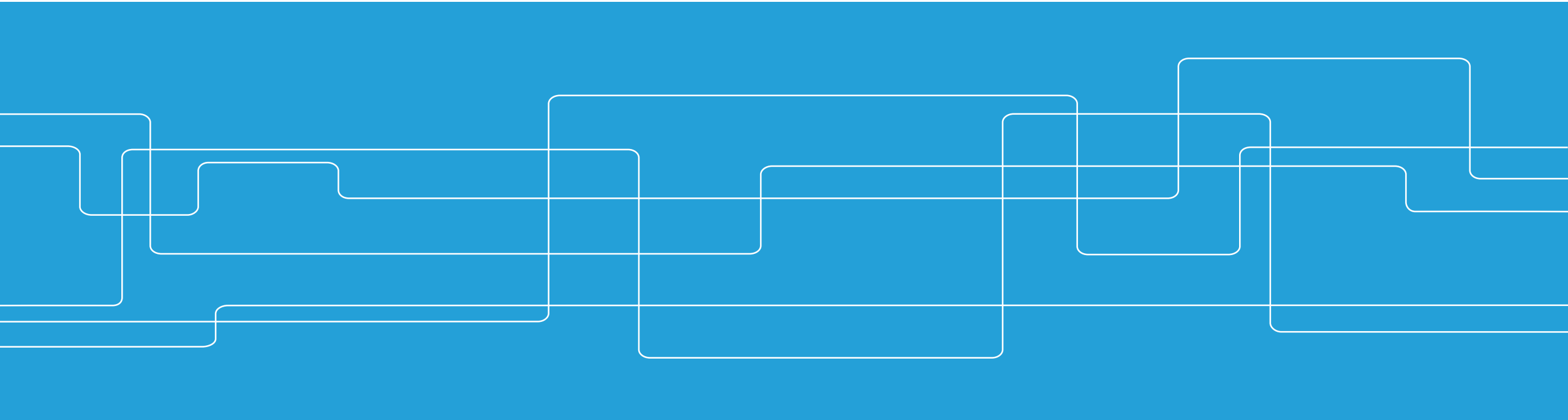




Prototyping Smart Manufacturing

A testbed project

October 25th 2018



Introduction

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The DigIn Project is part of Produktion 2030, and is running between 2017-2020. Six actors are involved: KTH, Eurostep, Scania, PMH, RISE/IVF, Solme. A research project funded by the Swedish Strategic Innovation Program Produktion2030, a joint venture of VINNOVA, Formas and the Swedish Energy Agency.



