



PLC VIRTUALI & CLOUD: TECNOLOGIE ABILITANTI PER LA NUOVA AUTOMAZIONE (Software-as-a-Service)

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BECKHOFF



Corporates goals

Machine builders

- Reduce **machine costs**
- Smart **machine optimization**
 - ✓ Optimize production cycle times
 - ✓ Optimize energy consumption
- Efficient **machine maintenance**
 - ✓ Dedicated and predictable
- Increase **machine attractivity**

End customers

- Reduce **production costs**
- Increase **product quality**
- Efficient **production control**
- Minimize **production losses**

→ **Increase competitiveness !!!**

Corporates goals

Simple route from data recording to dashboard



Corporates goals

Simple route from data recording to dashboard:

1. Data logging: a number of different **fieldbus systems** can be used to record a machine's sensor data, with use of existing cabling and **different topologies**.



Corporates goals

Simple route from data recording to dashboard:

2. Communication: the recorded sensor data can be communicated onward on the basis of **communication standards**, which can be integrated **simply** and **securely** into **existing IT infrastructures**.



Corporates goals

Simple route from data recording to dashboard:

3. **Data historicisation:** the entire communication data can be stored in a **long-term archive**.



Corporates goals

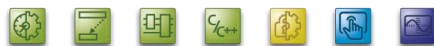
Simple route from data recording to dashboard:

3. Analysis: the user **views** data and **configures** his **analyses** in the runtime engineering. From this configuration, **completed PLC code** can be generated.

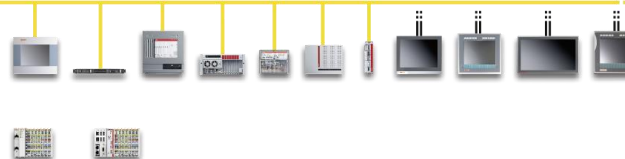


Corporates goals...how?

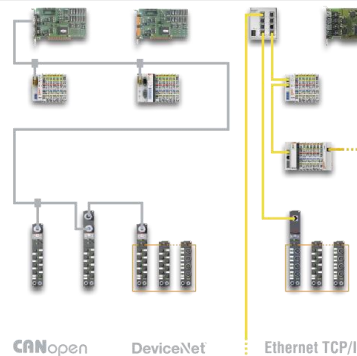
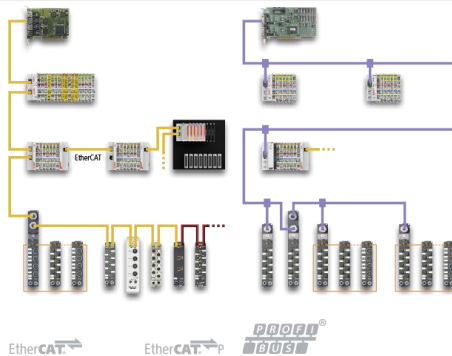
Automation



IPC



I/O

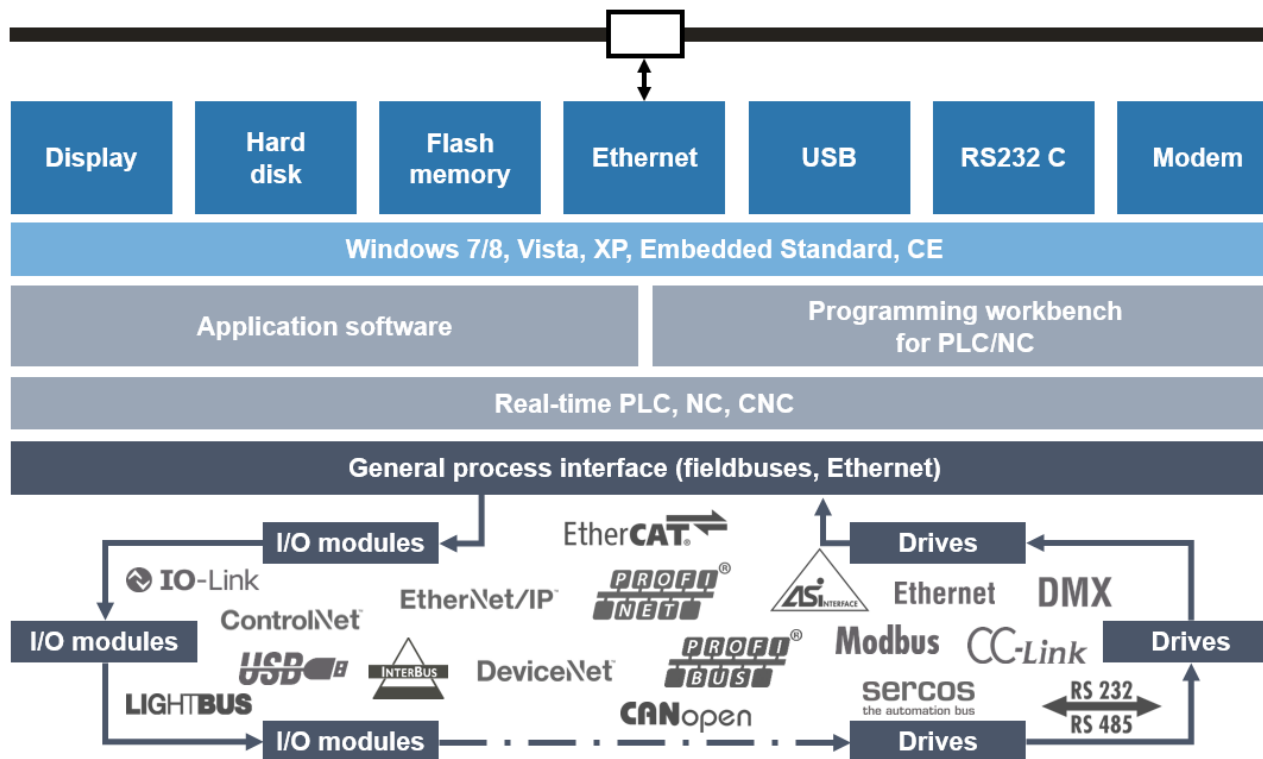


Motion



...implementing **open automation** technology...

Corporates goals...how?



...based on **PC Control** technology!

