# Symbiosis of smart objects across IoT environments

*688156 - symbIoTe - H2020-ICT-2015*

# Report on second External Liaisons Workshop

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# Executive Summary

As a Research and Innovation Action, symbIoTe has to open the theoretical and practical challenges around IoT interoperability to the research. The organization of a scientific workshop focusing on these topics would attract researchers across Europe to share experiences and exchange ideas on their work. Hence, symbIoTe, together with BIG-IoT (a sister project belonging to the IoT-EPI cluster), co-organized the "3rd International Workshop on Interoperability and Open Source Solutions for the Internet of Things", co-located with the **Global IoT Summit 2018** (GIoTS 2018), in Bilbao, Spain, on June 4-7, 2018. Moreover, in order also to target innovation aspects, symbIoTe co-hosted the IoT Innovation Hackfest during the **IoT Week 2018**, collocated with GIoTS 2018. In this hackfest, we asked for innovative ideas on how to use the symbIoTe middleware in commercial domains.

The workshop proposal was submitted to the conference organizing committee in December 2017. The Call for Papers was open till the end of March 2018 and the accepted papers, after being reviewed by the workshop's technical program committee, were notified by the end of April 2018.

In total, 6 papers were accepted for presentation, out of the 8 submitted. symbIoTe had 2 papers while BIG-IoT had 2 papers accepted. The topics covered from the accepted papers were organized in two sessions: i) Approaches on Semantic Interoperability, ii) Privacy, Security and Business Aspects. Moreover two invited talks were planned. Omar Elloumi from Nokia and General Chair of OneM2M was the first invited speaker and his talk was entitled "Scaling the Internet of Things". The second invited speaker was Bill Weinberg from Open Source Sense and Linux Pundit presenting a talk entitled "Open Source, Security and IoT". The participation was quite high (approx. 40 participants) and there were many participants from organizations not related to the two IoT-EPI projects, which renders the overall workshop successful.


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# 1 Introduction

The second symbIoTe workshop has been organized on the basis of the successful experience on the "2nd International Workshop on Interoperability and Open Source Solutions for the Internet of Things" held in Stuttgart, Germany in 2016. The strong collaboration with BIG-IoT project (a sister project belonging to the IoT-EPI cluster) and the interest in common scientific fields, led to the co-organization of the "3rd International Workshop on Interoperability and Open Source Solutions for the Internet of Things", co-located with the **Global IoT Summit 2018** (GIoTS 2018), in Bilbao, Spain, on June 4-7, 2018.

symbIoTe and BIG-IoT projects collaborated in a very tight way in order to achieve the expected resonance of the workshop. For this edition of the event a dedicated web site has been set up and a shared approach undertaken for the realization of the information campaign for attracting relevant contribution to scientific discussions.

A specific event has been also co-organised as aside event of the IoT Week in Bilbao: the IoT Innovation Hackfest. The collaboration with IoT-EPI, IoT Forum led to the organization of specific challenges related to symbIoTe, BIG-IoT and FIESTA-IoT projects. The symbIoTe's prize winning team had to present and pitch their innovative idea on how to improve services using the symbIoTe offerings.

The deliverable is organized as follows: Section 2 provide the details for the preparation of the workshop, from the initial idea and the submission of the workshop proposal, to the dissemination of the Call for Papers. Section 3 provides the details from the actual workshop, i.e., the workshop agenda, the participants and the workshop post proceedings under preparation. Section 4 provide details on the IoT Innovation Hackfest.


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# 2 Workshop preparations

The section provides the details on the preparation of the workshop, from the initial idea, to the collaborations for shaping the workshop objectives and topics and to the final Call for Papers (CfP) and the selection of the Technical Program Committee (TPC).

## *2.1 Motivation*

Already from the DoA of symbIoTe, the consortium has envisioned to organize two workshops around IoT Interoperability, the first one taking place on the 1st year of the project, to help us identify trends and interesting solutions in the domain, and the second one on the 3rd year of the project, where we could expose our approach and exchange ideas on concrete research challenges. Moreover, following the successful organization of the "2nd International Workshop on Interoperability and Open Source Solutions for the Internet of Things (InterOSS-IoT 2016)," we decided to follow the same 'recipe': invite an IoT-EPI RIA to co-organize the workshop with us and involve several members of the IoT-EPI community to the Technical Program Committee.

Towards the end of November 2017, together with BIG-IoT (with which we co-organized the InterOSS-IoT 2016 workshop, we identified that a good opportunity to host the next workshop would be to submit a proposal at the 2nd Global IoT Summit (http://www.globaliotsummit.org/), collocated with the IoT Week 2018, on June 2018, at Bilbao.

## *2.2 IoT-EPI involvement*

As mentioned earlier, the decision was to co-organize the InterOSS-IoT 2018 workshop together with BIG IoT. It was decided that the organizers of the workshop would be the following:

- Program Committee co-chairs
  - Ivana Podnar Žarko, University of Zagreb, symbIoTe Technical Coordinator
  - Martin Serrano, INISIGHT, National University of Ireland Galway, BIG-IoT partner
  - Arne Broering, Siemens AG, BIG-IoT Technical Coordinator
  - Sergios Soursos, Intracom Telecom, symbIoTe Project Coordinator
- Publicity Chair
  - Achille Zappa, INISIGHT, National University of Ireland Galway, BIG-IoT Dissemination Leader
  - Gino Carrozzo, Nextworks, symbIoTe Dissemination Leader

In addition, several other IoT-EPI projects were represented in the TPC committee (see Section 2.5).

## *2.3 Previous workshops*

This workshop is actually the 3rd edition of the event, initially organized in 2014 by the FP7 OpenIoT project in Split, Croatia, on the 18th of September 2014, co-located with the SoftCOM 2014 conference. Dr. Martin Serrano and Prof. Ivana Podnar Žarko have participated in the organization of the 1st workshop. The second edition was organized by symbIoTe, in collaboration with BIG-IoT, and it was co-located with the IoT 2016


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conference, in Stuttgart, Germany, on the 7th of November 2016. It was decided by the co-organizers that the workshop will take place every 2 years.

## 2.4 Topics / CfP

The workshop proposal was submitted to the GIoTS 2018 organizers on the 24th of November, 2017 and the confirmation of its acceptance was received on the 3rd of December, 2017. The workshop's topics of interest included, but were not limited to, the following:

**IoT Principles, Design and Technology**

- Interoperability solutions for IoT systems and platforms
- Standardisation efforts related to IoT solutions and Applications
- Key concepts for interoperable IoT architectures
- Semantic models for the IoT Platforms Data Exchange
- Security, privacy and trust for IoT Devices and Platforms
- IoT device Data Mash-Ups and platforms Orchestration
- Solutions for IoT platform federations and interworking
- Distributed ledger technology for interoperable IoT ecosystems

**IoT Experiments, Practice and Applications**

- IoT applications and real life deployments, e.g., in Smart Cities, Healthcare, Industrial IoT, Robotics, Autonomous Vehicles
- Experiences from real industrial IoT deployments
- Recent advances in open source IoT platforms and tools
- Experimentally-driven Internet of Things experience
- Business perspectives on IoT ecosystem creation
- Business models and marketplaces

The complete proposal for the workshop is attached as Appendix A – Workshop proposal while the final Call for Papers text is available as Appendix B – Workshop Call for Papers.

