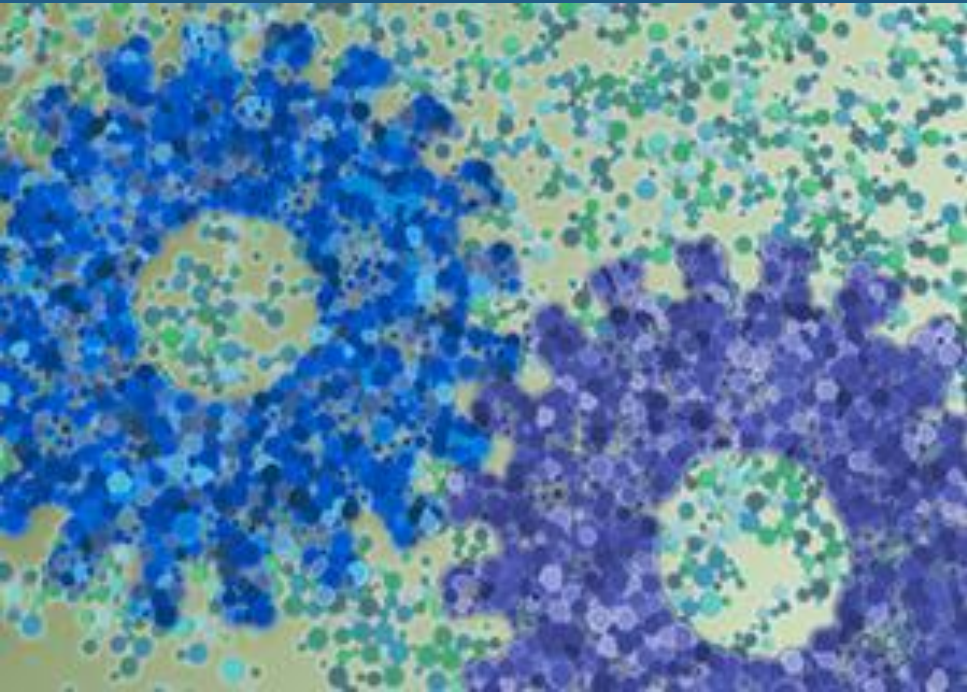


COMPOSITION - Ecosystem for Collaborative Manufacturing Processes – Intra- and Interfactory Integration and Automation



