ROS in Large-scale Factory Automation

by Michael Gentner (BMW AG)
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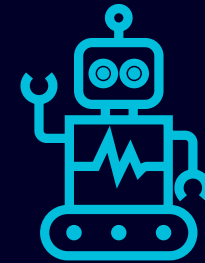SIEMENS

ROS in Large-scale Factory Automation
What did we do in the past with open source?

"Siemens ♥ Open Source"

Siemens is "FullMember" of ROS-industrial consortium

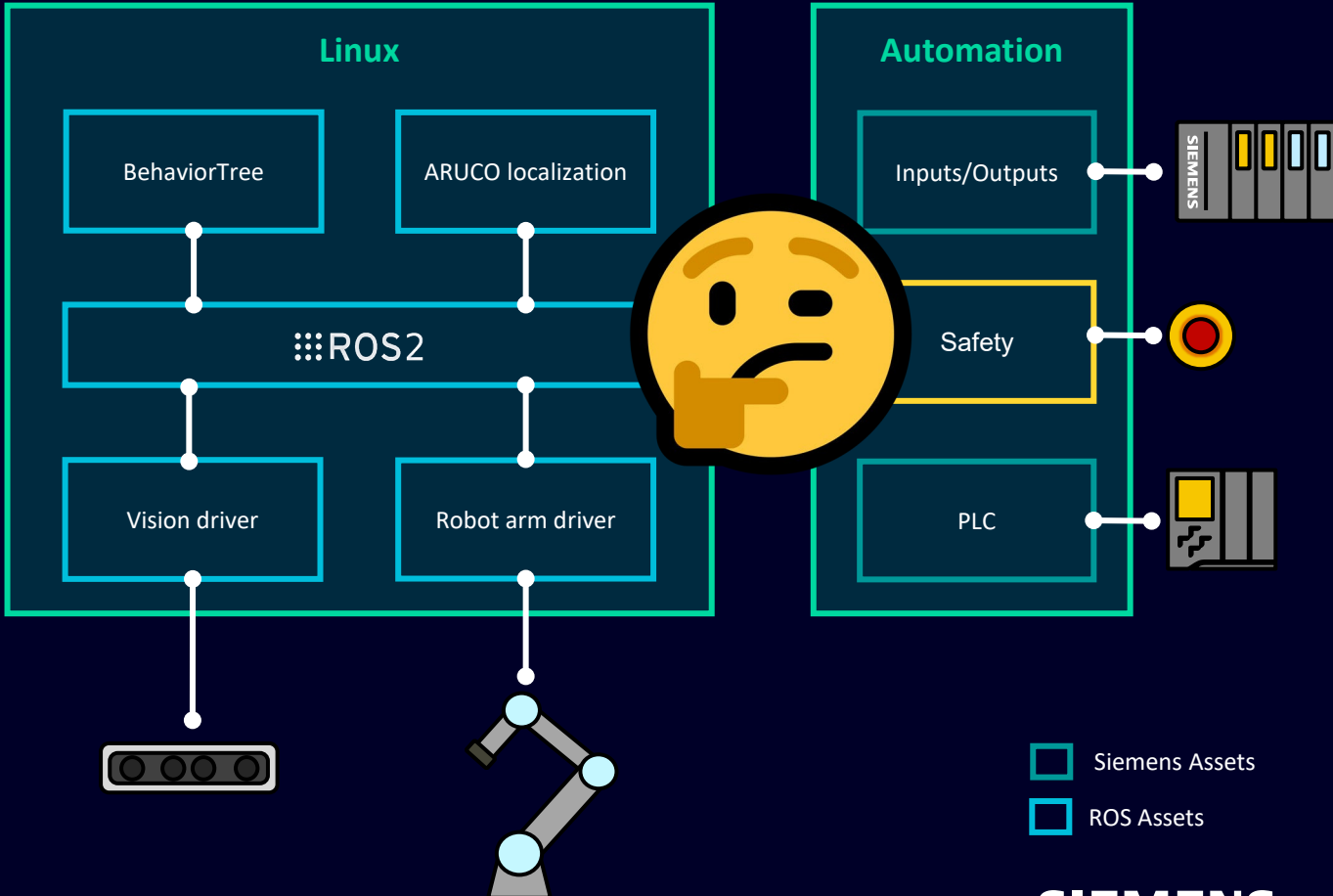Siemens uses ROS in research and development

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ROS in Large-scale Factory Automation
What challenges did we face?

