Daniel Huber, 12. May 2015

Industrie 4.0 -
Possible use cases in the process industry
International Conference – Tallinn, Estonia

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St. Peter‘s Square in Rome

4. April **2005**, Pope John Paul II. died two days before

8 years later (**2013**):
His successor Benedikt XVI. has stepped down, a new Pope has been elected

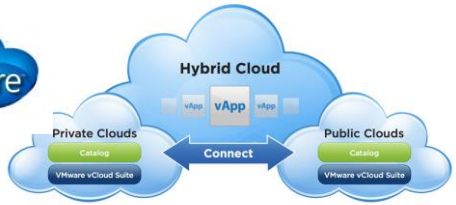
Quelle: www.spiegel.de

Industrie 4.0
The 4th industrial Revolution

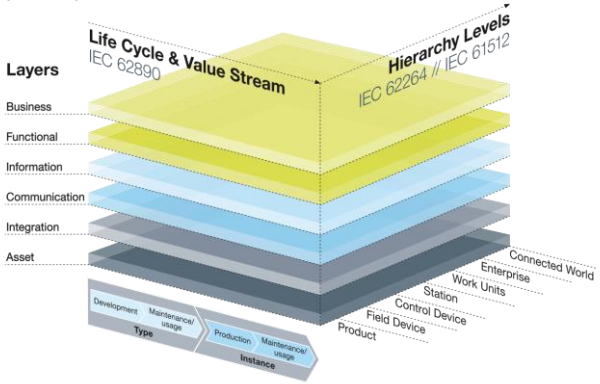
- 2013: Most people older than 14 years own a cell phone; more than 70 % a smart phone
  - New Generation „Y“ (employees, operators, …)
  - New requirements on Human Machine Interface
  - Attractiveness of industrial work needs to be improved
- The majority of process data coming from sensors and actuators is not used today, since not needed for control
  - In future, data is available in form and numbers as never before and can be processed in “real time”
  - Potential for availability, productivity and quality
- „In Germany we need to learn to produce SW as we produce cars”
  - Germany depends on Asia (CN, KR) for HW, e.g. Smartphones and USA for SW, e.g. Google Android
- Change in consumer behavior leads to change in production and related value chains
  - E.g. „Lot size 1“ in car production
  - Impact for the process industry

Source: JIM-Studie, Fraunhofer Institut

Industrie 4.0 for the process industry



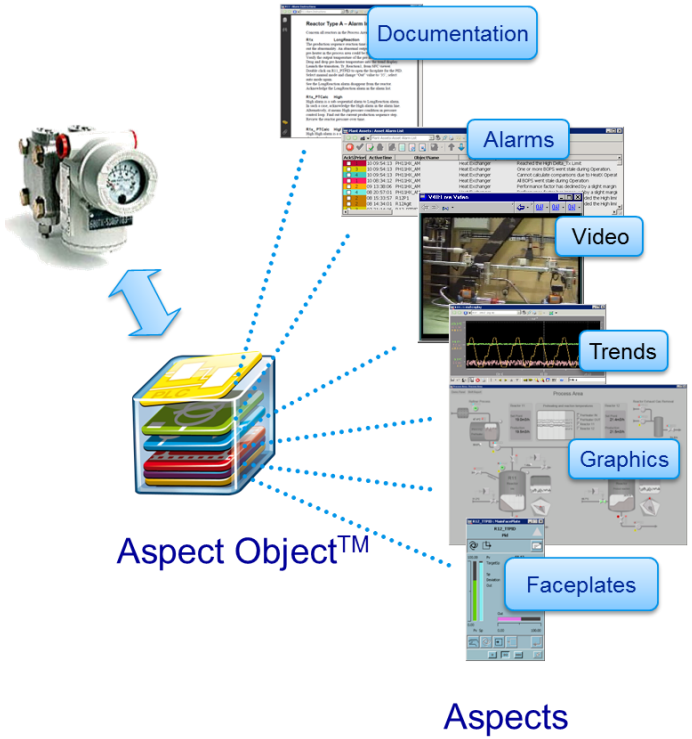
Reference Architecture Model Industrie 4.0
(RAMI4.0)



