidence, security, anonymity, encryption, censorship, surveillance

- Innovation ecosystems (start-ups etc.)

- Open standards, certification, transparency

Privacy and Data Protection

> Privacy and data protection issues complicate trade negotiations, freedom of information rules, digital rights, intellectual property protection and financial regulation

> Divergent legislative and legal developments

- US tends to view data privacy as an **economic right** (primarily treated as a trade issue), protection of *specific types* of data, protection against *unreasonable search and seizure* by *government*

vs.

- EU tends to view data privacy as a **fundamental right** (going beyond trade issues), protection of *broad classes* of data, general protection against *data privacy invasion* by *private* actors

Policy Issues: Questions

> In what way do privacy and data protection touch upon EU-US collaboration in the IoT/CPS domain?

- What are barriers and opportunities?

> What other EU and/or US policy issues have an important impact on EU-US collaboration in the IoT/CPS domain?

- What are the related barriers and opportunities?

- Where do different legal frameworks and regulations or social and political preferences create important obstacles for the joint development and deployment of technologies?