Siemens "Autonomous Factory Lab" in Nuremberg, Germany

Components of the mobile robots in the lab

Linux

BehaviorTree

ARUCO localization

ROS2

Vision driver

Robot arm driver

Automation

Inputs/Outputs

Safety

PLC

Siemens Assets

ROS Assets

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// POTENTIALS FOR SMART AUTOMATION

Body Shop Part Handling

Logistics Part Handling

Assembly
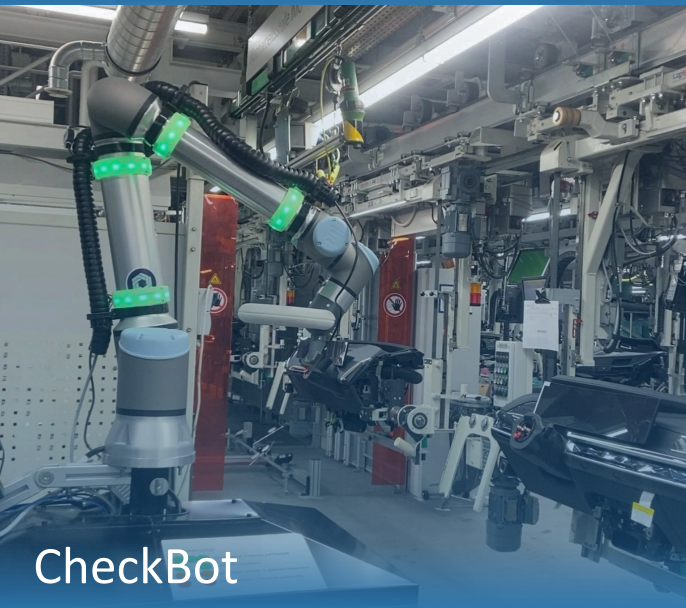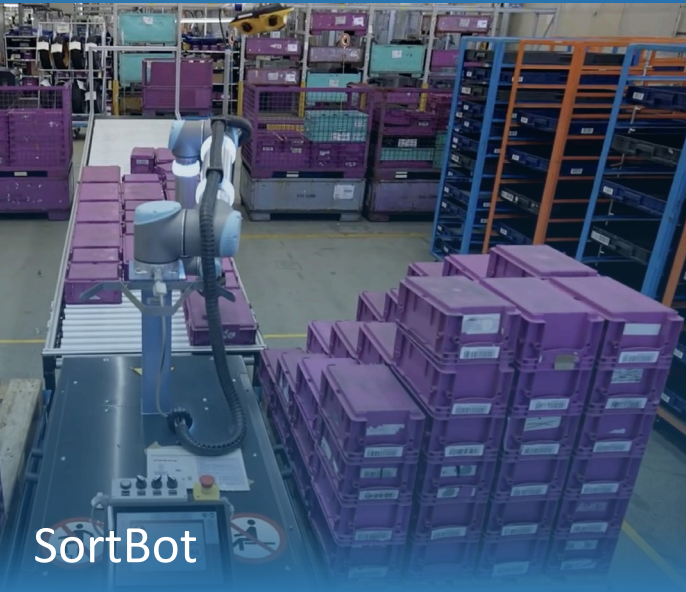
Battery Cell Manufacturing

