BaSys 4.0

Basissystem Industrie 4.0

Making networked production easy with Digital Twins

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GEFÖRDERT VOM

Bundesministerium
für Bildung
und Forschung

Challenges of Industrie 4.0

Heterogeneous Devices

- Different Manufacturers
- Different Interfaces

Integration of Legacy Devices

- Old devices are not capabale of Industrie 4.0

Unified Interfaces

- Unified access to data

Software has to address these challenges!

About BaSys 4.0

Public funded, national reference project

- 15 Partners from academia and industry
- Fraunhofer IESE is coordinator
- Development of open source Industrie 4.0 middleware
- Implements main Industrie 4.0 concepts in shopfloor
- Runtime: 07/2016 – 06/2019

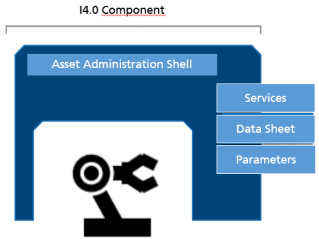
Open Source

- Eclipse Open-Source Project
- www.eclipse.org/basyx

BaSys 4.0 Building Blocks

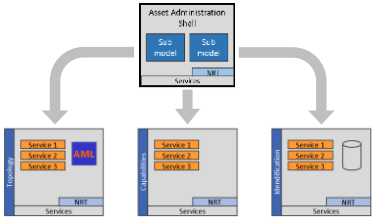
Asset Administration Shell
(Digital Twin)

- Digital representation of devices
- Independent of manufacturer
- Standardized



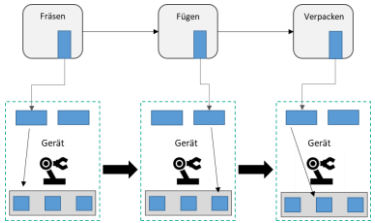
Sub Models

- Provide information in a structured way
- Topology
- Device Services



Service-Based Production

- Changeable production



Virtual Automation Bus

- End-to-end communication
- Communication spanning different networks and protocols

NRTNL (Non Realtime Network Layer)
RTNL (Realtime Network Layer)

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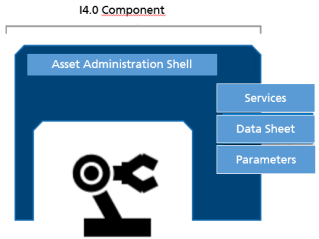

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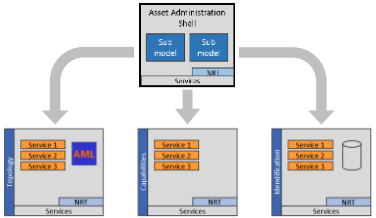

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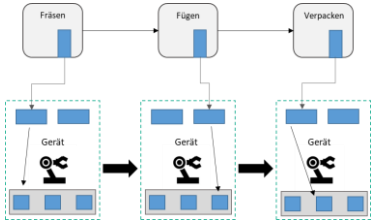

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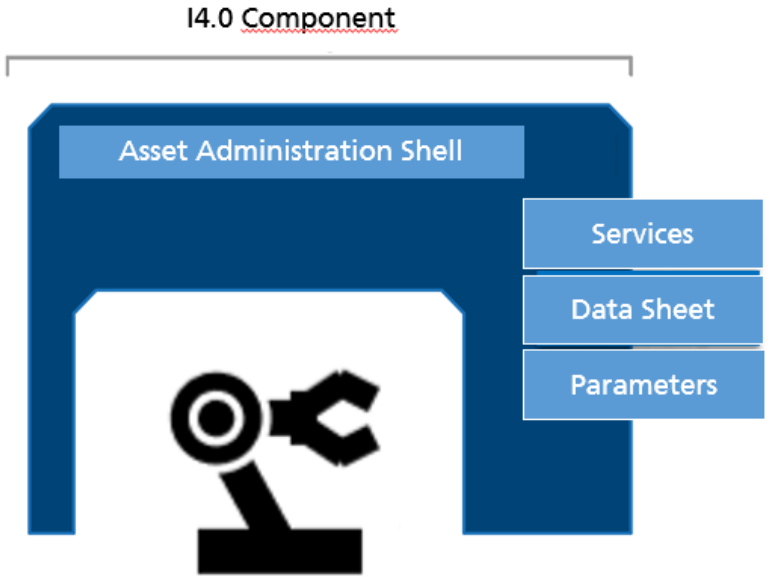
BaSys 4.0 – Asset Administration Shell

Digital representation of assets

- ***Independent of Manufacturer***
  - Standardized Interface

- ***For all relevant entities***
  - Product, Devices, Worker
  - Central Industry 4.0 component



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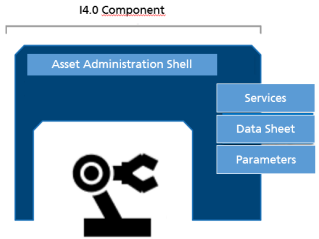

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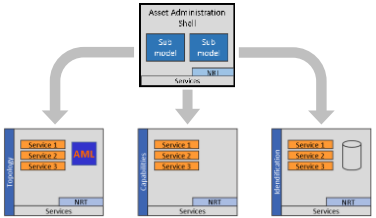

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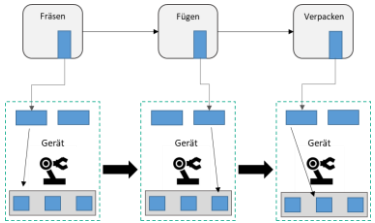

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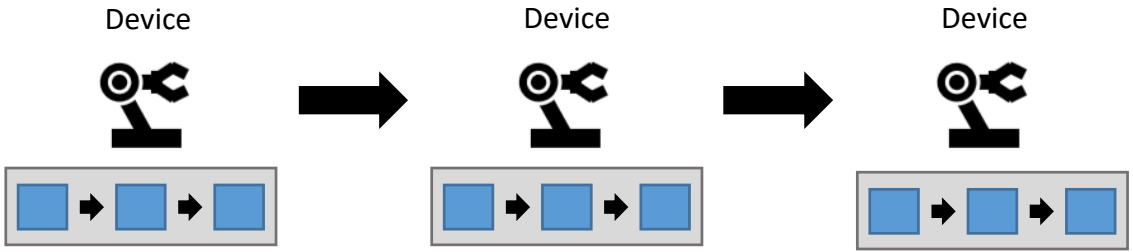
BaSys 4.0 – Changeable Production

