Design-Driven Enterprise
From Configuration to Manufacturing

Variant-rich MTS or CTO

01.04.2022

THE BEST RUN SAP

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**

So, they engage an external consulting company to propose **a new approach**.

Design-Driven Enterprise

AGIL.EFFICIENT.CUSTOMER-CENTRIC

- **Increase the level of automation** in the process flow from engineering into sales, production, service with **model once configure anywhere.**

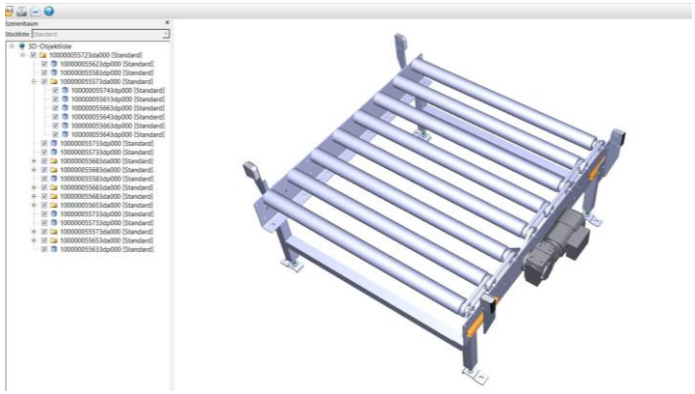
- Use a **smart product structure** as **single central solution** to achieve **high level of consistency, automation and accuracy** across all departments.

- Improve the leverage of their existing investment in the **SAP core**. **Reduce complexity** of applications outside of the core.

Relationship between CAD, Classic BOM and Product Structure

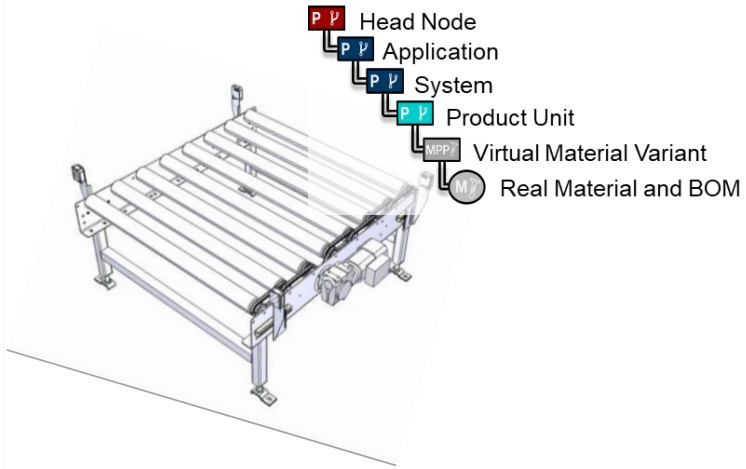
Why can‘t I use the CAD or Classic BOM instead?

CAD Structure



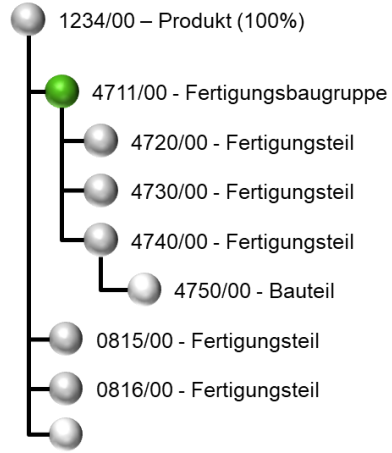
The **CAD Structure** describes the geometrical relationships between the BOM elements. The **variance** therefore is **implicitly described**.

Product Structure



The **Product Structure** models variance structurally and thus it is **able to incorporate variance information directly** and link it to CAD documents.

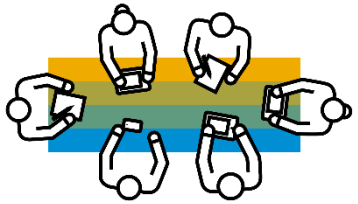
Classic BOM



The **Classic BOM models** variance on a material level and therefore **does not scale very well**.

Model once configure anywhere

Our Vision: Digital Thread 4.0 automates all business processes



Product Teams…

…feed the product model with new iterations and versions, aligned with customer requirements and compatibility

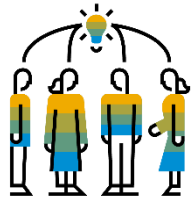
Feed

Consume

Digital Product Structure

Consume

Feed



Extended Enterprise…

…consumes product model/information to buy, make, sell/configure, simulate or maintain a product.

Webinar 1 – Create Portfolio & Product Structure

Webinar 1 – Consume in Sales

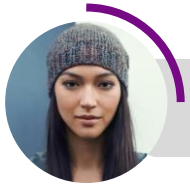
Webinar 2 – Consume in Manufacturing (01.04.2022)

Webinar 3 – Consume in Service (08.04.2022)

Recap – From Design to Sales: Detailed Process Flow

Anton
Product Manager

Barbara
Systems Engineer



Carla
Engineer

Daniel
Sales Rep

Overview product portfolio

Map product features

Extend product features

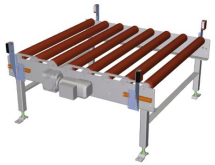
Revise product features

Adjust system models

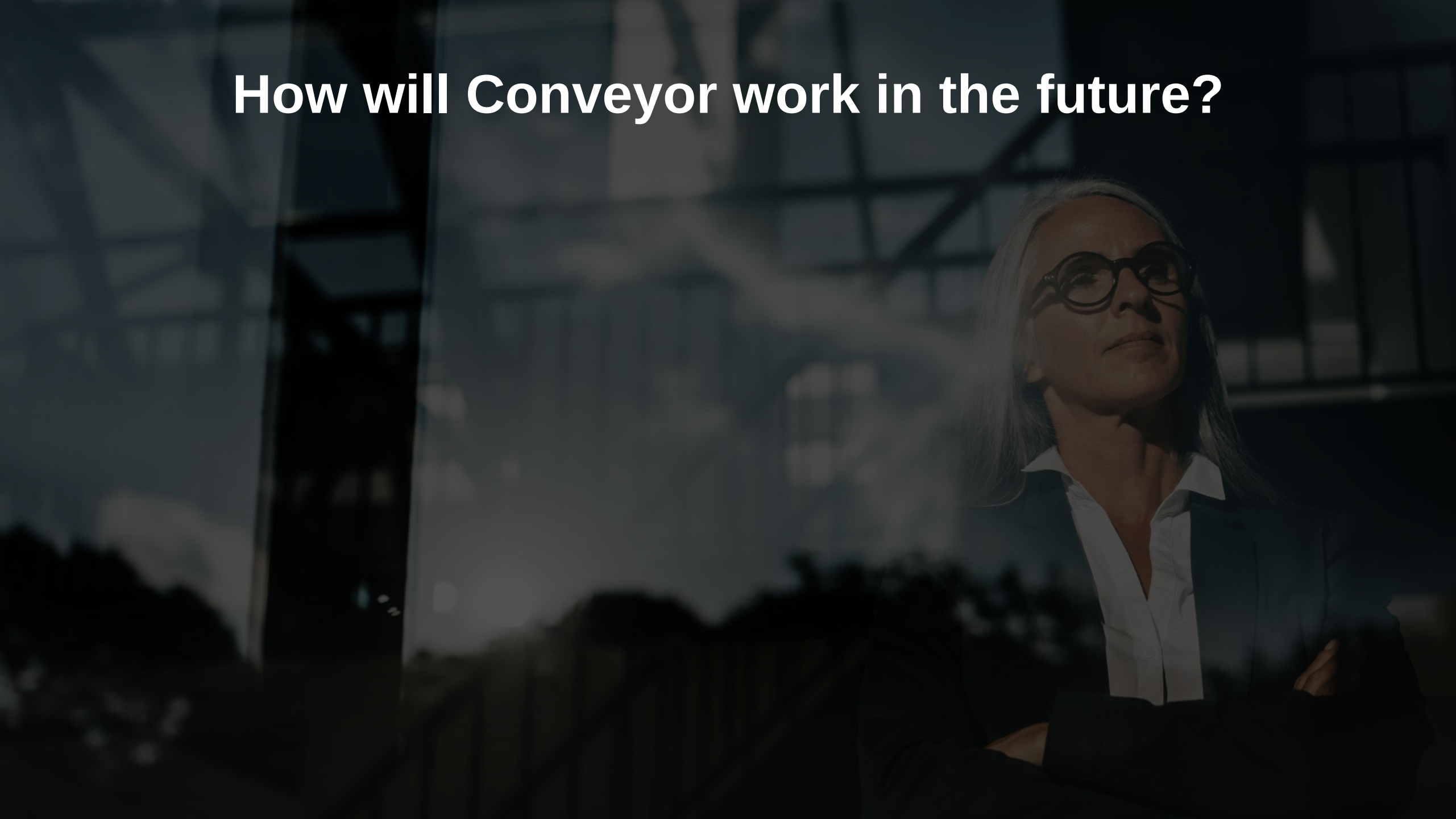
Complete detailed engineering

Handover to sales

Sell via Configure Price Quote

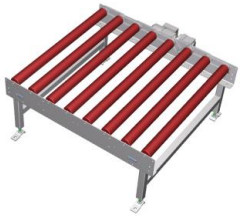


How will Conveyor work in the future?



DESIGN-DRIVEN ENTERPRISE MTS/CTO

From Configuraton to Manufacturing



PRODUCT MANAGEMENT | DESIGN | ENGINEER | SELL | PURCHASE | PLAN | MANUFACTURE | OPERATE

Product
- Variant Management
- Configuration Management
- Innovation Management
- Requirements Management
- Systems-Engineering
- Product Validation

Detailed Engineering
- Material Management
- Component Classification
- eBOM
- 3D-Model

Internal/external Collaboration
- Design Collaboration
- Document Collaboration
- Systems Engineering

in Production
- Routing Management
- Integration of MTM
- Work Instruction Management
- Change Mgmt and Integration across and within different SAP BOM-types
- BOM Knowledge Management, Conversion and Configuration
- Configuration of Quality Management

in Service
- Configuration of services, documents, and serviceBOM

in Sales
- Enhancement of configuration with application knowledge

Modelling
- Life Cycle Management of Product model
- Management of Variant Configuration with Engineering Knowledge

Customer Order - Configuration

Document Collaboration
Supplier Collaboration (only with Ariba)
Visual Product Analysis

Short- to Midterm-Planning and Optimization
- Order network
- Production Optimization considering product configuration dependent routing capacity, demand, takt times, set up times, man power and tooling while also considering material availability.

Order Management
- Generation and Release of production orders

Assembly
- Configuration specific work Instructiion

Inline Quality Management
- Collection of configuration specific quality data during each production step.

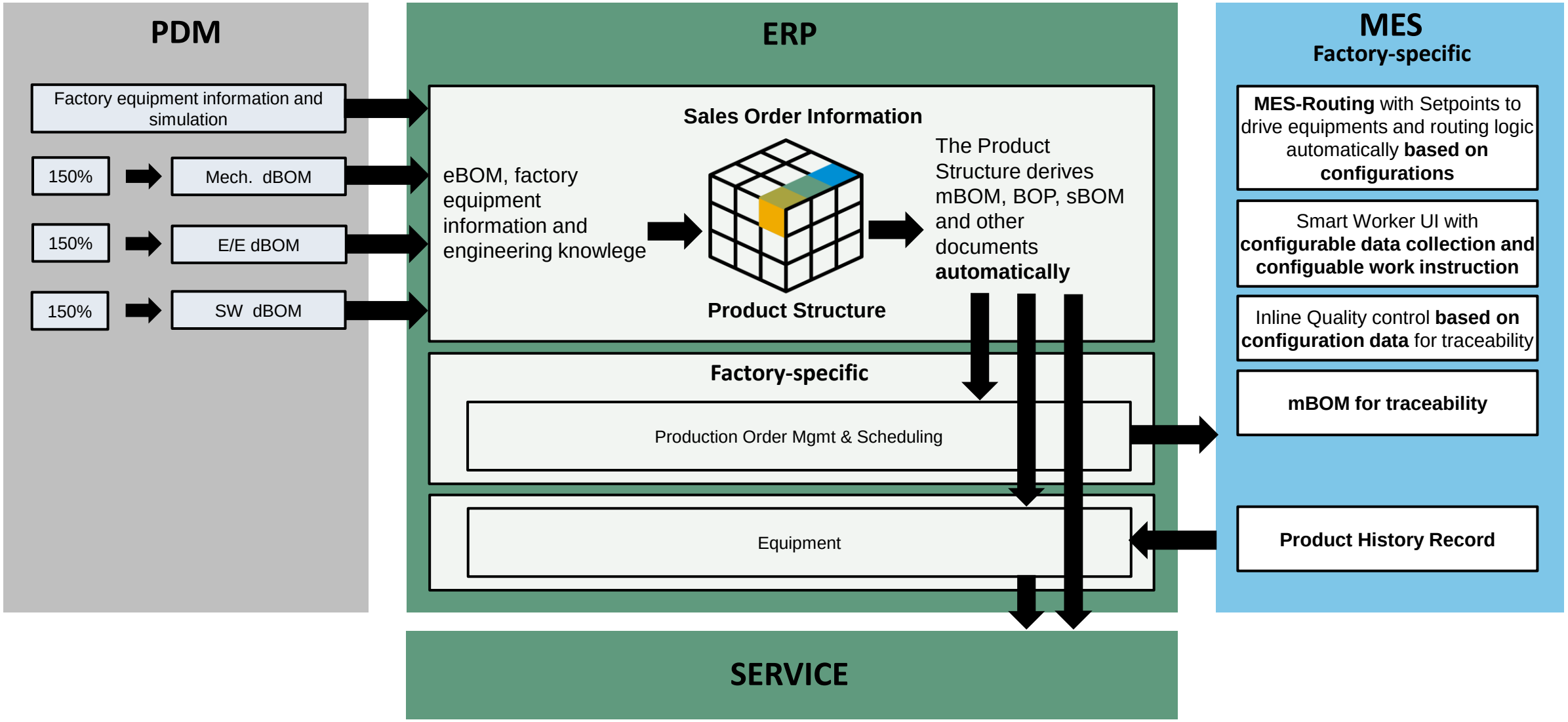
Machine Integration
- Configuration specific machine control

Intelligent Asset Management
Providing the digital twin to internal and external collaboration partners
IOT services

Service-Management
- Ticketing
- Service-Order Mgmt.
- Service Order Execution
- Visual Spareparts
- Visual Service-Instructions
- Digital Twin Insight
- Digital Twin Monetarization

Automatically generated Engineering Data for Planning & Execution

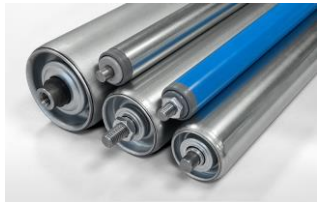
Architecture



Handling variants in Make-to-Stock and Configure-to-Order scenarios

Using Material masters or material variants per variant to run MTS.

