CoPro Integration Framework

Rapid integration of real time model based applications into heterogeneous IT system environments

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Assumptions & Goal

- Model based applications provide an important contribution to optimized plant coordination solutions
- Amount and quality of model based applications in industry increases
- Still a gap to integrate offline evaluated models into an online production IT System environment
- Goal is to reduce obstacles to realize online model based applications for plant cooperation applications and other model based online solutions
- Approach: IT Solution for real-time data orchestration of distributed model based plant coordination applications in process industries
How to integrate online model based applications seamless into several levels of an heterogenous industrial IT system environment?
Goal: Shrink time and efforts to bring model based online applications into industrial use
CoPro Integration Framework

Production Planning
Demand Supply Planning
Material Management
Supply Chain Management

Local control systems

Detailed Scheduling
Tracking
Reporting
Forecast
Decision Support
Plant Coordination

COPRO - Integration Framework

Interaction Master
Real-Time Model Integration

Optimizer &
Online Models
e.g. AIMMS
gPROMS
Dymola
MATLAB
ClearVu

Generic Data interfaces
SQL, SAP RFC, BPML, B2MML, ...

Generic Data interfaces
OPC DA, OPC UA, SQL, ...

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Generic Data interfaces
FMI API, OPC DA, ODBC, ...

MES
PIMS
LIMS

Advanced HMI

Data Reconciliation

Big Data Analysis

Plant Unit 1
Plant Unit 2
Plant Unit n

Networks (steam, hydrogen, intermediates, ...)
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Centralized Engineering

Flexible Distribution of runtime engines

Adaptable to specific requirements:
• Reliability
• Performance
• IT-Security
• Compliance
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Flow Rate

Tank Level

ERP
Advanced HMI
DSP
SCM

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Valve State

Schneider Electric
Honeywell
ABB
SIEMENS

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First Prototype Installation

Use Case INEOS in Köln
CoPro Integration Framework – Use Case

• INEOS in Köln operates an integrated petrochemical complex, processing mainly naphtha and natural gas as major feedstock to produce base chemicals

• More than twenty plants, more than ten utilities networks and a large number of storage tanks at site

• Complex interaction between the different plants and site logistics as well as with other plants owned by other companies in the chemical park

• Use case 1: “Optimal site and cracker planning and scheduling including the optimisation of single plants and DSR (Demand Side Response)”

• Covers optimization of coupled production processes and their coordination with the operation of the power plant, including purchase and production of electric power, switching on and off of units and scheduling of shutdowns

• One important part: Optimisation of the Ammonia Network at INEOS in Köln
**Application:** Optimisation of the Ammonia Network at INEOS in Köln

**Involved Partner:** INEOS in Köln, TUDO, LeiKon, SABISU

**Optimisation of Scheduling**
- Modelling done in Julia/JuMP by TUDO
- New HMI Approach developed by SABISU
- IT Integration by LeiKon

**Needed data (from different sources at INEOS in Köln)**
- Production targets (Demand Supply Planning Tool)
- Energy prices (Web Application)
- Initial conditions of the tanks, plants, apparatuses (DCS or OSI PI)
- Planned maintenance activities (SAP)

**Work Flow Management**
- IntexSuite serves as data handling tool and runtime environment
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L'OPRO - Integration Framework
Interaction Master
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Results & Trigger

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Plant Conditions
CoPro Integration Framework – Use Case

Daily site planning workflow up to now

1. Step: CoPro Workflow in parallel

SAP
OSI PI
DSP

Demand Supply Planning (Feasibility Check)

triggered

Scheduling

daily/weekly reports

Set-points

DCS

Results of optimizer

Excel

Innovative HMI

OSI PI

archived for further analyses

cyclic calculation or triggered

results

Logistics

CoPro Integration Framework

– Use Case

CoPro | Optimisation of the ammonia network at INEOS in Köln | confidential
CoPro Integration Framework – Use Case

Vision of Follower Projects & Business Case INEOS in Köln beyond CoPro

- DSP (Feasibility Check)
- SAP
- OSI PI
- Logistics
- DCS
- DCS
- DCS

Results of optimizer
daily/weekly reports

Innovative HMI

Scheduling Engine

Cyclic calculation or triggered

results

archived for further analyses
**CoPro Integration Framework - Benefits**

**Benefits for TUDO as a typical model developer**
- supports “rapid prototyping and development”
- no need to implement interfaces to production IT systems
- can concentrate their efforts to core competence of model development
- can use open visualization features without need to develop and to deliver it by means of model development tools
- online data validation features can be swapped out of the model part
- smooth support especially in the commissioning and model adaption phases
- archived results of model calculations can be used for further model improvements
- strategies for online model adjustments (rolling horizon) can be implemented

**Benefits for INEOS in Köln as a typical use case provider**
- can modify model parameters without touching the code
- can transfer model results to other systems in a flexible way
- can use established as well as innovative HMI interfaces
- can change models and model provider without need to develop a whole application
- rapid and secure use of online model based applications
The projects leading to this application have received funding from the European Union’s Horizon 2020 research and innovation program
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www.spire2030.eu/copro