Requirements

Vertical: SCADA / MES / ERP with PLC

- ✓ Access to process data in PLC

Horizontal: PLC with PLC

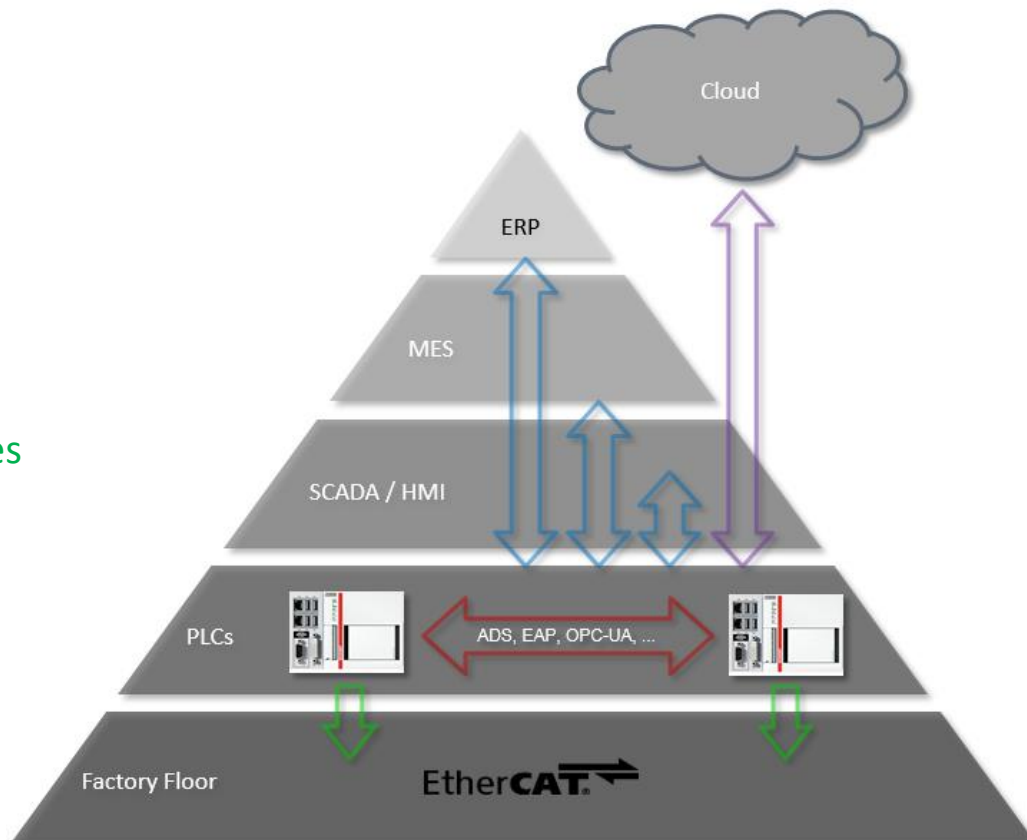
- ✓ Protocol access for data exchange

I/O: PLC with Fieldbus

- ✓ Access to data profiles in shop floor devices

Cloud: PLC with Cloud

- ✓ Access to Cloud for Data Logging



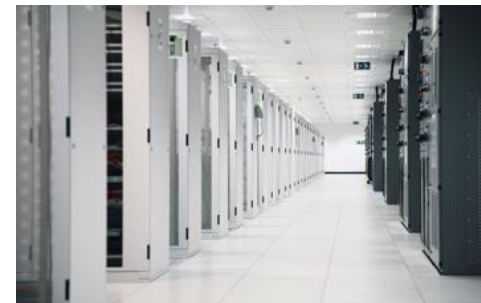
Implementation Strategies

More and detailed data

- ✓ Metadata
- ✓ Easy and secure data access
- ✓ Infinite data storage

Powerful and scalable tools

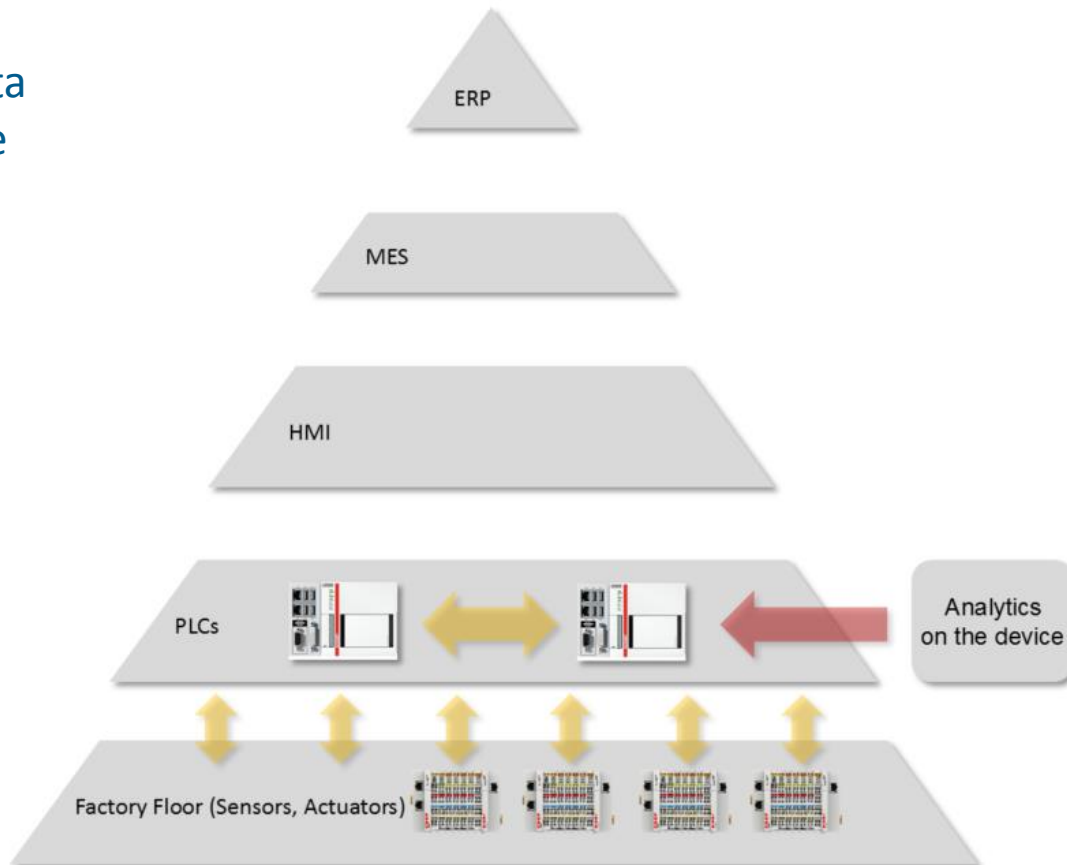
- ✓ Location-independent availability
- ✓ High usability
- ✓ High uptime and reliability
- ✓ Easy integration into infrastructure
- ✓ Use of standards



Implementation Strategies

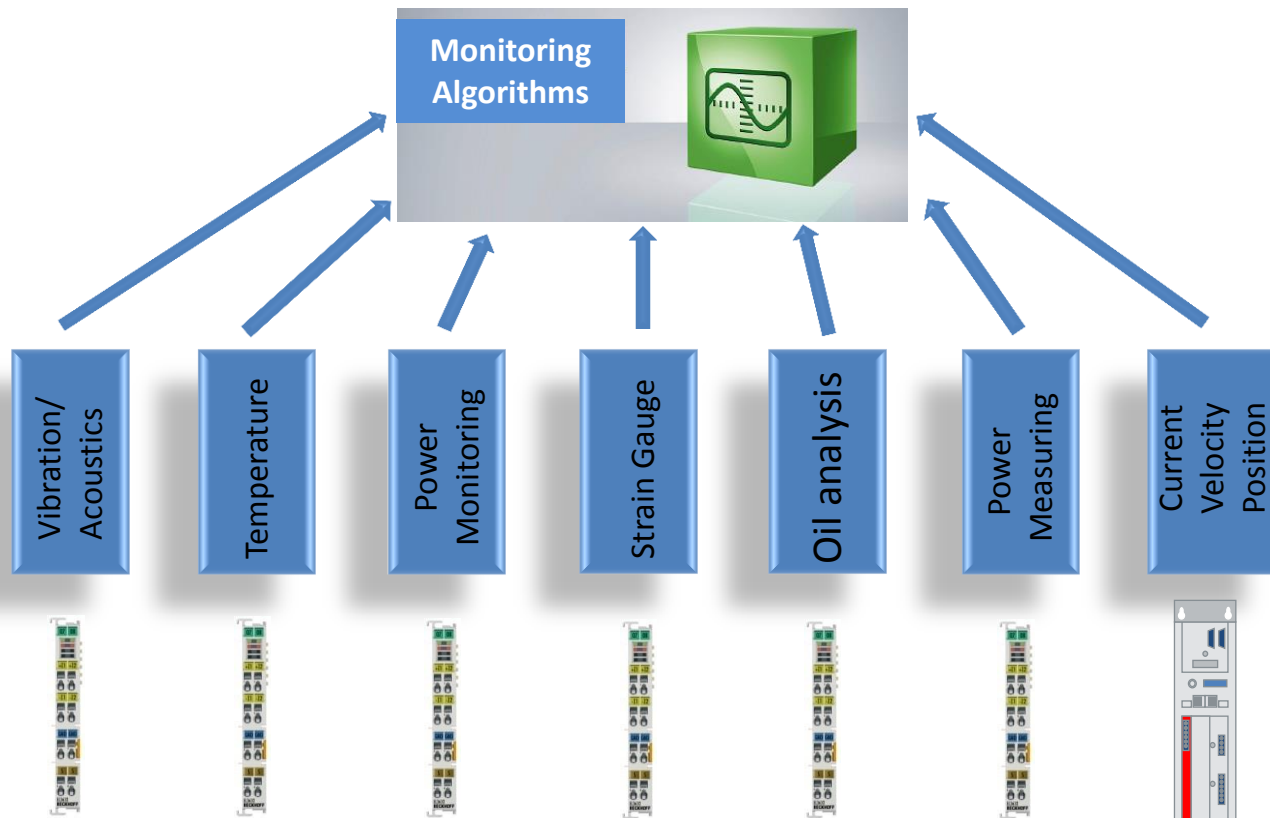
“More detailed data”

- ✓ Capture more process data
- ✓ Data transport / exchange
- ✓ Data storage
- ✓ Data analysis
- ✓ Data security



Implementation Strategies

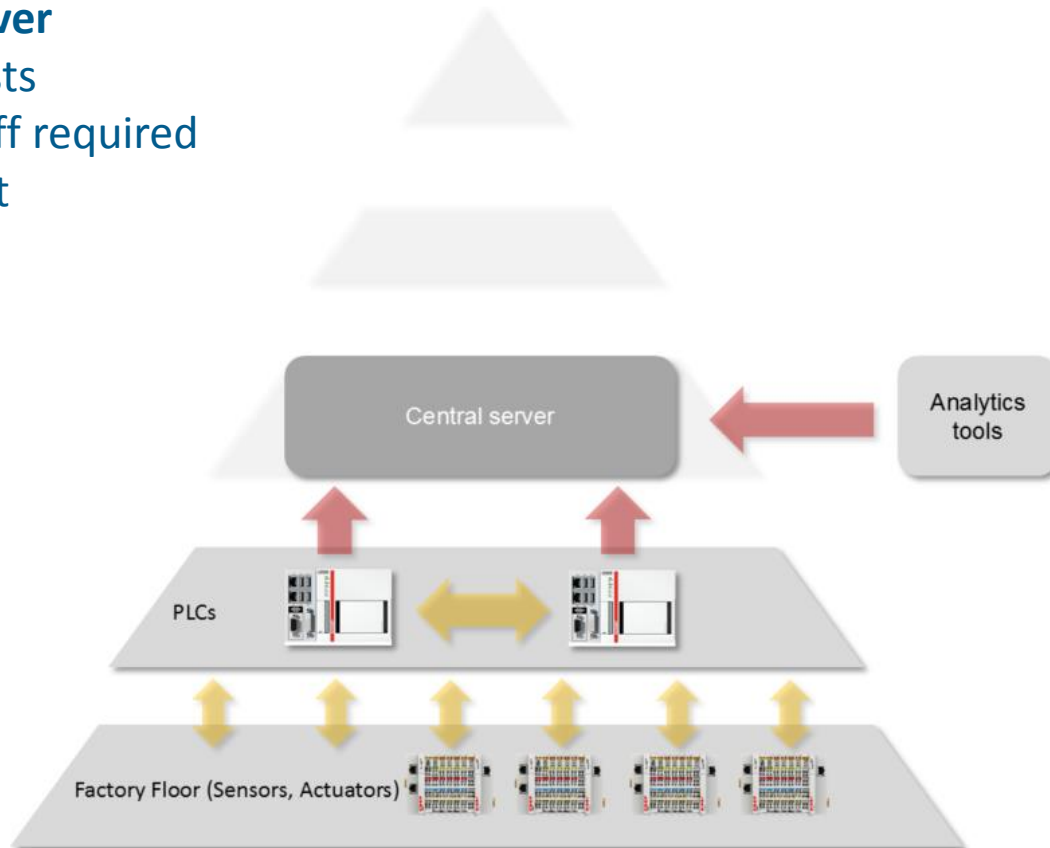
Example: Condition, Power Monitoring



Implementation Strategies

Current solution: **central server**

- ❌ High hard-/software costs
- ❌ High know-how and staff required
- ❌ High maintenance effort
- ❌ Poor scalability
- ✅ Good security

