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# IOT WEEK 2018 REPORT

- FOREWORD.....2
- A BRIEF OVERVIEW OF IoT WEEK 2018.....3
- 2018 IEEE GLOBAL INTERNET OF THINGS SUMMIT (GloTS).....6
- PROGRAM OVERVIEW .....8
- CONCLUSION .....18
- ORGANIZING COMMITTEE, SPONSORS AND PARTNERS .....189
- EXHIBITORS.....18
- ANNEX: SESSION REPORTS.....21



## FOREWORD



Sébastien Ziegler President of the IoT Forum

This year, the 8th edition of IoT Week in Bilbao has once again demonstrated the vibrant energy and creative spirit of the IoT community. The conference brought together over 850 experts currently active in the Internet of Things domain, from 39 countries, including 255 speakers. With a catalog of 162 sessions and activities, IoT Week has explored new territories, built bridges and formed new collaborative connections. This year's conference has again enriched our vision of the future evolution of the Internet of Things.

Additionally, following a successful event last year, the second edition of the *Global IoT Summit* was held with the support of IEEE, which included a selection of 75 scientific articles, as well as the publication of recent global innovations in IoT.

The IoT Forum aims to promote international cooperation and dialogue within the Internet of Things domain. That's why we're particularly delighted with the growing level of cooperation with other networks. It's been a pleasure to associate with key partner organizations, such as the ITU, AIOTI, BDVA, ECSO, TM Forum, and OASC to name just a few, as we built a wider and richer program, held over five days in the marvelous city of Bilbao. We cooperated closely with the five European Large Scale Pilots (LSPs) on

the Internet of Things, and received active support from the European Commission, with two CSAs bringing valued contributions. We're looking forward to developing our partnerships and collaborations further for next year's IoT Week.

This year's edition included a number of new activities, including a brokerage event, a start-up competition, and two new program tracks focused on smart farming and 5G-IoT convergence. To share the learnings of the event, information from **168 presentations** has been made available by our speakers on the IoT website: <https://iotweek.org/presentations-2018/>.

I would like to take this opportunity to thank all those who contributed to making this event possible, including all the volunteers, our excellent moderators and speakers, all our partners and supporters. This includes, of course, our local host, **IK4-Tekniker**, that has handled such a complex event with professionalism and proficiency, with the active support of the **Basque Government**, the **Biscaya** Local Administration, the **SPRI Group** (Basque Business Development Agency), **Euskatel** and **Ibermática**. Thanks to the hospitality of these organizations, we had the privilege of experiencing the Basque Country's unique culture, which I hope will forever remain a living part of the European and World heritage.

Finally, allow me to thank all the members of the IoT Forum whose support is essential in organizing IoT Week. The IoT Forum is a nonprofit, independent, self-funded and member-driven organization, which aims to promote international dialogue and cooperation.

We look forward to welcoming you to the next edition of IoT Week that will take place in **Aarhus, in Denmark, from 17th to 21st June 2019**.

**Sébastien Ziegler**  
President of the IoT Forum

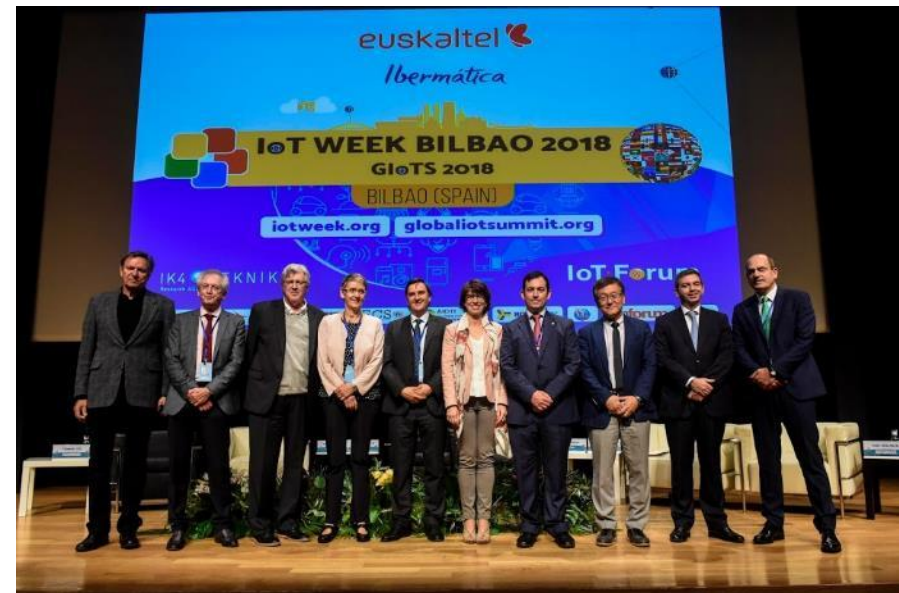
## A BRIEF OVERVIEW OF IoT WEEK 2018

The 8th edition of IoT Week and the 2nd Global IoT Summit were held in Bilbao, Spain from 4th-7th of June 2018. This year's IoT week was organized by local host IK4-TEKNIKER as well as the IoT Forum.

### Conference Attendance

The conference included over 160 sessions, held over four days, attended by more than 850 participants. The participants were given the opportunity to hear insights from and interact with IoT experts, industry practitioners and policy makers on a number of IoT topics, challenges and future trends. Key areas included: Emerging IoT Research and Development, IoT and Big Data, 5G Convergence, IoT and Smart Cities, IoT and Artificial Intelligence, IoT Security and Data Protection, IoT Market and Business Model, Smart Farming and Food Security, and IoT and Advanced Manufacturing.

In addition to presentations and panel discussions, a brokerage event and a startup competition were also held. The brokerage event provided an opportunity to establish new business collaborations, while the competition gave young startups a chance to increase their visibility, receive valuable feedback and gain recognition. This year's event also included a series of workshops, as well as a Hackfest.



*Figure 1 Speakers of IoT Week Plenary Session*

The conference hosted over 250 top-level experts, who spoke on IoT innovation, challenges and future trends. This was a unique opportunity for experts and enthusiasts to connect with others within the thriving IoT community, whilst learning about latest developments in the domain too.



## 2nd Global IoT Summit (GloTS)

The second Global IoT Summit (GloTS) was endorsed by IEEE and led by the IEEE Subcommittee on IoT, in collaboration with the IoT Forum. For the summit, cutting-edge scientific articles on IoT innovation were selected and presented, alongside the results of latest research projects into the field.

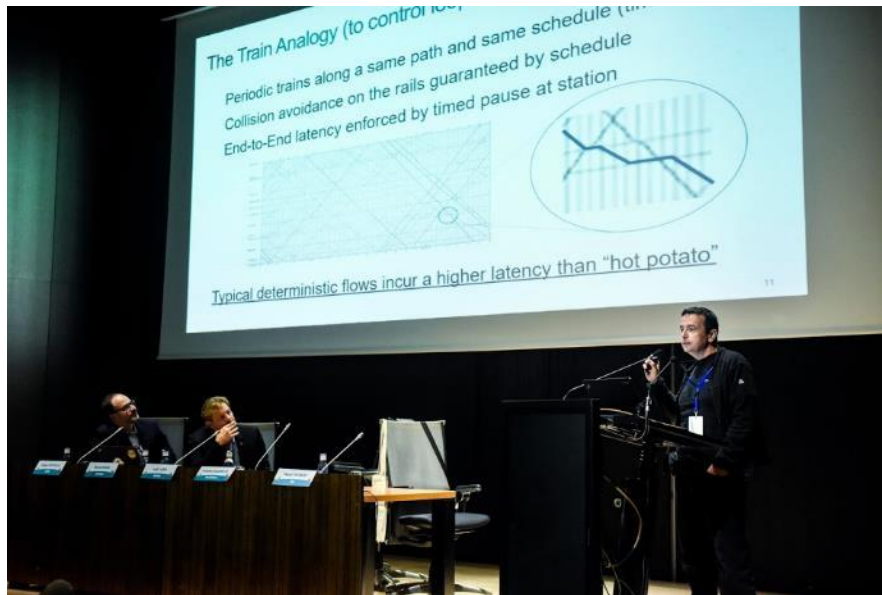


Figure 2 Dr. Pascal Thubert, Cisco at GloTS Opening Plenary Session

More than 70 papers were presented, by authors from 24 countries. The Award for Best Paper was given to authors Fang-Jing Wu, Gurkan Solmaz and Emo Peter Kovacs, for their paper titled "Toward the Future World of Internet of Things".

## Startup Competition

A number of interesting and innovative projects were presented at the startup competition, for which 13 startups were selected: **IMATEK, Ironchip, Arque, Zolertia, Recycl3R, Stockare, WiseHome, SocialAndCare, IDAB-IIoT, Symplio, WICASTR, Myruns and StandardAccess.**

The winning innovative projects were:

- I prize - Symplio, Bilbao (Spain)
- II prize - StandardAccess, Dingle (Ireland)
- III prize - Recycl3R, Palma de Mallorca (Spain)



Figure 3 The Startup Competition participants

### Exhibition Area

The exhibition area provided an excellent space for sharing ideas and networking, with more than 50 exhibitors showcasing latest IoT solutions.



*Figure 4 Representatives of the European Commission visiting the Exhibition space*

### Rich Networking Opportunities

Once again, IoT Week proved to be an environment that not only provided opportunities to learn about IoT challenges and opportunities, but also to

network within a relaxed setting with industry leaders, academics and public administration officials from around the world.



*Figure 5 Gala Dinner at the VIP Area of San Mames Stadium*

### Next Year – IoT Week 2019 Aarhus

IoT Week 2019 is set to be held in Aarhus, Denmark from the 17th to the 21st of June 2019. The local host will be IT-Forum, and the venue will be Musikhuset, the largest concert hall in Scandinavia.

## 2018 IEEE GLOBAL INTERNET OF THINGS SUMMIT (GloTS)



Following the success of the first Global IoT Summit (GloTS) in 2017, alongside IoT Week at the International Conference Centre in Geneva, this year saw the 2nd edition of the Global IoT Summit, which was supported by the IEEE ComSoc. Having fulfilled the objectives of its first edition, this year's summit brought with it a new drive to assemble research and bring together eminent experts in the IoT field. Latest research and industry insights point to an astonishing paradigm shift in this field, paving the way for innovation in a number of areas. Once again, the conference has continued to place emphasis on critical innovations that will impact research, real-world applications and the effects of these changes on society as a whole.

Despite this, the transformation of the IoT vision into a reality will invariably present several challenges, in particular in the fields of architecture, communication, services, computational intelligence, storage and governance, as well as core areas of sensor development and material engineering. This year's summit included additional efforts to attract new researchers from diverse, cross-disciplinary domains in order to better address the challenges of this emerging discipline. The GloTS-2018, which ran alongside 2018 IoT Week, discussed breakthroughs in IoT and the feasibility of making IoT, including wireless sensor network technology, truly ubiquitous with new cloud and edge computing technologies, big data analysis, citizen engagement, privacy and cybersecurity, and governance.



Figure 6: The Opening Session of GloTS, on June 4

The conference offered a prime space for industry leaders, academics, professionals, government officials, and students to discuss and foster knowledge about the emerging technology, business applications and social impacts of this technological field. These ideas were explored in various activities, including:

### 3 keynotes:

- **Dr. Ciprian Popoviciu.** President and CEO, Nephos6
- **Dr. Pascal Thubert.** R&D Principal Engineer, Cisco
- **Dr. Bruno Michel.** IBM Research - Zurich

**73 technical papers, selected from 131 submissions,** and formulated as technical track sessions and workshops on:

- IoT Enabling Technologies,
- IoT Applications and Services
- IoT Experimental Results and Deployment Scenarios
- Security and Privacy for Internet of Things



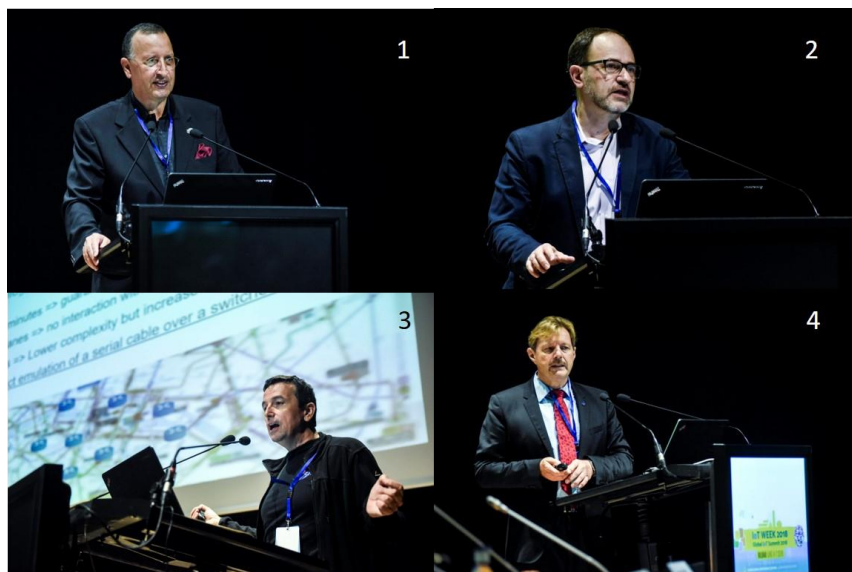


Figure 7: Speakers of the GIoT Opening Session: 1) Latif Ladid, 2) Ciprian Popoviciu, 3) Pascal Thubert and 4) Bruno Michel.

#### Five workshops on hot and emerging topics:

- User Centric Smart Cities Services (UCSC'18);
- Industrial Internet of Things Security (WIIoTS'18);
- Word Workshop on Interoperability and Open-Source Solutions for the Internet of Things (InterOSSIoT 2018);
- Semantic Interoperability in the IoT and WoT;
- Scaling Up IoT

#### Three industry sessions

- EU- China 5G IoT Large Scale Pilots
- IPv6-based IoT Deployment Around the World
- Cybersecurity & IoT



Figure 8: TPC Chair, Dr. Antonio Skarmeta speaking in GIoT Industry Forum I: "IoT Industrial Development"

First of all, we'd like to thank the European Commission for their funding of a number of vital IoT-related research projects, that have formed the backbone of this flagship conference. We'd like to thank the many public and private organizations supporting this event: the IEEE Comsoc; the IEEE Initiative on Internet of Things; our keynote speakers; the workshop and special session chairs; the authors and all attendees. It is the enthusiastic participation, networking and knowledge-sharing of the attendees themselves that make this event truly memorable. We hope the conference will plant seeds of knowledge and innovation that will bloom in years to come, to the benefit of the economy, society as a whole, and the daily life of all individuals.

We also hope our attendees enjoyed the event's diverse agenda, the opportunity to meet IoT enthusiasts, and the chance to network with industry experts currently driving the future of IoT. Finally, we hope our guests enjoyed exploring Bilbao and the surrounding areas as part of this experience that embraced technology and innovation, as well as friendship, culture and renowned Spanish cuisine.



## PROGRAM OVERVIEW

### PLENARY SESSIONS



Figure 9: Alex Bengoa, during his speech at the Opening Plenary Session

The plenary sessions involved high quality keynote speeches and presentations, including the following moments:

1. IoT Week 2018 Opening Plenary Session
2. IoT Week 2018 Keynotes: "Network Centric IoT Service Development - Reflections and Perspective from Service/Telco Provider and from Platform and Hardware Provider"
3. IoT Standards Trends & Convergence Plenary Session
4. IoT Week 2018 Closing Ceremony

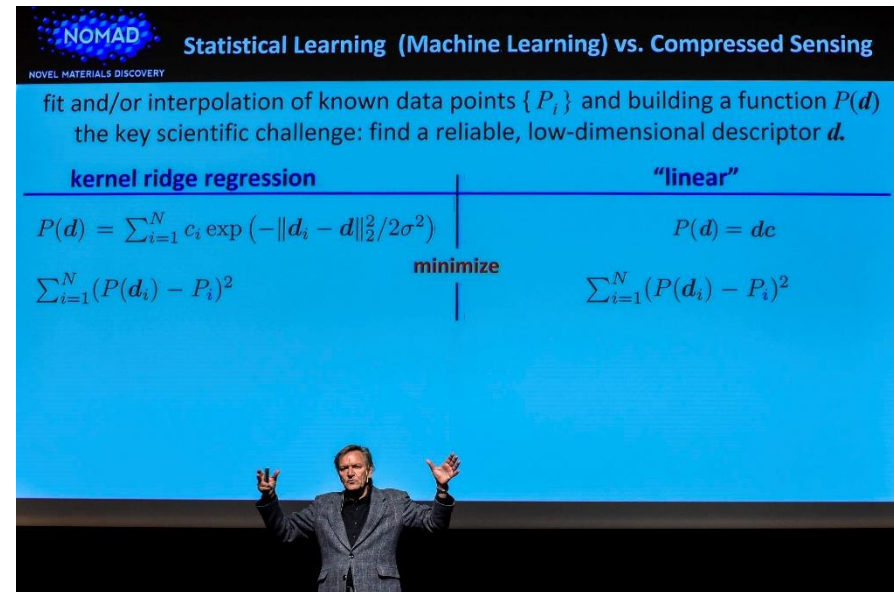


Figure 10: Professor Matthias Scheffler, during his speech at the Opening Plenary Session



Figure 11: The closing ceremony speakers

## THEMATIC SESSIONS

The key topics surrounding emerging IoT technologies and issues were grouped into program tracks, which were then discussed in the event's thematic sessions. The ten principal program tracks were:

### 1. Emerging IoT Researches and Technologies

Participants engaged with some of the latest developments in IoT research and development in sessions that explored emerging technologies, solutions and trends in the IoT landscape, as well as the societal challenges these developments present. The 'Emerging IoT R&D' program track included sessions on topics such as:

New Trends on Smart Agriculture

Future European Strategy and Funding Opportunities for IoT

Blockchain Technology and IoT New Challenges

Nanotech and Dust IoT: The Next Frontier

Enabling Next Generation of Energy Services with IoT

Smart Living Environments: ACTIVAGE (LSP)

IoT for Sustainable Development in Africa

New Trends for IoT and Satellite Networks

Building IoT Cross-Domain and Cross-Platform Interoperability

Extracting Value from Next General Digital Infrastructure (Big Data, IoT, Edge, 5G, HPC, Cloud, AI)

Create-IoT: EU-Brazil Collaboration on IoT for Sustainable Development

EU-ASIA Collaborations on IoT for Sustainable Development

Spreading the Web of Things

IoT, Trust & Morning Coffee – What you Always Wanted to Know About Trust

### AloTI WG2 Innovation Ecosystems Masterclass: Learn with and from the Bilbao IoT Ecosystem



Figure 12: : Left to right: Benoit Abeloos, Visa Vallivaara, Pekka Nikander and Anatole Kratiger, taking part in a discussion on “Blockchain Technology and IoT New Challenges”, conducted by Peter Wittenburg

### 2. IoT Market and Business Model

The IoT Market and Business Model' program track included the discussion of market perspectives, new financial and business models, and the impact of IoT on society, sustainable development and future industries. The sessions of this track included the following:

IoT Marketplaces from EU Projects

Novel Business Models for Smart Cities

Business Model Innovation as Driver for Change

### 3. IoT Security and Data Protection

The 'IoT Security and Privacy' program track addressed inter-alia issues such as IoT cybersecurity development and the impact of new personal data

protection laws and privacy regulations at a European level (GDPR, WP29, etc.) and in other regions. The sessions in this track were:

Emerging IoT Threats and Ethical Hacking

IoT Security & Data Protection at a Crossroad

Everything You Always Wanted to Know About IoT & GDPR Compliance

eHealth and Smart Home Data Protection

Addressing the Cybersecurity Emerging Technologies

IoT Security Challenges in Vertical Sectors

Trusted IoT Strategies for the Future

#### 4. IOT4SCC: Joint Workshop on IoT for Smart Cities & Communities Platform Convergence

The adoption of Internet of Things (IoT) as part of various smart city ventures across the globe has propelled the idea of utilizing information and communication technologies (ICTs) to support urban services. In order to improve citizens' quality of life, city stakeholders are increasingly building alliances and initiating projects with public and private entities to explore new technologies.



