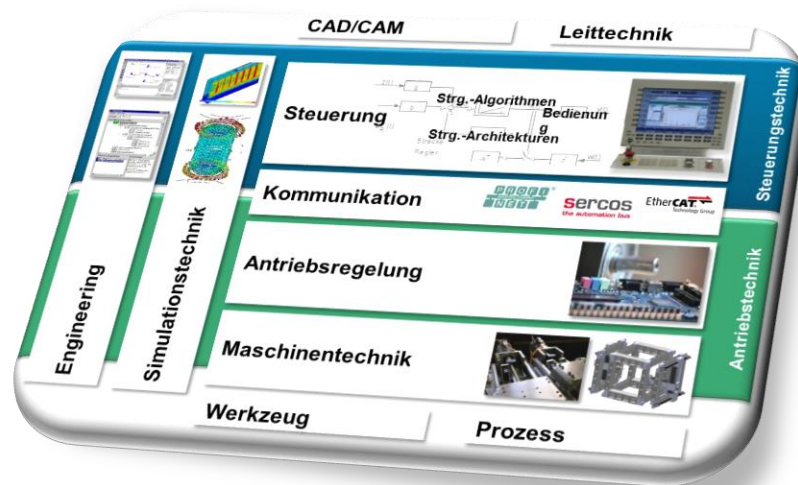# ROS 2.0 AND OPC UA: A STATUS UPDATE

Stuttgart, November 3, 2016

Universität Stuttgart

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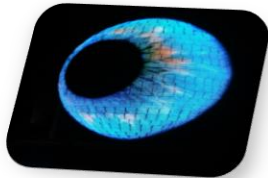Phone +49 711 685 – 84625 | Fax +49 711 685 – 82808

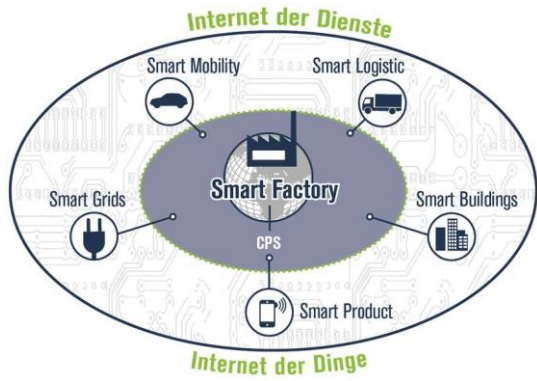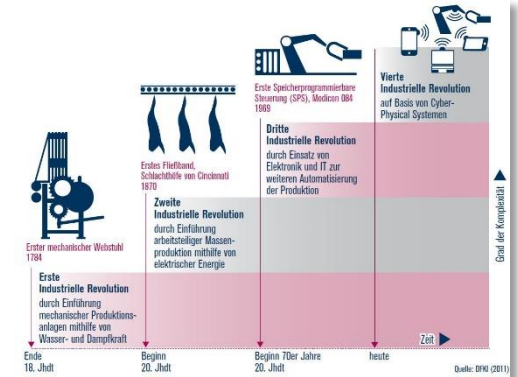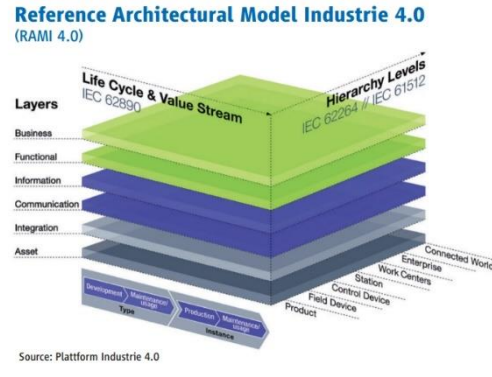matthias.keinert@isw.uni-stuttgart.de

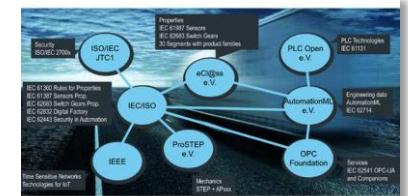**Universität Stuttgart**

Agenda

- **Recap**
- Status
- Outlook

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Recap
Driving force of technological developments