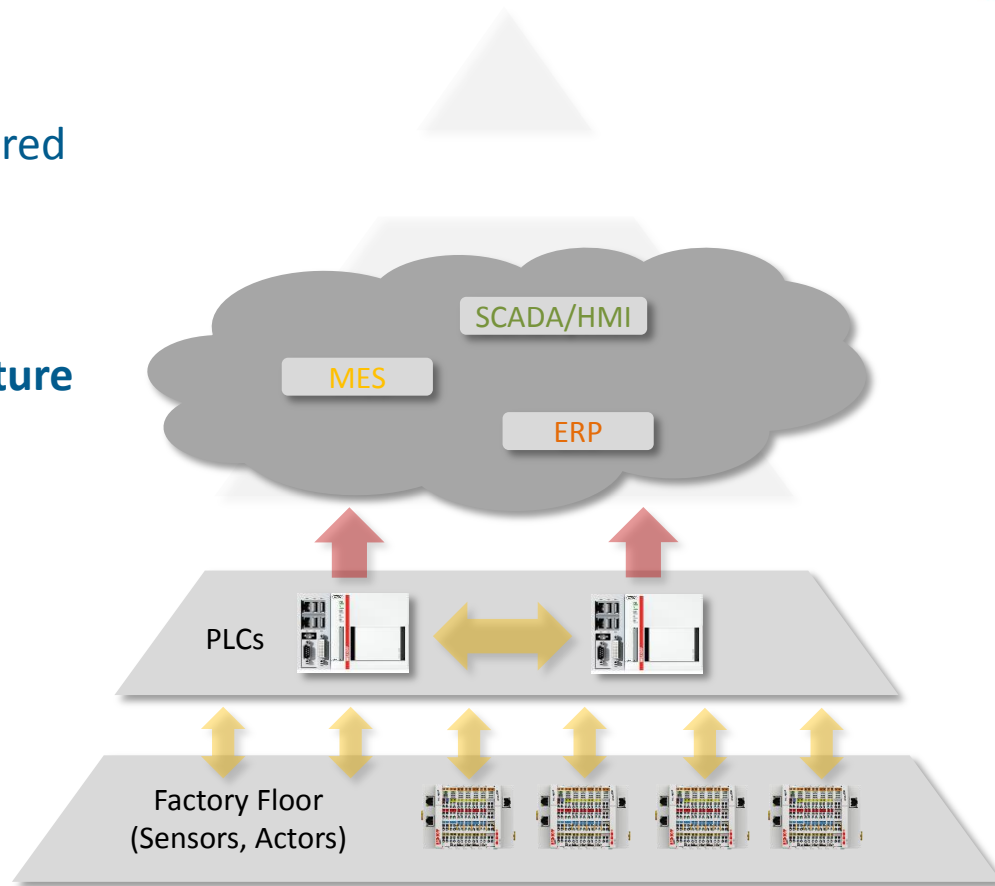


Implementation Strategies

Better solution: **Cloud services**

- ✓ Low hard-/software costs
- ✓ Little know-how and staff required
- ✓ Low maintenance effort
- ✓ Great scalability
- ✓ Good security

The cloud breaks the classical structure

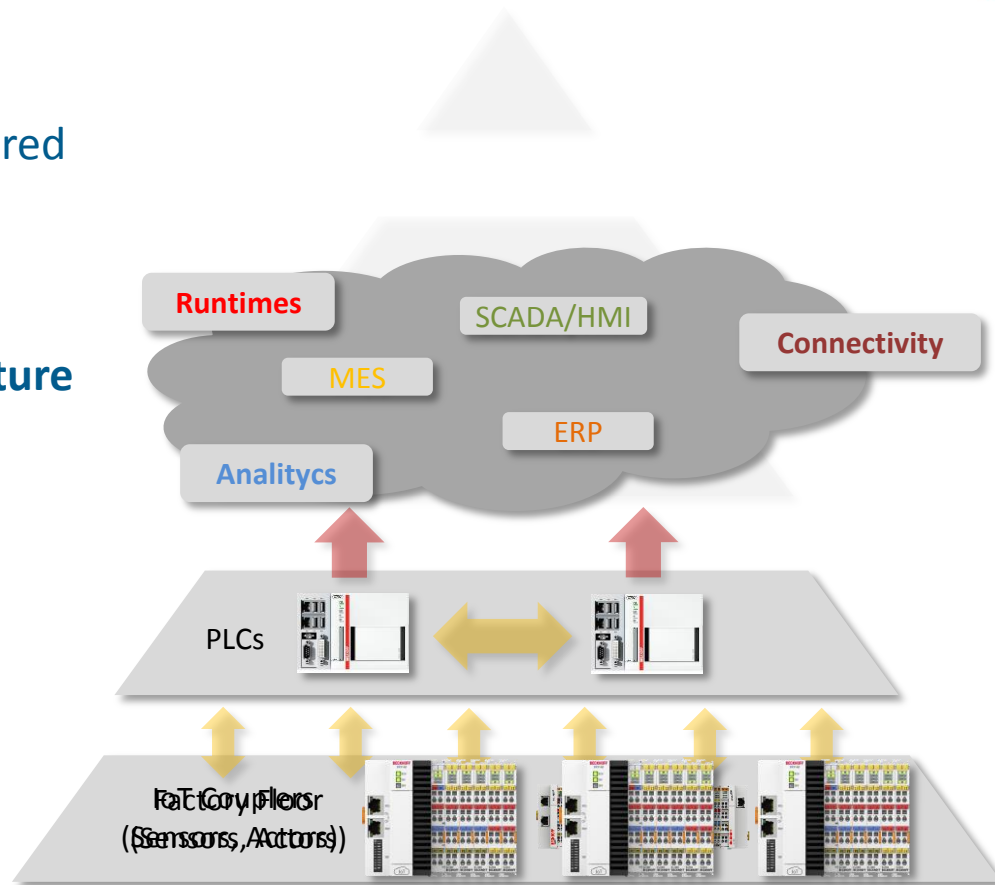


Implementation Strategies

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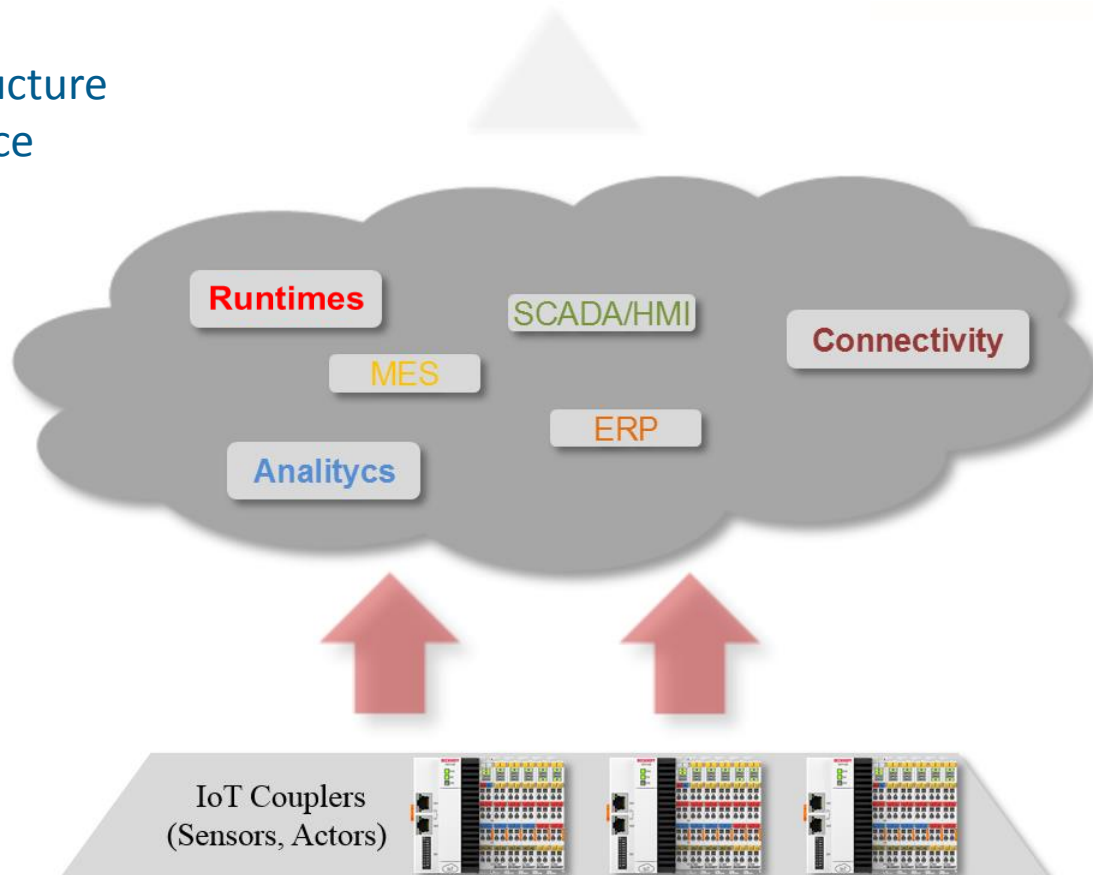


