Industrie 4.0 vs. Industrial Internet of Things

Session Co-chairs: Tobias Meisen, RWTH Aachen, and Chonggang Wang, Interdigital, Inc.

The advancement of digital information and the widespread networking of devices and systems using Internet technology opens new business opportunities and optimization potentials in manifold application areas. Among others these are transportation, healthcare, smart homes and industrial environments. Institutions, scientists and inventors have proposed several umbrella terms summarizing technologies, concepts and infrastructures to realize the next generation of networked sensing capabilities and data propagation.

Cyber-Physical Systems (CPS) and the Internet of Things (IoT) are examples for two emerging concepts. CPS are an integration of embedded devices and physical environments. They exchange data by using communication infrastructures and thereby interconnect with users. The IoT refers to a global information network of interconnected heterogeneous physical objects (e.g. sensors, machines, cars, robots, drones, buildings, and other items). In general, they are uniquely addressable and use standard Internet protocols for communication. Hence, they become capable to exchange data. For the industrial domain, these terms have been further specialized into Industrial IoT (IIoT) or Industrial Internet. The German government has declared that the changes driven by related technologies, become the next industrial revolution and coined the term 'Industrie 4.0'.

The differences between the terms or initiatives mainly concern communities, stakeholders, application domains, geographical focus and representation. Further, IIoT semantically describes a technology movement, while Industrie 4.0 is associated with the expected economic impact. Nevertheless, considering both as research and innovation initiatives, there is, as previously illustrated, no realization of these concepts so far that uses exclusive technologies or methods.

For both Industrie 4.0 and IIoT the expectations of industry and other stakeholders are very high. In the end of 2014, Gartner put IoT to the top of their hype cycle, the so-called "peak of inflated expectations". In addition, the World Economic Forum 2016 (*Slogan: Mastering the Fourth Industrial Revolution*) made IIoT the focus of the event. Hence, it is of no surprise that, across the global, several major research initiatives have started to leverage the promised potentials of a fourth industrial revolution. However, critical voices are gaining weight. In June 2016, "Handelsblatt Global" (Germany's largest business newspaper) titled "The efficiency lie" and gave "an in-depth look at how investment in our digital future is failing to increase productivity". Another example is the new book by the economist Robert Gordon. He argues that the expected productivity growth from preceding industrial revolutions is much higher than of digitalization.

In this session, German and U.S. researchers from both academia and industrial talk about Industrie 4.0 and IIoT. They take a position regarding the diverse voices and present the different visions of the concepts and the associated challenges from the German and

American point of view, as well as industry and academia. Thereby, the speakers address several different and interesting areas of this broad topic.

Presenting challenges and opportunities of a connected industry, Daniel Ewert (Robert Bosch Group) presents the vision and necessary core activities from an industrial point of view. Thereby, he addresses technical and regulatory barriers and approaches to answer the raised issues.

Taking a closer look at IIoT, artificial intelligence and the more specific machine learning are closely related topics. In his talk, Rahul Mangharam (University of Pennsylvania) presents Data Predictive Control and his Interactive Energy Analytics engine. He introduces the latter as the Siri for querying buildings' energy use and highlights the potentials of visions like the IIoT.

As previously mentioned, IoT and CPS have manifold application areas. In contrast to the other talks, Fan Bai (General Motors) looks at the Internet of Vehicles. One part discusses the infrastructural challenges of a network of vehicles, whereas the second part elaborates one example of such vehicular applications.

In another talk, Daniel Schilberg (University of Applied Sciences Bochum) discusses the topic of interoperability in a system of interconnected technical systems. In doing so, he raises the questions if standardization is the right way to go, or if IIoT needs an adaptive integration to succeed.