⇨ Digital Intelligence

⇨ Connectivity
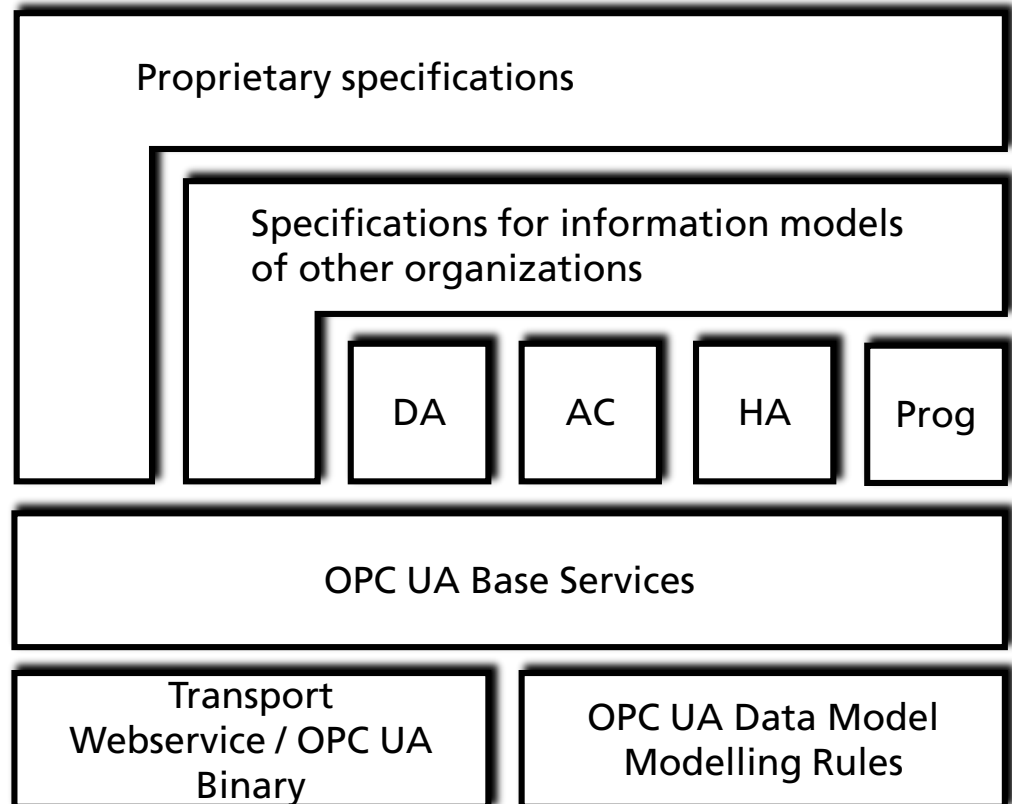
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Recap
OPC Unified Architecture

- Base Services and data models for

    - Data Access

    - Methods

    - Events

- Platform independent communication stack

- High performance

- Integrated security

- Possibility for the specification of further information models

Proprietary specifications			
Specifications for information models of other organizations			
DA	AC	HA	Prog