## 2.5 TPC committee

A preliminary list was included in the workshop proposal, but the TPC members were contacted after the acceptance of the workshop. The final TPC list included members from both the IoT-EPI community (symbIoTe, BIG-IoT, bIoTope, TagItSmart, InterIoT) as well as external experts, with the number of external members being slightly higher. The final list consists of 19 members and is included below (as well as in Appendix B – Workshop Call for Papers):

- Giuseppe Bianchi, University of Roma Tor Vergata, Italy
- Jean-Paul Calbimonte, HES-SO, Switzerland
- Gino Carrozzo, Nextworks, Italy
- Kary Främling, Aalto University, Finland
- Christoph Grimm, Kaiserslautern Unversity of Technology, Germany
- Reinhard Herzog, Fraunhofer IOSB, Germany
- Darko Huljenić, Ericsson Nikola Tesla, Croatia
- Gianluca Insolvibile, Nextworks, Italy
- Srdan Krco, DunavNET, Serbia


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- Danh Le Phuoc, Technical University of Berlin, Germany
- Steffen Lohmann, Fraunhofer IAIS, Germany
- Florian Michahelles, Siemens, Germany
- Jelena Mitic, Siemens, Germany
- Cosmin-Septimiu Nechifor, Siemens, Romaina
- Carlos Enrique Palau Salvador, Universitat Politécnia de Valencia, Spain
- Mirko Presser, Alexandra Institute, Denmark
- John Soldatos, AIT, Greece
- Thomas Usländer, Fraunhofer IOSB, Germany
- Arkady Zaslavsky, CSIRO, Australia

## *2.6 Information Campaign*

Representatives of symbIoTe and BIG-IoT projects formed a team that organized the information campaign. In collaboration with BIG-IoT project, a dedicated web site and domain has been set up: http://www.inteross.org/ (see Figure 1), and the name has been selected in such a way to be general for other domains where interoperability and OSS aspects are important (not necessarily only for IoT). Apart from the dedicated web site, the workshop was announced on the symbIoTe site (see Figure 2).

To execute the campaign, we used the common IoT reflectors via email (e.g. AIOTI, IIC, IoT Events, IoT IEEE, IoT Council and IERC mailing lists, general Call for Paper announcement mailing list) to announce the call for paper and created posts on symbIoTe website and social media accounts to capture perspective authors' interest. The information campaign started soon after the confirmation of the workshop approval by the Global IoT Summit chair and continued up until the day of the event.


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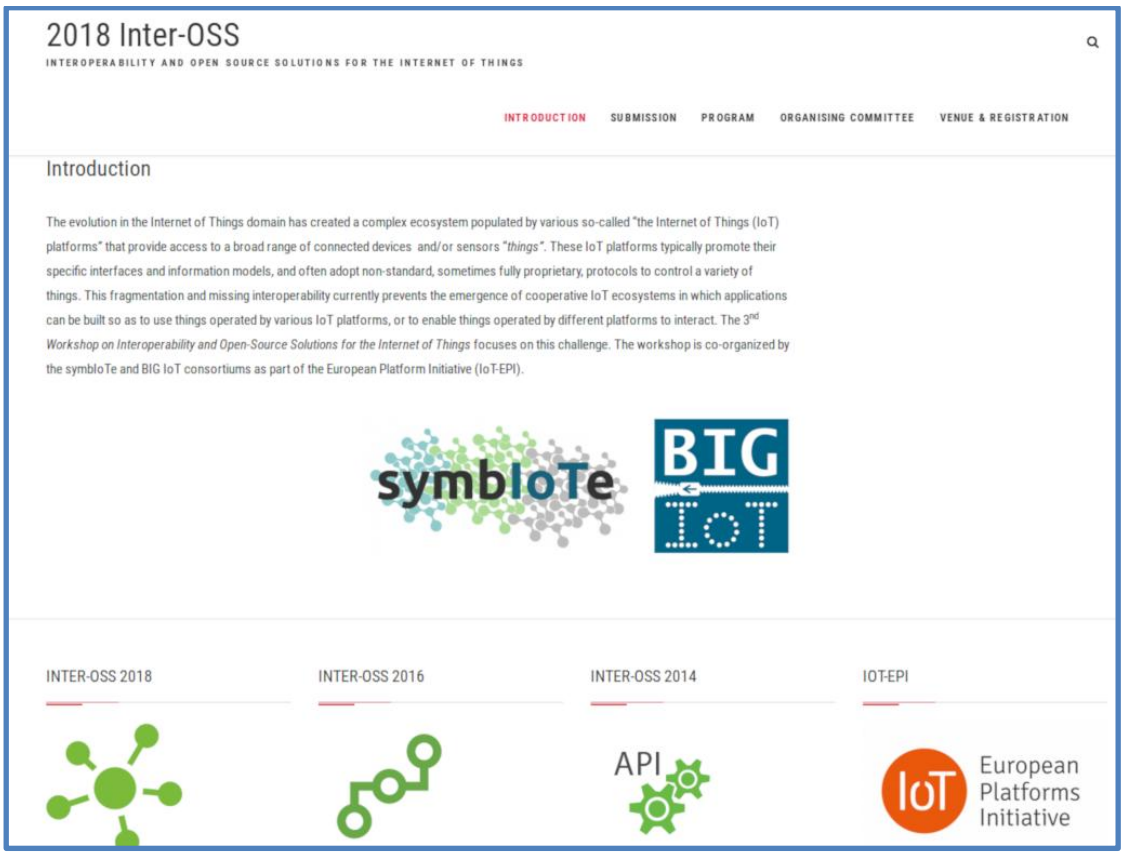


Figure 1 – The workshop main site (www.inteross.org)