MTS
Make-to-Stock



Design

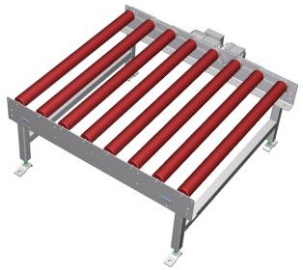
Supply Chain

Manufacturing

Sell

Aftermarket Service

CTO
Configure-to-Order
closed



Design

Sell

Supply Chain

Manufacturing

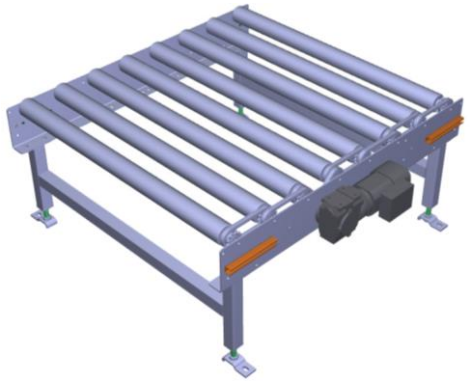
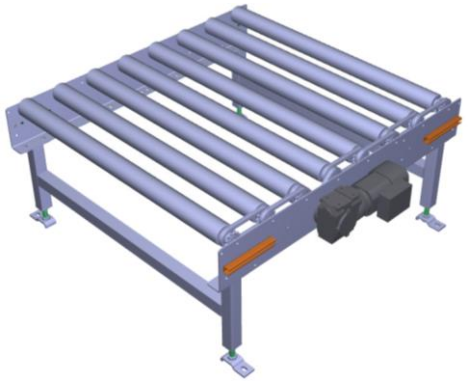
Aftermarket Service

Configuration in sales order to run CTO.

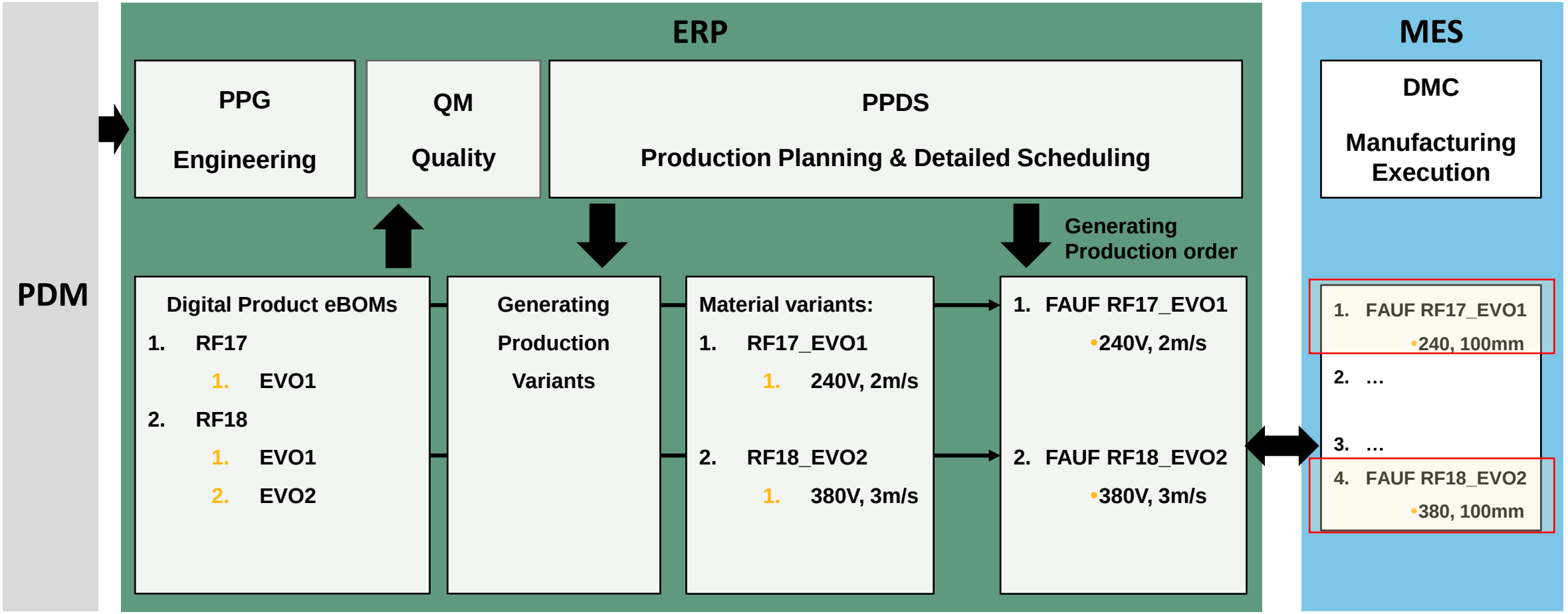
Optional:

- Create material variants
- Configure in PPG

Overview of product variants and customizability

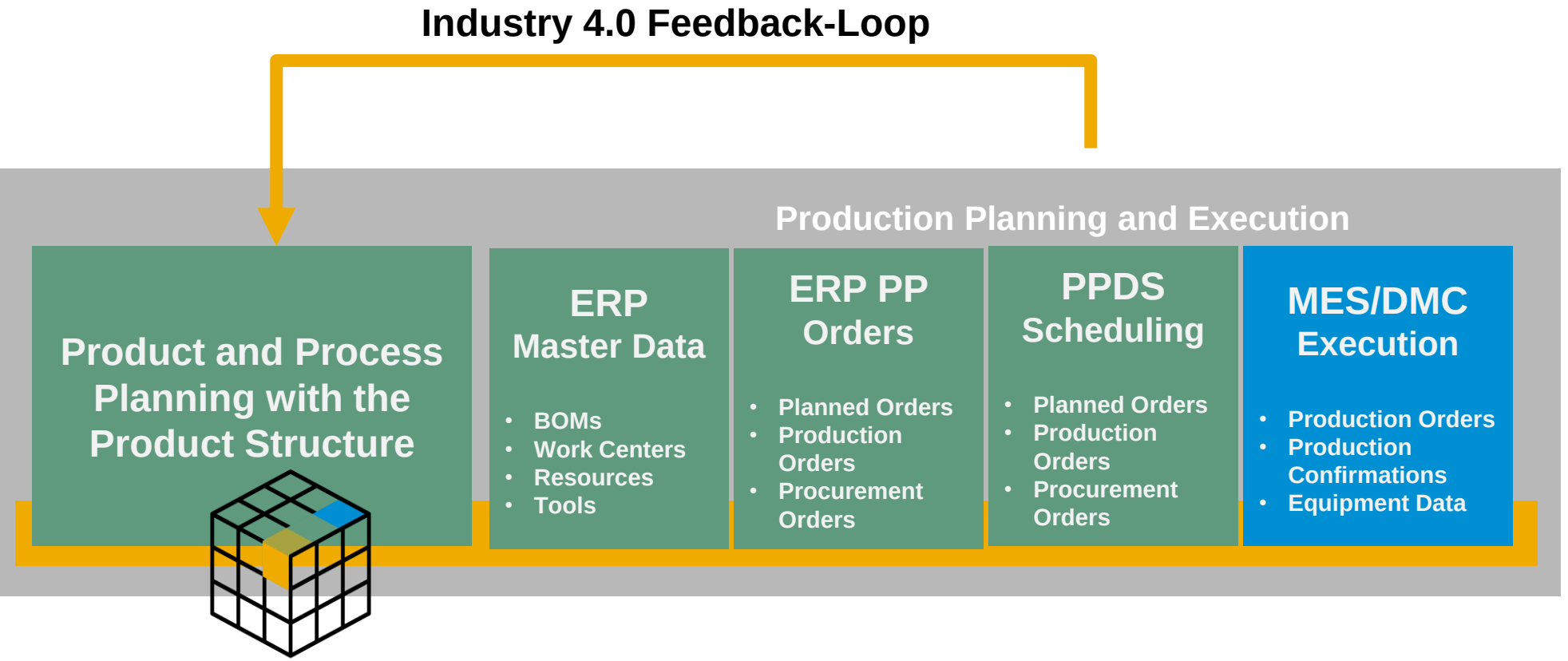
	Variant RF17 RF17_EV01	Variant RF18 RF18_EV01
		
Photoelectric barrier	no	no
Motor power	240V	380V
Speed	2.00 m/s	3.00 m/s
Adaptable to customer requests	no	no

Overview product variants and production orders



Handover w/ LOIPRO 5
Production order with all manufacturing data

Validation of Manufacturing Parameter in Product Structure



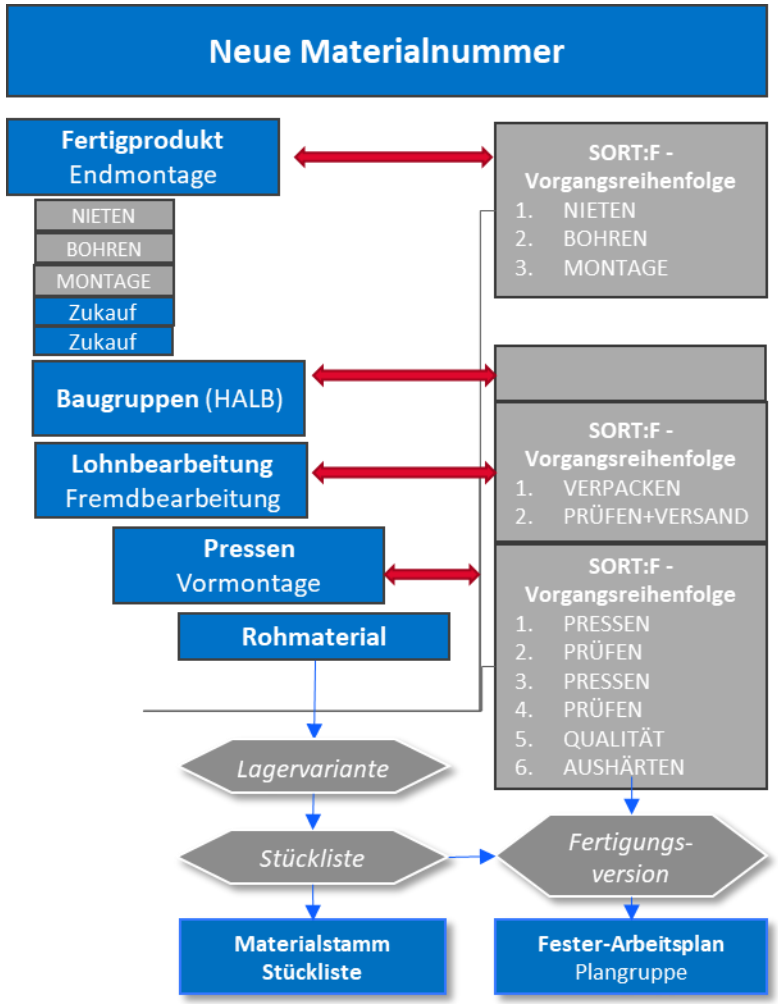
Use Cases

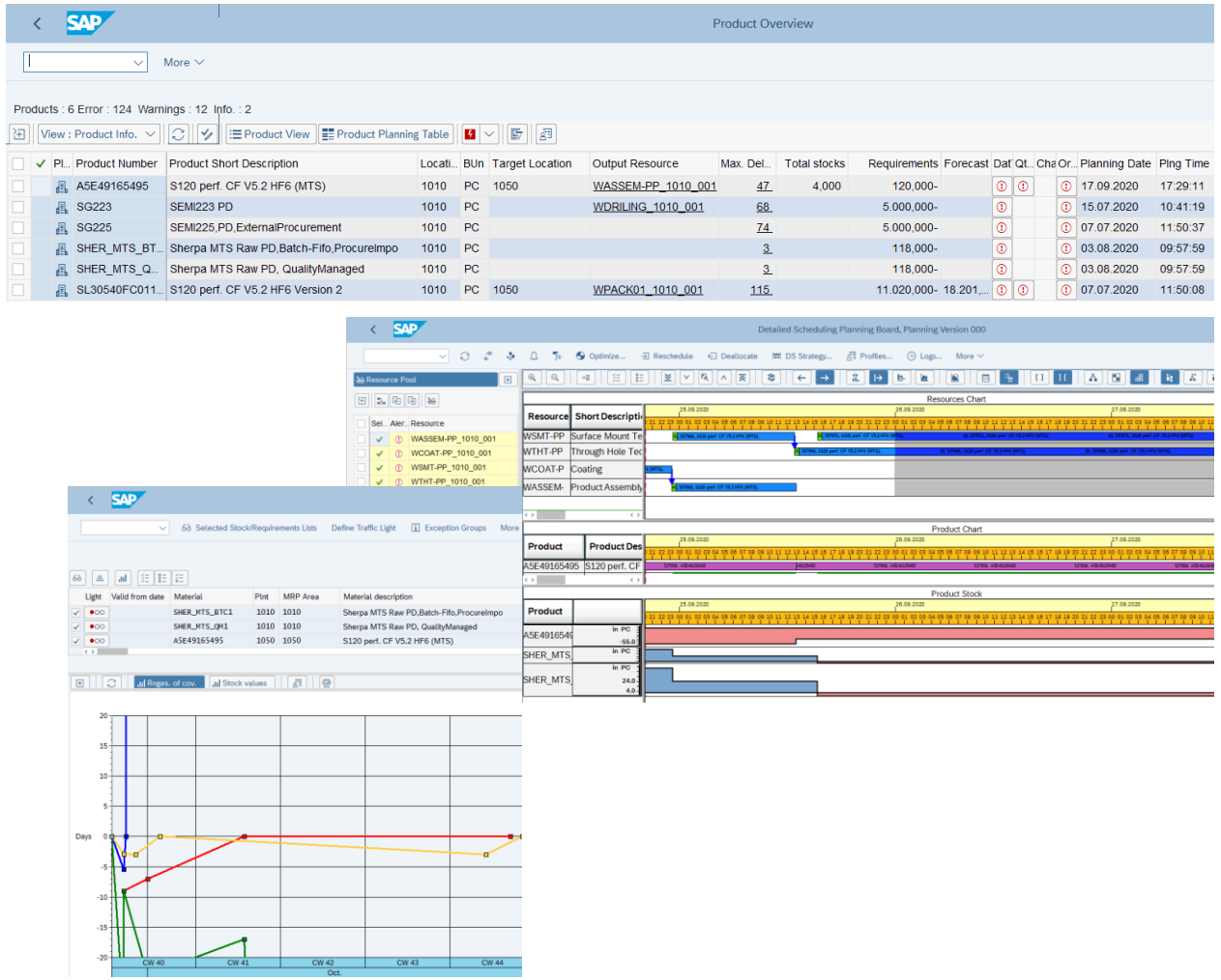
- Simulation before production
- Monitoring and fine tuning during production
- Product mix scenarios
- Input into 3D simulation tools
- Feedback to PDM system to close the loop with design

Validation can be used for many types of data: routings, set up times, tooling, sequences …

Example: Routing Optimization via PPDS Simulation

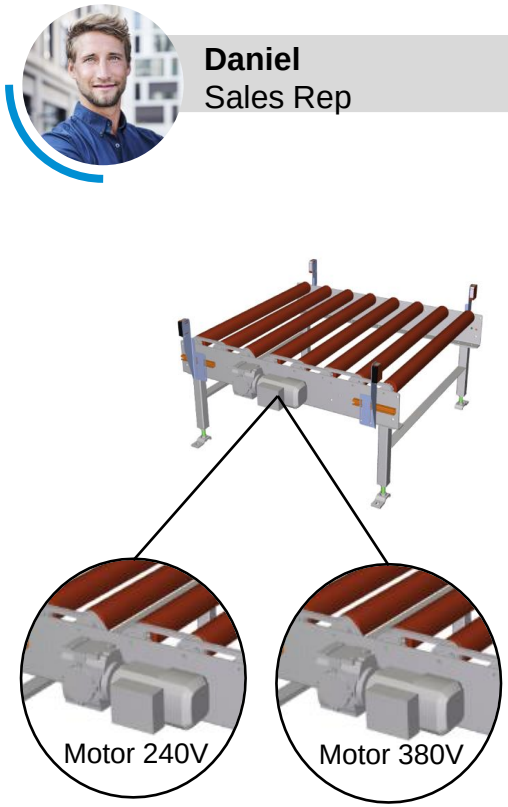
Can I generate the routing for optimal capacity for a given product mix?