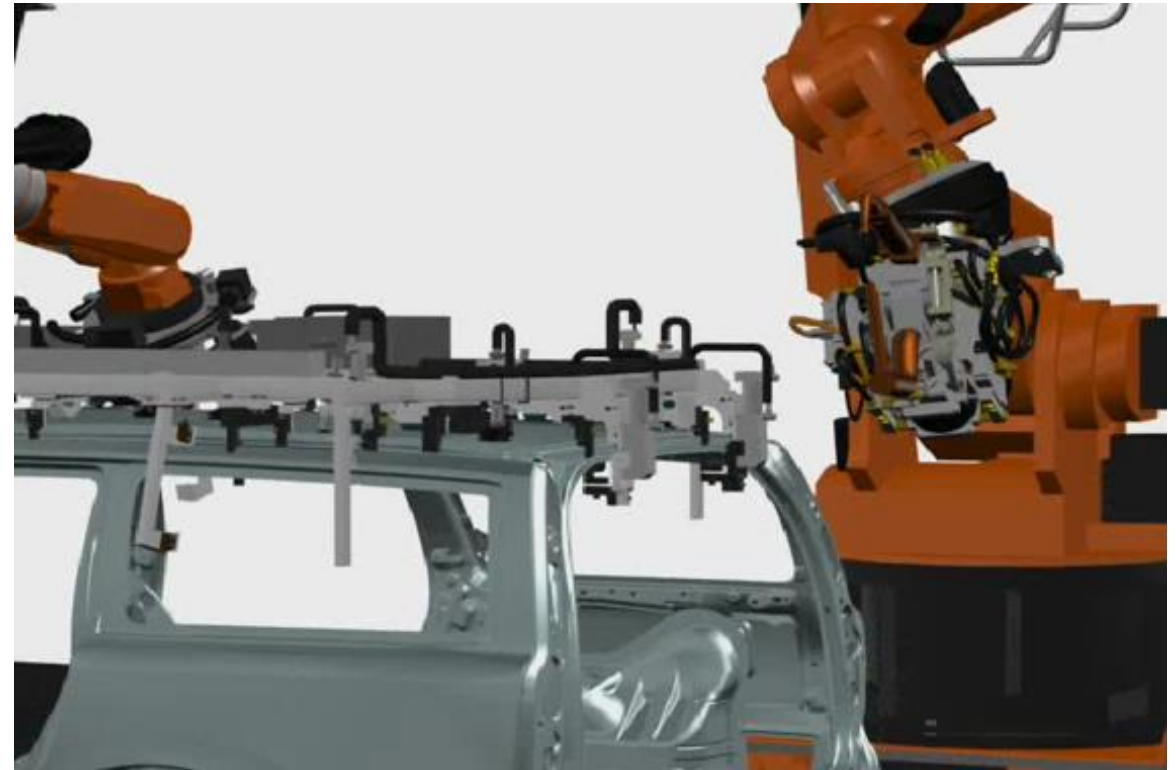
Industrial opportunities

Digital modeling and simulation

Automation

IoT with sensors and information on demand

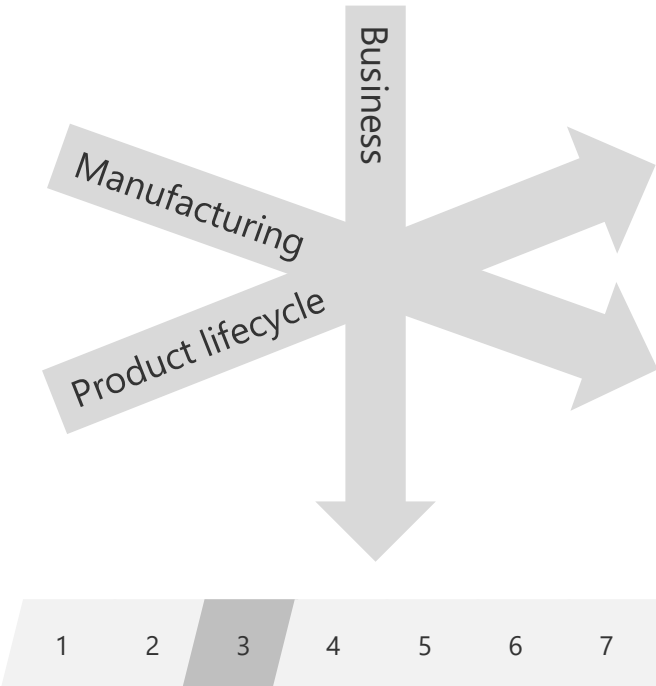
Distributed control and communication standards



Industrial challenges

1. Products and manufacturing systems are complex, interdependent, systems.
2. The business is order based, creating customized products on order.
3. Both product, manufacturing systems and orders change and require up-to-date information.

1. Data in manufacturing is often unstructured, hidden and plentiful.
2. Manufacturing data needs to be elicited and transformed into information.
3. Challenge to combine the rich information from design with data from manufacturing to update models and make smart decisions.



The targets of DigIn – an infrastructure for Smart manufacturing



Testbed for smart manufacturing

- Try out new technologies in line with Industrie 4.0



Create digital twins based on integrating engineering and production IT-systems

- Closing the gap between unstructured data, design structure and business process using standards – ISO 10303-239 PLCS



Updated Digital twins

- Digital twin kept up-to-date based on feedback, creating knowledge for next round



