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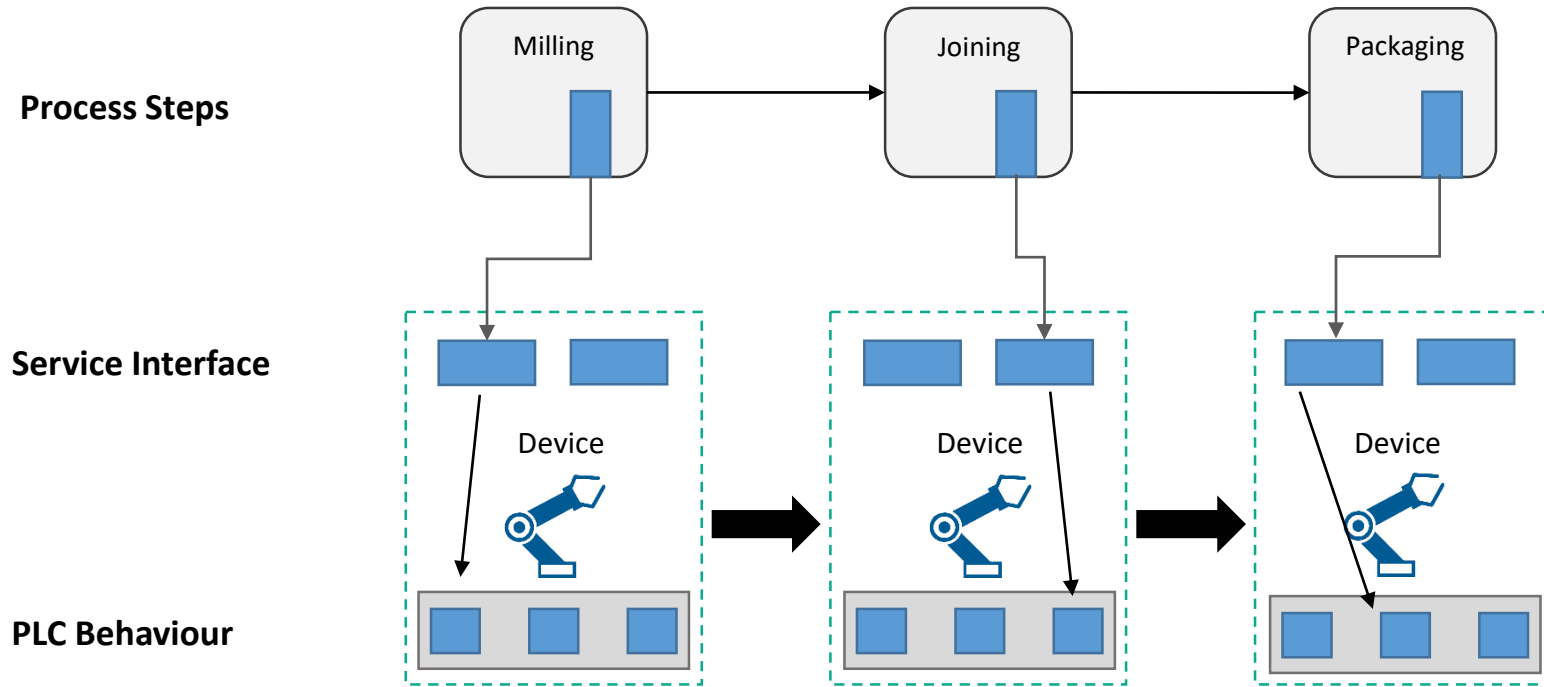
OW2

# Making Industry 4.0 easy with Eclipse BaSyx

Frank Schnicke, Fraunhofer IESE

It is not the strongest or the most intelligent who will survive but those who can best manage **change**.  
— Charles Darwin

# Service-based Production



# What is BaSys 4.2?

## National Reference Project

- 19 partners, coordinated by Fraunhofer IESE
- Goal: Manufacturer independent interoperability based on Asset Administration Shells
- Runtime: 07/2019 – 06/2022