How will Conveyor work within SAP in the future?

Process Flow: Industrial Engineering & Execution on the shop floor



Daniel
Sales Rep

Emma
Industrial Engineer

Fred
Key-User Production

Gregor
Assembly Operator

Review Product Structure

Overview Industrial Engineering

Create material variant

Create routings

Configure sales order

Create data package for shop floor

Overview Digital Manufacturing Cloud

Supervisor order release

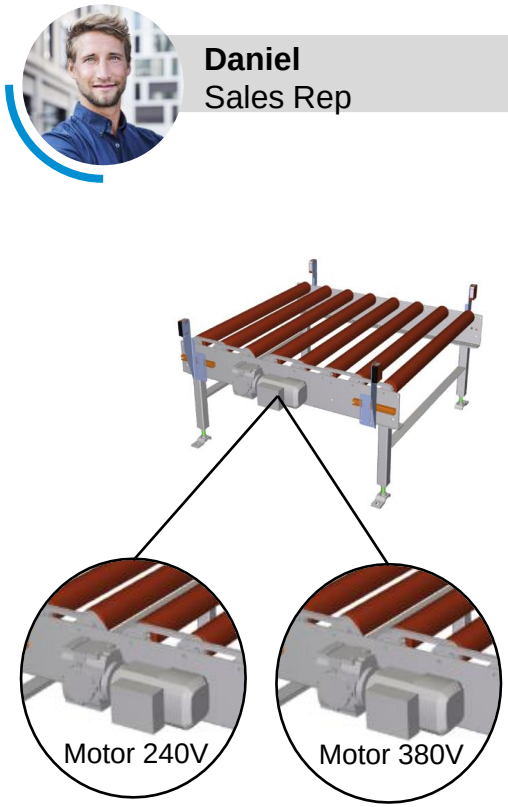
Assemble with visual work instruction

Confirm serial numbers and consumptions

Perform quality check

Check confirmations in ERP

Process Flow: Industrial Engineering & Execution on the shop floor



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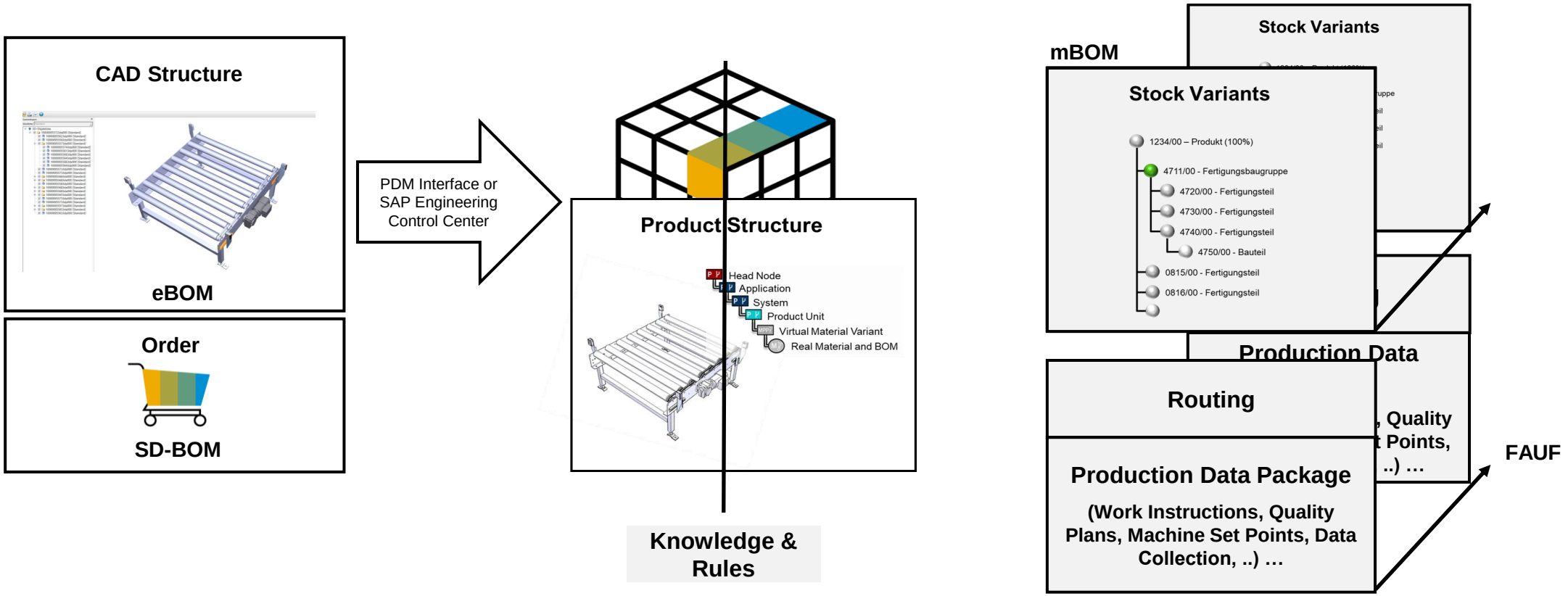
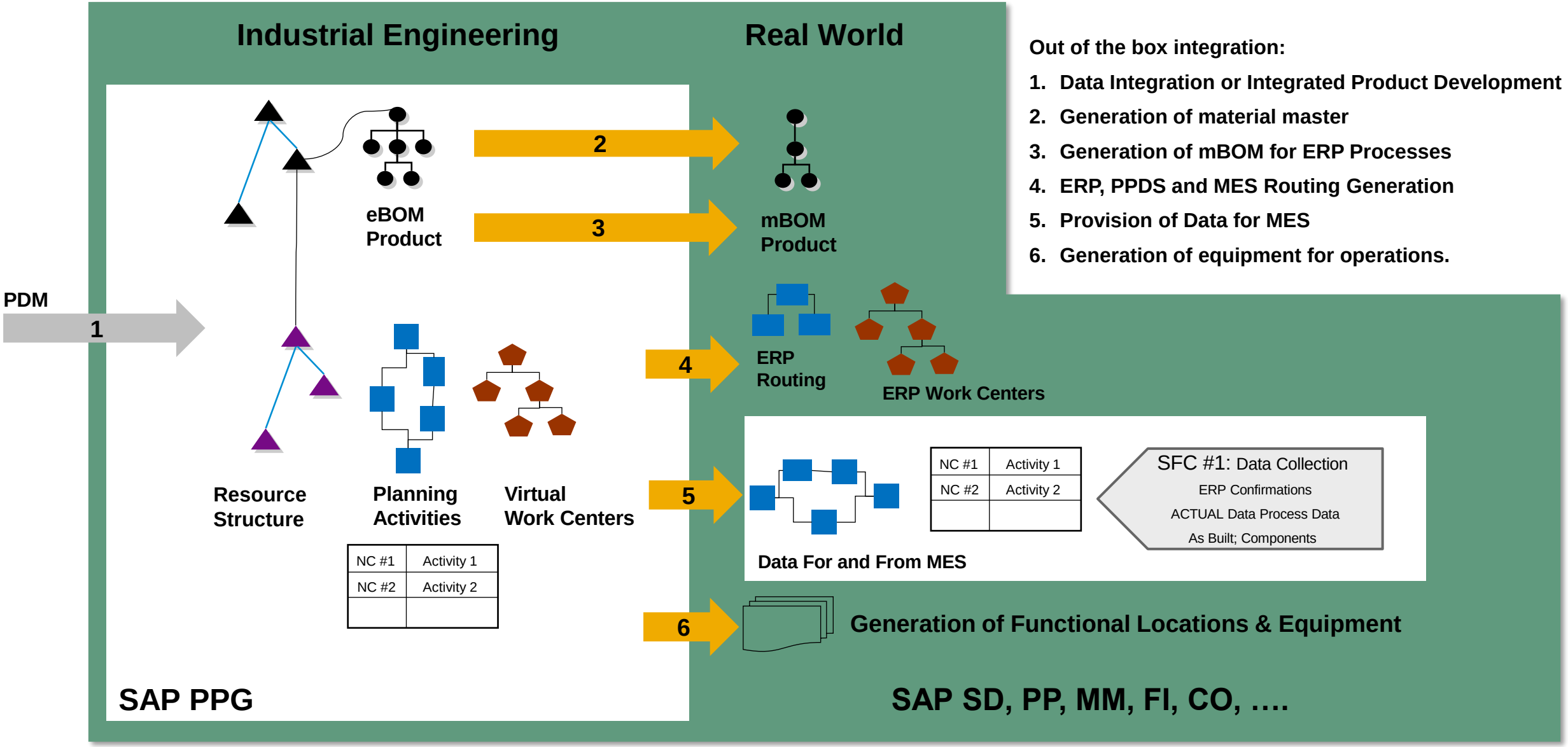
Review released product structure



- The **CAD Structure** provides the geometrical relationships between the BOM elements and the 3D (SAP VE) viewing data.
- The **Product Structure** contains different views for eBOM & mBOM.
- The **Product Structure** supports the sales configuration (Webinar 1).
- In this webinar the **Product Structure** generates the **Classic BOM models,** routings and other documents/settings for planning and production.

“Virtual” Industrial Engineering and “Real” ERP World in a single solution



Out of the box integration:

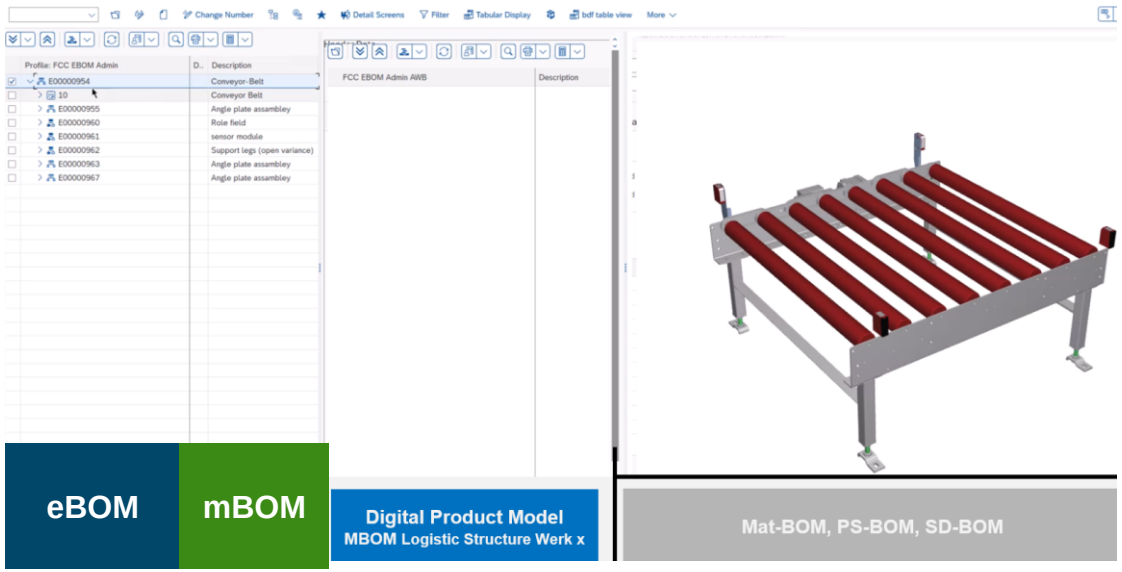
1. Data Integration or Integrated Product Development
2. Generation of material master
3. Generation of mBOM for ERP Processes
4. ERP, PPDS and MES Routing Generation
5. Provision of Data for MES
6. Generation of equipment for operations.

Review Product Structure

Business Outcomes

*"As an **Engineer**, I want to use the product structure so that downstream processes can be executed automatically."*

Emma
Industrial Engineer



Process Highlights & Benefits

Provide integrated Information of product development disciplines including mechanical, electronic/electrical & software structures into one product definition

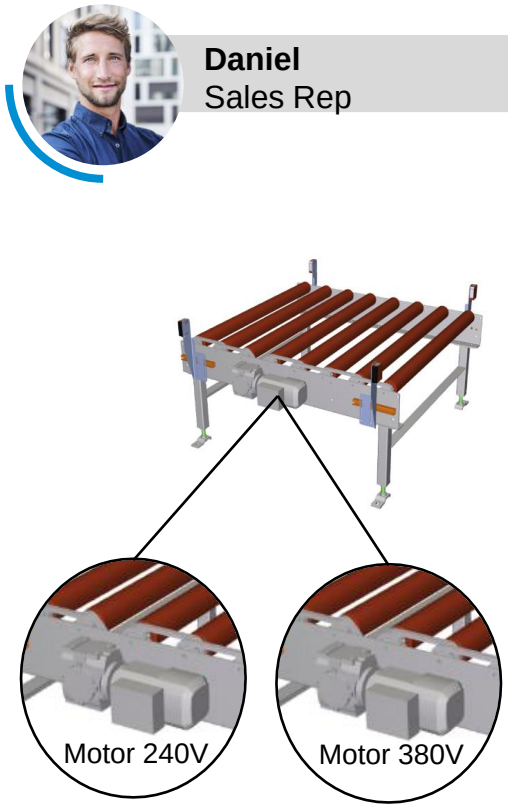
Plan the missing production data production aids, production documents, working instructions, …..

