Design-Driven Enterprise
From Design to Manufacturing

For custom-engineered projects (ETO)

22.04.2022

Our model company

Conveyor Solutions AG is a manufacturer of

- components
- equipments
- systems

for sorting and transporting of luggage or packages.

They

- configure to customers needs (CTO/MTS),
- design customer specific solutions (ETO, CTO+),
- manufacture in large quantities.

Conveyor’s Challenge

Senior management would like to

- Become more **customer centric** and **agile**
- Reduce **cost** and **workload**

Now we focus on **their project business** unit.

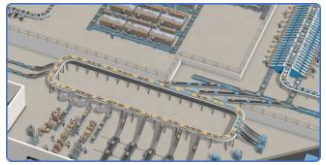
Can they use the same **standard MES system** to manufacture custom-designed solutions, which was choosen for their configurable products business?

(See webinar 2 for the configurable MES scenario)

What capabilities are required to solve Conveyors‘ business challenges?

DESIGN-DRIVEN ENTERPRISE

Engineer to Order (full scope)



BID PURCHASE

BID
- Inquiry Intake
- Design Collaboration with Customer
- Quotation Specification
  - Receive und store customer requirements.
  - Create BID-TOS (from Template, from scratch or from Excel-Input).
  - Create Solution proposal (Drawings, Specs, etc) und send them to the Customer by Document Control Center (Collaboration).
  - Negotiation of the solution proposal.
- Quotation Costing
  - Start Easy-Cost Planning
  - Calculate cost
  - Create a SAP offer/bid (SD – based on commercial product) and do the pricing based on the calculated costs.

PURCHASE
- Design & Purchasing Collaboration with Supplier

TECHNICAL PLAN

TECHNICAL PLANNING
- Basic Design for all disciplines
- Create Layouts for the plant
- Proof the bid content
- Define activities for quality and material management

ORDER FULFILLMENT
- Create customer related to quotation
- Fine tuning of work breakdown structure, the TO and its links (Networks, Milestones)
- Detailed scheduling of the project (PS)
- Cost estimation based on networks and its activities
- Cash management, invoce and billing plans, down payment processing
- Budgeting
- Release of structures (Project versions)
- Execute first down payments (if required)

ENGINEER

TECHNICAL DESIGN
- Detailed Design for all disciplines
- 3D-mechanical engineering with PLM-direct integration
- Material take out
- Planning of production 6 procurement (PS)
- Collaboration with customer & suppliers
- Release of documents for next phase
- Manufacturing Work Instructions, Routing, Quality management
- Service-BOM, Documents, Planning

ORDER FULFILLMENT
- Release Advance Procurement
- Invoicing of Suppliers
- Confirm engineering hours
- Concurrent project costing
- Claim management

PURCHASE PLAN

PLANNING
- Release Engineering position in TOS for production or procurement (growing structure)
- Integration of TOS and project management creates automatically production and procurement orders
- Costing based on the now available product information
- Scheduling of production orders and procurement orders
- Capacity analysis and optimization of production (PS-PPDS)
- Hand-over production orders to MES
- Change Management
- Track procurement orders

MANUFACTURE

ORDER MANAGEMENT
Release of production orders

ASSEMBLY
Work Instruction

INLINE QUALITY MANAGEMENT
Recording of data collection in the product history record (digital twin)

MACHINE INTEGRATION

DELIVER INSTALL INVOICE

DELIVERY
- Delivery directly from the project
- Dispatch and transport processing
- Site Processing
- Confirmations
- Procurement of Installation Material and Services
- Project/Site Controlling
- Invoicing (vendor)
- Billing (Customer)
- Cash-Management

ORDER FULFILLMENT
- Release Advance Procurement
- Invoicing of Suppliers
- Confirm engineering hours
- Concurrent project costing
- Claim management
- Acceptance of the complete delivery by the customer
- Analysis based on POC (Percentage of Completion)
- Final Billing to Customer

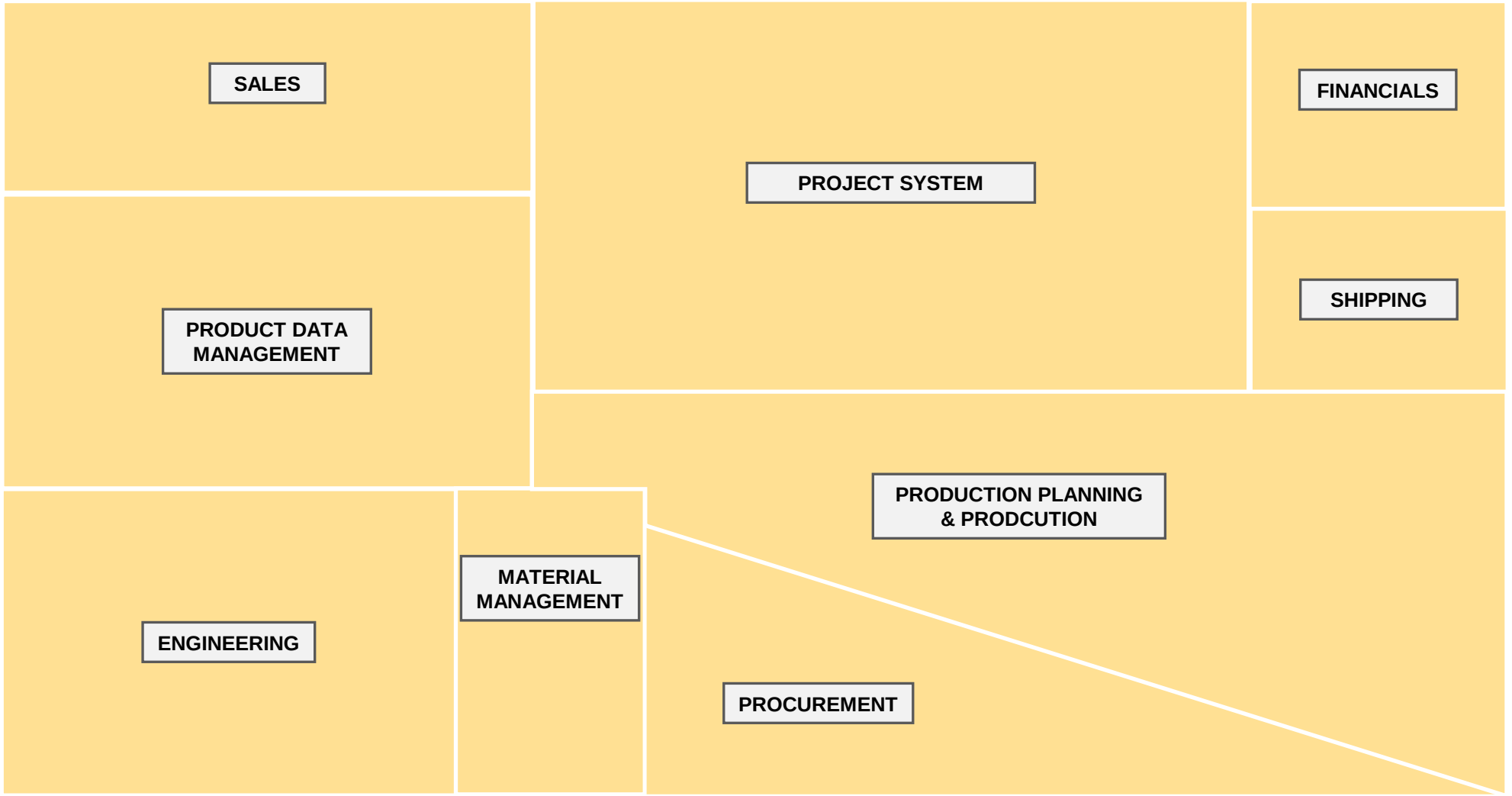
OPERATE

INTELLIGENT ASSET MANAGEMENT
Providing Digital Twin (as installed, as maintained) to service providers and IOT services

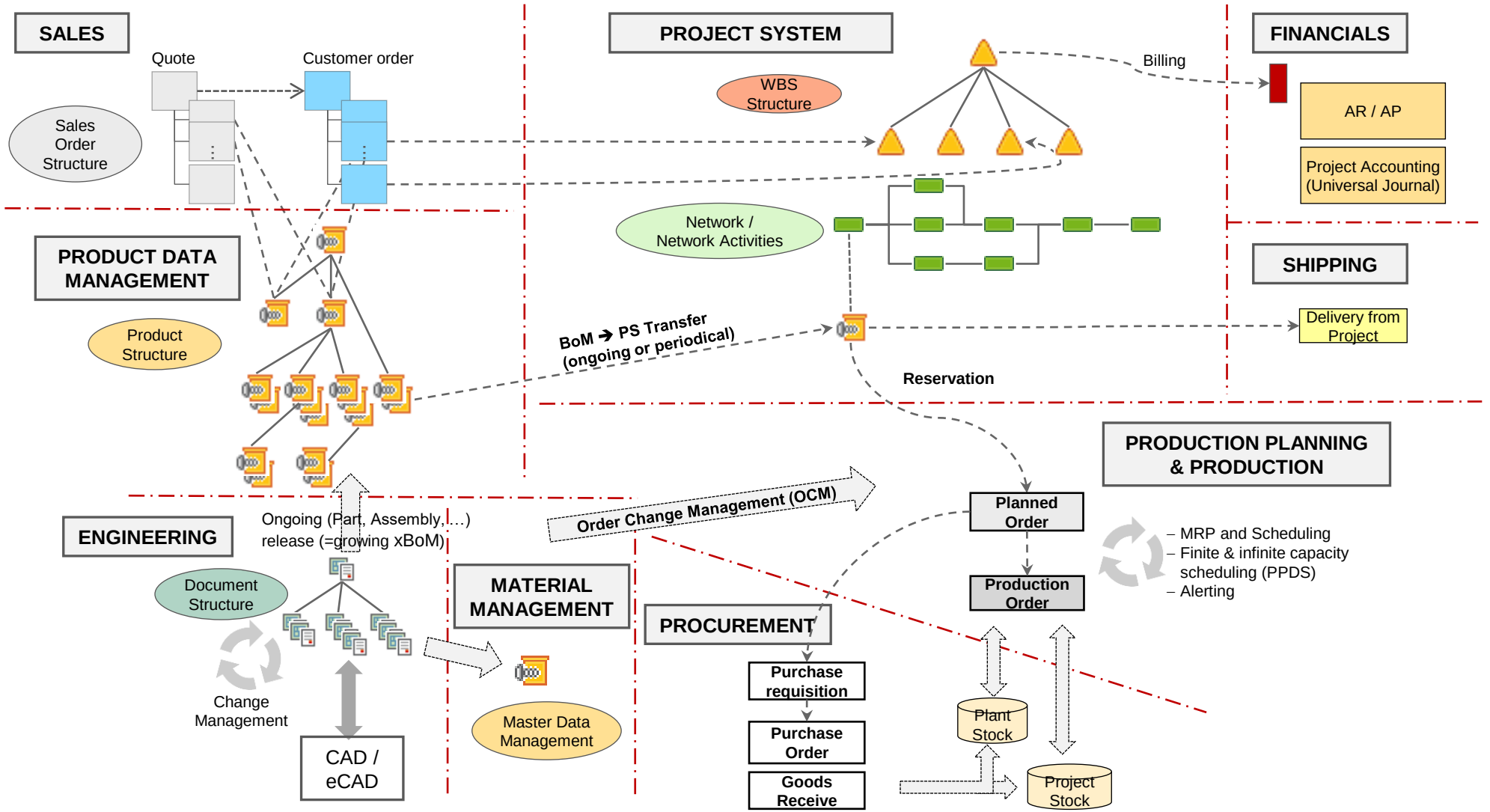
SERVICE MANAGEMENT
- Ticketing
- Service-Ausführung
- Service Order Execution
- Visual Spareparts
- Visual Service-Instructions
- Digital Twin Insight
- Digital Twin Monetarization

THE BEST RUN SAP

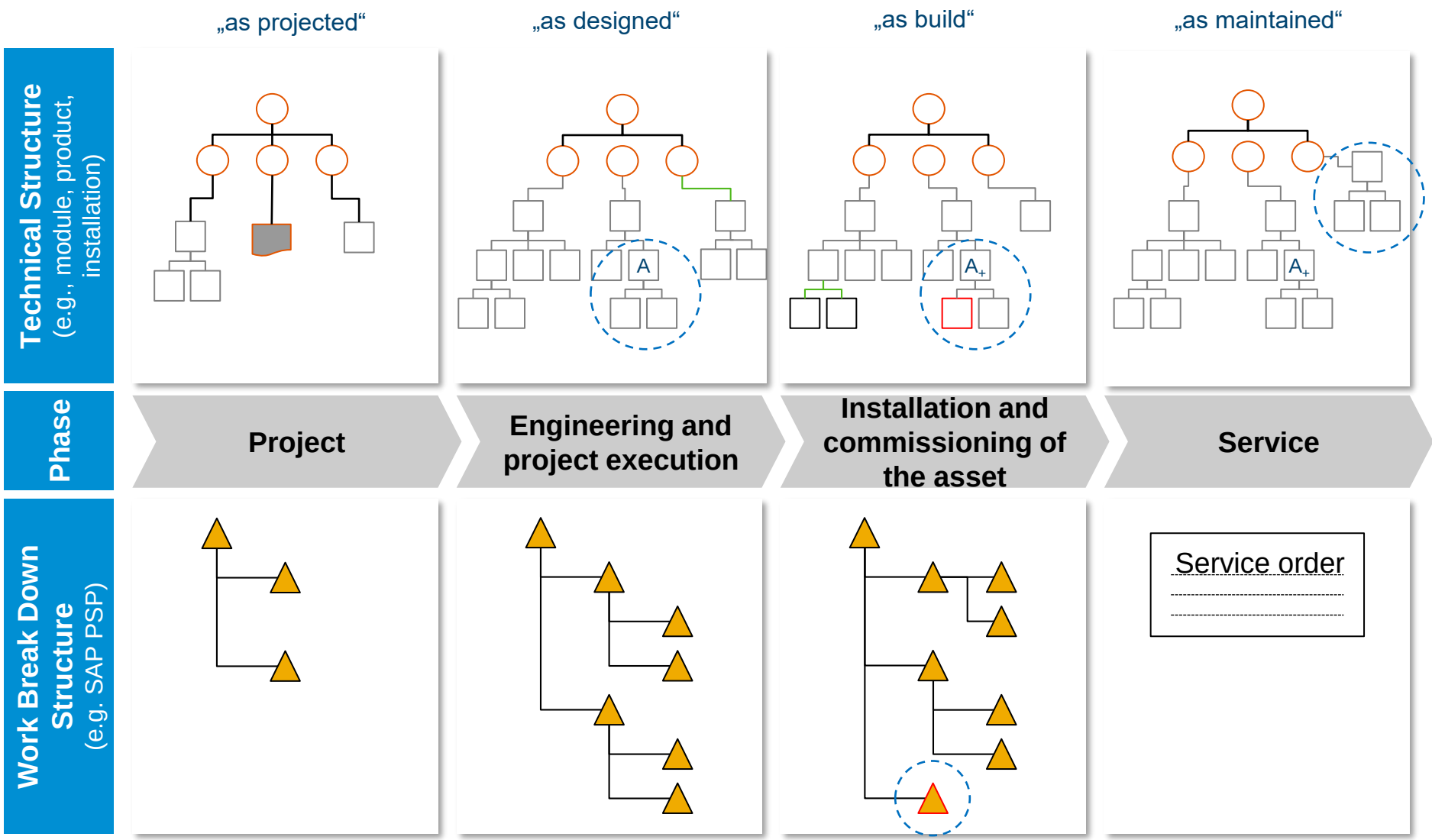
Design-driven Enterprise Architecture for ETO