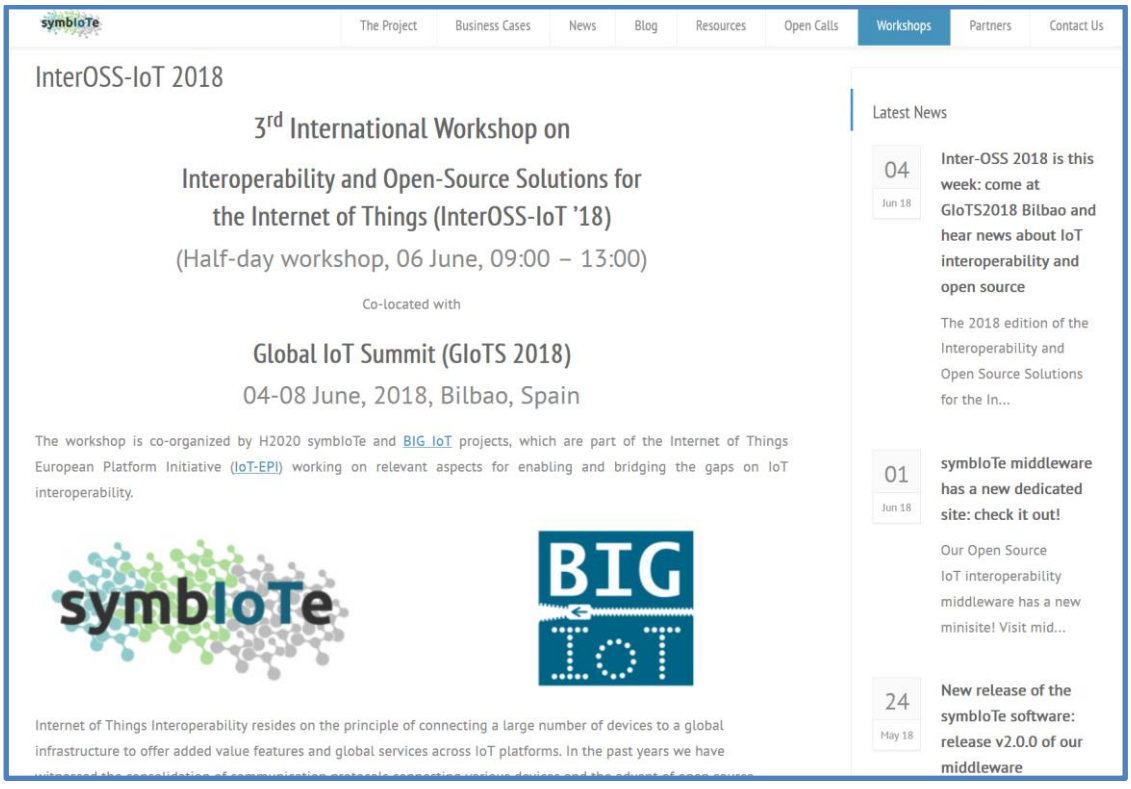


Figure 2 – The workshop summary page at symbIoTe's web site


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# 3 Workshop details

In this section, we provide more details about the impact of the workshop, i.e., how many submissions were received, how many papers were selected for presentation, the participation during the workshop and the overall impressions.

## *3.1 Review process*

For the reviewing process, each TPC member was assigned 2-3 papers to review. Our target was that each reviewed paper receives 3-4 reviews so that the authors could receive valuable feedback on their submissions and the chairs could easily decide which submissions to accept for presentation. The tool used to manage the reviewing process was EDAS, provided by the GIoTS 2018 conference organizers.

Overall 8 papers have been submitted. Upon completion of the evaluation process, 6 papers were selected for publication and presentation (2 from symbIoTe and 2 from BIG IoT). All 6 accepted papers had an average review score of “good (3)” and above.

## *3.2 Workshop agenda*

Apart from the presentation of the six (6) accepted papers, the format of the workshop allowed for two invited talks, which strengthened its attractiveness and impact. The six papers were grouped in two sessions based on the focus and the two invited talks were given prior to each session. More details on the workshop agenda are provided in the following table:

| Time | Title | Presenter(s) |
|---|---|---|
| 09:00 – 09:10 | Welcome and Opening Statements from symbIoTe and BIG IoT. | Sergios Soursos,<br>*Intracom SA Telecom Solutions*<br>Arne Broering,<br>*Siemens AG* |
| 09:10 – 09:40 | **Invited Talk: Scaling the Internet of Things** | Omar Elloumi,<br>*Nokia, OneM2M General Chair* |
| **Session 1: Approaches on Semantic Interoperability**<br>**Chair:** Ivana Podnar Zarko, University of Zagreb - FER | | |
| 09:45 – 10:05 | Towards Semantic Model Extensibility in Interoperable IoT Data Exchange Platforms | Yulia Svetashova,<br>*Robert Bosch GmbH* |
| 10:05 – 10:25 | Ontology-driven Device Descriptions for IoT Network Management | Kristina Sahlmann,<br>*HTW Berlin* |
| 10:25 – 10:45 | Enabling IoT Platform Interoperability Using a Systematic Development Approach by Example | Michael Schneider,<br>*Karlsruhe Institute of Technology* |
| 10:45 – 11:15 | Coffee Break | |
| 11:15 – 11:45 | **Invited Talk: Open Source, Security and IoT** | Bill Weinberg,<br>*Open Source Sense, Linux Pundit* |
| **Session 2: Privacy, Security and Business Aspects**<br>**Chair:** Martin Serrano, INSIGHT, National University of Ireland Galway | | |
| 11:45 – 12:10 | Privacy risk analysis in the IoT domain | Jose L. Muñoz,<br>*Technical University of Catalonia* |
| 12:10 – 12:35 | LATe: A Lightweight Authenticated Time Synchronization Protocol for IoT | Renzo E Navas,<br>*IMT Atlantique* |


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|---|---|---|
| 12:35 – 13:00 | From Innovative Niches to a Cooperative IoT Ecosystem | Sofia Aivalioti, *Sensing & Control* |
| 13:00 | End of Workshop | |

## *3.3 Invited Talks*

Two important Invited Talks enriched the workshop program value and impact:

- **Omar Elloumi** from Nokia, OneM2M General Chair, who addressed the audience on *Scaling the Internet of Things* by providing an overview on the status of IoT industrial adoption and its scalability aspects, highlighting the interoperability remaining challenges and presenting a visionary perspective on how to address the coming scaling challenges.

Figure 3 – O. Elloumi keynote at 3rd InterOSS-IoT workshop

- **Bill Weinberg** from Open Source Sense and Linux Pundit, who gave a keynote on *Open Source, Security and IoT* in which he focused on the role of open source in the ongoing IoT ecosystems and examined security aspects of open source software


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Figure 4 – B. Weinberg keynote at 3rd InterOSS-IoT workshop

The profiles of the two keynote speakers and their relevance in the IoT community are provided in the summary:

**Dr. Omar Elloumi** leads the oneM2M technical plenary, a partnership project chartered to advance interoperability standards for consumer, enterprise and industrial IoT. He joined Nokia in 1999 and held several positions including research, strategy and system architecture. He is currently with Nokia Bell-Labs and CTO of the group where he is responsible for standards and system architectures for IoT. Dr Elloumi is co-editor of books on M2M communications and Internet of Things. He is also involved in program committees of several international conferences and magazines on M2M and IoT.

**Bill Weinberg** has three decades experience of open source software in different areas, from embedded and open systems, telecommunications, automotive, to other mobile technology. Most recently, as a Senior Director at the Linux Foundation and at Black Duck Software and currently at Open Source Sense as co-founder, Bill led the open source strategy practices, guiding global technology companies and enterprise software organizations in enhancing their ROI from open source, leading remediation and migration projects, and helping to launch new initiatives, including ONAP. Bill was a founding team-member at MontaVista Soft. and worked at OSDL, Lynx Real-Time Systems, Acer Computer Brazil, and Microtec Research.


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## 3.4 Participation, discussion items and overall impressions

The workshop attracted much participation from people outside the two co-organizing projects. There were around 40 people attending the workshop, out of which only 7 where from symbIoTe and BIG-IoT. The overall comments we received were quite positive: the workshop was well structured and covered a wide range of topics: from semantic interoperability to security aspects and business models. There were many questions after the presentation of each paper and several discussions took place. The topics of the invited talks were also very welcomed from the participants. The presentations of the workshop were made available to the workshop participants and paper authors through workshop's dedicated site, as agreed with all authors and presenters.

## 3.5 News post on symbIoTe web site

After the successful completion of the InterOSS-IoT 2016 workshop, symbIoTe posted a respective news item on its web site, providing photos from the event, as well as open access to the presentations given by symbIoTe members. More information can be found here: https://www.symbiote-h2020.eu/blog/2018/06/21/symbiote-in-action/ (see also Figure 5).