Synchronize product data, structures, access and documents across the extended enterprise

Provide digital twin foundation early in production phase

Better decision-making due to accurate definition of the product that combines design and business information

Process Flow: Industrial Engineering & Execution on the Shop floor



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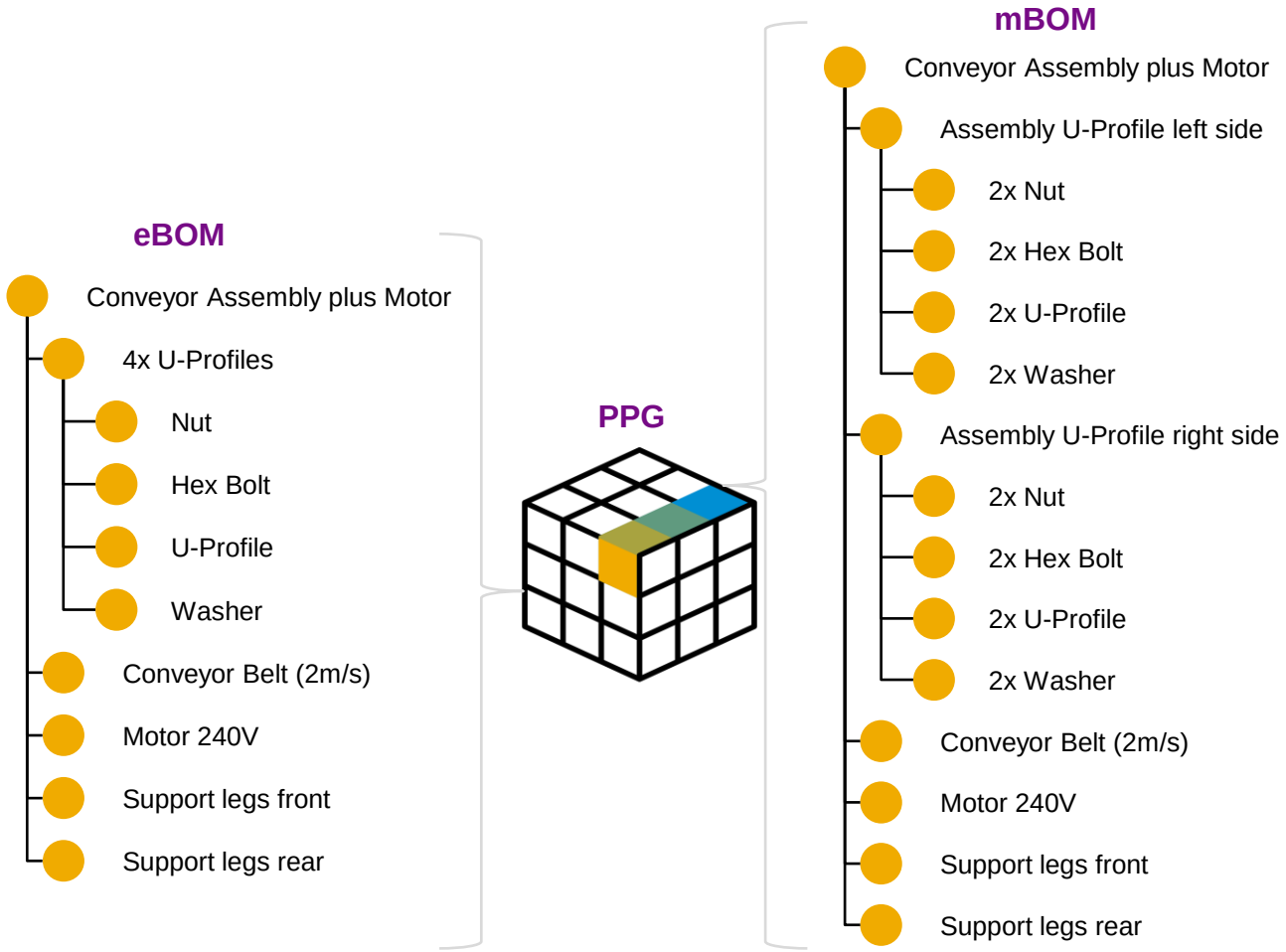
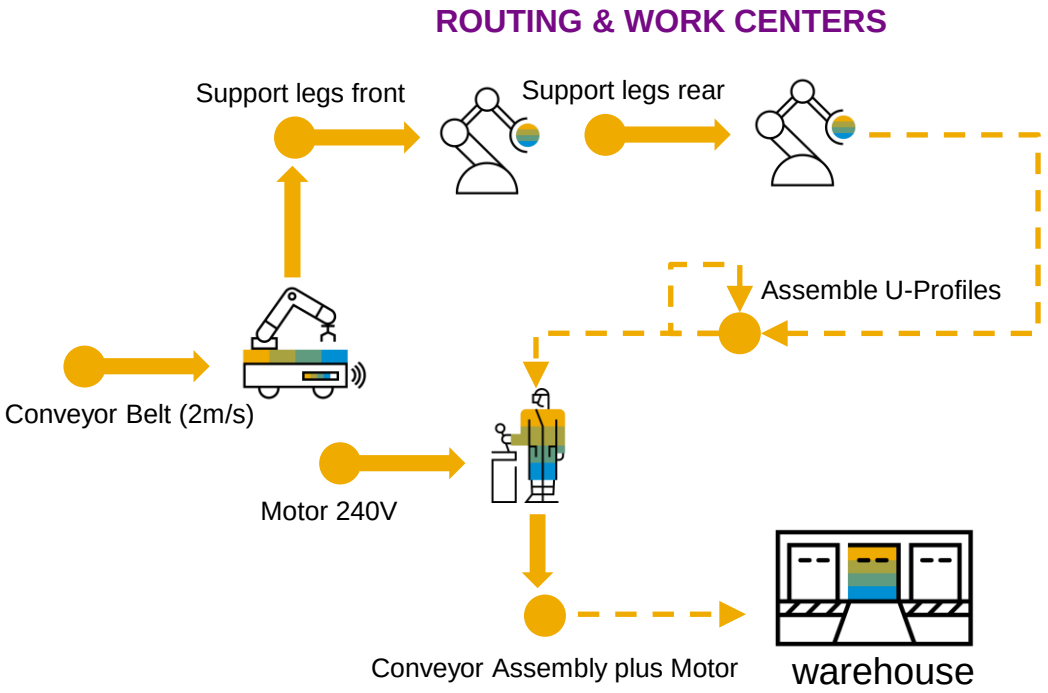
Engineering & Manufacturing View





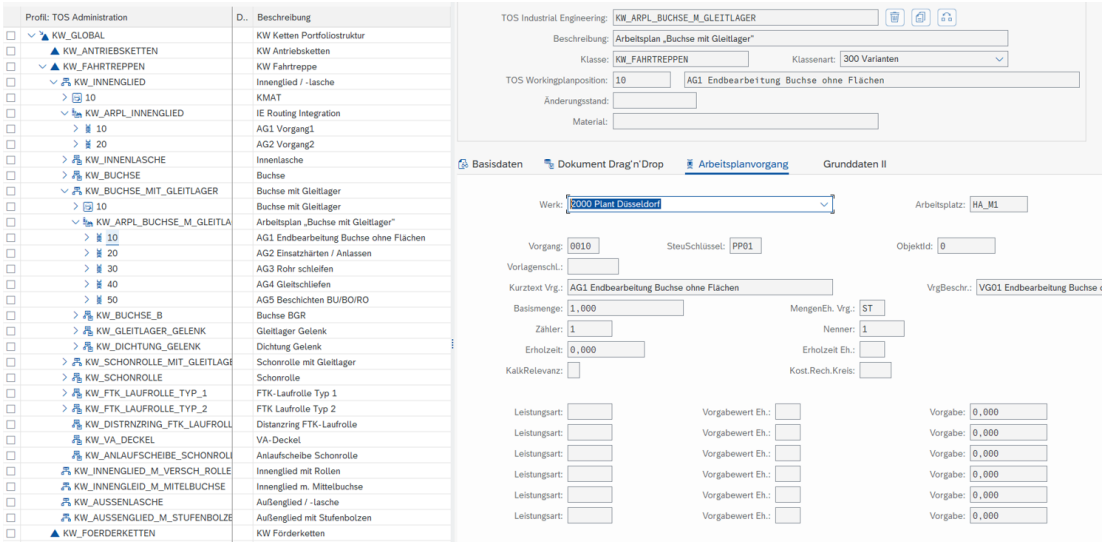
- **All parts of the mBOM are logistically relevant and can be used in SAP (SAP material ID required).**
- **The sequence is not defined in the mBOM but in the BOP (Bill of Processes).**
- **A complete mBOM always has a direct plant reference.**

Overview Industrial Engineering

Business Outcomes

*"As an **Industrial Engineer**, I want to complete the product data so that downstream processes can be executed automatically."*

Emma
Industrial Engineer



Process Highlights & Benefits

Unify product development disciplines including mechanical, electronic/electrical & software structures into one product definition

Manage detailed mechatronic engineering data on a single platform

Synchronize product data, structures, access and documents across the extended enterprise

Provide digital twin foundation early in design phase

Better decision-making due to accurate definition of the product that combines design and business information

Process Flow: Industrial Engineering & Execution on the shop floor

Daniel
Sales Rep

Emma
Industrial Engineer

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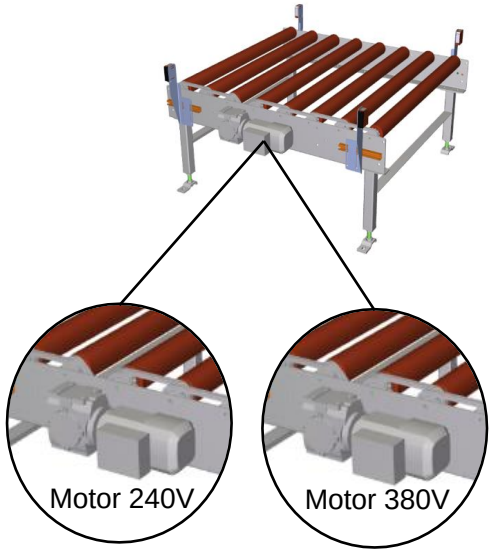
Assembly Operator



Review Product Structure

Overview Industrial Engineering

Create material variant

Create routings

Configure sales order

Create data package for shop floor

Overview Digital Manufacturing Cloud

Supervisor order release

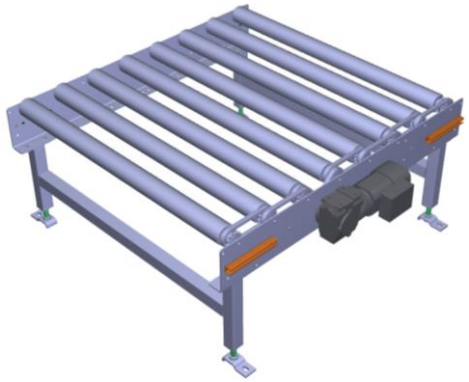
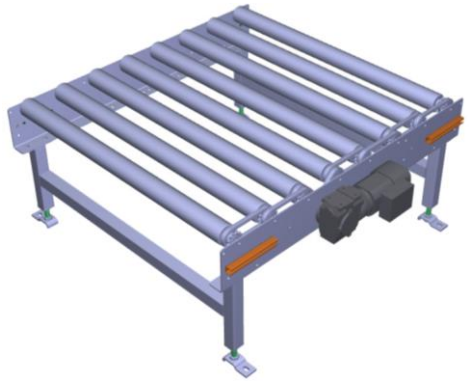
Assemble with visual work instruction

Confirm serial numbers and consumptions

Perform quality check

Check confirmations in ERP

Creating material variants

	Variant RF17 RF17_EV01	Variant RF18 RF18_EV01
		
Photoelectric barrier	no	no
Motor power	240V	380V
Speed	2.00 m/s	3.00 m/s
Material number	XXXXX	ZZZZZ

In this demo, we will perform a configuration with material variant matching in the sales order (CTO) as well as the creation of material variants in the PPG.

As a result, we receive an invariant assembly with a substructure that can be manufactured.

Create material variant

Business Outcomes

*"As an **Industral Engineer**, I also want to be able to configure to enable efficient production with many variants."*

Emma
Industrial Engineer

	Variant RF17 RF17_EV01	Variant RF18 RF18_EV01
		
Photoelectric barrier	no	no
Motor power	240V	380V
Speed	2.00 m/s	3.00 m/s
Material number	XXXXX	ZZZZZ

Process Highlights & Benefits

Generate the different types of production BOMs and the stock variants

Generate routings for each variant or use configurable routings

Provide manufacturing data package for MES per variant

Change variants

Find and reuse variants in sales process

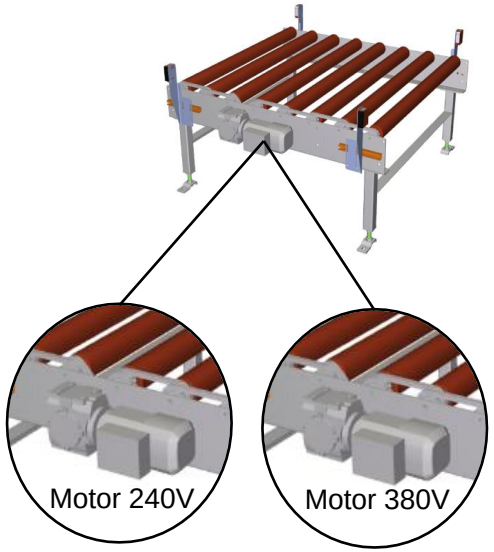
Process Flow: Industrial Engineering & Execution on the shop floor

Daniel
Sales Rep

Emma
Industrial Engineer

Fred
Key-User Production

Gregor
Assembly Operator



Review Product Structure

Overview Industrial Engineering

Create material variant

Create routings

Configure sales order

Create data package for shop floor

Overview Digital Manufacturing Cloud

Supervisor order release

Assemble with visual work instruction

Confirm serial numbers and consumptions

Perform quality check

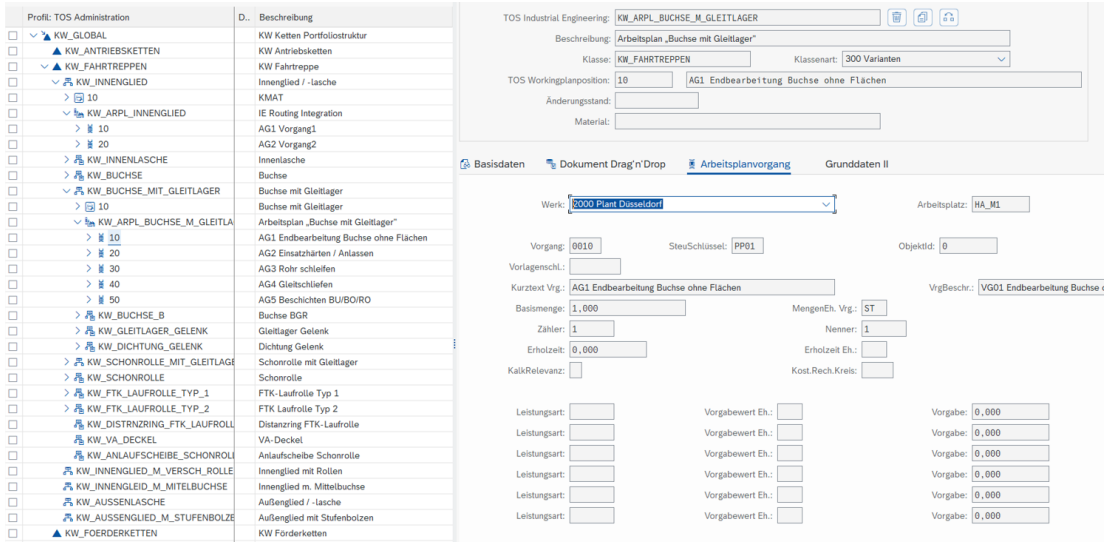
Check confirmations in ERP

Create routings

Business Outcomes

*"As an **Industrial Engineer**, I want to create plant-specific routings to accommodate the different production situations in the plants."*

