

Challenge 2: Assistant for Production Equipment Engineering

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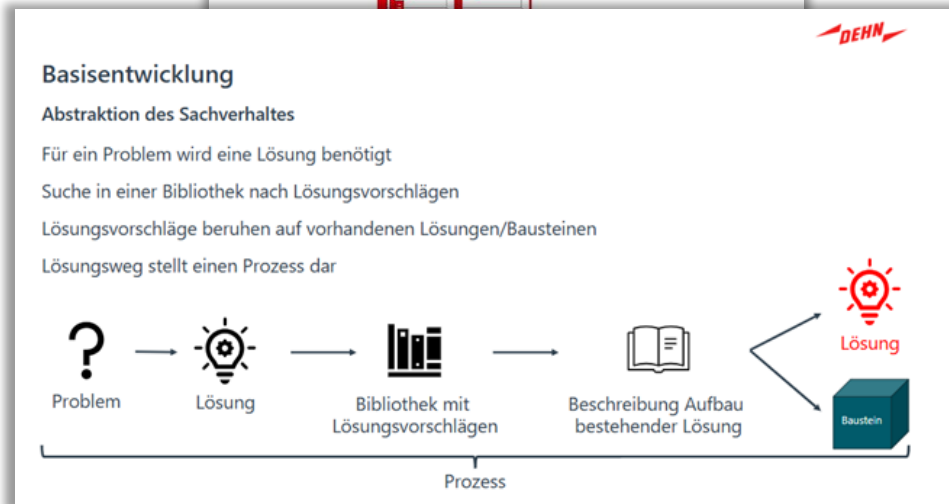
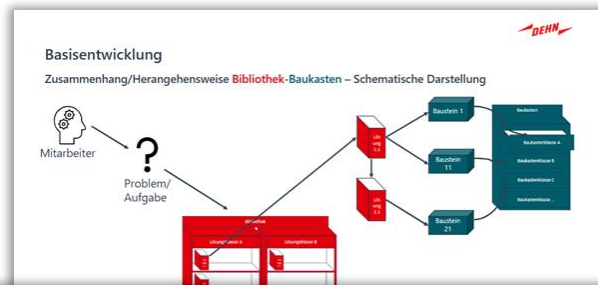
A smart assistant could streamline the development of suited production equipment from modules.

Status Quo

- Existence of a **modular library of solution components** developed by prod. equipment engineering department
- Input is currently **manual** and **links existing solutions and problems** with a **library of proposed solutions**
- **Modular concept** for implementing production setups and workflows
- **Combination of solution components** to realize suitable manufacturing solutions

Task

- Goal of **(partial) automation** of the previously manual selection process
- Use of a **smart solution** to support "inexperienced" users in finding suitable solutions
- **Promotion of closer collaboration**