Implementation Strategies

Better solution: **Cloud services**

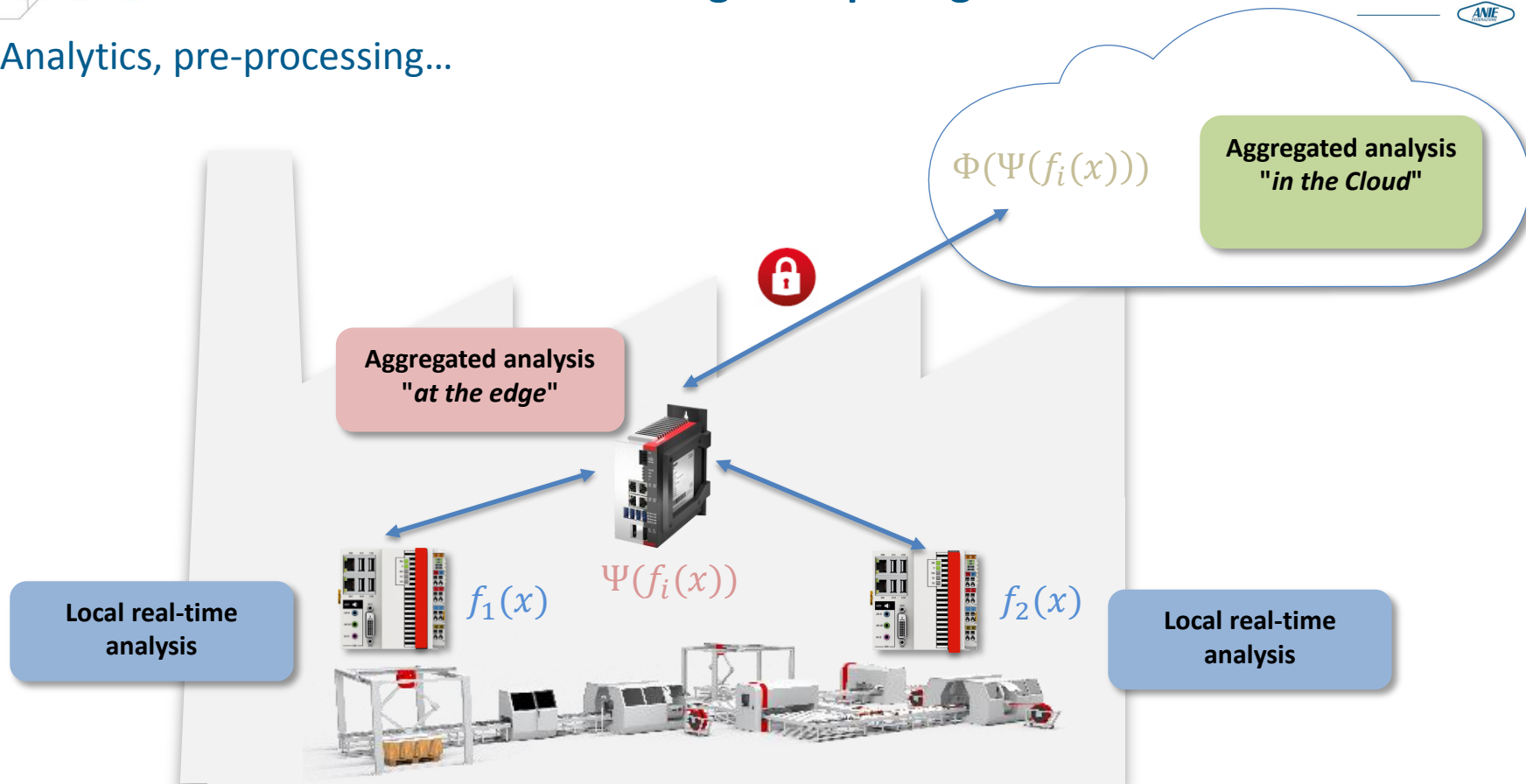
The cloud breaks the classical structure

- ✓ **IaaS**: Infrastructure as a Service
- ✓ **PaaS**: Platform as a Service
- ✓ **SaaS**: Software as a Service



Use case: local and edge computing

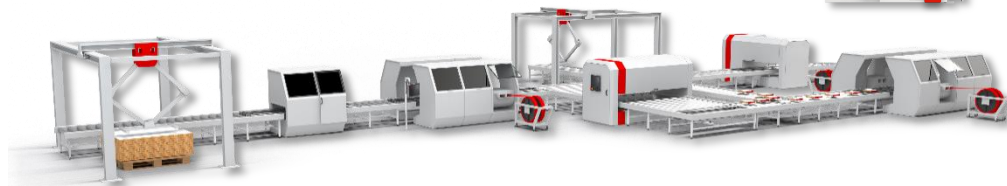
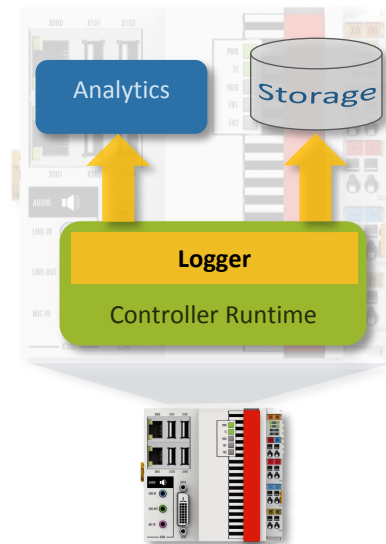
Analytics, pre-processing...



Scenario

Analytics as Local Application

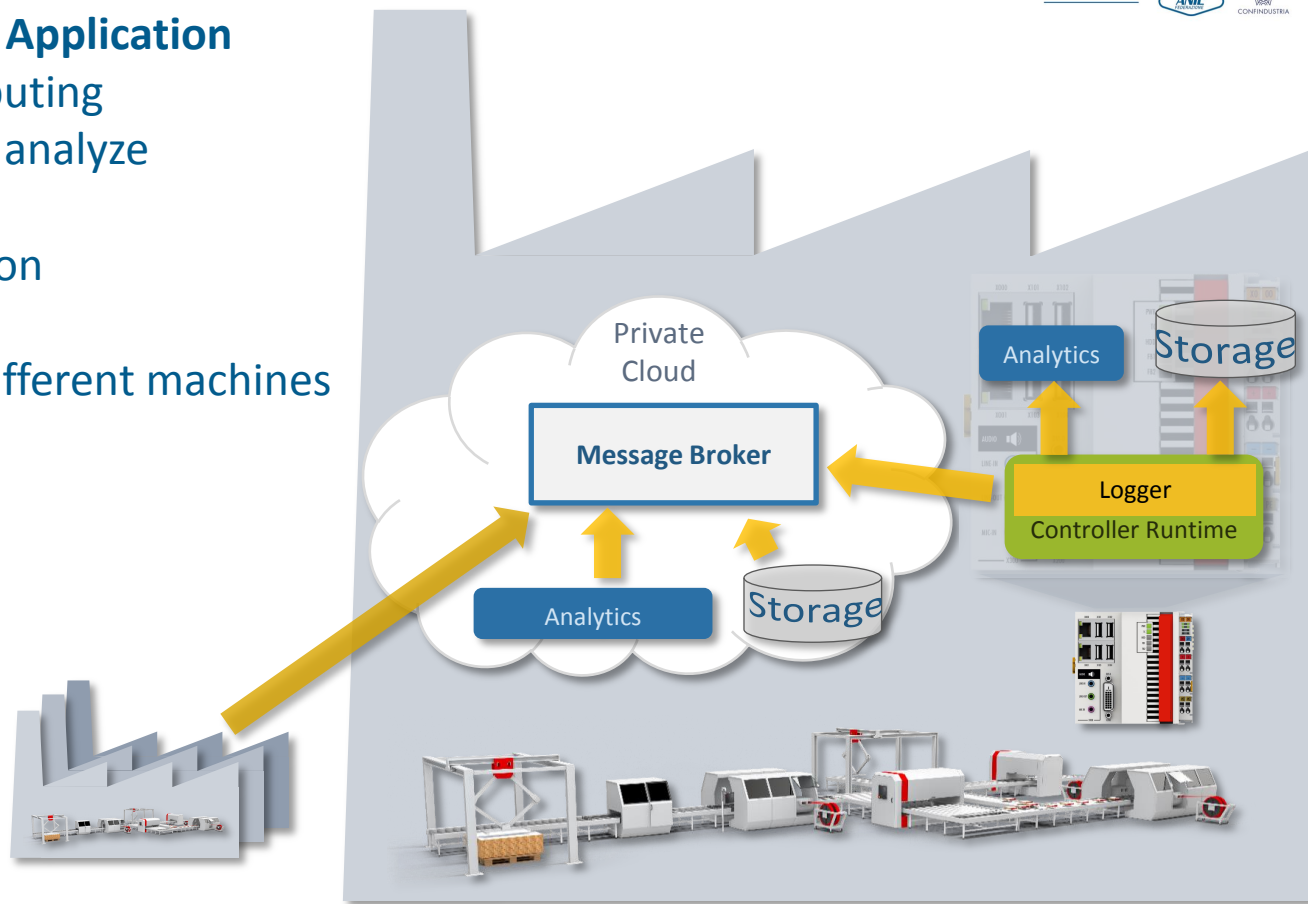
- ✓ Cyclic data logging
- ✓ Local data storage
- ✓ Local analyses