Emma
Industrial Engineer



Process Highlights & Benefits

Use virtual routings in early product development phases

Create routings in one application

Integrated product and manufacturing view

Manage variants

Use 3D models for better planning processes

Process Flow: Industrial Engineering & Execution on the shop floor

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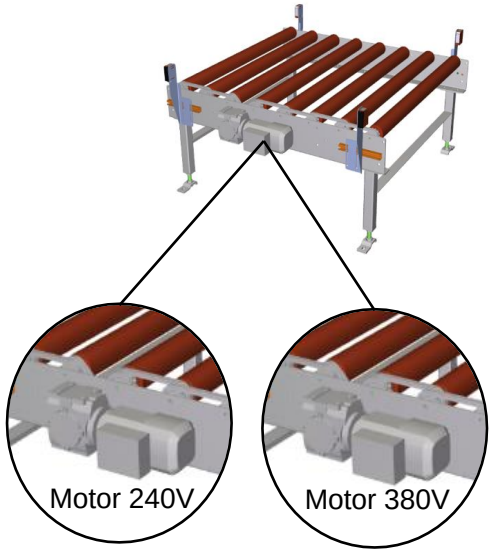

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Create routings

Configure sales order

Create data package for shop floor

Overview Digital Manufacturing Cloud

Supervisor order release

Assemble with visual work instruction

Confirm serial numbers and consumptions

Perform quality check

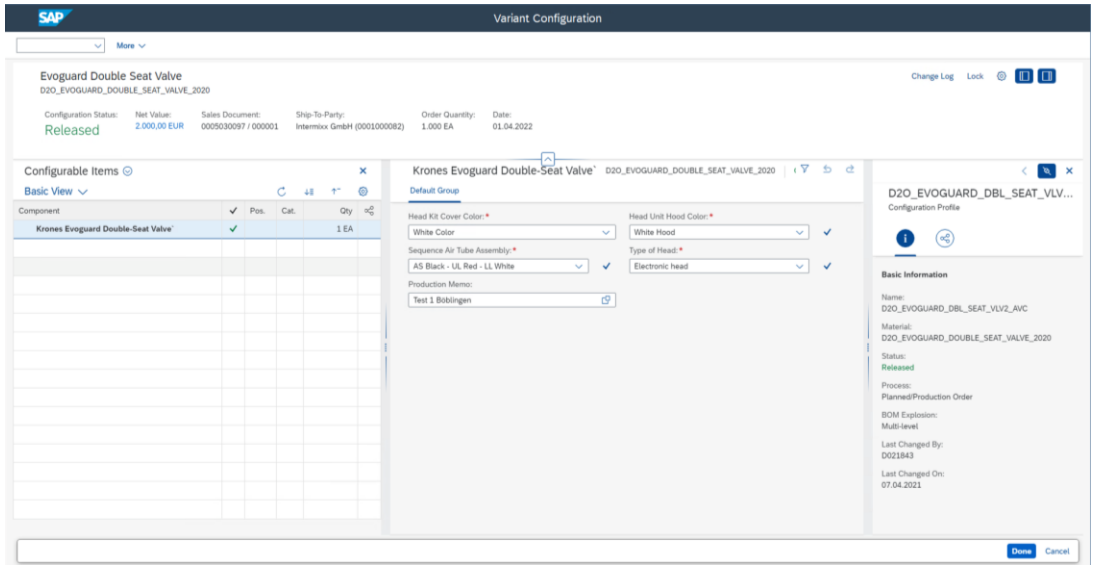
Check confirmations in ERP

Configure sales order

Business Outcomes

*"As a **Sales Rep**, I want to be supported in configuring a sales order so I can do an order confirmation fast and error free."*

Daniel
Sales Rep



Process Highlights & Benefits

Reduce creating sales order time

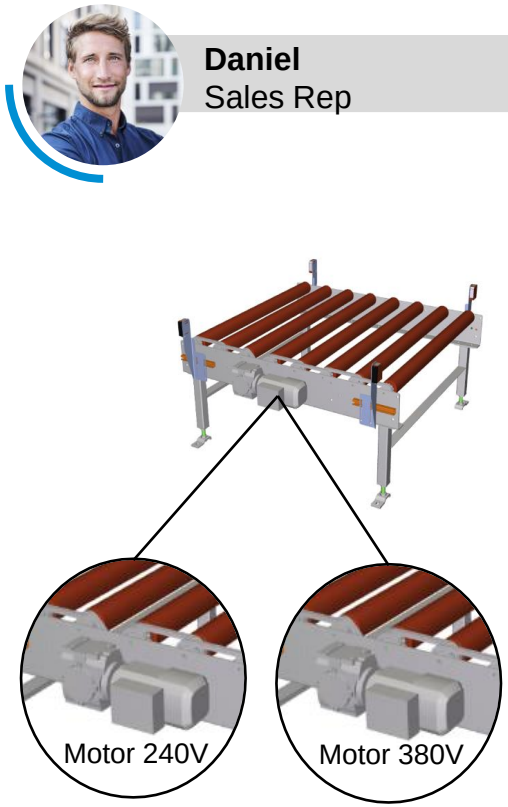
Enhance the sales order configuration process with engineering knowledge to create error free sales order without additional engineering support

Start manufacturing and procurement processes

Automated document generation

Integrate Front- and Backend Systems

Process Flow: Industrial Engineering & Execution on the shop floor



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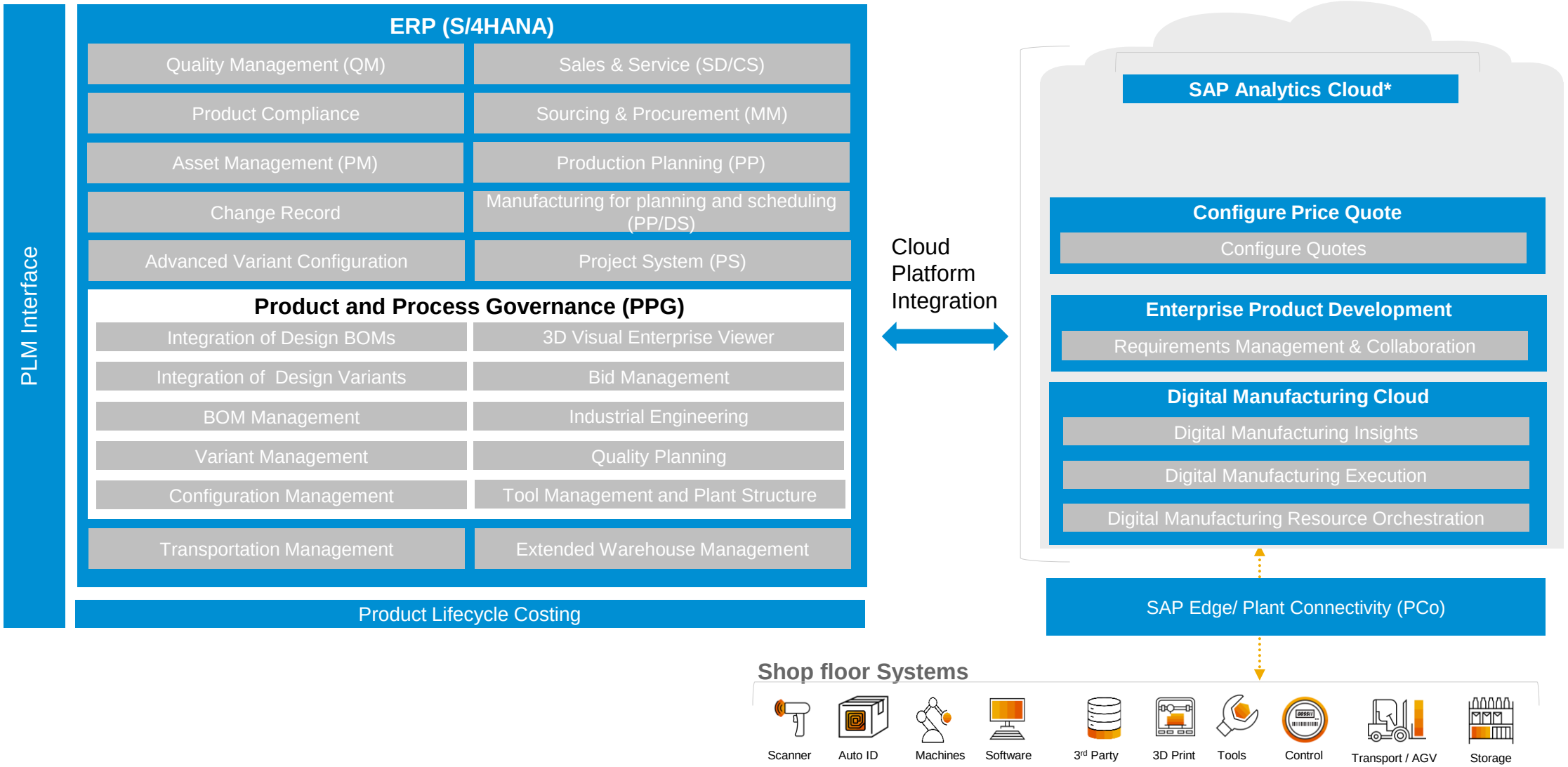
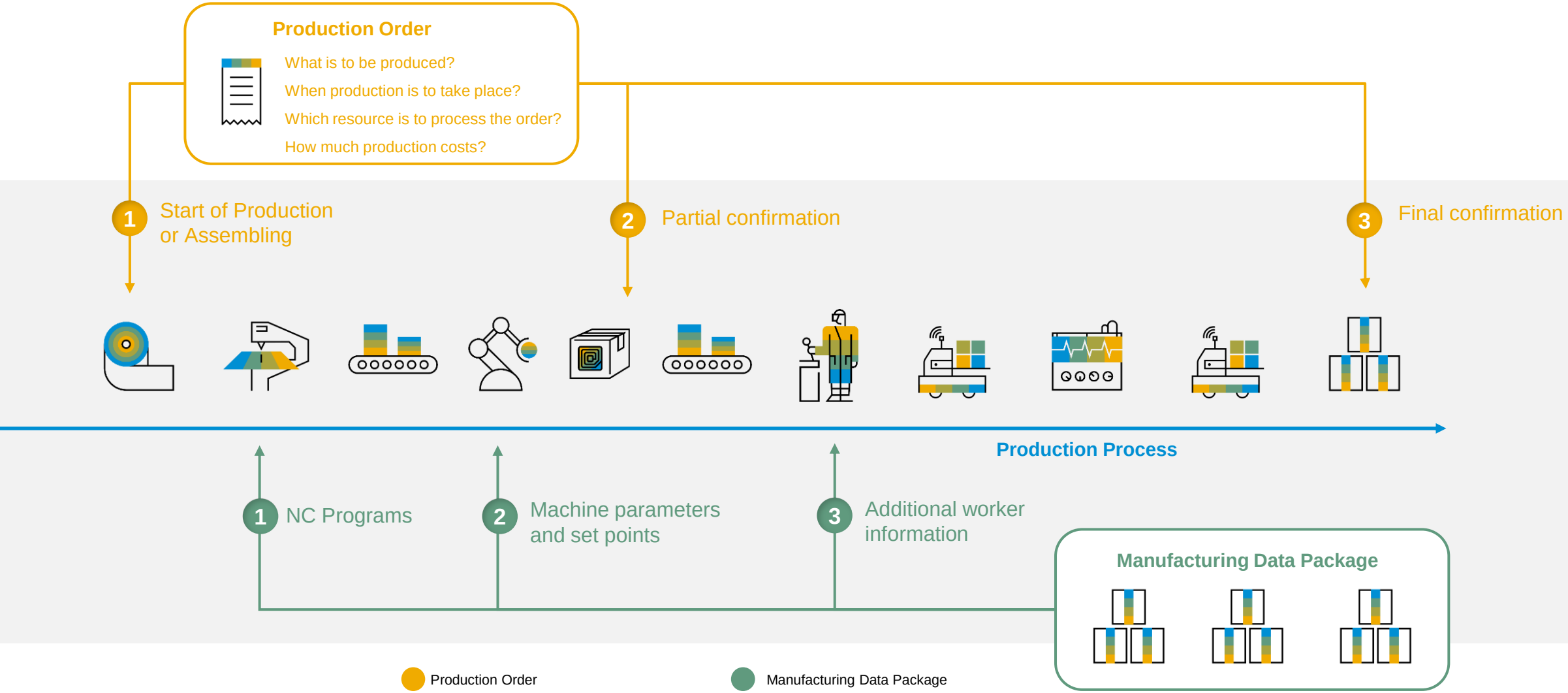
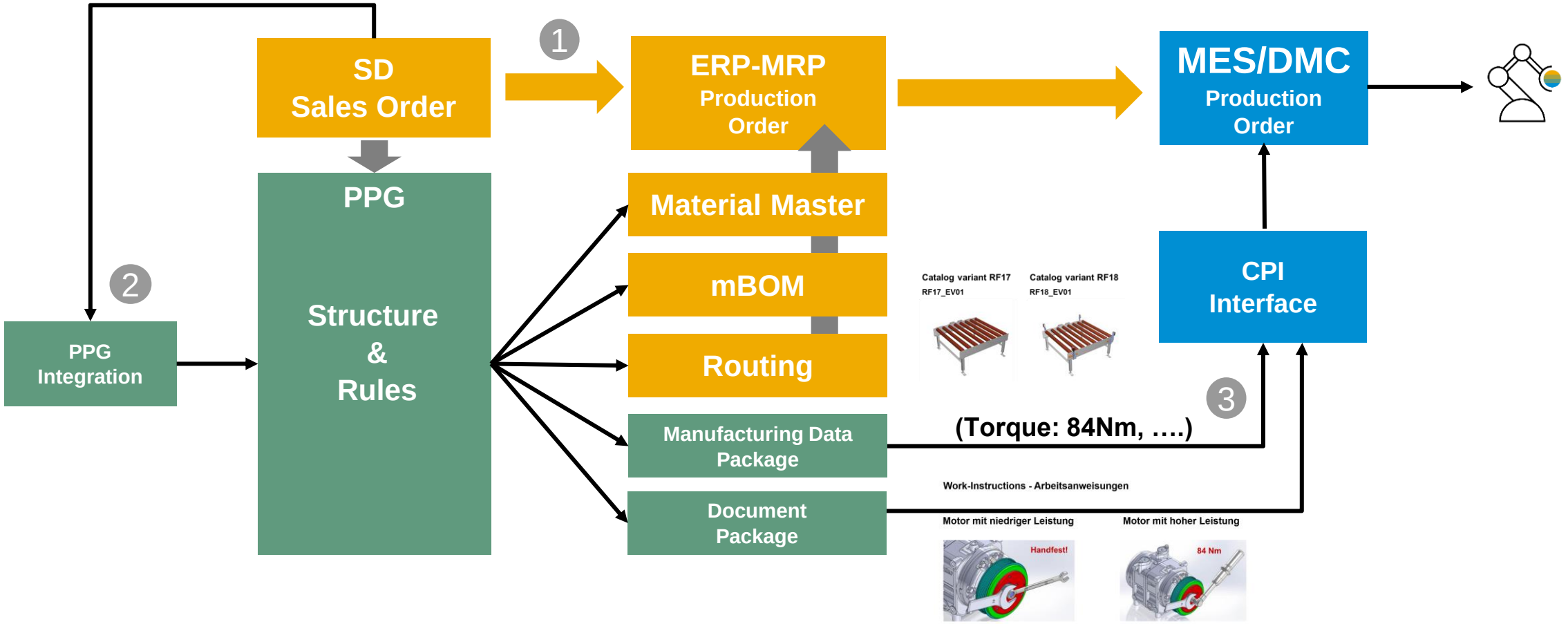
Architecture ERP & MES



