Digital Market Places

Secure ad-hoc cloud-based market places supporting cross-organizational production processes.

The workshop will offer room for teams to collaborate on intriguing research questions related to the realization of a secure and trustworthy cloud infrastructure that implements digital market places (DMPs). While current DMP service providers like eBay and Amazon provide a generic platform for conducting business, these infrastructure are primarily targeted to humans. The need of collaborative industries however requires support for trans-sectorial transactions and real-time trading. As a consequence DMPs should be more agile, perhaps even created on demand for one single transaction. The challenge is to create cyber secure market places that also protect data. Some data must stay in the market place - e.g. a product spec - and agents of suppliers may interact with them, and may communicate only the results of a won bid. The program of the workshop leaves room for additions by the participants.

Academic Lead

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These two companies share a common interest and innovation need for distributed systems technology that facilitates a flexible, secure, digital interworking of companies and institutions.

Challenge

The challenge is to provide a distributed systems concept, as well as implementation directions, that supports flexible digital collaborations between organizations. Major characteristics of the digital collaborations are 1) ad hoc workflows that are instantiated after 2) an ad hoc, fully automated auction (e.g. for the just-in-time delivery of 4 mechanical parts) that was won by an enterprise 3) where the (sensitive) information exchanged in the auction was securely removed from the domains of the losing bidders. The process is recursive, the winning enterprise, for instance, creates an auction for production and logistics capacity. Ultimately, the factories and logistic chains are instructed (e.g. by scripts, programs) in detail what and when to do. In this systems of systems scenario, complexity explodes unless the digital collaborations are constructed from a repetitive pattern of ICT that also facilitate design space separation, cyber security and robustness. Clearly, in the engineering of complex (multi-scale) machines as well in systems of collaborative robots (e.g. smart factories) and collaborative intelligent transport systems, one encounters similar issues.

The digital market places consist of a set of connected secured extranets, and transaction software which serves as trading platform, e.g. computers bidding on in an auction and subsequent production of demanded technologies. Communication between the different systems components is supported by open-linked data technologies that enable access to complex and sensitive data structures and services. The governance of such digital market places requires access control mechanisms, provenance of data and rules for collaboration and monitoring and enforcement mechanisms. These rules include rules defining the collaboration (B2B) as well as rules defined by governments (G2B). In order to being able to safeguard security and introducing provenance mechanisms on top of the open-linked data technology we aim at combining digital ledger technology with open-linked data technologies. This combination will allow for advanced access control mechanisms and forms an important basis for trustworthy distributed data storage and sharing.

The aim of the workshop is to create the basis for such digital market places. We intend to bring together businesses and scientific disciplines including computer networks, business informatics, artificial intelligence and law, ontologies, systems architectures and
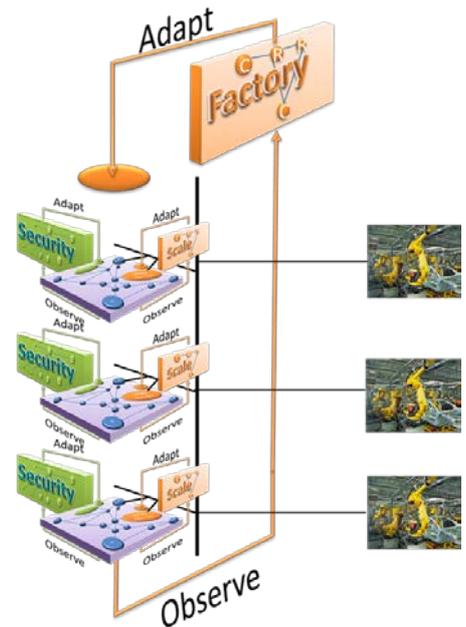

Figure 1 In this IOT concept, a robot arm is connected to a cloud based networking and IT infrastructure – a slice. The slice is experienced as a familiar (yet virtual) Internet environment that allows companies to interoperate their software on a familiar way. A security system takes care of cyber security and watches which information leaves the slice. A scaling and distribution system optimizes the performance of the slice in terms of capacity and latency and distribution over cloud data centers. The Factory manages the system of slices and how they interwork, e.g. how many robots are necessary and what they produce jointly. Furthermore, the Factory or another slice can control physical network connections, e.g. via SDN. Companies controlling a robot could use the slice to auction the production capacity of the robot. Factory software, can be recursive, suggesting how complex IoT systems can be generated. In other cyber physical systems, the slices control cars, logistic services, farms, computers, ICT services, ...

ICT service design. Based upon recent experiences from the SARNET project we will define the infrastructure for digital market places. The trustworthiness will be safeguarded by agent-based monitoring and control agents that implement the rules. This agent-based model will be based upon [1] while for modeling the norms within these agents we will build upon [1], [3] and [4].

Input for workshop participants
The workshop aims at developing an open standard for secure, ad-hoc, cloud-based market places supporting cross-organizational production processes. All knowledge produced by the participants will be publicly available. The participants to base the digital market places on open standards and are trying to establish a business environment that is attracts public, private and scientific experts to make contributions. The participants will receive the most recent information on:
1. Secured extranets, rule governance, agent-based monitoring and control, open-linked data and digital ledger technology, generating complex distributed systems.
2. Scientific publications from the participants.
3. A briefing on the assignment for the workshop by representatives of the participating organizations.

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