Today

- PLC control production steps
- Defined and standardized blocks (EN/IEC 61131)
- Realize real time control

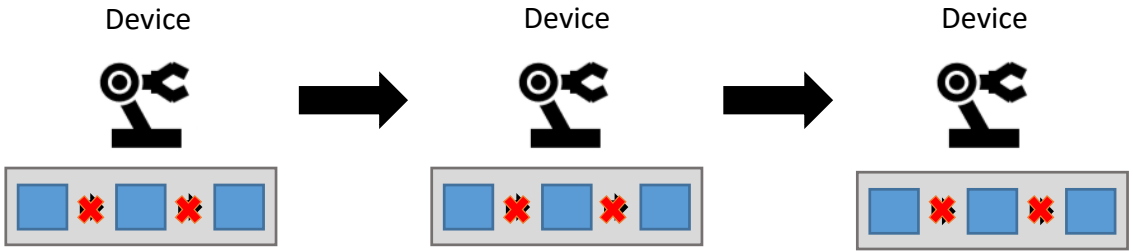
But: No easy changeability



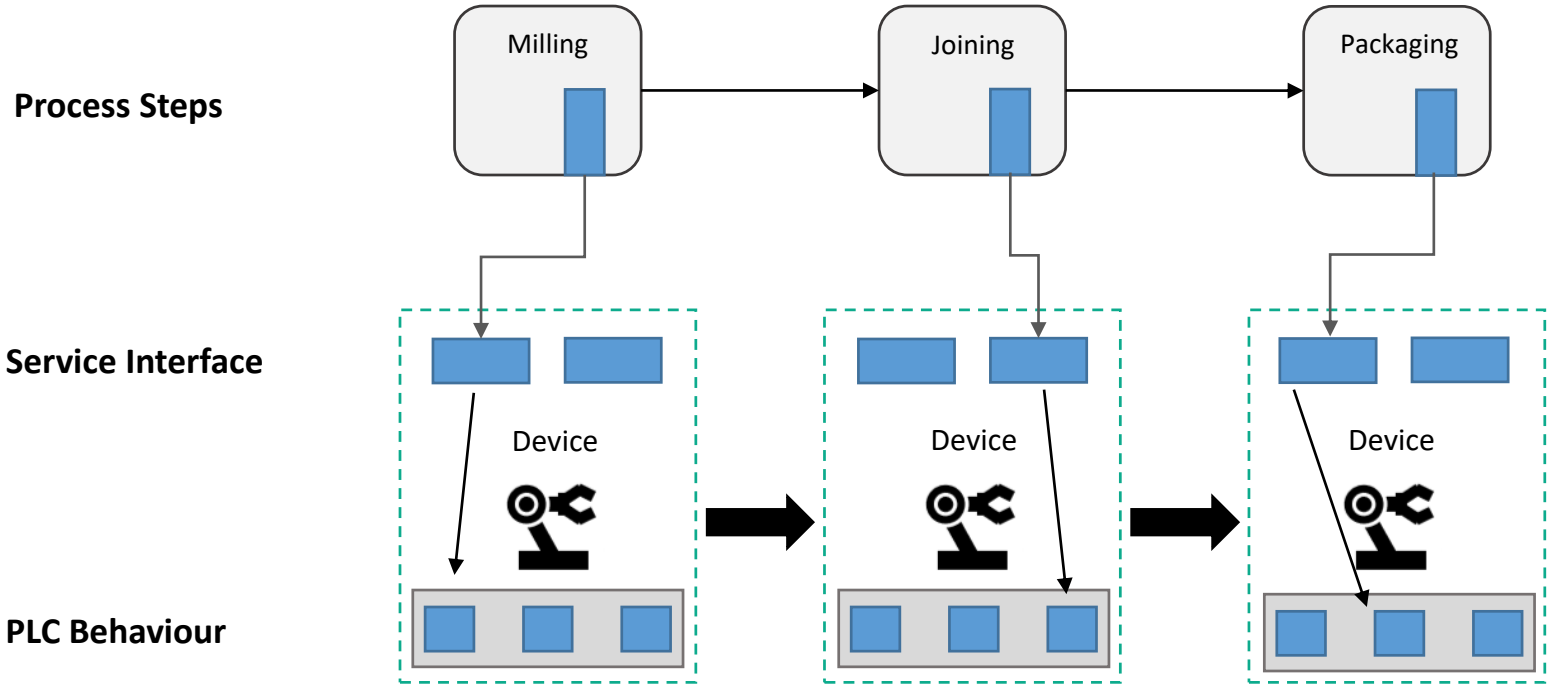
BaSys 4.0 – Changeable Production

BaSys 4.0

- Uses PLC for real time behaviour
- PLC realize callable services

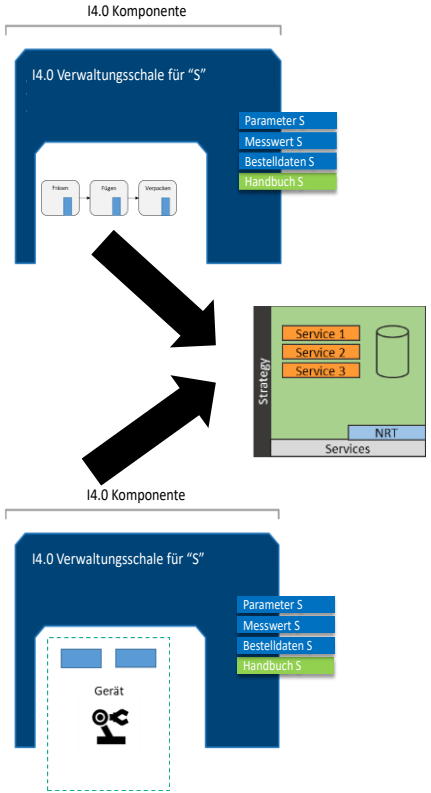


BaSys 4.0 – Changeable Production

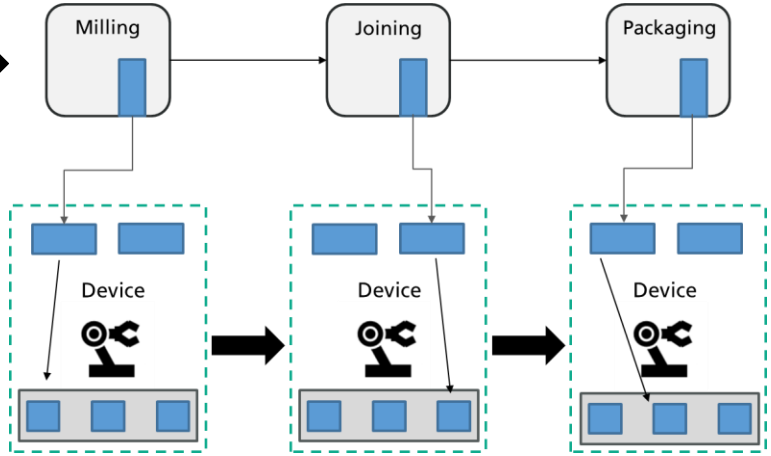


BaSys 4.0 – Service-Based Production

- Required services (=Recipe)
- Service Parameters
- Provided Services



- Mapping between recipe and device services

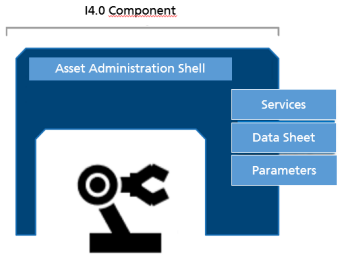


BaSys 4.0 Building Blocks – Usage

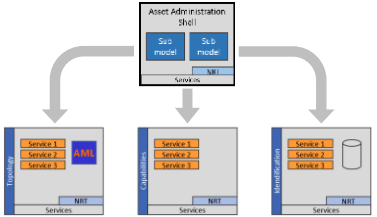
BaSys 4.0 Building Blocks can be used individually