OPC UA Base Services

Transport Webservice / OPC UA Binary	OPC UA Data Model Modelling Rules

Source: based on ascolab GmbH

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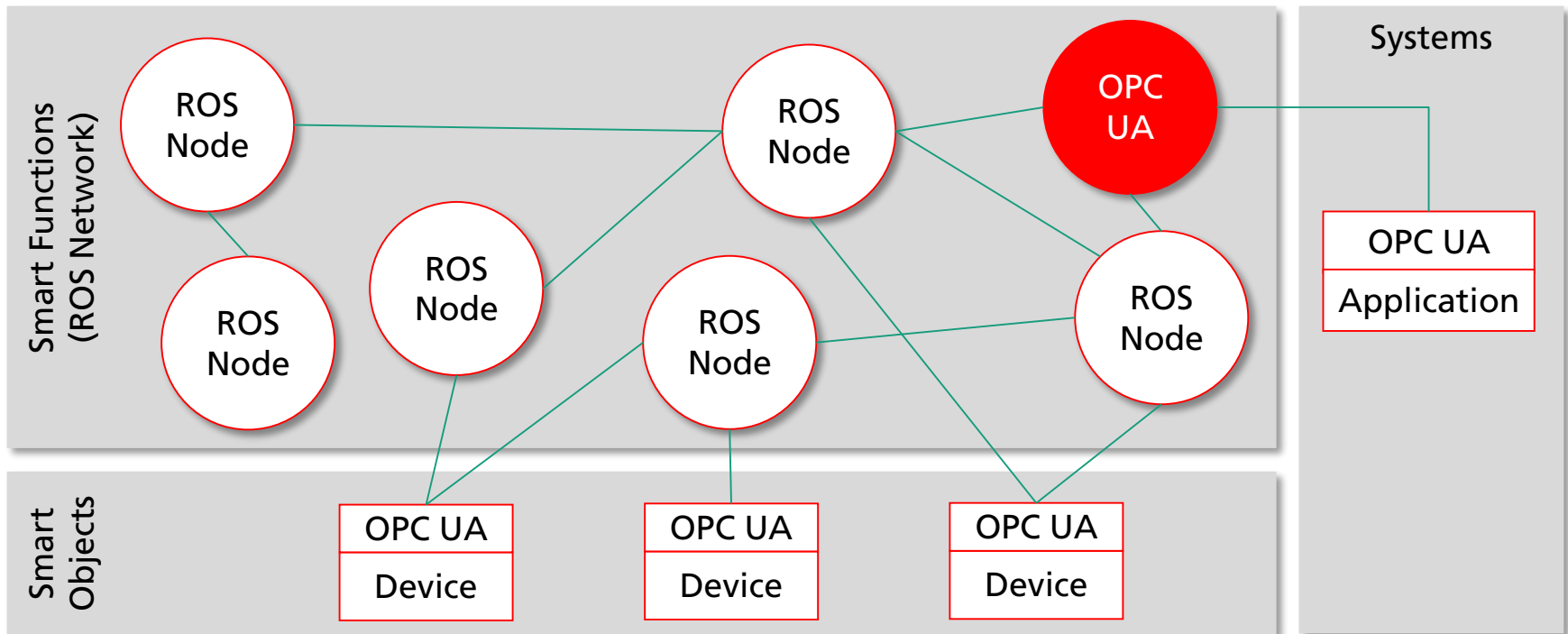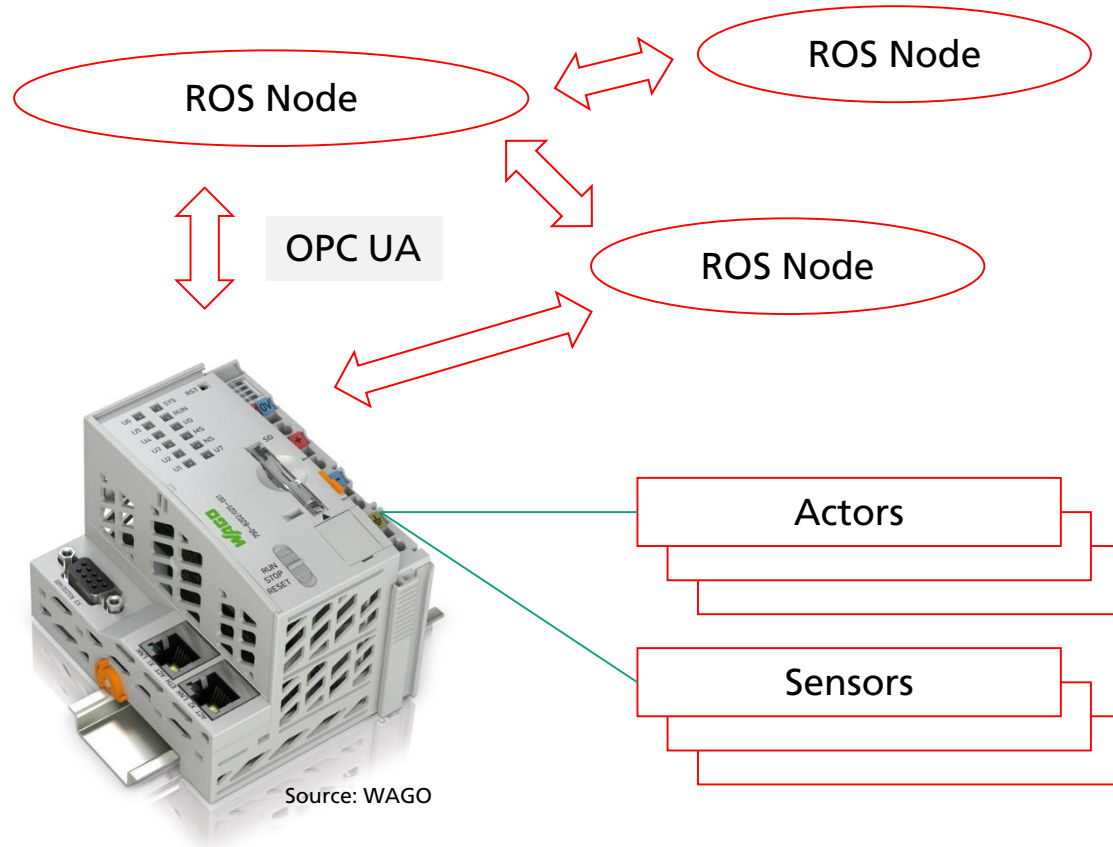
Recap
ROS based on OPC UA for seamless integration