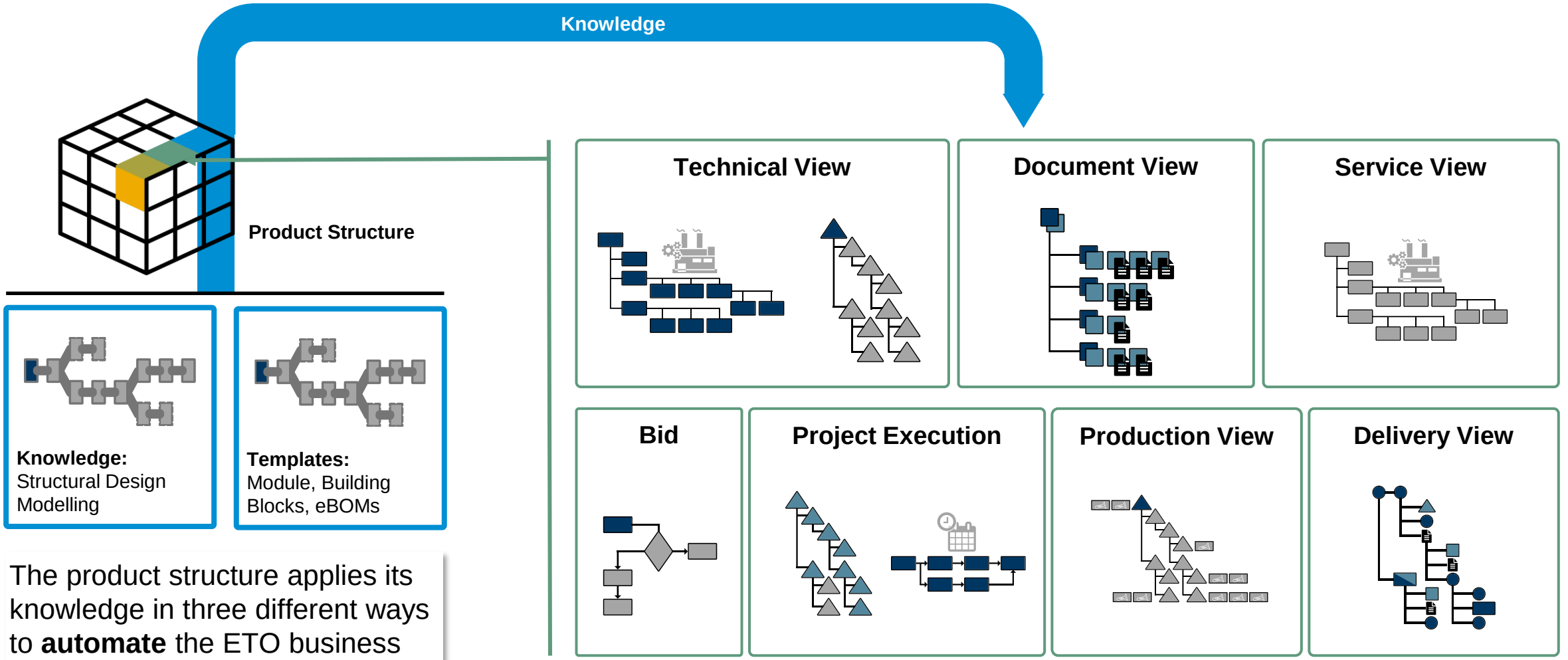
Design-driven Enterprise Architecture for ETO



Each phase requires special structures

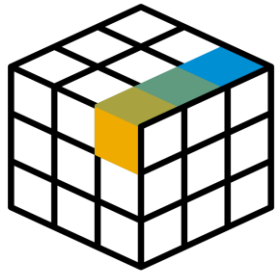


Design-Driven Enterprise: Product Structure Automation

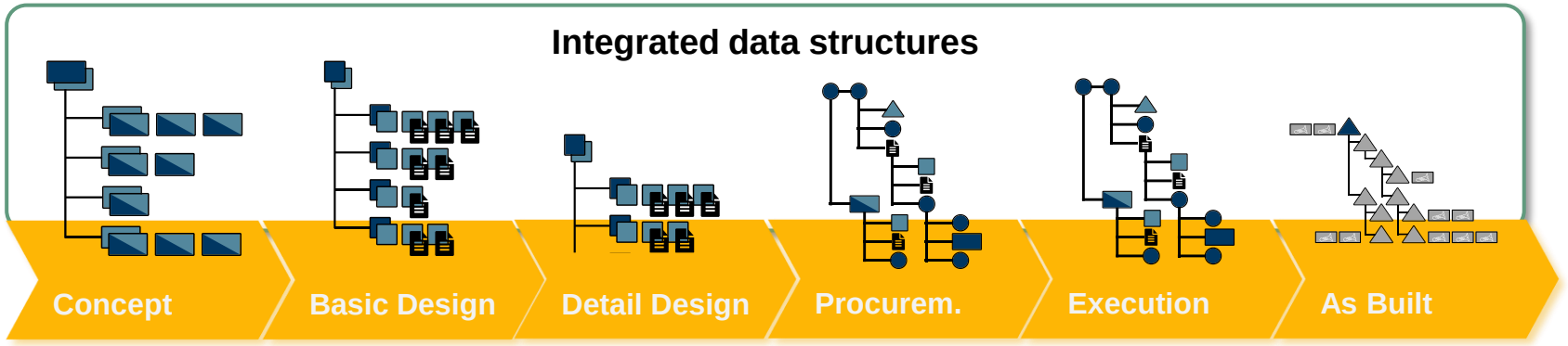


The product structure applies its knowledge in three different ways to **automate** the ETO business processes.

Design-Driven Enterprise: Product Structure Integration



The product structure knowledge results in a **seamless integration and automation** of the ETO process.



View: **functions**

View: **documents**

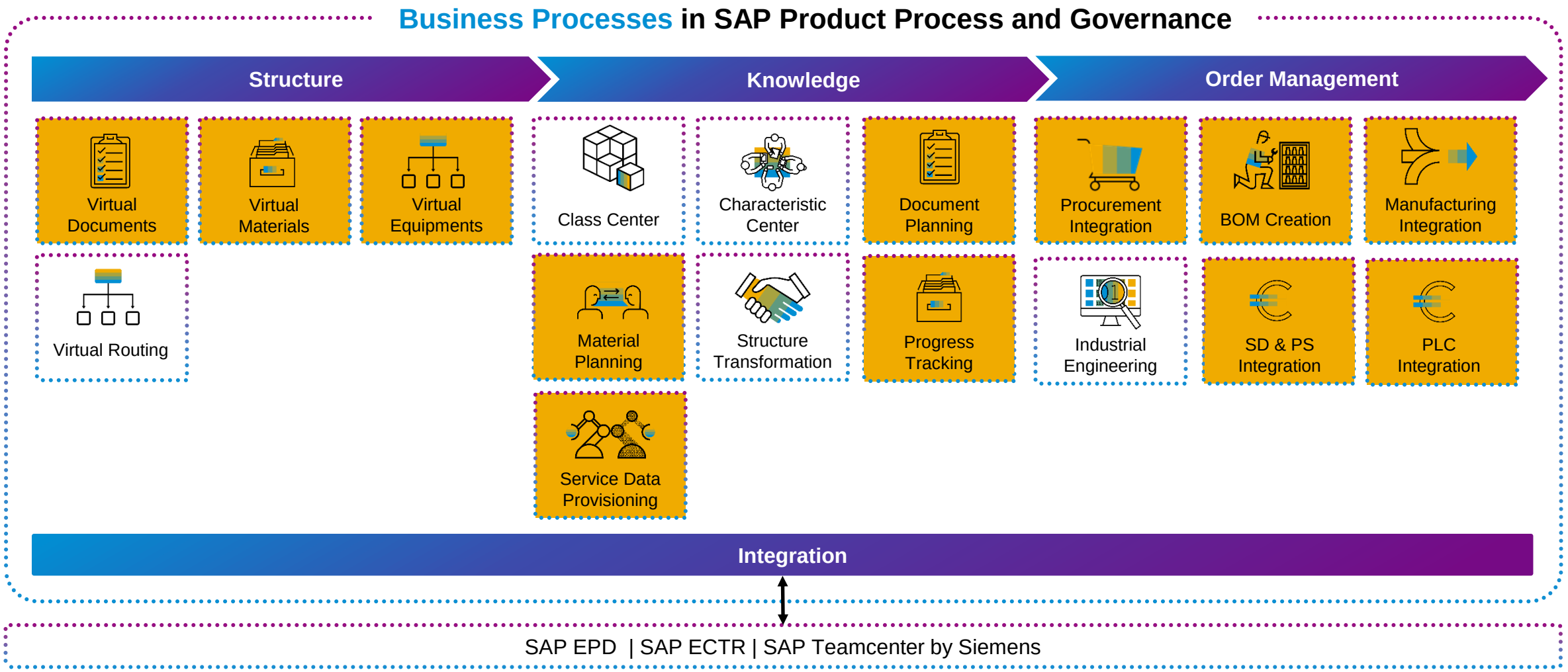
View: **material**

View: **schedule**

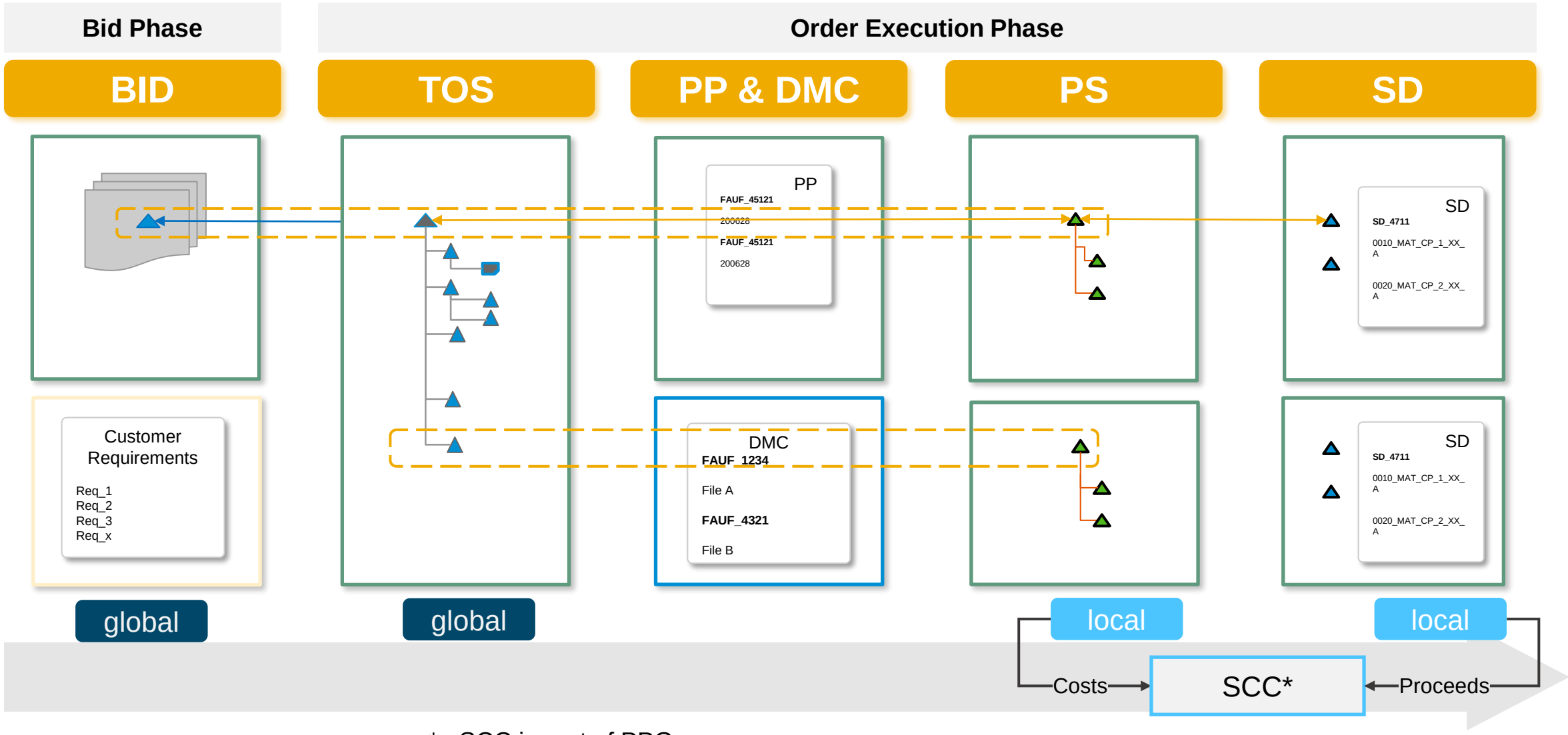
View: **costs**

View: **customer**

The business processes in SAP PPG are designed to help our customers address the needs of the design-driven enterprise.