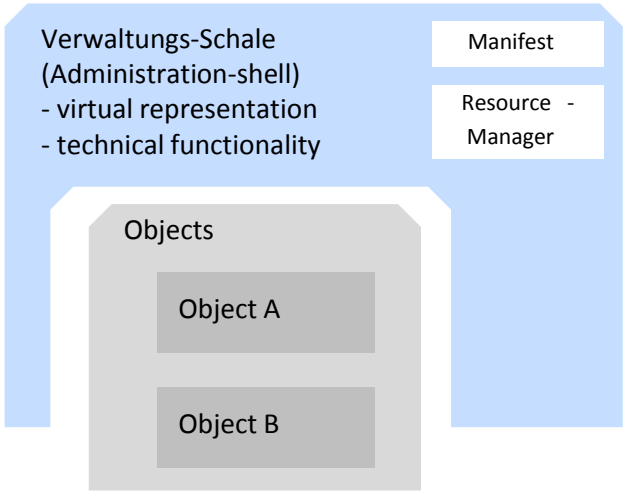
Technology is available; first proprietary products are available; standards to be worked on

Industrie 4.0 Komponente
Industrie 4.0 Component

ABB 800xA Aspect Object™

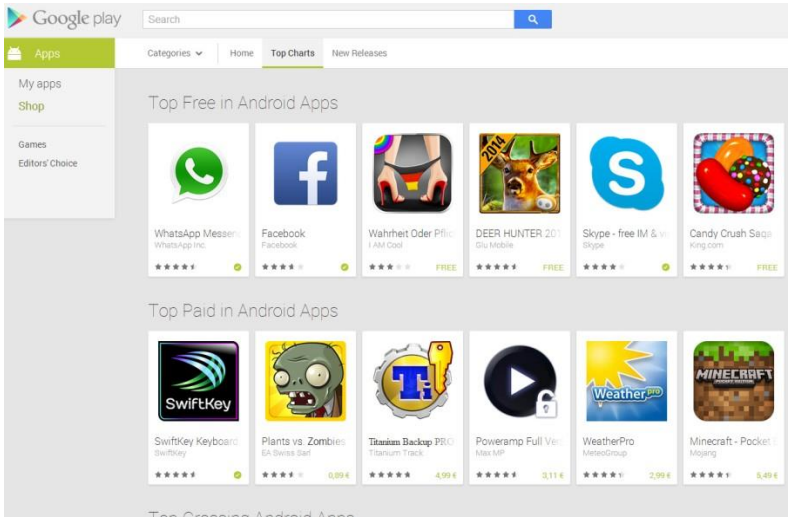


Industrie 4.0-Komponente



Proprietary Solutions already in use

Dystopian Vision – „The Circle“ from Dave Eggers
Full Transparency



2014

2020

Data security and Data safety are key topics

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Industrie 4.0
Market Needs – Example Chemical Industry

- Equal capacity utilzation
- → Functional flexibility

Multi-Product / Multi-Purpose Plants

- Plant Expansion
- → Consistent, supplier independent interfaces

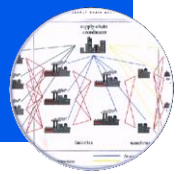
Modular Plants / Package Unit Integration

- Demand driven production capacity
- → Scalability (fast increase or decrease of production capacity)