- Platform and manufacturer independent communication within ROS networks using OPC UA Pub/Sub and TSN

- Provision of OPC UA endpoints of ROS networks for superimposed systems (e.g. MES) and parallel systems (M2M)

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Recap
Case Study

Source: WAGO

- WAGO PFC200 Linux Fieldbus Coupler

- OPC UA Server implemented using open62541

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Recap
Approach

Userland Code

ROS client library API

Abstract DDS API   **Abstract API**

optional access to DDS specific API

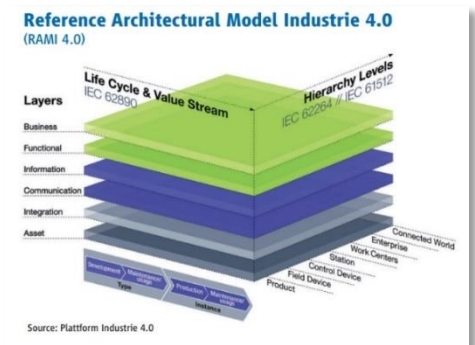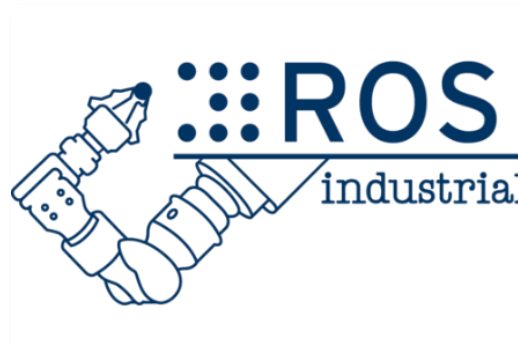| RTI Connext	PrismTech OpenSplice	Twin Oaks Software CoreDX	**OPC UA** ...