Overview – PPG Capabilities 1: Automated PS-Integration

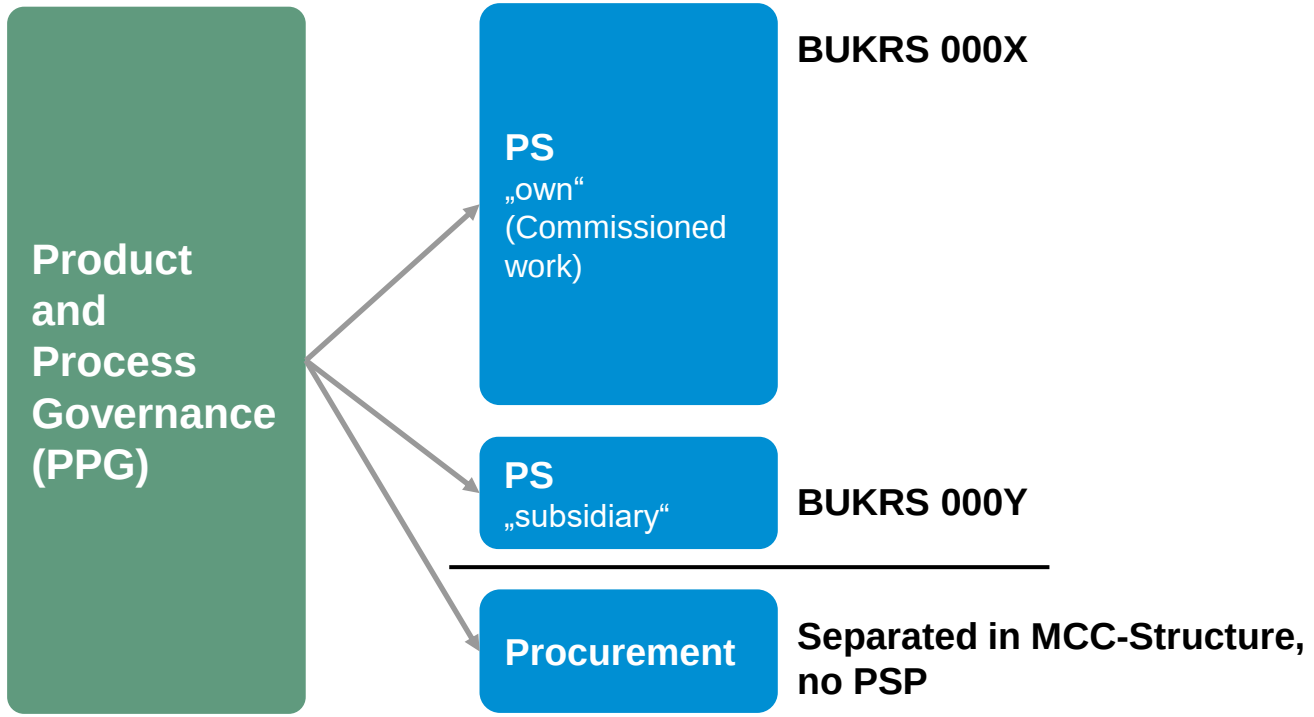


* SCC is part of PPG

Overview – PPG Capabilities 2: Multi Project Assignment

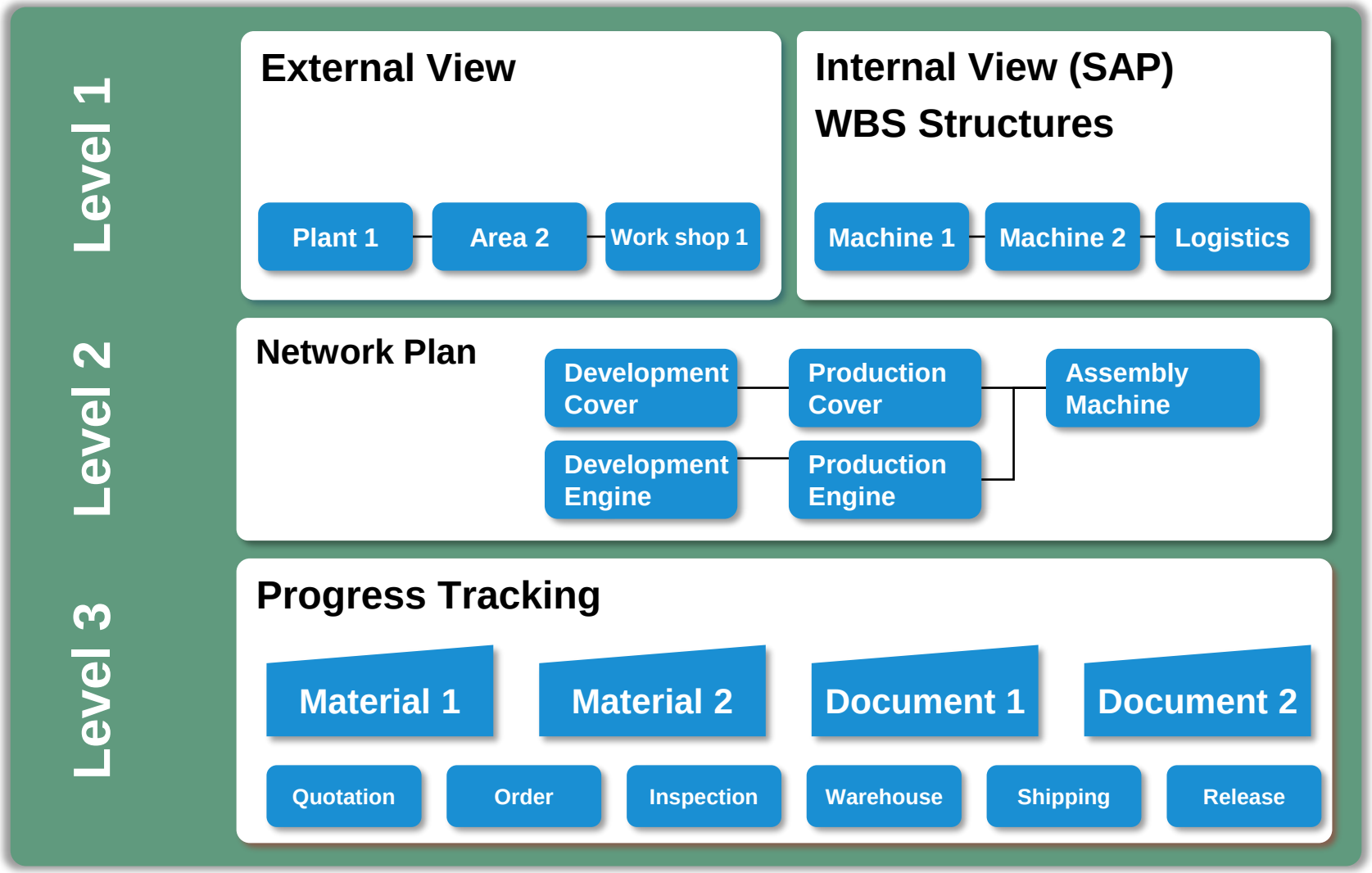
Example: Global cross-company code supplies and services determination

Global Engineering Structure

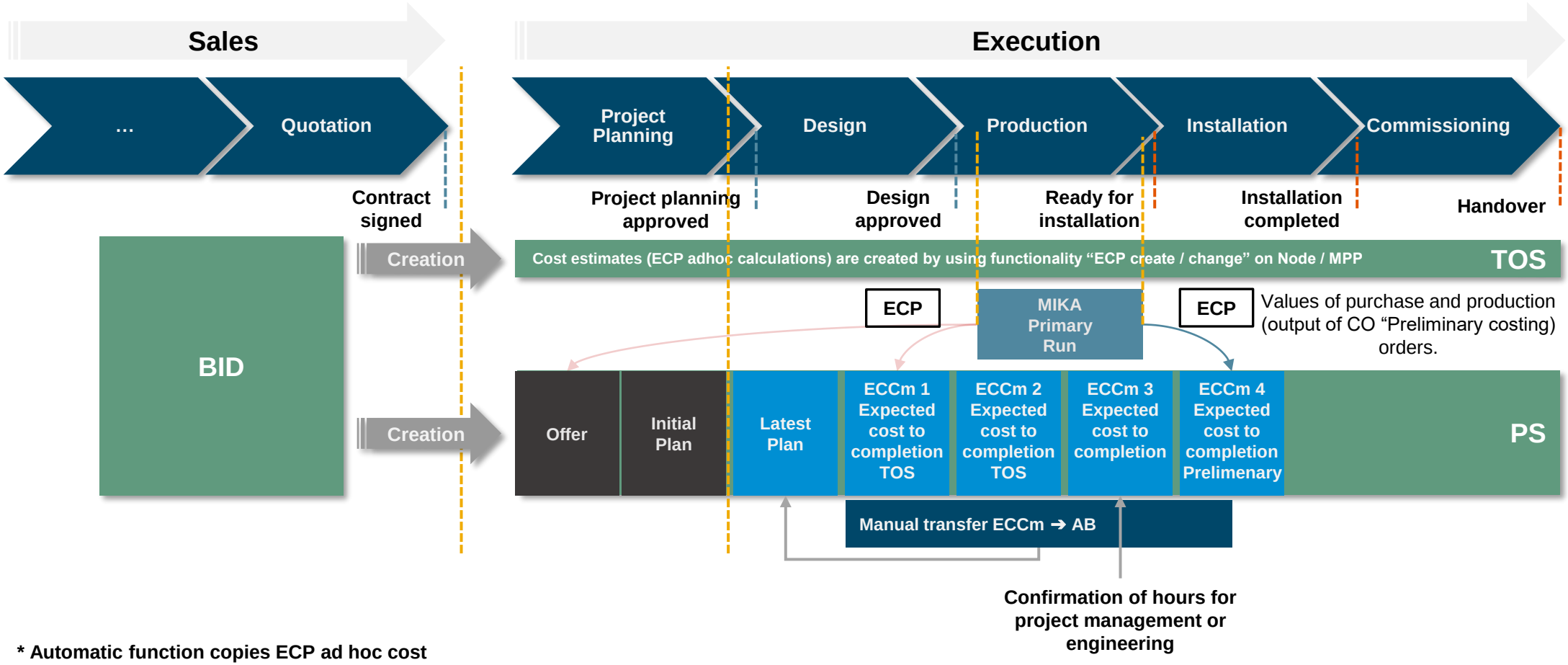


1. Control Indicator (DoW = Division of Work)):
   - **Purchasing (1000)**
   - **Engineering (2000)**
   - **Manufacturing (9000)**
2. Assignment of different projects and SD orders
3. Global Project Management

Overview – PPG Capabilities 3: TOS Integrated Progress Tracking



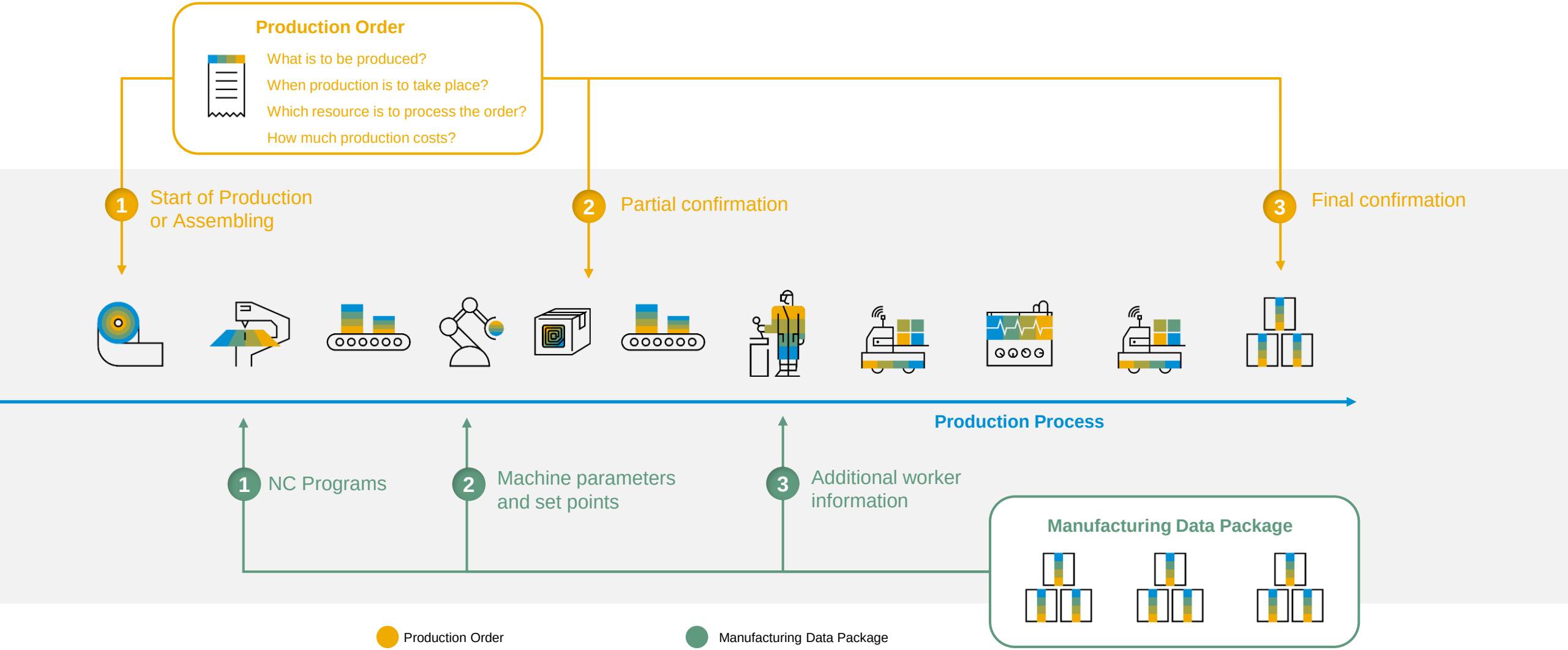
Overview – PPG Capabilities 4: Concurrent Project (Manufacturing) Costing



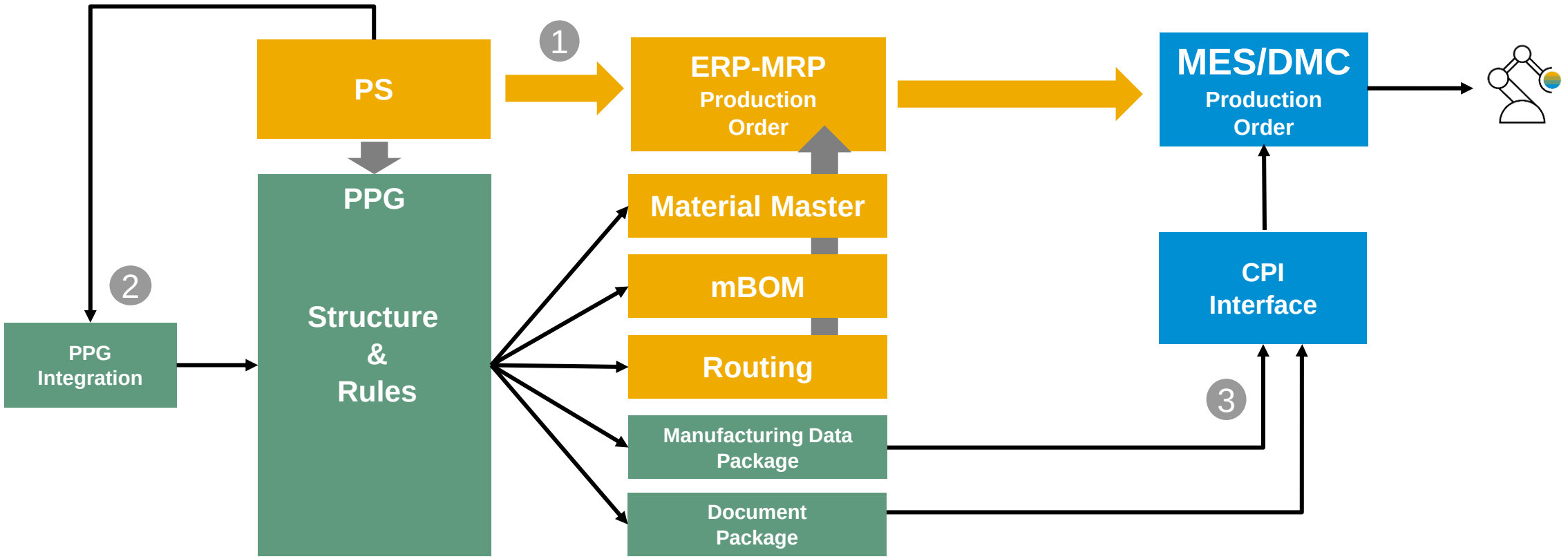
*** Automatic function copies ECP ad hoc cost estimates to ECP PS cost estimates including linkage ECP / TOS / PS.**

How do we solve Conveyors‘ business challenges in manufacturing?