Figure 13: The speakers of the IOT4SCC's Joint Workshop, Session 1: "Insights on Recent Trends and Evolution"

Given this context, IoT Week 2018 provided a platform for bringing together diverse knowledge bases, that could then be leveraged to effectively support the ongoing exploration and application of IoT. Smart cities are set to bring about positive social change, and a central driver of this change will be IoT-based services for citizens, as well as the adoption of IoT-enriched governance and IoT-enriched human capital. However, there remain gaps in the planning, execution and interoperability of IoT-based services. In light of this, IoT Week 2018 saw international initiatives and organizations sharing knowledge and discussing the potential for coming together to develop more open and interoperable solutions for smart cities. Sessions in this track included:

Welcome and Introductory Remarks

Session 1: Insights on Recent Trends and Evolution

Session 2: Smart City IoT Convergence: Platform and Solutions Convergence & Interoperability

Breakout A: IoT Integration and Interoperability in Smart Cities (Southbound)

Breakout B: Cross-Domain Applications (Northbound)

Day 1 Wrap-up Session

High Level Panel: IOT4SCC IoT SDG and Urban Agendas

Session 3 - Implementation: Large Scale Pilots and Open Calls

Breakout C: IoT and Smart Cities: Personal Data Protection Strategies and Guidelines

Breakout D: Open APIs

IoT Standards Trends & Convergence Plenary Session

## 5. IoT & Big Data

Under the umbrella term, 'Making the Data Revolution Happen', this program track addressed IoT & Big Data, and offered a series of sessions in which senior experts provided overviews in the form of short presentations on concrete use cases. The central question here was: how can Big Data preparation, wrangling, analytics and reporting be adapted in order to streamline and optimize data intensive projects to make them more reusable and scalable? The specific sessions included the following topics:

Trust and Technology - can it go together?

Computational Power and Efficiency - will it help overcoming barriers?

Machine Learning and Big Data - Will it help transforming Data into Knowledge?



Figure 14: Dirk Helbing and Peter Wittenburg at the track on IoT & Big Data

## 6. 5G – IoT Convergence (hosted by TM Forum)

The Convergence of Wireless Communications is a requirement for the full deployment of 5G. New challenges and opportunities were introduced and debated in the '5G Convergence' program track, hosted by TM Forum. This track included sessions such as:

5G – IoT Convergence: An Overview

An Interactive Session on 5G IoT Ecosystem Integration & Management

5G and IoT: The Security and Privacy Challenges





Figure 15: Franck Boissière, speaking in a session on 5G-IoT Convergence

## 7. Artificial Intelligence and IoT

The 'Artificial Intelligence and IoT' program track included the discussion of advances in the development and democratization of A.I. solutions that have the potential to address global challenges relating to poverty, hunger, health, education, the environment and others. The list of the topics addressed included:

Linking A.I. and IoT in Smart Cities

Artificial Intelligence and the Sustainable Development Goals

Creating value by AI and Big Data: Industrial Applications, Challenges and Outlooks



Figure 16: Marcelo Zuffo, speaking about Linking A.I. and IoT in Smart Cities

## 8. IoT for Active and Healthy Ageing

The development of IoT solutions within the 'Active & Healthy Ageing' (AHA) domain has seen the creation of dynamic ecosystems to confront the systematic challenges of health and social care. 'AHA-IoT' services are being offered to individuals, who then produce a high volume of personal data. Consequently, the production and consumption of personal data across domains have become major concerns with regard to data privacy, security, authentication, access consent, ownership, storage management. The sessions in Bilbao that aimed to deal with these issues included:

Smart Living Environments: ACTIVAGE (LSP)

Active and Healthy Ageing IoT

## 9. Smart Farming and Food Security

The 'Smart Farming and Food Security' track enabled the discussion of the latest IoT technology trends in the farming and food sectors. Industrial solutions as well as current European projects were used as an entrance point to explore gaps in the industry, current trends and key demands. The sessions comprised the following:

- New Trends on Smart Agriculture

- Industrial Solutions on Farming and Food Security

- Integrated and Smart Food Value Chain

- Farming and Food Security Ecosystems

## 10. IoT and Advanced Manufacturing

A particularly prominent topic within Basque industrial strategy, the 'IoT and Advanced Manufacturing' program track provided the opportunity for the discussion of international initiatives, various industrial solutions and current ecosystems (local and international) as well as ongoing standardization initiatives. The sessions of this track included:

- Worldwide initiatives: IoT in Manufacturing Initiatives in America and EU

- Solutions and Experiences Coming from the Industry

- Ecosystem and Advanced Manufacturing



*Figure 17: Left to right: Thorsten Hülsmann, Susana Larrea, Jorge Rodríguez Erdoz and Franck Boissiere, debating on "Ecosystem and Advanced Manufacturing"*

## WORKSHOPS



Figure 18: A session as part of the SAREF4City Validation Workshop

Once again, IoT Week presented a series of great workshops and panel sessions that ran parallel to the thematic sessions. The topics of these workshops were:

### 1. IoT Security and Privacy Capacity Building Workshop

IoT Security and Privacy Capacity Building Workshop, part I

IoT Security and Privacy Capacity Building Workshop, part II

### 2. SAREF4CITY Validation Workshop

SAREF4CITY Validation Workshop, part I

SAREF4CITY Validation Workshop, part II

SAREF4CITY Validation Workshop, part III

### 3. IoT in Manufacturing

Insights from the Industry

R&D Initiatives and Results

### 4. Urban Resilience Workshop

Session 1: In Search of Sustainable and Resilient Cities

Session 2: Cities are as Smart as their Citizens!

### 5. Harvesting: A New Challenge for Powering IoT Nodes

Harvesting: A New Challenge for Powering IoT Nodes, part I

Harvesting: A New Challenge for Powering IoT Nodes, part II

### 6. Next Generation Internet Workshop

### 7. U4IoT Workshop

IoT Adoption Barriers – Which, Why and How?

End-User Engagement Tools and Methods for IoT Projects

### 8. Why Should IoT Innovation Actions Engage with Artists?

## STARTUP COMPETITION

On Tuesday, 5th June, 13 innovative startups participated in the IoT Week 2018 Startup Competition, judged by a panel of six senior members. The selected startups were: IMATEK, Ironchip, Arque, Zolertia, Recycl3R, Stockare, WiseHome, SocialAndCare, IDAB-IIoT, Symplio, WICASTR, Myruns and StandardAccess

The winners of the Startup Competition were:



- I award – **Simplio**, Bilbao (Spain)
- II award – **StandardAccess**, Dingle (Ireland)
- III award – **Recycl3R**, Palma de Mallorca (Spain)



Figure 19: Left to right: Marilín Gonzalo, Marian Gabilondo, Tanya Suarez and Alex Gluhak welcoming guests to the Startup Competition

## INNOVATION HACKFEST

This year, IoT Week organized an Innovation Hackfest for software developers, systems architects, services and solutions designers, entrepreneurs students, researchers and business makers from start-ups, large industry groups and industrial research units. The Hackfest allowed these individuals to explore the potential of IoT platforms, technologies, solutions and applications that are the result of 3 years of projects within

the IoT-EPI (European Platforms Initiative. The winning projects of the Innovation Hackfest were:

- Winner of the FIESTA IoT Challenge – **WiseHome FIESTA – Power Consumption Signature Analysis**
- Winner of the BIG IoT Challenge – **CALIFIED – Air Quality Calibration Via Big IoT Data**
- Winner of the Symbiote Challenge – **Symbiote for Smart Parts**

## BROKERAGE EVENT

On June 6th, IoT Week 2018 also hosted a matchmaking event for business persons, entrepreneurs, researchers and innovators to network through face-to-face meetings. This one-day event was tailored towards innovative companies, universities and researchers interested in sharing new project ideas and finding collaboration partners for the development and implementation of Internet of Things technologies and applications.

## SOCIAL EVENTS AND SITE VISITS

In addition to these professional sessions, IoT Week 2018 fostered familiarity and networking among its participants through a series of social events and site visits. These included:

- The **Coffee Breaks** and **Networking Lunches** during the week organized next to the Exhibition Area at the Euskalduna Conference Center, to allow participants to visit the stands..
- **IoT Week 2018 & GloTS Welcome Reception** with the support of **Open & Agile Smart Cities** that took place on 5th June with the participation of Dr. **Sébastien Ziegler**, President of the IoT Forum and Mr. **Martin Brynskov**, Chair of the OASC.
- **The Official GIOTS and IoT Week 2018 Gala Dinner** took place on Wednesday 6th June at the San Mamés Stadium's VIP area, where



delegates had the opportunity to take a closer look at one of the most beautiful football stadiums of the world, that will host games in the UEFA EURO 2020.



Figure 20: A collage showing some of the diverse opportunities for networking during coffee breaks



Figure 21: Sébastien Ziegler, Alex Bengoa and Martin Brynskov during the Welcome Reception



Figure 22: The Official GloTS and IoT Week 2018 Gala Dinner

#### IK4 - TEKNIKER Visit

The IoT Week 2018 local host, IK4-TEKNIKER is a not-for-profit Research & Innovation entity whose mission is to enhance companies' competitiveness. IK4-TEKNIKER is active in areas surrounding industry digitization and the increasing connectivity of machine2machine, machine2human, machine2workshop, whorshop2factory and factory2value chain (including the end customer). On Friday 8th June, delegates were offered the opportunity to watch on-site demonstrations on sensing, wireless networks, maintenance, artificial intelligence and big data as applied to a number of different sectors and solutions.



*Figure 23: The IoT Week delegation during their visit to IK4 TEKNIKER*

### **Santander City Visit**

On Friday, 8 June, The City of Santander organized a combined visit to the Santander Smart City Demonstration Center, the R&D lab at the University of Cantabria as well as a tour of Santander's street-level initiatives to explore Smart City deployments.



*Figure 24: The IoT Week delegation during their visit to Santander Smart City Demonstration Center*

## CONCLUSION

From our first edition in 2011 in Barcelona to this 8th edition in Bilbao, IoT Week has grown organically, consolidating the event as a leading global conference that each year attracts top experts in IoT technology from Europe and all over the world..

Following last year's successful event, this year's program built on the traditional tracks on Emerging IoT Research and Development, IoT and Big Data, IoT and Smart Cities, IoT Market and Business Model, and IoT Security and Data Protection, with a number of important additions to enrich the program of activities. The new additions to our catalog included the following program tracks:

- Artificial Intelligence and IoT,
- 5G and IoT Convergence,
- Smart Farming and Food Security,
- IoT and Advanced Manufacturing
- IoT for Active & Healthy Ageing.

Thanks to the involvement of international organizations and the European Commission, the second **IEEE endorsed Global IoT Summit (GloTS)** also enabled us to attract more researchers and academic experts. The spectacular facilities of the Euskalduna Congress Centre facilitated networking and collaboration within the event since it could be held in a single venue. This unique location meant we could construct our largest ever Exhibition Area that was home to over 50 Exhibitors, a startup

competition, the Hackathon, a brokerage event, numerous private meetings and workshops, and other social events to foster synergies among our participants.

Our participants also had the opportunity to visit the headquarters of our Local Host IK4 Tekniker in Eibar, to experience the Smart Santander project, to enjoy an unforgettable gala dinner at the amazing new San Mames Stadium (home of Athletic Bilbao FC) and sample exquisite Basque gastronomy.

IoT Week is a nomadic yearly conference, which has already been hosted by some of Europe's most dynamic cities. During the Closing Plenary Session, we were delighted to announce that next year's IoT Week will for the first time take place in **Aarhus (Denmark), from 17th to 21st June 2019.**

We look forward to seeing you again at what promises to be an unmissable event.

Looking forward to meeting you again at the



**IoT WEEK 2019**  
**17. - 21. JUNE**  
**AARHUS · DENMARK**





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ECS

IEEE  
ComSoc  
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AIOTI  
ALLIANCE FOR INTERNET  
OF THINGS INNOVATION

BDV  
BIG DATA VALUE  
ASSOCIATION

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## IOT WEEK EXHIBITORS



SYNCHRONICITY



EMBERS



## ANNEX: SESSION REPORTS

The following appendixes contain the summaries of some of the sessions of the IoT Week 2018 in Bilbao:

### APPENDIX 1: PLENARY SESSIONS.....23

IoT Week 2018 Opening Session .....	23
High Level Perspectives on IoT .....	23
Plenary Keynote Speech.....	24
IoT Week 2018 Keynotes .....	25
Closing Remarks .....	27

### APPENDIX 2: THEMATIC SESSIONS.....29

Emerging IoT Researches and Technologies .....	29
New Trends on Smart Agriculture.....	29
Future European Strategy and Funding Opportunities for IoT .....	29
Blockchain Technology and New IoT Challenges.....	30
Enabling Next Generation of Energy Services with IoT .....	32
IoT for Sustainable Development in Africa .....	32
New Trends for IoT and Satellite Networks .....	33
Create-IoT: EU-Brazil Collaboration on IoT for Sustainable Development .....	34
EU-ASIA Collaborations on IoT for Sustainable Development .....	35
Spreading the Web of Things.....	36
IoT, Trust & Morning Coffee – What you Always Wanted to Know About Trust .....	36

IoT Market and Business Model .....	38
IoT Marketplaces from EU Projects .....	38
Novel Business models for Smart Cities .....	39
Business Model Innovation as A Driver for Change.....	39
IoT Security and Data Protection.....	41
Emerging IoT Threats and Ethical Hacking .....	42
IoT Security Challenges in Vertical Sectors .....	43
IOT4SCC: Joint Workshop on IoT For Smart Cities & Communities Platform Convergence and Sustainable Development.....	45
General comments on the Joint Workshop .....	45
Session 2: Smart City IoT Convergence: Platform and Solutions Convergence & Interoperability .....	46
Breakout A: IoT Integration and Interoperability in Smart Cities (Southbound).....	49
Breakout B: Cross-Domain Applications (Northbound) .....	50
Breakout C: IoT and Smart Cities: Personal Data Protection Strategies and Guidelines .....	52
Breakout D: Open APIs .....	53
IoT & Big Data – Making the Data Revolution Happen .....	54
5G - IoT Convergence (hosted by TM Forum).....	56
5G – IoT Convergence: An Overview.....	56
An Interactive Session on 5G IoT Ecosystem Integration and Management .....	59
5G and IoT: The Security and Privacy Challenges.....	60

Artificial Intelligence and IoT .....	61
Linking A.I. and IoT in Smart Cities .....	61
Artificial Intelligence and the Sustainable Development Goals .....	61
Creating Value by AI and Big Data: Industrial Applications, Challenges and Outlooks.....	63
Smart Farming and Food Security.....	65
Industrial Solutions on Farming and Food Security .....	65
Integrated and Smart Food Value Chain.....	67
IoT and Advanced Manufacturing.....	67
Worldwide Initiatives: IoT in Manufacturing Initiatives in America and EU.....	67

Solutions and Experiences Coming from the Industry.....	68
APPENDIX 3: WORKSHOPS.....	70
IoT in Manufacturing: Enabling Industry 4.0 .....	70
R&D Initiatives and Results .....	70
U4IoT Workshop .....	70
IoT Adoption Barriers – Which, Why and How .....	70
APPENDIX 4: STARTUP COMPETITION .....	72
APPENDIX 5: INNOVATION HACKFEST .....	74
APPENDIX 6: BROKERAGE EVENT .....	76
CONTRIBUTORS TO THE SESSION REPORTS .....	77

## APPENDIX 1: PLENARY SESSIONS

### IoT Week 2018 Opening Session

#### Welcoming Remarks

To kick off IoT Week 2018, **Sébastien Ziegler**, President of the IoT Forum, and **Alex Bengoa**, Director of IK4 TEKNIKER (the local host), welcomed all our distinguished guests, speakers, moderators and participants to the conference. Over 250 speakers were in attendance, each highly qualified in different aspects of the Internet of Things. The conference began with an overview of the programme and the keynote sessions to come. IoT Week 2018 was a diverse conference, bringing together participants from many different countries to share their ideas. Additionally, the event incorporated social events such as the San Mames Gala Diner, Santander City Visit and the IK4 TEKNIKER Visit.