Scenario

Analytics as Private Cloud Application

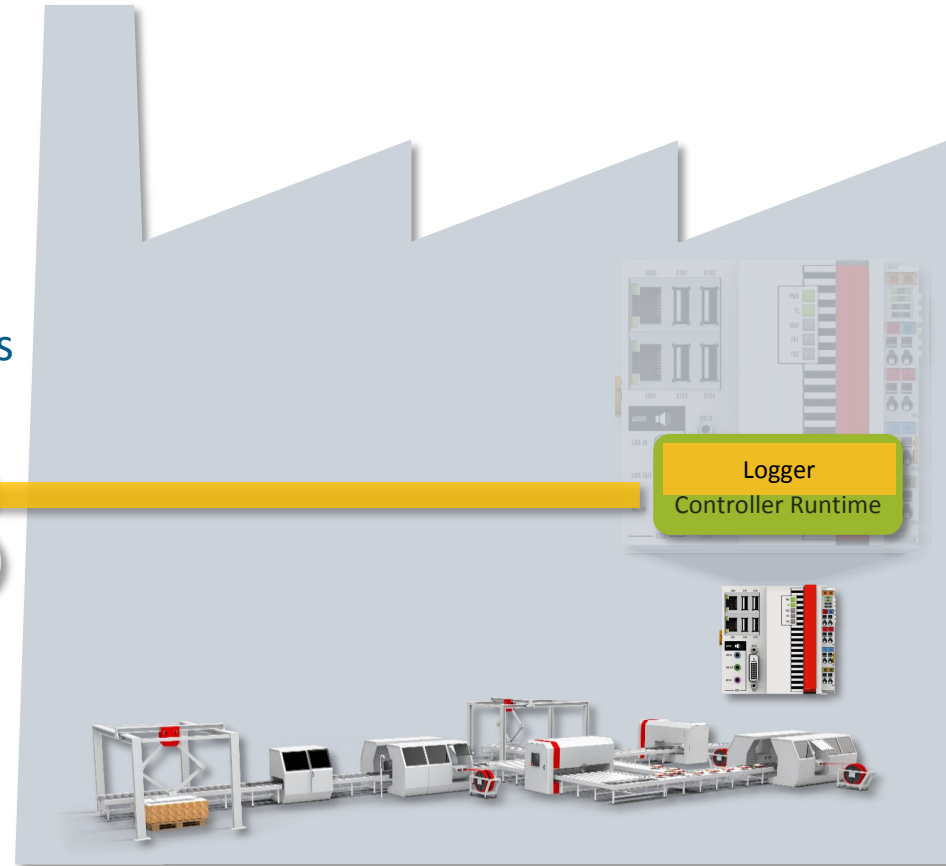
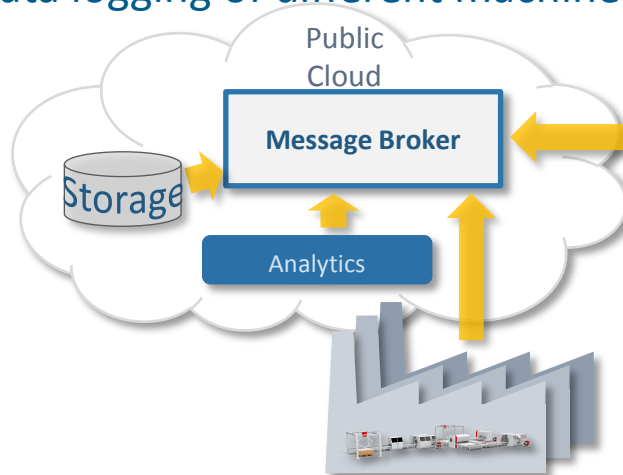
- ✓ Use private cloud computing within your network to analyze and aggregate data
- ✓ Communication based on IoT technology
- ✓ Cyclic data logging of different machines



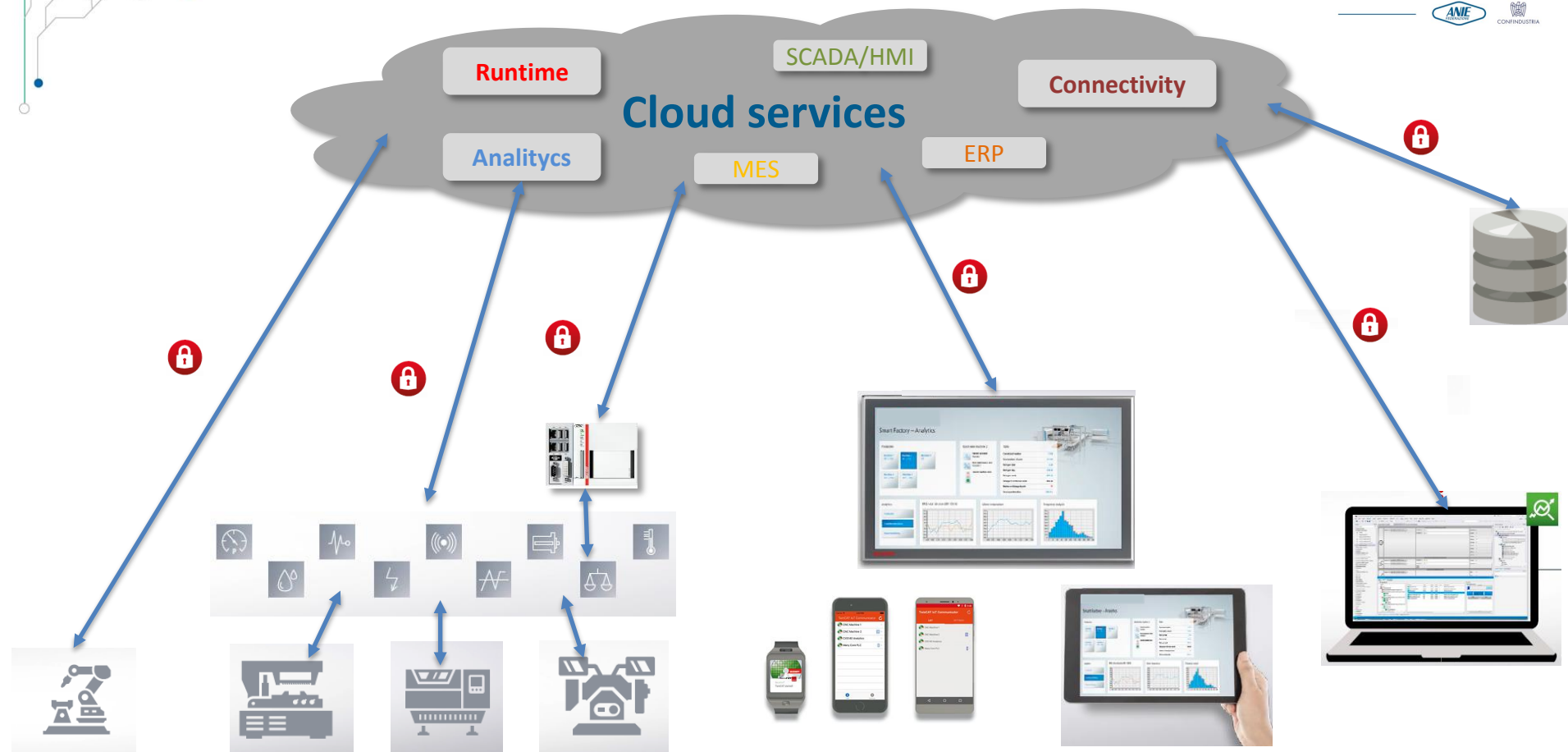
Scenario

Analytics as Public Cloud Application

- ✓ Use public cloud computing within your network to analyze and aggregate data
- ✓ Communication based on IoT technology
- ✓ Cyclic data logging of different machines



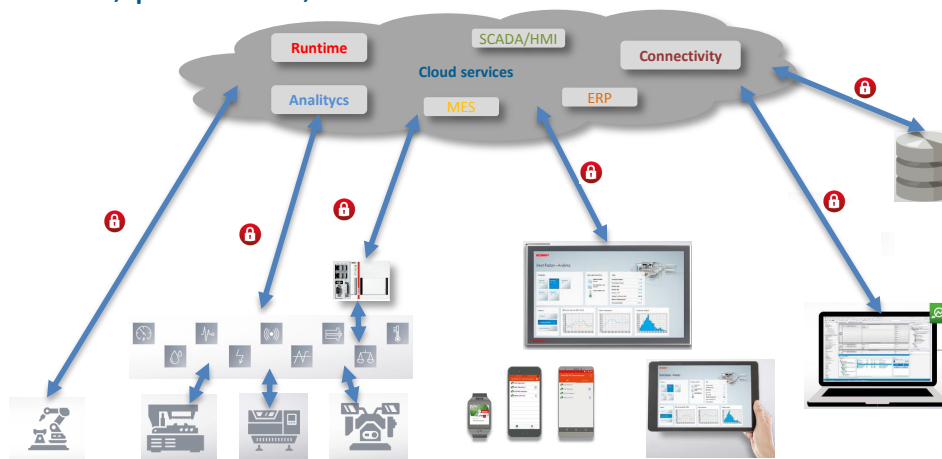
Use case: Cloud-based services



Use case: Cloud-based services

Cloud-based services:

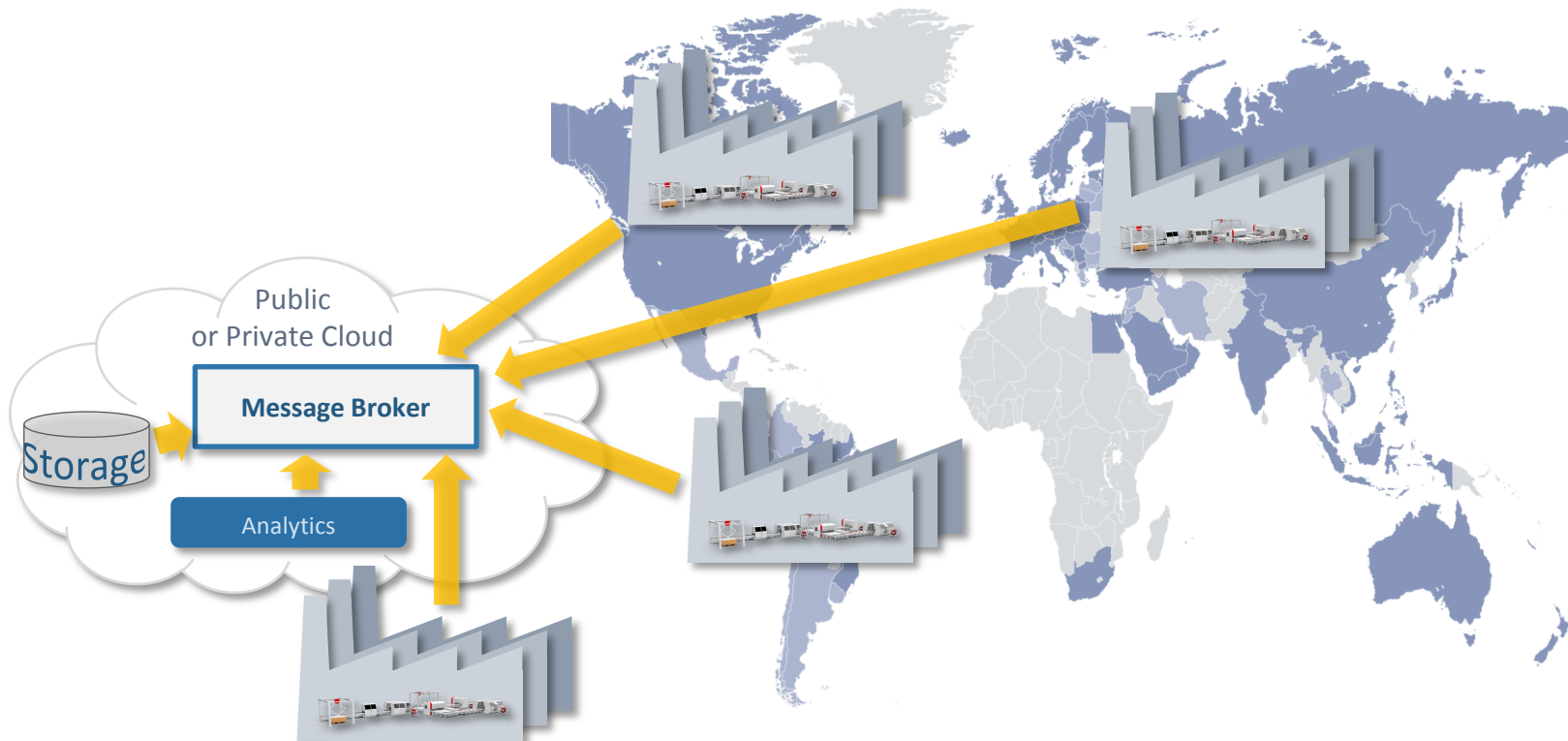
- Within the IoT everyone can communicate with everyone – “**dehierarchization**”
- Important informationen will be send directly **from the source**
- Complex analysis is available for the **smallest devices** / “things”
- Machine independent **data-aggregation**
- **Optimized** of products, processes, machines and maintenance



Scenario

Analytics as Public or Private Cloud Application

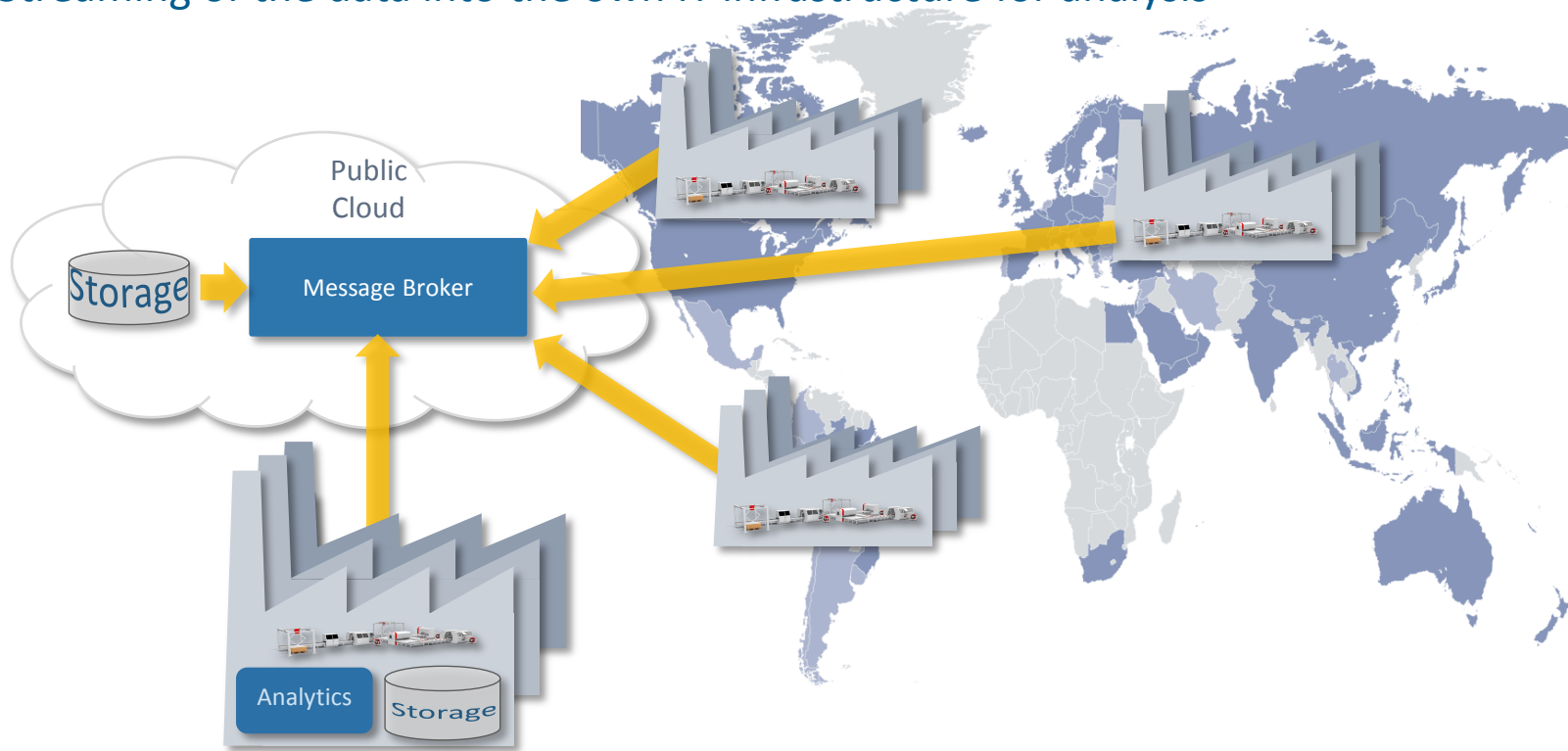
- ✓ Cloud computing enables easy global machine analysis



Scenario

Analytics as Public or Private Cloud Application

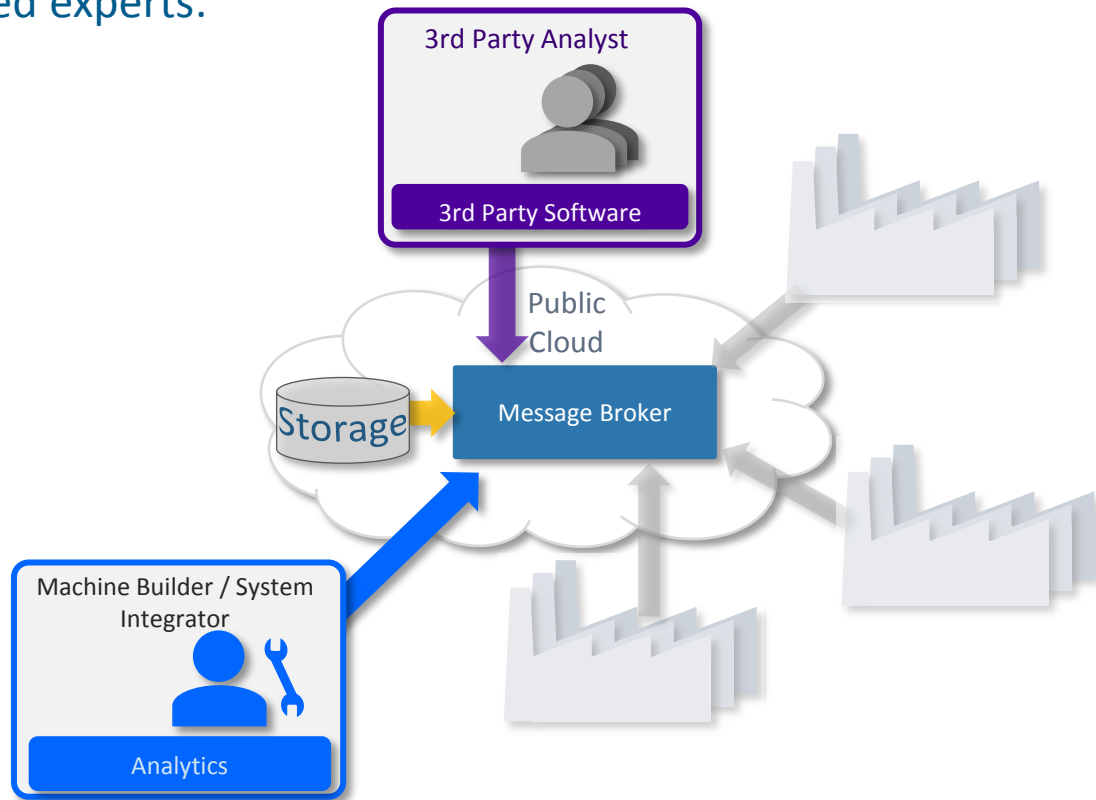
- ✓ Streaming of the data into the own IT infrastructure for analysis