Manufacturing Information Flow



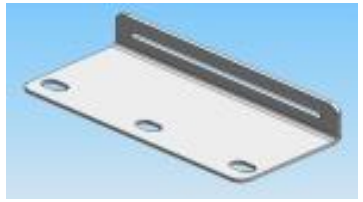
Automated Generation and integration of Manufacturing Data Data



1. The TOS defines the product und generates a production order.
2. The PPG integration and data model assigns or generates the specific production data for released nodes.
3. To provide more detailed data for each production order to MES a manufacturing data package is generated.

Example – Lot size 1 – Manufacturing Phases

Manufacture of components

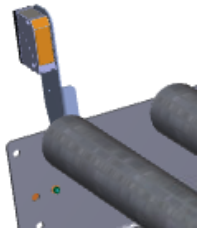


1. Material View:
    1. Raw Material
2. ERP Routing 01:
    1. Activity 10: Cutting
    2. Activity 20: Bend
3. Manufacturing Data Package:
    1. Details for laser controller

Phase 1 – Base Frame

1. Material View:
    1. Side Panel
    2. Roller
    3. Screws
2. ERP Routing 02:
    1. Activity 10: Assemble
3. Manufacturing Data Package:
    1. …..
    2. ……

Phase X – Optical barrier



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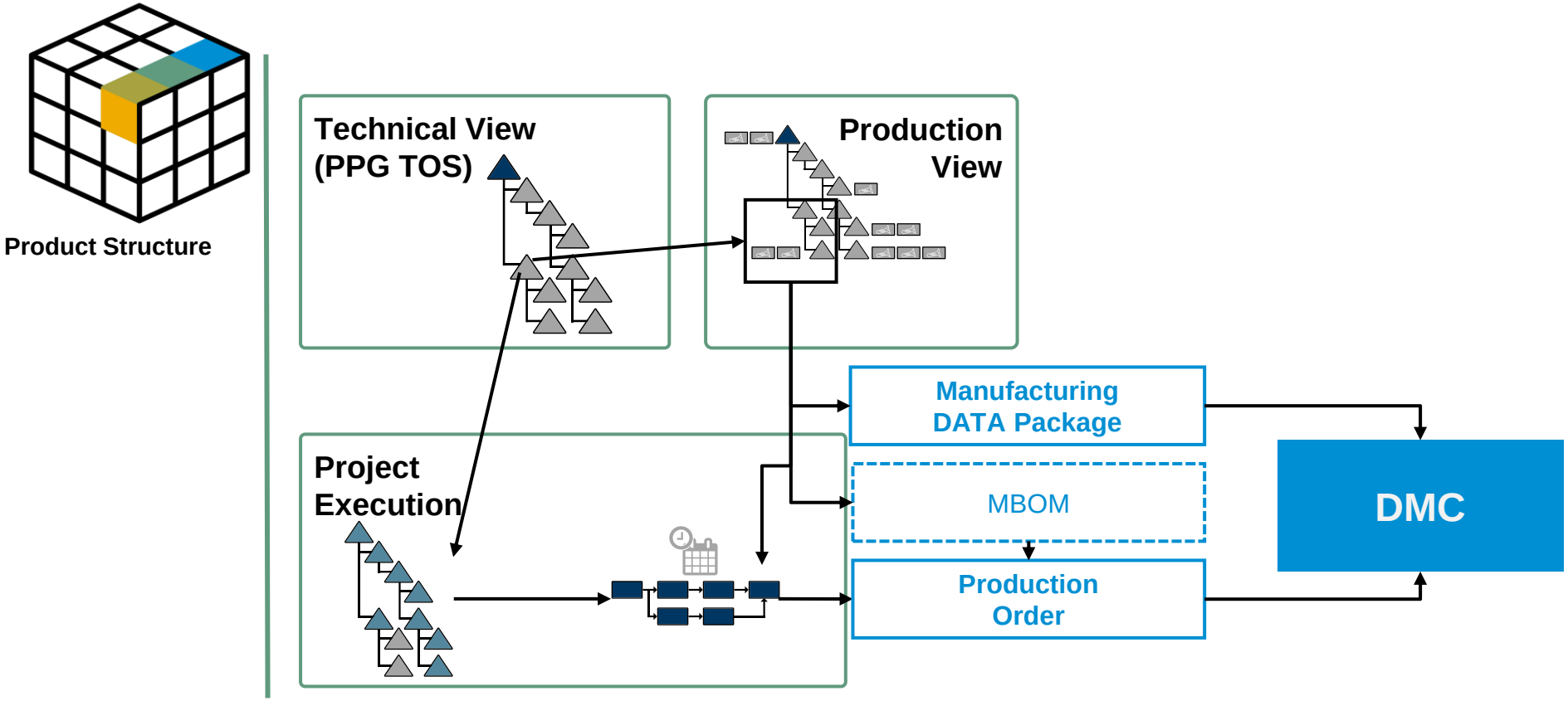
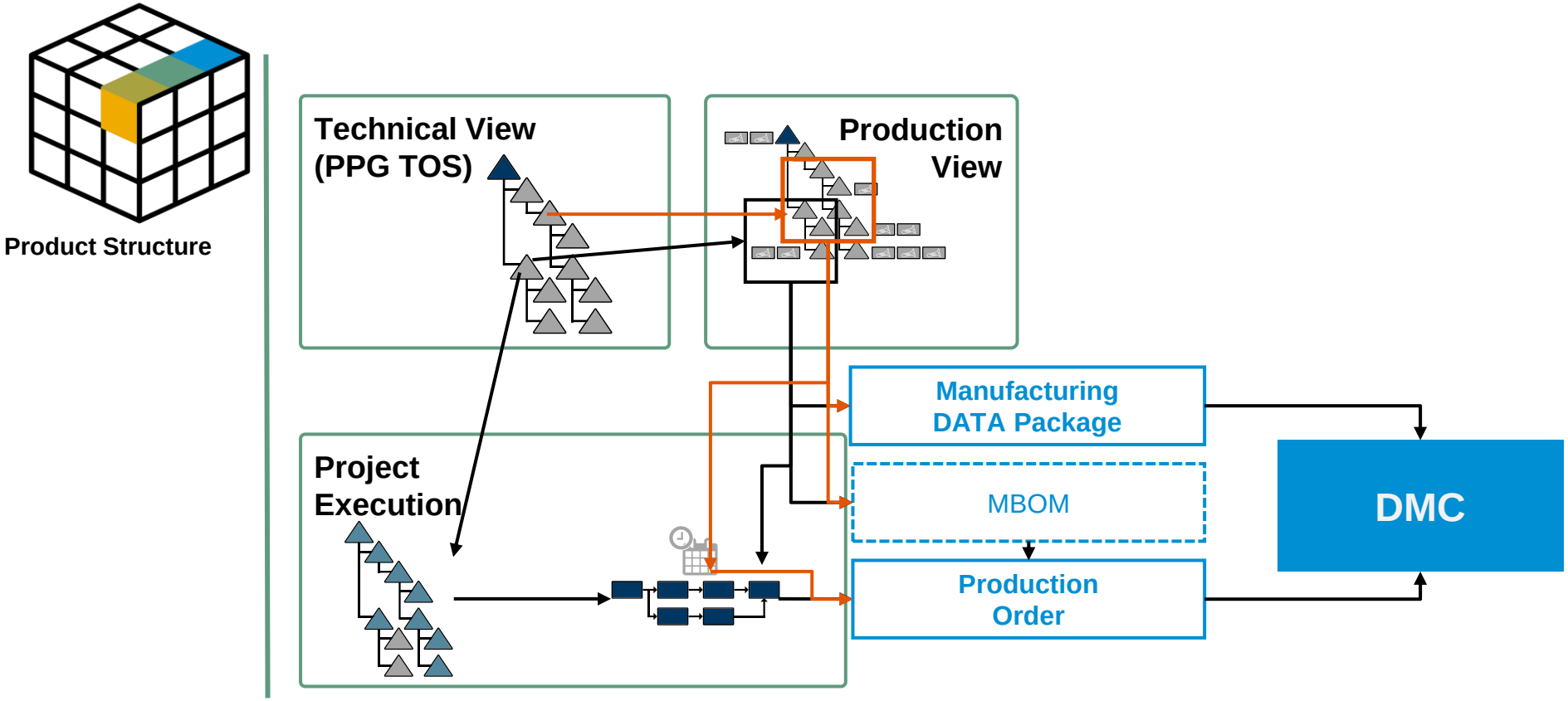
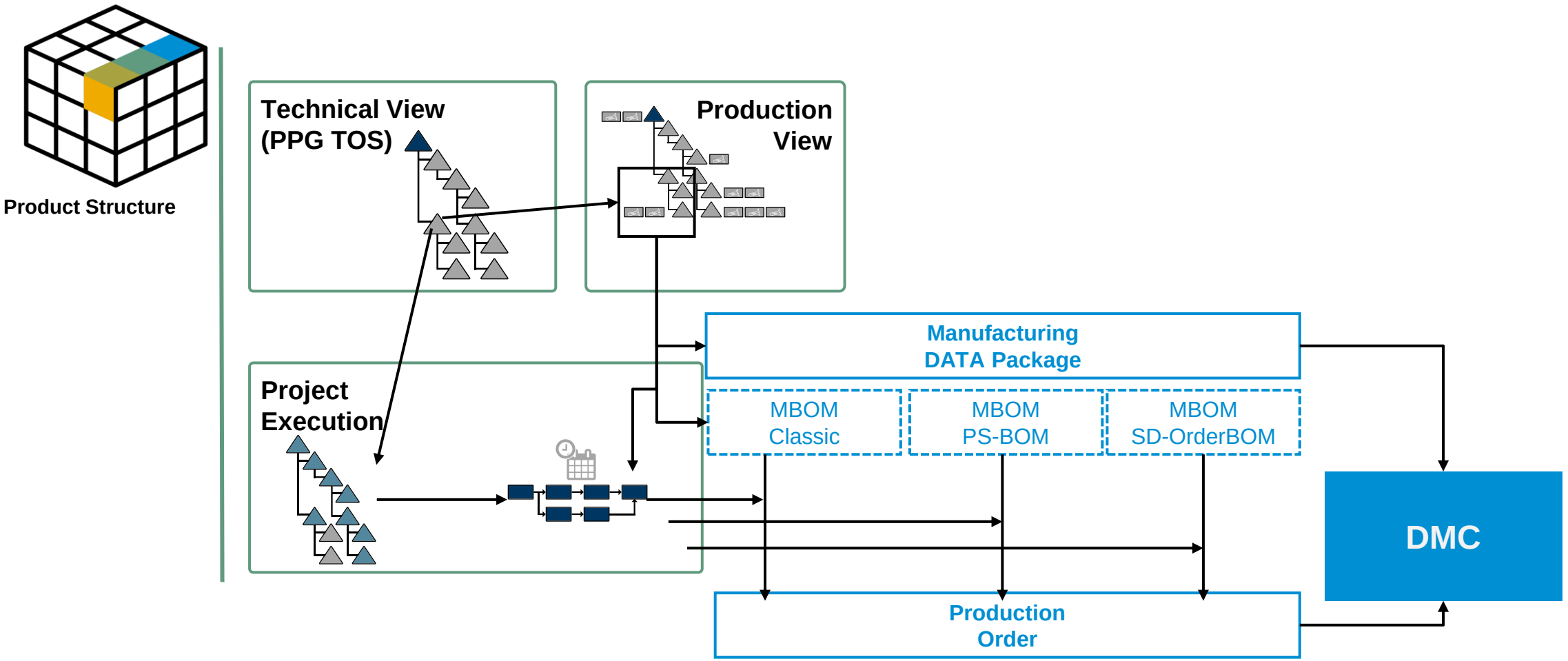
Hand-over to Manufacturing: Overview