Figure 25: Speakers of the IoT Week 2018 Opening Session

Mr. **Asier Abaunza**, Delegate Councillor for Urban Planning of the Bilbao City Council, and Ms. **Estíbaliz Hernández Laviña**, Deputy Minister for Technology, Innovation and Competitiveness from the Government of the Basque Country, gave speeches on the status of institutional IoT in their respective areas. Following this, **Dr Chaesub Lee**, Director of the ITU

Telecommunication Standardization Bureau, and **Mechthild Rohen**, Head of Unit for “Internet of Things” at DG Communications Networks, Content & Technology, provided supra-national perspectives on IoT.

#### High Level Perspectives on IoT

The second part of the session featured distinguished keynote speakers who shared perspectives on IoT from both the private and public sector.



Figure 26: Alex Bengoa, director of IK4 TEKNIKER



The keynote speakers were:

- **Alex Bengoa**, Director General, Fundacion Tekniker
- **Craig Bachmann**, Executive Director, TM Forum
- **Francisco Arteché**, CEO, Euskaltel Group
- **Kees Van Der Klauw**, President, Alliance for Internet of Things Innovation (AIOTI)

### Plenary Keynote Speech

**Dr Matthias Scheffler**, Professor at the Fritz Haber Institute in Berlin, spoke on the topic, 'Making the Data Revolution Happen -- Turning Billions of Data from Computational Materials Science into Knowledge using AI'

The chairman of this session, **Dr Sébastien Ziegler**, President of the IoT Forum then offered some closing remarks to complete the Plenary Session.



*Figure 27: Dr. Matthias Scheffler during his Keynote Speech*

## IoT Week 2018 Keynotes

MODERATOR: Mirko Presser

### KEYNOTE SPEAKERS

- Oscar Fafián, IoT & Industry 4.0 Manager, Euskaltel Group
- Alicia Asín Pérez, CEO, Libellum

### SUMMARY

This session focussed principally on the relationship between business and the IoT Ecosystem, and how this interaction impacts applications, startups and organisations.



Figure 28: Alicia Asin and Oscar Fafian. A keynote session conducted by Mirko Presser (in the middle)

Mr. Oscar Fafian (Euskaltel) presented “IoT Driving the 5th Play” - a Telco Approach on Initiating IoT-Based Service Development Systems (Health, SmartCities, Industry 4.0, Smartliving)’.

Now that most telecommunications companies boast a ‘quad-play’ offer (internet, voice, mobile and television), IoT can open new opportunities for delivering additional services to both the residential and business markets. These additional services refer to the ‘quint-play’ which includes connected or smart devices. This keynote speech explored the strategy used to build an ecosystem between local and international partners, as well as to develop, deploy and deliver services for Smart Cities, Smart Living, Smart Health and Industry 4.0.

IoT is the operator  
fifth-play

It's not technology,  
it's ecosystem

We should be ready  
to play in the new  
battle field

Telco services + Smart Home = Quintuple Play



Next, Ms. Alicia Asin (Libelium) presented her speech entitled ‘Reflections on the IoT on its way to 2020: Risks and opportunities of the IoT towards a legacy of greater transparency and democracy’.

For modern Smart Cities, both the opportunities presented to them and the challenges facing them will continue to evolve up until 2020 and beyond. In recent years, multiple cities have become ‘Smart’. Many have applied Internet of Things technologies for different purposes, including transport monitoring, measuring pollution levels, water conservation or finding parking spots. However, this development might be labelled a “dream of efficiency” because although some cities have adopted sensor technology, most are still merely discovering it. Still, today’s citizens are concerned

about pollution and climate change, meaning they want their governments to take greater environmental responsibility.



In this speech, Alicia Asín also analysed the evolution of the application of Internet of Things in Smart Cities. This analysis traced this evolution from the first tentative business models, to the present day in which IoT applications are pushing the boundaries of technology, economics and society. In version 2.0 of Smart Cities, it's citizens that are driving change. They are demanding certain levels of quality of life; their actions are giving rise to grassroots efforts; citizens are increasingly taking it upon themselves to identify risks. Indeed, Smart Cities and the Internet of Things allow people to interact with their environment, their city and their regional governments in new ways. That's because open data initiatives make municipal activities more transparent. This transparency is an important element of democracy and could be the greatest legacy of the application of IoT.



Figure 29: The IoT Standards Trends & Convergence Plenary Session, with Bilel Jamoussi, Martin Brynskov, Jesús Cañadas, Marco Carugi, Raúl García Castro, Patrick Guillemin, Gilles Thonet and Kees van der Klauw



## Closing Remarks

To close this section of proceedings, the IoT Week President and representatives of the Host Committee thanked all participants (speakers, attendants, partners and sponsors). They also highlighted that this year's conference had expanded since the 2017 edition, with over 900 participants from 49 countries present at IoT Week 2018.



Figure 30: The Closing Ceremony

It was also time to announce the GloTs Best Papers, the three best hackathon projects and the three startup competition winners. The announced winners were:

### GloTs Best Papers

- Best Paper: **“Toward the Future World of Internet-of-Things”**, by Fang-Jing Wu (TU Dortmund, Germany), Gürkan Solmaz (NEC

Laboratories Europe, Germany) and Ernő Peter Kovacs (NEC Europe Ltd., Germany)

- Finalist: **“Why Channel Hopping Makes Sense, even with IEEE802.15.4 OFDM at 2.4 GHz”**, by Jonathan Munoz (INRIA-Paris, EVA team, France), Paul Muhlethaler (INRIA, France), Xavier Vilajosana (Universitat Oberta de Catalunya, Spain) and Thomas Watteyne (INRIA, France)
- Finalist: **“Situation Modelling, Representation and Querying in Context-as-a-Service IoT Platform”**, by Alexey Medvedev (Monash University, Australia), Alireza Hassani (Monash University, Australia), Arkady Zaslavsky (CSIRO, Australia), Pari Delir Haghighi (Monash University, Australia), Prem Prakash Jayaraman (Swinburne University of Technology, Australia), Sea Ling and Maria Indrawan-Santiago (Monash University, Australia) and Niklas Kolbe (University of Luxemburg, Luxemburg).



Figure 31: Antonio Skarmeta and Sébastien Ziegler, handing the GloTs Best Paper Award.

### Startup Competition Winners

- First prize— **Symplio**, Bilbao (Spain)
- Second prize— **StandardAccess**, Dingle (Ireland)
- Third prize — **Recycl3R**, Palma de Mallorca (Spain)

### Best Hackathon Projects

- Winner of the FIESTA IoT Challenge – *WiseHome FIESTA – Power Consumption Signature Analysis*
- Winner of the BIG IoT Challenge – *CALIFIED – Air Quality Callibration Via Big IoT Data*
- Winner of the Symbiote Challenge – *Symbiote for Smart Parts*

Finally, Karsten Dehler, from the It-Forum, the local host of the IoT Week 2019, announced the next edition of the conference which will take place in Aarhus, Denmark, from 17th to 21st June 2019.



Figure 32: Karsten Dehler announcing in the Closing Ceremony that IoT Week 2019 will take place in Aarhus, Denmark

## APPENDIX 2: THEMATIC SESSIONS

### Emerging IoT Researches and Technologies

#### New Trends on Smart Agriculture

MODERATOR: Srdjan Krco

SPEAKERS:

- Denis Sakuma
- Juergen Sturm
- Edwin Hecker
- Joël Bacquet

SUMMARY:

All panel participants first gave 10-minute presentations outlining their perspectives on current trends and how these might evolve within the smart agriculture domain. This was then followed by an interactive discussion, involving a variety of questions from the moderator and the audience.

Among the significant challenges highlighted in this discussion were: the interoperability of smart agriculture solutions, data ownership and the role of large agriculture vendors in the development of smart agriculture ecosystems. Furthermore, the prominence of agriculture within the digital agenda of the European Commission (EC) was recognised, alongside the European Commission's continued support in this domain. Indeed, a principal driver of smart agriculture has been the IoT-LSP program as well as AIOTI activities.

#### Future European Strategy and Funding Opportunities for IoT

MODERATOR: Peter Wintlev-Jensen

SPEAKERS:

- Rositsa Georgieva
- Franck Boissière
- Mario Dionisio
- Joël Bacquet

SUMMARY:

This session presented the audience with the EU's vision and strategy for IoT Research and Innovation, moving into the Horizon Europe timeframe. The session had a focus on increasing trust and security, as well as moving towards edge computing and data centric architectures. It also provided an overview of shorter-term funding opportunities under Horizon 2020. Representatives from the European Commission DG CNECT and DG ENER made special mention of the SME-orientated call for proposals from large-scale pilots in the fields of Smart Cities, Agriculture and Healthy Living.



## Blockchain Technology and New IoT Challenges



Figure 33: The speakers of the session

MODERATOR      Peter Wittenburg

### SPEAKERS

- Anatole Krattiger
- Pekka Nikander
- Visa Vallivaara
- Benoir Abeloos

### SUMMARY

In future years, billions of smart IoT devices will generate huge amounts of data - which will include personal information that needs to be protected. Therefore, one of the great challenges in this area is designing and

implementing a data protection and security framework. This session delved into the legal aspect of data management and the potential for a framework to be implemented using Blockchain technology (BCT). Finally, the EC were given an opportunity to outline their key programmes and initiatives in this field. Questions addressed to the speakers included:

- What is BCT useful for in terms of data management & access?
- How can BCT be incorporated scientifically without compromising on flexibility where it's implemented?
- How can we integrate BCT functionality into our solutions to help solve ongoing issues?
- How can we achieve full traceability when data exists outside trusted spaces?
- What are the comparative costs of using traditional technology?

As moderator, **Peter Wittenburg** (Max Planck Society and Research Data Alliance) introduced the session, referring to the debate and issues raised in workshops on big data during IOT Week. The previous year's event saw broad agreement that persistent identification and global resolution of identifiers to meaningful state information should be applied unilaterally. This year, the workshop included a session on the ethical/legal issues surrounding this area, with discussion of the potential for the development of a Digital Object based data infrastructure. Within this infrastructure, for instance, identifiable DOs could be linked to blockchain entries that contain smart contracts on the specified DOs and the transactions made.

**Anatole Krattiger** (Prisma Innovations LLC and former WIPO Director) gave a talk that focussed on intellectual property and patent aspects. Both TCP/IP and BCT are not patented, meaning they have the potential to drive economic innovation. However, BCT could be also used to manage patents due to its persistent and traceable function for storing specific actions. The same applies to activities surrounding trademarks and licenses, that are crucial for the functioning of our economy. That said, there remains no

comprehensive legal framework for many areas artificial intelligence is currently being applied, such as in the case of autonomous vehicles. Thus, Krattiger highlighted that technologies such as BCT are of great relevance for a functioning IoT domain, though much still needs to be done in order to develop a suitable legal framework, and to fully understand how BCT could be applied in complex contexts.

**Pekka Nikander's** (Professor of Industrial Internet at Aalto University) focus was on a 'reality check' of BCT, in order to overcome the 'hype' around this technology. "Blockchains are touted as the panacea for IoT security, but they are bulky." This poses the question of whether these technologies actually make sense when employed with IoT. IoT devices need to be small, BCT nodes are the opposite. A typical Ethereum archival node with a full history requires 1.1 TB stored in SSD, and to carry out a full sync using typical server class PCs and Finland's fastest network will take 2 weeks. The reality with Ethereum is that it takes 2 minutes to secure a transaction, meaning a cost of roughly 1 \$ for an average transaction and only "full nodes" can verify transactions. Despite the fact that there are new BCT implementations such as IOTA, Pekka reached the conclusion that BCT is not a panacea for IoT security problems. BCT technology may be useful for solving specific aspects, though it remains expensive in terms of energy consumption.

**Visa Vallivaara** (Research Scientist at VTT) spoke on smart contracts. This is a key aspect of BCT, given that future smart machines are expected to act evermore independently, meaning they'll need the capacity to bargain autonomously. Smart contracts are special transactions within state-of-the-art BCTs. They can be understood as "programmed agents" that handle events within the realm of a blockchain domain, under certain conditions and in pre-defined ways. No trusted third party is required to execute such smart contracts in a "trusted" BCT environment. Vallivaara determined that the combination of clearly identifiable Digital Objects with Smart Contracts seems a strong concept. However, she also identified serious challenges such as "erroneous and thus non-smart contracts", the absence of a legal

framework around smart contracts, a lack of clarification of the trustworthiness of data providers and the aforementioned scaling issues. She demonstrated a case study that presented how programming is being carried out, as well as potential dangers of smart contracts.

**Benoit Abeloos** (Policy Officer Startups and Innovation Unit, Directorate General Communications Networks, Content and Technology at EC) highlighted the EC's strong interest in BCT, that even resulted in a European Parliament resolution. This resolution on the 16<sup>th</sup> May 2018 led to the foundation of self-study programs (<http://www.europarl.europa.eu/news/en/press-room/20180516IPR03622/use-blockchain-model-to-cut-small-firms-costs-and-empower>). Additionally, Abeloos drew attention to the program being pushed forward by DG FISMA and DG Connect for a more competitive and innovative European financial sector ([https://ec.europa.eu/info/publications/180308-action-plan-fintech\\_en](https://ec.europa.eu/info/publications/180308-action-plan-fintech_en)). The backdrop for each of these activities is that Europe wants to take a global lead in the rollout and uptake of BCT. In light of that, an observatory, a forum and information days are being organised, with the intention of improving the standardisation of BCT, with the combined application of IoT and BCT also under observation.

This discussion revealed that there remain some expectations surrounding BCT that cannot be realised. BCT can only be used for "small data" issues such as noting events, transactions, etc, and isn't intended for the storage of metadata and data, meaning that the real transfer of data is being carried out externally of BCT. Furthermore, the costs of this technology have been highly underestimated and the legal frameworks are lacking in clarity. Indeed, as **Pekka Nikander argued**, BCT is not a panacea for all IoT security problems. BCT has the potential to handle highly specific tasks, but only with careful and rigorous testing.

## Nanotech and Dust IoT: The Next Frontier

MODERATOR: Marilín Gonzalo

SPEAKERS:

- Peter Connock
- Santos Merino

### SUMMARY

Peter Connock, PENTA Director, presented the PENTA program. The program has a focus on the European digital economy, helping SMEs and larger companies to get funding for development and research. SMEs often don't have time or resources to identify potential funds for them, so the program supports them to locate and connect with funding programmes that they fit with.

Santos Merino, Head of Sensors Research Area in the Surface Chemistry and Nanotechnologies Unit at IK4-TEKNIKER, presented four user cases during the session. Case 1 referred to blood sensors using microfluidics to provide a quick diagnosis for doctors in emergency situations. Case 2 described a kind of sensor used in patients with cancer that detects circulating cells in the blood. Case 3 focussed on allergens. It's highly important to detect allergens in production lines shared by food companies, and this sensor can detect allergens in 30 minutes as an alternative to waiting 2-3 days for results from a lab. Case 4 was about bacteria detection, in this case, Legionella, making this a very useful tool for public health.

## Enabling Next Generation of Energy Services with IoT

MODERATOR: Juan Rico

SPEAKERS

- Bruno Michel
- Luis Layo Rivacoba
- Mauricio A. Spirito
- François Sonnet
- Mario Dionisio

### SUMMARY

The session explored how IoT is currently transforming the energy sector, as well as how progress in IoT will change this domain in the future. The session started with Mr Mario Dionisio from the EC presenting the current framework for the development of EU innovations. He spoke about the projects the EC will be funding in the short term. Following this, Luis Layo from Iberdrola, introduced Bidelek 4.0, a demonstration of fully digitalized grid exploiting the opportunities this brings to a utility. The next speaker was Bruno Michel from IBM, presenting his perspective why energy efficiency isn't just about electricity, and why heat expenditure needs to be improved to a much higher degree, especially with a focus on Data Centers. Next, Maurizio Spirito from ISMB presented a number of longer-term innovative initiatives funded by the EC, in particular the Storage4Grid project. Finally, François Sonnet introduced a cutting-edge solution brought forward by the Solarcoin foundation which focuses on blockchain and cryptocurrencies for trading with renewables. He spoken on how these new energy sector schemes will grow consumer opportunities.

## IoT for Sustainable Development in Africa

MODERATOR: Pedro Maló – Philippe Cousin

SPEAKERS:

- Dr. Mamour Diop, UPPA – Researcher



- Alexander Ntoko, ITU: Chief of the Operations and Planning Department - Speaker
- Fiifi Baidoo, iSpace: Co-founder and Chief technology officer – Speaker
- Congduc Pham, Pau University: Professor of Computer Science – Speaker

## SUMMARY

### Session objective:

The objective of this session was to present the most recent advances and news regarding EUAfrica collaborations on IoT, active projects and initiatives. It also included a look into upcoming initiatives which are open to new collaborators. The goal was to highlight best practices in International Cooperation and discuss ways to make international cooperation on IoT within the African region more effective and definitive.