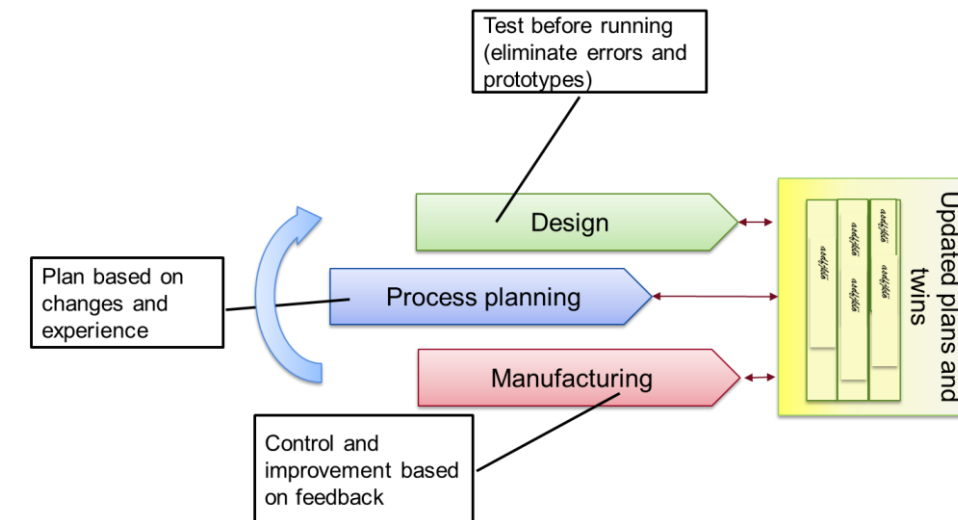
Reflecting industrial complexity

- Changes in interdependent products, production systems and orders



Open and cloud based

- Using Microsoft Azure makes it possible to use the cloud



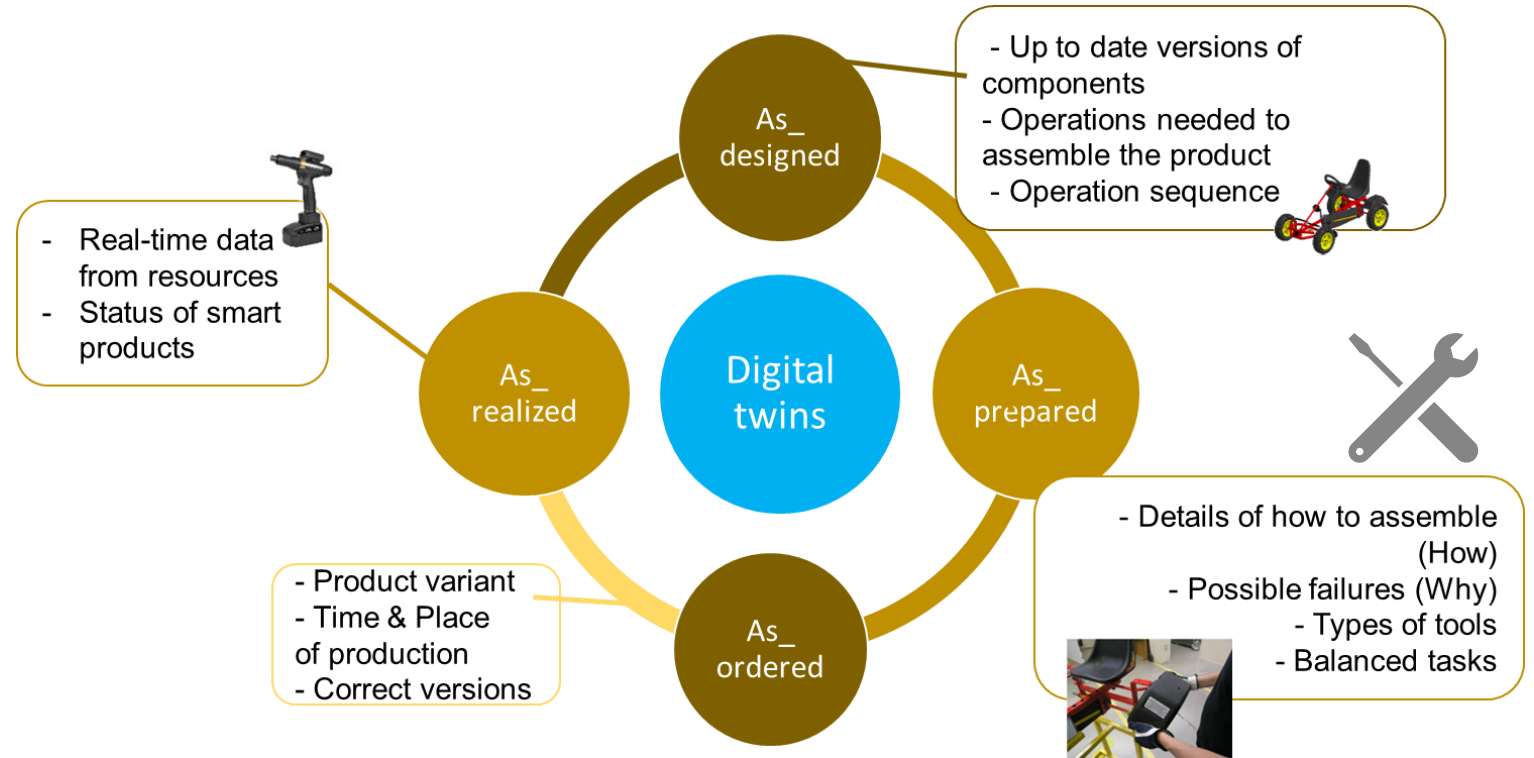
Digital twins

Product (pedal car) – process (assembly) – resource (handheld torque tool)

The Digital Twin – A replica of the physical product and production system with all the information needed

Consolidating lifecycle stages and PPR-context

Key concept in the smart factory



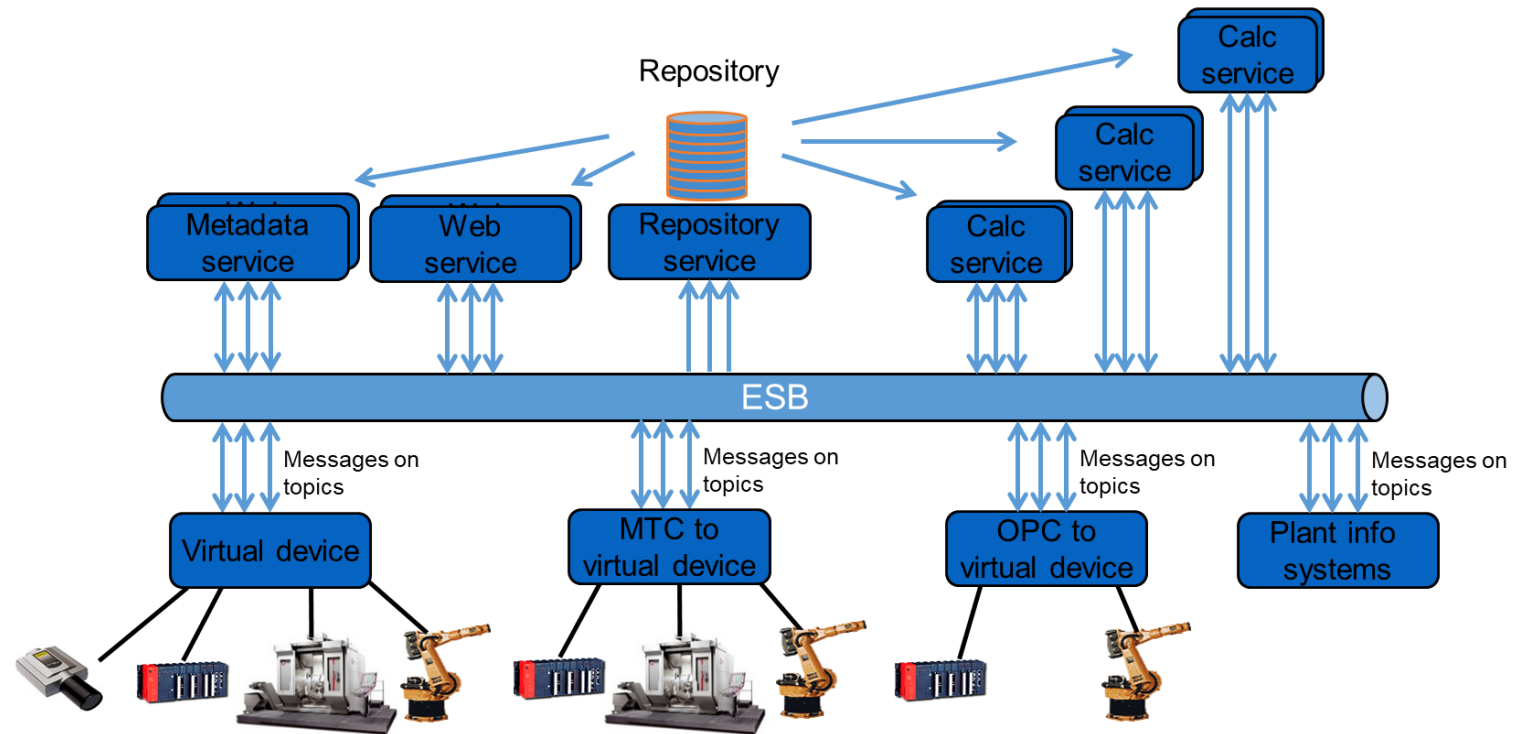
Infrastructure based on enterprise service bus

