TRAIN 2 - from Gare du MIDIH to Open Source Digital Manufacturing Platforms



MIDIH, towards a flexible, modular and open source Reference Architecture for a digital manufacturing platform for Industry 4.0 MIDIH, towards a flexible, modular and open source Reference Architecture for a digital manufacturing platform for Industry 4.0

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MIDIH Project - Technical Outline

The MIDIH Open Platform extends the Open Source **BEinCPPS** Platform with new components and functionalities such as edge-oriented factory automation, brownfield interoperability & Industrial Analytics.

- An <u>edge-oriented distributed</u> <u>architecture</u> (derivative work from Connected Factories FoF11 projects FAR EDGE, AUTOWARE and DAEDALUS) implementing the <u>IEC61499 standard in local</u> <u>clouds</u> according to the ARTEMIS Arrowhead (and ECSEL Productive 4.0) projects.
- A set of <u>open APIs to</u> <u>interoperate</u> MIDIH OS Platform with proprietary solutions for Cloud Manufacturing (Siemens Mindsphere), PLM (Dassault 3DExperience), ERP (SAP Hama) and IoT (GE Predix).
- A <u>MIDIH Industrial Analytics</u> <u>Platform</u>, made up by a set of specific Open Source components <u>for CPS/IOT</u> <u>Data Management</u>, from different Open Source projects such as APACHE, federated via an Enterprise Service Bus.

Industrial Reference Models and Architectures for IIoT

MIDIH project aims at developing a meta-model where the four main Reference Architectures concerned with CPS/IOT and Industry 4.0 domains could be aligned and interoperated for the development of Smart Factory, Smart Product and Smart Supply Chain reference implementations: <u>the FIWARE RA, the IDS RA,</u> <u>the IIC RA and the Plattform Industrie 4.0 RAMI 4.0</u> have been therefore considered, as main inputs for MIDIH.





IIRA Layered Databus: A Data-Driven approach

MIDIH follows a data-driven approach, inspired by the IIRA Layered Databus Architectural Pattern and its Machine-Unit-Site and Intersite layers.



The Inter-site Databus encompasses cross-site interactions, so typically cross-Factory, cross-Enterprise value chain interactions

The Site and Unit layers could also be coincident, but we can identify the Unit layer with Edge-Cloud layers in Production Line vs. Factory, Department Assets vs. Enterprise.

This is the level of Real World Sensors, Objects, Devices, Machines, Products. Often, this Databus is embedded as Smart System (e.g. a CPPS, a Robot, a Car, a Truck, a Container.

MIDIH Reference Architecture: functional layers and capabilities



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MIDIH Data-driven Reference Architecture

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Open Source Componentes Identification and mapping





Advantages and disadvantages of the Implementation lanes

Commonalities

- Flexibility and Agility, speed, Cost-effectiveness, Ability to start small, share maintenance cost
- Open, Interoperable, Integrable, Scalable platform at Low costs.

Pros FIWARE vs APACHE:

- Standard API for accessing Context Information
- Brings a standard to Interchange Data based on a common Context Information Management Layer, and it is capable to deal with the wide variety of IoT protocols.
- Several GEs are based on apache components (i.e. Draco Nifi, Cygnus Flume, ..)
- The FIWARE Marketplace (showcases of the best solutions and services based on FIWARE).

Cons:

- Lack of vendor expertise; Low platform security & Comprehensiveness.
- Fewer applications in real environments.
- Community/Ecosystem Apache has a stronger community, So, a greater support and evolution of the components



MIDIH Integrated Platforms

Smart Factory, Smart Product & Smart Supply Chain Functionalities



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- Collection and transfer of all types of data (Data Ingestion)
- Real-time analytics, processing huge amount of streaming data in order to predict and detect events based on underlying patterns and correlations (processing DiM), applying edge computing techniques
- **Storage** layer for persisting all type of **data** (past data, meta-data, models) **Data Persistence**.
- Data-analytics services on multidimensional and complex data, including exploratory analysis, multivariate analysis, predictive analytics and deep learning (processing DaR)
- **Visualization services** to enable users to contextualize, understand and apply results for better decision making
- Collaboration between OEMs and subcontracts through standardized interfaces
- Global real-time visibility regarding production, inventory, and materials;
- Supply chain decision-making through **advanced analytics** and next generation optimization software, allowing a quick response in supply chain planning's;
- Provide mechanisms for **secure data sharing** based on digital identity, sharing policy, sharing agreement and data certification.



Smart Factory & **Smart Product** MIDIH Open Source RA Implementation

FIWARE/APACHE Components

MIDIH Foreground Components

Commercial Solutions

Smart Supply Chain MIDIH Open Source RA Implementation

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MIDIH Innovation Lighthouse Pilots



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THANK YOU!

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