Manufacturing Information Flow



Automated Generation and integration of Manufacturing Data Data



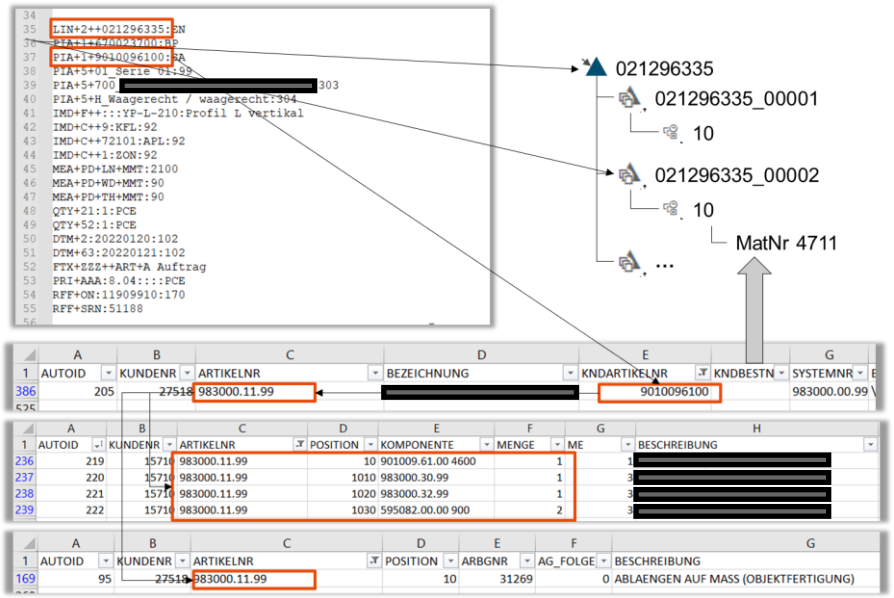
1. The SD Order configures the product und generates a production order.
2. The PPG integration and data model assigns or generates the variant specific production data.
3. To provide more detailed data for each sales configuration to MES a manufacturing data package is generated.

Create manufacturing data package for shop floor

Business Outcomes

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

Emma
Industrial Engineer



Process Highlights & Benefits

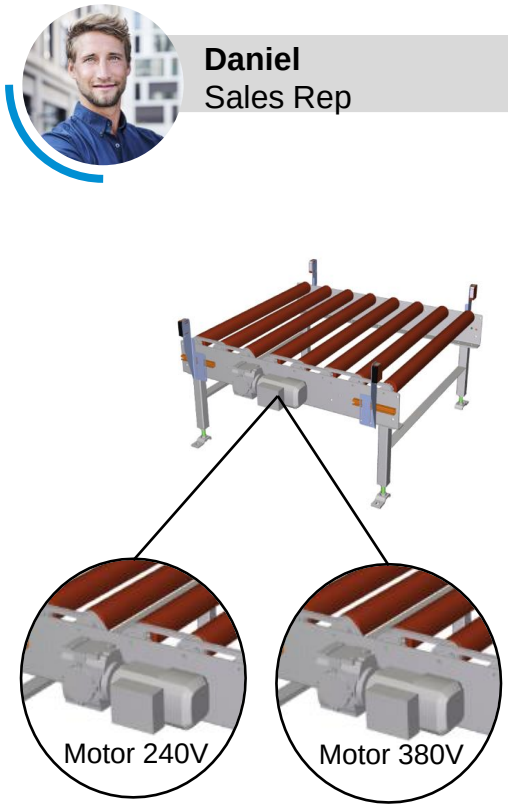
The automation level increases if the shop floor is provided not only with a variant specific routing and mBOM but also with all other instructions in a single data package.

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

The ability of the product 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.**

Process Flow: Industrial Engineering & Execution on the shop floor



Daniel
Sales Rep

Emma
Industrial Engineer

Fred
Key-User Production

Gregor
Assembly Operator

Review Product Structure

Overview Industrial Engineering

Create material variant

Create routings

Configure sales order

Create data package for shop floor

Overview Digital Manufacturing Cloud

Supervisor order release

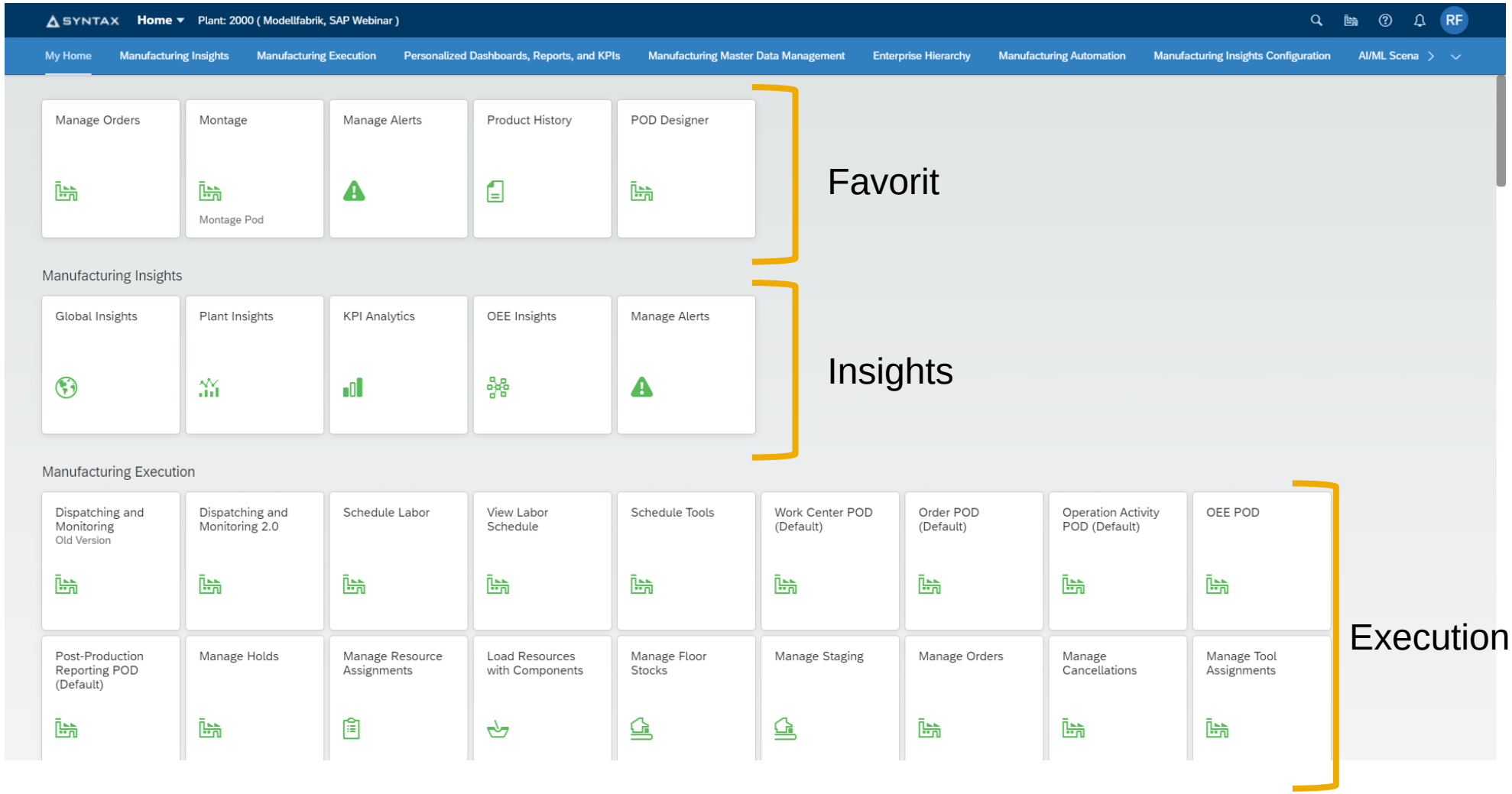
Assemble with visual work instruction

Confirm serial numbers and consumptions

Perform quality check

Check confirmations in ERP

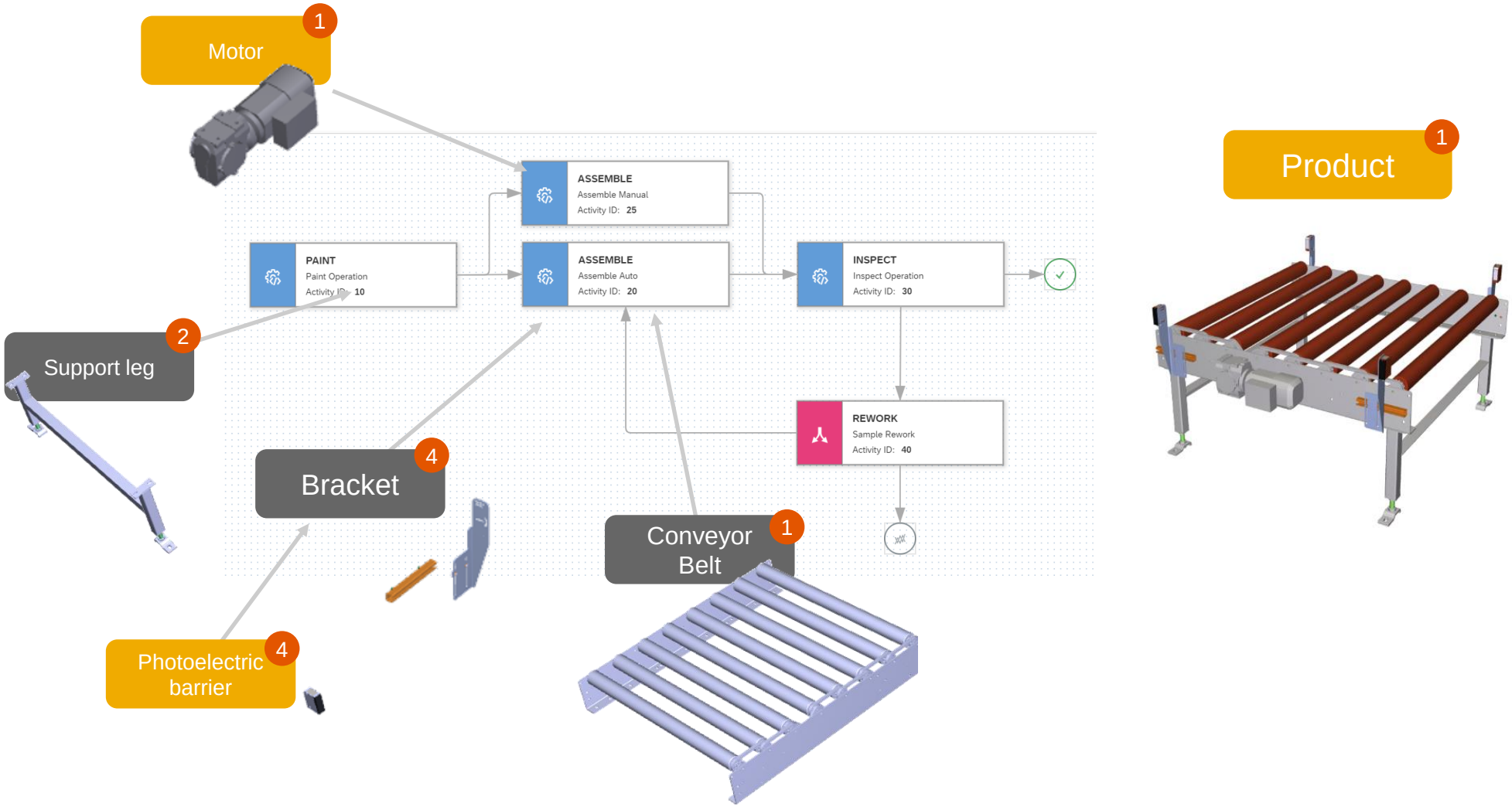
SAP Digital Manufacturing Cloud – Launchpad



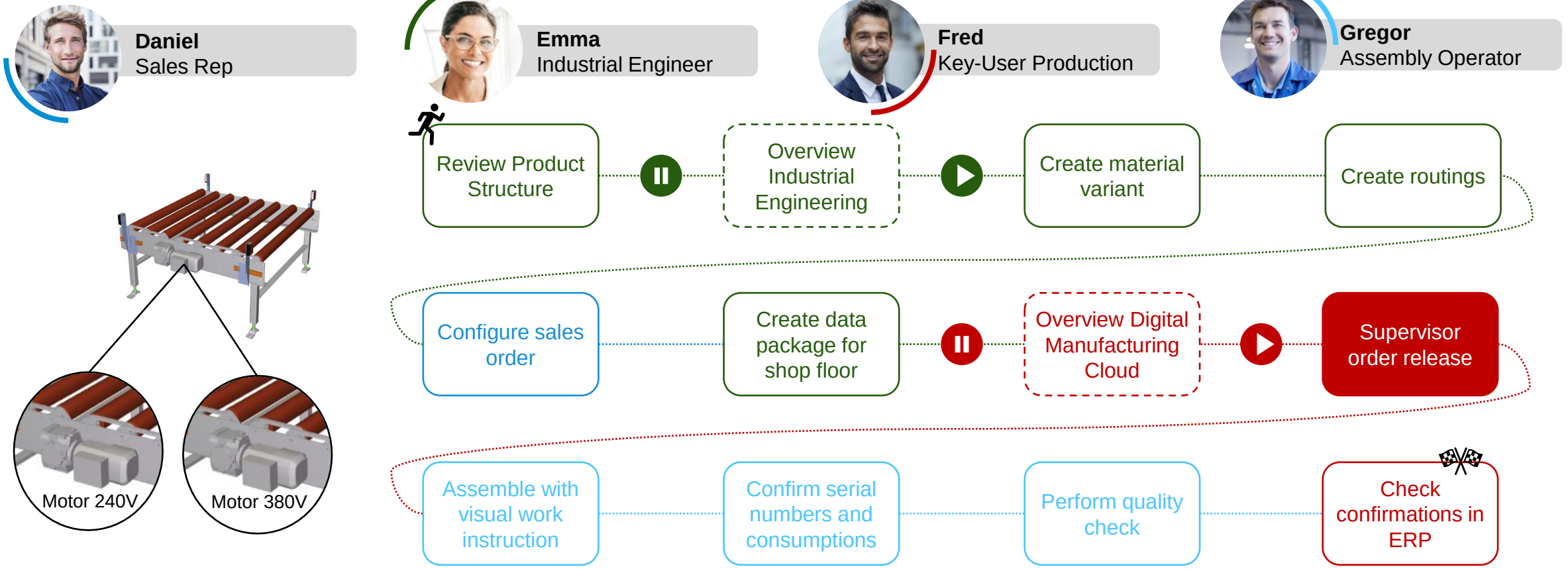
Digital Manufacturing Cloud is an MES solution.