Messages sent on topics
in Kafka service bus

Communication like
Twitter

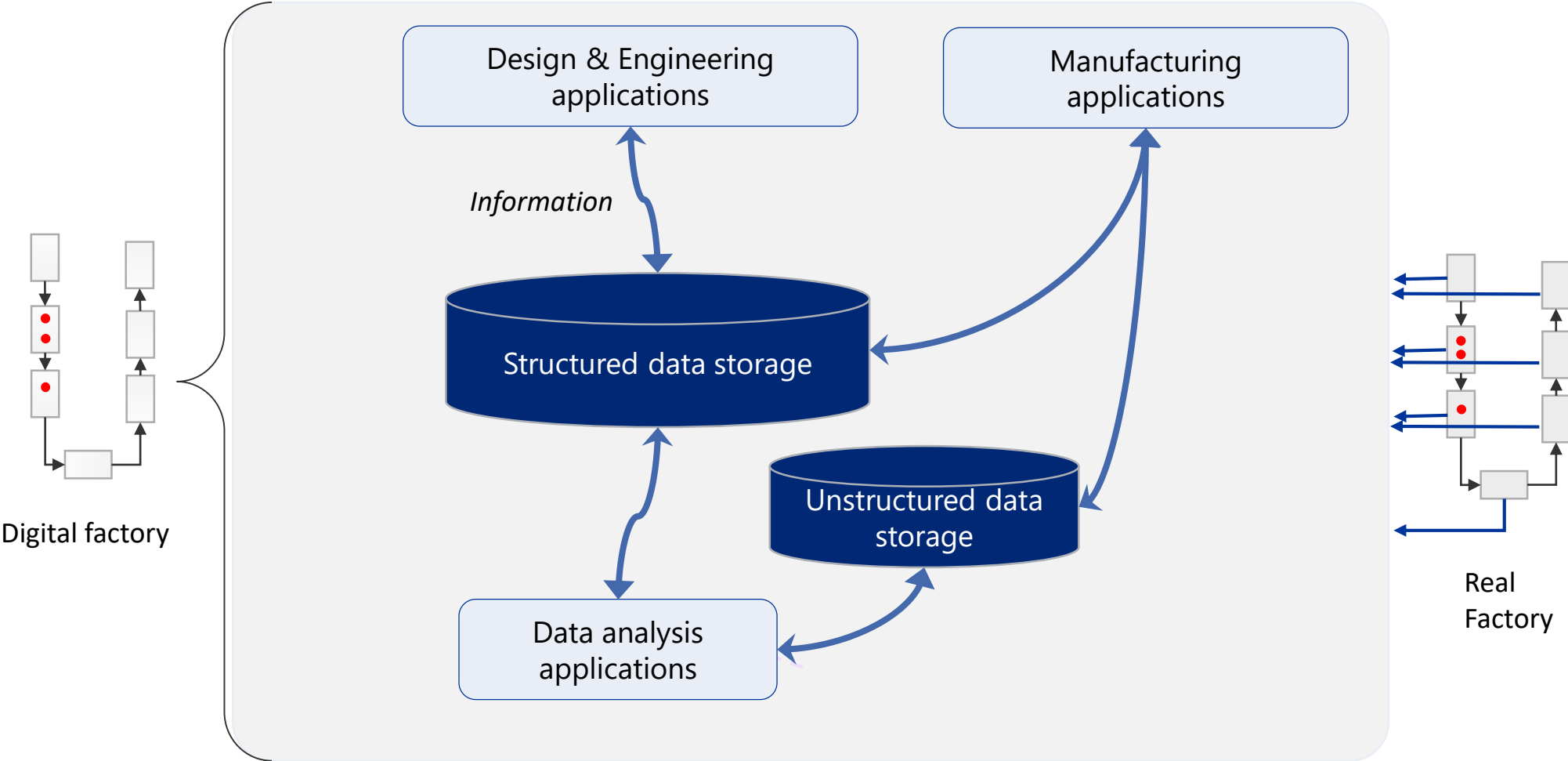
Result from previous
research projects in
manufacturing