IoT Applied to Factories of the Future

Marc Jentsch
Fraunhofer FIT



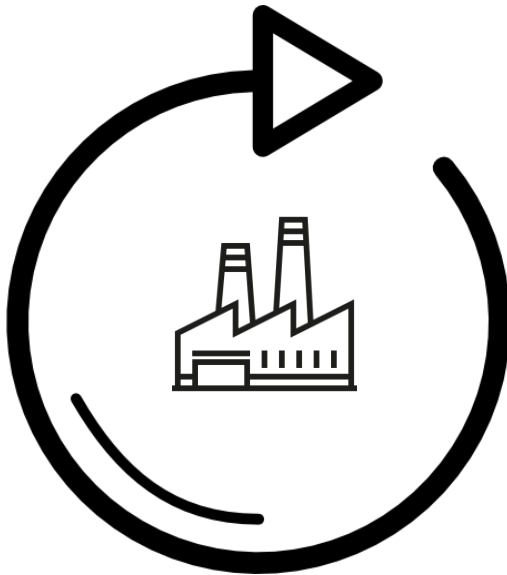
Co-funded by the
European Union



COMPOSITION

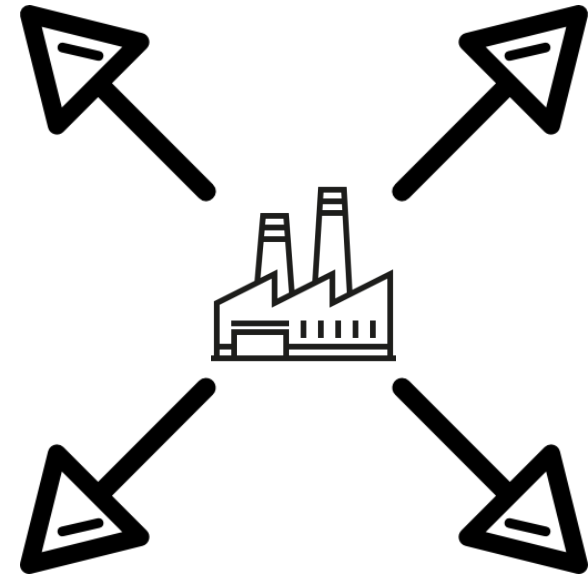


COMPOSITION



Intra Factory

Value Chain



Inter Factory

Supply Chain



Introduction of Pilot Partners

Boston Scientific

- Medical Device Manufacturer
- Optimization of Internal Processes



- Lift Manufacturer
- Optimization of Waste Processes



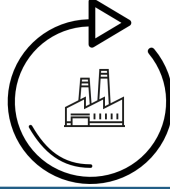
- Recycling Company
- Customer Relationship with Kleemann





Use Cases

| Tier | Use Case |
|--------|---|
| Tier 1 | UC-BSL-2 Predictive maintenance |
| | UC-KLE-1 Maintenance decision support |
| | UC-KLE-4 Scrap metal collection and bidding process |
| | UC-ELDIA-1 Fill-level notification – Contractual wood and recyclable materials management |
| Tier 2 | UC-BSL-5 Equipment monitoring and line visualization |
| | UC-KLE-2 Delayed process step |
| | UC-BSL-3 Component tracking |
| | UC-ATL-3 Searching for recommended solutions |
| Tier 3 | UC-KLE-3 Scrap metal and recyclable waste transportation |
| | UC-BSL-7 Automatic long term tracking of high value materials for physical security |
| | UC-BSL-4 Automatic solder paste touch up |
| | UC-KLE-7 Ordering raw materials |
| | UC-ATL-1 Selling software/consultancy |
| | UC-ATL-2 Searching for solutions |
| | UC-ATL/NXW-1 Integrate external product into own solution |
| | UC-NXW-1 Decision support over marketplace |



- Forecast Motor Breakdowns of Polishing Machine



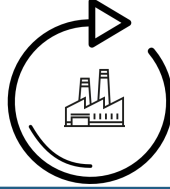
Challenge

Technology

Application



UC-KLE-1 Maintenance Decision Support



- Combine Historical Breakdown Data with Vibration Sensor Data
- Vibration 0.038 m/s^2 data at 1.344 kHz (3 axes)



Challenge Technology Application



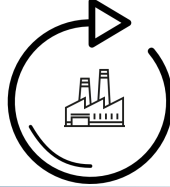
Figure 21: Bossi Motor (internal)



Figure 22: Bossi Motors (external)