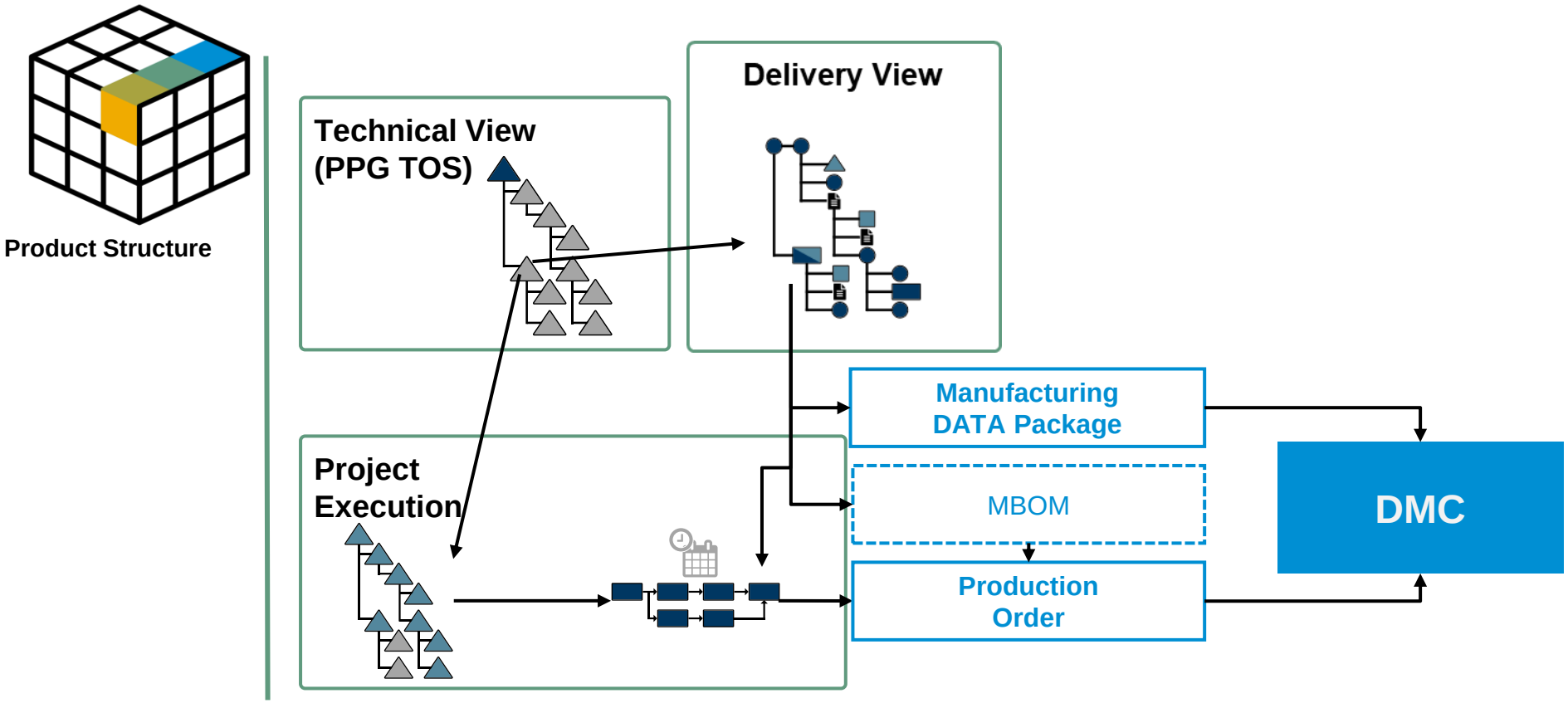
Hand-over to Manufacturing: Network Plan and Release to Manufacturing



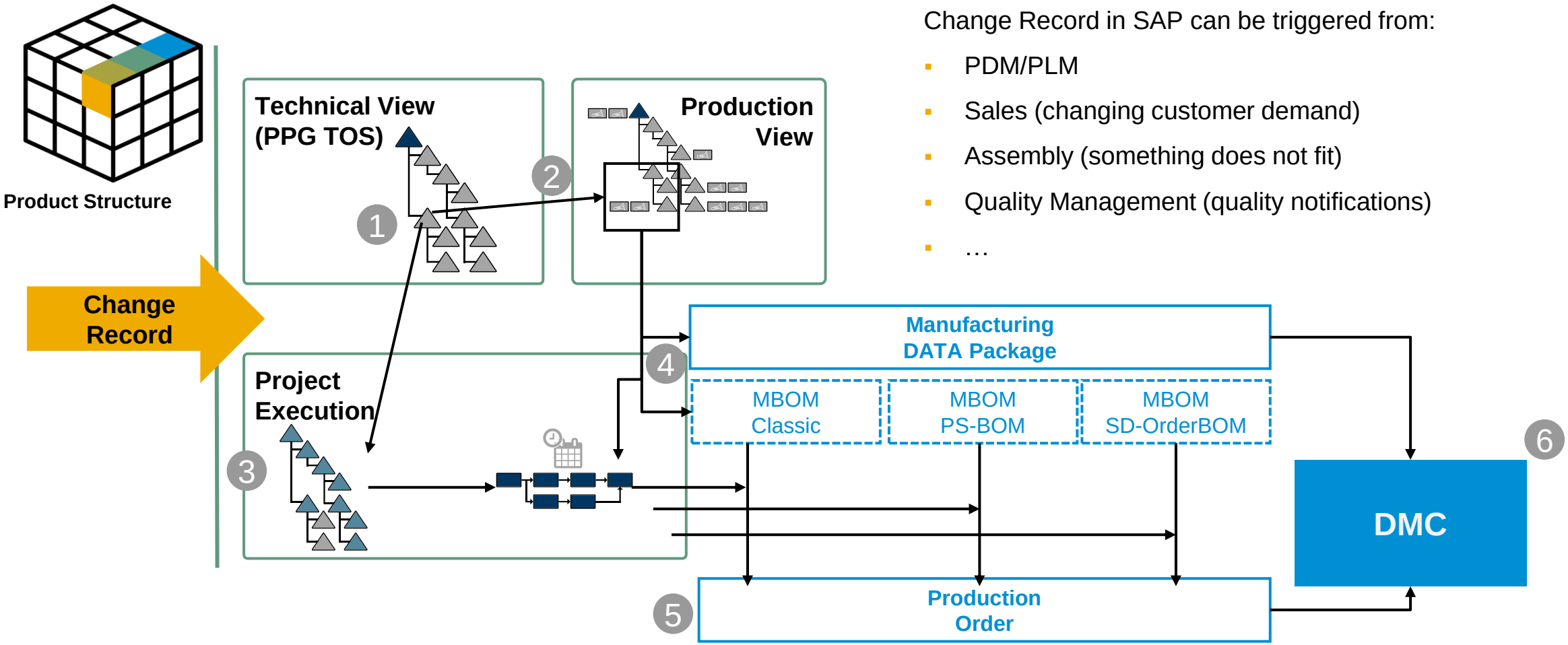
Hand-over to Manufacturing: Different BOM-types are supported



Hand-over to Manufacturing: Disassembly is supported



Hand-over to Manufacturing: Change Management is supported

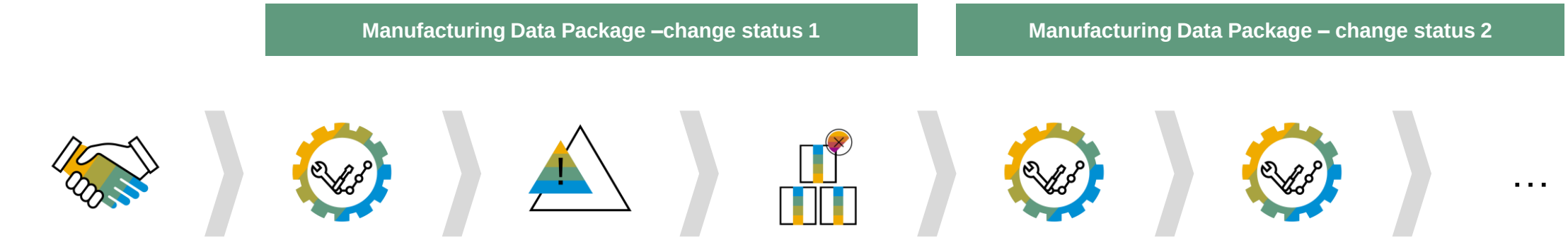


Change Record in SAP can be triggered from:

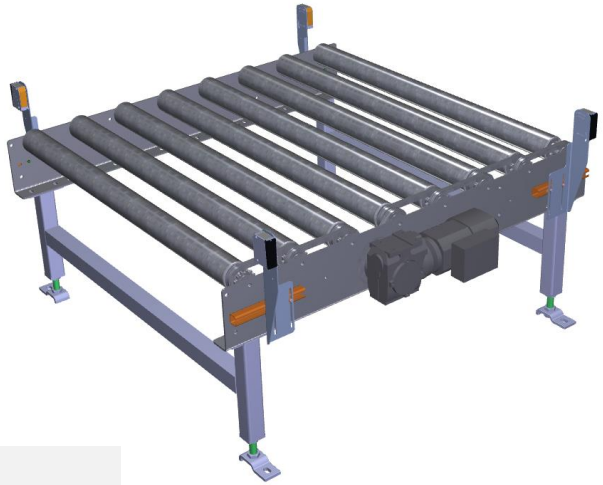
- PDM/PLM
- Sales (changing customer demand)
- Assembly (something does not fit)
- Quality Management (quality notifications)
- …

How will Conveyor work within SAP in the future?

Simplified Process Flow



From Design to Manufacturing: Detailed Process Flow



Order Execution Phase

Product and Process Governance (PPG) | Digital Manufacturing Cloud (DMC)

Create technical order structure

Lars
Project Engineer

Create data package for shop floor

Overview DMC & order release

Fred
Key-User Production

Review data package

Gregor
Assembly Operator

Order Execution Phase

Digital Manufacturing Cloud (DMC) | PPG | Digital Manufacturing Cloud (DMC)

Assemble with visual work instruction

Gregor
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Rework data package

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Report non conformance

Raise alert & send to ERP

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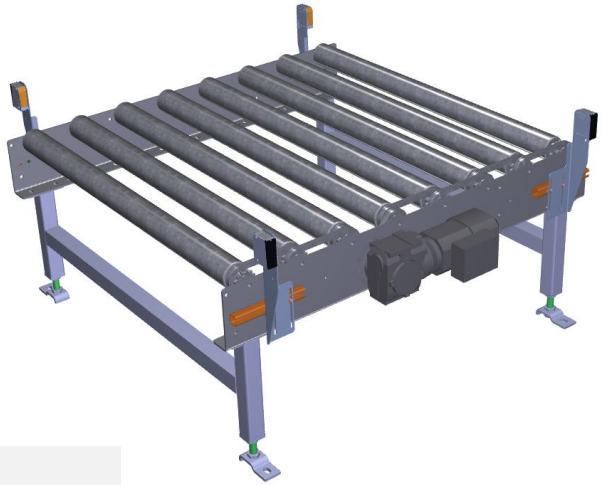

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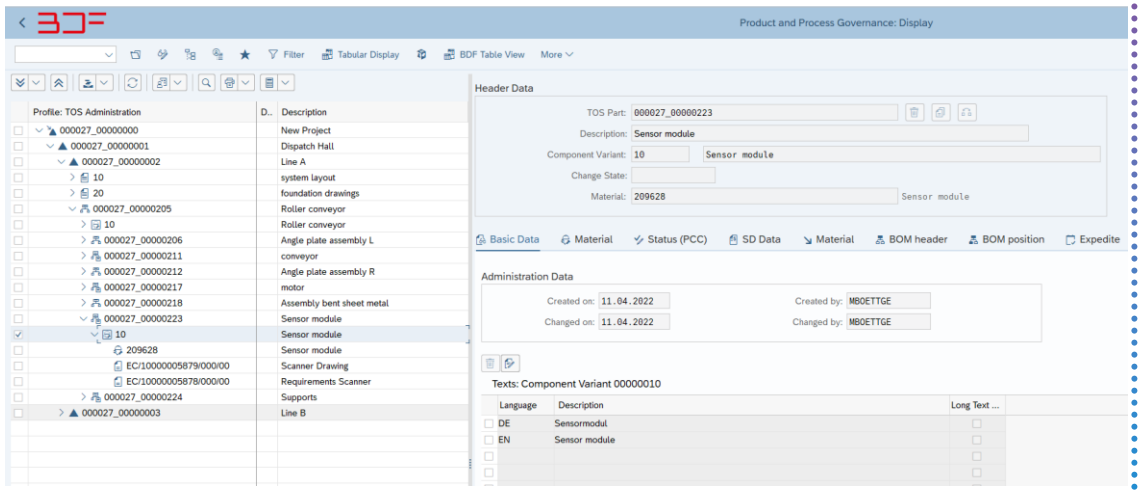
Create technical order structure

Business Outcomes

*“As an **Project Engineer**, I want to create the product data so that downstream processes can be executed automatically.”*

Lars
Project Engineer



Process Highlights & Benefits

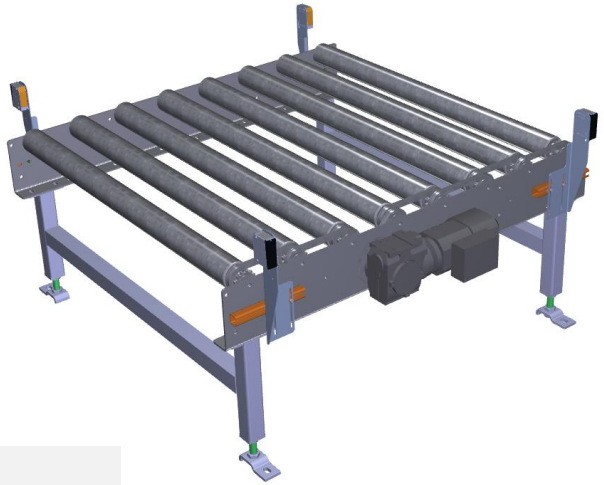
In the technical order structure (TOS) the allocation of the scope of supply and services (LLU indicator) is planned.