Basic development

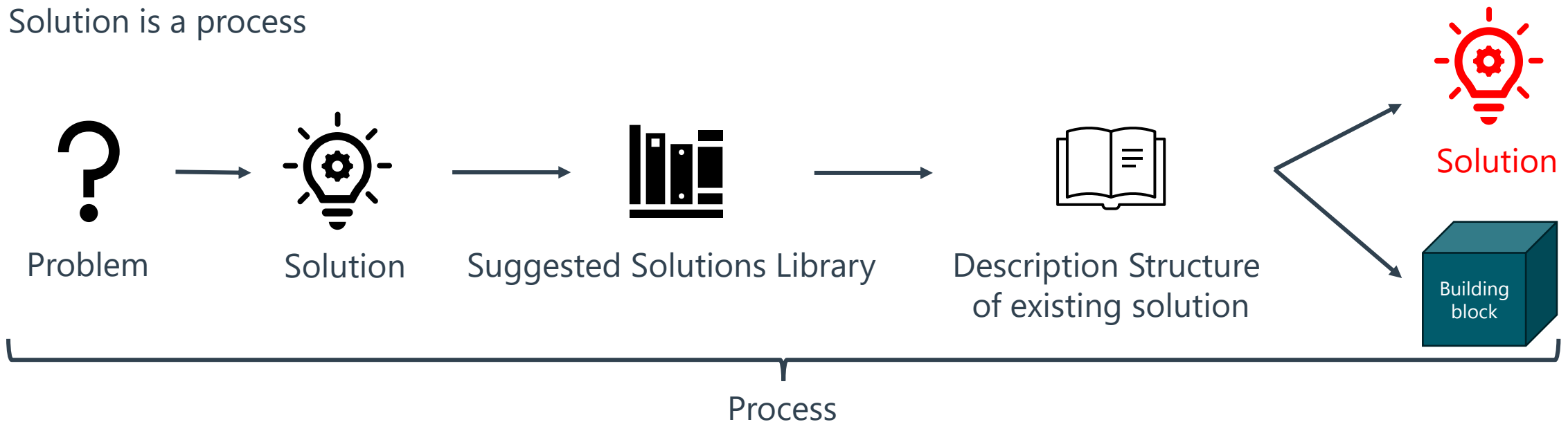
Abstraction of the facts

A problem needs a solution

Search a library for solutions

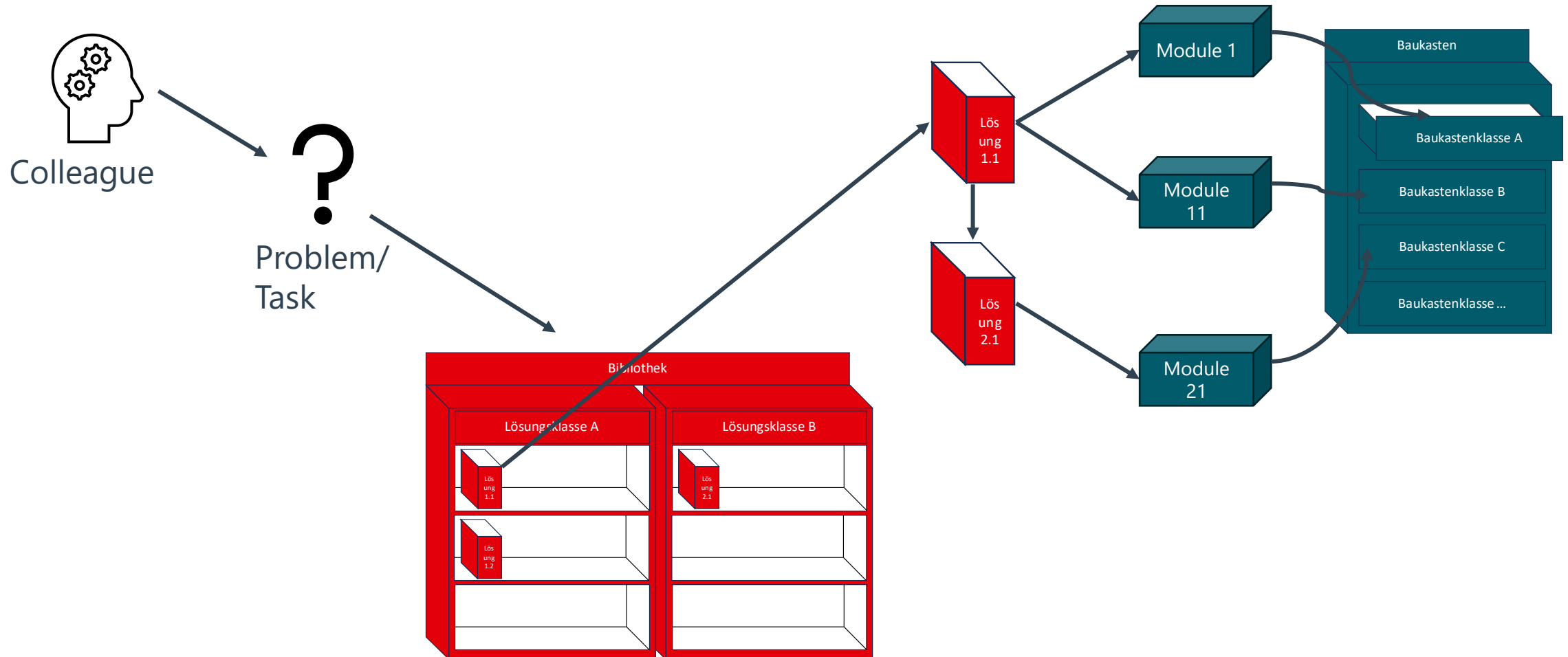
Proposed solutions are based on existing solutions/building blocks

Solution is a process



Basic development

Context/Approach **Library** Toolkit – Schematic Representation



Basic development

What is a **building block** and what is a **solution**?