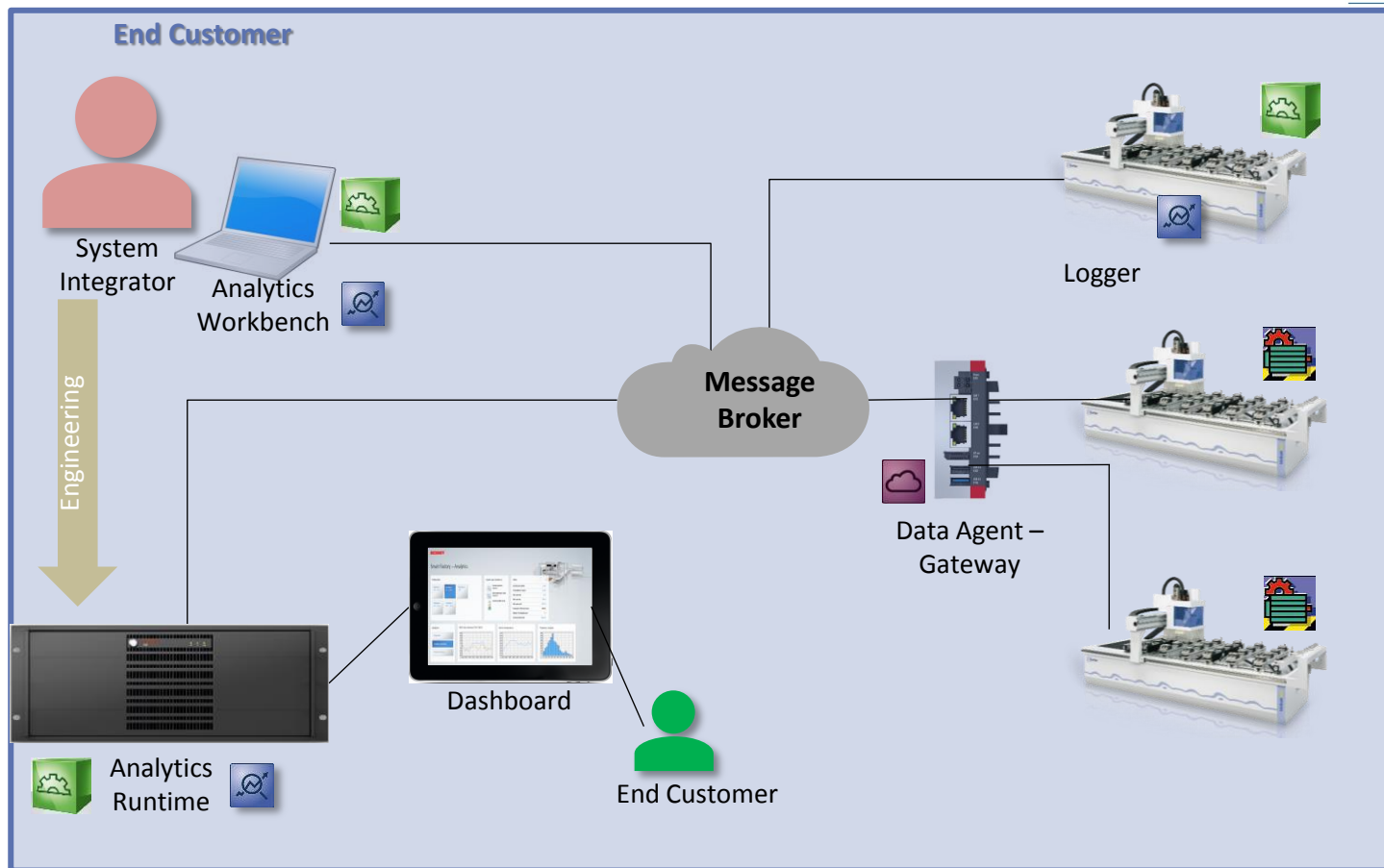
Scenario

Analytics as Public or Private Cloud Application

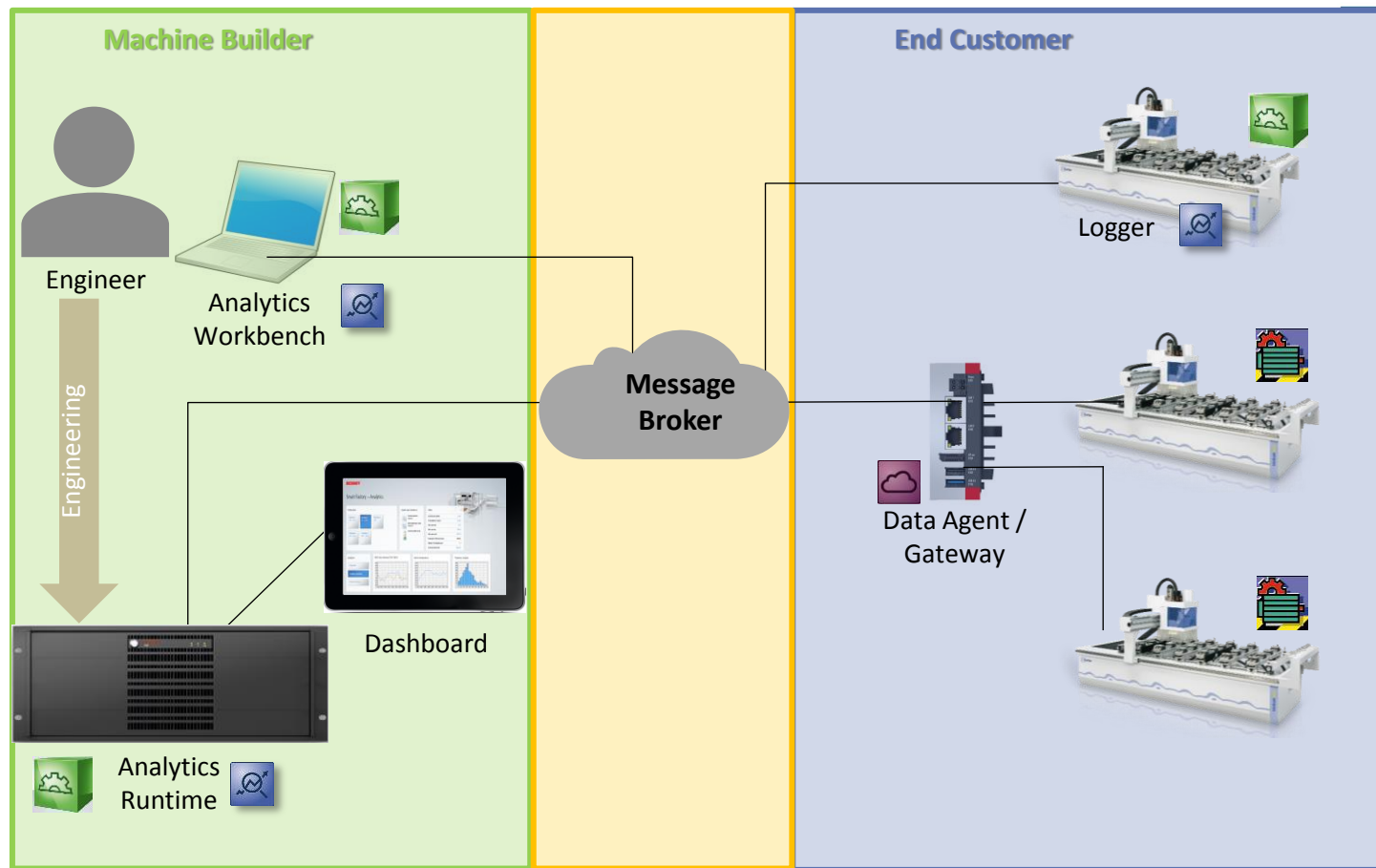
- Give partial data access to specialized experts:
 - ✓ Machine optimization
 - ✓ Support
 - ✓ Condition Monitoring
 - ✓ Maintenance
 - ✓ ...