### Presentations:

Alexander Ntoko talked about Interoperability in IoT Identification. The key presented criteria for this were: extendable - introducing local namespaces globally without conflicts; international support – Unicode 3.0-character set with UTF-8 encoding; secure – defines standard mechanisms for client/server authentication via built-in Public Key Infrastructure; distributed – administration: secure management over the public network by owner at any location and service: replication of any service into multiple service site which can be distributed into cluster of servers.

Congduc Pham spoke about the Importance of long-range, low-energy radio technologies for Africa and how IoT can enhance rural areas. In general, robustness and sensitivity can be increased when transmitting at a slower rate. For instance, when a Sigfox message is sent relatively slowly in an ultra-narrow band of spectrum. Max throughput= $\sim 100$ bps. LoRa also increases

time-on-air when maximum range is needed, but LoRa uses spread spectrum approach. Throughput= $\sim 300$ bps – 37500bps.

Fifi Baidoo discussed supporting IoT innovation in African IoT hubs with the objective of iterating and extracting value from value-added IoT innovative services on the technologies in WAZIUP ([www.waziup.eu](http://www.waziup.eu)) and FIWARE ([www.fiware.org](http://www.fiware.org)). There was a focus on the strategy of sharing IoT Technologies' practices throughout regional IoT ecosystems made up of innovation communities and stakeholders (e.g. entrepreneurs, startups, technology hubs, SMEs).

Dr. Mamour Diop talked about the Experience of IoT in Africa and the many opportunities for IoT application in Africa, such as for irrigation, livestock farming, fish farming and aquaculture, storage and logistics, agriculture and the environment. According to WAZIUP, EU and African cooperation action targeting sub-Saharan African countries. It aims to accelerate innovation in Africa via cutting-edge IoT cost-effective communication and big data technologies deployed on PaaS and know-how. There was discussion of an OPEN SOURCE project addressing the IoT demands of developing countries, to tailor IoT and Big-Data PaaS platforms in the context of Africa in order to offer value-added, cost-effective, reliable and energy efficient services. Additionally, the benefits of the phenomenon to African developers who mostly rely on lower entry-level innovations was discussed.

## New Trends for IoT and Satellite Networks

MODERATOR: Olivier Gudet

SPEAKERS:

- Andreas Foglar
- Thomas Watteyne
- Adrian Quesada Rodríguez

#### SUMMARY:

During this session, we traveled over to the communication stack. With Thomas Watteyne, we explored the world of microcontrollers that allow us to gather information over the course of a decade, using the power of just two AA batteries.

Thomas also explained the benefits of utilising IPv6, and the work done by the 6TiSCH initiative. He raised the point that despite the small size of the equipment and low consumption, there's no compromise on the reliability. The mesh networks application could be rapidly deployed in various environments, from the desert to the mountains, regardless of extreme conditions in terms of temperature. Next, Andreas explained to us how to build a simple and secure IPv6 network using the SAVE network that relies on the phone address scheme to simplify implementation over several sites or countries. With this solution, protection against the unauthorized use of the network can be guaranteed, since the routing is predictive. This structure also allows for very minimal latency over the network.

Finally, Adrian explained how Costa Rica has successfully deployed an IoT network in its forests in using satellite technology. The journey to setting up the network took 10 years, however the network that was developed locally has now been launched and is now able to gather information about the forest once-a-day compared to the monthly readings of the past.

#### Create-IoT: EU-Brazil Collaboration on IoT for Sustainable Development

MODERATORS: Gabriel Antonio Marao, Pedro Maló

#### SPEAKERS:

- Emilio Tissato Nakamura
- Samuel Moniz
- Guilherme Corrêa
- Carlos Kamienski



Figure 34: Gabriel Marao (right), ready to moderate the panel

#### SUMMARY:

##### Session objective:

The objective of this session was to present 3 new EU-Brazil IoT Pilot projects (OCARIoT, SWAMP, FASTEN), to discuss research/development/piloting approaches, to discuss difficulties and explore collaborations (between the 3 projects, with the EU IoT LSP initiative).

##### Presentations:

Emilio Nakamura talked about the OCARIoT – A smart childhood obesity caring solution that used IoT potential with the objective of promoting the improvement of eating and physical disorders, as well as the prevention of child-onset obesity (between 9 and 12 years old).

Following this, Carlos Kamienski talked about the SWAMP – Smart Water Management Platform, IoT Pilot Project. The SWAMP project develops IoT-based methods and approaches for smart water management in precision irrigation domain, and pilots them in Italy, Spain, and Brazil.

Samuel Moniz talked about the FASTEN initiative – Flexible and Autonomous Manufacturing Systems for Custom-Design Products. It has the aim of developing a flexible and scalable robotic system for integration with mass customization production lines: integrating robotics, AM and IoT and technologies; standardizing data repository and decision-making integration, from end-users (consumers) services to the manufacturing and supply levels; optimizing, synchronizing and improving the coordination in real-time of production and logistics activities; validating and demonstrating the FASTEN Framework in two cross-sectorial industrial pilot cases; and improving the overall effectiveness of supply-chain performance and decision-making.

### EU-ASIA Collaborations on IoT for Sustainable Development

MODERATORS: Pedro Maló, Philippe Cousin

SPEAKERS:

- Philippe Cousin
- Congduc Pham
- SeungMyeong Jeong
- Wenbin Li

SUMMARY:

#### Session objective:

The objective of this session was to share latest news on EU-Asia collaborations on IoT, including active projects as well as looking forward to

activities open to collaboration with others. The goal here was to also to give insight into best practices, the lessons learnt about international cooperation and to discuss ways to develop cooperation on IoT with Asian countries.

#### Presentations:

SeungMyeong Jeong talked about Wise-IoT, an EU-KR Collaboration, and why horizontalizations are urgently needed. They are particularly necessary for a highly fragmented market with small vendor-specific applications; reinventing the wheel: same services developed again and again; each contains its own technologies without interop; end-to-end platform: common service capabilities layer; interoperability at the level of communications and data; seamless interaction between heterogeneous applications and devices.

Philippe Cousin spoke about the EU-China IoT Cooperation following the 2016 white paper, and why IoT is so important. He discussed the development of IoT in the future; the movement towards a hyperconnected society; how massive and secure IoT deployments could be enabled by 5G; the benefits from other technology fields; the fusion of IoT, big data, cloud computing and generic connectivity; automated vehicles; E-health and smart living; smart farming and food safety; industrial IoT; focused zones in smart cities; and retail.

Wenbin Li talked about the FED4IOT: 2018-2020 EU-JP. The Fed4IoT is federating IoT and cloud infrastructures to provide scalable and interoperable Smart Cities applications, by introducing novel IoT virtualization technologies. The goals of Fed4IoT are: credible demonstrations based on cross-border business and/or societal applications of robust interoperable technologies; concrete implementations of interoperable solutions that integrate IoT, Cloud and Big Data including security; facilitation of the development of cloud-

enabled, secure and trustworthy IoT/big data applications; promotion of the use of data related to Smart Cities and the creation of new increasingly efficient services; joint contributions to standardization activities under the cooperation of EU- Japan.

Congduc Pham spoke on the long history of EU-South East Asia Collaboration in this field. South East Asia is a fast-growing region, however many countries are still categorized as low and middle-income countries. IoT in SEA, as in many other regions of the world, is gaining incredible interest for a vast variety of applications. It was also highlighted that Singapore, Thailand and Malaysia should be considered separately from other SEA countries.

### Spreading the Web of Things

MODERATOR: Soumya Kanti Datta

SPEAKERS:

- Jorge Berzosa Macho
- Iker Larizgoitia Abad
- Danh Lephuoc

### SUMMARY:

In the introduction to this session, the moderator Soumya Kanti Datta illustrated how interoperability affects consumer experience in IoT and how WoT could help in that regard, with a demonstration developed for H2020 HIGHTS project that showed WoT in action.

The first speaker, Jorge Berzosa Macho, provided a brief outline of interoperability mechanisms provided by the W3C WoT architecture, with a focus on the use case of resource constrained devices. Next, Iker Larizgoitia Abad talked about his current work towards the standardization of the process of integrating products beyond embedded devices to the WoT. Finally, Danh Lephuoc talked about how semantic processing and reasoning will facilitate AI-driven services in the context of using W3C Thing Description and proposed WoT Architecture and Scripting APIs.

### IoT, Trust & Morning Coffee – What you Always Wanted to Know About Trust

MODERATOR: Kees Van der Klauw

SPEAKERS:

- Arthur Van der Wees
- Alena Siarheyeva
- Tanya Suarez
- Georgios Karagiannis

The Alliance for Internet of Things Innovation (AIOTI) hosted this ‘first-of-a-kind’ session on what is considered the most important factor in the success and adoption of Internet of Things: trust.

While technology and applications in IoT have seen ongoing significant progress in terms of cost, availability and performance, the non-technical aspects of IoT have been undervalued, giving rise to delays and even roadblocks in the uptake of IoT.

Though there are many technical and rational aspects that impact trust, the formation of trust in this context continues to be founded on perception rather than fact. Trust is a subjective feeling relating to one’s expectations in relation to a promise, and that promise being reflected in reality. In other words, whether users believe that a company will do good job protecting their personal data when using their products, and whether they find, in practice, that they meet their expectations. The outcome of this question



may not be based on facts, but rather on expectations, perception and even misinformation.

AIOTI's Alena Siharheyeva (chair of the Working Group on IoT Ecosystems) and Arthur v.d. Wees (co-chair of the Working Group on Policies) presented an overview of the many aspects of trust.



*Figure 35: Kees Van Der Klauw was the moderator of the session*

### **Multiplicity**

- Trust between humans and systems (H2M, M2H)
- Trust between machines (M2M)
- IoT in public domain, semi-public and private domain
- Sub-segmentation and subcategorization of physical, cyber and cyber-physical domains
- Who is involved in the deployment and ongoing resilience of IoT ecosystems?

### **Complexity**

- Trust in complex cyber-physical systems
- Trust in design & engineering of complex systems
- Trust in inter-connecting, integration & deployment
- Trust in keeping up to date and resilient
- Trust in systems one is part of, but not knowingly or informed

This overview demonstrates that building trust involves a scope that goes far beyond any individual discipline. This means any of those disciplines can make or break trust. A strong interaction between engineers, designers, academics, and representatives from business, government, and society (end-users) is therefore required, not after IoT propositions are launched, but in the design process itself.

AIOTI proposed a simplification of this issue by considering it in light of a number of specific trade-offs:

### **Trade-offs**

- Primary and secondary use of data
- Levels of transparency and data sharing
- Benefits and dangers of engaging with IoT
- Unintentional and intentional bias and consequences



*Figure 36: Georgios Karagiannis*

Arthur Van der Wees presented key 3 propositions to stimulate a more trustworthy take-up of IoT, which included the installation of an ethical board and structural reviews, creating explicit data business customer relations with the end-user as main stakeholder, and a framework for learning how to handle new technologies. Subsequently, AIOTI's Standardization Working Group co-chair Georgios Karagiannis presented how standards play a key role in building a secure, reliable and trustworthy IoT.

Next, AIOTI's Board Member Tanya Suarez led the engaging discussion related to the question "How do we engage with our customers and other stakeholders in IoT value chains so that we can trust each other, whether machine, human or hybrid?" While the audience had predominantly academic and technical backgrounds, many came up with clear examples that supported the need to take trust aspects into account in a very early stage of IoT development. Franck Boissière -Policy Coordinator & Programme Officer Internet of Things Unit, DG CONNECT, European Commission complemented the discussion with his observations from a policy point of view.

## IoT Market and Business Model

### IoT Marketplaces from EU Projects

MODERATOR: Joël Bacquet, Pedro Maló

SPEAKERS:

- Bruno Almeida
- Eunah Kim
- Nikolaos Kaklanis
- François Fischer
- Juan José Hierro

SUMMARY

#### Session objective:

The goal of this session was to discuss industry and research approaches to IoT Marketplaces in order to identify areas in which the two can learn from each other. Another topic was potential collaborations, and the feasibility of building towards a joint Digital Single Market(place) for IoT.

#### Presentations:

Bruno Almeida talked about IoT Catalogue ([www.iot-catalogue.com](http://www.iot-catalogue.com)). The IoT-Catalogue is a web-based catalogue and decision support tool for Internet-of-Things (IoT) solutions. It brings IoT users and technology providers together, bridging gaps between domain needs and IoT products with validated solutions with components, assembly guides, and more.

Eunah Kim presented SYNCHRONICITY, an IoT Product Marketplace. It's a marketplace that seeks to deliver a Digital Single Market for IoT-enabled smart cities in Europe and beyond, building an open innovation ecosystem around the proposed digital single smart city marketplace.

Nick Kaklanis talked about ACTIVAGE, an IoT Marketplace. The ACTIVAGE IoT Marketplace is a one-stop-shop for all Active and Healthy Ageing (AHA) Applications based on any IoT Platform.

Juan Jose Hierro spoke about the FIWARE Marketplace, the open source platform of choice for building smart solutions. Smart Solutions gather data from many different sources (including, but not limited to, IoT) to build a “picture” of the real world, before processing and analysing that information in order to implement the desired intelligent behaviour.

### Novel Business models for Smart Cities

MODERATOR: Luis Muñoz

SPEAKERS:

- Ajith Balakumar
- Davor Meersman
- Natalie Samovich

#### SUMMARY

This session included three speakers that each addressed novel business models in the context of smart cities. The first speaker, Natalie Samovich (ENERCOTIUM), highlighted the business models arising from digital transformation in the energy sector. Issues such as ‘anything-as-a-service’, a multi-sided market, the problems around partnerships reciprocity and freemium models were all discussed.

The second speaker, Davor Meersman (OASC), highlighted the fact that the smart city is a growing market with a pattern of innovation-exploration-behavioural experimentation in its life cycle. He mentioned the possibilities that projects such Synchronicity might bring in exploring innovative business models.

Last but not least, Ajith Balakumar (FORTHCODE), explained the main catalysts for changing business models. Among them were IoT, blockchain and deep learning. Several discussions were held around the role of existing stakeholders in new business models, as well as the limitations of present regulation.

### Business Model Innovation as A Driver for Change

MODERATOR: Dr. Mirko Presser (Aarhus University)

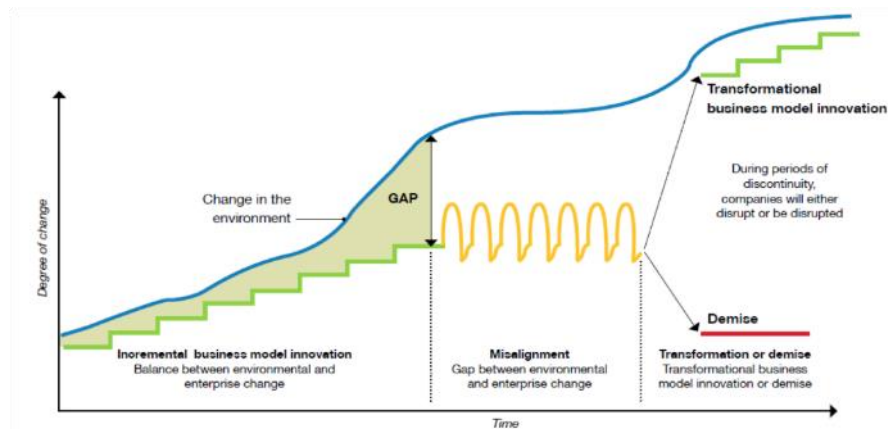
SPEAKERS:

- Martin Jørgensen
- Martin Strohbach
- Andrea Siviero
- Elena Alfaro

#### SUMMARY:

From a technology perspective, IoT is a complex area. It has lead to the creation of new classes of applications, and multiple business opportunities for technology companies, new application and service providers as well as businesses developing new business models.

Business models seek to make sense of how businesses operate. In essence, they provide a hypothesis to be implemented and proven. They are essentially presented as a narrative that describes the customer, the customer value, the revenue collection of the model and the delivery of this value. Business model innovation (BMI) has already been shown to outperform product and process innovation. However, BMI also requires a stronger commitment from the innovating organisation to make changes within itself.

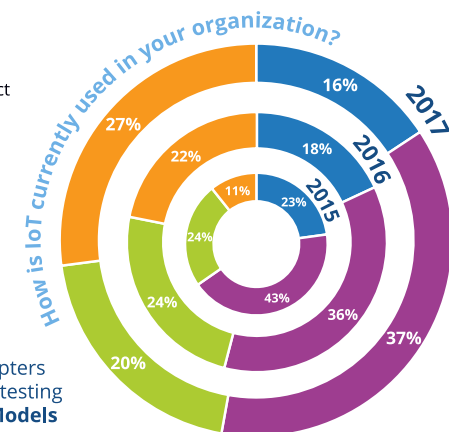


In this session, four panelists presented different perspectives of BMI and IoT from their respective organisations.

Andrea Siviero is a Research Manager within IDC, a global provider of market intelligence and advisory services in the technology area. He spoke on his expertise in IT trends and strategies across industries in the European market, specifically on BMI and IoT.