Flexibel „scalable“ Plant capactiy

- Globalisation
- → Location flexibility

Distributed Production

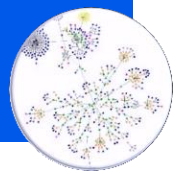


- Heterogeneous and global markets
- → Standardization

Supplier independence

- Communication infrastsructure
- → Availability of information

Connected Value Chains



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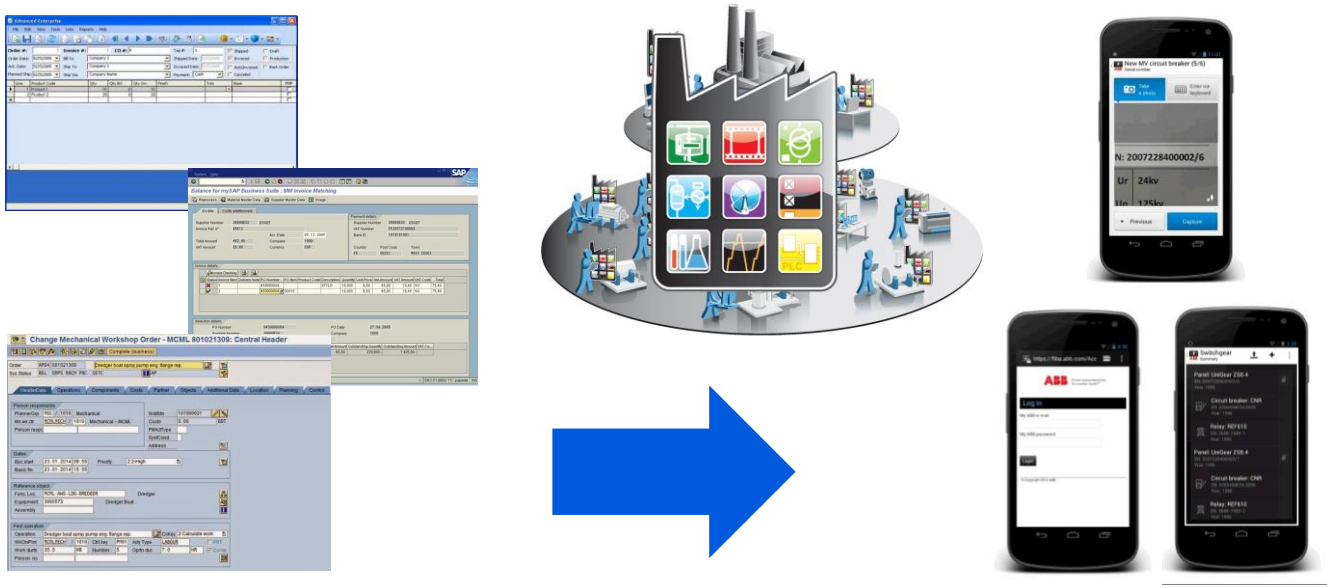
Mobile Applications (Apps) – new user interfaces
Example – FIBA mobile Service App



- Workingprocesses using mobile applications
  - iOS, Android
- User friendly and optimized interaction- Ease of Use
- Adapted user interface – Look & Feel

FIBA = Field Installed Base Analyzer

After-Sales-Service
Example– Smart Helmet

- Integration of Service Data in user interface of the next Generation
- 3D Analysis of the work environment
- „Hands-free“ user manuals
- Support for less experienced personnel
- Alarm message to service technician regarding unsafe situations