- Building block
 - > Any self-contained mechatronic/mechanical/software/electrical **unit** that **cannot execute a process on its own**.
 - Are elements of the **modular system**.
 - e.g. robots
- Solution
 - > A solution is a **series of building blocks** and/or other **solutions** for the implementation of a process. Which **can thus be completely reused**, as cross-departmental issues have already been clarified in detail.
 - Are elements of the **solution library**.
 - e.g. labeling FRED
- Process
 - > A process generates an output (physical / virtual) **from an input, with the help of the solution.If**
 - no output is generated, it is not a process, but a function.
 - e.g. component decoration by labelling FRED

Basic development

Presentation of the modular system

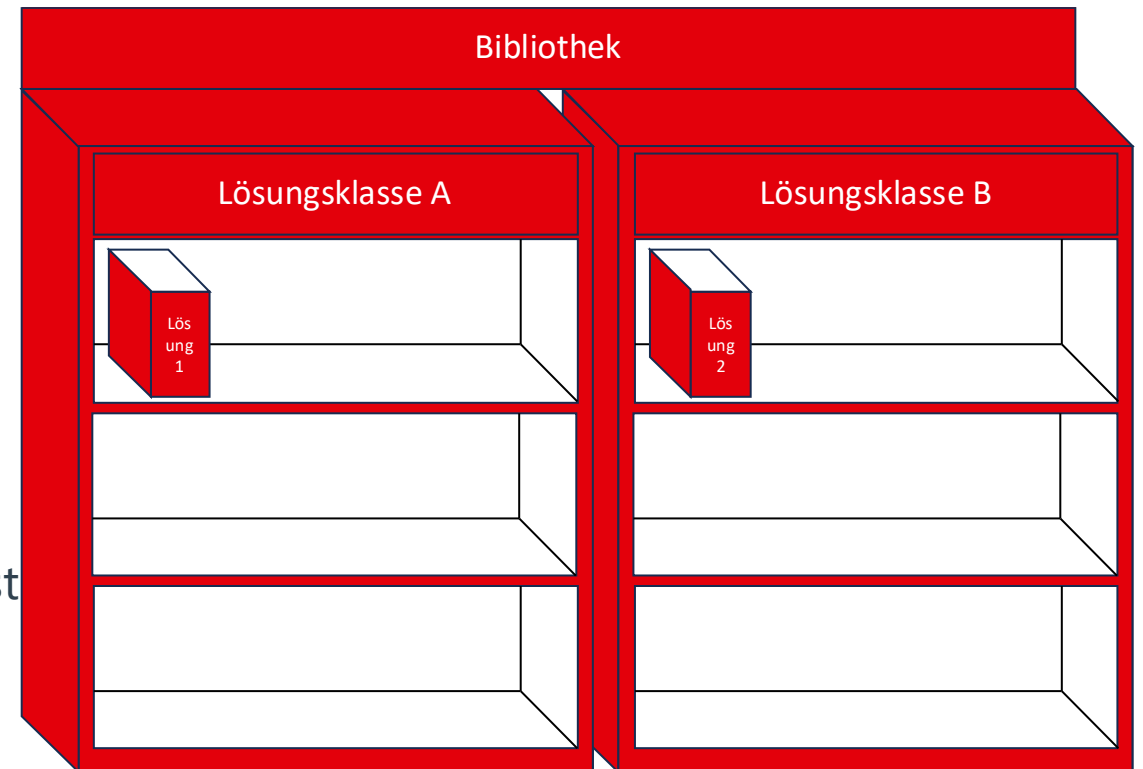
- Structure conceivable like a filing cabinet
- Each drawer corresponds to a "component class"
- Building blocks are "sorted" into the corresponding drawer
- Drawers can be subdivided separately, similar to an alphabetical index, represent "sub" component classes



Basic development

Presentation **of the library**

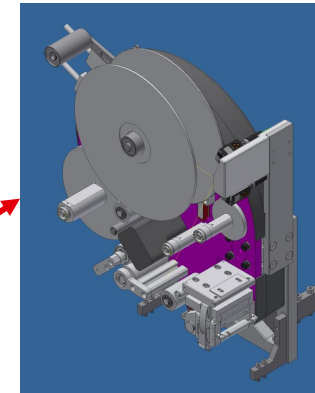
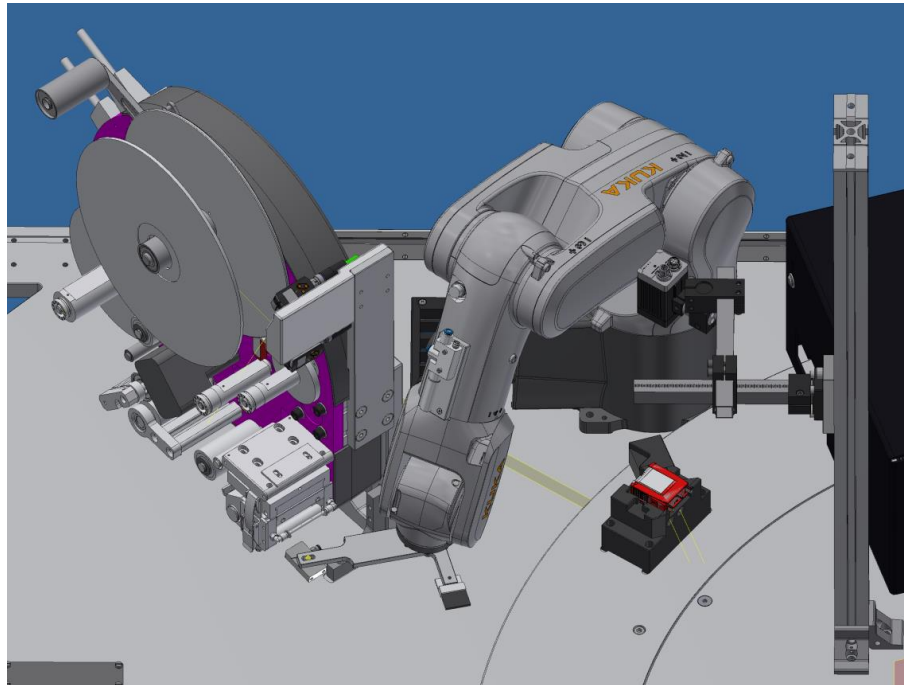
- Structure conceivable like a library
- Each bookshelf corresponds to a "solution class"
- Solutions are "sorted" into the associated shelf
- Shelves can be divided separately again, similar to the division in libraries
- Solutions are comparable to non-fiction books
Explains what the solution looks like, what it consists of and what it aims to achieve