- Mere data collection
- IoT data analyzed but no impact on processes yet
- IoT data analyzed with impact on processes
- IoT leading to new business models

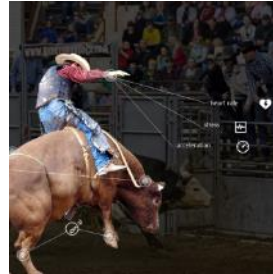
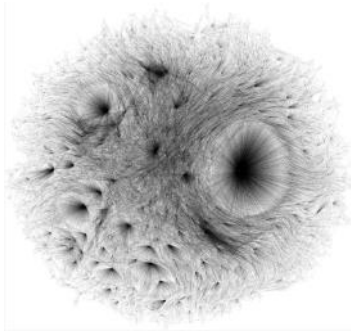
**27%** of European adopters are using IoT for testing **New Business Models**



Elena Alfaro is the Global Head of Data & Open Innovation for BBVA Group, a body whose work includes the generation of machine learning algorithms that constitute the intelligence behind BBVA's digital products, as well as the transformation of BBVA's skills and culture into a more data-driven organization. She also leads the Group's efforts to make the most of Open Innovation, both for the bank itself and for the partners in its external ecosystem. Elena has a BA in Economics & Business Administration from the Universities of Sunderland (UK) and Universidad Autónoma (Madrid), and a Master in Intangibles Analysis and Management.

She also took part in the 2013 edition of the "40-under-40 Young European Leaders" and has participated since last year as one of the 9 members of the AI Expert Group currently advising the Spanish Government on the development of these technologies at a national level. During the session, Elena presented her experience in the development of more data-driven services at BBVA.





Martin Strohbach is Director of Research at AGT International, Darmstadt, Germany and is responsible for managing AGT's research projects and transferring results to AGT's products and solutions. He is leading research in the area of IoT platforms, computer vision, and machine learning on time series data that is currently executed in five H2020 projects. He is also contributing to the development of AGT's IoT World Graph, a semantic representation of the information exposed by AGT's AI platform. His presentation entitled "IoT is a kNow show" presented AGT's development on the experience economy of sporting events using IoT.

Martin Jørgensen has a background as an engineer working at companies like Siemens, Motorola and Intel, and has now become an IoT entrepreneur and innovator, having overseen more than 20 IoT projects ranging from startups to global industrial enterprises.



#### IoT Security and Data Protection



Figure 37: Roberto Cascella was the coordinator of the IoT Security and Data Protection Track

## Emerging IoT Threats and Ethical Hacking

MODERATOR: Fabio Di Franco

### SPEAKERS

- Stefan Lüders
- Marc Gebert
- Stefano Bianchi
- Andrea Balogh

### SUMMARY

The session on “Emerging IoT Threats and Ethical Hacking” provided insights into how organisations deal with emerging threats, and how manufacturers and researchers can find technical solutions to mitigate attacks. The speakers argued that unfortunately, so far, not enough has been done to secure IOT devices against DOS attacks and guarantee the integrity and confidentiality of data.

Luckily, a new generation of chips are coming to the market with improved security and AMP (advanced malware protection), meaning they privacy by design already in place. Indeed, it is possible to develop a more secure ecosystem by leveraging secure on-chip cryptographic primitives, secure system development lifecycles as well as isolated processes in all hardware components.

Moreover, anomaly-detection intrusion detection systems can provide another level of defence. These systems, once trained, are able to model normal behaviours and alert when something unusual happens. This is one of the best ways to protect from unknown threats, with a minor drawback of a longer training period in order to generate more meaningful alerts as well as the difficulty in distinguishing between errors and anomalies themselves. Obviously, technical measurements are not sufficient if not

complemented and supported by well-defined processes and well-trained people.



*Figure 38: Fabio Di Franco, moderating the session*

That said, there is a long way to go before secure applications are the norm. In fact, many innovators working on niche industrial markets don't even have the skillset to develop secure software, or the processes of re-inventing their product to make it more secure is too costly for them. Therefore, it's expected that successful attacks will increase until either the market requires security or regulation forces critical infrastructure to deploy secure products.

## IoT Security Challenges in Vertical Sectors

MODERATOR: Gabriele Rizzo

### SPEAKERS

- Marco Scamuzzi
- François Fischer
- Afonso Ferreira

### SUMMARY:

In recent times, we've seen examples of how a global domain within the information environment, an apparently entirely virtual concept, can leave a profound mark on our everyday lives. These examples included the Dyn DDoS attack, which blacked out one of the largest DNS in North America, effectively taking down the Internet; the WannaCry, Petya and last year's wave of ransomware attacks which raised awareness about how vulnerable our infrastructure still is, in particular in hospitals and NIS essential services providers (to the point that without its hardcoded kill switch, WannaCry would very likely have had disastrous consequences) despite all the efforts to build established cyber hygiene. In addition to this, we've seen a recent spike in coinminer malwares, that are aimed at breaking the cryptocurrency bubble, increasing the availability of almost untraceable money to be used to finance black market activities and destabilising the currency market.

The 'cyberspace' domain is made up of the Internet, networks, systems, electromagnetic spectrum, peripherals, data, and users in the information environment. In short, cyberspace permeates everything, everywhere, in every domain. Cyberspace has had an enormous impact, with IoT one of its tendrils. Interconnecting "things" from OT and IT brings with it a number of issues that need to be better understood, because though we are deeply

immersed in cyberspace, there remains insufficient knowledge and awareness about how the impacts of cyberspace on our lives.



Figure 39: Afonso Ferreira

The phenomenon of digital transformation, a hot topic from 2015 still seeing a great deal of hype, is pushing enterprises and governments towards the digitisation of assets and processes, as well as the convergence of people and technology, as evident in the involvement of first smartphones, and then wearables in day-to-day lives. Furthermore, this trend shows no sign of stopping, in fact it will accelerate and gather strength. Therefore, vertical sectors will need to take this phenomenon into account to remain relevant and secure.

The most affected sectors will be:

- Defence and Space. Since cyberspace is a domain of operations and all assets will become more domain-agnostic, and the need for ultrawideband will shape the appearance of space in combination with next-generation networks. In fact, the Internet of Battlespace Things is already a paradigm over the Atlantic.
- Transportation. With railways and automotives the principal actors here, sensorising assets (be they cars, trucks or rolling stock) and offering broad room for cyberspace interversion due to persistent connectivity, digitisation will be a key impact.
- Industry 4.0. As IT/OT convergence pushes companies to seize opportunities, often without first thoroughly assessing security, with the result that a number of systems are exposed on the internet, unprotected or with minimal protective measures, leading to a surge of attacks to SCADA systems in the last 6 months.
- eGovernment. With its vast surface of interconnection (and therefore potential for attack), eGovernment is being structured for: giving services to the regional governments to streamline citizen interaction with central agencies; preparing foundations for broad interoperability within government databases and datacentre infrastructure; and organising the complex web of activities around providing each citizen with a legal digital persona and using that identifier as a single point of contact throughout all national embodiments of the government – which implies being able to connect, protect and interoperate with data infrastructure.

Thus, there is a clear need for security, built from the ground up and taking the aforementioned verticals into account. Implementing security by design is not only the safest, but also the cheapest way of doing this. Clear examples of this security come from isolation/segregation in vehicle-cloud

ecosystems such as the ‘Jeep hack’ which meant the automotive brand had to recall 1.5m vehicles. With regard to transportation, there remains the “new kid on the IoT block” – safety, the nightmare of all security experts. Safety and security were born for two quite radically different needs, but now they are forced not only to coexist, but also to converge in a single engineering and validation approach. These intersecting demands will become relevant as automated driving becomes normalised with 5G.

When examining security by design, data integrity is a key concept that requires consideration from the outset. This refers to the authentication of the source of information and the validation of the information to prevent spreading of false or malicious information through the massive machine-to-machine vertex of the 5G use case triangle, which will become extremely relevant in the case of transportation or industry 4.0. This holds potentially nefarious consequences for safety and human life, making it an important pillar to be taken into consideration. We need to maintain safety in security.

Then there’s the need for users and designers to implement these ideas using a hands-on approach. Hands-on approaches also ease acceptance processes and incorporation into best practices. Approach by-design needs to be understandable for the customer as well as for the designer, across all industry sizes. As such, there is the need for a label for cybersecurity, similar to energy certification or marketability in Europe (the CE marking) that is equally straightforward and comprehensible to regular people. To achieve this, finding a way for laboratories to accredit to the required standard could be a useful way forward.

We are still a long way from living the reality of cyberspace in our everyday lives, and this gap might not be easily overcome. The speed of human perception and cyberspace are drastically different, and only a comprehensive approach as discussed will give results that can be leveraged in commercial and government sectors.



## IOT4SCC: Joint Workshop on IoT For Smart Cities & Communities Platform Convergence and Sustainable Development

### General comments on the Joint Workshop

Do the limbo: Standards Convergence for IoT and Smart Cities & Communities, by Martin Brynskov



Figure 40: Martin Brynskov

The two-day workshop “IoT and Smart Cities and Communities Platform Convergence” brought together the leaders in this field to talk about requirements and standardisation to support IoT and smart cities and communities – by agreeing upon the simplest common ground.

Though English remains the best language for exchanging ideas with international colleagues and friends, a common language for IoT and smart city platforms and systems is an essential part of what we are missing today.

Each platform and sensor uses in its own language, and often invents its own terminology too.

In a nutshell, this is a key challenge facing cities in their digital transition.

The workshop on [IoT and Smart Cities and Communities Platform Convergence \(IoT4SCC\)](#) gathered stakeholders who create environments for smart cities to flourish.

The goal was to encourage exchange between city representatives – those who work hard to help their city’s transitions into the digital age – and the representatives of standards developing organisations (SDOs), like the ITU-T, IEC, ETSI, CEN/CENELEC, NIST and so many more, who are working hard to find the aforementioned common language.

Another goal was to exchange best practices between on-going projects on European and international scales, such as SynchroniCity, one of five EU IoT Large-Scale Pilots, and SharingCities, one of 15 EIP-SCC lighthouse projects. The workshop also served to strengthen the efforts that these projects are undertaking in amplifying the cities’ voices to international decision-makers and to present their approach towards an innovative ecosystem that doesn’t leave the cities locked-in to one vendor.

The concept behind these efforts is standards-based innovation and procurement.

### How low can we go: Let’s do the standards limbo!

What cities don’t need are ever more new, comprehensive standards. What they need is an up-to-date baseline, a set of standards that can support their decisions when trying out and procuring IoT-enabled services for their citizens. OASC calls this baseline set of recommendations “Minimal Interoperability Mechanisms”. They are intended to help cities, so they won’t wake up with a ‘bad hangover’ services equivalent – noticing that they handed over their wallet to the bartender and have no clue how to get it back. They can ask to get it back of course, but the final decision is not theirs, and it will come at a steep price.

So, in order to keep the wallet – that is control over the city’s data, algorithms, IoT sensors, and much more – safe and in their own hands, cities need to know what exactly they are buying from providers. They need standards to make their legacy systems compatible, and they need to know if they can easily replace these systems with other systems. Standards can help with all this. Such standards have to be the simplest common ground that many cities agree to. Or in other words, everyone involved in the development of smart cities should ask themselves: “How low can we go?”

The IoT4SCC workshop did not provide a single go-to answer that solves all challenges of IoT and smart cities & communities right away, but we’ve reached our goals and brought together important decision-makers from cities, SDOs, research and academia as well as NGOs and associations from all over the world to exchange, showcase, debate, and finally, to take the next step.

On behalf of all IoT4SCC organisers, we would like to thank all speakers who presented their work and shared their ideas and visions at the workshop. In short, to all those who made the workshop a success. Thank you! The dialogue continues at the Connected Smart Cities Conference in Brussels on 17 January 2019, and at IoT Week 2019 in Aarhus, Denmark, 17-21 June.

Note:

The IoT and Smart Cities and Communities Platform Convergence workshop took place for the second time, building on the [successful session during IoT Week 2017](#) in Geneva to advance convergence of standards.

## Session 2: Smart City IoT Convergence: Platform and Solutions Convergence & Interoperability

MODERATOR: Tanya Suárez

SPEAKERS:

- Lindsay Frost
- Jesús Cañadas
- José Manuel Cantera
- Kees Van der Klauw
- Martin Brynskov
- Svetoslav Mihaylov
- Omar Elloumi
- Olavi Luotonen
- Ramy A. Fathy

### SUMMARY

**‘IoT and Smart Cities & Communities. 33 key points for policy-makers’ by Tanya Suárez.**

When [Martin Brynskov](#), Chair of Open & Agile Smart Cities (OASC), first asked me to moderate the panel of Internet of Things and Smart Cities & Communities Platform Convergence at [IoT Week in Bilbao](#) this year, my first thought was: “10 presentations on Smart Cities - won’t everything have been said by the 3rd presentation?”



Figure 41: Olavi Luotonen, Tanya Suarez and the rest of speakers of the session

Now, those of you that have been asked to moderate sessions at events of varying size with diverse audiences will know what I'm talking about. However, I can honestly say that this was the first time that I have come across 10 panellists, speaking on a relatively narrow subjects who, without exception, kept my eyes glued to them and their screens, with my ears tuned to their next sentence.

While replicating all the content here isn't feasible, I did want to share one or two of the key take-aways from each panellist. I hope they will be as enlightening for you as they were for me:

[Olavi Luotonen](#) of the European Commission's DG CONNECT IoT Unit was refreshingly honest as he kicked off with his first piece of advice for would-be Smart City implementers:

1. **Put the cats on the table:** kickstarting a project, probably designed 3 years ago, and sticking to what was in the original proposal, is evidence that you don't have the ability to learn and adapt to your environment.
2. **Grow big ears:** listen to the community. This is the key ingredient for sustainability and is one of the founding principles of the concept of Living Labs.
3. **Do what it says on the box:** Apparently, many proposals focus on clever acronyms that leave unclear what the project is actually all about.

Olavi's colleague, Svetoslav Mihaylov of the Smart Mobility and Living Unit added:

4. **The tail should not wag the dog:** we must start with societal needs and then work on the data needed to solve these.

[Jesús Cañadas](#), Head of Sector, of the Spanish Ministry for Information Society and the [Digital Agenda](#) had the following advice:

5. **Don't introduce verticality into horizontal domains:** Smart Cities require open interfaces and open standards and the role of [ITU](#) and similar organisations is critical here
6. **Avoid vendor lock-in.** Procurement processes need to consider what happens to the infrastructure, devices and data when the contract ends.
7. **Be open to different business models.** This is a huge challenge for current procurement regulations but is an essential requirement for a data-driven economy.

Lindsay Frost, NEC Laboratories Europe, Sector Forum for Smart and Sustainable Cities and Communities (SF-SSCC), [ETSI](#) Board member agreed with the points above and added:

8. **Many needles in many haystacks.** There is a huge amount of information on standards for Smart Cities; this information needs to be ordered and prioritised in a way that users can find what they need.

9. **Twist your brain 90°** from technologist to policy maker to understand what data needs to be shared to create new value.

10. **Call a spade a spade.** We must use common ontologies; ITU and [SAREF](#) are acting unifying forces here.

11. **Keep climbing the data pyramid.** Even if you have to find a way to charge, it is still worth the effort.

Kees van der Klauw, Chair, Alliance for IoT Innovation ([AIOTI](#)) provided a different perspective:

*Everything is hunky dory. Or is it? Cities are still working in silos. Budgets are organised according to these silos and the return isn't seen by the investor.*

12. **Everything is hunky dory. Or is it?** Cities are still working in silos. Budgets are organised according to these silos and the return isn't seen by the investor.

13. **Embrace Negative Naggers.** Individuals who consistently question why something is being done are critical for the success of Smart Cities

14. **Don't believe the hype.** How can you expect applications (which are mature), to be developed on platforms (which aren't)?

Ramy Ahmad Fathy, Egypt, Vice-Chair [ITU-T](#) Study Group 20 for IoT and Smart Cities and Communities and an AI entrepreneur had the following advice:

15. **Go beyond the buzzwords.** What does transforming cities into smart cities actually mean? Set targets that are related to the challenges in the city.

*60,000 people are added to Chinese cities every day. This gives an idea of the scope and the size of the challenge. And Cairo is the world's fastest growing city.*

16. **Bring real numbers into the game.** 60K people are added to Chinese cities every day. This gives an idea of the scope and the size of the challenge. And Cairo is the world's fastest growing city.

17. **Show me the money.** Some Smart City goals may have hefty bills attached to them and need to be carved into bite-sized piece. Standards can help different pieces fit together.

18. **Focus through focus groups.** Standards must be developed from the community. Bring other stakeholders into the standards debate.

19. **Mind the Gap:** Engage in forward looking research and continuously look at areas that need to be addressed.

20. **Don't ignore data monetisation.** This needs to be a topic that is on the table.

Martin Brynskov, Chair of the [OASC](#) summarised the lessons learned from a global network of connected cities:

21. **From opportunity to risk management.** We must transition from simple exploration of the potential to management of the risks that are associated with mass deployment.

22. **We need MIMs.** Minimal Interoperability Mechanisms to help users link systems together.

23. **We are crash test dummies.** So build in iteration; we will make mistakes and this is OK.

24. **Don't start from scratch.** [OrganiCity](#) has a play book that can be used by any city wanting to explore the road to transformation, and [SynchroniCity](#) has a framework for standards-based innovation and procurement, ready to use.

25. **Leave room for wild cards.** You will have good ideas for sure, but you don't have the monopoly on the best ones.



26. **One size doesn't fit all.** When it comes to the T&Cs for data, look at the specifics of the use.

Key pointers from Jose Manuel Cantera from the [FIWARE Foundation](#) were:

27. **The here and now.** Data can be used in many contexts. Data may be immediate or as part of historical sets that provides a view of how things evolve over time...

28. **Remember Schrödinger's cat.** Categorising information is important; know when someone was observed may be relevant for a given piece of data

[Omar Elloumi](#), Nokia Bell Labs, tech lead of oneM2M and Smart Grids Standards and Chair of AIOTI Working Group on Smart Cities offered more commercial considerations:

29. **No longer any colour as long as its black.** Cities have wide range of connectivity options. Just be careful about the total cost of deployment.