Extended to engineering
applications in assembly

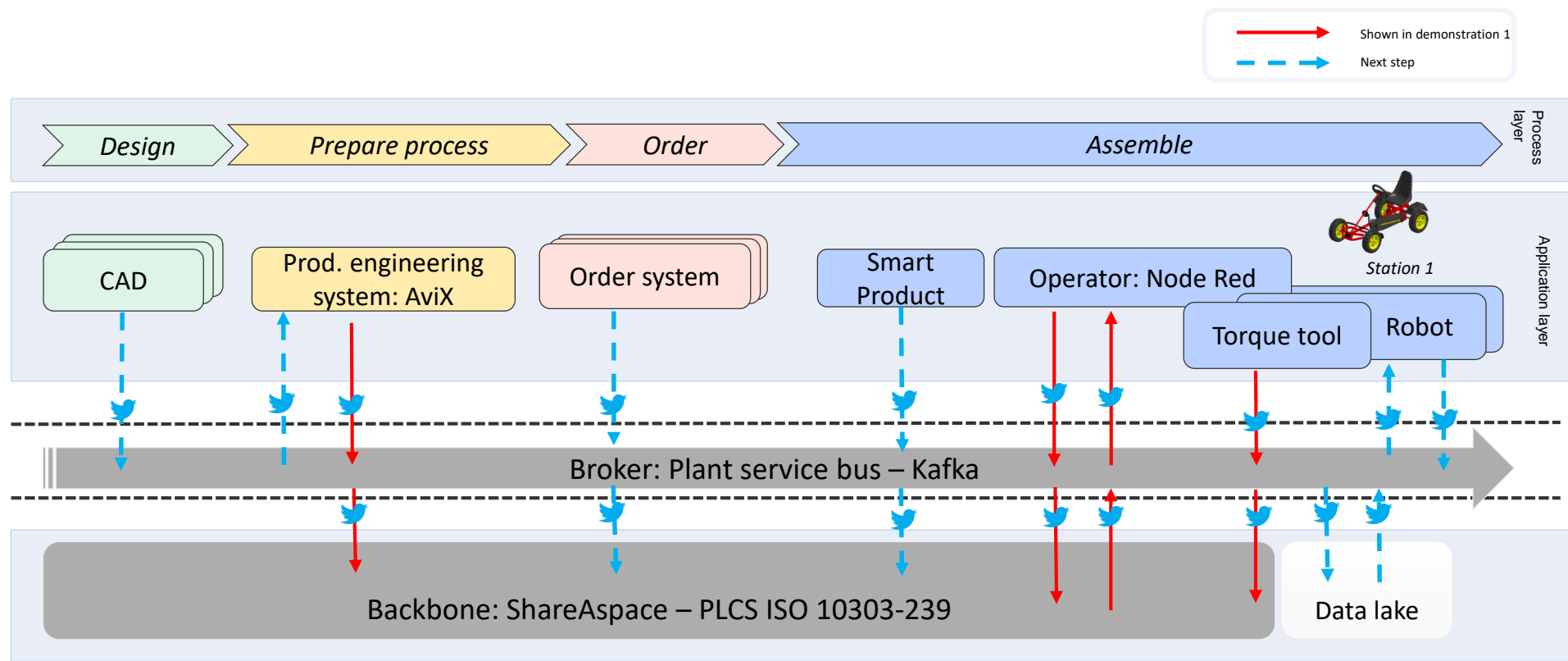


Source: FFI LISA and SIP IoT
Twittrande verktygsmaskinen

Digital factory

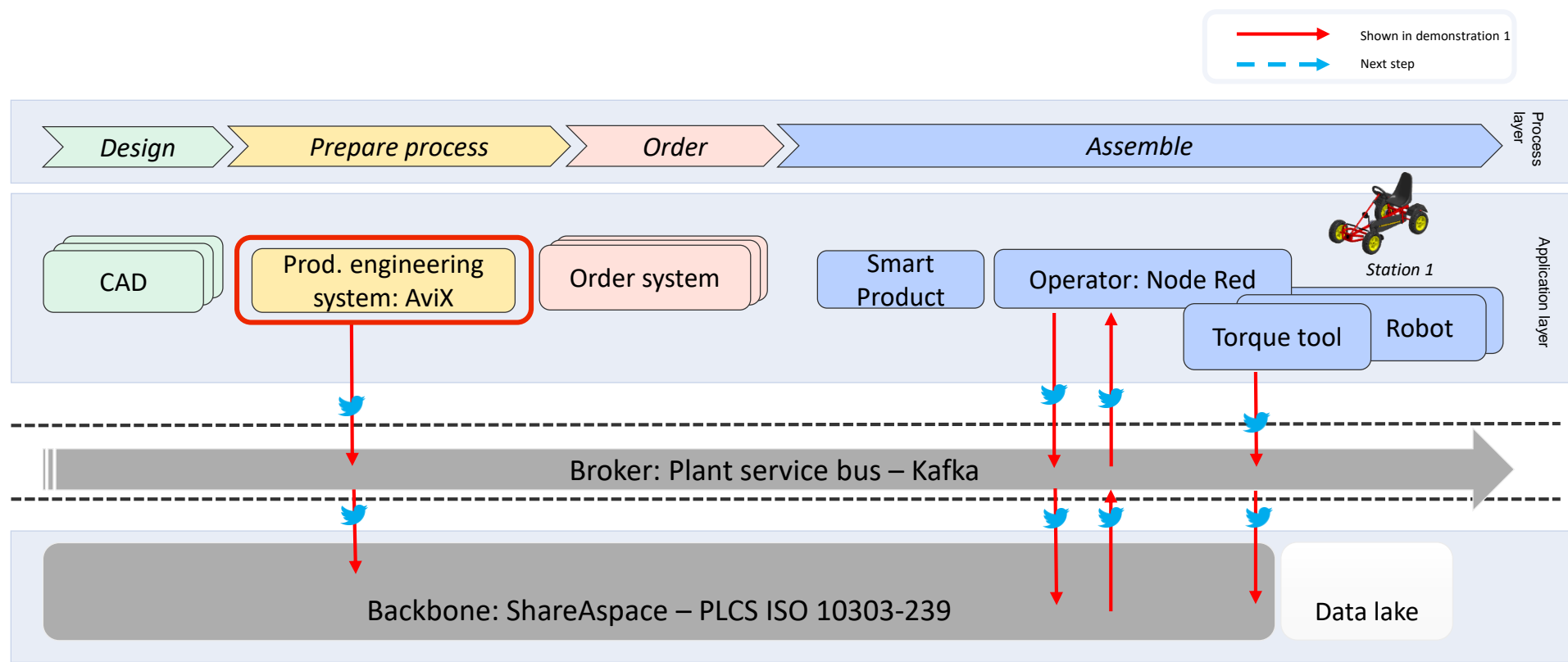


Digital factory – a combination of applications and models



Communication of information is happening *non-sequentially*

Implementation as of now



AviX

Production Engineering System

AviX 4.7.1

Arkiv Redigera Verktyg Visa Hjälp

Balanseringsträd Variantkoder

Tempo Generellt Kompletterande

Identifiering och tid

Namn: Ny2 Placera vänster bakskärm
Nummer: 4
Tid: 17,0 s Frekvens: 1

Filmsekvens

Film: C:\Users\gunilla\Documents\Mina dokument\Projekt\Di
Start: 00:00,00
Stopp: 00:00,00 Längd:

Använda artiklar

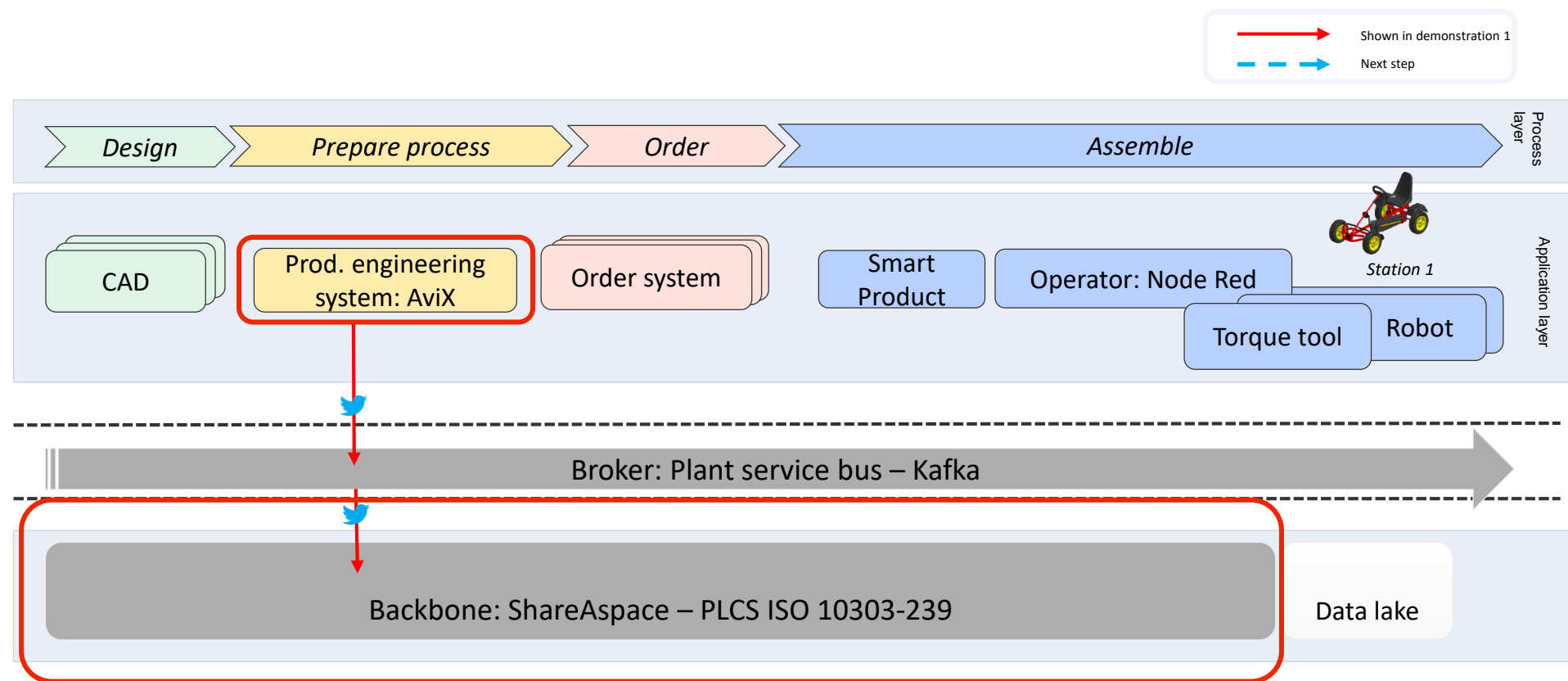
Artikel	Åtgång	Posi...

Balansgraf Balanseringsresultat Resursbemannning Metodres

300
250
200
150
100
50
0
[s]

Pedal Car Line
Trampbil all variants
Stationer
[1] Station 1
[100] Flytt av fixtur
[200] Lås fixtur
[300] Kontrollera chassinummer
[1] Placera framram, (2016-12-09)
[2] Montera framram
[3] Justera framram (2016-12-09)
[4] Ny2 Placera vänster bakskärm (2016-12-09)
Placera
Tryck
Slå
[5] Montera skruv vänster skärm
[6] Momentdra vänster skärm (2016-12-09)
[7] Placera höger skärm
[8] Montera skruv höger skärm
[9] Momentdra höger skärm
[10] Placera vänster skärm
[11] Placera höger skärm
[12] Placera handbroms
[13] Momentdra handbroms
[14] Lossa på handbroms
[15] Kontroll bromshävarm
[16] Kontroll av vit reflex
[400] Signera
[100] Flytt av fixtur
[200] Lås fixtur
[2] Station 2
[3] Station 3
[4] Station 4
Namnlös
Namnlös

Implementation as of now



ShareAspace

Information Backbone and Information Hub

ShareAspace / DigIn01

CollectionAdmin
Administrator@OEM

Order/Task/Acti...

Quick search

CreateEditOpen InWhere Used

Queries

All Activity

All Activity Actual

All Customer Order

All Generic Work Schedule

All Task

All Work Schedule

Participant queries

Personal queries

Charts

Activity Actual by Name

All Activity

(1 selected) 170 hits

Station 1 Task 22 ID-31000

Lås fixtur

Station 1 Task 3 ID-1000

Kontrollera chassinummer

Station 1 Task 3 ID-31000

Kontrollera chassinummer

Station 1 Task 4 ID-1000

Placera framram,

Station 1 Task 4 ID-31000

Placera framram,

Station 1 Task 5 ID-1000

Montera framram

Station 1 Task 5 ID-31000

Montera framram

Station 1 Task 6 ID-1000

Justera framram

Station 1 Task 6 ID-31000

Justera framram

Station 1 Task 7 ID-31000

Placera vänster bakskärm

Station 1 Task 8 ID-31000

Montera skruv vänster skärm

Station 1 Task 9 ID-31000

Momentdra vänster skärm

Station 2 Task 1 ID-1000

Flytt av fixtur

Station 2 Task 1 ID-31000

Flytt av fixtur

Station 2 Task 10 ID-1000

Äntra skruv bakre

Station 2 Task 10 ID-31000

Äntra skruv bakre

Station 2 Task 11 ID-31000

Äntra skruv främre

1 of 2

(Station 1 Task 7 ID-31000) Placera vänster bakskärm

Activity

ID: Station 1 Task 7 ID-31000

Name: Placera vänster bakskärm

Sequence: 7

Execute Task

Execute Task: (Station 1 Task 7) Placera vänster bakskärm

Require Consumable

Add

ID

Name

Role

Quant...

Require Component

Add

ID

Name

Role

Quant...

C...