- Example: Digitisation of Production

Asset Administration Shell (Digital Twin)



Sub Models



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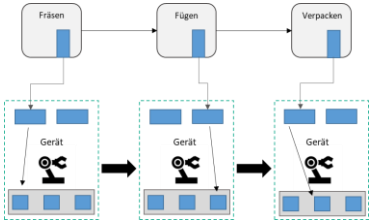

Virtual Automation Bus

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BaSys 4.0 - Availability

SDK (Java/C++)

- Asset Administration Shell
- Virtual Automation Bus

Components

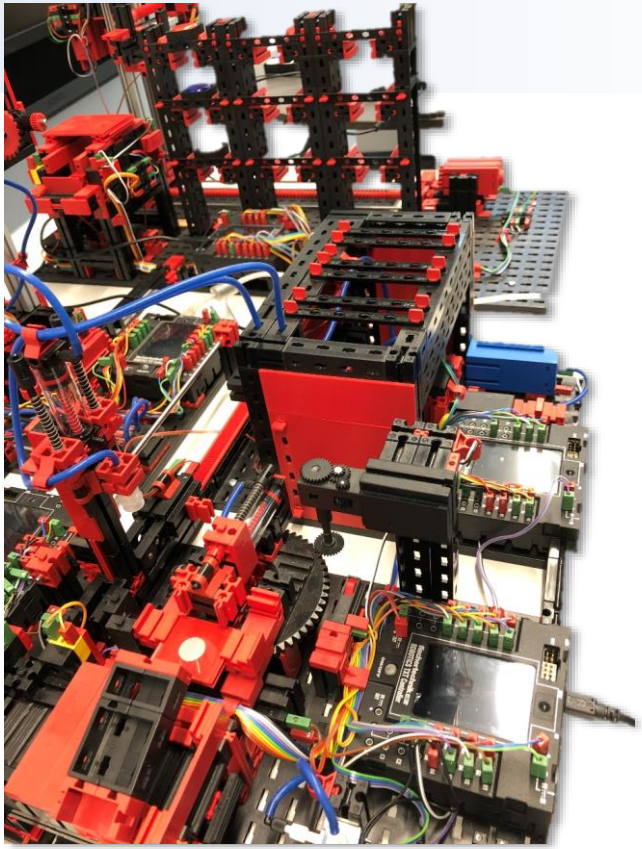
- Reference components
- Registry / discovery of components

Download:

- http://www.eclipse.org/basyx

Demonstrator

- Context
  - Legacy production of brake discs
  - Extraction of production data
- Solution
  - Connection of legacy PLCs to BaSys middleware
  - Use of NetApp BaSys Connector



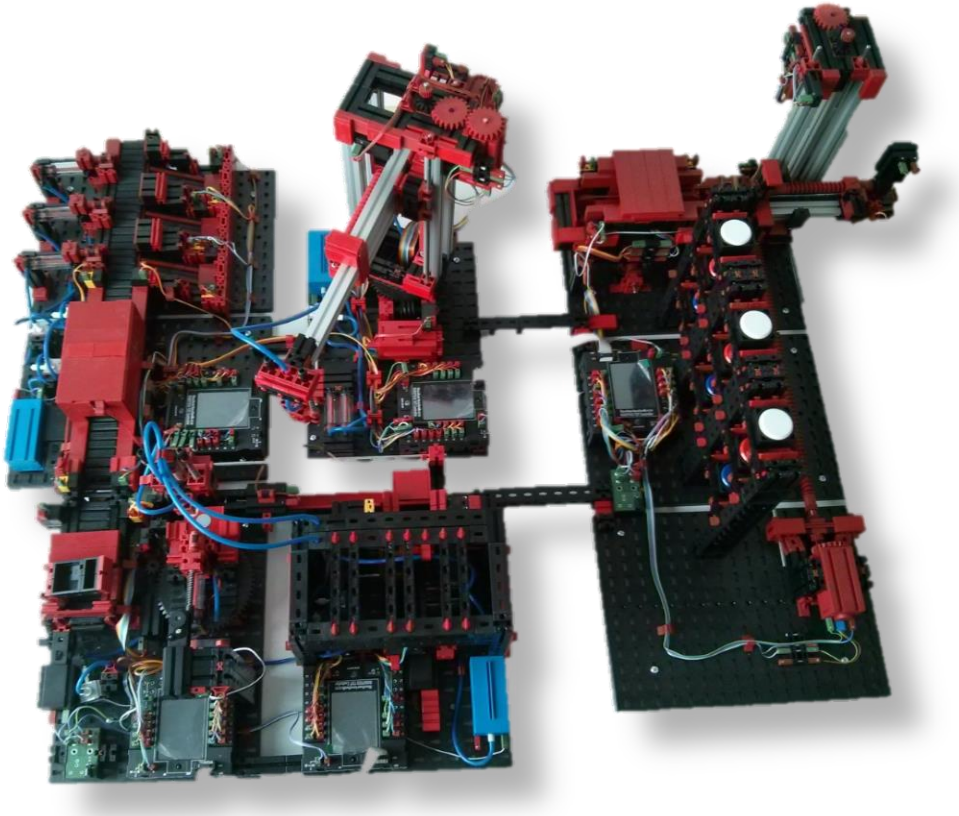
Brake Disk Demonstration Plant (Fischertechnik)