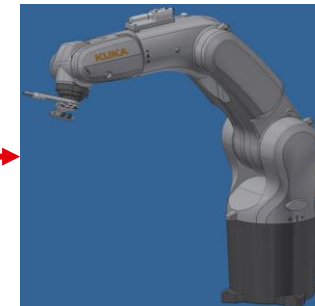
Basic development

Example solution and partial solutions

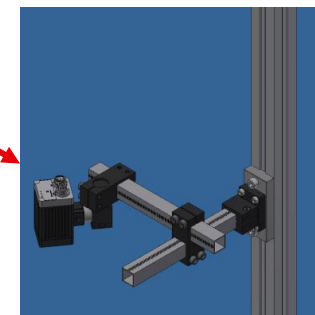
Labeling – FRED
Solution: Apply Label
No.: 100000



Partial Solution:
Print
and Deploy Label
No.: 100001



Partial Solution:
Pick Up,
Manipulate and
Attach Label
No.: 100003

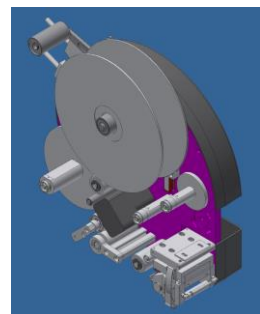


Partial solution:
Check position,
determine
and correct
offset
No.: 100004 and

Basic development

Example partial solution and its building blocks

Partial Solution:
Label Printing and Deployment
