

Semantic dataspace for battery production equipment

S. Gouttebroze¹, D. Marchand¹, T.R. Joseph², T.S. Haugland³, S. Krishnamurthi³, S. Clark³

¹ SINTEF Industry, Oslo, Norway, ² SINTEF Ocean, Trondheim, Norway, ³ SINTEF Industry, Trondheim, Norway
Contact: sylvain.gouttebroze@sintef.no

Context

Strong international competition:

- Development of GigaFactories in Europe
- Need for competitive equipment (made in Europe)
- Accelerate ramp-up of production
- Agile manufacturing

Key Enablers

- Collection of data from the equipment
- Integration of data through the production line
- Data analysis for process optimization
- Connection to digital twin

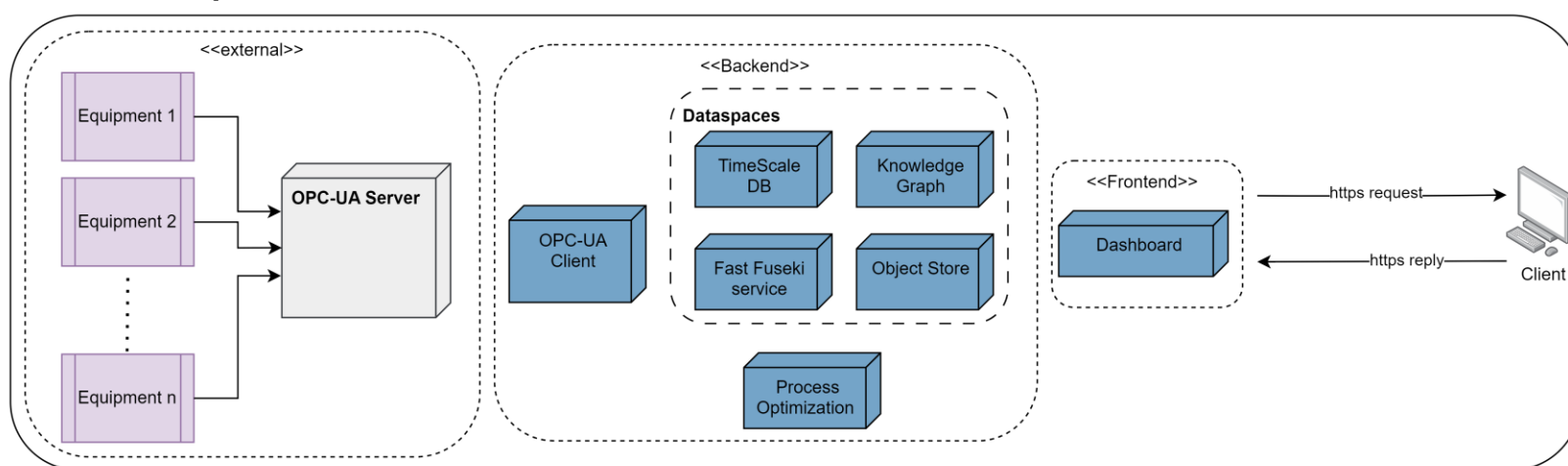
Challenges [3]

- Data and equipment heterogeneity
- Various modes of data exploitation
- Lack of standardisation and common representation
- Rapid industry changes

BATMACHINE Focus

- Only electrode production: slurry mixing, coating and calendaring
- Ontology and data models for common representation
- Co-development of equipment and data integration
- Exploitation of the data for Intelligent process control

BATMACHINE DataSpace



Data Acquisition

- Rely only on OPC-UA protocol
- Configuration of the channels to be recorded
- Semantic description of channels → Knowledge graph

Data storage

- Dedicated databases for different resource types
- Storing also offline measurements

Data Analysis

- Dashboard visualization with Grafana
- Semantic search and graph exploration
- Link to BattMo simulation software (in progress)
- Link to standard AI package (not started)

Process control

- Operator support (not started)
- Smart algorithm based on stored knowledge (not started)

Similarities with other works

Production pilot data management [1] (Already in place)

- Focus on connecting equipment
- Tag/channel visualization
- Export of data

Ontology based dataspace [2] (datasets on Zenodo)

- Focus on sharing data
- Infrastructure dataspace very similar
- Ontologies for process and battery properties

Same global trends and approaches in these parallel works.

Future work

- Complete the next steps with integration of process control and external tools
- Ensure and demonstrate compatibility with other datasets
- Test viability in industrial environment

Perspectives

- Fast deployment of optimal parameters from lab-scale testing
- Early correction measures to ensure product quality
- Coupling with digital twins to accelerate ramp-up

References:

[1] A. Kampker et al., 5th Conference on Production Systems and Logistics, 2023

[2] S.P. Stier et al., Energy Technol. 2024, 12, 2301305

[3] https://www.ffb.fraunhofer.de/content/dam/ipt/forschungsfertigung-batteriezelle/Bilder/presse-medien/whitepaper-ramp-up/Whitepaper_Mastering%20Ramp-up%20of%20Battery%20Production.pdf