## Open Source

- Eclipse Open-Source Projekt: [www.eclipse.org/basyx](http://www.eclipse.org/basyx)



Deutsches  
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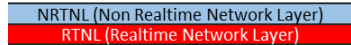


A Bosch Company

# BaSys 4.2 Building Blocks

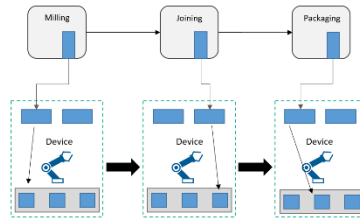
## Virtual Automation Bus

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



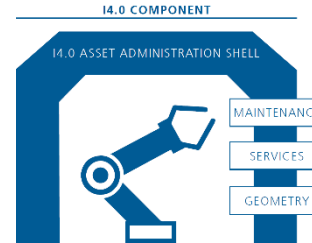
## Control Components

- Changeable production



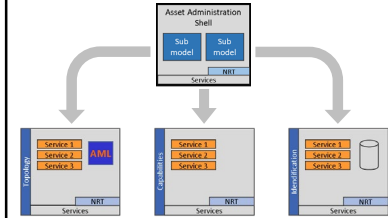
## Asset Administration Shell (Digital Twin)

- Digital representation of assets
- Independent of manufacturer
- Standardized



## Sub Models

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



# BaSys 4.2 Building Blocks

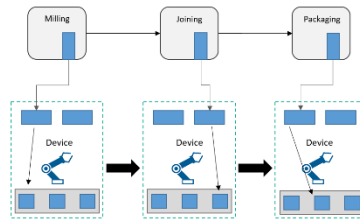
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- Communication spanning different networks and protocols

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

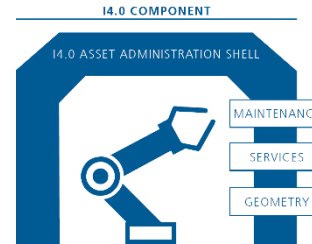
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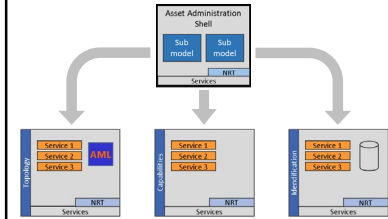
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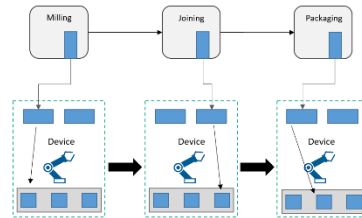
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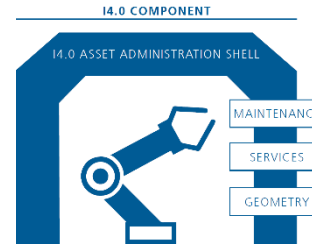
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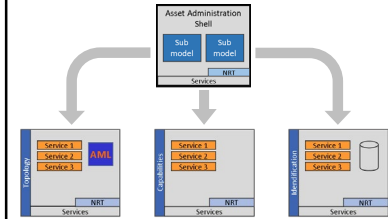
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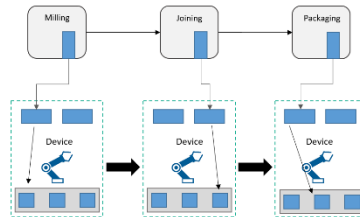
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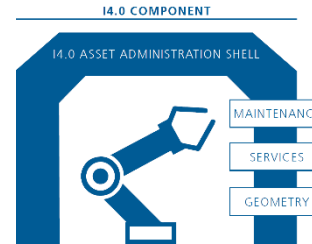
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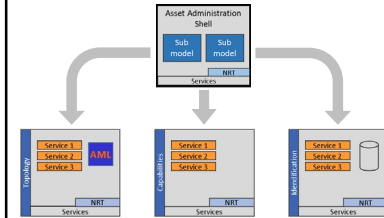
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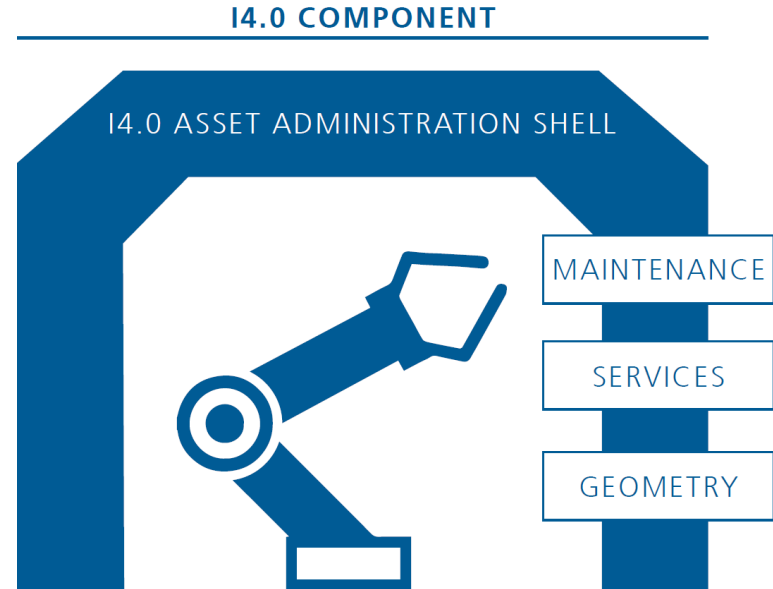