No.: 100001



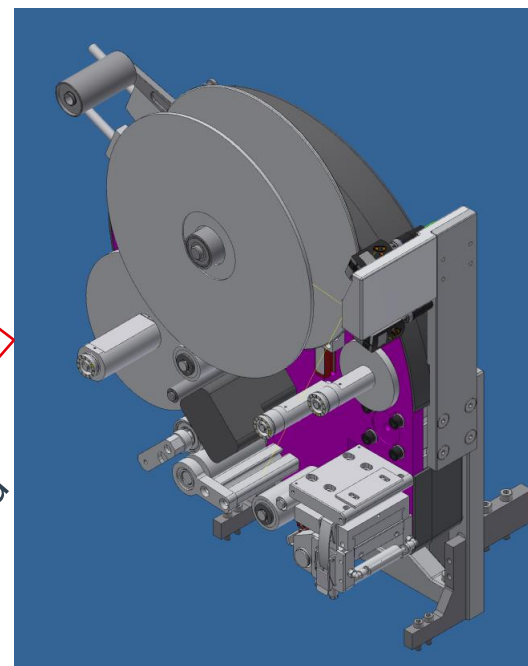
200027



200017
200073
200074
200025



200068

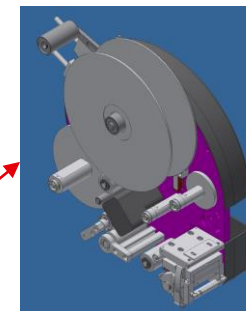


Tax. Modules
system-related

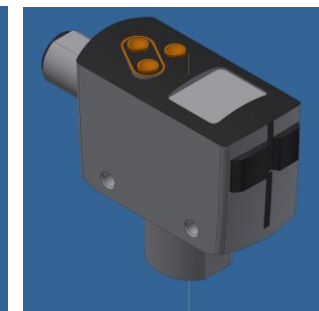
Building
blocks
system-related

Mech. Building
blocks

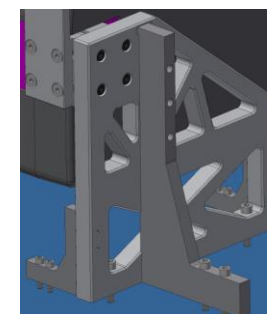
Modules
company-related



200027



200068



200069

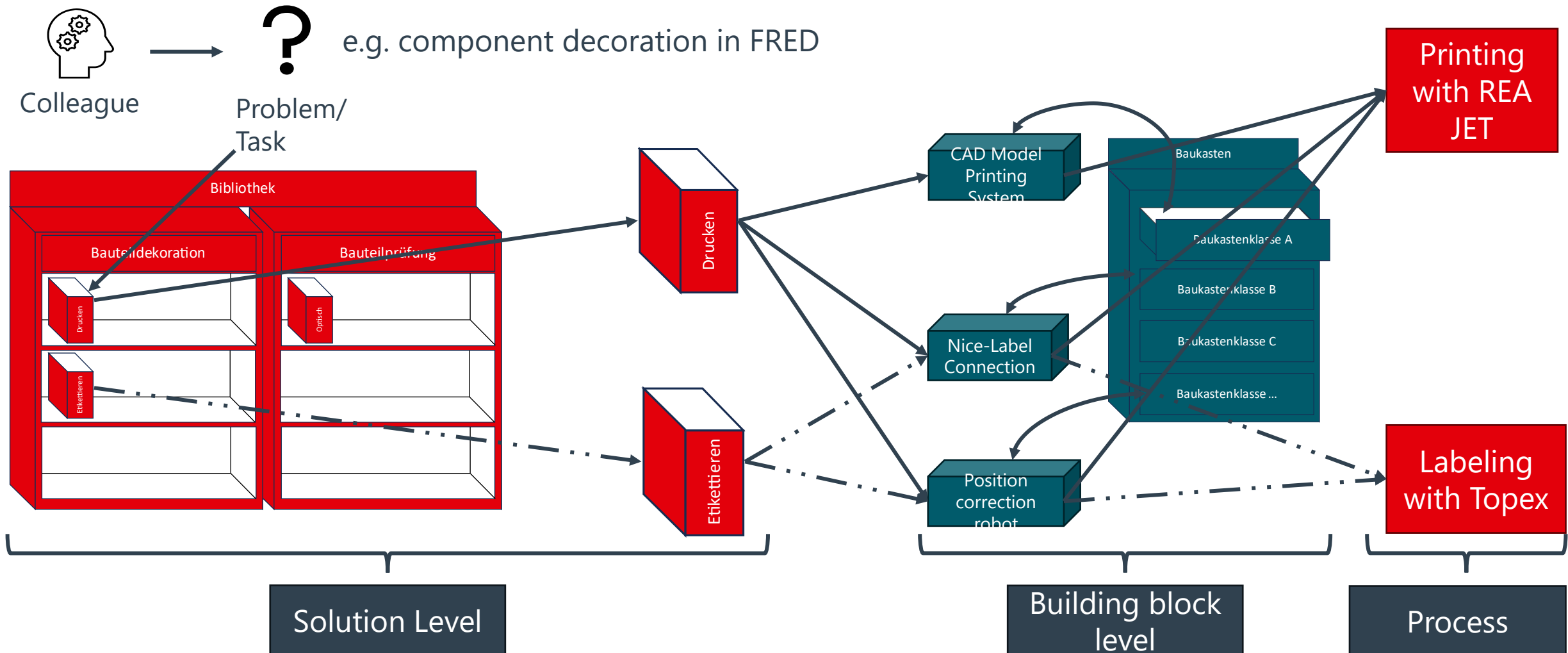


200028



Basic development

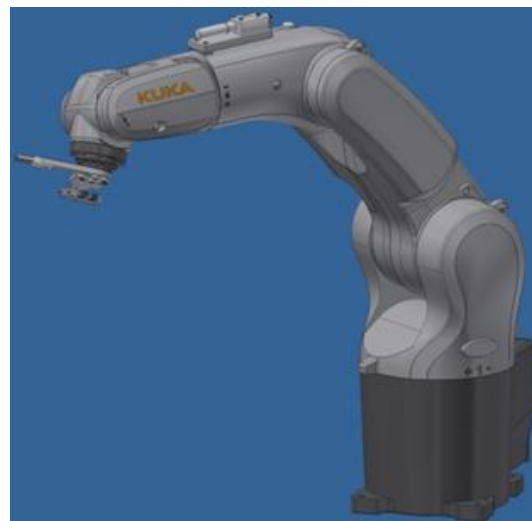
Context/Approach **Library Toolkit** – Complex Practical Example