Quelle: DAQRI Smart Hellmet

Vision – the intelligente plant
Semi-autark Operation

Alarm & KPI Storage Cluster

Cassandra

Powered by Windows Azure

Big Data Analytics Cluster

hadoop MapReduce

openstack CLOUD SOFTWARE

CLOUD FOUNDRY

Smell

Temperature

Movements

Sounds/Noise

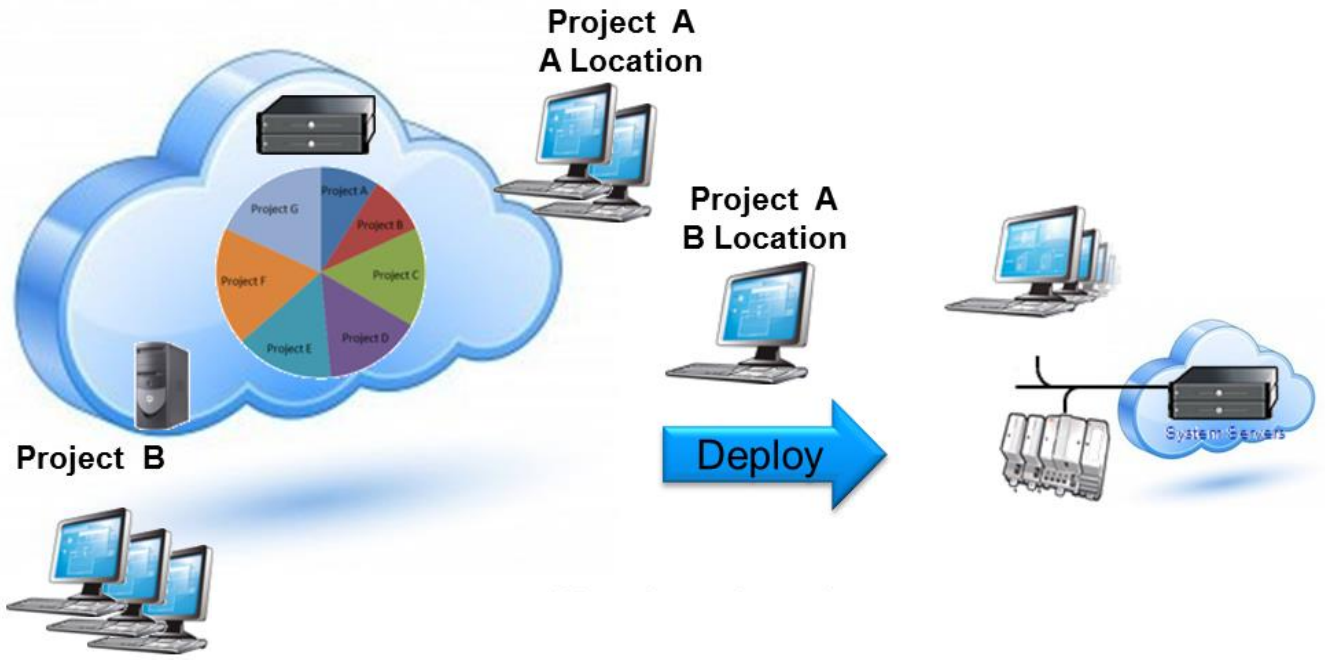
OPC Unified Architecture

Virtual Plant – Virtual Commissioning

Virtual Plant / Virtual Commissioning

- As preparation for the actual production
- Every process is first simulated and verified
- The physical mapping will be done only when final solution is available

Virtual Engineering – Cloud Engineering



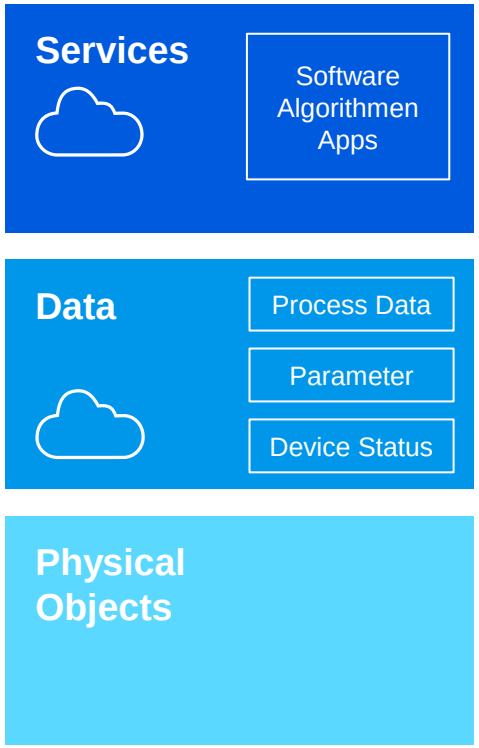
- **Cloud Engineering**
  - Hardware and supplier independent
  - Scalable resources
  - Use of various supplier applications

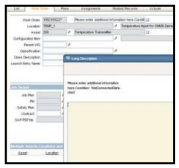
Plug & Produce
Vertical Integration with FDI and Industrie 4.0

FDI – a new standard for field device integration

… but what happens to installed base?

… and what happens when Industrie 4.0 comes?