0015

1856236 Mud...

CU

1

Required Resource

Assigned work group:

Perform in work center: (Station 1) Station 1

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

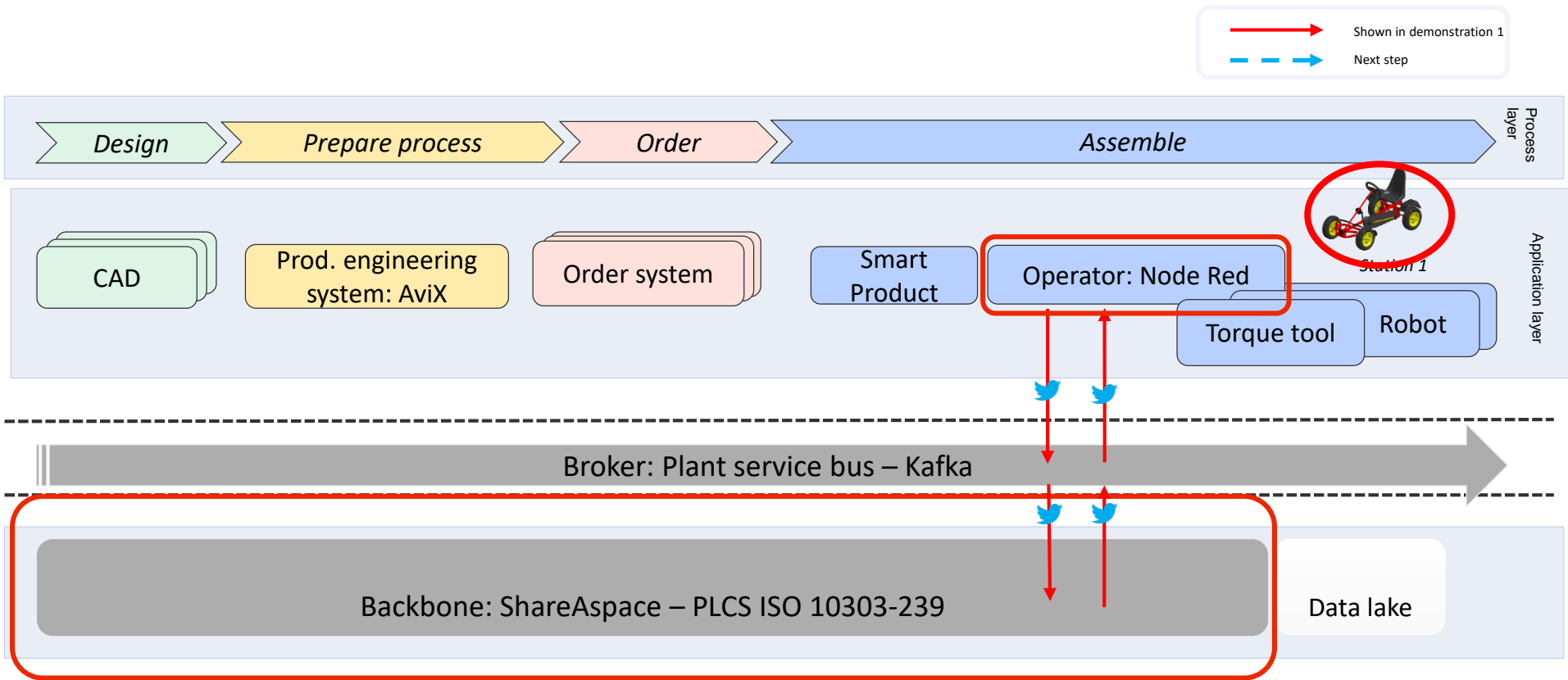
16

17

18

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Implementation as of now



Node Red

Operator information – connects hardware devices, APIs and different services

Station 1 - Task by Task

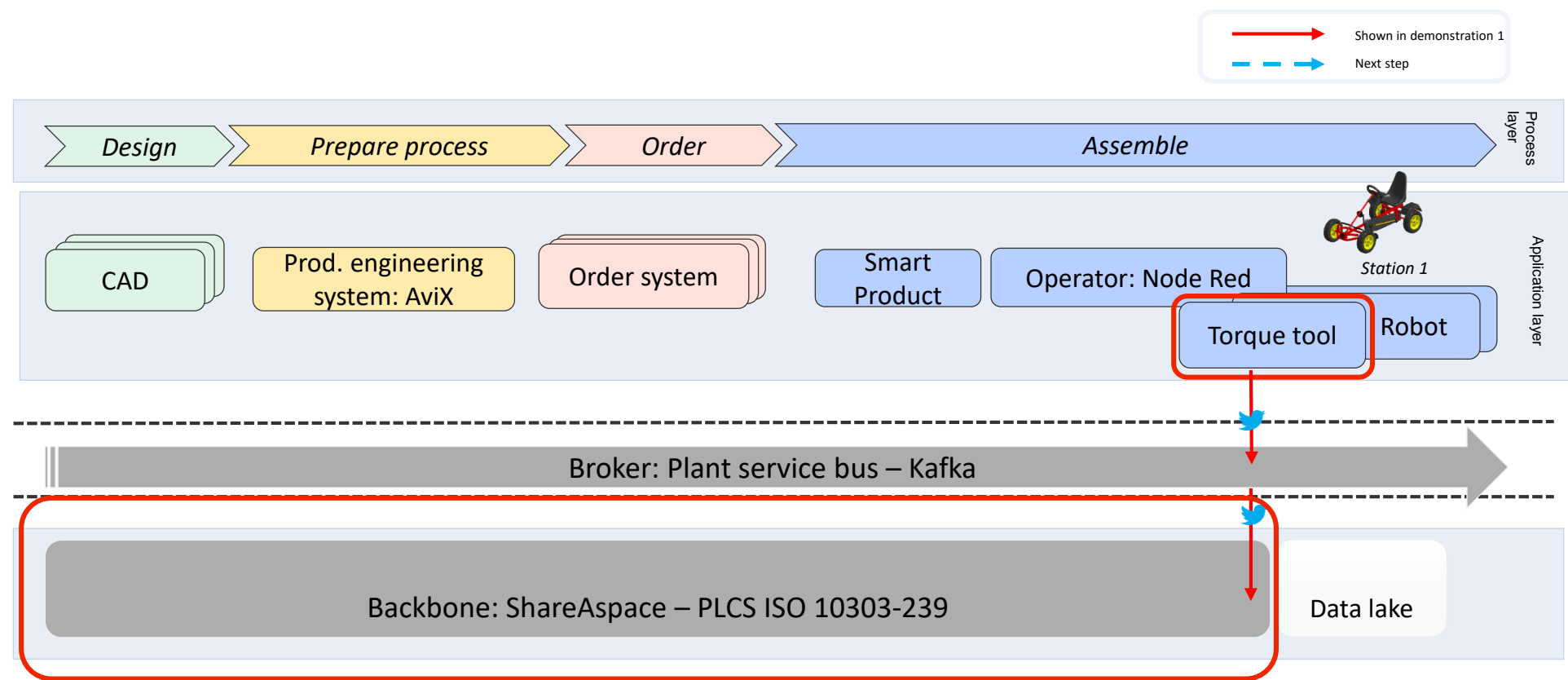
Please select desired task:
9



Task Nr.	Instruction	Time [sec]	Component	Tool	Required Torque	Consumable	Qty.
Station 1 Task 9	Momentdra vänster skärm	1.44		ETV STB-30-10-B	2 Nm		



Implementation as of now



Connection to assembly line

Connected Torque Tools

Order/Task/Acti...

Work Schedule ...

▼

⊞

(ID-31000) Trampbil 2020 RED,

⊞ (Station 1 Task 1 ID-31000) Flytt av fixtur

⊞ (Station 1 Task 2 ID-31000) Lås fixtur

⊞ (Station 1 Task 3 ID-31000) Kontrollera chassinummer

⊞ (Station 1 Task 4 ID-31000) Placera framram,

⊞ (Station 1 Task 5 ID-31000) Montera framram

⊞ (Station 1 Task 6 ID-31000) Justera framram

⊞ (Station 1 Task 7 ID-31000) Placera vänster bakskärm

⊞ (Station 1 Task 8 ID-31000) Montera skruv vänster skärm

▼ ⊞ (Station 1 Task 9 ID-31000) Momentdra vänster skärm

⊞ (0063) Momentdra vänster skärm

⊞ (Station 1 Task 10 ID-31000) Placera höger skärm

⊞ (Station 1 Task 11 ID-31000) Montera skruv höger skärm

⊞ (Station 1 Task 12 ID-31000) Momentdra höger skärm

⊞ (Station 1 Task 15 ID-31000) Placera handbroms

⊞ (Station 1 Task 16 ID-31000) Momentdra handbroms

⊞ (Station 1 Task 17 ID-31000) Lossa på handbroms

⊞ (Station 1 Task 18 ID-31000) Kontroll bromshävarm

⊞ (Station 1 Task 19 ID-31000) Kontroll av vit reflex

⊞ (Station 1 Task 20 ID-31000) Signera

⊞ (Station 1 Task 21 ID-31000) Flytt av fixtur

⊞ (Station 1 Task 22 ID-31000) Lås fixtur

⊞ (Station 2 Task 1 ID-31000) Flytt av fixtur