Basic development

Example partial solution and its building blocks

Partial solution: Pick up, manipulate and attach the label
No.: 100003



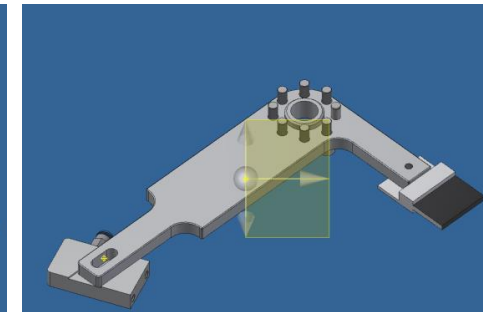
Mech. Building blocks

Tax. Modules system-related

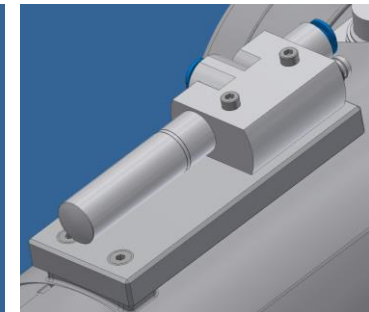
Modules company-related



200001



200071



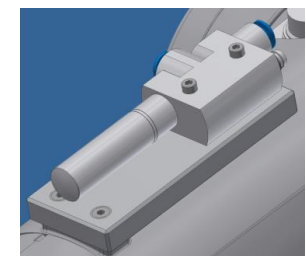
200070



200025
200019



200023
200022
200001
200020
200021



200067

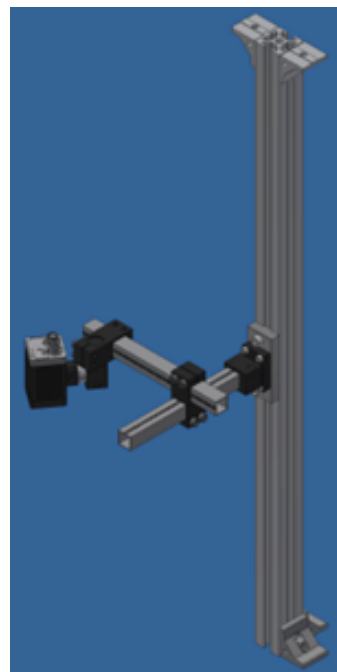
Maintenance/Repair

Development/SCM

Basic development

Example partial solution and its building blocks

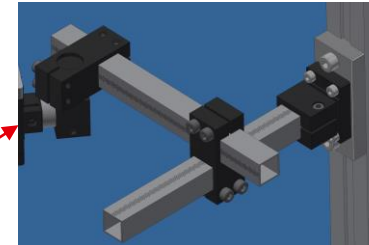
Partial solution:
Determine and correct offset
No.: 100004 and 100005



Mech. Building
blocks

Tax. Modules
system-related

Roboted. Building
blocks
Modules
company-
related



200072



200013
200016
200026



200011
200025
200018
200019



200022
200012
200000

Referencing

Correction of coordinates
based on camera data

200022

Maintenance/Repair Camera
Self-Test

Basic development

Overview of the construction kit/library

Library:

Prozessnummer	Prozessname	Prozessart	Merkmalklasse 1	Merkmalklasse 2	Merkmalklasse 3	Handbedingung 1	Handbedingung 2	Verknüpfungen Prozesskette	Verknüpfungen Bauelemente	Hinweise	Ablageort konstruktiv	Ablageort steuerungstechnisch	Ablageort prüftechnisch	Ablageort robotertechnisch
100000	Etikett applizieren	Hauptprozess	Drucken	Korrigieren	Applizieren	Vollautomatisierung	Etikettgröße 50x30	100001 - 100006	Baukasten		3040983	TIA-Projekt: V:\BMB\Team\VORR\1040855 - FRED 3038260\ST\SPS (TIA)\FRED 3040983 Kamera: S:\D+S\Collaboration\Kamerapruefung\Programme etc\Job_Fred V:\BMB\Team\ST\TIA Bibliotheken\V18\ST_Favoriten_V18	V:\BMB\Team\VORR\1040855 - FRED 3038260\ST\KUKA V:\BMB\Team\ST\KUKA\Kt_Bibliotheken	
100001	Etikett drucken und bereitstellen	Teilprozess	Drucken	Bereitstellen	-				100000 Baukasten	Nice-Label -> Datenbank	3040988			
100002	Etikett abholen und manipulieren	Teilprozess	Manipulieren	Greifen	-				100000 Baukasten	I/O -> beachten siehe Checkliste	3040634			
100003	Versatz ermitteln	Teilprozess	Kontrollieren	Erkennen	-				100000		3040795			
100004	Position korrigieren	Teilprozess	Korrigieren	-	-				100000		3040795			
100005	Etikett applizieren	Teilprozess	Greifen	Applizieren	-				100000		3040634			
100006	DMC-Code lesen	Teilprozess	Erkennen	Auswerten	-									
100007	Steckzeil zuführen	Hauptprozess												
100008	Baueil prüfen	Hauptprozess												
100009	Kodierschl Kontrolle	Teilprozess												
100010	Trennbank Kontrolle	Teilprozess												
100011	Prüfung statisch	Hauptprozess												V:\BMB\Team\VORR\1040855 - FRED 3038260\PS
100012	Prüfung dynamisch	Hauptprozess												V:\BMB\Team\VORR\1040855 - FRED 3038260\PS
100013	Prüfung Isolation	Hauptprozess												V:\BMB\Team\VORR\1040855 - FRED 3038260\PS
100014	Prüfkennzeichen drucken	Hauptprozess												
100015	Paketieren	Hauptprozess												