The TOS determines which items are **to be procured where and how:**

- Procurement: own / external (procure / make) / customer
- Engineering: internal / external / customer
- Differentiation of the individual locations and all combinations

Provide digital twin foundation early in design phase

From Design to Manufacturing: Detailed Process Flow



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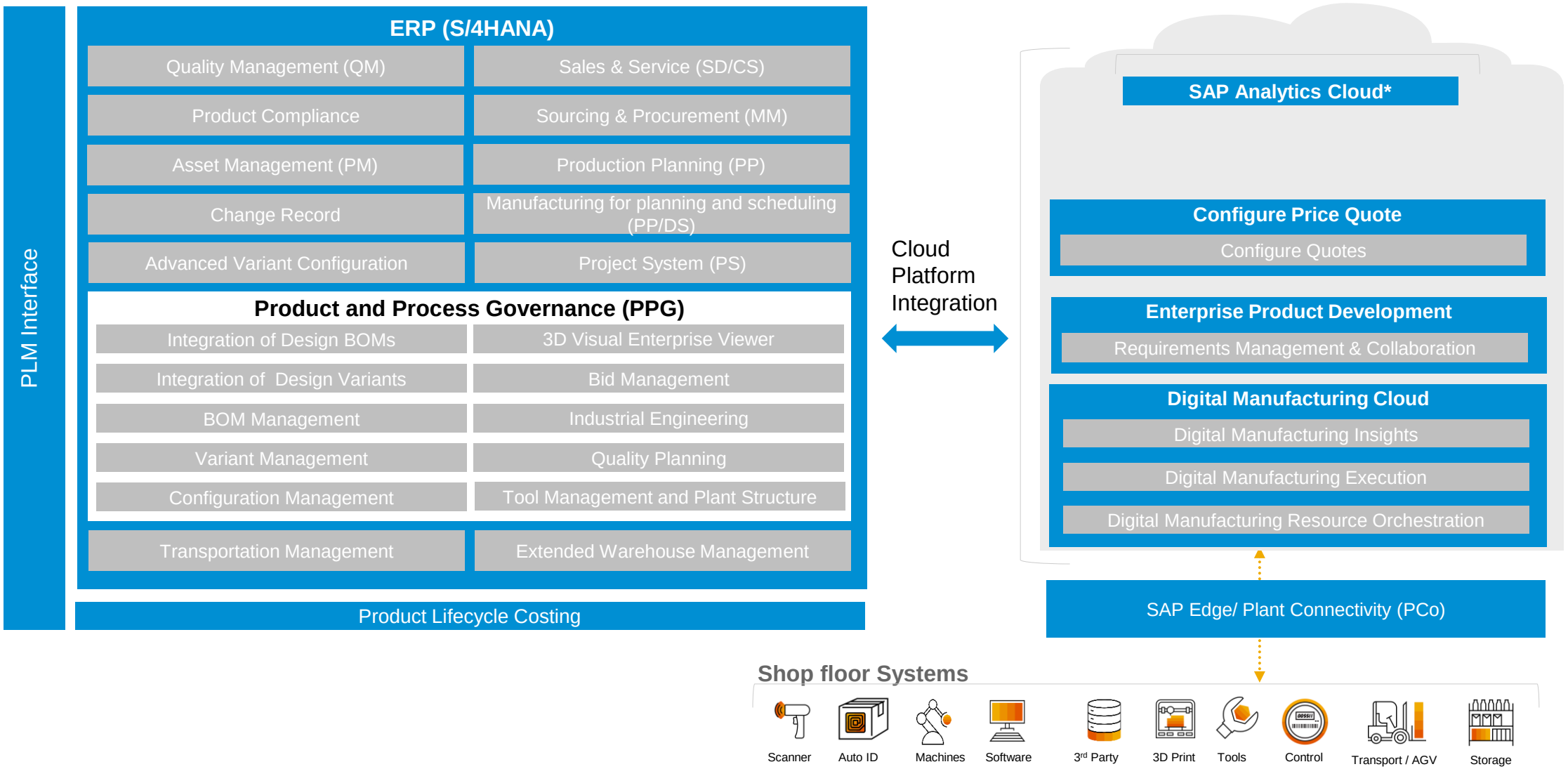
Architecture ERP & MES

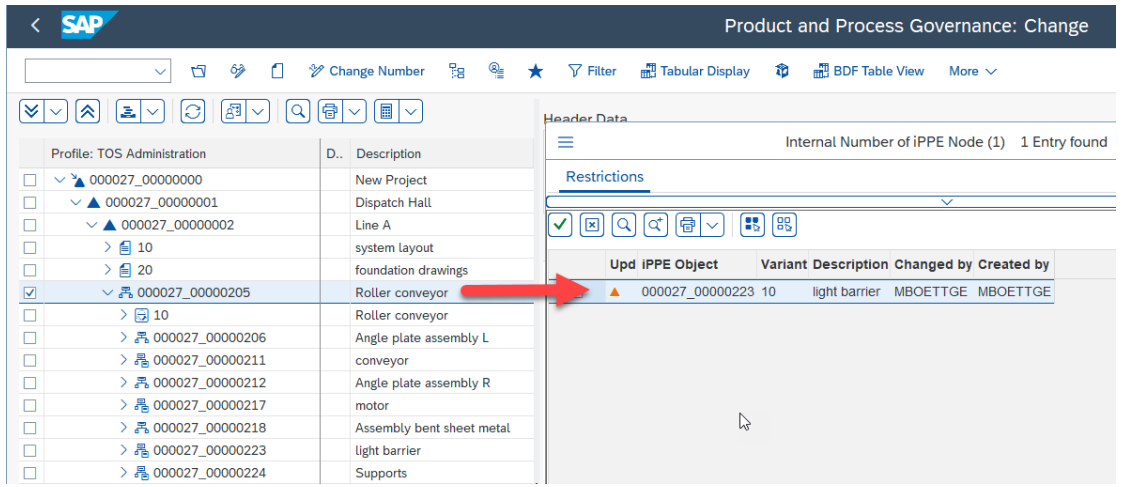


Create manufacturing data package for shop floor

Business Outcomes

*"As a **Project Engineer**, I want to supply the shop floor with all the relevant data so that production can be started and there are no queries."*

Lars
Project Engineer



Process Highlights & Benefits

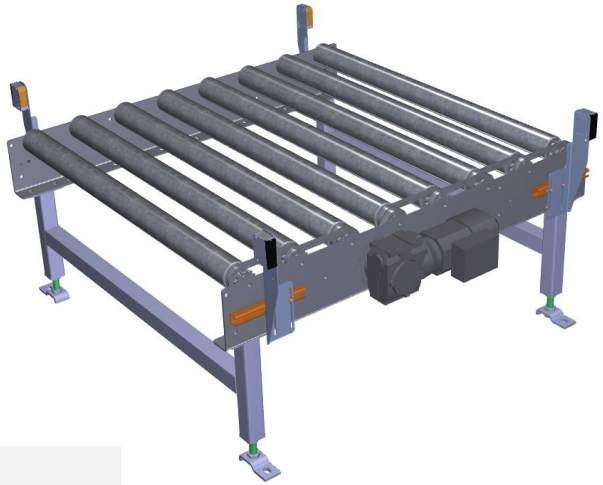
The automation level increases if the shop floor is provided not only with a variant specific routing and mBOM but also with all other instructions in a single data package.

Change management is simplified if only the data package needs to be edited. Thus new products can be launched faster.

The ability of the technical order structure to **configure the manufacturing data package automatically** allows to fully leverage the flexibility of the robots.

The complexity in the manufacturing execution system and customization effort is **reduced.**

From Design to Manufacturing: Detailed Process Flow



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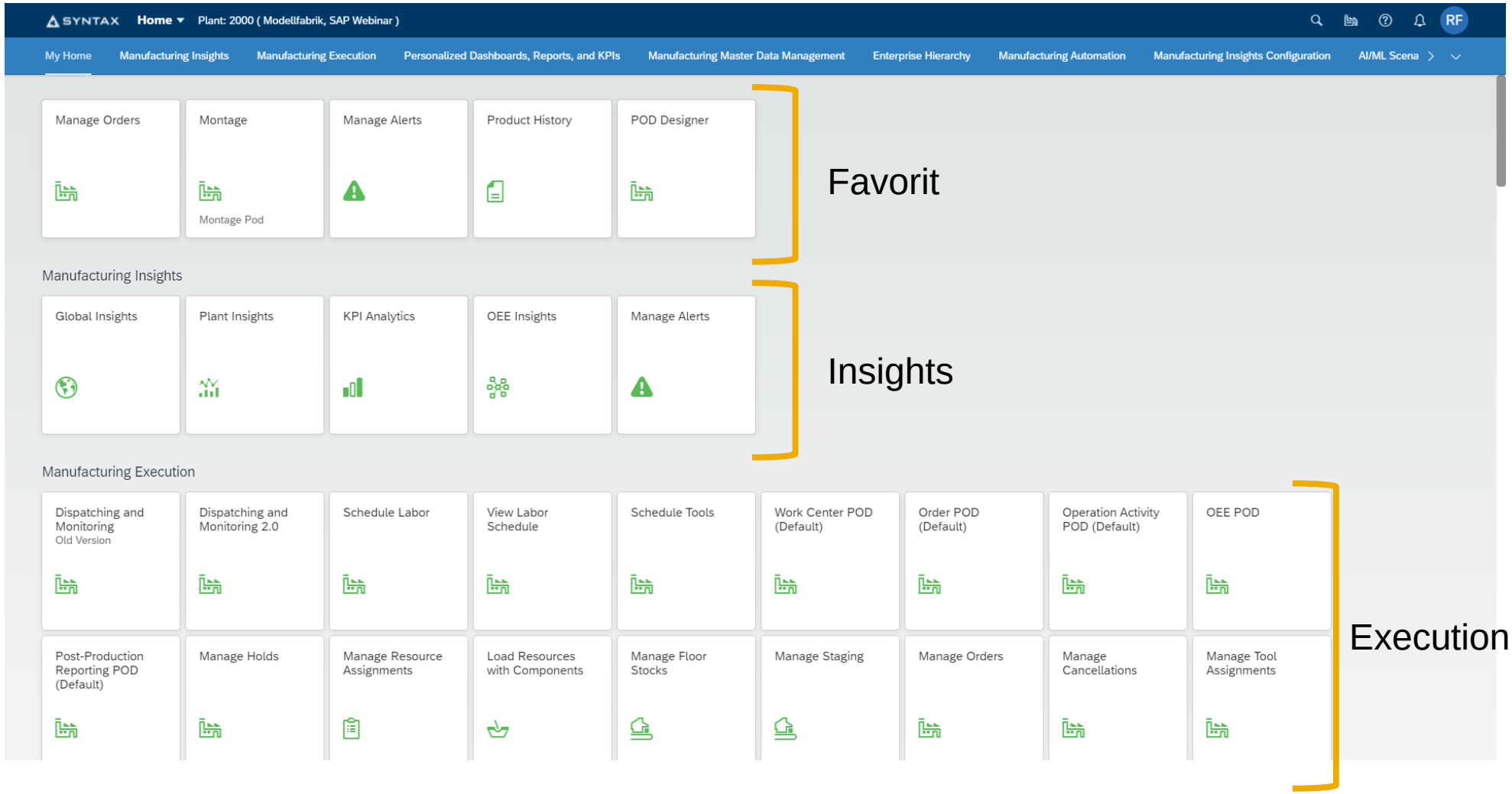
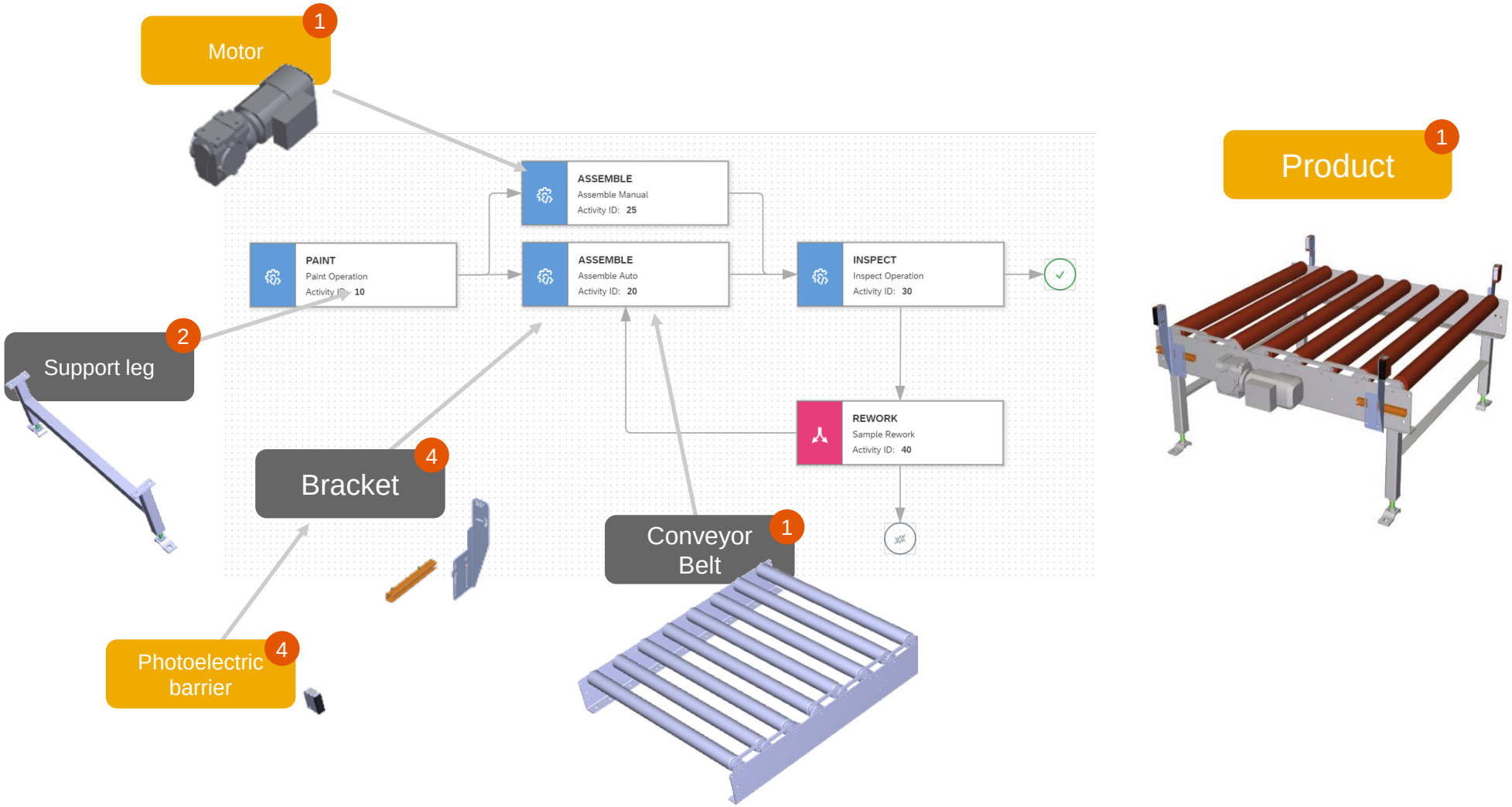
SAP Digital Manufacturing Cloud – Launchpad