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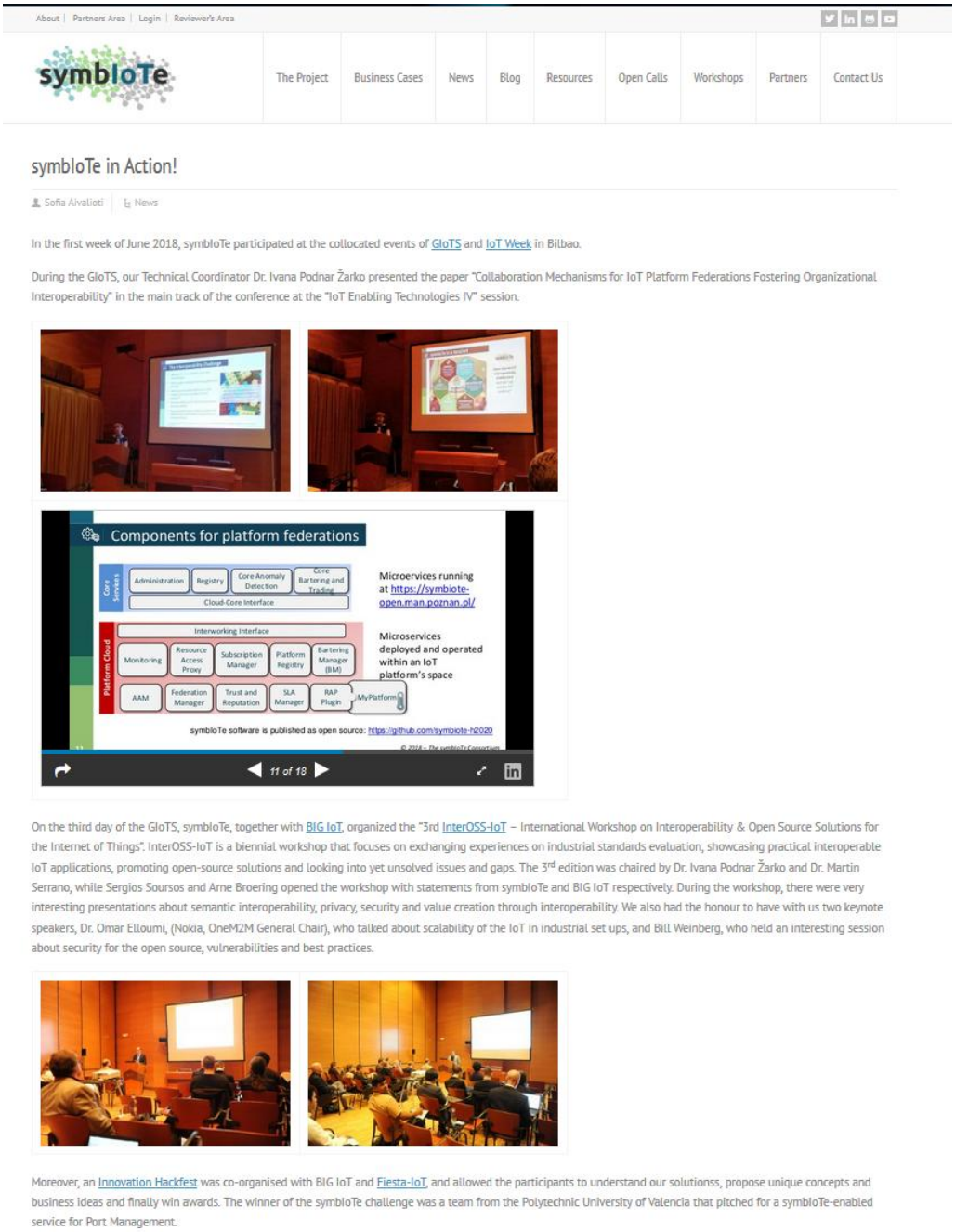


Figure 5 - News post on symbIoTe's web site for the InterOSS-IoT 2018 workshop

## *3.6 Workshop proceedings*

The workshop proceedings are included in the Proceedings of the Global IoT Summit. The steering committee of the Summit decided to publish the proceedings at IEEE Xplore Digital Library, as IEEE ComSoc was supporting GIoTS.


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# 4 IoT Innovation Hackfest

The second event that was co-organized by symbIoTe, together with the BIG IoT and Fiesta projects, was the IoT Innovation Hackfest. Each project offered one hackfest challenge (see Appendix D – IoT Innovation Hackfest: symbIoTe challenge). The teams that subscribed to the hackfest had to think of and present innovative services built on top of the offered technologies by the three projects. After the pitches, the judges (two representatives from each research project) had voted for one winning team for each challenge.

There were 18 participants registered at the devpost site (see previous link). Based on the evaluations from the judges, the following teams received the three money prizes:

| Proposal/Team | Prize | Funding project |
|---|---|---|
| WiseHome Fiesta - Power Consumption Signature Analysis | 1000€ | FIESTA |
| CALIFIED - Air Quality Calibration via Big IoT Data | 750€ | BIG IoT |
| SymbIoTe for Smart Ports | 500€ | symbIoTe |

The winning team for the symbIoTe challenge had presented an idea on how to improve the services offered in commercial ports in the domain of logistics, using the symbIoTe offerings.

The three winning teams were announced on the same day, during the awards session of the closing ceremony of the IoT Week event.

Figure 6 – The winning team of “SymbIoTe for Smart Ports”, together with the symbIoTe coordinator, during the award ceremony of IoT Week 2018.


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# 5 Summary and Conclusions

This deliverable provides an overview of the organization and conduction of the "3nd International Workshop on Interoperability and Open Source Solutions for the Internet of Things", co-located with the **Global IoT Summit 2018**, in Bilbao, Spain, on June 4-7, 2018. The workshop proposal was submitted to the conference organizing committee in December 2017. The Call for Papers was open till the end of March 2018 and the accepted papers, after being reviewed by the workshop's technical program committee, were notified by the end of April 2018.

The topics covered from the accepted papers to be presented varied and where organized in two sessions: i) Approaches on Semantic Interoperability, ii) Privacy, Security and Business Aspects.

The workshop proceedings are included in the Proceedings of the Global IoT Summit. The steering committee of the Summit decided to publish the proceedings at IEEE Xplore Digital Library, as IEEE ComSoc was supporting GIoTS.

A specific event has been also co-organised as aside event of **the IoT Week 2018** in Bilbao: the IoT Innovation Hackfest. The symbIoTe's prize winning team had to present and pitch their innovative idea on how to improve services using the symbIoTe middleware in commercial domains.


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# 6 Abbreviations

| | |
|---|---|
| CfP | Call for Papers |
| InterOSS-IoT | Interoperability & Open Source Solutions for the Internet of Things |
| TPC | Technical Program Committee |


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# Appendices

## *Appendix A – Workshop proposal*

### 3rd Workshop on Interoperability and Open-Source Solutions for the Internet of Things (InterOSS-IoT 2018)

Co-located with

**Global IoT Summit 2018**
June 4-7 2018, Bilbao, Spain

| | |
|---|---|
| **Title** | 3rd Workshop on Interoperability and Open-Source Solutions for the Internet of Things (InterOSS-IoT 2018) |
| **Length of the workshop** | Full day event |
| **Organizers** | The workshop will be organized by two H2020 projects, symbIoTe and BIG IoT, both running projects by the end of 2018 which are part of the European Platform Initiative (IoT-EPI).<br> <br><br> <br><br>Names/affiliations and contact information of the organizers:<br><br>1. Ivana Podnar Žarko (University of Zagreb Faculty of Electrical Engineering and Computing, Croatia)<br>e-mail: ivana.podnar@fer.hr<br>Dr. Ivana Podnar Žarko is Associate Professor at the University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia, where she leads the Internet of Things Laboratory. She is the Technical Manager of the H2020 project symbIoTe. She was leading the UNIZG-FER team participating in the FP7 project OpenIoT:and has participated in a number of FP7, FP6 as well as national research projects. She was a guest researcher (2000) and research associate (2001) at the Technical University of Vienna, and a postdoctoral researcher (2005-2006) at the Swiss Federal Institute of Technology in Lausanne (EPFL).<br>Her main research interests are on large-scale distributed systems, IoT, and Big data processing. She has co-authored more than 60 scientific |