Maintenance Mgmt

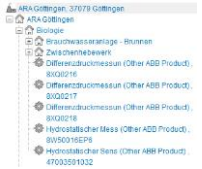
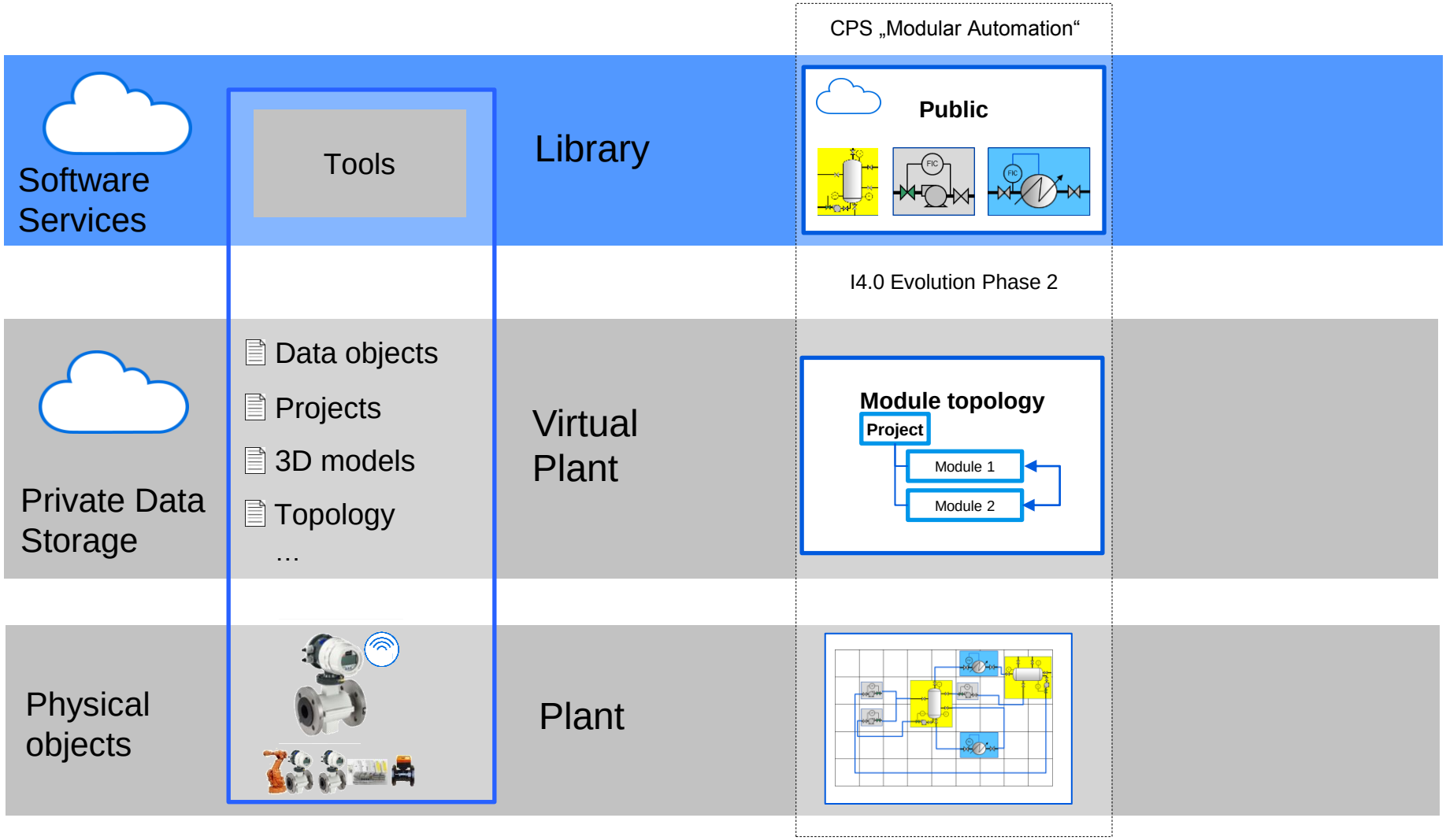


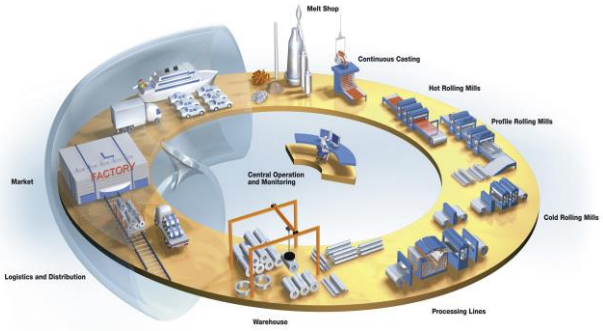
ABB *My Control System* Portal

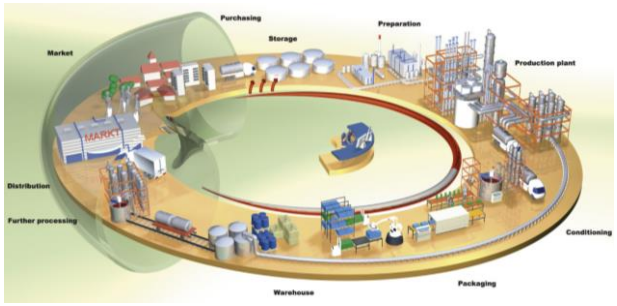
Field Devices

Modular Plant as Cyber Physical System



Big Data for the value chain
New opportunities due to data analysis





Use of

- Production Data
- Customer Data
- Energy Prices
- Installed Base Information
- Logistic Costs
- Weather Information