UC-KLE-1 Maintenance Decision Support

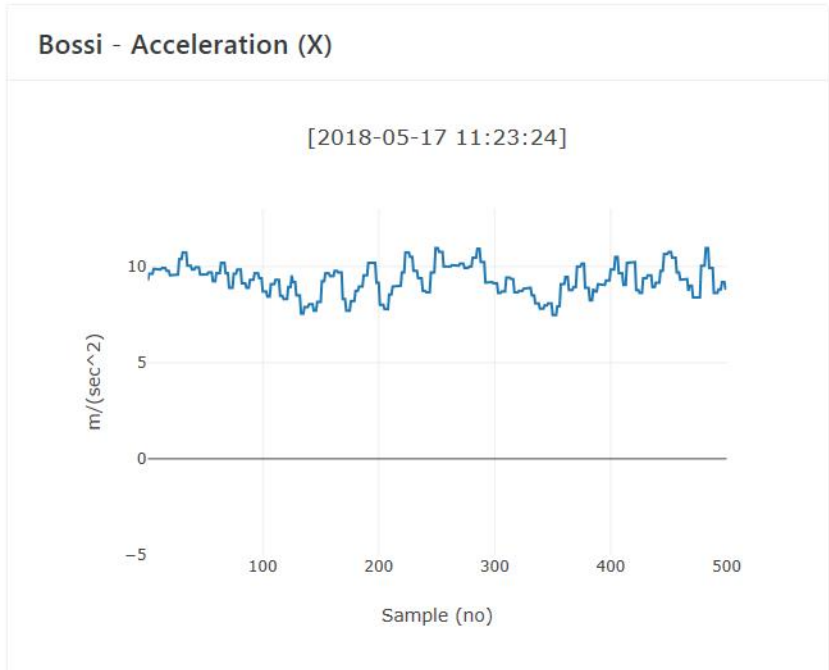
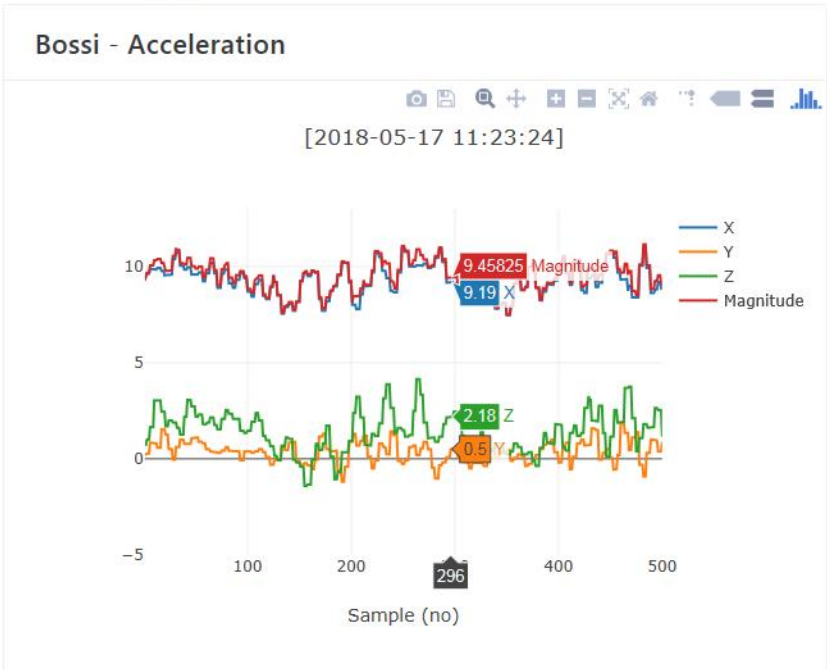


- COMPOSITION DSS
 - Maintenance Board >
 - KPIs
 - Links >
 - Fault Diagnosis
 - Personnel
 - Tasks
- SUPPORT
 - Documentation
 - COMPOSITION Project

Bossi Machine Probabilities

| | | | | | | | |
|---|--|---|--|---|--|--|--|
| Normal Operation Current Probability : 36.32% | | Mechanical Failure Current Probability : 50.47% | | Electrical Failure Current Probability : 32.41% | | Hydraulic Failure Current Probability : 70.44% | |
|---|--|---|--|---|--|--|--|

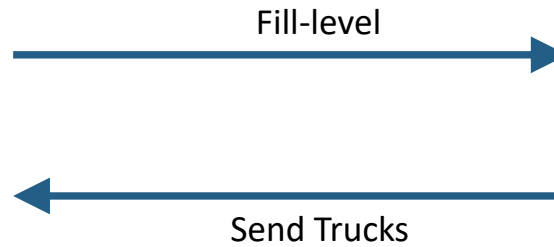
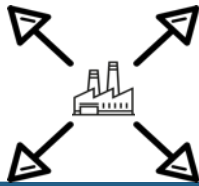
Vibrometer graphs



[Challenge](#) [Technology](#) [Application](#)



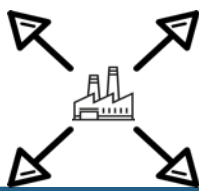
UC-ELDIA-1: Fill-level Notification



Challenge Technology Application



UC-ELDIA-1: Fill-level Notification



Sx1272mbas Lora communication module attached on the mcu PCB, Antenna HRLV-MaxSonar EZ (MB1043) Ultrasonic Sensor and a 4 AA Battery Pack



LoRa gateway access to Ethernet and power within 100m radius from the bins

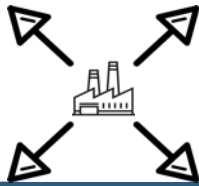


Sensor Position

Challenge Technology Application



UC-ELDIA-1: Fill-level Notification



- Maintenance Support
- Bottleneck Detection
- Material Containers**
- Material Bins
- Marketplaces
- Company
- Messages