Kit:

Kit Nummer	Version	Bestellnummer	Bestellkategorie	Hersteller	Typ	Eigenschaft 1	Wert 1	Eigenschaft 2	Wert 2	Eigenschaft 3	Wert 3	Ablageort konstruktiv	Ablageort steuerungstechnisch	Ablageort prüftechnisch	Ablageort robotertechnisch	Standard:	Quelle:
200000		Q KR 6 R900 2	Roboter	KUKA	KR 6 R900 2	Traglast [kg]	6,00 Reichweite [mm]		900 Eigengewicht [kg]		35 DIS IAM 3016887					Datenblatt/Read Me	
200001		Q KR 4 R600	Roboter	KUKA	KR 4 R600	Traglast [kg]	4,00 Reichweite [mm]				DIS IAM 3040634					Datenblatt/Read Me	
200002		Q Verbindungskabel KUKA SPS 10m	Roboter equipment (KUKA)	KUKA	SPP Verbindungskabel 10m	Länge [m]	10,00									Datenblatt	
200003		Q Verbindungskabel KUKA SPS 10m	Roboter equipment (KUKA)	KUKA	SPP Verbindungskabel 5m	Länge [m]	5,00									Datenblatt	
200004		Q PROFINET für KUKA	Robotersoftware (KUKA)	KUKA	KUKA PROFINET /S 6.0	Protokoll	PROFINET									Read Me	
200005		Q Werkzeugausrüstung KUKA	Robotersoftware (KUKA)	KUKA	KUKA GripperSportTech 5.0	Länge [m]										Read Me	
200006		Q Anschlusssatz SPS KUKA	Roboter equipment (KUKA)	KUKA												Read Me	
200007		Q KUKA Hauptprogramm	Robotersoftware (KUKA)	DEHN ST	coil_src	Ansprechpartner	KIH/DAA	Software	WorkVisual							Read Me	
200008		Q KUKA EA_Fred 11 Pal_Rob	Roboter dokumente (KUKA)	DEHN ST	Profinet I/O Tabelle	Ansprechpartner	KIH/DAA										
200009		Q SPS Bib DMC Code auswerten	SPS Baustein (SIEMENS)	DEHN ST	FC Etik Kam DMC	Ansprechpartner	KIH/THP/NBR/...	Version	V18 Upd.3	Bibliotheks konformität	Ja	V:\BMB\Team\ST\TIA Bibliotheken\V18\ST_Favoriten_V18				Read Me	
200010		Q SPS Bib Etikett Typ erkennen	SPS Baustein (SIEMENS)	DEHN ST	FC Etik Kam Etik	Ansprechpartner	KIH/THP/NBR/...	Version	V18 Upd.3	Bibliotheks konformität	Ja	V:\BMB\Team\ST\TIA Bibliotheken\V18\ST_Favoriten_V18				Read Me	
200011		Q SPS Bib DMC Code auswerten	SPS Baustein (SIEMENS)	DEHN ST	FC Etik Kam Versatz	Ansprechpartner	KIH/THP/NBR/...	Version	V18 Upd.3	Bibliotheks konformität	Ja	V:\BMB\Team\ST\TIA Bibliotheken\V18\ST_Favoriten_V18				Read Me	
200012		Q SPS Bib Etiketten Rob Datenaustausch	SPS Baustein (SIEMENS)	DEHN ST	FC Etik Rob Datenaustausch	Ansprechpartner	KIH/THP/NBR/...	Version	V18 Upd.3	Bibliotheks konformität	Ja	V:\BMB\Team\ST\TIA Bibliotheken\V18\ST_Favoriten_V18				Read Me	
200013		Q Job Etikett versetzen/Versatz ermitteln	Job (SensioPart)	DEHN ST	Job Etikett versetzen	Ansprechpartner	KIH/HAC/NBR	Version	2.8.2.1			S:\D+S\Collaboration\Kamerapruefung\Programme etc\Job_Fred				Read Me	
200014		Q Job DMC Code lesen	Job (SensioPart)	DEHN ST	Job DMC Code lesen	Ansprechpartner	KIH/HAC/NBR	Version	2.8.2.1			S:\D+S\Collaboration\Kamerapruefung\Programme etc\Job_Fred				Read Me	
