I4.0@Bosch – central challenges and opportunities in realizing the connected industry

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This talk presents Bosch's vision of the connected industry and current core activities in realizing this vision. It addresses technical challenges as well as regulatory barriers when implementing IoT technologies in a corporate context.

In March 2016 Bosch announced the Bosch IoT Cloud, a cloud-based platform offering a range of services for industry 4.0 solutions such as database services, machine-to-machine communication, authentication, identity management, management of devices, machines, gateways, and so on.

One central promise of such platform approaches is the vertical decoupling of applications and a separation of concerns. While nowadays the same developers often address machine integration, data processing and user interface within one application, a platform allows for specialists to focus on the single aspects most suited for their respective background: Machine integrators focus on connecting assets to the platform and application developers program against the platform's generic interfaces and services. The expected results are better overall (software) quality, improved reusability and scalability of single components, applications and services, as well as improved overall efficiency through the ability to share resources.

However, by separating data sources and sinks data loses its context. In an integrated application, the context and with that the meaning of the generated data is known to all developers implicitly and the application is tailored for the respective use case. In a platform-based approach the context of data must be modelled explicitly and data must be annotated accordingly so that applications are able to look up its context and interpret and handle the data correctly. This can be achieved using semantic web technologies. Here one creates joint information models, shared vocabularies or ontologies, to achieve a common understanding of concepts and their relations. The context of a thing is then modeled by relating it to these concepts and to other entities. The result is a gigantic graph representing all things of the respective domain with their relations. The graph allows for additional applications beyond the original scope of providing context for data sources, e.g. gaining additional insights by reasoning or querying for superordinate relationships. Under the hood the graph is represented as a set of triples in the rdf format which are stored in so called triple stores. Queries against a triple store are then formulated in the SPARQL query language.

While semantic technologies are understood well enough in academia, they have yet to achieve industry level maturity. Current shortcomings include primary requirements as fine grained access control (driven by labor protection law and data privacy act) or validation, and a lack of mature tools. Consequently semantic technologies are still an expert domain. Additionally, in spite of considerable efforts, there still are no common models or concepts and a missing consensus between the mayor players on how to proceed or collaborate.

This talks presents our approach to tackle named problems. We currently develop means to selectively grant or deny access to single data triples instances based on individual user permissions and tools to lower the barriers for traditional developers as well as domain experts. We also work on tools for collaborative and decentralized model design, management and exchange. However, Industry 4.0 is a joint effort. To truly realize connected industries and an interoperability of systems the core industry players as well as academic partners need to bundle resources and overcome reservations to build common models and a joint understanding.