Demonstrator - Product

- Product: Brake Discs
  - Ceramic Brake
  - Carbon Ceramic Brake
  - Wolfram Ceramic Brake

Source: https://commons.wikimedia.org/wiki/File:PCCB_Brake_Carrera_GT.jpg

Demonstrator - Platform



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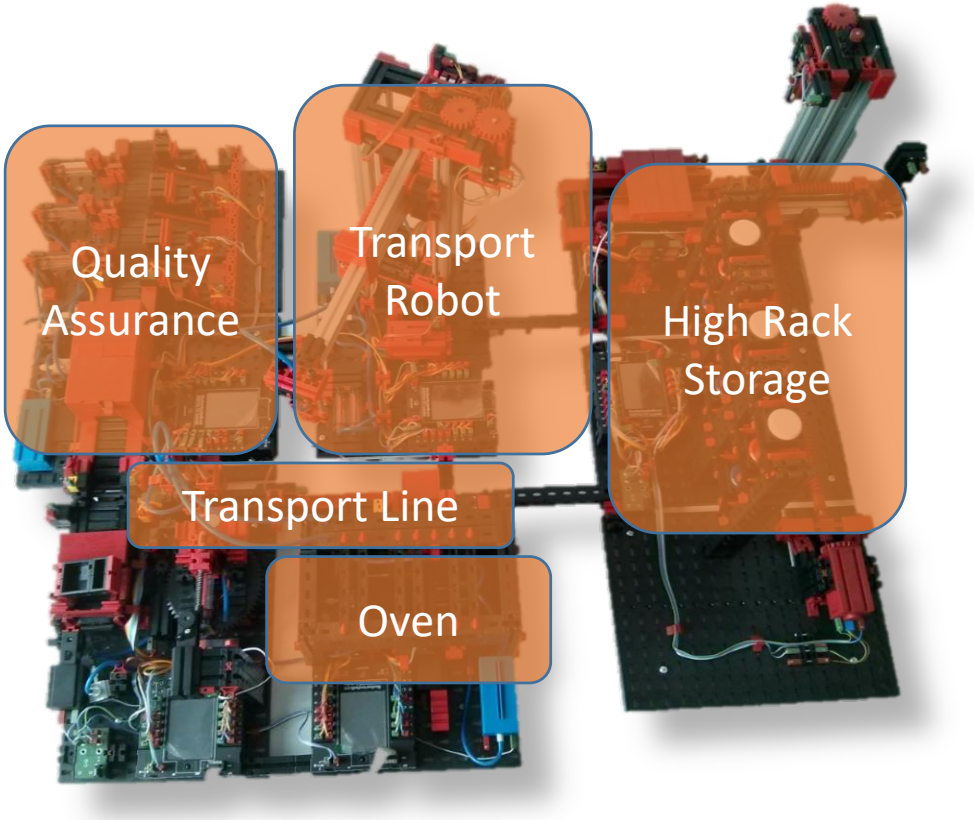
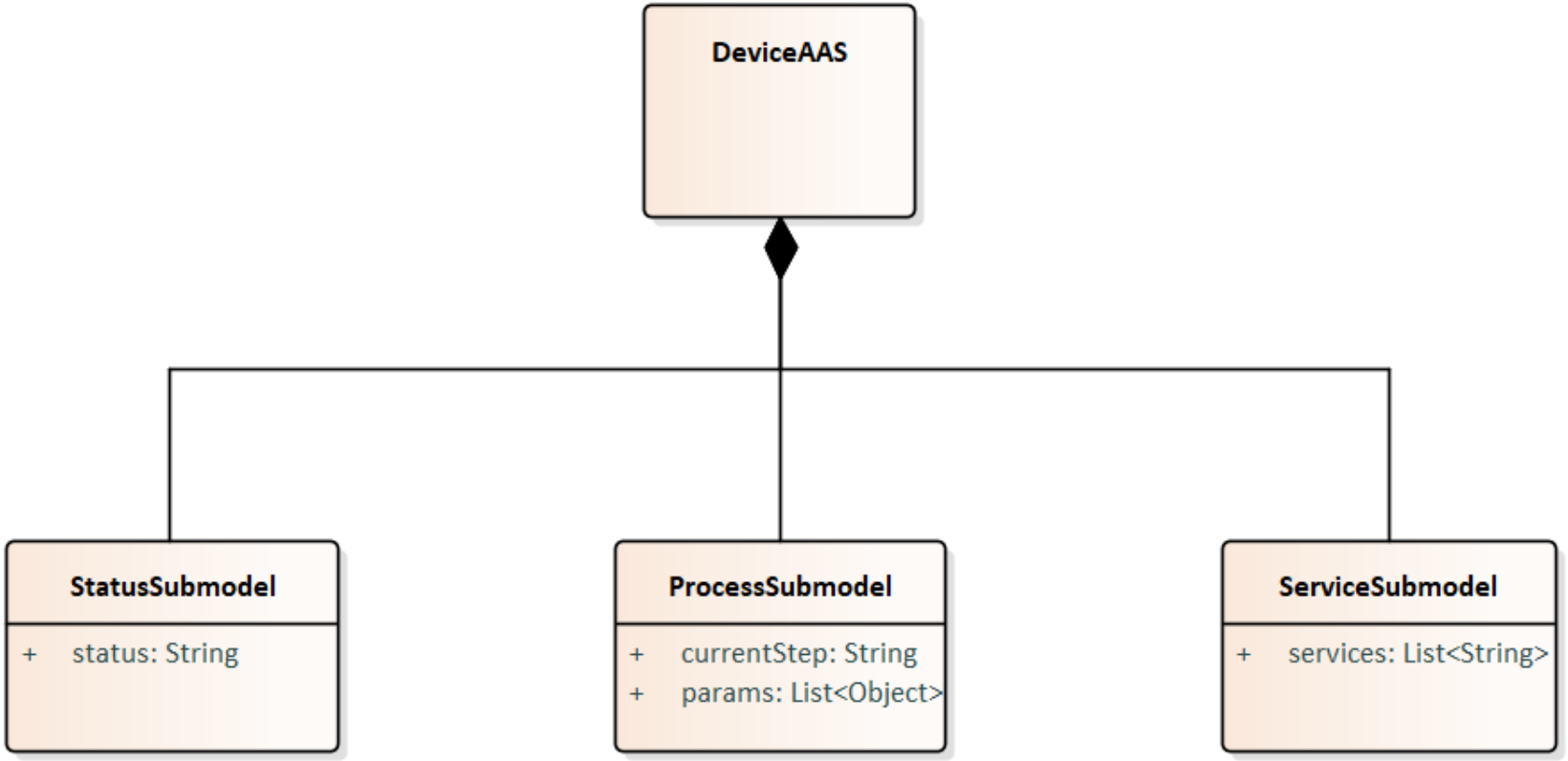
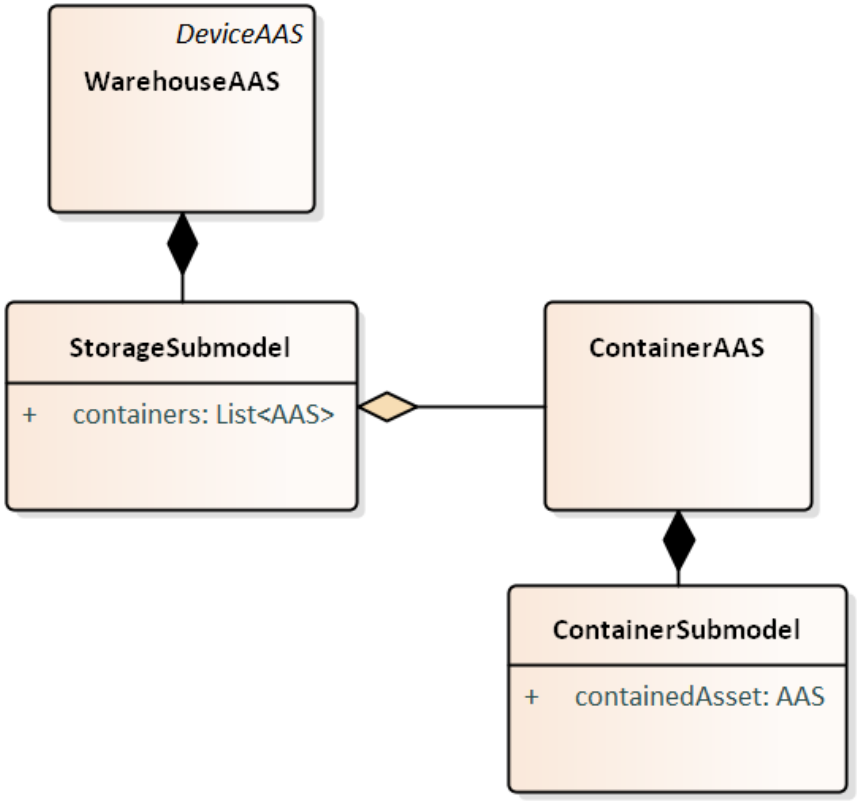