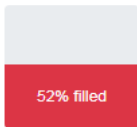
Material Management Containers



Container A

| | |
|---------------------|-------------|
| Content | Metal burrs |
| Full in | 6 days |
| Current fill level | 52 % |
| Last emptied | 12 days ago |
| Price if sold today | 120 € / ton |

Filling prediction



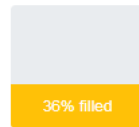
6 5 30
days hrs min
5.2 / 10 t



Container B

| | |
|---------------------|-------------|
| Content | Scrap metal |
| Full in | 1 days |
| Current fill level | 36 % |
| Last emptied | 2 days ago |
| Price if sold today | 140 € / ton |

Filling prediction



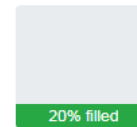
1 15 20
days hrs min
5.4 / 15 t



Container C

| | |
|---------------------|-------------|
| Content | Scrap metal |
| Full in | 5 days |
| Current fill level | 20 % |
| Last emptied | 5 days ago |
| Price if sold today | 100 € / ton |

Filling prediction

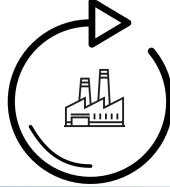


5 10 20
days hrs min
1.6 / 8 t

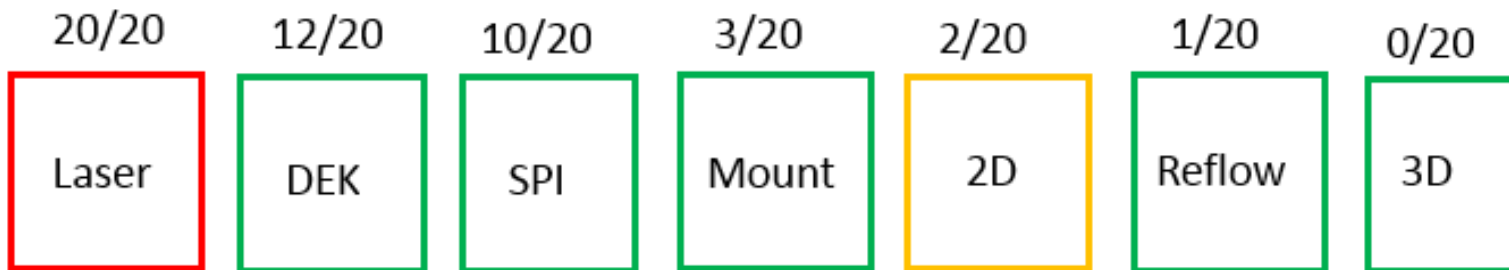
Challenge Technology Application



UC-BSL-5 Equipment Monitoring and Line Visualisation



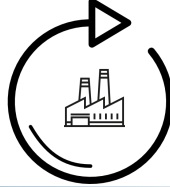
- Real time visualisation of production line's efficiency
 - Representation of Involved Equipment
 - Light Tower Equipment Status
 - Actual Production
 - Target Production