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| | journal and conference papers in these domains, and has served as a program committee member for a number of international conferences and workshops (e.g., IEEE Globecom, CCNC, ISCC). She is a member of IEEE and was the Chapter Chair of IEEE Communications Society, Croatia Chapter (2011-2014). She was one of the organizers and program chair of two editions (in 2014 and 2016) of the International Workshop on Interoperability & Open Source Solutions for the Internet of Things (InterOSS-IoT).<br><br>2. Martin Serrano (INSIGHT, National University of Ireland Galway, Ireland)<br>e-mail: martin.serrano@insight-centre.org<br>Dr. Martin Serrano is a recognized Research Data Scientist with more than 15 years of experience in industry and applied research within a wide range of successful European (FP5-FP7/H2020) collaborative software projects, Irish National Projects (HEA PRTLI, SFI) and also Enterprise Ireland (EI) innovation projects. Dr. Serrano is a recognized IoT expert on Semantic Interoperability and Distributed Data Systems, an end-to-end Solutions Architect with a strong background on applied semantic and systems interoperability, Smart Technology, Services and Network Management and Communications and Data Management Systems. Dr. Serrano is a continuous contributor to the Scientific, Research and Innovation agenda for Europe (SRIA). He actively investigates Semantic-based Cloud Infrastructures and Big Data Management, Data Bases Stream Processing, BIG Data Analytics Services, Cyber-Physical Systems (CPS) Control, Privacy and Security aspects for IoT, Sensor Networks, Body networks and their deployment in cloud computing environments. Dr. Serrano has a leading role at the European Research Cluster for the Internet of Things (IoT) and he is board member at the Connected Smart Cities Network. He is an active member of IEEE (Computer and Communication Societies) and ACM with more than 100 pair reviewed publications and He is the author of 4 academic books in related areas.<br><br>3. Arne Broering (Siemens, Germany)<br>e-mail: arne.broering@siemens.com<br>Dr. Arne Bröring is a Research Scientist at Siemens' corporate research unit in Munich (Germany). Previously, he worked as a researcher for Esri (Switzerland), the 52°North open source initiative, as well as the University of Münster. He has a Masters degree in Geoinformatics from the University of Münster (Germany) and received his PhD related to IoT, Semantic Web and Sensors from the University of Twente (Netherlands). He has been one of the key designers of the Sensor Web Enablement framework at the Open Geospatial Consortium (OGC). As the chairperson of the Sensor Observation Service working group, he has co-authored multiple international standards. More recently, he has been involved in standardization at the W3C and its Web of Things group. Since 10 years, |


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| | he is researching on IoT related topics, has contributed to over 70 publications, and has served on various programme committees for conferences and workshops. He has been involved in numerous research projects (FP-7, H2020) and is currently the Technical Coordinator of the BIG IoT project (http://big-iot.eu).<br><br>4. Sergios Soursos, Intracom Telecom, Greece<br>email: souse@intracom-telecom.com<br>Dr. Sergios Soursos is a Master R&D Engineer at Intracom S.A. Telecom Solutions, Greece, working on IoT interoperability (coordinating the H2020 project symbIoTe) and big data analytics. He has also worked on cloud traffic management (FP7 SmartenIT), information-centric networking (H2020 POINT, FP7 COMET), peer-to-peer networking and overlay network management (FP7 SmoothIT), smart grids and demand response systems (GSRT DAMAZO). He has been a Research Associate at the Network Economics and Services Group of the Athens University of Economics and Business (AUEB), Greece, working on network economics and pricing, game theory and modeling, overlay networks and grid computing. He holds the BSc (1999) in Informatics, the MSc (2001) in Information Systems and a PhD (2010) on pricing schemes for on-demand resources with focus on access networks and grid computing facilities, from AUEB, Greece. Dr. Soursos has presented his work in numerous academic conferences and workshops and has received scholarships and awards from Greek institutions and companies. He has co-chaired the EC DG INFSO's Future Internet Socio-Economics Task Force. |
| **Brief description (abstract, scope and timelines)** | The evolution in the Internet of Things domain has created a complex ecosystem populated by various Internet of Things (IoT) platforms that provide access to a broad range of things. These IoT platforms typically promote their specific interfaces and information models, and often adopt non-standard, sometimes fully proprietary, protocols to control a variety of things. This fragmentation and missing interoperability currently prevents the emergence of cooperative IoT ecosystems in which applications can be built so as to use things operated by various IoT platforms, or to enable things operated by different platforms to interact. The 3$^{nd}$ Workshop on Interoperability and Open-Source Solutions for the Internet of Things focuses on this challenge. The workshop is co-organized by the symbIoTe and BIG IoT consortium as part of the European Platform Initiative (IoT-EPI).<br><br>The main objective of this workshop is to exchange experiences and ideas with the IoT community as well as contribute to build new knowledge around open issues and gaps on Internet of Things interoperability, architectural principles and standardization efforts. It will showcase practical experiences on interoperable IoT solutions and promote open-source solutions. |


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| | Gartner predicts that “through 2018, half the cost of implementing IoT solutions will be spent integrating various IoT components with each other and back-end systems.” This means that the industry needs interoperable solutions and we would like to provide an environment where the industry attending the IoT week has the chance to explore interoperability solutions stemming from research and innovation projects. In particular, since IoT-EPI project funded by H2020 are entering in their final 3rd year, we can expect mature solutions to be described and showcased during the workshop. |
| **Planned format** | Scientific workshop (2 invited talks + presentations of peer-reviewed papers)<br>Organized as a scientific event, the workshop will combine two keynote talks on interoperability aspects of the Internet of Things, with contributions from the participants to further advance IoT research and solution space through a specific Call for Papers (CfP). Researchers and practitioners from academy and industry will share their experiences on IoT platforms and middleware with specific focus on interoperability aspects. It is expected that a number of 8 to 12 peer-reviewed scientific articles will be selected for presentation during the workshop. Participants are expected to expand their understanding of IoT interoperability aspects and open issues, and to identify and discuss existing and emerging solutions enabling IoT interoperability, standards supporting platform interoperability, as well as open-source initiatives. |
| **Number of expected participants** | 30-50 |
| **Indicative TPC list (based on previous events, to be confirmed)** | 1. Karl Aberer, EPFL, Switzerland<br>2. Payam Barnaghi, U. Surrey, UK<br>3. Jean-Paul Calbimonte, EPFL, Switzerland<br>4. Gino Carrozzo, Nextworks, Italy<br>5. Oscar Corcho, Universidad Politecnica de Madrid<br>6. Manfred Hauswirth, Fraunhofer FOKUS<br>7. Reinhard Herzog, Fraunhofer IOSB,<br>8. Darko Huljenić, Ericsson Nikola Tesla, Croatia<br>9. Prem Jayaraman, RMIT University, Australia<br>10. Mirko Presser, Alexandra Institute<br>11. John Soldatos, AIT, Greece<br>12. Tajana Šimunic Rosing, University of California, San Diego, USA<br>13. Thomas Usländer, Fraunhofer IOSB, Germany<br>14. Arkady Zaslavsky, CSIRO, Australia<br>15. Arndt Marylin, ORANGE<br>16. Elloumi Omar, Alcatel-Lucent<br>17. Patricia Martigne, Orange |