Body Shop Special Cases

SortBot

CheckBot

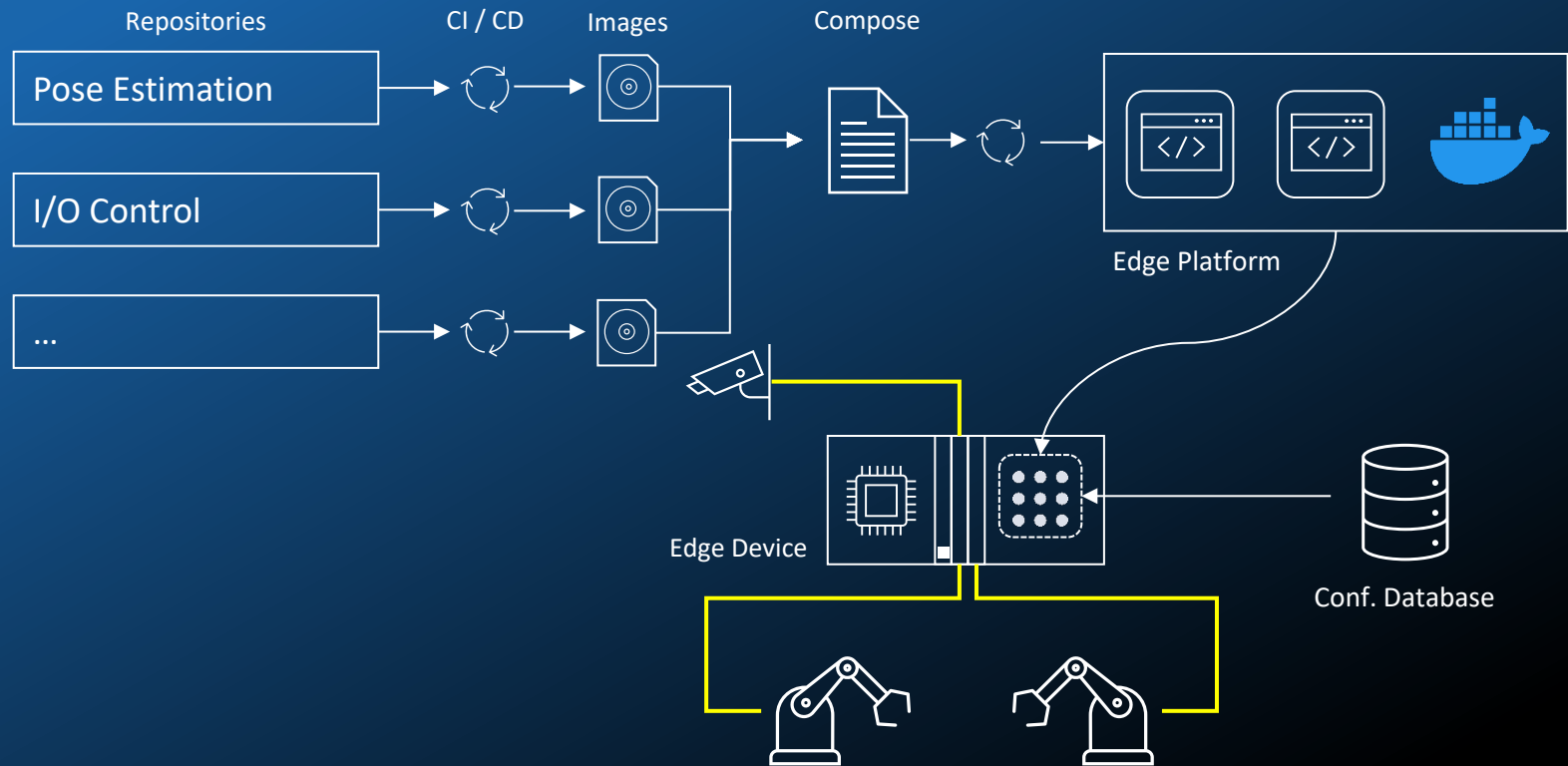# // CHALLENGES WE FACE(D)

Deployment

Operation

Integration

Device Management

(Integration) Testing

Configuration Management

Repositories

Pose Estimation

I/O Control

...