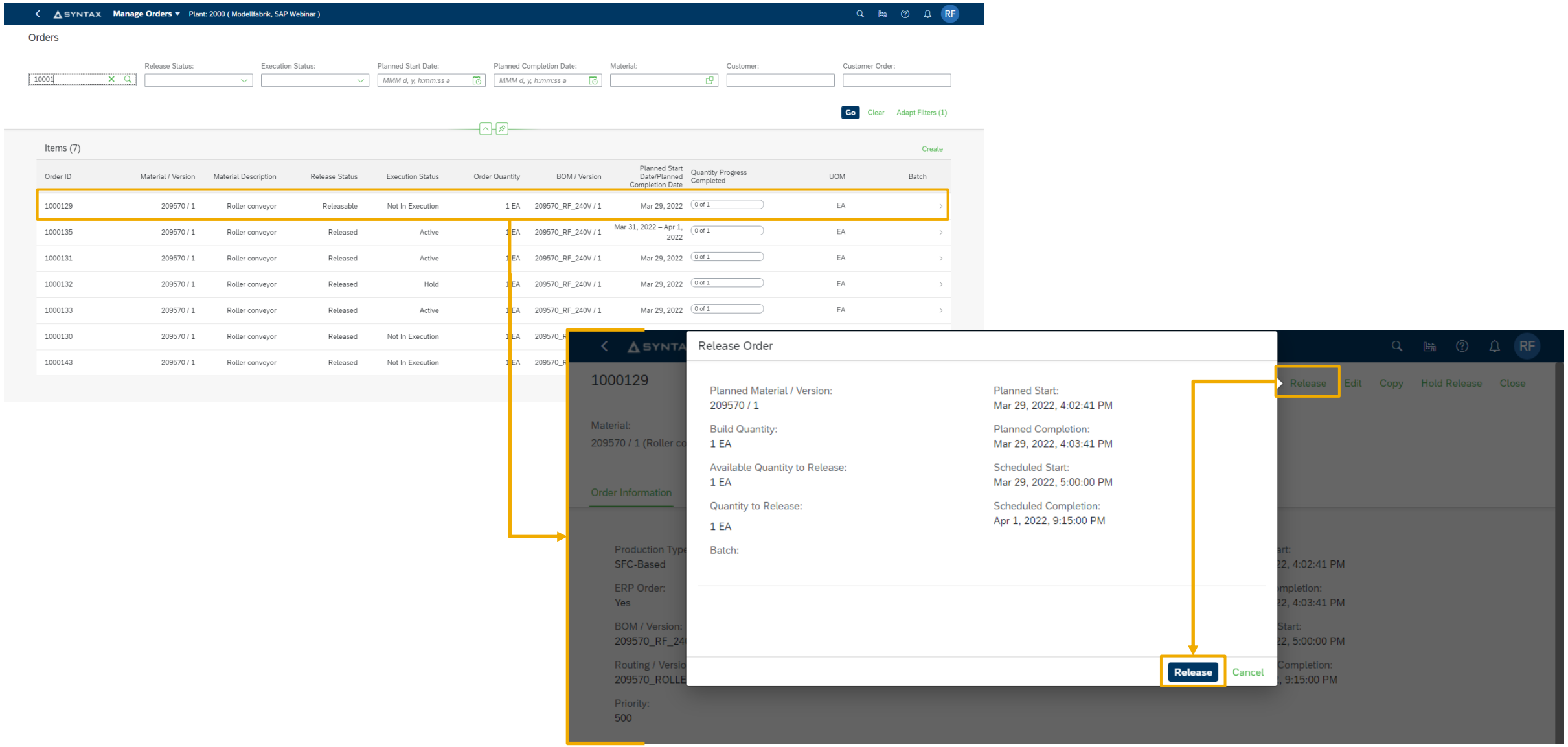
Digital Manufacturing Cloud is an MES solution.

The MES solution covers manufacturing execution, analytics and scheduling. It guides the worker, integrates with machines and provides full traceability of the production process.

Flexibility in the SFC Definition enables the exact Genealogy



Supervisor order release



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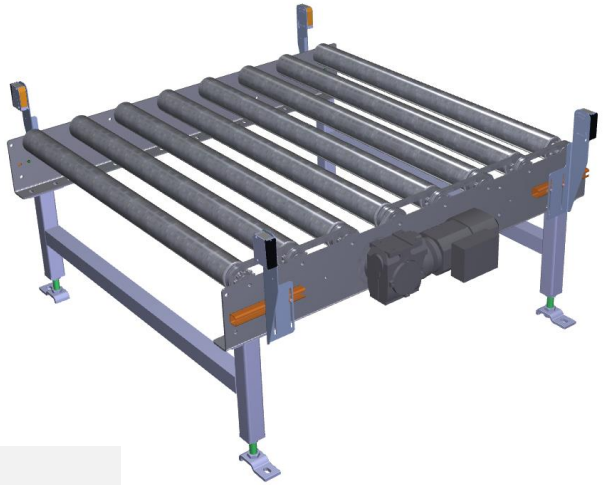

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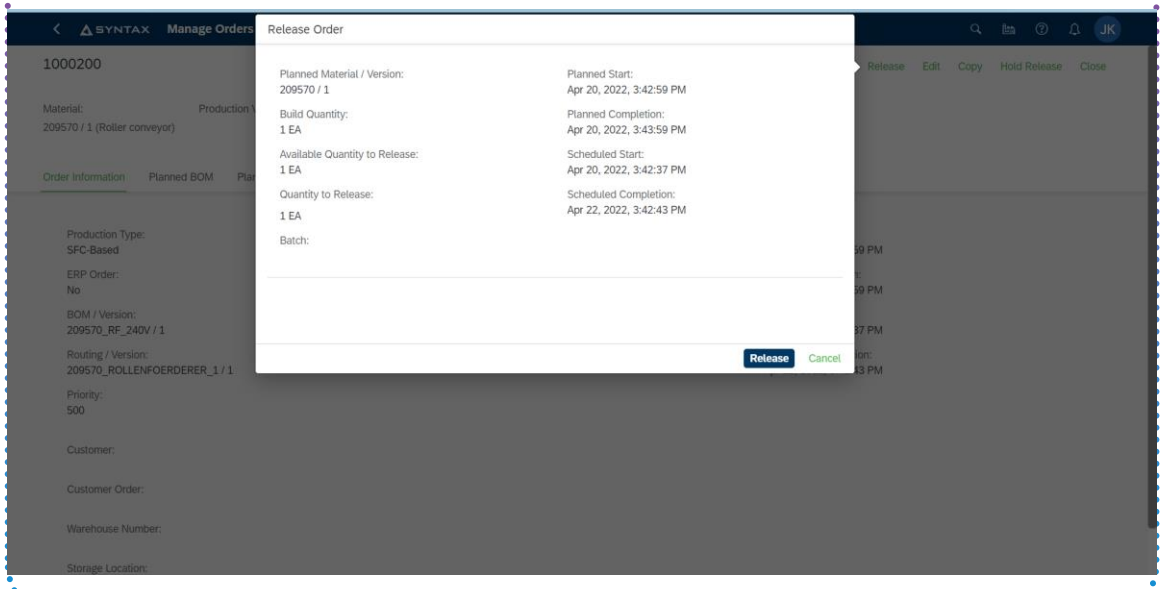
Business Outcomes

*"As **Assembly Operator,** I want to review relevant data for my tasks to work error free."*

Gregor
Assembly Operator



Process Highlights

Work error free

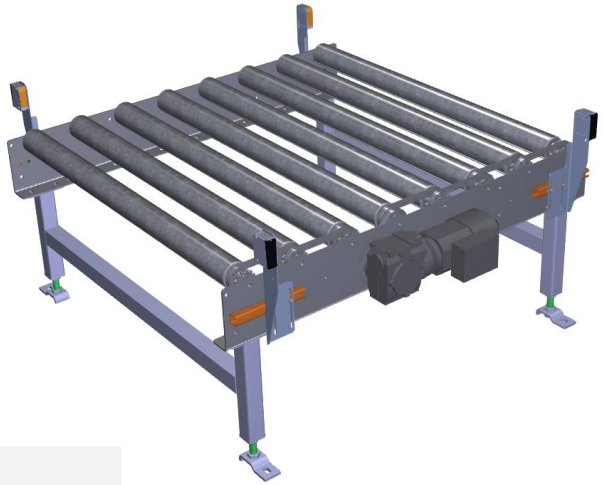
Review all relevant Order details before release

React just in time changes e.g. Priority

Visualize Bom, Routing, Status, Customer and Yield/Scrap Progress view

Full integrated interface with ECC, S/4HANA and S/4HANA Cloud

From Design to Manufacturing: Detailed Process Flow



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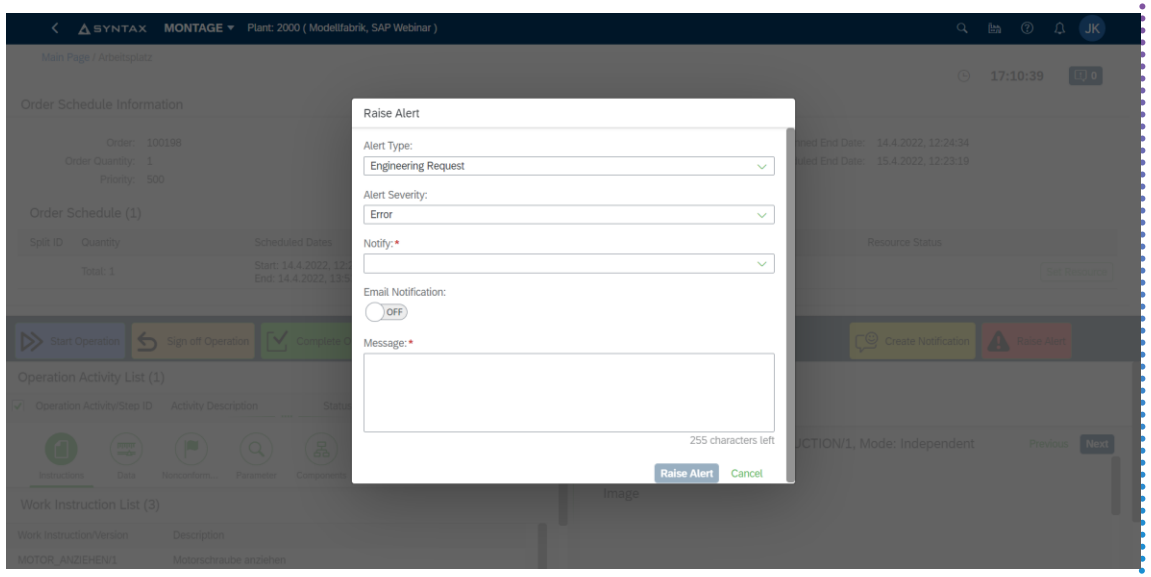
Raise alert & send to ERP

Business Outcomes

*"As an **Assembly Operator,** I want to inform my supervisor in case of errors or malfunctions during production"*

Gregor
Assembly Operator



Process Highlights

Send alerts to ERP System

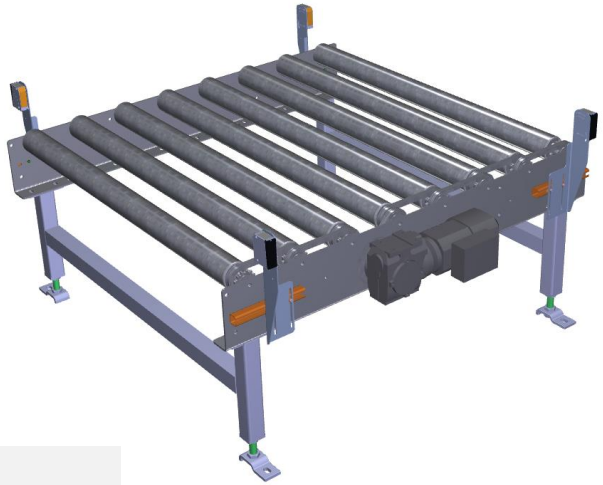
Include text to specify the alert

Choose from different type of alerts

Allow to inform supevisors by email

Manage raised alerts, by closing or reopening them

From Design to Manufacturing: Detailed Process Flow



Order Execution Phase

Product and Process Governance (PPG) | Digital Manufacturing Cloud (DMC)

Create technical order structure — **Lars**, Project Engineer

Create data package for shop floor

Overview DMC & order release — **Fred**, Key-User Production

Review data package — **Gregor**, Assembly Operator

Order Execution Phase

Digital Manufacturing Cloud (DMC) | PPG | Digital Manufacturing Cloud (DMC)

Assemble with visual work instruction — **Gregor**, Assembly Operator

Review data package

Rework data package — **Lars**, Project Engineer

Report non conformance

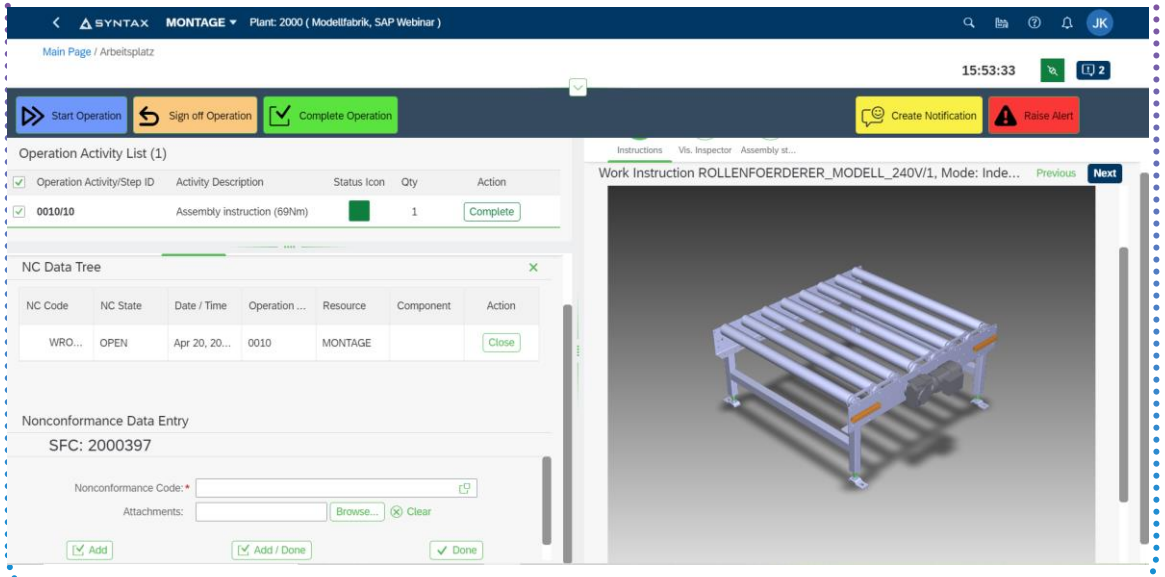
Raise alert & send to ERP — **Gregor**, Assembly Operator

Report non conformance

Business Outcomes

*"As an **Assembly Operator,** I want to log errors, warnings or to inform supervisors during production, so that everything is well documented."*