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| | 18. Joerg Swetina, NEC<br>19. Cosmin-Septimiu Nechifor, Siemens<br>20. Florian Michahelles, Siemens<br>21. Ovidiu Vermesan, SINTEF, Norway<br>22. Steffen Lohmann, Fraunhofer IAIS, Germany<br>23. Victor Kardeby, Acreo Swedish ICT, Sweden<br>24. Kary Främling, Aalto University, Finland<br>25. Carlos Enrique Palau Salvador, Universitat Politécnia de Valencia, Spain<br>26. Raffaele Gravina, UNICAL, Italy<br>27. Sergios Soursos, Intracom Telecom, Greece<br>28. Peter Kostelnik, INTERSOFT, Slovakia<br>29. Jelena Mitic, Siemens, Germany |
| **Brief description of advertising plan** | The InterOSS-IoT workshop has a tradition of publishing technical papers which are application-driven or based on implemented demonstrators towards industry market solutions as well as results stemming from academic projects. InterOSS-IoT uses a procedure for post-proceedings publication based on a two-step journal style peer-review process to ensure high-quality of published papers. In the first review cycle a selection of papers that will be presented at the event is reviewed by at least three TPC members. After the workshop, the authors are asked to provide revised versions of their papers taking into account review comments and comments received during the presentation of their paper at the workshop. Revised paper versions are again peer reviewed/checked by the TCP members (not necessarily the same) to ensure the final quality of published papers.<br><br>InterOSS-IoT 2018 post-proceedings would be published by Springer in the Lecture Notes on Computer Science series.<br>The first edition of this event has selected papers published as post proceedings in **LNCS Volume 9001 2015**, http://link.springer.com/book/10.1007/978-3-319-16546-2<br>The second edition of this event has selected papers published as post proceedings in **LNCS Volume 10218 2017**, http://www.springer.com/gp/book/9783319568768<br><br>We will pursue this post-proceeding strategy also within the 3rd edition of the event, rather than to follow the proposed format for GIOTS workshop papers and publication in IEEE Xplore.<br><br>The workshop organizers plan to setup a workshop site by December 15 and start promoting the event through the relevant IoT research channels (mailing lists) and within the IoT-EPI community (e.g. IoT-EPI has more than 1000 followers on twitter).<br>We propose the following timeline:<br>• Submission deadline: March 2, 2018 |


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| | • Notification of acceptance: May 4, 2018<br>• Workshop date: June 4, 2018<br>• Camera-ready papers due for post-proceedings: June 30, 2018<br>• Expected publication of the LNCS volume September/October 2018 |
| **Workshop history** | This would be the third edition of the InterOSS-IoT workshop series.<br><br>The 1st edition of the workshop was held in 2014 in Split, Croatia and announced as<br>**Workshop on Interoperability and Open-Source Solutions for the Internet of Things**<br>Held in Conjunction with 22nd International Conference on Software, Telecommunications and Computer Networks (Softcom 2014), September 18, 2014, Split, Croatia<br>Invited talks by Bill Weinberg (Senior Director from Open-Source Strategy Consulting at Black Duck Software, USA) and Markus Weinberger (Director of Bosh IoT Lab, Switzerland).<br><br>The workshop featured two invited keynote talks, an invited presentation of the OpenIoT platform, 10 oral presentations of original scientific papers, and a demo session closely aligned to the workshop main topics. The original scientific papers presented at the workshop and accepted for publication in this volume underwent a rigorous two-step review process and acquired a total of three reviews, where two reviews were authored by the Technical Program Committee members from academia and one Technical Program Committee member from industry. There were 15 papers initially registered for presentation at the workshop and in the end of the review procedure 10 papers were selected for oral presentation at the workshop and publication in the workshop post-proceedings.<br>The 2nd edition of the workshop was held in 2016 in Stuttgart, Germany and announced as<br>**Second International Workshop on Interoperability and Open-Source Solutions for the Internet of Things, InterOSS-IoT 2016,**<br>Held in Conjunction with IoT 2016, Stuttgart, Germany, November 7, 2016,<br>Invited talk by Ralph Müller (Eclipse Foundation Europe GmbH, Managing Director). More details are available at the workshop website: http://iot-epi.eu/inteross-iot-workshop/.<br><br>The 2nd InterOSS-IoT workshop featured an invited keynote talk and 13 oral presentations of original scientific papers. The event attracted around 40 participants who contributed constructively to all discussions. The workshop post-proceedings volume includes selected and extended papers presented at the workshop covering a wide range of aspects related to IoT interoperability, such as semantics, security, business models, and applications. All papers underwent a rigorous two-step review process so that the final selection of 11 papers is included in this volume out of 17 |


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| | papers that were initially submitted for review. |

# Call for Papers (draft)

The fast evolution of the Internet of Things towards IoT Platforms Interoperability resides on the principle of enabling capabilities for connecting a large number of devices to a global infrastructure in a more efficient way to offer added value features and global services across IoT platforms. In the past years we have witnessed the consolidation of communication protocols connecting various devices and the advent of open source frameworks for IoT interoperability. Standardization initiatives, industry alliances, and collaborative research projects have developed solutions to address the challenge of IoT interoperability. Sensor, actuator, and “thing” description formats as well as communication protocols and APIs have been designed. Today, they are available to build advanced solutions and entire ecosystems based on interoperable IoT platform technologies.

The challenges ahead rely on utilizing and advancing interoperable IoT platform technologies for handling complex tasks and global interconnected systems. The advantages of IoT platforms interoperability can be useful for trendy verticals with high impact on the society, e.g. smart cities and ports, healthcare, automated manufacturing lines, connected robots, or autonomous vehicles. Open source interoperability solutions and open standards remain a viable option to automate the collaboration between otherwise closed IoT platforms with key challenges related to semantics, uniform APIs, security, privacy and trust issues, as well as technology uptake with increasing deployments.

Following the success of the previous two editions, the “3rd Workshop on Interoperability and Open-Source Solutions for the Internet of Things (InterOSS-IoT)” focuses on exploring the potential of interoperable IoT platform technology to facilitate and enhance the creation of complex systems and associated open source technology and open protocols.

The workshop addresses current challenges in the IoT domain and promotes uptake by the industry from emerging open source solutions and best practices from IoT deployment experiences. Organized as a scientific event, workshop’s objective is to foster the exchange of practical experiences within the IoT community as well as contribute to create new ideas around open issues and gaps on Internet of Things platforms interoperability, architectural principles, standardization efforts, and deployment experiences.

We invite authors to submit scientific papers reporting advance in the state of the art and practical experiences on interoperable IoT solutions, e.g. solutions relying on open-source software as well as emerging concepts and visionary papers.