30. **Open data:** Consider carefully if your RFP should really ask for turnkey solutions (end-to-end network connectivity + hardware + application). You may find you gain in the long run if you require instead component reusability.

31. **Beachheads for Smart City procurement:** Commercially viable and sustainable use cases that are cross-domain are the best place to start.

32. **No IoT platform will dominate.** But the Not-Invented-Here syndrome needs still to be avoided at all costs.

33. **From data points to data streams.** Our next challenge is to consider how can they be processed and how we can scale capacity.

Martin Bynskov, it is a real credit to you that you were able to put together such a well- balanced group of experts.

And one more thing. My sincere thanks to all for keeping to the allotted 8 slides and 10 minutes. It meant that your messages were punchy and to the

point. As I said earlier, it has been an absolute privilege to share the stage with you. I look forward to progressing the conversation at IoT Week 2019 in Aarhus, Denmark, June 17-21.

### Breakout A: IoT Integration and Interoperability in Smart Cities (Southbound)

MODERATOR: Eunah Kim – Alexander Gluhak

SPEAKERS:

- Antonio Skarmeta
- Hanna Niemi-Hugaerts

SUMMARY:

The session on 'IoT Integration and Interoperability in Smart Cities (Southbound)' started with an introductory presentation from the co-chair Eunah Kim (Device Gateway SA). She began with an overview of the landscape of IoT standardisation in the connectivity, horizontal and telecommunications fields, followed by a mapping out of IoT SDOs/Alliances. Figures were shared which showed that many SDOs and Alliances are working towards standardisation in very similar areas. This could add complexity when it comes to choosing IoT solutions, demonstrating the importance of interoperability. In addition, Kim explained the scope of southbound and northbound, in order to focus the discussion on particular areas.



Figure 42: From left to right: Antonio Skarmeta, Hanna Niemi-Hugaerts, Eunah Kim and Alexander Gluhak during the “Breakout A” Session

As the first main session speaker, Professor Antonio Skarmeta (Odin Solutions S.L./UMU) provided detailed information on smart city development and deployment in Murcia, Spain. Murcia has introduced a wide scope of smart city applications, including smart parking, city utility management, and others. The presentation gave detailed explanation of how smart city infrastructures were selected, developed and deployed. It also explored the barriers to installing fully-digitised solutions within the existing infrastructure and provided many useful lessons to consider in the process of smart city deployments in older European cities.

The next presentation was given by Hanna Niemi Hugaerts (Forum Virium). This talk provided an in-depth explanation of smart city developments and deployments in Helsinki, Finland. Hanna Niemi Hugaerts spoke about the motivation behind, and objectives of, Helsinki’s smart city projects. She also

illustrated how they benefit citizens; and the ways citizens’ lives will be altered by smart city projects. Her speech gave valuable insights into the importance of the planning phase of smart city initiatives. It included detailed case studies and real deployment examples, as well as outlining planned future work in this field.

Both presentations gave comprehensive information about the application of smart city infrastructure, in particular when targeting southbound issues. After the presentations, a panel discussion took place on the question, “How interoperable do we need to be?” This was discussed in light of the debate over promoting industry innovation versus developing standardised solutions for interoperability. This led to the exploration of the most important considerations when it comes to IoT interoperability, given the current heterogeneity of IoT edge. Naturally, both the importance of standardisation was explored, as well as the need for IoT certification. Both panels emphasised the significance of data sharing, as well as the need to leave the choice of systems and platforms up to the market itself. Finally, the crucial role of personal data protection within a secure system was emphasised in this discussion.

### Breakout B: Cross-Domain Applications (Northbound)

MODERATORS: Martin Brynskov – Nathan Pierce

#### SPEAKERS

- Benno Seiler
- Claus Mullie
- Javier García Díaz
- Ulrich Fastenrath

#### SUMMARY

An open and common market for city data has been a vision as long-standing as the internet itself, and remains a challenging one to achieve.

Recently, several large initiatives, such as the European IoT Large Scale Pilots and the European Innovation Partnership on Smart Cities and Communities (EIP-SCC), have been moving forward to find a common technical ground for standards-based innovation and procurement that works for cities, delivered by the market.

This session gathered representatives from both the demand and supply side of this field to identify key trends for adding cross-domain interoperability in tenders and procurement efforts.

Benno Seiler, Deputy Director Urban Development and Head of Economic Development at City of Zurich opened the session. He described the four core principles driving the smart city agenda in Zurich: people-centric, connected and collaborative, open and sovereign, agile. Following these principles, the city of Zurich defines four challenges each year across all domains – solving them together with local start-ups and SMEs, citizens, academia and government representatives.

Claus Mullie, Consultant at Bax & Company and representing the SCORE project, asked two key questions that keep smart city makers like Benno Seiler awake at night. Firstly, how do we include openness or technological debt in our financial risk assessment of digital public infrastructure? Secondly, to what extent is open code a requirement for digital public infrastructure and how can we pair this with interoperability requirements in procurement?

After the cities presented their view, the supply-side was given the floor starting with Ulrich Fastenrath, Head of Mobility and Fleet Intelligence, BMW, representing the BioTope project. He painted a picture of a future involving an autonomous driving scenario supported by diverse city data and IoT devices, both on board and surrounding the car.



*Figure 43: Claus Mullie*

To make this vision a reality in the near future, certain standards are needed, without which different systems won't speak the same language. This is the core problem today among silos, systems and platforms: they don't understand each other. That's where CEN/CENELEC, a European standards developing organisation (SDO), comes in. The organisation was represented in this session by Javier García Díaz, Vice-Director Technical of CEN/CENELEC and General Director of UNE, the national Spanish SDO. He argued that a holistic and long-term vision is needed in order to best support smart developments, not only for intelligent transport systems, but for all domains. This vision includes citizens' engagement and co-creation as well as sharing and showcasing results and best practices.

This vision is being developed currently by two major programmes supported by the European Commission. Firstly, there's the EIP-SCC, a multi-million Euro programme to support the digital transition of cities and

communities, and secondly, there's the European IoT Large-Scale Pilots, such as SynchroniCity. Closely working together, both programmes are driving the process of standards convergence based on the need for cities to make agile and open digital transitions. These initiatives are enabling the scaling up of IoT-enabled urban solutions that make cities better places to live in with the help of ICT. Why are the aforementioned standards so important? They help cities to procure innovative services that fit the system that is already deployed within. Overall, we're not quite yet there, but we're making important progress.

#### Breakout C: IoT and Smart Cities: Personal Data Protection Strategies and Guidelines

MODERATORS: Antonio Kung, Mara Ballestrini

SPEAKERS:

- Pasquale Annicchino

#### SUMMARY

These two sessions were organised by OASC and the Synchronicity project with the support of Create-IoT, with Antonio Kung (Trialog) acting as a moderator. Mara Balestrini (Ideas for Change) and Pasquale Pasquale Annicchino (Archimede Solutions) were involved in the sessions.

The first session included the following:

- A presentation on the citizen viewpoint for smart cities (Mara Balestrini)
- A presentation on the privacy-by-design viewpoint for smart cities (Antonio Kung)
- A proposal to carry out a risk analysis session (Antonio Kung)



Figure 44: Pasquale Annicchino and Antonio Kung during the session

Two use cases were selected: open data (proposed by the moderator) and bike sharing application (proposed by the audience)

The second session included the following:

- A practice viewpoint for smart cities based on the Synchronicity undertaking (Pasquale Annicchino)
- A risk analysis session on the selected use cases. This included the identification of breaches, threats and their consequences, and measures against them.
- The moderator concluded with a call for contributions to ISO/IEC 27570 privacy guidelines for smart cities.

The slides were updated during the sessions and were made available. Participation in the session was lively, with inputs from the IoF2020 (Alexander Berlin) and BDVA (Nathalie Bertels).



## Breakout D: Open APIs

MODERATOR: Martin Brynskov – Sébastien Ziegler

### SPEAKERS

- Marco Carugi
- Martino Maggio

### SUMMARY

Lately, the notion of Open APIs has gained traction not only among researchers and developers, but also among the telecommunications industry, for example with the recently published Open API Manifesto by industry association TMForum. In addition, standards developing organizations such as ITU are looking into the subject in their effort to support cities and communities.

Seen as the drivers of scalability for IoT-enabled services for smart cities and communities, Open APIs are expected to enable new opportunities for economic growth and citizen participation at the same time.

Representing the work of AIOTI and the ITU Focus Group on Data Processing and Management for Smart Cities and Communities, Marco Carugi started his talk by identifying the challenges of cross-domain platforms: interoperability and the lack thereof. However, Carugi highlights that the key to integration of platforms is based on open source and open standards.

Another different, though complementary, approach is the IES-City Framework of US American standards developing organization NIST. Launched by several partners, the goal was to create a reference framework and to facilitate convergence among the high volume of ongoing initiatives and standards developing consortia. They identified three core challenges: a lack of knowledge exchange, a lack of standards convergence, and a lack of scalability. That's where Pivotal Points of Interoperability (PPI) comes in. Similar and complementary to the Open & Agile Smart Cities' Minimal

Interoperability Mechanisms (MIMs), the PPIs allow for low-key, minimum interoperability between systems.

Meanwhile, the OASC MIMs are being developed and defined within the SynchroniCity IoT Large-Scale Pilot – a project that aims to demonstrate that scalability of IoT-enabled city services can be reached using MIMs. Martino Maggio, Senior Research at Engineering and SynchroniCity architecture lead presented the approach as actual specifications of the interfaces at interoperability points. MIMs are standard, and open, APIs and guidelines that cities have to implement in order to ensure flawless interoperability of systems. The APIs and guidelines will be put to a real-life test with the current open call and the applications resulting from it.

## IoT & Big Data – Making the Data Revolution Happen

*By Georg Wittenburg and Peter Wittenburg*

This workshop raised three related topics on Big Data which are of great relevance and need to be addressed to overcome emerging bottlenecks:

- Trust and Technology - can they go together?
- Computational Power and Efficiency - will this help overcome barriers?
- Machine Learning and Big Data - will they help transform data into knowledge?



*Figure 45: Dirk Helbing and Peter Wittenburg*

In the first session, Dirk Helbing described the comprehensiveness of information on the Internet about a number of topics, in particular about

citizens. He also highlighted the inherent danger, even for our democratic societies, if we do not carefully design and take appropriate measures. Basically, he called for informational self-determination and made clear that the core of the action needed isn't technological, but social. Decentralised self-organizing systems remain a distant prospect, and technology can assist with that. Peter Wittenburg described a new perspective on data that could help to construct a binding link between social and technical aspects. The concept of "Digital Objects" with clearly defined and identified data entities assigned by persistent and globally resolvable identifiers can act as the constitutional element of a rich data society, allowing a more dynamic situation due to the volume and complexity added through billions of smart IoT devices. Visa Vallivara pointed out that Blockchain technology combined with the notion of Digital Objects could be an effective technology for building trust in the nascent data economy. Data identities can be coupled with Blockchain tracing to capture contracts and events in real-time, adding foundations for greater trust. Overall, there are some approaches to establish greater trust using Digital Objects and Blockchain technology, however this only presents a small step towards trustworthy management and use of data. Therefore, societal norms are urgently needed to improve trust.

In the second session, Thomas Lippert explained how understanding the human brain, as part of the Human Brain Project, requires exascale computing as well as Artificial Intelligence algorithms running on modular supercomputer architectures. That is the nature of large simulation models which will require centralised facilities. In fact, simulation tasks are now so extreme that four European HPC centres are collaborating to easily shift computational jobs between their machines. Dimitris Koureas pointed out that large computational facilities are just one dimension, and the huge fragmentation from data organisation to semantics needs to be overcome to make data work more efficient.

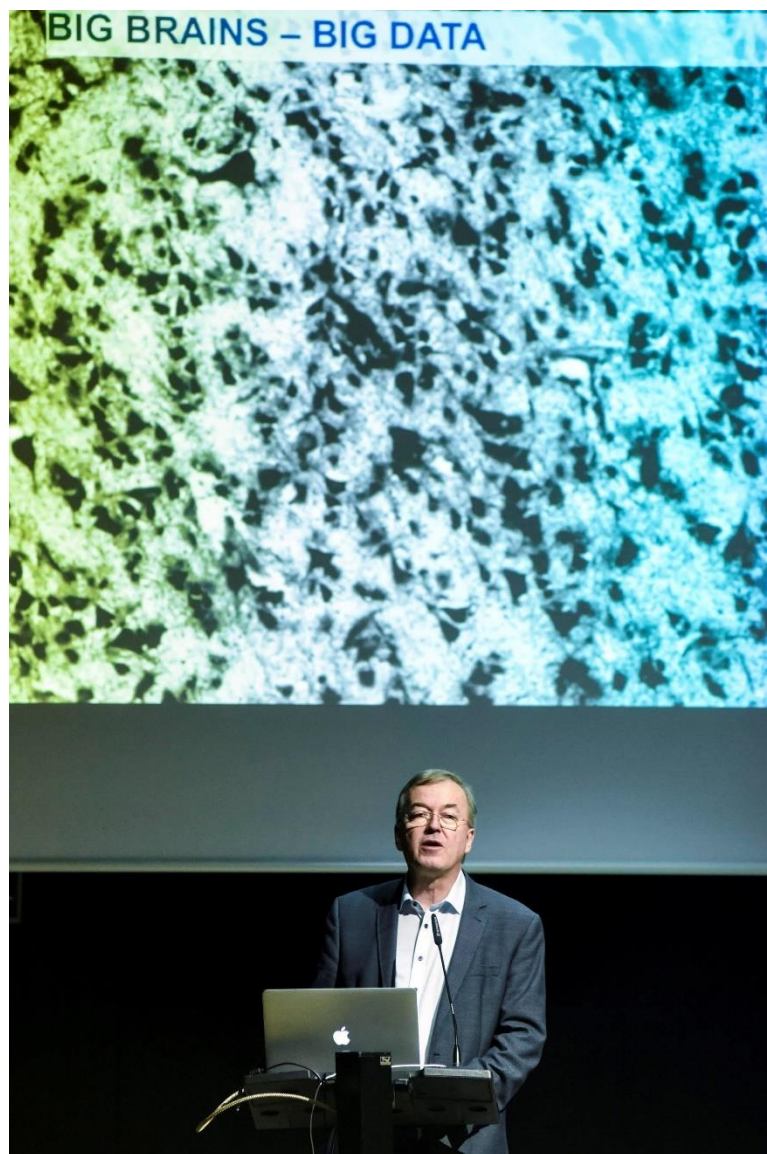


Figure 46: Thomas Lippert

As an example, he referred to the huge biodiversity collections available worldwide which cannot be exploited due to their full potential for benefitting environmental stability. Milan Petkovic listed multiple challenges in the domain of healthcare research. In addition to the technical fragmentation, the legal fragmentation in Europe is hampering fast progress too. That said, new platforms are under development to integrate health data, and the use of AI to respect privacy at organisations such as Phillips, will facilitate big data approaches in health.

In general, it can be concluded that advances in providing large computational facilities to work on the huge volumes of IoT generated data with AI methods are necessary. But that we should not overestimate the use of edge computing for AI. Computational power alone however will not be sufficient to master the challenges. We need considerable investments to overcome the fragmentation at the various dimensions.

In the third session, Matthias Scheffler gave an impression of big data applications in material science dealing with vectors of billions of elements. Advanced machine learning and other statistical methods running on high performance computers are used to come to new categorisations of compound materials which may help finally to find answers to certain challenges much faster, for example in the domain of IoT devices. Wojciech Samek opened the black box of machine learning and suggested methods to better understand how neural networks reason. We need to prevent situations in which machine learning will be deployed unilaterally, which could lead to wrong decisions due to artefacts in training materials, for example, which the creators may not have been aware of. Finally, Graziela Figueredo used examples from vehicular data and incidents to outline how to setup and run a process to get from abundant data to actual and actionable insights. Smart devices create so much data that proper selection, summarisation and presentation of data are essential to turning data into impactful messages.

In summary, it's important to reemphasise that we have many extremely helpful statistical algorithms and machines to help us execute complex calculations. However, the success of these tools is critically dependent on the availability of large data sets requiring appropriate regulatory mechanisms. In addition, we need to be careful of over-relying on these statistical machines; in many cases, proper selection and presentation methods need to be applied in order to effectively transmit messages.

This workshop was the second on Big Data within the realm of the IoT Week. In 2017 we put the topics of "identification and identity resolution" (of data being generated by IoT devices) at the centre of the presentations and discussions. There was a clear central message that the identity of data objects needs to be taken seriously, both in science and industry. In 2018, the workshop focussed on three main areas that need to be urgently addressed in order to produce scalable methods.

- Technology such as identified Digital Objects combined with Blockchain technology that can assist in creating a more trustworthy data domain. That said, it will be the combination of technological and social approaches (including science, laws, new paradigms, norms, ethics, and Zeitgeist) that will be most effective in solving problems.
- Large central computational facilities will be needed to tackle the many large problems. Smaller facilities can help find solutions on a smaller-scale, however overcoming the phenomenon of wide-reaching fragmentation means scaling up in terms of facilities.
- Machine learning and other statistical methods are great tools for tackling even complex problems. However, we still need to better understand how classifiers are actually functioning in order to convert results into understandable messages.

- Additionally, it became clear in this workshop that AI methods and a higher degree of automation is needed to enable new scientific and business methods, e.g., to automatically generate approximate hypotheses to drive understanding of multi-dimensional problems.