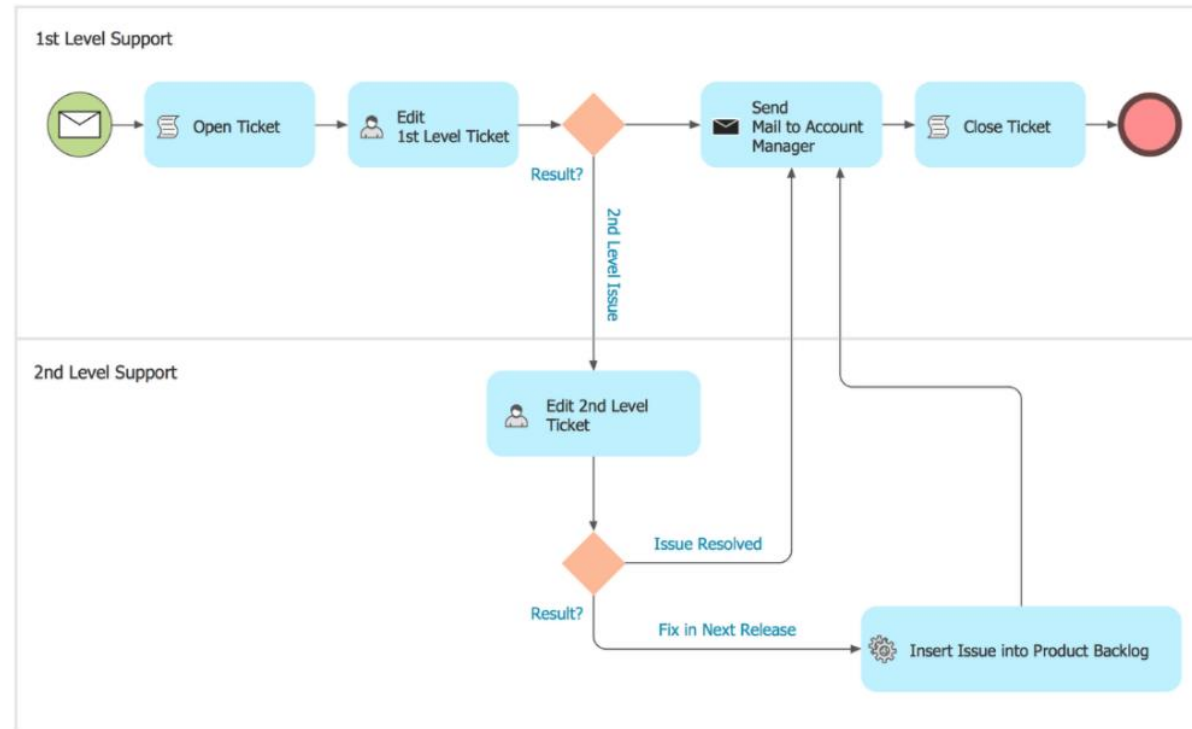
Challenge Technology Application



UC-BSL-5 Equipment Monitoring and Line Visualisation



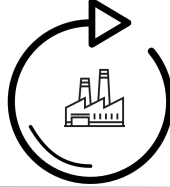
- BPMN: Business Process Model and Notation
 - Graphical Notation for Specifying Business Processes
 - Available Software Tools to Execute Logic behind a BPMN Model



Challenge

Technology

Application



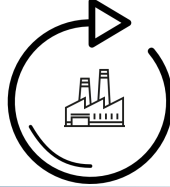
BPMN Modeller

The BPMN Modeller interface displays a process flow diagram with the following steps: Start Event → Laser Mark → DEK solder ree printing → SPI Inspection → Mount → 2D AOI → Reflow → 3D AOI → End Event. A toolbar on the left provides various BPMN symbols and editing tools. At the bottom, there are buttons for 'BPMN diagram', 'SVG image', 'Upload for monitoring', 'Upload to DFM', and 'Open New Diagram'.

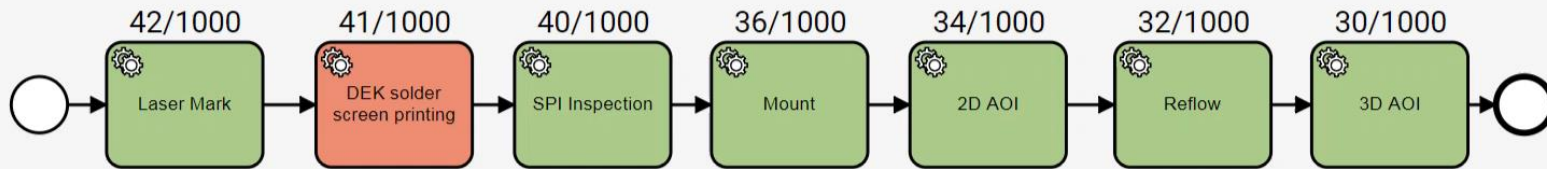
The configuration panel on the right is titled 'machine_1' and includes the following details:

- General**
 - Id**: machine_1
 - Name**: Laser Mark
- Documentation**
 - Element Documentation**: This machine marks the ID of PCB with laser.