⊞ (Station 2 Task 2 ID-31000) Lås fixtur

⊞ (Station 2 Task 3 ID-31000) Kontrollera chassinummer

⊞ (Station 2 Task 4 ID-31000) Montera pedal - hö sida

⊞ (Station 2 Task 5 ID-31000) Momentdra pedal - hö sida

⊞ (Station 2 Task 6 ID-31000) Placera styrstång

⊞ (Station 2 Task 10 ID-31000) Äntra skruv bakre

⊞ (Station 2 Task 11 ID-31000) Äntra skruv främre

✎ Edit Structure

📄 Open In ▾

(ID-31000) Trampbil 2020 RED, > (Station 1 Task 9 ID-31000) Momentdra vänster skärm

✓	SoftType	ID	Name	Assigned Workcenter
✓	🔍	0063	Momentdra vänster skärm	

Name: Momentdra vänster skärm

Used Component

Add

ID	Name	Role	Quan...
----	------	------	---------

Input Consumable

Add

ID	Name	Role	Quan...
----	------	------	---------

Resources as realized

Executed by Personnel: 👤 Gunilla S (0075)

Performed In Work 🏢 (Station 1) Station 1

Center:

Workunit and Feedback

Add

ID	Name	Feedback Value	
...	0028	ETV STB-30-10-B	2.5 Nm

1

2

3

4

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17

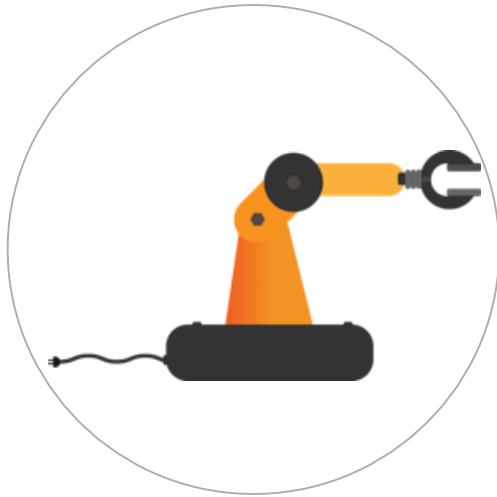
18

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To conclude

- **The digital factory is**
 - A combination of applications and models
 - Structured and unstructured data
- **Storing lifecycle data on the digital twin**
- **Information hub (ShareAspace) based on PLCS ISO 10303-239**
- **No information silos – all information exposed and available through the hub**
- **One of the defined ways of implementing administration shells**
 - Exposing standardized information about physical assets through the hub and through the twittering bus communication

What is next?



Adding IRBs

Adding a robot



Adding Smart products

Making the products contain their own information



Digital twin feedback

Knowledge source for early phases

Thank you!

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hampus.wraner@eurostep.com