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

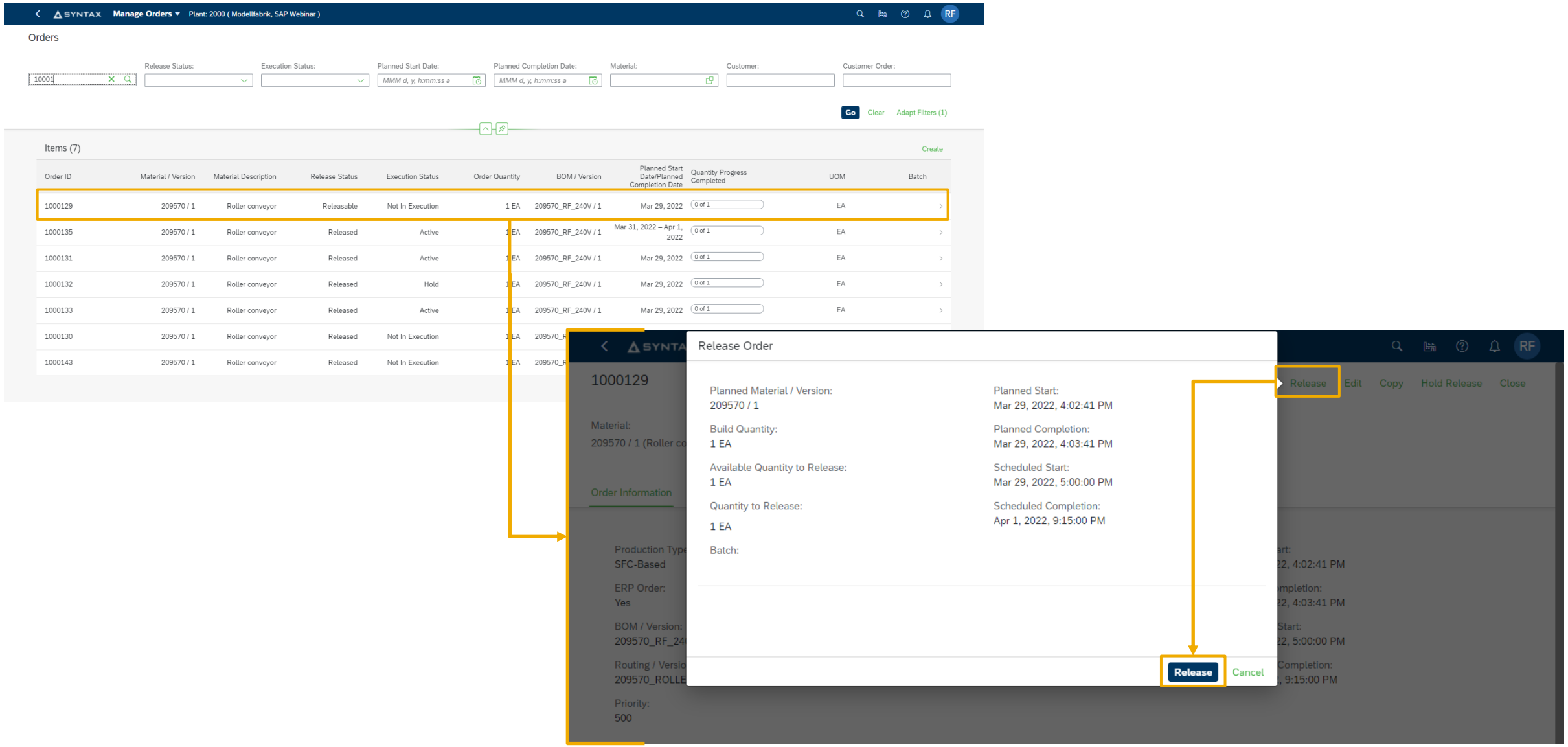
Flexibility in the SFC Definition enables the exact Genealogy



Process Flow: Industrial Engineering & Execution on the shop floor



Supervisor order release

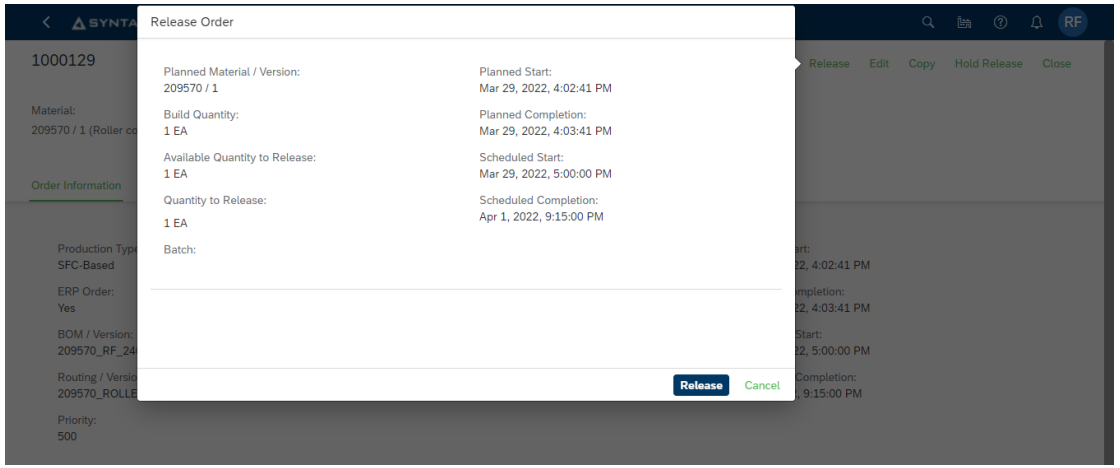


Supervisor order release

Business Outcomes

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

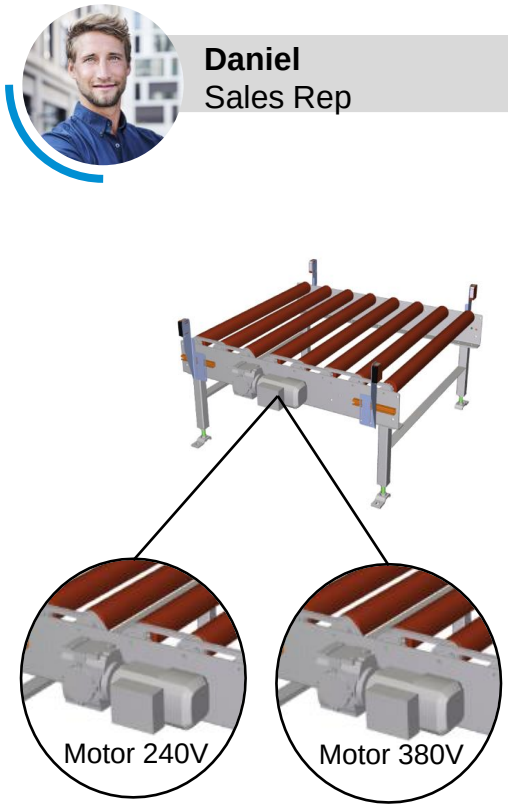
Fred
Key-User Production



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

Process Flow: Industrial Engineering & Execution on the shop floor



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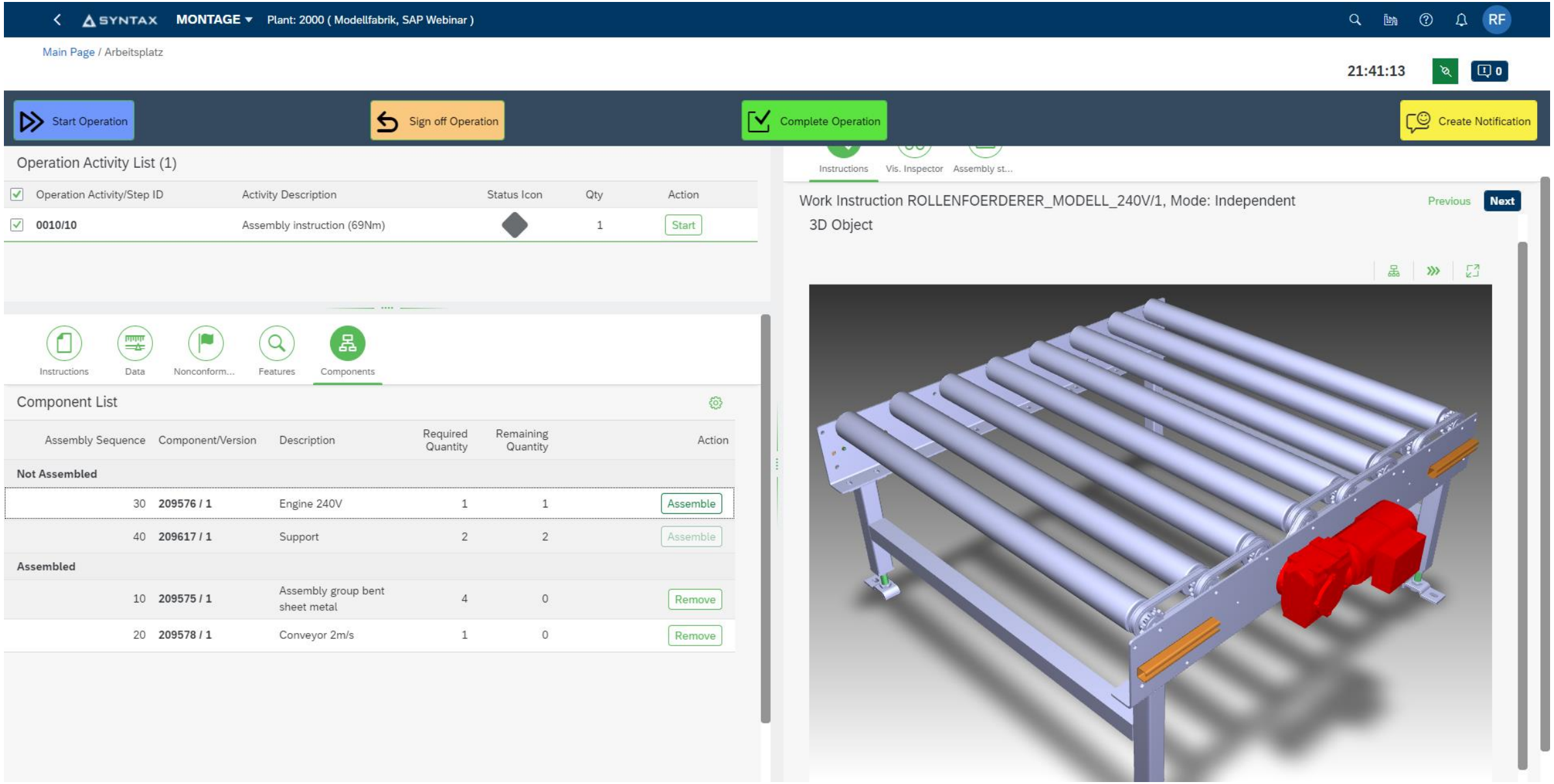
Assemble with visual work instruction

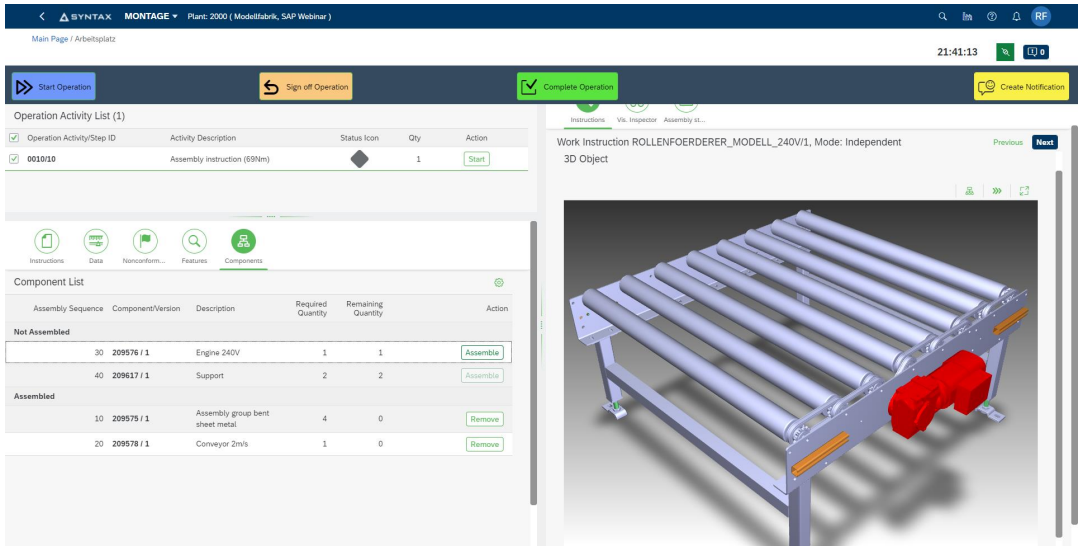


Assemble with visual work instruction

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 CTO/MTS BoM

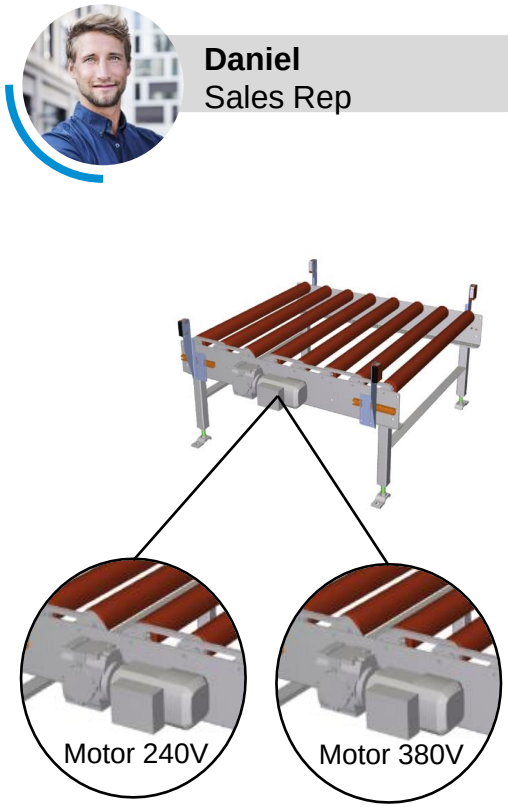
Use text based work instructions and visual work instructions like images, drawings or 3D models