CI / CD

Images

Compose

Edge Platform

Edge Device

Conf. Database

// CHALLENGES WE FACE(D)

Deployment

Operation

Integration

Enabling maintenance personnel

Building trust

Enable Use Case Builders

Simple HMI

Simplified Use Case Building

Support

Takeaway: Don't forget the REAL user!

// CHALLENGES WE FACE(D)

Deployment	Operation	Integration

Connection to brownfield

Safety functions

Controlling I/Os

Edge Device

Safety PLC

Brownfield PLC

TCP

Profinet
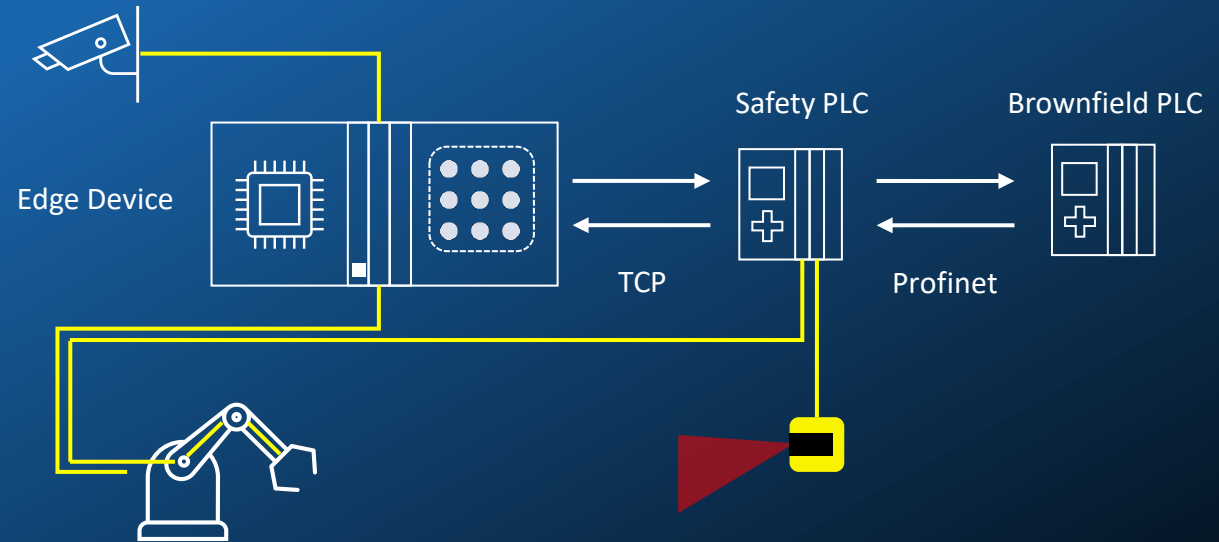
It does work, but …

… it is quite complicated to configure on the PLC and IPC side.
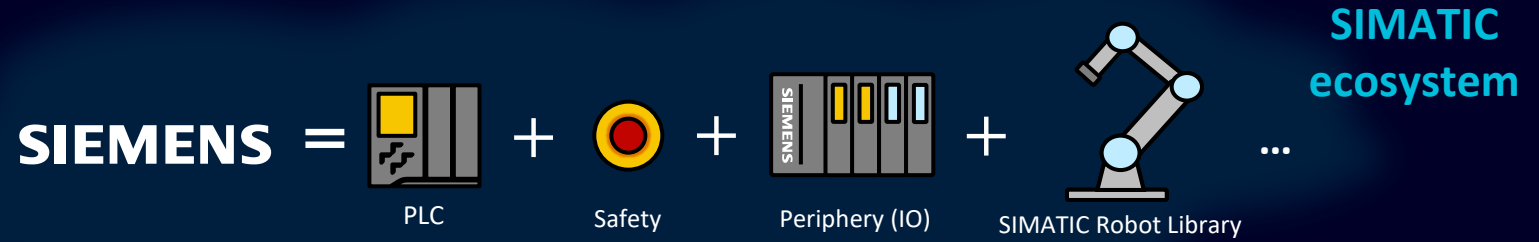
… interface adjustments require a lot of effort.