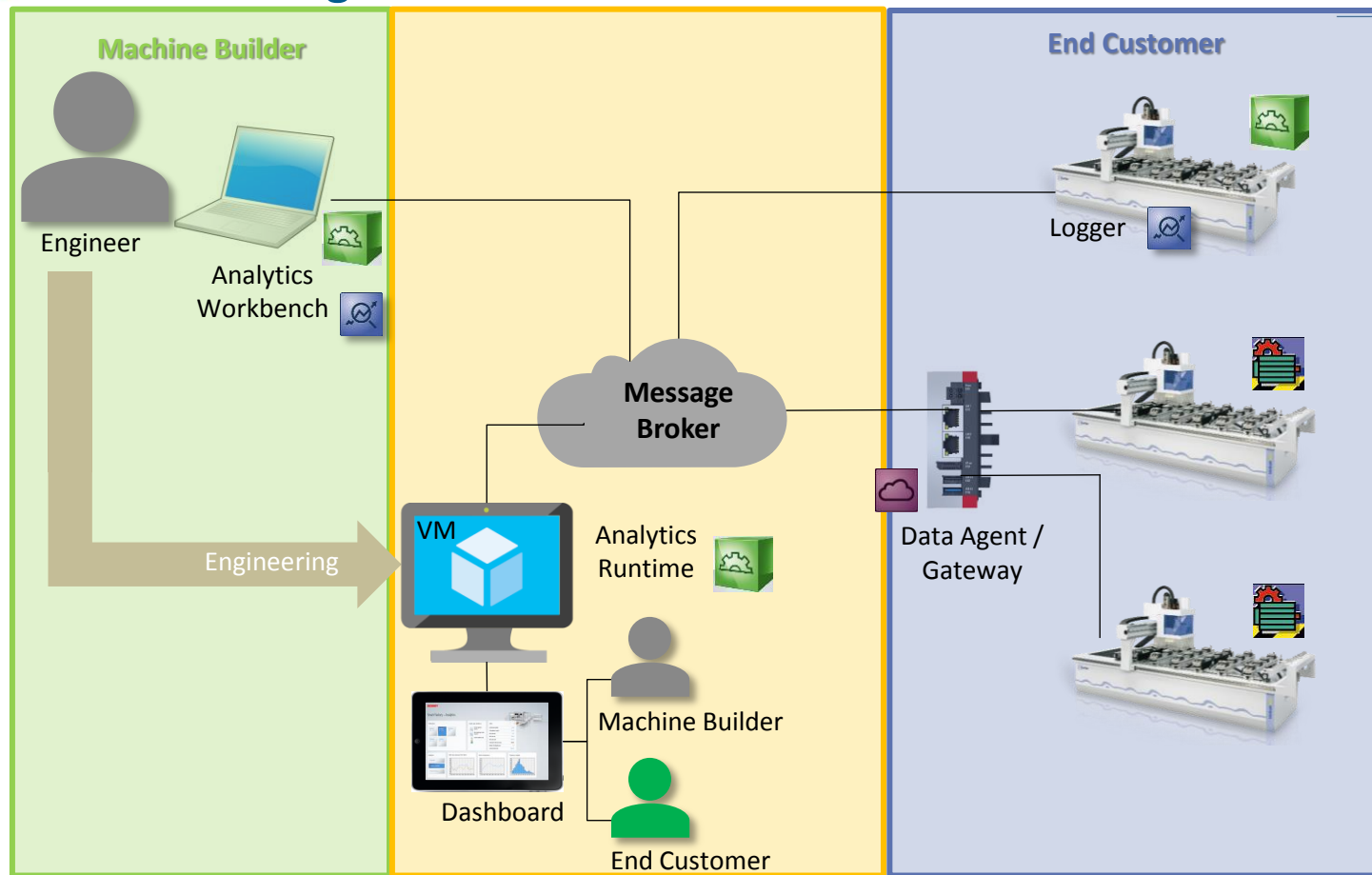
Challenge – End Customer



Challenge – Machine Builder New Services



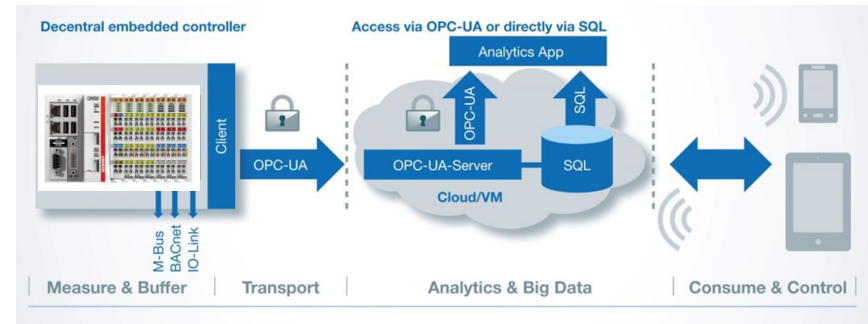
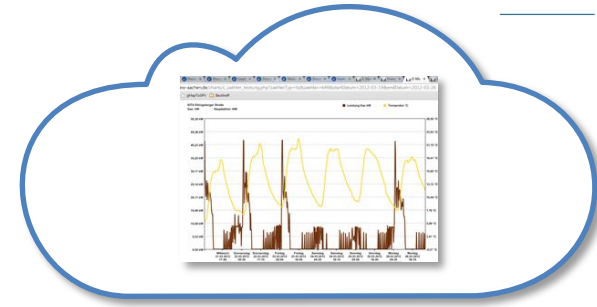
Challenge – Scenario Cloud Virtual Machine



Success story

Regio-IT Smart Metering (2014)

- Decentral measurement of energy data
- Data e.g. gathered via M-Bus
- Optional local buffering of data
- Central database for historical data
- Self-configuration on startup:
 - ✓ Sampling rates
 - ✓ Buffer size
 - ✓ Endpoint URL
 - ✓ ...
- Secure connection via OPC UA
- Central website as frontend

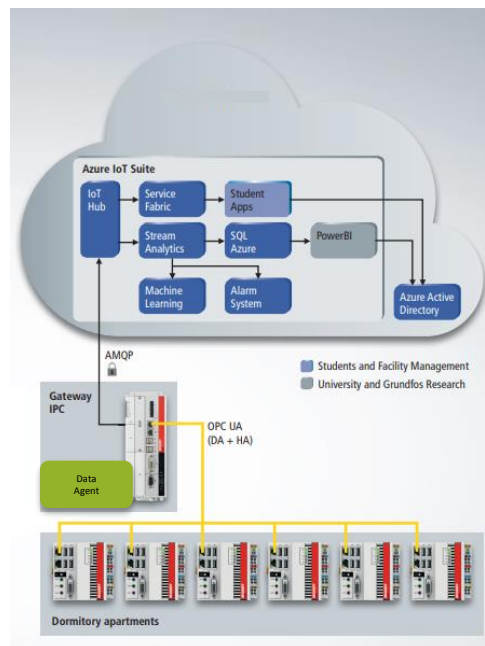


UA_MethodCall			
BOOL	Execute	Done	BOOL
DWORD	ConnectionHdl	Busy	BOOL
DWORD	MethodHdl	Error	BOOL
TIME	Timeout	ErrorID	DWORD
Vendor specific	InputArguments	InputArguments	Vendor specific
Vendor specific	OutputArguments	OutputArguments	Vendor specific

Success story

Grundfos Living Lab (2015)

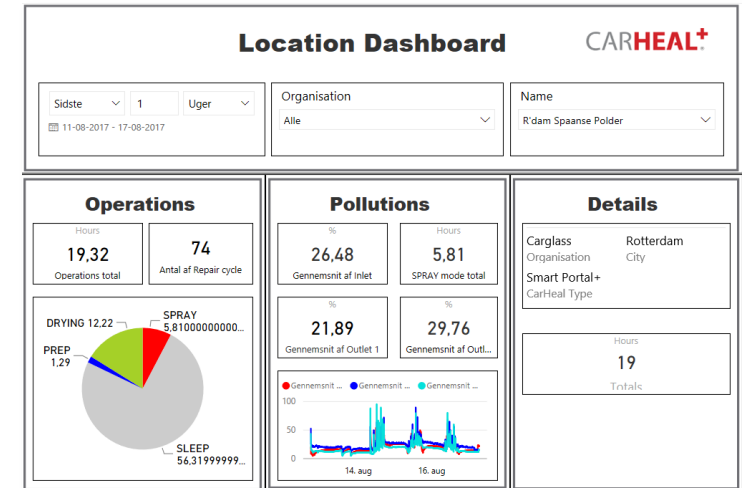
- 160 connected smart apartments in a student dormitory in Aarhus, DK
 - Every apartment equipped with PC-based PLC devices
-
- ✓ Cyclic logging of energy data
 - ✓ Approximately 3200 data points
 - ✓ Data send to Cloud
 - ✓ Analytics and Machine Learning
 - ✓ Data access for inhabitants



Success story

CarHeal Smart Repair Cabins (2017)

- Special, patented painting technique
- Fast and low-priced paint jobs
- Cabins equipped with IoT technology
- Different data send to cloud:
 - ✓ Services on Microsoft Azure
 - ✓ Environmental data (pollution, ...)
 - ✓ Cabin status info (cycles, ...)



IoT and Analytics: new opportunities, new business models!

Simple **IoT** integration:

- system-integrated with IoT
- cloud connection based on open standard protocols:
- one engineering platform
- IoT Edge device, also for retrofits

Simple data **analysis**:

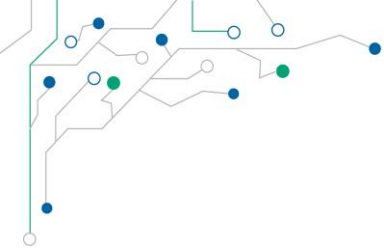
- system-integrated with Analytics
- easy data storage and analysis
- various simple and useful algorithms
- automatic code generation
- individual analysis dashboards

Benefits for end users:

- ✓ lower production costs
- ✓ optimised product quality
- ✓ optimised overview/transparency in production
- ✓ fewer machine downtimes
- ✓ increased productivity and availability
- ✓ cloud-based services (predictive maintenance)

Benefits for machine builders:

- ✓ lower machine costs
- ✓ simple and fast diagnosis: predictive maintenance/
- ✓ machine/process optimisation
- ✓ new business models



Grazie per l'attenzione