# BaSys 4.0 – Asset Administration Shell

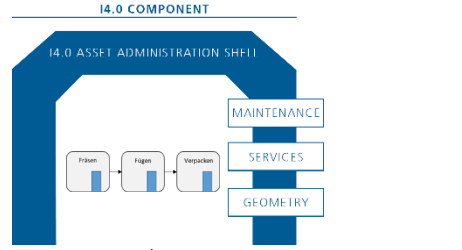
## ***Digital representation of assets***

- ***Independent of Manufacturer***
  - Standardized Interface
  
- ***For all relevant entities***
  - Product, Devices, Worker
  - Central Industrie 4.0 component

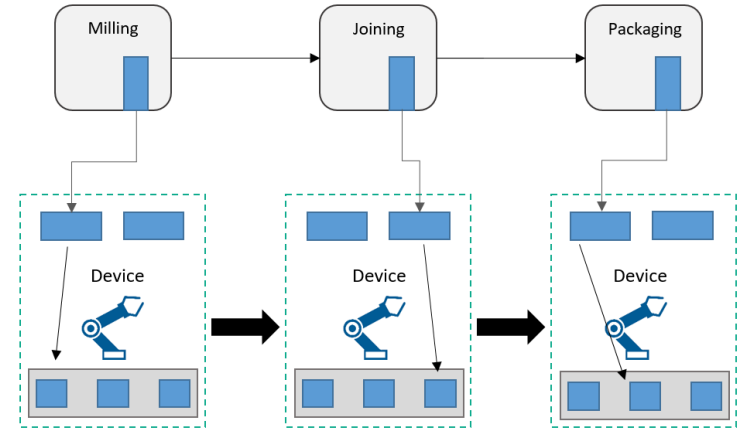
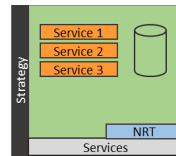


# BaSys 4.0 – Changeable Production

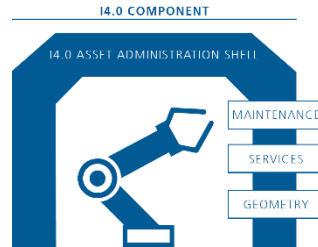
- Required services (=Recipe)
- Service Parameters