At the next IoT Week in Aarhus in 2019, we'll be organising a workshop on Big Data in IoT and suggestions for the focus points are welcome.

### 5G - IoT Convergence (hosted by TM Forum)

#### 5G – IoT Convergence: An Overview

MODERATOR: Craig Bachmann

SPEAKERS:

- Sergio Takeo Kofuji
- Georgios Karagiannis
- Franck Boissière

SUMMARY:

At this year's IoT Week event in Bilbao, experts from the TM Forum were invited to participate as panellists, speakers and workshop hosts. Craig Bachmann led an expert panel addressing 5G and IoT convergence, and discussing the 5G and IoT value chain. The panel explored application areas in which 5G could be leveraged, the consequent interoperability challenges that need to be addressed and standards that need to be met. The session included a high volume of detailed information, as illustrated below in the overviews of 8 key topics which ranged from strategic direction to tactical challenges and opportunities.





Figure 47: Georgios Karagiannis, Franck Boissiere and Sergio Takeo Kofuji

Experts included:

[Georgios Karagiannis](#), Speaker, Vice Chair - AIOTI WG03 - Principal Strategist in Standardization and Industry Development - Huawei Technologies Düsseldorf GmbH

[Franck Boissière](#), Speaker, Internet of Things Unit, DG CONNECT, European Commission - Policy Coordinator & Programme Officer

[Sergio Takeo Kofuji](#), Speaker, Escola Politécnica Da Universidade De Sao Paulo, Brazil - Professor Dr

Main topics and insightful discussions addressed the following:

## 1- IoT and 5G overview:

a. 5G will bring higher bandwidth, increased reliability with lower latency, higher data traffic capacity, and will be a driver of innovation. 5G will be an enabler of AR/VR, autonomous driving and industrial IoT.

b. 5G will be more scalable, flexible, customizable through network slicing. 5G must be faced around user requirements in different industry verticals. Phase one set to arrive within 1-2 years. Dedicated 5G product to appear on the market as of ±2021-2022.

c. Top 10 key revenue industries forecasted for 5G will be:

- Energy & utilities
- Manufacturing
- Public safety
- Healthcare
- Public transport
- Media & entertainment
- Automotive
- Financial services
- Retail
- Agriculture

## 2- SDOs working on 5G & IoT:

a. A number of Standards and Industry organization are working on the convergence of IoT and 5G, these groups must collaborate to ensure interoperability:

- 3GPP
- TM Forum
- IEC

- ITU-T
- GSMA
- AIOTI
- 5GAA
- 5GACIA
- 5GSA

**3- 5G and IoT are at the core of the new connected value chain. Key areas: autonomous driving, smart factory, healthy aging. IoT is a key application of 5G but is really a complex set of long tail applications and “end to end” options.**

- 5G KPIs: Long duration of power supply, low latency, connectivity density...
- IoT connectivity options: Zigbee, LoRa, Sigfox, Bluetooth, cellular with NB-IoT, LTE-M, etc.
- From a regulators perspective there are many different frequencies making it tricky to produce standards and ensure interoperability.

**4- 5G & IoT standards challenges: the key challenges for the near term as the market begins “buying” and suppliers try to simplify solutions.**

- Interoperability
- Supply and demand = chicken and egg situation
- Innovation – standards can’t keep pace
- Non-technical aspects including investment
- Policy & legislation
- Acceptance

**5- 5G Technology has innovative capabilities that will be implemented in many ways to support IoT**

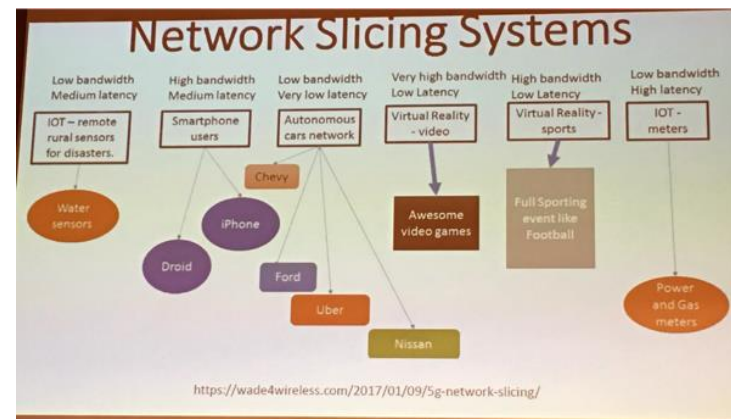
- Very low battery consumption

- Low latency
- Network slicing
- Device to device
- Location accuracy
- Edge computing

**6- 5G IoT Applications are diverse from the simple to the complex and mission critical:**

- Guaranteed QoS for mission-critical apps
- Pervasive IoT services
- Innovative VR/AR industry applications
- Connected cars, drones and robotics
- Optimized on-demand network and cloud services

**7 - 5G enables network slicing, which is an easily misunderstood concept. The panelists addressed the question “What is network slicing?”**



**8 - Panelists agreed that Ecosystem Management will be a key capability for the success of IoT and 5G convergence.**

## An Interactive Session on 5G IoT Ecosystem Integration and Management

MODERATOR: Craig Bachmann

SPEAKERS:

- Thandi Demanet

### SUMMARY

Thandi Demanet led an Ecosystem Management workshop attended by 50+ delegates. The participants shared insights and Ecosystem Management requirements for interoperability, “open” ecosystems, exposing IoT capabilities, ecosystem security by design, value creation modeling, new business models, and monetization. The session also described the work being done within the TM Forum to develop an Ecosystem Business Architecture. Today, the lack of an Ecosystem Business Architecture, along with a lack of a common language and understanding on how to share risk and reward across the ecosystem environment have limited the progress. Key issues of monetization, management and trust are large challenges across partners and dynamic ecosystem participants. The connected nature of end users and suppliers across platforms becomes both a challenge for business assurance and an opportunity for new business models.



Figure 48: Craig Bachmann, moderating the session

The interactive session used “Smart Rail transportation” in understanding the various business, technology, and market ecosystem components that will need to work together to create new value streams.

Ecosystem Business Architectures are quickly becoming an area of concentrated interest.

## 5G and IoT: The Security and Privacy Challenges

MODERATOR: Srdjan Krco

SPEAKERS:

- Sergio Cozzolino
- Eva Fogelström
- Do Van Thanh

SUMMARY

In this session, the following representatives of mobile industry took part: Eva Fogelström (Ericsson), Do Van Thanh (Telenor Research) and Sergio Cozzolino (SIM Group - GSMA).

As expected given the name of the session, in addition to the general direction of the industry with regard to 5G, the discussion also revolved around the security and privacy challenges as well as the best ways to approach them and resolve. The need to ensure communication links and protocols as well as to include mechanisms for identification of manipulated data was also been considered, and the necessity of standardisation also highlighted.



Figure 49: Eva Fogelström, Do Van Thanh and Sergio Cozzolino



## Artificial Intelligence and IoT

### Linking A.I. and IoT in Smart Cities



Figure 50: Stefano Bianchi, the moderator of the session

MODERATOR: Stefano Bianchi

SPEAKERS:

- Marcello Knorich Zuffo
- Irene López de Vallejo
- Michael May

SUMMARY

The session explored different complementary approaches to the interconnection of AI technologies and IoT data analysis in the smart city domain. Speakers provided different insights into upcoming evolutionary

stages of AI, and how this will keep pace with an the exponentially expanding IoT ecosystem.

Presentations spanned from biology-inspired approaches to managing swarm-like interactions between intelligent devices (Marcello Knorich Zuffo, Universidade de São Paulo, Full Professor at Politecnico Engineering School), to industrial platforms functionally supporting complex IoT architectures (Michael May, Siemens AG – Corporate Technology, Head Company Core Technology Data Analytics & Artificial Intelligence), to innovative solutions for decentralized IoT data exchange in distributed AI scenarios (Irene López de Vallejo, DEXI Ocean Protocol Foundation, Director of Partnerships and Business Development).

### Artificial Intelligence and the Sustainable Development Goals

MODERATOR: Mythili Menon

SPEAKERS:

- Marek Havrda
- Franck Milet
- Andrea Balogh

SUMMARY

Objective: This session sought answers on how AI can be applied to accelerate the achievement of the targets within the 17 Sustainable Development Goals (SDGs). Accordingly, this session provided examples of how AI is potentially one of the most powerful enablers of the SDGs, which can break barriers faced by the developing world and revolutionise data management for sustainability purposes.



Figure 51: Irene López de Vallejo speaking to the audience of the AI & IoT Panel

### Introduction:

Artificial intelligence is expected to take the world by storm by serving as one of the most pervasive technologies, capable of influencing key aspects of our lives and fundamentally changing the way we use and interact with technology. As such, AI possesses the ability to utilise vast amounts of complex and heterogenous information and translate it into real insights and associated responses. This capacity bestowed on Artificial Intelligence is expected to serve humans in solving world's most enduring problems and also help in the quest for sustainable development.

As the research on AI-related technologies is on the rise, it is expected that a wide range of associated services and products will be added to the market thereby serving various socioeconomic sectors. With this dynamic

trajectory of AI-related research, these technologies are expected to provide the much-desired boost to the global digital economy, while also providing AI-enabled smart solutions which are capable of monitoring and responding to changes in greenhouse gas emission, water pollution, diagnosis of diseases, excessive energy consumption, protection of flora and fauna and facilitating the transition to smart cities. In this scenario, AI is expected to serve as a key catalyst in the achievement of the Sustainable Development Goals and the collection and interpretation of data for the indicators of each stipulated goal.

### Discussion(s)

This session was chaired by Ms. Mythili Menon from Mandat International.

*Marek Havrda, GoodAI, Strategy Advisor*

Mr. Havrda provided an overview of the role that Artificial Intelligence can play in the achievement of the Sustainable Development Goals. He highlighted that several developing countries were heavily investing in smart cities to harness the digital components of AI with the aim of improving urban policies and operations and restoring regions which are on the cusp of environmental degradation.

Mr. Havrda also touched upon the topic of how smart buildings and homes, smart grids, smart transportation and smart manufacturing have leveraged AI technologies and machine learning so that these systems are able to recognize and learn patterns related to various activities and monitor parameters

*Franck Milet, Secondworld Sàrl, CEO & Founder*

Mr. Millet, through his presentation, provided key insights on combining the streams of virtual reality (VR) and artificial intelligence to achieve Sustainable Development Goal 11 on "Sustainable Cities and Communities".

He presented the unique perspective that dissemination of knowledge about these technologies through social avenues such as gaming will promote their wide-spread use, to foster social, cultural and economic change, which is essential to break barriers and empower under-represented communities. These means can also be adopted to inspire children and inculcate innovative ideas and promote e-learning.

*Andrea Balogh, United Technologies Research Center, Ireland, Research Scientist*

Ms. Balogh presented the famous ANASTACIA project under the European Union Horizon 2020 programme. This project addresses the problems associated with cybersecurity for the Internet of Things. Accordingly, Ms. Balogh provided highlights of the AI-enabled anomaly-based intrusion detection system for the Internet of Things, which is expected to provide dynamic security enforcement for smart city establishments, thereby catering to Sustainable Development Goal 11 and Sustainable Development Goal 16 “Peace, Justice and Strong Institutions”.

#### **Outcome:**

This session was well attended with over 100 participants. During the panel discussion, the audience unanimously called for the development of a Declaration on “Artificial Intelligence for Sustainable Development” during the second edition of this workshop at the next IoT Week 2019 in Denmark.

## **Creating Value by AI and Big Data: Industrial Applications, Challenges and Outlooks**

MODERATOR     Ana García Robles

#### **SPEAKERS**

- Milan Petkovic
- Rodrigo Castiñeira
- Óscar Lázaro
- Thanasis Poulakidas
- Aitor Arnaiz

#### **SUMMARY**

This session, organized by the Big Data Value Association ([www.bdva.eu](http://www.bdva.eu)) in collaboration with the BDV PPP lighthouse projects and several key stakeholders in both Big Data and Robotics, aimed at exploring the opportunities and challenges of applying data-driven AI solutions in sectors of high economic and societal value for Europe. The session addressed the sectors of Healthcare, Bio Economy, Transport, Logistics and Mobility and Manufacturing, providing concrete examples of value created as well as specific sectorial challenges for the success of this technology and touched on the vision for AI in those sectors.

In the health and healthcare domain, represented by the BigMedilytics project ([www.bigmedilytics.eu](http://www.bigmedilytics.eu)), the main data challenges identified are interoperability, methods and ecosystem for data sharing, missing and noisy data and data volume. Additionally, the main AI challenges identified are: Relevant Clinical Question First; Right Data (representative and of a good quality); Ratio between number of patients and their variables should fit the AI method; Relationship between data and ground truth should be as direct as possible; Regulatory ready; enabling validation; and, Right AI Method. An

specific use case called “From Asset management to workflow optimization” was used to show value created and to guide the discussion.



*Figure 52: Milan Petkovic*

In the transport, mobility and logistics domain, represented by the Transforming Transport project ([transformingtransport.eu](http://transformingtransport.eu)), the main barriers identified for Big Data and Artificial Intelligence adoption are access to data and data awareness (to collect, store and analyse data. with great potential in this sector with low adoption of those technologies). The example of Smart Highways was used to show the great potential of this technology in a sector of very low adoption of Big Data and AI, and to highlight the need of creating awareness of the value of data and the impact in developing new business models and transforming companies in the sector.

Bio-economy sectors such as agriculture, fisheries, and forestry were represented by the DataBio project ([www.databio.eu](http://www.databio.eu)), that provided multiple examples of expected value that Big Data technologies and AI-assisted services will bring to each of these economical areas accelerating the bio-economy market penetration. Potential value created was illustrated by the concrete example of “Prediction and real-time alerts of diseases and pests breakouts”. Identified challenges and barriers for adoption include: Data sharing (and management), identified as very important for high quality localized analysis; Platform synergies, not just for stacking components, but synthesizing flexible pipelines with feedback control and easy cloud-edge-local deployment; Recognizable ecosystem building, with continuous effort and long-term vision; and Transparency and fairness, identified as a key aspect for adoption.

The Smart Manufacturing sector was represented by the Big Data Boost 4.0 project (<http://boost40.eu/>) and enriched by the specific use case of AI for Collaborative Robotics provided by IK4-Tekniker, complementing the Big Data approach with a Robotics perspective. Big Data and AI are game changers in Manufacturing including the traditional sectors. Boost 4.0 project provided examples of expected value created in areas such as Smart Digital Engineering, Smart Planning, Smart operations and digital workplace, Smart connected production, and Smart maintenance and service. Main challenges identified for adoption are adoption of common standards, a free flow of industrial data in a secure and safe (trusted) environment, safety and security in the usage of algorithms, transparency and trust in data and algorithms. It was also highlighted the importance of the sovereignty of AI and data platforms.

Through the AI for collaborative robots use case IK4-Tekniker presented its vision on multimodal interaction, addressing individual channels (such as gesture recognition, voice interpretation, etc) using a multi-channel fusion layer with semantics interoperability and reasoning. Identified value that AI



brings to collaborative robotics is variability (adaptive, integrable, extensible), Easy to use, affordability (short term ROI), Safety, and capabilities (intelligence). This example also highlighted the complementary aspect of data and experience for AI. Trust (both in the data and the robot) was identified as an important and critical aspect in the collaboration between robots and humans.

Input from the different interventions and the brief final discussion demonstrated the great potential that Big Data and AI technologies offer to different sectors of high economical and societal value, but also highlighted important common challenges and risks (in many cases of cross-cutting or horizontal nature) such as interoperability, data access and sharing, quality of the data, data awareness, sovereignty, trust, fairness and transparency. The vision of a common European Data Space aims at overcoming some of the above-mentioned barriers. To secure a leadership position in the global economy additional investments in research are needed to secure a trusted co-evolution between humans and AI-based systems including awareness, skills development and ecosystem building actions to support a fair and agile transformation of value chains and ecosystems.

## Smart Farming and Food Security

### Industrial Solutions on Farming and Food Security

MODERATOR: Aitor Arnaiz

SPEAKERS:

- Tomo Popović
- Jérôme Bandry
- Joseba Izaguirre
- Thomas Engel

SUMMARY:

This session began with a short introduction on each speaker as well as an outline of the session objectives. The focus here was to show industrial solutions marketed or under development in the area of farming and food processing, with a special request in detailing how IoT technologies are being applied in these solutions. Presentations therefore fell under these focuses. The first four presentations addressed particular areas of results, such as integration platforms, sensors and autonomous vehicles, whereas the final talk posed some general questions current trends in the machinery industry.

Dr. Aitor Arnaiz (IK4-Tekniker) presented a meta-platform for information management and performance optimization of poultry production, in fact one of the first results of IoF2020 project. The platform operates with information from farm production, transport and slaughterhouse and includes interoperability with other commercial platforms and acquisition systems. Key benefits and impact of the solution were explained.



*Figure 53: (Left to right) Aitor Arnaiz, Jérôme Bandry, Thomas Engel, Joseba Izaguirre and Tomo Popovic*

Mr. Joseba Izaguirre (IK4-Tekniker) provided an overview about several sensor products. The presentation focused on the development process, from idea to product, including prototyping, test benches, preseries, and certification. Sensors included low cost distributed sensing series -regarding robust “plug, play & forget”, as well as high end sensor systems prepared for identification of oxidation, quality characteristics and aroma.

Dr. Tomo Popovic (University of Donja Gorica) introduced a specific solution (TagItWine) developed in the context of TagItSmart H2020 project in order to allow wine brand protection and counterfeit prevention. The solution is based on the use of SmartTags with augmented functionality (such as the inclusion functional ink) together with support systems (e.g. historical data

in the cloud). The presentation also showed how TagItWine solution is being applied and marketed.