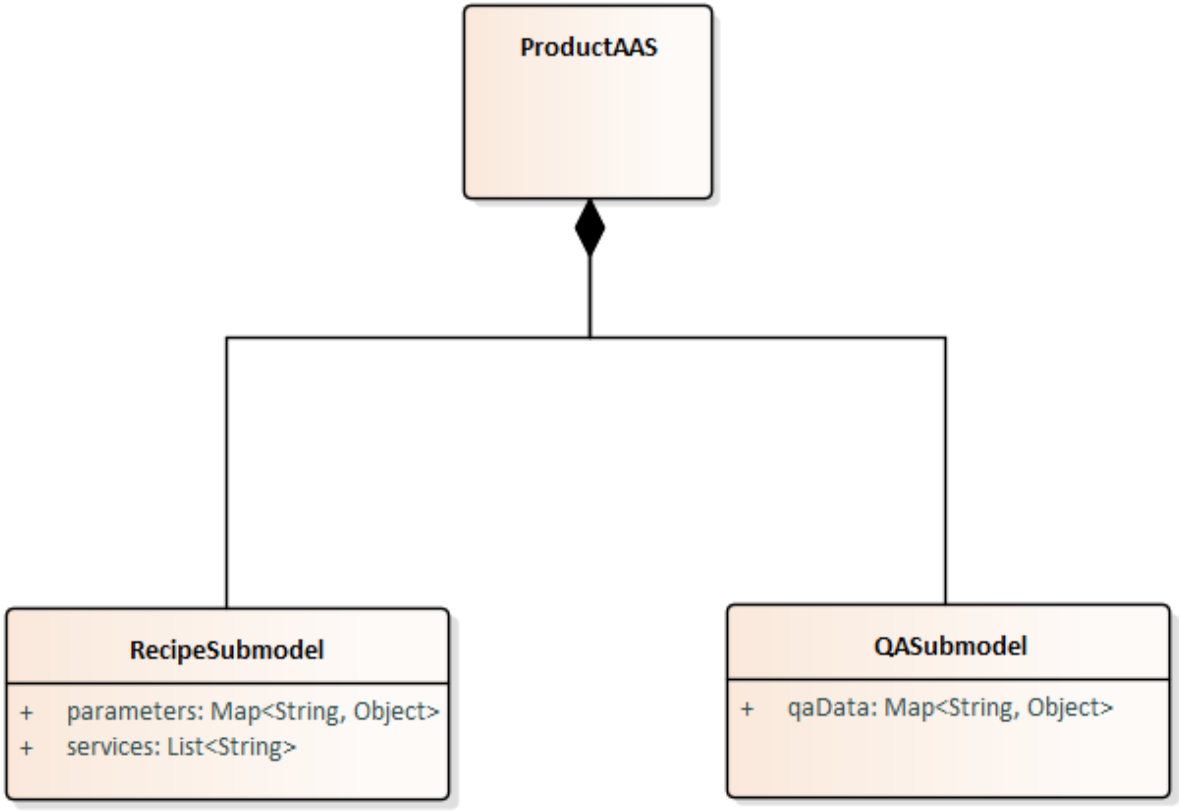
AAS Structure - Device



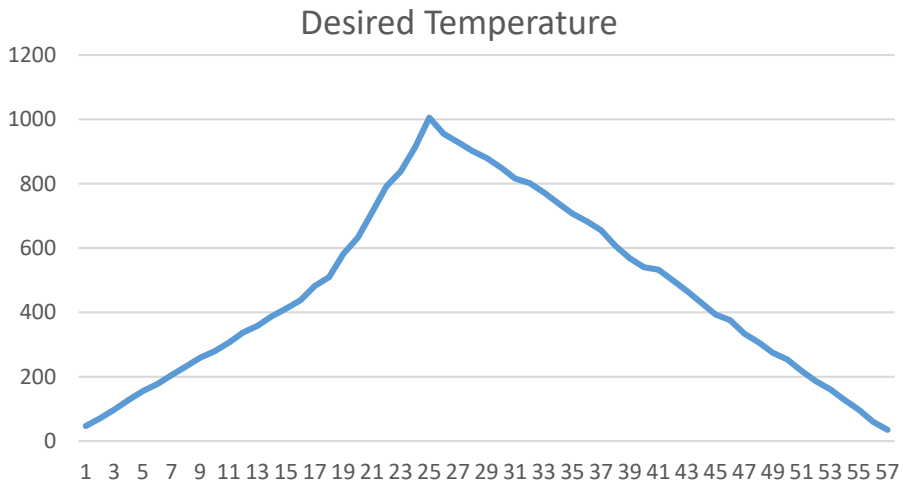
AAS Structure - Warehouse

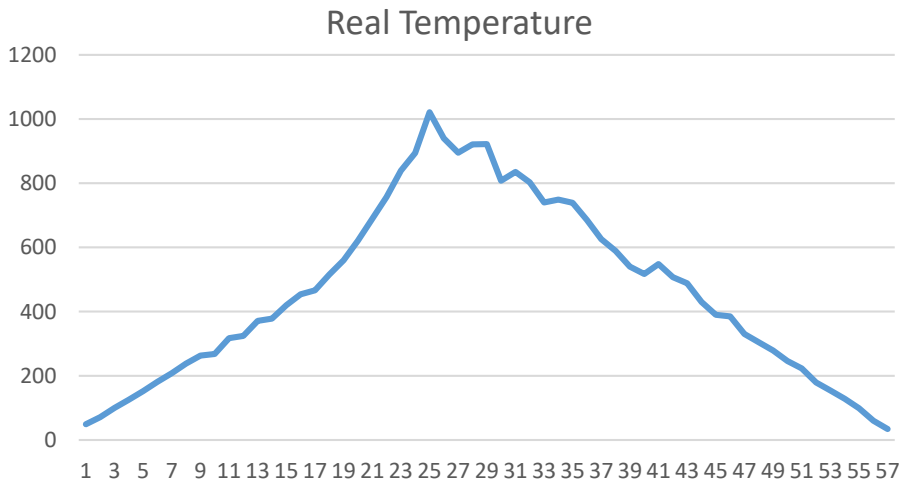


AAS Structure - Product