- Mapping between recipe and device services



- Provided Services



# Eclipse BaSyx

## Open Source

- Eclipse Open-Source Projekt: [www.eclipse.org/basyx](http://www.eclipse.org/basyx)
- License: Eclipse Public License 2.0

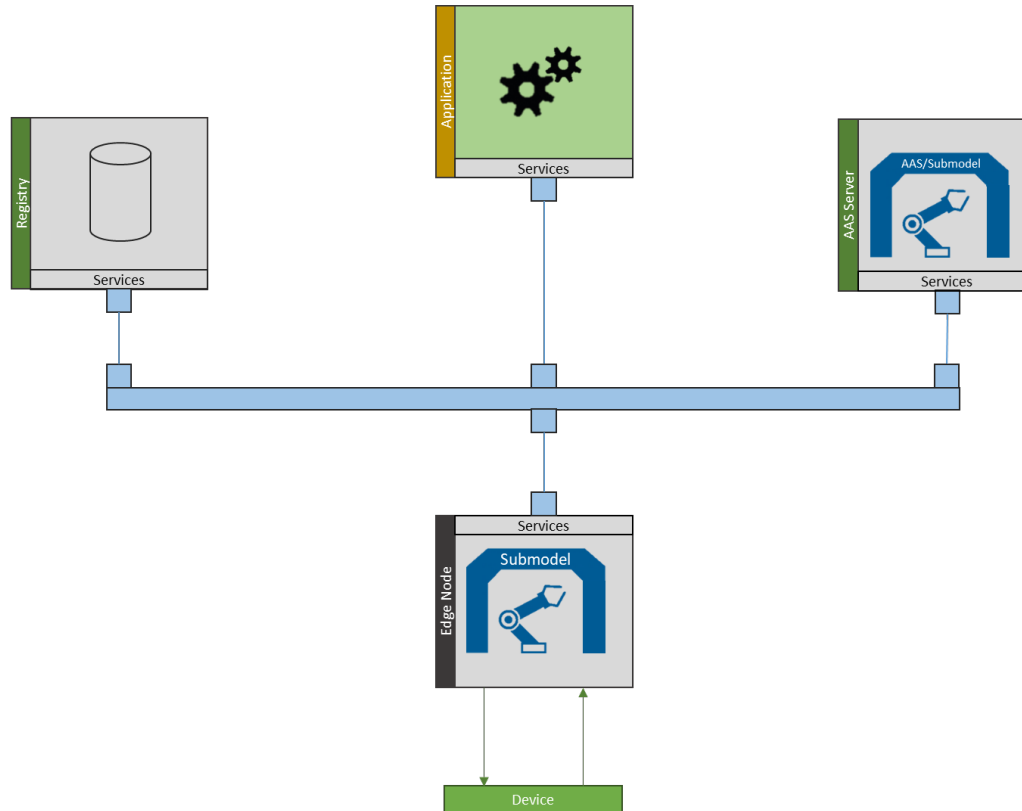
## SDK (Java/C++/C#)