… connection stability is not guaranteed.

ROS in Large-scale Factory Automation
What is our answer to these challenges?

SIEMENS – Assets:

SIEMENS = [PLC] + [Safety] + [Periphery (IO)] + [SIMATIC Robot Library] ...

SIMATIC ecosystem

Our innovation:
Software to connect SIMATIC and ROS

::ROS / PLC

:::ROS – Assets:

:::ROS = plumbing + tools + capabilities + community

ROS ecosystem

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ROS in Large-scale Factory Automation
BMW and Siemens collaboration challenge

SIMATIC-based automation cell
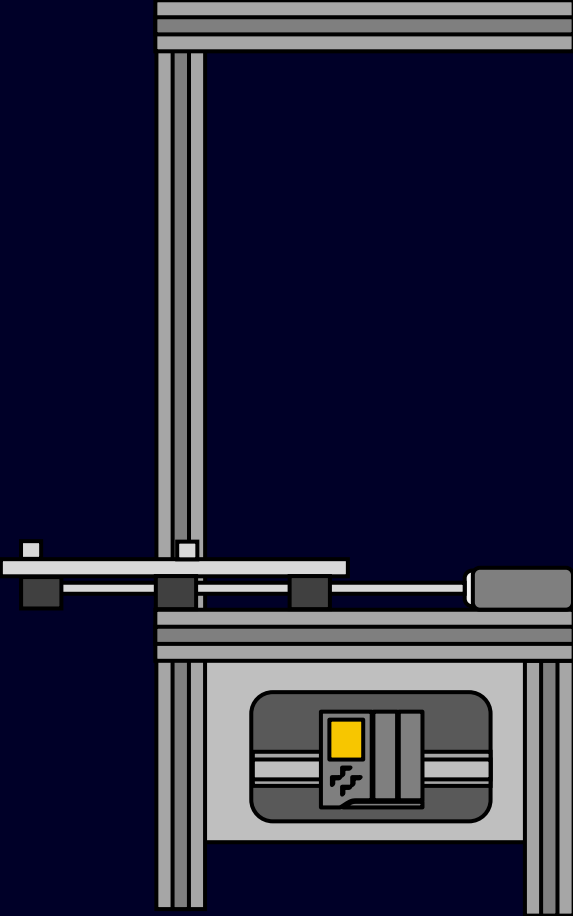
Currently the task is done manually (!)

Parts to supply the cell with

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BMW and Siemens collaboration challenge