**Topics of interest include (not limited to):**
IoT Principles, Design and Technology

- Interoperability solutions for IoT systems and platforms
- Standardisation efforts related to IoT solutions and Applications
- Key concepts for interoperable IoT architectures


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- Semantic models for the IoT Platforms Data Exchange
- Security, privacy and trust for IoT Devices and Platforms
- IoT device Data Mash-Ups and platforms Orchestration
- IoT platform federation

IoT Experiments, Practice and Applications

- IoT applications and real life deployments,
  e.g., in Smart Cities, Healthcare, Industrial IoT, Robotics, Autonomous Vehicles
- Experiences from real industrial IoT deployments
- Recent advances in open source IoT platforms and tools
- Experimentally-driven Internet of Things experience
- Business perspectives on IoT ecosystem creation
- Business models and marketplaces

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# *Appendix B – Workshop Call for Papers*

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IEEE COMMUNICATIONS SOCIETY Internet of Things

## 3rd Workshop on Interoperability and Open-Source Solutions for the Internet of Things (InterOSS-IoT 2018) (in conjunction with Global IoT Summit 2018)

### Organizing Committee

**Workshop General Chairs:**
Ivana Podnar Žarko (University of Zagreb Faculty of Electrical Engineering and Computing, Croatia)
Martin Serrano (INSIGHT, National University of Ireland Galway, Ireland)
Arne Broering (Siemens, Germany)
Sergios Soursos, Intracom Telecom, Greece

### Technical Program Committee

- Karl Aberer, EPFL, Switzerland
- Payam Barnaghi, U. Surrey, UK
- Jean-Paul Calbimonte, EPFL, Switzerland
- Gino Carrozzo, Nextworks, Italy
- Oscar Corcho, Universidad Politecnica de Madrid
- Manfred Hauswirth, Fraunhofer FOKUS
- Reinhard Herzog, Fraunhofer IOSB,
- Darko Huljenić, Ericsson Nikola Tesla, Croatia
- Prem Jayaraman, RMIT University, Australia
- Mirko Presser, Alexandra Institute
- John Soldatos, AIT, Greece
- Tajana Šimunic Rosing, University of California, San Diego, USA
- Thomas Usländer, Fraunhofer IOSB, Germany
- Arkady Zaslavsky, CSIRO, Australia
- Arndt Marylin, ORANGE
- Elloumi Omar, Alcatel-Lucent
- Patricia Martigne, Orange
- Joerg Swetina, NEC
- Cosmin-Septimiu Nechifor, Siemens
- Florian Michahelles, Siemens
- Ovidiu Vermesan, SINTEF, Norway
- Steffen Lohmann, Fraunhofer IAIS, Germany
- Victor Kardeby, Acreo Swedish ICT, Sweden
- Kary Främling, Aalto University, Finland
- Carlos Enrique Palau Salvador, Universitat Politécnia de Valencia, Spain
- Raffaele Gravina, UNICAL, Italy
- Sergios Soursos, Intracom Telecom, Greece
- Peter Kostelnik, INTERSOFT, Slovakia

### Call for Papers

Internet of Things Interoperability resides on the principle of connecting a large number of devices to a global infrastructure to offer added value features and global services across IoT platforms. In the past years we have witnessed the consolidation of communication protocols connecting various devices and the advent of open source frameworks for IoT interoperability. Standardization initiatives, industry alliances, and collaborative research projects have developed solutions to address the challenge of IoT interoperability. Sensor, actuator, and "thing" description formats as well as communication protocols and APIs have been designed to build advanced cross-domain IoT solutions and entire ecosystems based on interoperable IoT platform technologies.

The challenges ahead are to advance interoperable IoT technologies for handling complex tasks and global interconnected systems in trendy verticals with high impact on the society, e.g. smart cities and ports, healthcare, automated manufacturing lines, connected robots, or autonomous vehicles. Open source interoperability solutions and open standards remain a viable option to automate the collaboration between otherwise closed IoT platforms with key challenges related to semantics, uniform APIs, security, privacy and trust issues, as well as technology uptake with increasing deployments.

Following the success of the previous two editions, the "3rd Workshop on Interoperability and Open-Source Solutions for the Internet of Things (InterOSS-IoT)" focuses on exploring the potential of interoperable IoT platform technology to facilitate and enhance the creation of complex systems and associated open source technology and open protocols.

The workshop addresses current challenges in the IoT domain and promotes uptake by the industry from emerging open source solutions and best practices from IoT deployment experiences. Organized as a scientific event, workshop's objective is to foster the exchange of practical experiences within the IoT community as well as contribute to create new ideas around open issues and gaps on Internet of Things platforms interoperability, architectural principles, standardization efforts, and deployment experiences.

We invite authors to submit scientific papers reporting advance in the state of the art and practical experiences on interoperable IoT solutions, solutions relying on open-source software as well as emerging concepts and visionary papers.

Topics of interest include (not limited to):

IoT Principles, Design and Technology

- Interoperability solutions for IoT systems and platforms
- Standardisation efforts related to IoT solutions and Applications


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- Jelena Mitic, Siemens, Germany

## Paper Submission Guidelines

All final submissions should be written in English with a maximum paper length of six (6) printed pages see web conference for instructions. Papers must be submitted through EDAS.

"IEEE reserves the right to exclude a paper from distribution after the conference, including IEEE Xplore® Digital Library, if the paper is not presented by the author at the conference."

## Important Dates

Paper submission deadline: February 16, 2018
Acceptance Notification: March 31, 2018
Camera-Ready Paper Submission: April 30, 2018

- Key concepts for interoperable IoT architectures
- Semantic models for the IoT Platforms Data Exchange
- Security, privacy and trust for IoT Devices and Platforms
- IoT device Data Mash-Ups and platforms Orchestration
- Solutions for IoT platform federations and interworking
- Distributed ledger technology for interoperable IoT ecosystems

IoT Experiments, Practice and Applications

- IoT applications and real life deployments, e.g., in Smart Cities, Healthcare, Industrial IoT, Robotics, Autonomous Vehicles
- Experiences from real industrial IoT deployments
- Recent advances in open source IoT platforms and tools
- Experimentally-driven Internet of Things experience
- Business perspectives on IoT ecosystem creation
- Business models and marketplaces

The workshop is organized by H2020 projects, symbIoTe and BIG IoT, which are part of the European Platforms Initiative (IoT-EPI).

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## *Appendix C – Submitted Papers*

The following table summarizes the outcome of the reviewing phase, i.e., the papers submitted (order in submission date), those accepted for presentation during the workshop as well as those rejected (in red).

| **Authors** | **Title** |
|---|---|
| Thomas Jell, Claudia Baumgartner, Jelena Mitic, Arne Bröring | Interconnecting IoT Platforms from different domains - Northern Germany Pilot |
| Yulia Svetashova, Stefan Schmid, Andreas Harth | Towards Semantic Model Extensibility in Interoperable IoT Data Exchange Platforms |
| Juan Hernández-Serrano, Jose L. Muñoz, Olga León, Lars M Mikkelsen, Hans-Peter Schwefel, Arne Bröring | Privacy risk analysis in the IoT domain |
| Kristina Sahlmann, Thomas Scheffler, Bettina Schnor | Ontology-driven Device Descriptions for IoT Network Management |
| Renzo E Navas, Laurent Toutain | LATe: A Lightweight Authenticated Time Synchronization Protocol for IoT |
| Gino Carrozzo, M. Pardi, Pietro Tedeschi, Giuseppe Piro, Mikolaj Dobski, Konrad Leszczynski, Alessandro Carminati, Matteo Di Fraia | Interoperation of IoT platforms in confined Smart Spaces: The symbIoTe Smart Space architecture |
| Michael Schneider, Michael Jacoby, Reinhard Herzog, Benjamin Hippchen, Sebastian Abeck | Enabling IoT Platform Interoperability Using a Systematic Development Approach By Example |
| Sofia Aivalioti, Lara López, Marcin Plociennik, Adam Olszewski, Corinna Schmitt, Yves Steiner, Davide Monforte | From Innovative Niches to a Cooperative IoT Ecosystem |


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## *Appendix D – IoT Innovation Hackfest: symbIoTe challenge*