Dr. Thomas Enghel (Jonh Deere) presented an overview of the agricultural robots and autonomous farming products of the company, followed by an identification of the challenges and drivers that are behind this robotics transformation. One of the key issues discussed was the potential initial introduction of these technologies in specialty crops, where labor cost reduction and qualified workforce shortage will be key drivers, whereas large arable farms will probably need cooperation with additional incentives and technologies.

Finally, Mr. Jerome Bandry (CEMA European Agricultural Machinery) provided an outlook of the actual the ‘digital farming’ concept and the challenges and needs related to the introduction of advanced agricultural machinery in Europe. The presentation, constructed in relation to the H2020 SmartAKIS (smart Farming) thematic network, gave basis to an interesting and short debate.

The complete session included nearly 100 attendees and was a very interactive event, including specific questions from the audience to speakers, concerning, for instance, the value of IoT technologies within these solutions and the current interest of final customers in these solutions. All in all, the session reflected well the bright future that IoT technologies could bring in the near future to the food and farming sector.

## Integrated and Smart Food Value Chain

MODERATOR: Srdjan Krco

SPEAKERS:

- Nuria De Lama
- Andrés Montero Aparicio
- Klaus Beetz

SUMMARY

Nuria De Lama (ATOS Research & Innovation), Andrés Montero Aparicio (Ministry of Agriculture, Fisheries, Food and Environment) and Klaus Beetz (Siemens AG) took part in our session on 'Integrated and Smart Food Value Chain'. In some ways, this session was a continuation of the session on new trends in smart agriculture. The speakers addressed the role of big data, the benefits of smart agriculture as well as the role and the support provided by public administrations to facilitate more rapid adoption of new technologies.

## IoT and Advanced Manufacturing

Worldwide Initiatives: IoT in Manufacturing Initiatives in America and EU

MODERATOR: John Soldatos

SPEAKERS

- Sergio Gusmeroli
- Jon Kepa Gerrikagoitia
- Aitor Alzaga
- Eduardo Kaplan Barbosa

SUMMARY

This session presented initiatives and projects that deal with the deployment and validation of IoT technologies in manufacturing in EU and Brazil. EU initiatives mentioned included the manufacturing-related activities of the Alliance for IoT Innovation (AIOTI) (i.e. notably the 11th Working Group of AIOTI) and of the Big Data Value Association (BDVA). Moreover, insights from Japan and the USA were provided during the panel discussion that followed the presentations. There were also presentations about the deployment of IIoT technologies in industrial plants from two complementary perspectives. The first was from the perspective of industrial requirements and the status of the shop floor and identified the merits of IIoT technology deployments. The second presentation presented emerging IIoT technologies and how they can benefit manufacturers. A main conclusion from the session was that IoT's adoption by Manufacturing is first and foremost a cultural and a management issue, rather than a technology issue. Manufacturers need to develop an IIoT and digitization friendly culture, along with proper management in order to adopt and fully leverage IoT opportunities. Moreover, senior management commitment is a prerequisite.



*Figure 54: Alberto Sotomayor Gurruchaga, R&D Manager of Ibermatica, speaking about "Solutions & Experiences Coming from the Industry"*

At the same time, the importance of policy, standardization and innovation initiatives (such as the ones undertaken by AIOTI/BDVA) can also be catalysts for a faster and wider adoption of IoT in manufacturing. Finally, there was a discussion about the role of open source software in industrial solutions, which remains a controversial issue. On the one hand there were positive insights about open source solutions ability to foster adoption and community building for IIoT innovations. On the other, there were also concerns about whether and how an open source approach could meet stringent industrial requirements.

## Solutions and Experiences Coming from the Industry

MODERATOR Aitor Alzaga

SPEAKER

- Jorge Rodríguez Edroso
- Fernando Reategui

SUMMARY:

The session Solutions and Experiences Coming from the Industry proposed two specific IoT solutions already used in the industry:

- Wind turbine 4.0: some remarks on gathering quality data for predictive maintenance. From Fernando Reategui, from ATEN2 Advanced Monitoring Technologies
- Industrial IoT Solutions: Mindsphere vs FIWARE, from Jorge Rodríguez from ATOS

Fernando Reategui highlighted the need for high quality of the data, although the current trends and focus of the IoT are more on the acquisition platforms than on measuring devices. The lack of quality data will impact both in the machine learning predictions and in the technology itself, not advancing in its great potential, and impacting, highly negatively in the Industry 4.0 development. Several examples were shown regarding the differences of data analytics with accurate and less accurate data, remarking that there should be a higher focus in the measuring device that could gather high quality data for better modelling of machine learning models.

Jorge Rodríguez focus his talk in the different industrial platforms available in the market for Advanced Manufacturing, highlighting two among all: FIWARE and Mindsphere. Mindsphere is a cloud based open IoT platform



developed by SIEMENS able to connect the different products, plants and systems of an Industry 4.0 company, providing specific analytic services for the optimization of Industry 4.0. FIWARE provides a powerful set of APIs for the development of Smart Applications in other vertical sectors too, for fast emerging of FIWARE providers in the market. Jorge Rodriguez Concluded with the statement that although there are at this moment many IoT Industrial Platforms and many applications for IoT data (condition monitoring, predictive maintenance...) is still too early to know which one would prevail. FIWARE and Mindsphere are well positioned in this field.



*Figure 55: Mikel Larrañaga, Senior Researcher at IK4-Tekniker, had a relevant role as technical coordinator of the panel*

## APPENDIX 3: WORKSHOPS

### IoT in Manufacturing: Enabling Industry 4.0

#### R&D Initiatives and Results

MODERATOR: John Soldatos

#### SPEAKERS

- Oscar Lazaro
- Sergio Gusmeroli
- Mario Dionisio
- Samuel Moniz

#### SUMMARY

This session was devoted to presentations that highlighted the affiliation of the Industrial Internet of Things with the digitization of the Industry. The first part of the session provided the perspective of the industry on how the fourth industrial revolution relates to IIoT. It presented the requirements and needs of industrial organizations and industrial automation solutions providers in terms of digital simulations, digital twins, data analytics, security and automation. Accordingly, the speakers provided insights on available and emerging IIoT solutions, with particular emphasis on how they will be used to fulfill industrial requirements. The first part of the session included also a policy-related presentation, which emphasize on EC's initiatives that are aimed to support the digital transformation of the industry, based on the increased and rapid adoption of IIoT technologies.

The second part of the session was more research oriented. In particular, a set of digital enablers for IIoT solutions in industrial plants were presented. Special emphasis was paid on presenting how BigData, Artificial Intelligence and Blockchain technologies can be used in industrial use cases. While most of the presented Industry4.0 applications focused on manufacturing, there

was also a presentation on how IIoT can impact various applications in the energy domain. Furthermore, emerging standards for the industrial internet was discussed, including reference architectures and their implementation status.

Overall, both parts of the session gave a very good overview of industry requirements for the Industry4.0 era and how IIoT solutions and technologies hold the promise to meet them. This was back-up with presentation of concrete business cases and use cases from industrial vendors and R&D projects representatives.

### U4IoT Workshop

#### IoT Adoption Barriers – Which, Why and How

MODERATORS: Jonas Breuer - Abdolrasoul Habibipour

#### SPEAKERS:

- Nathalie Stembert
- Ines Vaitinen
- Wim Vanobberghen
- Anna Ståhlbröst

#### SUMMARY

The aims of this workshop were to: 1) identify and discuss end-users adoption barriers related to IoT implementations, 2) potential enablers for adoption, 3) foster discussion and knowledge sharing between LSPs, 4) connect to other domain experts not part of the LSPs. To do so, a three-step process was followed during the workshop to: 1) brainstorm potential adoption barriers, 2) discuss and categorize them, 3) assess potential ways to tackle the barriers. The discussion that was facilitated by the stepwise process was lively and interesting insights were shared and learned. The

U4IoT CSA will use this data as a starting point for their work on adoption barriers in the coming year.

To start, nine workshop participants were divided into two tables (Table 1: Four participants; Table 2: Five participants). In total 45 adoption barriers were identified in the workshop. Together with the participants, we first eliminated some of the items that were similar and combined the items that were related. In so doing, we ended up with 24 adoption barriers. After that, these items were classified in four main themes, namely, 1) most important, 2) most challenging, 3) most expensive, and 4) most common

Most challenging: Complexity, intrusive and loss of control, standardization/interoperability and the lock-in with private companies, relevance of technology (fundamental question)

Most important: Isolation from the society, killing creativity and RoI issues for end-users, usability and functionality, relevance for users/citizens

Most common: Unnecessary data gathering, force changes on user's daily life and the danger of cheating, legal unclarities, lack of transparency (including Terms & Conditions), data misuse of data controllers

Most expensive: Communication and power consumption issues, Design constraint like devices size, underlying infrastructure (e.g. stable servers or simply connectivity)

In the last step, participants were invited to discuss potential solutions for tackling the barriers. For each of the adoption barriers, the recommendations and suggestions on how to tackle IoT adoption barriers were collected and discussed in greater details. The workshop ended by sharing insights of both tables with the rest of the participants and reflecting on the results of both tables.



*Figure 56: One of the workshops in progress*

## APPENDIX 4: STARTUP COMPETITION

The Startup Competition took place on Tuesday 5 June 2018. It was organized by the IoT Forum, IK4 TEKNIKER and Up! Euskadi, the Basque Entrepreneurship Ecosystem agency. Digital Catapult and IoT Tribe acted as official collaborators.



Figure 57: The Startup Competition Participants, with the members of the Jury

After a preliminary selection, 13 startups were accepted to participate in the Competition: IMATEK, Ironchip, Arque, Zolertia, Recycl3R, Stockare, WiseHome, SocialAndCare, IDAB-IIoT, Symplio, WICASTR, Myruns and StandardAccess. Their representatives presented their pitches to a jury compound by senior experts:

- Jose Miguel Landeta, IK4-TEKNIKER
- Alexander Gluhak, Digital Catapult
- Tanya Suarez, BluSpecs / IoT Tribe
- José Antonio Campos, Deusto University
- Irene López de Vallejo, DEX I Ocean Protocol Foundation

- Esther Paguey, BIC GIPUZKOA

### The Participant Startups

Startup	City	Website
IMATEK	Mungia (Spain)	<a href="https://www.imatek.eus">https://www.imatek.eus</a>
Ironchip	Barakaldo (Spain)	<a href="https://ironchip.net/">https://ironchip.net/</a>
Arque	Montreal (Canada)	<a href="http://www.arque.io/">http://www.arque.io/</a>
Zolertia	Barcelona (Spain)	<a href="https://zolertia.io/">https://zolertia.io/</a>
Recycl3R	Palma de Mallorca (Spain)	<a href="https://recycl3r.com/">https://recycl3r.com/</a>
Stockare	Bilbao (Spain)	<a href="http://www.stockare.com/">http://www.stockare.com/</a>
WiseHome	Sao Paulo (Brazil)	<a href="http://wisehome.com.br/">http://wisehome.com.br/</a>
SocialAndCare	Zaragoza (Spain)	<a href="http://www.socialandcare.com/?lang=en">http://www.socialandcare.com/?lang=en</a>
IDAB-IIoT	Granada (Spain)	<a href="http://www.idab-iiot.es/">http://www.idab-iiot.es/</a>
Symplio	Bilbao (Spain)	<a href="http://www.symplio.com/">http://www.symplio.com/</a>
WICASTR	London (UK)	<a href="https://wicastr.com/">https://wicastr.com/</a>
Myruns	Donostia (Spain)	<a href="https://www.myruns.com/myruns-3">https://www.myruns.com/myruns-3</a>
StandardAccess	Dingle (Ireland)	<a href="http://web.standardaccess.co/">http://web.standardaccess.co/</a>



## The Awarded Startups

After the deliberation, three projects were awarded as the most innovative of the Competition:

- I award – **Symplio**, Bilbao (Spain)
- II award – **StandardAccess**, Dingle (Ireland)
- III award – **Recycl3R**, Palma de Mallorca (Spain)



*Figure 58: Symplio, a project from Bilbao, being awarded*

## APPENDIX 5: INNOVATION HACKFEST

The “2018 IoT Week” is one of the mayor events organised in Europe for the IoT community and public in General, organised by the IoT Forum this mayor event has always look to innovate and keep the IoT community updated with the trendiest research activities and engage their participants with industrial stakeholders. In this 2018 edition, under the umbrella of continue innovation, the IoT week focused on organising activities and providing a space for materializing innovative and unique ideas that may disrupt the IoT market(s).



Figure 59: Presentations and deliberations took place during the HackFest

The “IoT Week hackathon” event is a well-established organised activity within the IoT Week that during past years has attracted participants, creating a competitive environment to innovate, design and create solutions. This year at the IoT Hackathon the evolution was reflected by including on each challenge the innovation as main track, and thus under the brand “2018 IoT Week Innovation Hackfest”, IoT experts, designers, developers, entrepreneurs, students and researchers to form teams not bigger than 4 participants and design/propose and present solutions considering previous project results to create a path to continuous improvement of those project results and a way to the markets to reduce design implementation efforts.

The main objective in the “2018 IoT innovation hackfest” was to motivate that results from H2020 European projects and innovative ideas can go into market products, services and solutions that can incentivise entrepreneurship (start-ups), market adoption (industries make use of available technologies), knowledge transfer (large industries) to adopt and adapt technology coming from donor projects in the form of open source technologies and include them in their business plan, and/or products ideas, and/or production process.

The Hack Master, Dr. Martin Serrano, explained: “The number of innovative ideas and the level of participation can be improved in the next edition, but the objective of engagement, showcase and the effect of connecting entrepreneurs with project results has been a success”. Dr. Serrano has organised several IoT hackathons and also participated and win in other ones like the one in IoT Conference back in 2014 hosted at the MIT media lab, and he expressed that this IoT Innovation Hackfest format is unique and well directed towards promote innovation and not only the use f technology but also to think in business modelling and business exploitation, what

makes 2018 IoT Innovation Hackfest pioneer and unique in Europe and the world.

The “2018 IoT Week Innovation Hackfest” had a participation of 20 participants from many parts of the world who formed 5 groups from which three managed to finalise their projects and submit them to the competition. The “2018 IoT Week Innovation Hackfest” allowed software developers, systems architects, services and solutions designers, entrepreneurs students, researchers and business makers, from different start-ups, large industry, industrial research units, etc., get together to explore the potential of the IoT Platforms, developed technologies, solutions and applications that reflect the results and promote the use of the outcomes of three IoT-EPI (European Platforms Initiative) projects i.e. (BIG-IoT, symbloTe and FIESTA-IoT).

#### The Jury

- Sergios Sousos - Intracom Telecom
- Arne Broering - SIEMENS AG
- Jelena Mitic - SIEMENS AG
- Ivana Podnar Zarko - University of Zagreb
- Luis Sanchez - University of Cantabria
- Philippe Cousin - EGM
- Mikel Larrañaga - IK4-Tekniker
- Martin Serrano - Insight (IoT Hackfest Master)

#### The Judging Criteria

- **Technical:** Does the project demo/code works? Is the use of proposed Platforms clear defined?
- **Business idea:** Does the IoT Service create value? Does it save money, create business opportunity, more value or new products?

- **Innovation:** Is it an amazing IoT use case / scenario / service? How the IoT service take advantage of the features and capabilities of BIG IoT or SymbloTe or FIESTA-IoT technologies?

#### The Winners:

The projects awarded at the Innovation Hackfest were:

- Winner of the FIESTA IoT Challenge – *WiseHome FIESTA – Power Consumption Signature Analysis*
- Winner of the BIG IoT Challenge – *CALIFIED – Air Quality Callibration Via Big IoT Data*
- Winner of the Symbiote Challenge – *Symbiote for Smart Parts*



Figure 60: The WiseHome FIESTA team celebrating their success with other Brazilian countrimen

## APPENDIX 6: BROKERAGE EVENT

The Brokerage Event took place on 6<sup>th</sup> June 2018 and was organized by the IoT Week 2018 and IK4 TEKNIKER, in collaboration with the Basque Enterprise Europe Network. The focus of the event was to promote interactions on the main topics that are impacted by IoT today:

- Emerging IoT technologies
- IoT and industry 4.0
- IoT and Big Data
- 5G Convergence
- IoT and Smarts Cities
- Artificial Intelligence and IoT
- IoT Security and Data Protection

This matchmaking event offered the possibility for business persons, entrepreneurs, researchers and innovators to carry out open networking activities during focused, 30-minute face-to-face meetings. This one-day event targeted innovative companies, universities and researchers interested in sharing new project ideas and finding collaboration partners focused on the development and implementation of Internet of Things technologies and applications.

Up to 43 participants, from 11 countries, got to know key R&D players offering their capacities, found new commercial, technological and research partners, presented their own know-how and innovative technologies and participate in the congress having scheduled predetermined meetings.

### The Brokerage Event Data

- Number of participants registered in the Brokerage Event: 43
- Countries represented: 11
  - Albania: 1
  - Belgium: 3
  - Denmark: 3
  - France: 3

- Germany: 5
  - Italy: 2
  - Netherlands: 3
  - Romania: 2
  - Serbia: 1
  - Spain: 18
  - Switzerland: 2
- Collaboration proposals: 33, of which:
  - To develop new products: 6
  - To develop new services: 4
  - To develop partnerships: 6
  - To cooperate in new projects: 5
  - To foster investments: 1
  - To offer expertise: 10
  - Undefined: 1
- Number of *bis-a-bis* meetings:
  - Registered: 15
  - And many more informal encounters, not registered.



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Figure 61: The "3Taula Txalaparta" showed a very much traditional way of communication during the Opening Ceremony



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