Potential usage of AutomationML to feed back data from the shopfloor into the digital planning models

5th AutomationML User Conference
Problem Statement

Welding of component

With data feedback (aim)

- Feedback from errors recorded automatically
- Integration of feedback in the planning process

Without feedback (current scenario)

- Welding of component
- Welding defects recognized
- Parameter optimized

Planning: New vehicle

Optimized parameter not fed back to the new planning process

Errors get repeated

Planning: Following ramp-up

Optimized parameters automatically flows back to planning tools

→ 'Old' errors are avoided and planning process optimized; faster and error-free ramp-up
Concept of an Optimized Manufacturing Digital Process Planning

Parts of the Concept

- **Integrated Digital Factory Planning Model**
  - 3D-model and kinematics
  - Control Code
  - Skills
  - Behavior

- **Central Data Repository**
  - Storing integrated planning data
  - Comparing and merging real and virtual data
  - Feedback to planning models

- **Data Acquisition from Shopfloor**
  - Standardized data acquisition from shopfloor
  - Identification of relevant data for planning models
Data Acquisition from Shopfloor Devices via OPC UA

Benefits through standard OPC UA Specifications provided by OPC Foundation and Companion Specification e.g. developed in cooperation with VDMA.

Most important spec. for the integration in automotive production environment:
- OPC UA Companion Specifications for FDI
- OPC UA Companion Specifications for Robotics
- OPC UA Companion Specifications for AutomationML
- OPC UA Companion Specifications for PLCOpen

Standardized information models are a key factor for an interoperable data exchange within the production.

- Hierarchical structure
- Semantically description
Architecture Shopfloor to Data Lake

SYSTEMS OF RECORDS

- Tool
- Robot
- PLC
- SCADA

SHOPFLOOR INTEGRATOR

- Integration Layer
- Aggregation Server

DATASTORAGE

- Data Lake
- Mongo DB

CONSUMERS

- AnalyticPlatform
  - DESCRIPTIVE
  - DIAGNOSTIC
  - PREDICTIVE
  - PRESCRIPTIVE

SUB SET OF DATA
Digital Factory Framework and AutomationML Data Model

Problems:
- Diverse perspectives from different domains
- Semantic heterogeneity issues
- Lack of a final design, capturing original intent from each perspective

Solution:
- Integrated AutomationML model semantically representing all engineering phases

Approaches
- Top-down modelling approach (TU Vienna)
- Bottom-up modelling approach: Alligator tool (University of Bonn)
- Combination of both: AutomationML ontology
Concept of an Optimized Manufacturing Digital Process Planning

- 3D planning
- Process planning
- Electrical planning
- Control Logic
- Virtual Commissioning

mongo DB

Planning Data Repository

compare merge

Sub set of data

Data Lake

Production Data Lake
Why MongoDB?

Central Data Repository

Data Functionality
1. Easy
2. Flexible
3. Fast
4. Versatile

Data Storage and Usage
1. High Availability
2. Workload isolation
3. Scalibility
4. Locality

Platform Independence
1. Local
2. On-premises
3. Private Cloud
4. Hybrid Cloud
5. Public Cloud
6. Fully managed cloud service

Slide Courtesy: MongoDB
Research
from the concept into real prototype

Definition of scope
Define shopfloor data for usage in planning tools
Identifying dataflow in shopfloor and planning
Developing mechanism to merge and compare data sets
Implementation in prototype production cell
Evaluation and redefining

Advantages

− Standardized access of data points through usage of OPC UA information models
− Optimization of planning processes through automatized usage of real production data
− Decreasing the commissioning and reducing the ramp-up time in new projects
Thank you.