

Intelligence at the Edge: Secure and Privacy Aware Consumer Centric IoT Services

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Abstract—This tutorial will initially highlight the challenges of cloud based IoT platforms stemming from supporting ultra-low latency and high mobility IoT services. To mitigate these challenges, the IoT industry is exploring Edge Computing (EC). Proximity to consumers, dense geographical distribution and support for mobility are enabling the industry to utilize EC for many IoT services. These include on-demand video distribution, localized analytics, augmented reality and connected vehicles. Security, privacy and trust are big challenges for consumer IoT service providers. The mentioned services will generate data about user environment, interaction pattern with IoT devices and utilize critical services like financial transactions. This presentation will describe many mechanisms needed to create a global security framework for consumer privacy. A connected vehicle scenario will be utilized to further illustrate the architecture and building blocks of EC as well as security, privacy of vehicular data, computing and dissemination to consumers

Index Terms—Edge Computing; Internet of Things; Privacy; Security.

I. VALUE OF THE TUTORIAL FOR THE ATTENDEES

The value of the tutorial is in the learning opportunity about Edge Computing [6], security [1] and privacy aware consumer centric IoT services. The current industry and academia are strongly investigating the role of cybersecurity in EC driven IoT applications and services. The participants will have an opportunity learn from the presenter's prototyping experiences on connected vehicles and advance their understanding about the industry trends.

II. LEARNING OBJECTIVES ALIGNED WITH THE VALUE STATEMENT

The learning objectives for participants focus on EC driven consumer centric IoT services. The tutorial will explain - (i) architectural building blocks, communication networks, application developments and (ii) security, privacy challenges. The tutorial will also discuss underlying technologies for EC enablement, prototyping experiences and demonstrations. These are highly related to the theme and several topics of the IEEE RCIS 2017.

III. DESCRIPTION OF HOW THE ACTIVITIES IN THE TUTORIAL SUPPORT THE LEARNING OBJECTIVES AND HOW THE PROPOSER WILL PASS HIS/HER MESSAGES ONTO THE ATTENDEES

The scope of the tutorial covers cloud and edge computing paradigms, IoT data processing mechanisms, service enablement & management, security, privacy & trust and application development relevant for EC enabled consumer IoT services. It will also discuss an IoT architecture for

connected vehicles, its underlying technologies, prototyping experiences and demonstrations.

The tutorial proposer will deliver the messages through presentation created from his past and current research experiences. The presentation will include references to several research papers published in IEEE & ACM conferences, magazines and Journals. Also, demonstrations of open source software frameworks will be shown to engage the participants into the tutorial.

IV. EXPECTED BACKGROUND OF THE ATTENDEES

This tutorial should be of interest to IEEE RCIS 2017 participants including the industry professionals and the academic community. Participants with all levels of knowledge (including the experts) on IoT, Edge Computing and Cybersecurity are encouraged to attend. Ideal preparation would be to have some basics regarding the mentioned technologies. Overall, the tutorial is expected to attract a mixed audience comprising of academia, industry, engineers and other stakeholders in IoT, EC and Cybersecurity.

V. A CONCISE DESCRIPTION OF MATERIAL(S) THAT WILL BE PROVIDED TO ATTENDEES

The tutorial slides will be provided to all attendees. Apart from that, an open source software framework for IoT data processing will be demonstrated and provided to the attendees. It is called Machine-to-Machine Measurement (M3) Framework [4], [5] which also allows application developers to understand which security mechanisms to choose based on the technologies used in an IoT application. Finally, the participants will also be provided with another software framework that allows creating security and privacy aware [2] consumer IoT services.

VI. TIMETABLE THAT CLEARLY INDICATES HOW THE INTERACTION WITH THE AUDIENCE WILL DEVELOP OVER TIME

Throughout the session, the presenter will have a bi-directional communication with the audience. The presenter encourages the attendees to ask a couple of questions at the end of each section. This ensures that the attendees have the content clear in their mind and there is no confusion. The ninety minutes for the tutorial will be split as follows.

