Predictive maintenance and quality control on autonomous and flexible production lines

With the implementation of an IoT infrastructure on the shopfloor level, through Boost 4.0 it will be developed a system able to collect data from multiple sources (e.g. company production tools, mobile robots, welding cells) with the main objectives to reduce the manufacturing costs (optimizing the production planning and maintenance costs) and increase the product quality.

Factory 4.0 Big Data Pilot Motivation

- Since the traditional automotive linear production process presents different criticalities (e.g. Saturation of processing stations and logistic equipments, space shortage at the lineside), the evolution is moving towards autonomous and flexible production lines.
- High manufacturing equipment maintenance cost due to lack of monitoring and analysis infrastructure.
- Learn to get value out of data through intelligent systems design, using real-time analytics to tailor products to customers and continually improve the processes.

Big Data for autonomous manufacturing

- Enable the optimal planning of the production missions and the management of the incoming events.
- Develop an analysis section which, based on the continuous data flow coming from the shopfloor, can determine the planning of the maintenance activities.
- Given the huge amount of data, a standardized and procedural scheme to follow will help the company to better understand data, by extrapolating only the useful information necessary at the time.

Competitive Advantages

- Production line operations time saving: +16%
- Zero defect manufacturing (10 ppm)
- Real-time, product-service value added networks
- Reduction of maintenance activities: +30%
- Overall cost reduction: +50%
- Enhanced work environments

Big Data Pilot Site

FCA CRF Campus Melfi, Digital Innovation Hub (DIH)
Melfi | Basilicata, Italy

Big Data Pilot Lifecycle Scope

- Digital Engineering
- Production Planning
- Smart Operations
- Smart Production
- Smart Services

Pilot Partners

- FCA: Automotive Lighthouse Factory
- Siemens: Architecture & Analytics Provider
- Prima Industrie: Laser Machine Provider
- Politecnico Milan 1863: System Designer
Boost 4.0 big data solution framework leverages on Big Data Europe (BDE) big data pipeline technologies, International Data Spaces Association (IDSA) specifications for data sovereignty, FIWARE NGSI-LD API for open IDS implementation and Hyperledger technologies for transaction traceability. Boost 4.0 big data platforms and technologies align to RAMI 4.0 and are integrated under the Digital Shopfloor Alliance (DSA) autonomous service framework to ensure reduced cost, time and effort in solution deployment and extensibility (https://digitalshopflooralliance.eu/).

**14.0 Big Data Pilot Solution Framework**

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<th>Service Models</th>
<th>Digital Manufacturing Platforms &amp; Services</th>
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<td>Assisted Reality (AR/VR) &amp; Engineering</td>
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<td>Services</td>
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<td>Plant IT Network: Wireless/IG, Wired Ethernet</td>
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<td>Data-driven Learning Services</td>
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<td>Digital Twin Planning Services</td>
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<td>MindApps AGV &amp; Machine Predictive</td>
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<td>Production OT Network: Deterministic</td>
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<td>Ethernet [TSN], OPC-UA, IDS/NGSI-LD</td>
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<td>Mind Nano: Data Collection Services</td>
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<td>Control Services</td>
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<td>Vision Interface [30 Hz], IoT Interface</td>
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<td>Real-Time Control Interface [125-1000 Hz]</td>
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<td>Field Device Network: Time Sensitive</td>
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<td>Network, Real-Time Ethernet, Digital, I/O,</td>
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<td>Camera Link, PiP</td>
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<td>Field Devices &amp; Product</td>
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</tbody>
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**Cybersecurity Modelling**

- (Big) Data & Service Modelling
- Data at rest
- Data-driven Learning Services
- Digital Twin Planning Services
- Simulation Services
- MindApps AGV & Machine Predictive Maintenance Services
- Production OT Network: Deterministic Ethernet (TSN), OPC-UA, IDS/NGSI-LD
- Vision Analysis and Production Data Services
- Mind Nano: Data Collection Services
- Control Services
- Vision Interface [30 Hz], IoT Interface 5G mmWave, 5G eMBB
- Real-Time Control Interface [125-1000 Hz]
- 5G URLLC
- Field Device Network: Time Sensitive Network, Real-Time Ethernet, Digital, I/O, Camera Link, PiP
- Field Devices & Product

Boost 4.0 led by:

- info@boost40.eu
- @boost4_0
- www.boost40.eu

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**I4.0 Big Data Pilot Features**

**Sector / Product:** Automotive

**Manufacturing Process:** Cutting/Welding

**Big Data Analytic Techniques:** Predictive maintenance optimal scheduling algorithms

**Big Data Platforms:**
- Siemens MindSphere (siemens.mindsphere.io)

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**Open I4.0 Big Data Pilot Pillars**

**International Data Spaces Association (IDSA):**

IDSA defines a reference architecture and an ecosystem, which supports sovereign exchange and sharing of data between industrial partners.

**FIWARE:**

FIWARE is a curated framework of open source platform components to accelerate the development of smart solutions for Industry 4.0.

**Hyperledger:**

Hyperledger is an open source collaborative effort created to advance cross-industry blockchain technologies.

The BDE offers an open source platform, allowing to build several Big Data components into a pipeline through a simple graphical UI.