Gregor
Assembly Operator



Process Highlights

Overview of available non conformances for a product

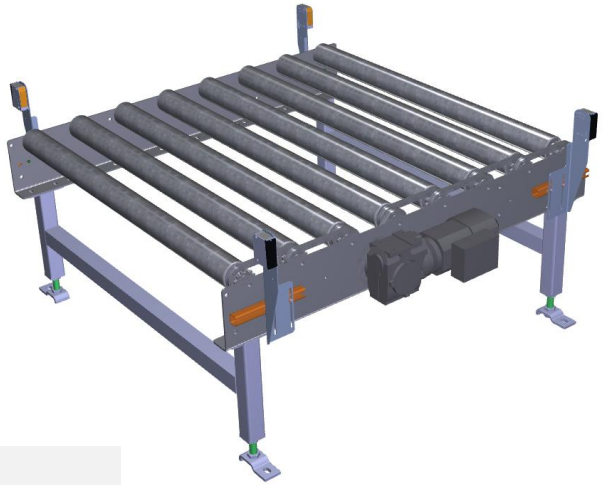
Log non conformance code by the operator

Automated disposition routing based on non conformance code

Attach files **of logged non conformance**

Close or open non conformance

From Design to Manufacturing: Detailed Process Flow



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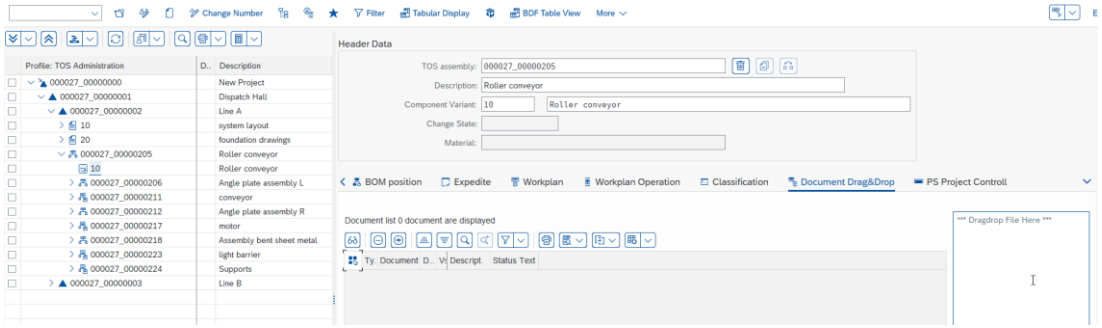
Rework manufacturing data package for shop floor

Business Outcomes

*“As a **Project Engineer**, I want to supply the shop floor with all the relevant data so that production can be started and there are no queries.”*

Lars
Project Engineer



Process Highlights & Benefits

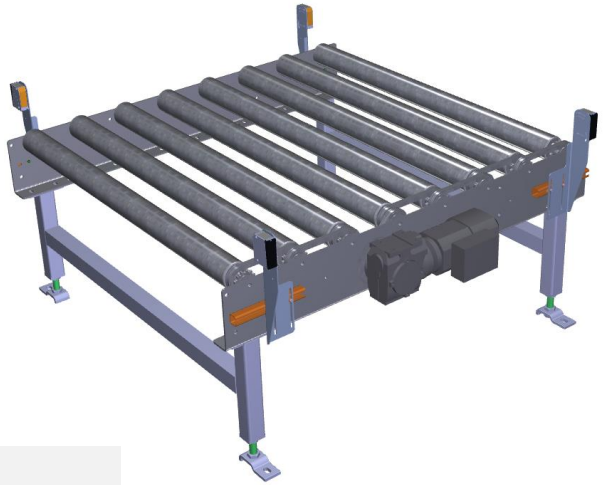
The automation level increases if the shop floor is provided not only with a variant specific routing and mBOM but also with all other instructions in a single data package.

Change management is simplified if only the data package needs to be edited. Thus new products can be launched faster.

The ability of the technical order structure to **configure the manufacturing data package automatically** allows to fully leverage the flexibility of the robots.

The complexity in the manufacturing execution system and customization effort is **reduced.**

From Design to Manufacturing: Detailed Process Flow



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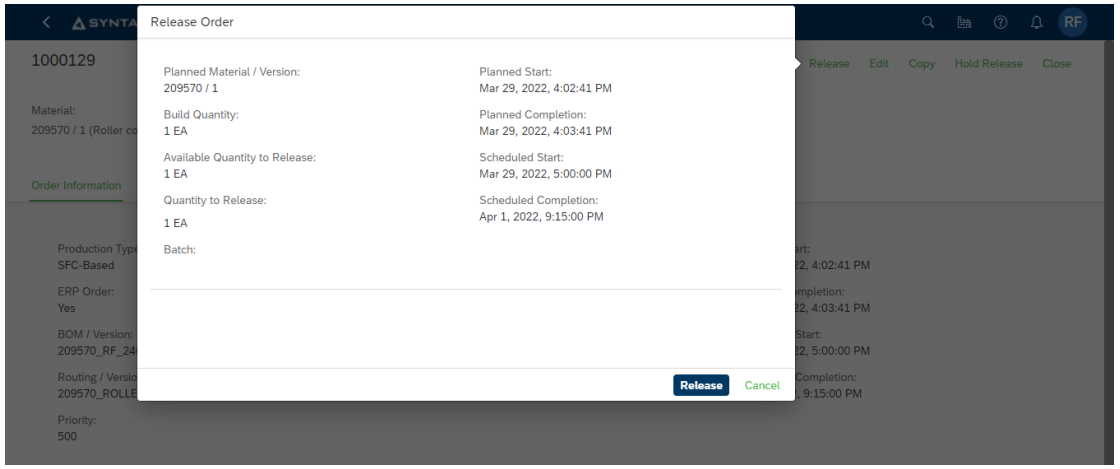
Business Outcomes

*"As **Key-User Production,** I want to decide which order should start so that I can influence the priority."*

Gregor
Assembly Operator



Process Highlights

Release an order to the shop floor

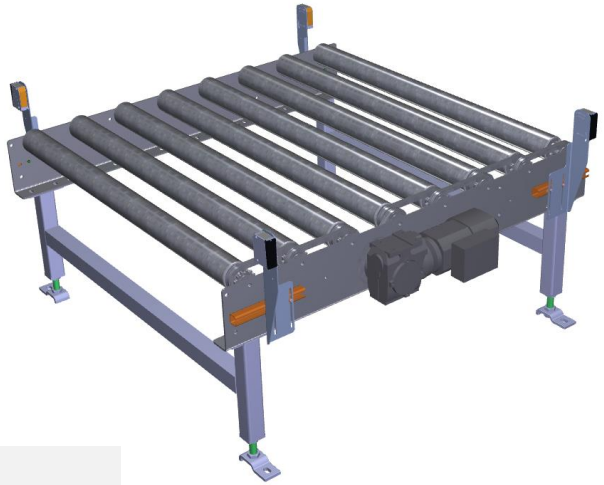
Review all relevant Order details before release

React just in time changes e.g. Priority

Visualize Bom, Routing, Status and Yield/Scrap Progress view

Full integrated interface with ECC, S/4HANA and S/4HANA Cloud

From Design to Manufacturing: Detailed Process Flow



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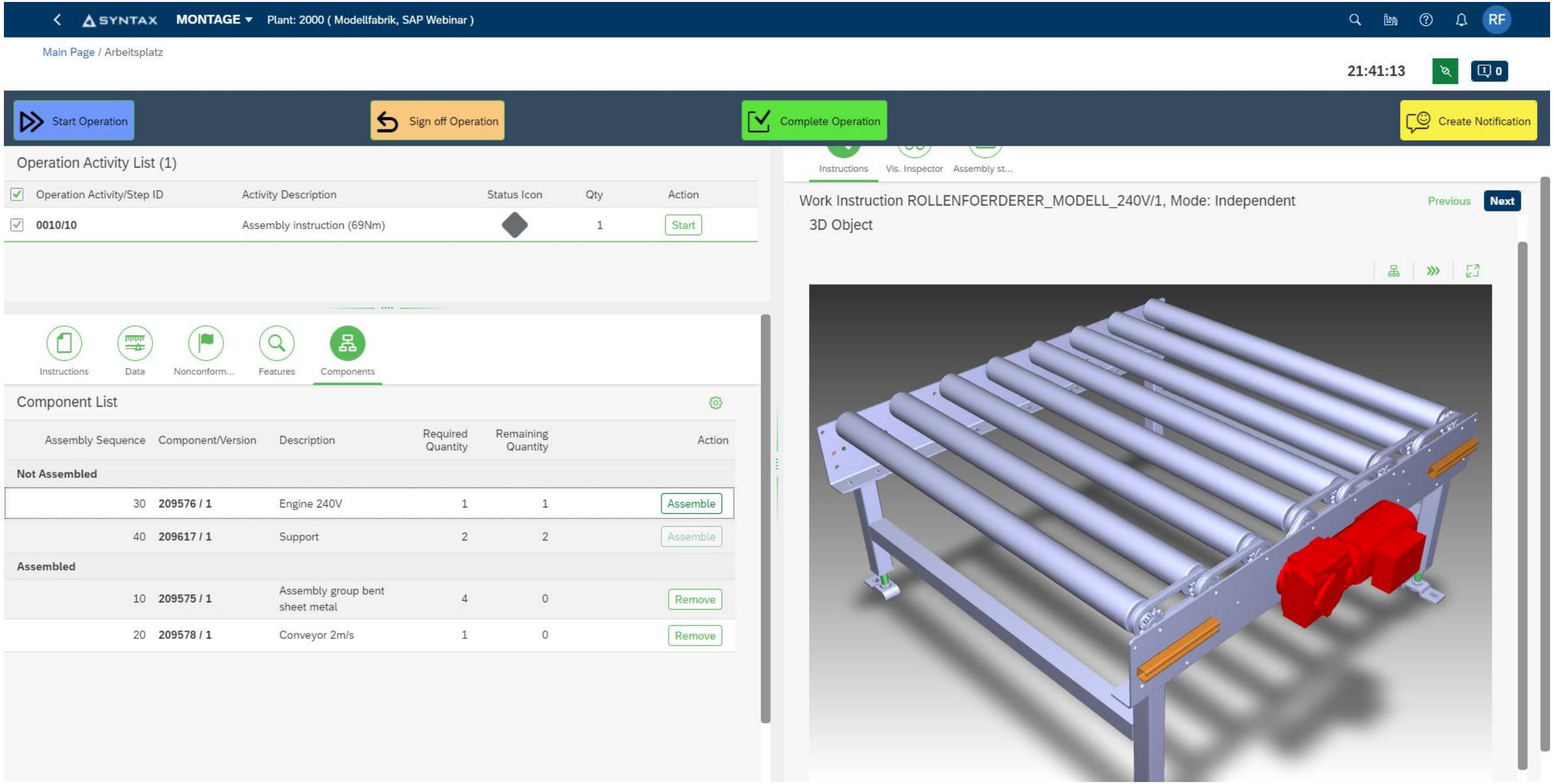
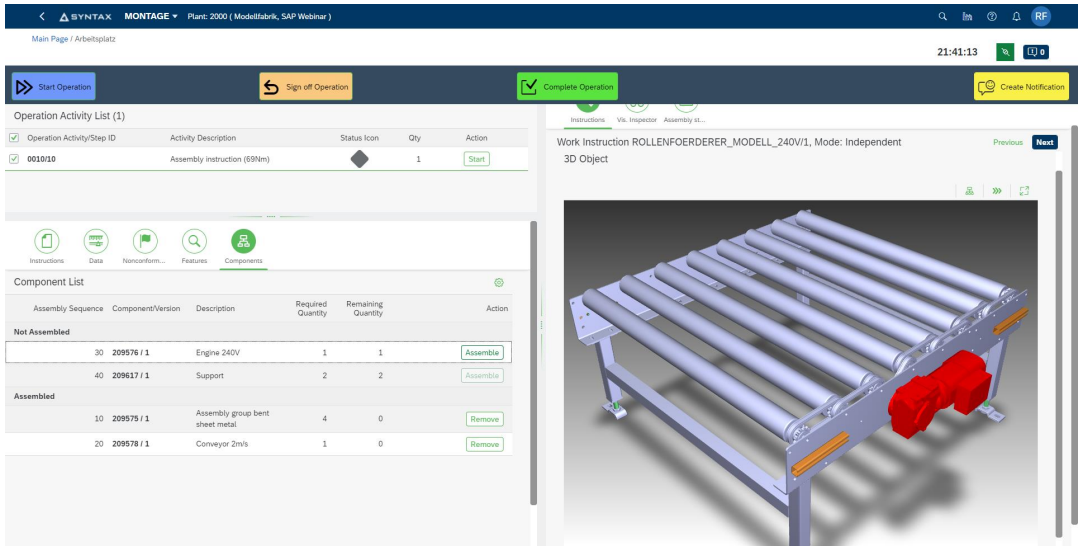


Assemble with visual work instruction

Business Outcomes

*"As an **Assembly Operator,** I want to see which components I have to use and how many remain so that I am always informed."*

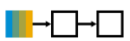
Gregor
Assembly Operator



Process Highlights

List all components based on ETO/CTO/MTS BoM

Use text based work instructions and visual work instructions like images, drawings or 3D models

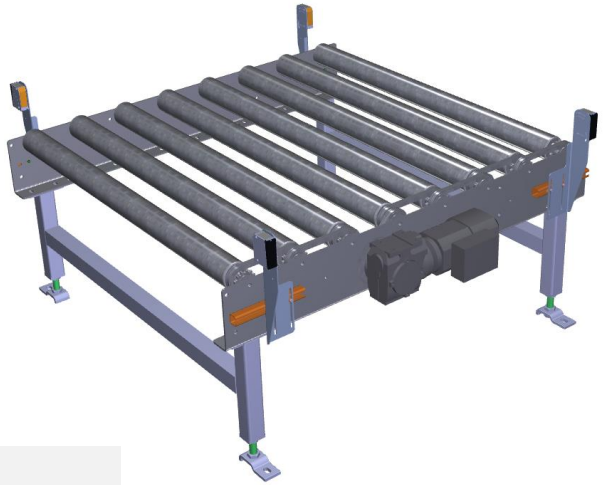


Choose the Assembly Mode: Choose Sequence and Choose Auto Next

Allow Skipping Components

Executing Discrete or Time-Based Assembly

From Design to Manufacturing: Detailed Process Flow



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Summary

The Design-Driven Enterprise is AGIL.EFFICIENT.CUSTOMER-CENTRIC

- ✓ **Increase the level of automation** in the process flow from engineering into sales, **production**, service via the **smart product structure**.

- ✓ **Increase the level of flexibility via integration of smart product structure, project management** and **manufacturing execution** in production.

- ✓ Achieve a **high level of consistency, automation and accuracy** across all departments by utilizing **the smart product structure within the SAP core**.

Design-Driven Enterprise

From Project Start to Service for the Project Business

29.04.2022

Thank you & see you soon.

Contact Information:

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Digital Supply Chain

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