

Interoperability Challenges and Solutions within Industrial Networks

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1. Motivation

Industrial networks depend on fast communication and flexible data use in corporate networks, thus in particular at transparent and flexible supply relationships extended with financial services, governmental services, IT services, and other services like for energy.

All the partners in the network faces, among other things, the challenge of the existence of a difficult-to-manage number of platforms, digital services, cloud solutions and IT services, which also include enterprise platforms for products and services. Interoperability usually only takes place within a solution and can only be realized across the board with a high translation effort. This creates a kind of barrier for finding and connecting new network partners. The goal of this workshop was to provide a forum for discussion of:

- Challenges and opportunity of existing network features also in terms of what has been proposed and what is available in terms of services and approaches.
- Requirements and potential business opportunities for future enterprise network and its resilience and robustness.
- Overcoming the continuing terminological and semantic challenges in terms of merging and sharing information.
- Realistic principles for interoperability in enterprise applications with questions such as:
 1. What R&D principles and approaches may enable Interoperable Enterprise Networks?
 2. What R&D principles and approaches are important for the industry joining and adopting?
 3. Why are these principles and approaches novel and worthy of exploring?
 4. How could we explore and work on these principles and approaches?
 5. How can we assess the potential impact of the principles and approaches?

The workshop has been executed in a hybrid way because of US participation. They are not allowed to travel. The other workshop participants were on site and could participate directly in the discussion.

2. Presentations and questions discussed

The workshop topics and questions are motivated by four related paper presentations. The four presentation covers technology, methodology, interface, security, simulation and messaging aspects related to digitalization and interoperability challenges in industry networks. The authors of the four papers presented the following topics:

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1. A Simulation Based Approach to Digital Twin's Interoperability Verification & Validation presented by Mamadou Kaba Traore, Université de Bordeaux. The focus was on the validation of the quality of digital twins concerning the mapping between reality and virtual representation.
2. Model based configuration of platforms for managing cross-organisational (business) processes by Thomas Knothe, Fraunhofer IPK. The focus was on automated platform configuration and generation from an enterprise model for resilient and persistent enterprise networks.
3. Advancing Data Exchange Standards for Interoperable Enterprise Networks presented by Nenad Ivezic, NIST and Marija Jankovic, Centre for Research and Technology Hellas. The focus was on a standardized ontology approach for messaging and use cases.
4. Challenges and opportunities of enterprises network design and services presented by Frank-Walter Jaekel, Fraunhofer IPK. The focus was on digitization in enterprise networks supported by enterprise models and on addressing challenges arising from IT vendor strategies and alternative approaches from the open source sector.

3. Results and outlook

The following main challenges are identified during the workshop with about 12 participants from research, standardization and industry:

1. Using digital twins to represent network partners and provide predictive simulation capabilities as well as enterprise modelling to generate the required services in the network,
2. The measuring of the quality of digital twins in terms of the distance between the digital twin and the represented reality,
3. The message standards for data exchange within an enterprise network as well as from the network level to the machines and back to the network level for further processing.

After the presentation a discussion took place on different topics:

- The measurement between a digital twin and the real world needs to be better understood to evaluate the quality of a digital twin.
- Enterprise models opens automatic code generation and might be useful for enterprise application design and implementation like the use of today game engines.
- Definition and reuse of building blocks related to standards, its mapping and modular ontologies such as described in IOF Website (industrialontologies.org).
- Federation of information to react early and reduce waste by decentralised messages and a flexible communication structure. This includes maintenance of the data in a distributed environment considering security, sovereignty and data ownership.
- The processes models should be generated by messages and vice versa the model might generate the message structure. This might also include the automatic generation of supply chains by message profiles and business rules incorporating smart contracts.

Finally, some initial actions have been defined. The definitions of Digital Twins are still wide and open. This could be an opportunity for Interop-Vlab to provide harmonised definition as a reference point for future research. The topics will be further discussed in interested groups between participants of the workshop as well as within the Interop-Vlab.