[Challenge](#) [Technology](#) [Application](#)



Viewer



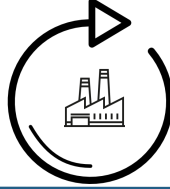
Last update: 11-08-2018 13:25:18 ■ normal ■ stopped ■ error



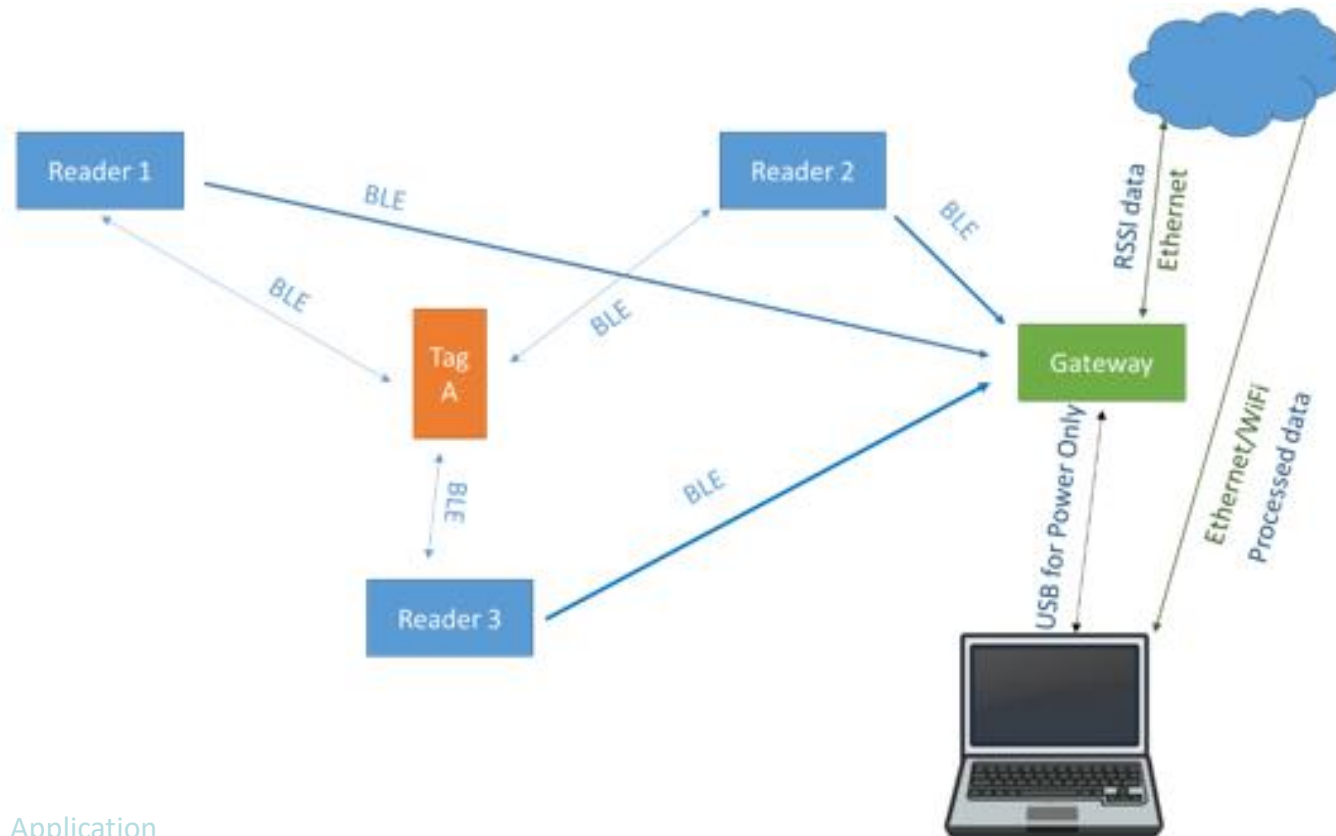
[Challenge](#) [Technology](#) [Application](#)



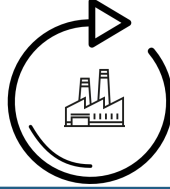
UC-BSL-3 Component Tracking



- BLE Tracking System
- Proximity-based: RSSI (Received Signal Strength Indication)



Challenge Technology Application



Test A

Tracking a single tag

[Challenge](#)

[Technology](#)

[Application](#)



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A wide-angle photograph of a large industrial facility, possibly a refinery or chemical plant, during sunset. The sky is a mix of orange, yellow, and blue. Several tall chimneys are visible, with one on the right emitting a plume of white smoke. The foreground shows various industrial structures, including storage tanks and piping. The overall scene is brightly lit by the low sun.

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