Camera to detected parts

Siemens-based automation cell
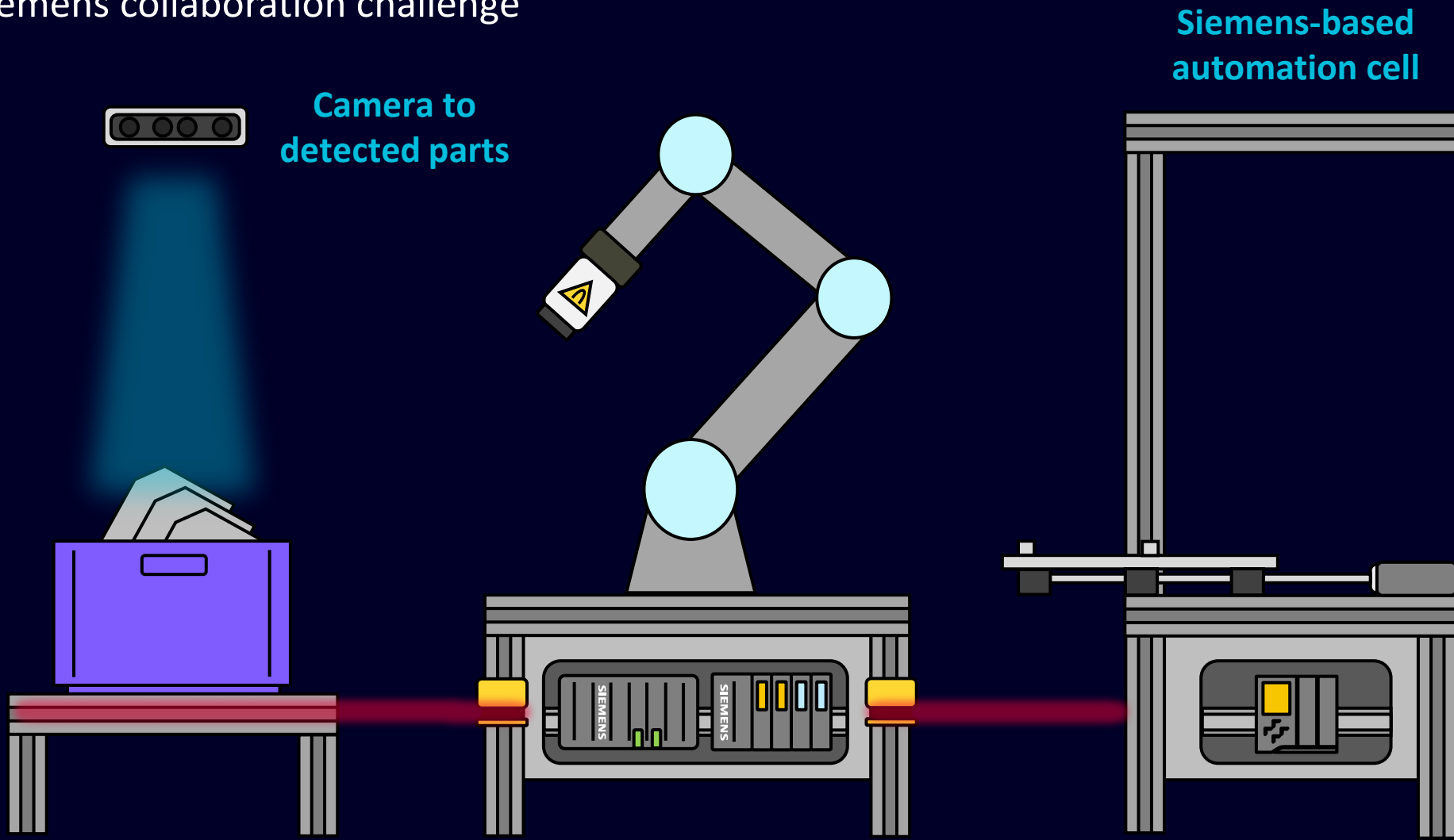
Parts to equip the cell with

SIMATIC- and ROS-based pick and place robot

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BMW and Siemens collaboration challenge