- Asset Administration Shell
- Communication

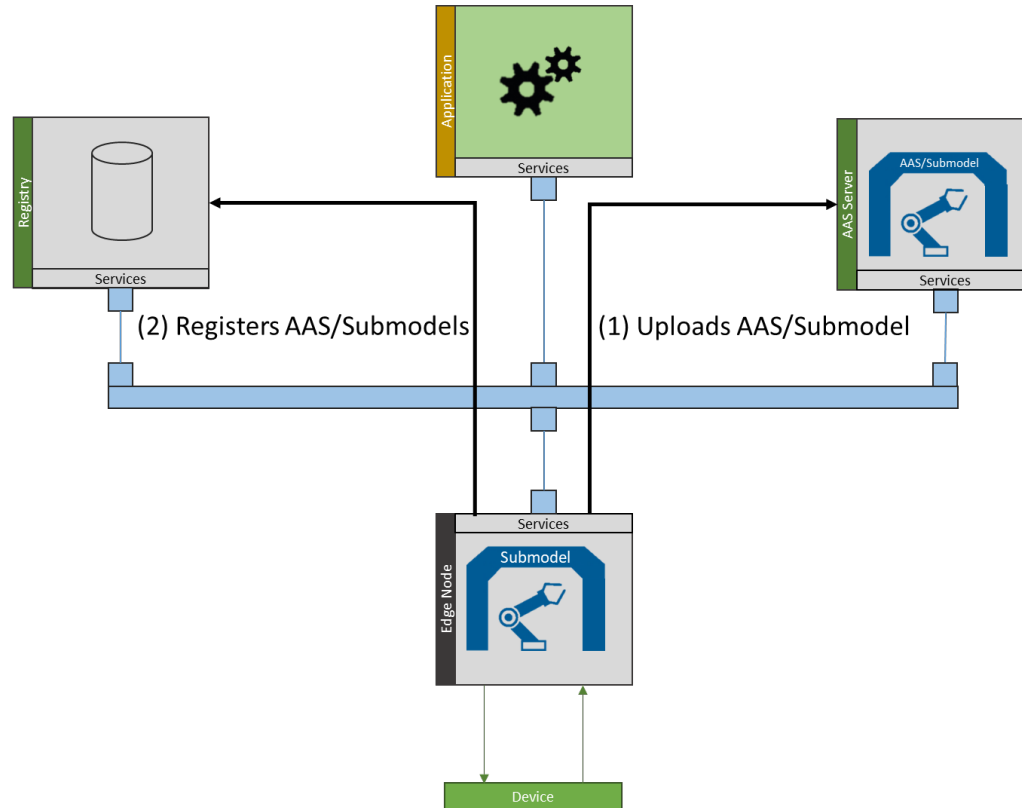
## Off-the-Shelf Komponenten

- Registry
- AAS Server

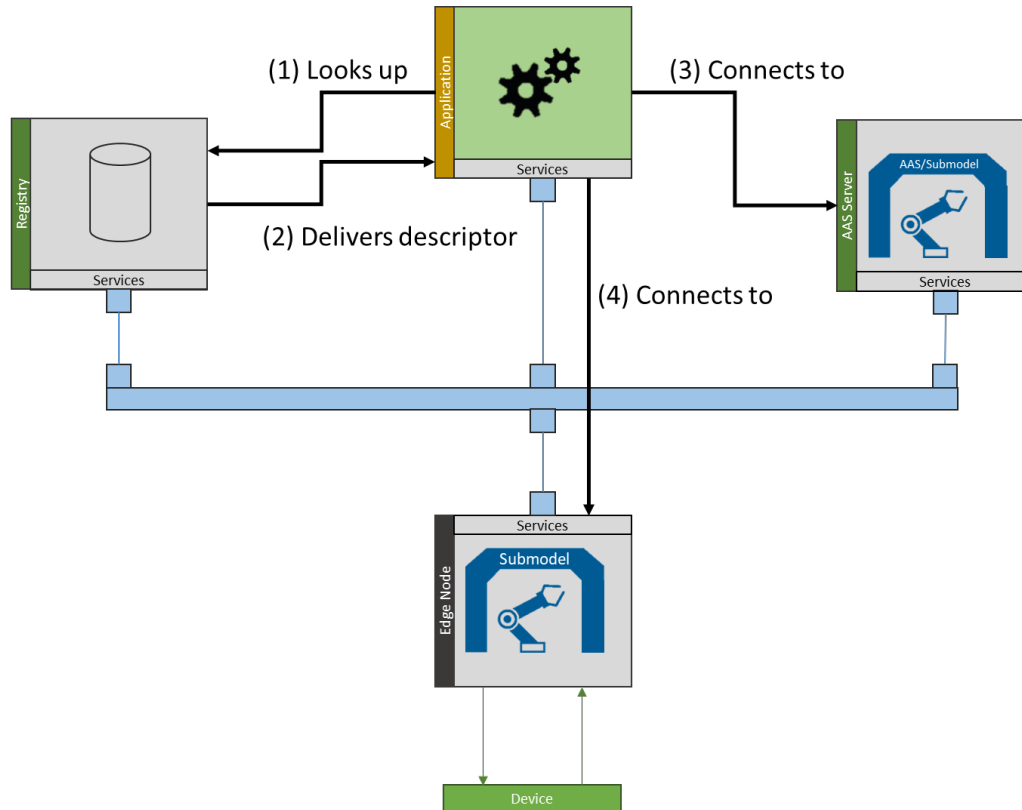
# Asset Administration Shell Infrastructure