For Optimization of

- Plant Productivity
- Plant Availbility
- Environmental Impact
- Resource-/Enery Efficiency

Alarm Management in the Cloud
For enterprise wide data

New methods

- Data storage of all data in a scalable, low cost Cloud
- Utilization of data across devices, systems, and plants
- Modern data analysis by means of cloud technologies

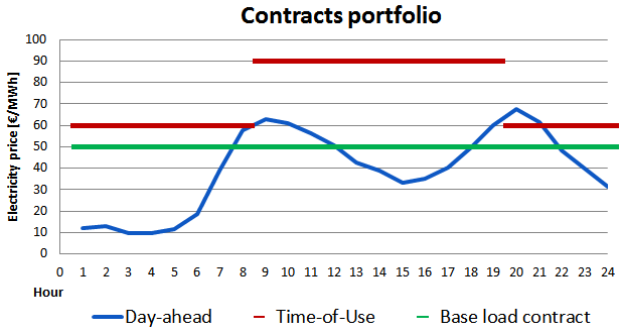
Global, central, cost efficient

- Enterprise wide view support corporate standards
- Cost recuction by means of central HW and maintenance

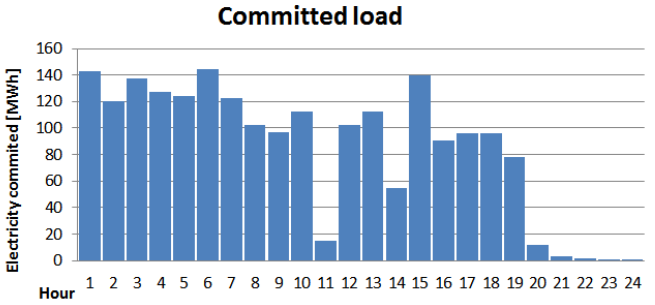
Simple

- Easy add on of further plants
- Collaboration: Reuse of configurations

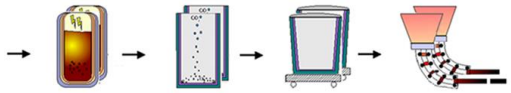
Scheduling of Energy-Intensive Processes
Energy Management Aspects



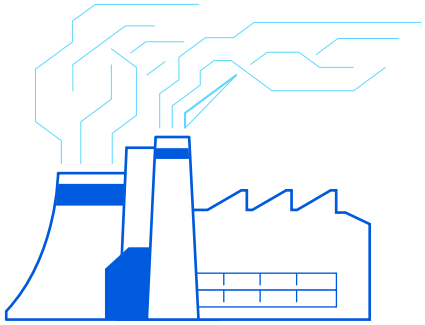
Multiple contracts – time dependent price levels



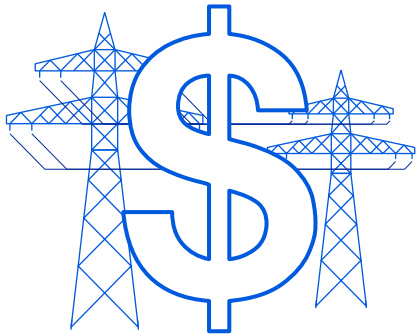
Pre-agreed load curve – penalties for deviation



Demand from production process



On-site generation – with special constraints



Selling back to grid

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Summary

- Industrie 4.0 will bring digitalization into the process industry
- Stepwise introdution of new products, methods, and business models (4th industrial Revolution)
- Industrie 4.0 leads to shorter Time-to-Market
- Chemical Industry has already adopted Industrie 4.0, other process industries (Steel, Pulp & Paper, etc) will follow

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for a better world™