# IoT Innovation Hackfest

as Part of the IoT Week 2018

## symbIoTe Challenge: Shared Sensors and Actuators

*Design, create and prototype a project-idea by using the symbIoTe technologies. They should help you to enable "IoT innovation" by creating a NEW BUSINESS IDEA based on interoperable and secure IoT solutions, or to promote "IoT knowledge transfer" by using symbIoTe IoT services and software components TO EXTEND A CURRENT PRODUCT/SOLUTION to offer shared sensors and actuators, and to contribute to a symbIoTe-based interoperable IoT ecosystem for the development of cross-platform and cross-domain IoT applications to accelerate MARKET ADOPTION OF INTEROPERABLE IOT PLATFORMS/SOLUTIONS. The pitch and the presentation of your project-idea should be supported by a working implementation (code) and/or a simulation video that should be submitted to be considered part of the IoT Innovation hackfest final evaluation.*

### Introduction

symbIoTe is an H2020 Research and Innovation Action and member of the IoT-European Platforms Initiative cluster that addresses a challenging objective of creating an interoperable IoT ecosystem. symbIoTe facilitates the cooperation of vertical IoT platforms, which are today typically offered as closed systems, to simplify the development of cross-domain and cross-platform IoT applications.
symbIoTe is creating an *interoperability framework* to enable IoT platforms to open up access to their devices/services in a controlled and secure manner, offering thus shared sensors and actuators with a goal to create new revenue streams for IoT platform providers. symbIoTe is not 'yet another IoT platform', as it is not designed to store any sensor-generated data, but rather a mediator facilitating the exchange of the necessary metadata describing the exposed IoT devices/services. Thus, symbIoTe mediates between IoT-based applications and platforms/devices/services or between various platforms. Application developers can design, build and deploy IoT-based applications in the symbIoTe ecosystem without deploying and owning any devices or IoT infrastructure.

### The symbIoTe Innovations

The main goal of symbIoTe is to devise a flexible and secure interoperability middleware across IoT platforms facilitating rapid development of IoT applications across platforms, platform collaborations as well as dynamic and adaptive smart objects and environments. This is accomplished by a series of innovations introduced by symbIoTe. The first innovation


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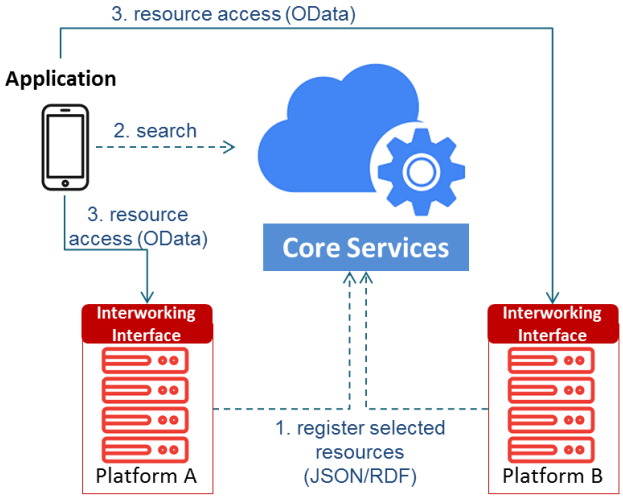
refers to building an IoT search engine for connected (virtualized) IoT resources, both sensors and actuators, where IoT platform providers can register their deployed resources and other platforms/applications can search and access them. The second innovation involves an abstraction layer for unified and secure usage of those resources across platforms. A third key ingredient is to implement high-level, domain-specific APIs ("domain enablers") for rapid cross-platform application development.

**What can you do with the symbIoTe Tools?**

By leveraging symbIoTe interfaces, developed components and software libraries, IoT platforms are able to offer unified and secure access to their sensors and actuators. The devices remain under full control of platform developers and owners, who define and manage access rights to their infrastructure. On the one hand, this supports application developers to rapidly create and deploy novel IoT applications over unified interfaces without the need to own and operate the IoT infrastructure. On the other hand, IoT platform providers and infrastructure owners are able to increase their user/developer base and create new revenue streams, since their infrastructure is used extensively in innovative cross-domain applications. This creates a vibrant IoT ecosystem facilitated by symbIoTe Core Services mediating between many IoT platforms offering devices, and applications using those devices.




Interactions between applications, symbIoTe-enabled platforms, and symbIoTe Core Services.

symbIoTe Core Services implement a search engine where applications can find adequate resources, while IoT platforms register and advertise offered resources (only the metadata). Platforms need to implement the symbIoTe Interworking Interface, for which symbIoTe provides a reference implementation (available at https://github.com/symbiote-h2020/SymbioteCloud), to offer uniform and secure access to their virtualized resources. Thus applications can access sensor data or invoke actuation services directly on the platform side through the Interworking interface. Access to resources is protected using a flexible mechanism Attribute-Based Access Control (ABAC), which allows platforms to define access policies at the resource level, while clients are granted access to resources when an adequate set of attributes is presented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### Topics for the symbIoTe challenge

- Software implementations that extend existing platforms to become part of the symbIoTe ecosystem and deployed sensors and/or actuators. Both the platform and resources need to be registered at an instance of Cloud Services running at symbiote-open.man.poznan.pl and made available for demonstration.
- Project-idea for a cross-platform or cross-domain application that could be enabled by the symbIoTe ecosystem illustrated by a video.

### Tools and APIs

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| symbIoTe Interworking Interface implementation | symbIoTe provides a reference implementation of the Interworking Interface written in Java using microservices available at https://github.com/symbiote-h2020/SymbioteCloud. The following components are required to be deployed so as to extend existing platforms: AuthenticationAuthorizationManager, CloudConfigService, Registration Handler and ResourceAccessProxy (RAP). In addition, we use EurekaService and ZipkinService. You need to create a custom RAP Plugin for your platform. |
| symbIoTe Core Services | symbIoTe offers a deployed instance of its Cloud Services available for this challenge. It is running at symbiote-open.man.poznan.pl. We will use it to test whether your platform and selected resources are adequately registered and symbIoTe-enabled. The open source implementation of the Core Services is available at https://github.com/symbiote-h2020/SymbioteCore. |
| symbIoTe information model | symbIoTe introduces the Core Information Model (CIM) defining basic concepts that are understood by all platforms. Since it is not possible to standardize everything, symbIoTe allows platforms to define Platform-Specific Information Models (PIMs) as an extension of the CIM. symbIoTe information models are represented as OWL2 ontologies available at https://github.com/symbiote-h2020/Ontologies. For reasons of simplification, you can use JSON descriptors for sensors and actuators, examples are given here. |
| symbIoTe Developers' Guide | Look at the wiki pages for making your platform symbIoTe-enabled: https://github.com/symbiote-h2020/SymbioteCloud/wiki. We recommend that you follow instructions for Downloading and configuring jar files. A video demonstrating all the required steps is coming soon. |
| symbIoTe overall | A good starting point is our technical blog, relevant entries are the following:<br>• Creating cooperative IoT platforms with symbIoTe, |


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| information | • Interoperability in the IoT world,<br>• How to make an IoT platform symbIoTe enabled and<br>• Initial steps to build a symbIoTe enabled App.<br><br>For more details visit the symbIoTe web site https://www.symbiote-h2020.eu/. |

All questions relevant to the symbIoTe challenge can be submitted to the following email address by June 6, at 12:00 CEST: iotweek-hackfest@symbiote-h2020.eu

symbIoTe Innovation Challenge – IoT Week 2018


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