- Minutes 0-5: Introduction of presenter and introduction to topic.
- Minutes 5-10: Cloud and Edge Computing, their pros and cons.

- Minutes 10-20: Network access technologies connecting IoT devices to an EC platform.
- Minutes 20-25: Answering any questions from the audience.
- Minutes 25-40: IoT data processing to EC platform to generate intelligence, demonstration of the M3 Framework and consumer centric IoT services.
- Minutes 40-45: Queries from the audience.
- Minutes 45-60: Security, privacy and trust in IoT services and EC platform.
- Minutes 60-75: Advanced architecture portraying connected vehicle use case, building blocks, security & privacy requirements and framework [3].
- Minutes 75-90: Open discussion and engagement with the audience.

VII. A SHORT BIO OF THE PRESENTER

Soumya Kanti Datta is a Research Engineer at EURECOM, France since 2012 and has worked on three French Pole SCS projects (Smart 4G Tablet, WL-Box 4G, Platform Telecom), one French ANR project (DataTweet) and is working on EU H2020 HIGHTS project. His research focuses on innovation, standardization and development of next-generation technologies in the IoT, Healthcare and Smart Cities. He has designed and developed an IoT platform supporting common service functions and running on a constrained device. He also developed a mobile application called Connect and Control Things that allows consumers to interact with connected devices via an IoT Gateway. He has published more than 60 research papers and articles in top ACM and IEEE Conferences, Magazines and Journals.

Soumya is a member of IEEE, IEEE Communications Society and IEEE Consumer Electronics (CE) Society. He leads the activities of IEEE CE Society Future Directions Team on IoT and is an Associate Editor in IEEE Consumer Electronics Magazine. He has also served several IEEE Conferences and Workshops in many capacities. He is also actively involved in oneM2M, W3C Web of Things Working Group and contributing to their standard development activities. He obtained an M.Sc in Communications and Computer Security from Telecom ParisTech (EURECOM), France.

VIII. A HISTORY OF THE TUTORIAL

The proposer has presented several derived versions of this tutorial previously in following conferences.

- IEEE WF-IoT 2016, December 12-14, 2016, Reston, VA, USA [Attendance around 40].
- IEEE TenSymp 2016, May 9-11, 2017, Bali, Indonesia [Attendance around 50].
- IEEE WCNC 2016 Workshop on Mobile Edge Computing and IoT, April 3, 2016 in Doha, Qatar [Attendance around 35].
- IEEE International Workshop on Consumer Centric Internet of Things, October 2-3 in Kuala Lumpur, Malaysia [Attendance 51].

Apart from that, the speaker also presented several tutorials on IoT in several previous conferences and SDO meetings.

- ETSI Workshop on Internet of Things in the Smart Home, March 21-22, 2016 in Sophia Antipolis, France.
- IEEE World Forum on Internet of Things 2015, December 14-16, 2015 in Milan, Italy.
- ETSI M2M Workshop, December 9-11, 2015 in Sophia Antipolis, France.
- IEEE MASS 2015, 19th October, 2015 in Dallas, TX, USA.
- IEEE NetSys 2015, March 8, 2015 in Cottbus, Germany.
- Journee Rupturs et Futur in Telecom ParisTech, March 5, 2015 in Paris, France.
- ETSI M2M Workshop, December 10-12, 2014 in Sophia Antipolis, France.
- Smart city event (Innovative city forum) in Nice, France on 26th June, 2014.

Various parts of the tutorial are presented as research papers in WF-IoT 2014, ISSNIP 2014, iThings 2014, IEEE Globecom 2014 WS TCS, RIoT 2015, FiCloud 2015, APNOMS 2015, NGMAST 2015, IEEE GCCE 2015, WOCC 2015, WF-IoT 2015, IEEE ICCE 2016, TenSymp 2016, ICCE-TW 2016, GCCE 2016 and WF-IoT 2016.

IX. ACKNOWLEDGMENTS

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