Cloudifying the Plant on the Example of Two Shop Floor Solutions

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Plamen Kiradjiev
Global CTO Industrie 4.0

Dirk Sperner
Solution Architect Internet of Things

Jochen Benke
Principal Integration and Industry 4.0
Intro: Plant & Cloud Dilemma

IBM Industrie 4.0 Reference Architecture – Digitization Needs Needs New Functionality

Two Solutions with Clear ROI, but How to Operate them in the Plant?

Cloudify Them: Cloud Pak for Manufacturing

Some Excerpts from an Ongoing Project
Intro: Plant & Cloud Dilemma
Manufacturing & Cloud – how do they fit together in practice?

Manufacturing:
- Latency
- Trust
- Control
- Security
- Safety
- Regulations
- Confidentiality
- Compliance
- Skill Gaps
- Employment

IoT / Cloud:
- Predictive
- Digital Twin
- Big Data
- Digitalization
- AI
- AR
- Micro Services
- CI / CD
- App Store
- Self-optimized Processes
- Autonomous Production

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The answer:

*Don’t heave the Plant to the Cloud,*

*Rather bring the Cloud into the Plant...*

*Even without any link to the Cloud.*
IBM Industrie 4.0 Reference Architecture – Digitization Needs Needs New Functionality
IBM’s three-layered **Industrie 4.0 Reference Architecture** leveraging IBM’s Hybrid Cloud strategy and laying the foundation for Digital Transformation...

*Refer to Industrie 4.0 Implementation at: [https://www.ibm.com/devops/method/content/architecture/iotArchitecture#industrie_40](https://www.ibm.com/devops/method/content/architecture/iotArchitecture#industrie_40)*
Two Solutions with Clear ROI, but How to Operate them in the Plant?
Even on highly sophisticated production lines, workers face numerous challenges.

- They often have to rely on their **own intuition and senses**.
- They waste a significant amount of time **looking for information**.
- They struggle due to **qualification gaps** and lack of experienced and knowledgeable senior practitioners.
Intelligent Automotive Manufacturing Assistant (IAMA)
Proven value through IBM AI, AR and IoT technology at the shop floor

**Inspector**
Improve inspection, failure detection and error-proofing processes with machine learning, acoustic and visual recognition. Train custom visual and acoustic inspection models to be used in handheld devices or fixed mounts.

**Explorer**
Get easy access to all of the documentation on your production line. Turn searching into finding.

**Expert**
An on-demand virtual assistant helps workers getting solutions to their problems in real time through a conversational and interactive interface.

**Peer Guide**
Through augmented reality, get instant and effective support from senior engineers located remotely.

**Cockpit**
Get immediate insights into operations and KPI status with an easy to navigate visual overview for the whole shop floor.

**Marketplace**
Organize your tools in a secure and convenient one-stop-shop.

Savings 7M€ p.a.
Some IAMA impressions

IAMA Explorer

IAMA Visual Inspector

IAMA Cockpit

IAMA Marketplace

IAMA Peer Guide
Plant Service Bus at German car manufacturer: OT meets IT

Rigid & not suited for Industrie 4.0

- Outdated
- Redundant functions & data
- High costs
- Error prone

Basis for Industrie 4.0: flexible production and new business models

- Reduced complexity, flexibility, standardized
- Linkage of isolated solutions
- Multi-cloud support, de-coupling shop floor from cloud, freedom to switch
- Massive data volumes

Basis for Industrie 4.0: flexible production and new business models

- Routing
- Transformation
- Mediation
=> Configured by Rules
Plant Service Bus – Flexible Integration, combined with Supreme QoS and Data Privacy Enforcement at the Shop floor

Flexible configuration at shop floor, integration layer and machine level based on **rules** defined in **natural language**, validated and deployable by production planner (non-IT) staff; streamlining change management, plug & produce enabler.

Classical **service bus** functionality for de-coupled integration of systems and machines, taking over integration logic, systems/machines, relief from integration-specific logic, enabling standardization of maintenance and release management.

Message Hub for MQTT messages for **scalability**, **performance** and **off-load**.

**Rules Engine**
- IBM ODM Rules

**Integration**
- IBM App Connect for Manufacturing

**Message Hub**
- WIoT Msg. Gateway
Cloudify Them: Cloud Pak for Manufacturing
IBM Cloud Pak for Manufacturing – Foundation for Manufacturers and OT vendors to Cloudify the Plants

Typical Pain Points

- **Siloed & propriety** systems with insufficient integration between applications, data & processes
- Lower levels of *maturity in application management* when compared to the enterprise IT staff
- **Lack of skills** to drive IT-OT convergence
- **Restricting the Industry 4.0 journey**, impacting deploying of advanced capabilities @ scale

Value Prop

- **Reduce costs by virtualizing** the infrastructure, requiring fewer on-premises support personnel
- **Realize higher value from data** - facilitate the integration of applications, data and processes on the plant floor
- Be **ready to deploy high value analytical capabilities** from edge to cloud at scale
- **Automated by-click** deployment
- **Simple pricing** model:
  - Per factory-based license
  - Per component used
Combining New Apps Deployment with Legacy Modernization and Location-Agnostic App Deployment = Immediate ROI

- **Legacy applications**
  - Spec. HW

- **Cloud Pak 4 Mfg**
  - Virtualized Legacy Apps
  - CP4M Apps
  - Partner Apps
  - IoT Apps

- **OpenShift**
  - Virtualized HW
  - 5G MEC
  - Any / Multi Cloud Providers: AWS, Alibaba, Azure, Google, IBM, ...

- **Modernization**
  - re-base

- **Production Zone**
- **IT Zone**
Some Excerpts from an Ongoing Project
A Highly Available Virtualized Self-Healing Plant Platform Based on RedHat Virtualization and OpenShift

- Provides the hardware and Cloud platform independent “Operating System” for Cloud Pak for Manufacturing
- RedHat Reference Architecture
- RedHat Cloud Suite Subscription based
Example PSB on OpenShift Configuration from a Real Implementation

PSB Worker Node Prod 1
- 32 Cores, 256GB+ RAM, 2TB+ disk
- 2 cores MQ+ACMfg MQTT Consumer & Provider
- 1 core MQ Cluster
- 4 cores IoT Msg GW server

PSB Worker Node Prod 2
- 32 Cores, 256GB+ RAM, 2TB+ disk
- 2 cores MQ+ACMfg MQTT Consumer & Provider
- 1 core MQ Cluster
- 4 cores IoT Msg GW server

PSB Worker Node QA
- 32 Cores, 256GB+ RAM, 2TB+ disk
- 1 core ODM
- 2 cores MQ+ACMfg MQTT Consumer & Provider
- 1 core MQ Cluster
- 1 core MQ Cluster
- 1 core IoT Msg GW webui
- 4 cores IoT Msg GW server

NFS v4, 20TB+
Automation Is King! Software defines Everything!

**Build Images**
- Image Pipeline
- Build all needed Docker Images

**Build Pods & Service**
- Create Plant Configuration files.
- Create Pipelines to derive Services and Deployment YAML.
- Test Integration & Performance Scenarios

**Centralize Logging**
- Ship all logs and error information to an central dashboard.
- Simulate operation and check information transparency.

**Add Security**
- Add all needed keys, directories and security settings.
- Test Integration Scenarios

**Centralize Metering**
- Ship all performance metrics to an central dashboard.
- Performance test and check information transparency.
Automated By-Click Deployment on the PSB Example

- Container Config
- Create Objects
- Deploy App

App running
Think Big, Start Smart, Act Fast.

Industrie 4.0 = Kooperation