Oven Burn Curve





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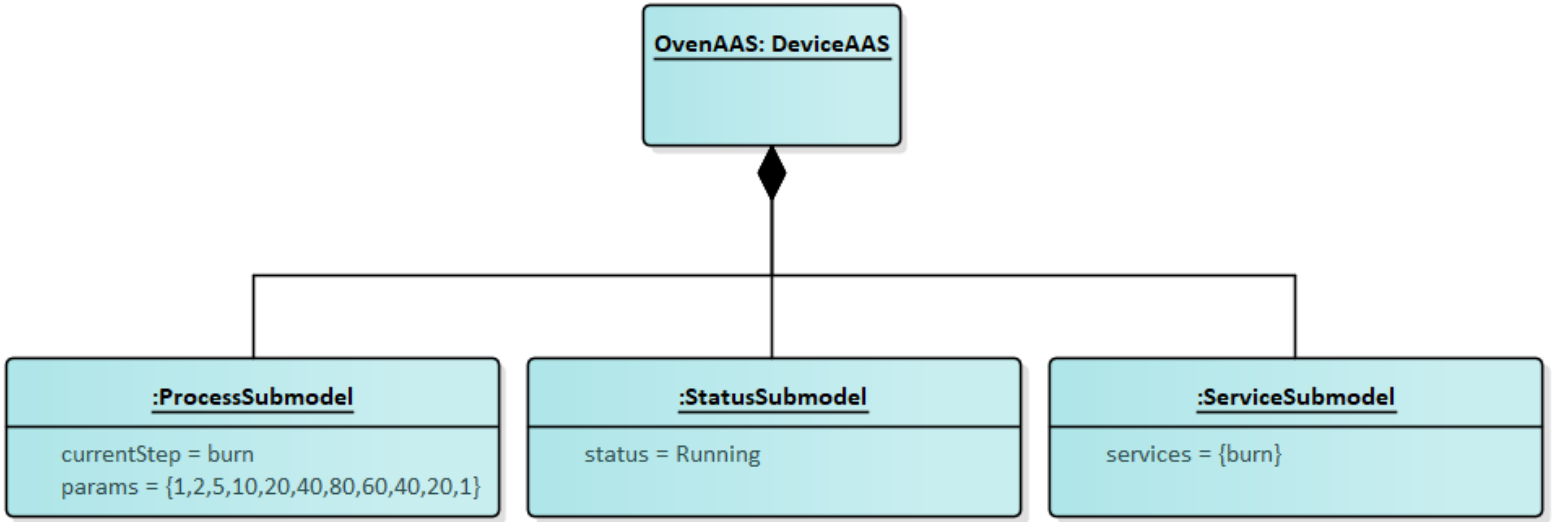
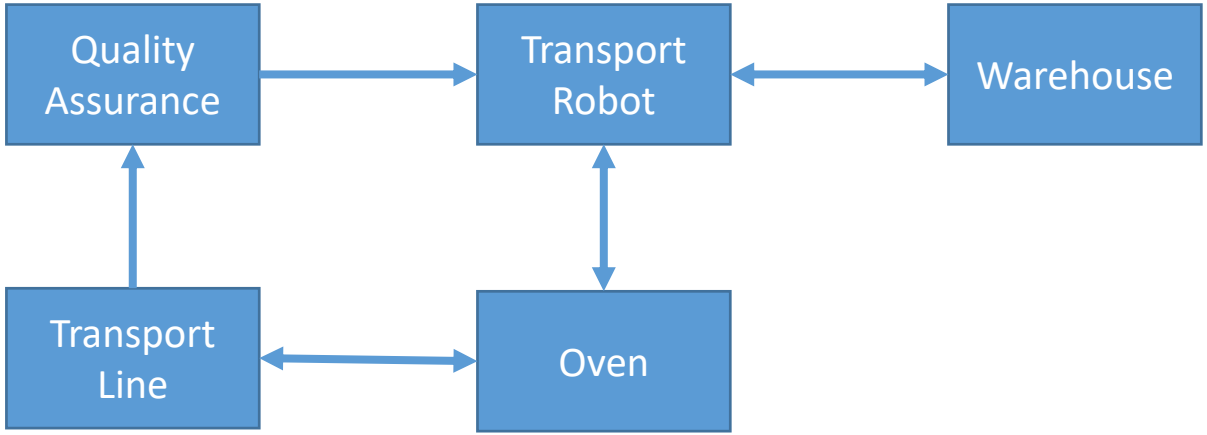
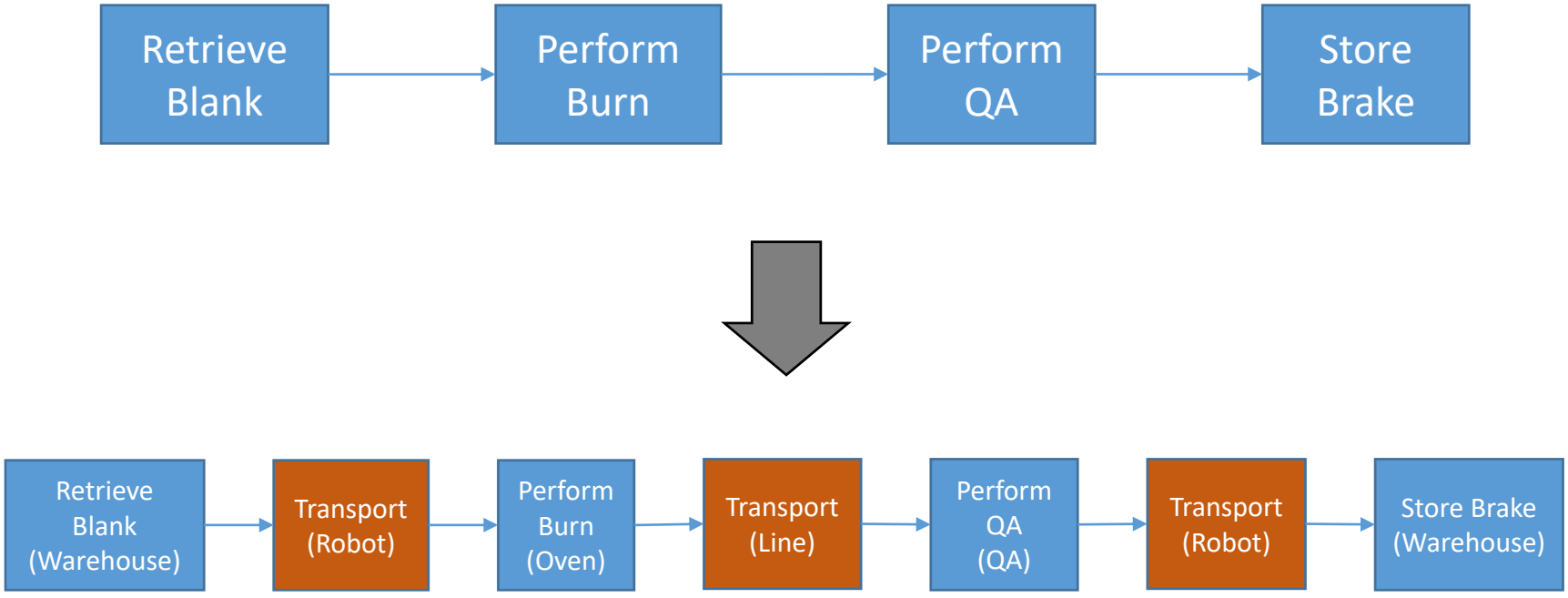