IndustrialOS

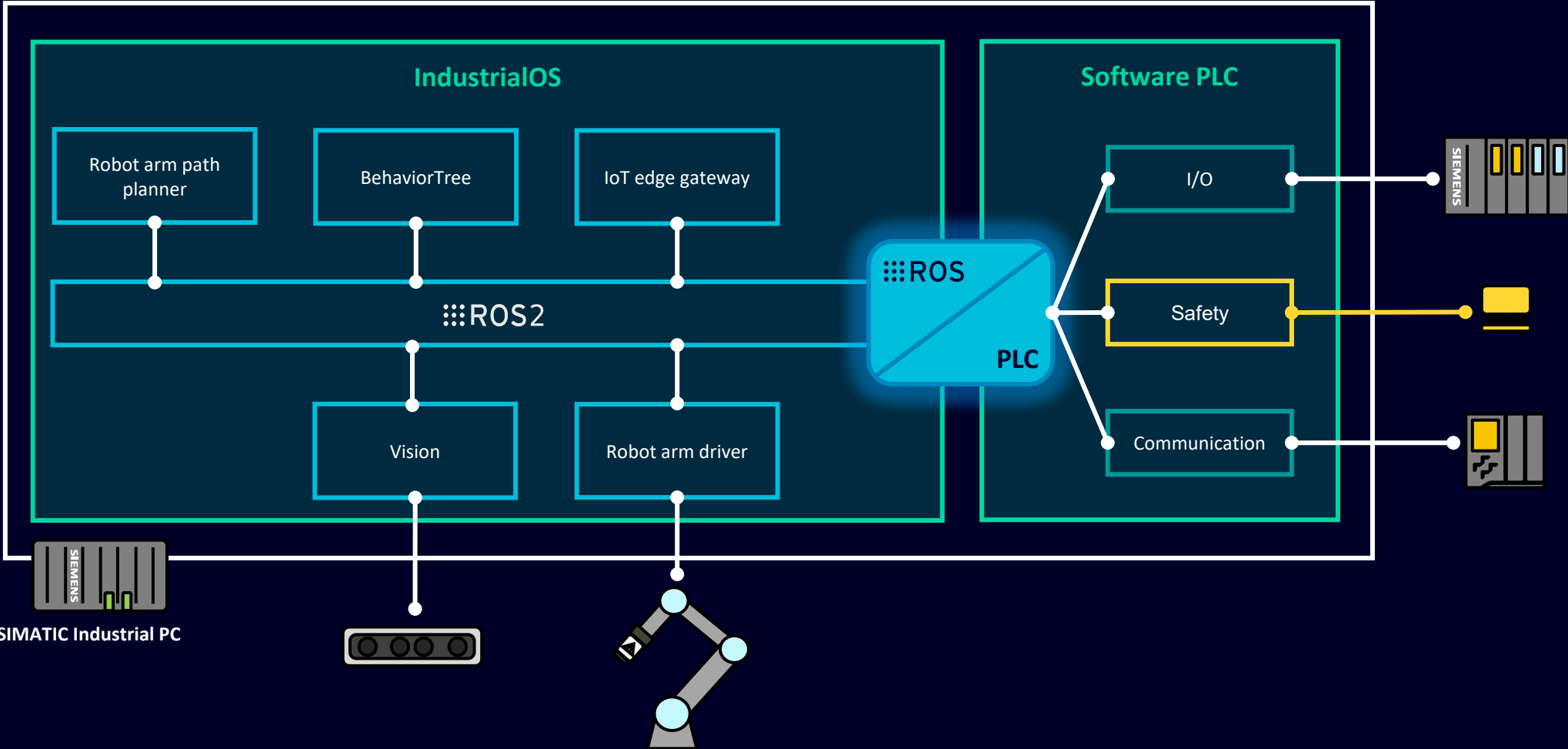|		
Robot arm path planner	BehaviorTree	IoT edge gateway

⁞⁞ROS2

Vision	Robot arm driver

⁞⁞ROS

PLC

Software PLC

- I/O
- Safety
- Communication

SIMATIC Industrial PC

☐ Siemens Hardware   ☐ Siemens Operating Systems   ☐ Siemens Assets   ☐ ROS Assets

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ROS in Large-scale Factory Automation
Current limitations of the pilot software

PLC:

- We support the S7 1500 Softwarecontroller – No other PLCs (Siemens hardware PLCs or third party) - But in work!

Communication protocol:

- We support the Realtime Information backbone – No other protocols (OPC UA, Profinet, …) - But in work!

- On ROS-side every middleware implementation (of DDS) can be utilized

- Tested data volume: 2 MB

- Tested data rate: 1kHz

ROS:

- We support ROS 2 (Humble) – No ROS 1 support

- The software connector support publisher and subscriber – No services and actions - But in work!

We are here to learn from you!

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// WE WOULD LOVE TO CHAT!

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BMW

Next Generation Robotics

ROS in Large-scale Factory Automation
Are you interested to learn more? - Visit our booth!

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Are you interested to learn more or test it? – Reach out to us or visit our booth (First Floor, Odeon)!

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Thank you!

BMW GROUP

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