# Asset Administration Shell Infrastructure



# Asset Administration Shell Infrastructure



# Artifacts of Eclipse BaSyx

- SwaggerHub: OpenAPI Documentation of all Components
- Maven Central (Java): SDK/Component Jar
- NuGet (C#): SDK
- DockerHub
  - Registry-Image
  - VWS-Server-Image
- Technology Compatibility Kit
  - Registry-TCK
  - AAS-Server-TCK
- Introductory Videos

# Tooling – AASX Package Explorer

The screenshot displays the AASX Package Explorer interface for a package named "01\_Festo.aasx". The main window is divided into three main sections:

- Left Panel:** Shows a submodel element with a URL `HTTP://PK.FESTO.COM/357PM0CP4BD` and a 3D model of a Festo vacuum generator.
- Center Panel:** A tree view of the AAS package structure. The selected element is "AAS 'Festo\_357PM0CP4BD' [IRI, smart.festo.com/demo/aas/1/1/4545765648365874]". It contains several submodels (SM) and properties (Prop):
  - SM "Nameplate" [IRI, www.company.com/ids/sm/4343\_5072\_7091\_3]
    - Prop "ManufacturerName" = Festo AG & Co. KG
    - Prop "ManufacturerProductDesignation" = OVEL Vacuum generato
  - SMC "PhysicalAddress" (5 elements)
    - Prop "ManufacturerProductFamily" = OVEL-5-H-10-P-VQ4-UA-Z-C
    - Prop "SerialNumber" = JO43
    - Prop "BatchNumber"
    - Prop "ProductCountryOfOrigin" = DE
    - Prop "YearOfConstruction" = 2019
  - SMC "Marking\_CE" (2 elements)
  - SMC "Marking\_CRUUS" (2 elements)
  - SMC "Marking\_RCM" (2 elements)
  - SM "Document" [IRI, www.company.com/ids/sm/2543\_5072\_7091\_2]
  - SM "Service" [IRI, www.company.com/ids/sm/6053\_5072\_7091\_5102]
  - SM "Identification" [IRI, www.company.com/ids/sm/6563\_5072\_7091]
  - SM "DeviceDescriptionFiles" [IRI, smart.festo.com/demo/sm/instanc
- Right Panel:** Details for the selected "Asset Administration Shell" (AAS).
  - Referable:** idShort: Festo\_357PM0CP4BD, category: CONSTANT
  - HasDataSpecification (Reference):**
  - Identifiable:** idType: IRI, id: smart.festo.com/demo/aas/1/1/4545764
  - Asset Reference:** assetRef: (Asset) (local) [IRI] HTTP://PK.FESTO.COM,
  - Asset:**
    - Referable:** idShort: FPK\_3s7plfdrs35, description: [EN] Festo OVEL Vacuum generator, [DE] Festo OVEL Vakuumsaugdüse
    - HasDataSpecification (Reference):**
    - Identifiable:** idType: IRI, id: HTTP://PK.FESTO.COM/357PM0CP4BD
    - Kind:** kind: Instance

At the bottom of the right panel, there are buttons for "Reload", "Drag from here!", "Show Content", "No errors", "Clear", and "Report ..".



# Summary

- Eclipse BaSyx enables quick start with Asset Administration Shells
- Lots of resources that enable easy start
- Usable in commercial products
- Easy adaptation due to open source