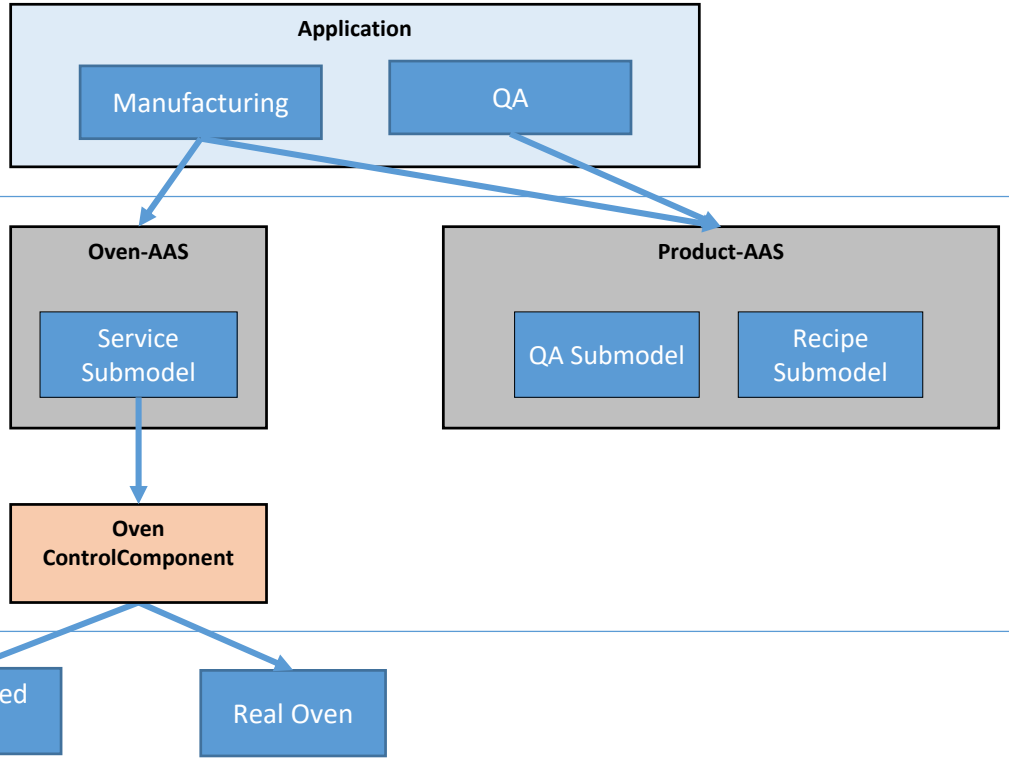
Topology


Quality Assurance
Transport Robot
Warehouse
Transport Line
Oven

Orchestration



Scenario View



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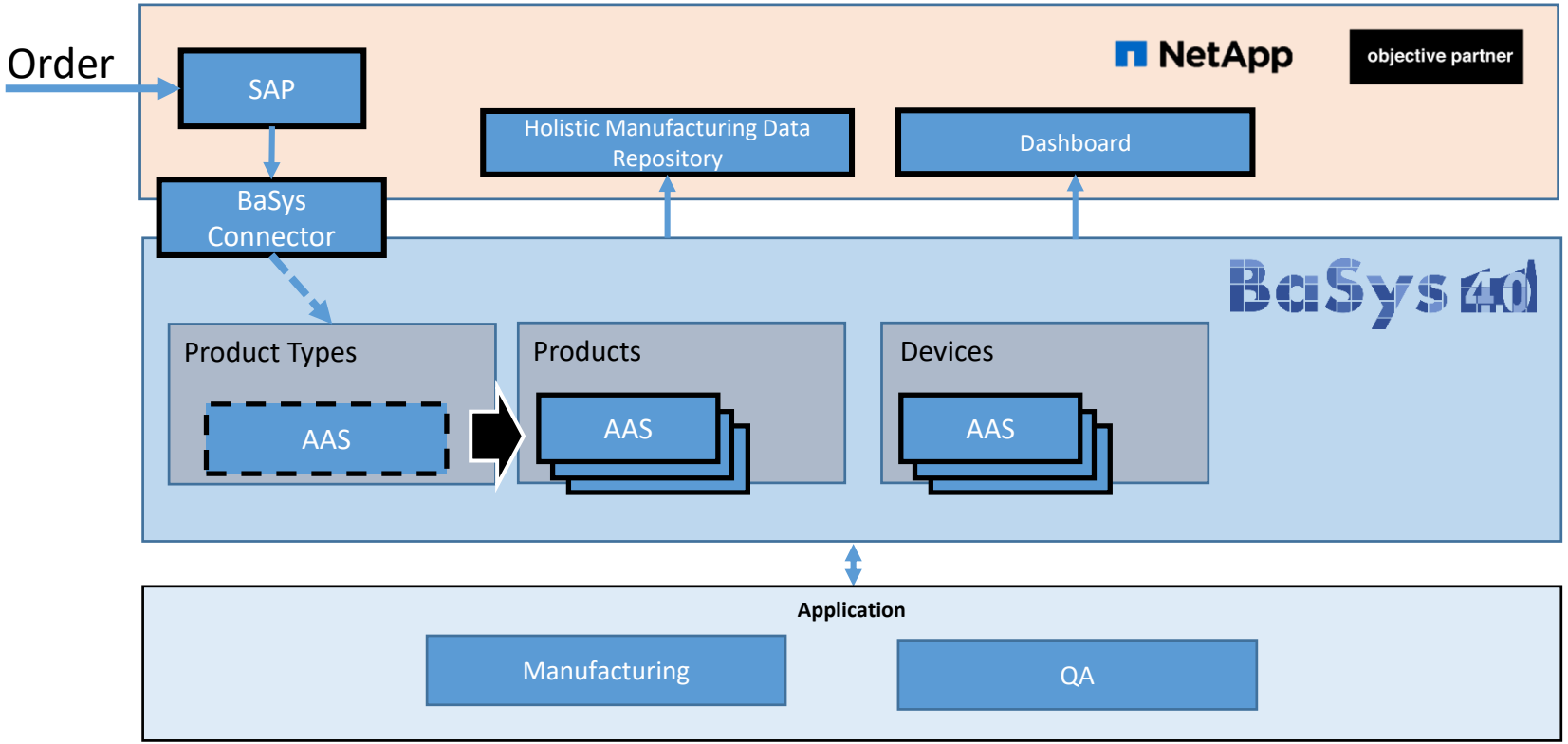

Image Sources

- https://icons8.de/icon/set/robot/metro