Choose the Assembly Mode: Choose Sequence and Choose Auto Next

Allow Skipping Components

Executing Discrete or Time-Based Assembly

Process Flow: Industrial Engineering & Execution on the shop floor



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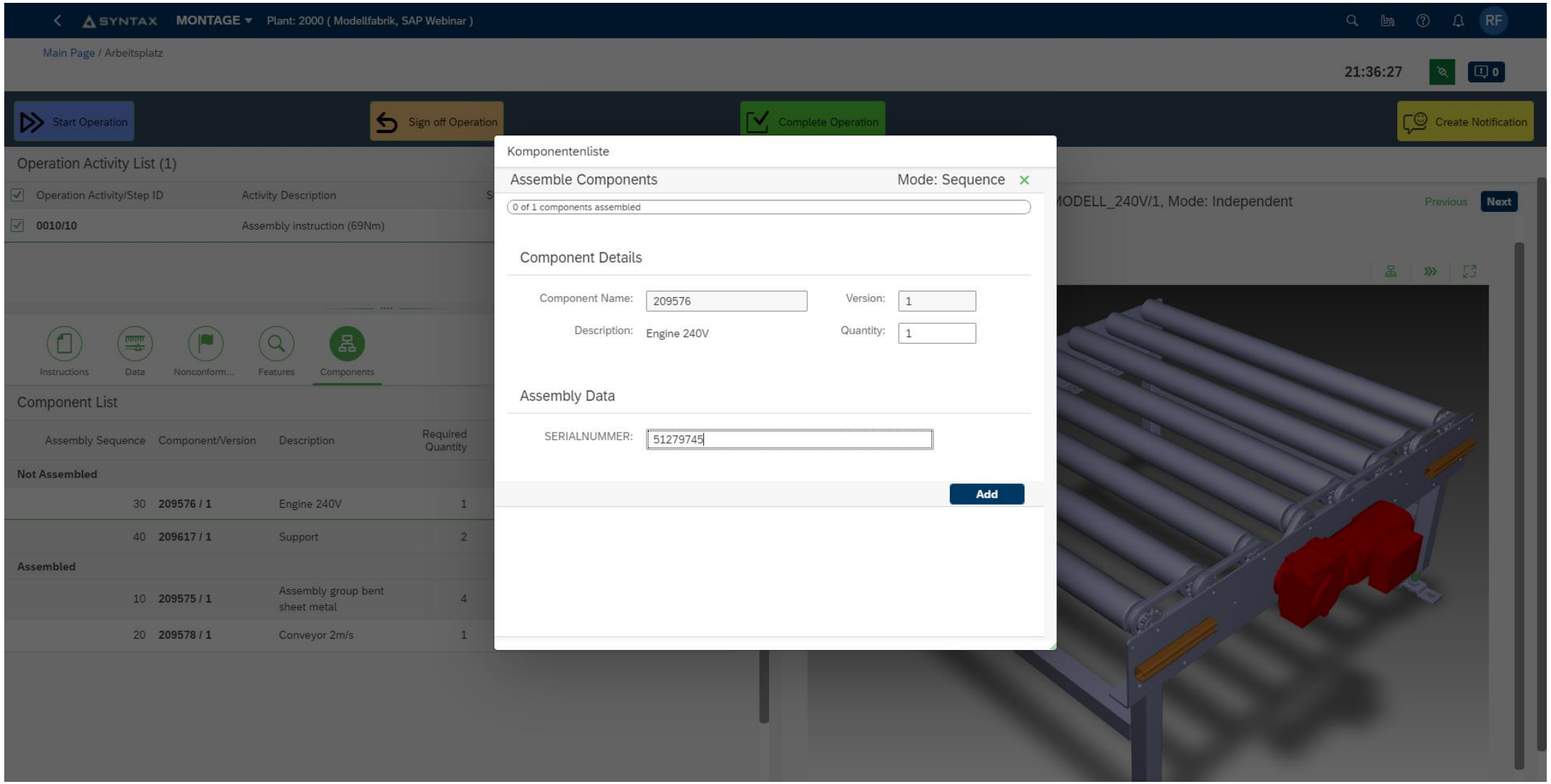
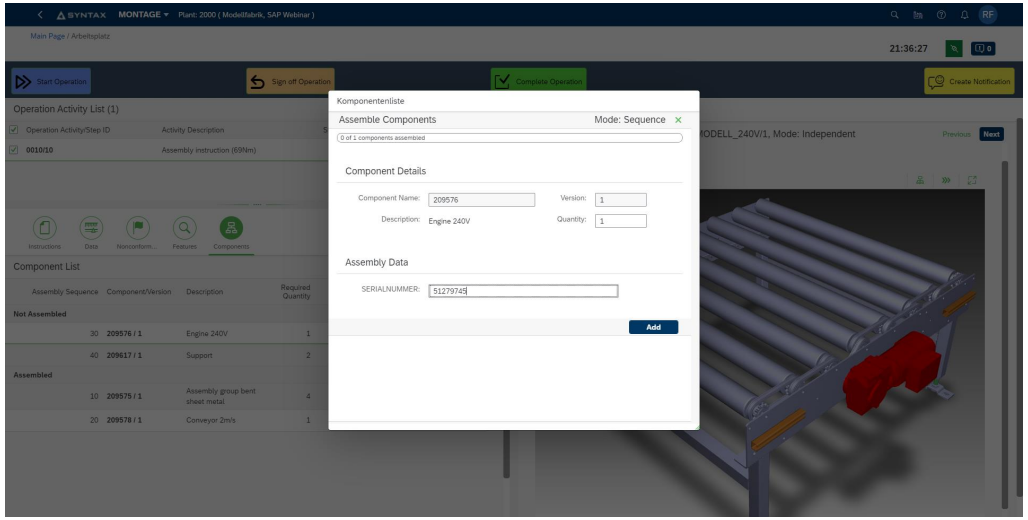


Confirm serial numbers and consumptions

Business Outcomes

*"As an **Assembly Operator,** I want to confirm my material consumption so that I know how much I still have."*

Gregor
Assembly Operator



Process Highlights

Assemble components based on CTO/MTS BoM

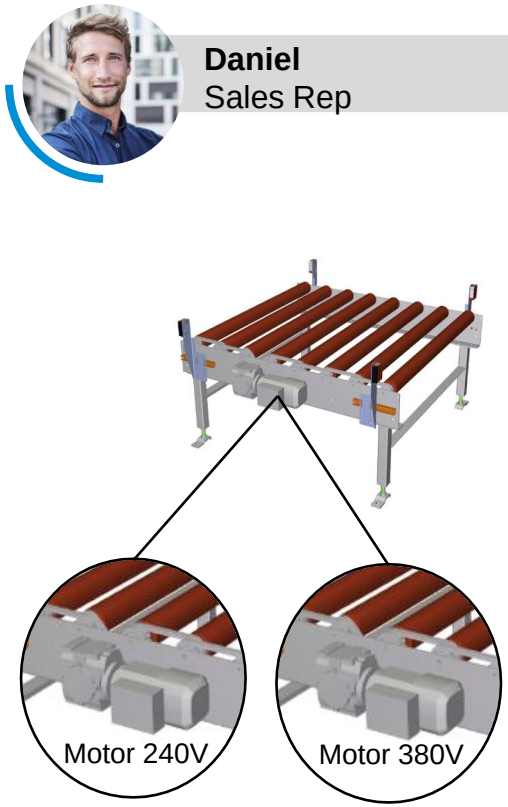
Validation of Serial # or Vendor Data

User guidance and Assembly steps

Enrichment Order-Specific Objects (Tolerance, Assembly Data, etc.)

Executing Discrete or Time-Based Assembly

Process Flow: Industrial Engineering & Execution on the shop floor



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SYNTAX MONTAGE Plant: 2000 (Modellfabrik, SAP Webinar) JK

Main Page / Arbeitsplatz

16:05:01 3

Start Operation | Sign off Operation | Complete Operation | Create Notification

Operation Activity List (1)

Operation Activity/Step ID	Activity Description	Status Icon	Qty	Action
0010/10	Assembly instruction (69Nm)		1	Complete

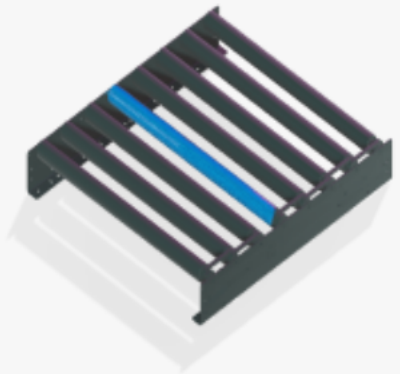
Instructions | Data | Nonconform... | Features | Components

Component List

Component/Version	Description	Required Quantity	Remaining Quantity	Action
Not Assembled				
209575 / 1	Assembly group bent sheet metal	4	4	Assemble
209578 / 1	Conveyor 2m/s	1	1	Assemble
209576 / 1	Engine 240V	1	1	Assemble
209617 / 1	Support	2	2	Assemble

Instructions | Vis. Inspector | Assembly st...

2000384 Resume 136% Source



SFC 2000384 is likely nonconformant.

Inspection Results

Search for ...

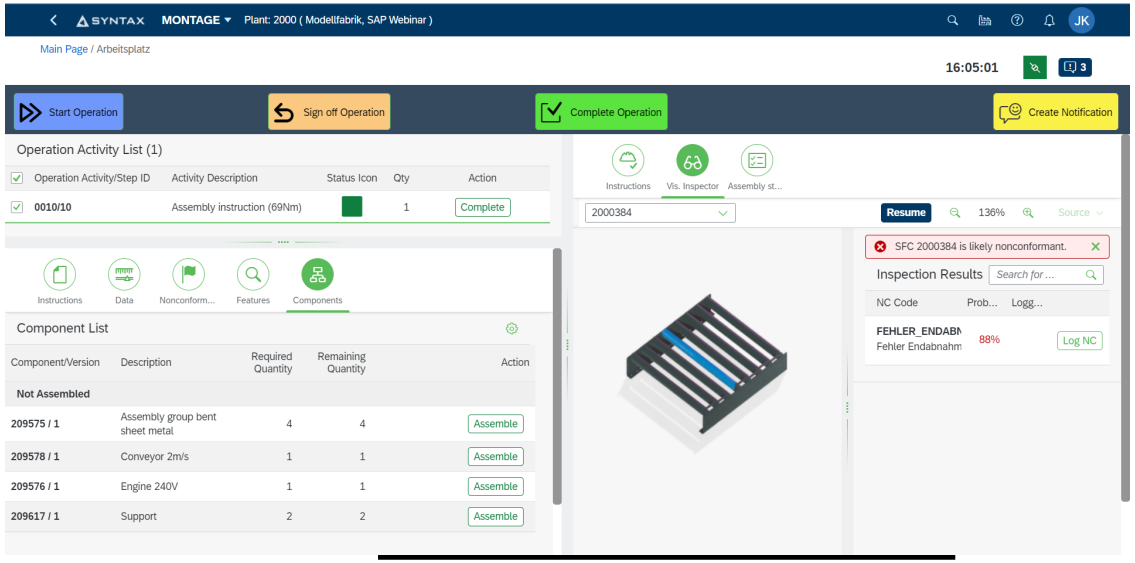
NC Code	Prob...	Logg...	
FEHLER_ENDABN Fehler Endabnahm	88%		Log NC

Perform quality check

Business Outcomes

*"As an **Assembly Operator,** I want to perform a quality check so that I know where I have to perform rework ."*

Gregor
Assembly Operator



Process Highlights

Connect machines with the DMC

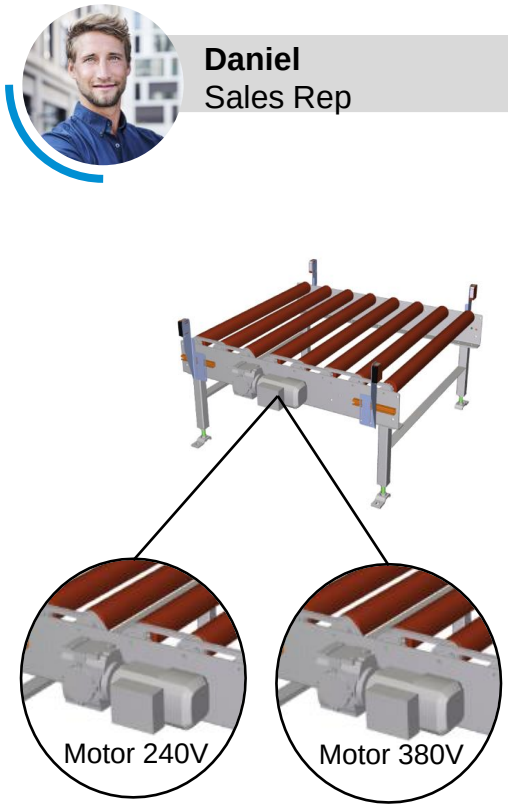
Log automatically machine signals

Using Artificial Intelligence for quality checks

Allows to log **AI based non conformance**

Inspect the finished product visually

Process Flow: Industrial Engineering & Execution on the shop floor



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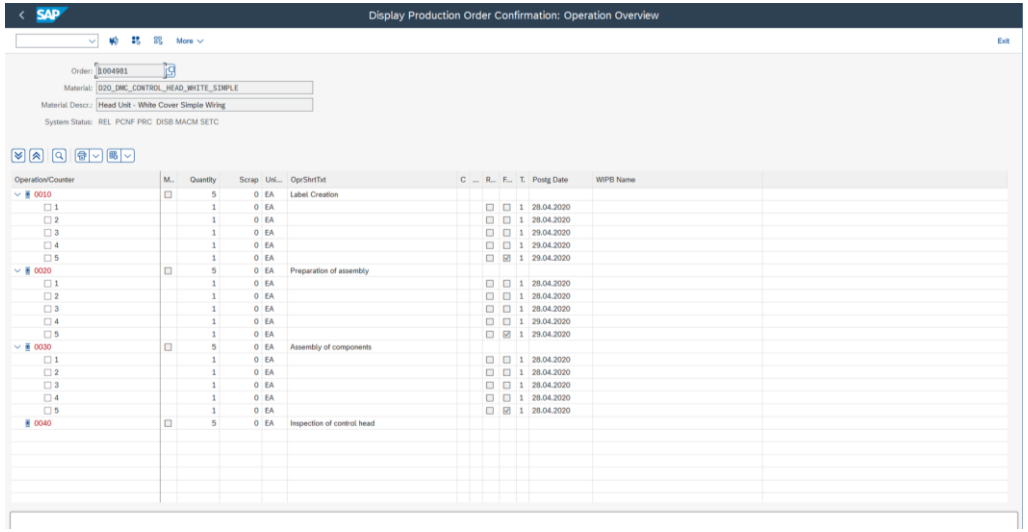
Business Outcomes

*"As an **Key-User Production,** I want to see the confirmations from the shop floor in ERP so that I can easily share the data with engineering, quality management, service, and so on."*

Fred
Key-User Production



Process Highlights

Powerful plug & play integration between ERP, EWM and DMC

Easily access and share manufacturing data (digital thread & digital twin)

Start collaborations and establish feedback loops to improve product quality or business processes

Fully automatic postings in ERP

Gain detailed views through shop floor Control Unit (SFC) when needed

Summary

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

- ✓ **Increased the level of automation** in the process flow from engineering into sales, production, service with **model once configure anywhere.**

- ✓ Using a **smart product structure** as **single central solution** to achieve **high level of consistency, automation and accuracy** across all departments.

- ✓ Improved leverage of their existing investment in the **SAP Core**. **Reduce complexity** of applications outside of the core.

Design-Driven Enterprise

From Manufacturing to Customer for Configurable Components and End-products

Variantenreiches MTS oder CTO

08.04.2022

Thank you & see you soon.

Contact Information:

Sunita Mathur
Business Development
Digital Supply Chain

SAP I M.: +43 664 8289569
Email: sunita.mathur@sap.com
LinkedIn: Sunita Mathur

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