200015		Q Job Etikett Typ erkennen	Job (SensioPart)	DEHN ST	Job Etikett Typ	Ansprechpartner	KIH/HAC/NBR	Version	2.8.2.1			S:\D+S\Collaboration\Kamerapruefung\Programme etc\Job_Fred				Read Me	
200016		Q Jobsatz Etikett applizieren	Jobsatz (SensioPart)	DEHN ST	Job Etikett applizieren	Ansprechpartner	KIH/HAC/NBR	Version	2.8.2.1			S:\D+S\Collaboration\Kamerapruefung\Programme etc\Job_Fred				Read Me	
200017		Q SPS Bib Ablauf Druck	SPS Baustein (SIEMENS)	DEHN ST	FB Etik Druck	Ansprechpartner	KIH/THP/NBR/...	Version	V18 Upd.3	Bibliotheks konformität	Nein	V:\BMB\Team\ST\TIA Bibliotheken\V18\ST_Favoriten_V18				Read Me	
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200019		Q SPS Bib Kommunikation Roboter	SPS Baustein (SIEMENS)	DEHN ST	FC Etik Rob Ansteuerung, FB Etik Rob	Ansprechpartner	KIH/THP/NBR/...	Version	V18 Upd.3	Bibliotheks konformität	Nein	V:\BMB\Team\ST\TIA Bibliotheken\V18\ST_Favoriten_V18				Read Me	
200020		Q Kuka Fkt Produktionsbetrieb	Roboterprogramm (KUKA)	DEHN ST	bearbeitungsprogramm[]	Ansprechpartner	KIH/DAA	Software	WorkVisual							V:\BMB\Team\VORR\1040855\Read Me	
200021		Q Kuka Fkt Etikett aufnehmen (Topex)	Roboterprogramm (KUKA)	DEHN ST	UP Abhol Topex[]	Ansprechpartner	KIH/DAA	Software	WorkVisual							V:\BMB\Team\VORR\1040855\Read Me	
200022		Q Kuka Fkt Etikett ausrichten/aufbringen (Topex)	Roboterprogramm (KUKA)	DEHN ST	UP Einlog DT[]	Ansprechpartner	KIH/DAA	Software	WorkVisual							V:\BMB\Team\VORR\1040855\Read Me	
200023		Q Kuka Fkt Etikett anbringen (Topex)	Roboterprogramm (KUKA)	DEHN ST	UP Buersten[]	Ansprechpartner	KIH/DAA	Software	WorkVisual							V:\BMB\Team\VORR\1040855\Read Me	
200024		Q Kuka Fkt Automatische Homefahrt	Roboterprogramm (KUKA)	DEHN ST	MoveHome(nHome-IN)	Ansprechpartner	KIH/DAA	Software	WorkVisual							V:\BMB\Team\VORR\1040855\Read Me	
200025		Q SIEMENS SPS	Hardware SPS	SIEMENS	CPU 1516 3 PN/DP												
200026		Q SENSOPART Kamera	Vision Sensoren	SENSOPART	V 20 C Allround	Umfang	Professional					DIS 3029556				V:\BMB\Team\VORR\1040855\Read Me	
200027		Q TOPEX Drucker	Etikettendrucker	TOPEX	TOPEX T200/T250 ZEBRA Treiber							DIS 3040506					
200028		Q SPS TCP/IP Anlagenname	NiceLabel	Software		Ansprechpartner	ZE/NBR/IWA	Treiber version	10.???	Bibliotheks konformität	Ja						
200029		Q SPS Bib Kommunikationsbaustein PS	SPS Baustein (SIEMENS)	DEHN ST	FB PS_COM	Ansprechpartner	NBR/IWA	Version	V18 Upd.3	Bibliotheks konformität	Ja						

Considerations & dependencies

I

**Focus on automation, only then
on user experience in using it**

A nice user interface is good, but first solving the automation task would be our focus

II

**Integration in other systems not
mandatory**

Due to the special nature of the challenge and its application, no integration into other systems is needed