Source: ros2.org

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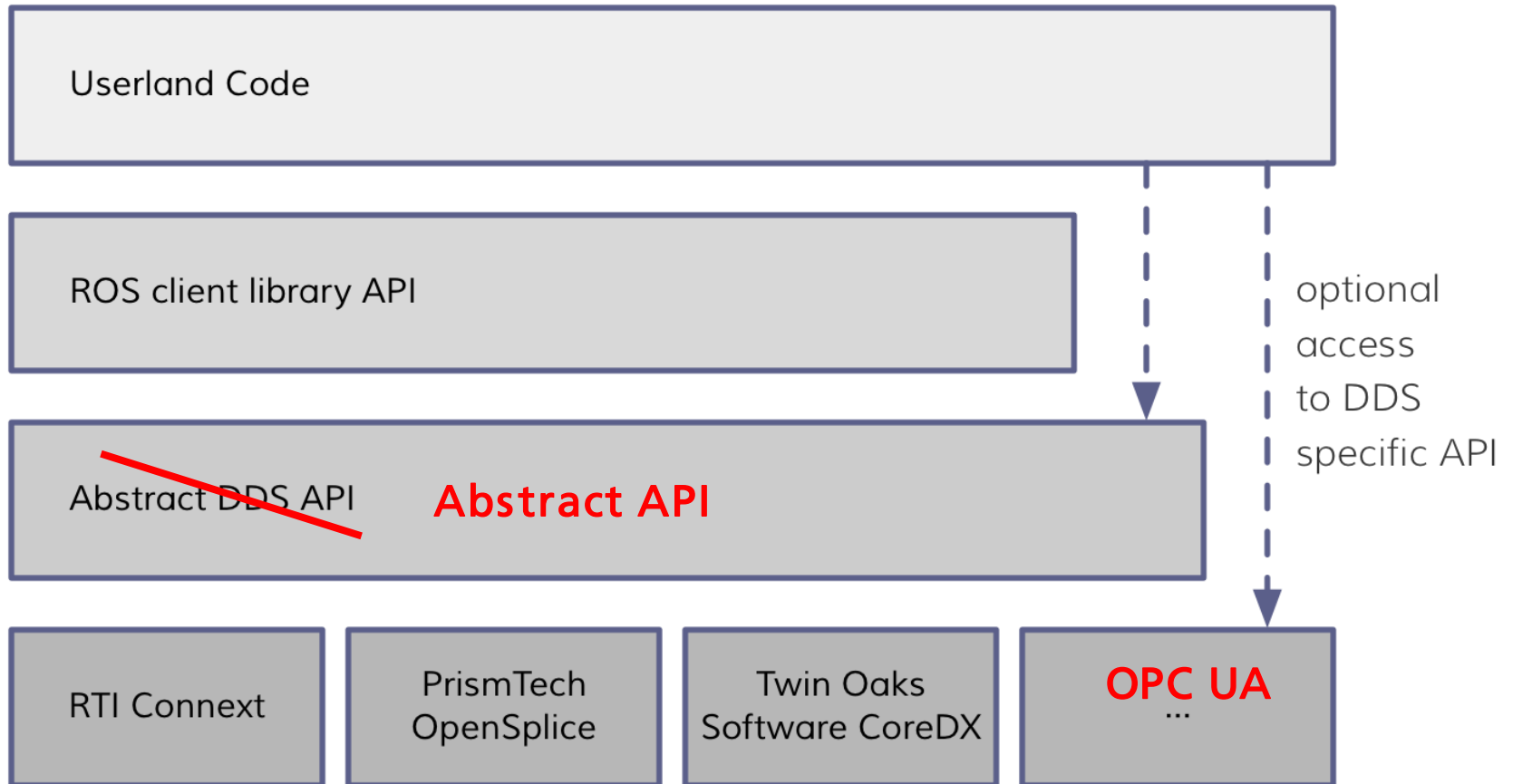
Recap
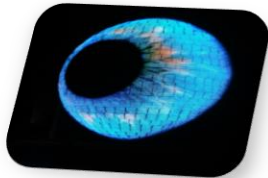## Making ROS relevant for Industrie 4.0

- OPC UA is a key technology in the context of Industrie 4.0

- ROS 2.0 enables the integration of the OPC UA communication technology

- ROS 2.0 based on OPC UA enables using OPC UA field devices and seamless integration of robots into production networks

- Completion of the OPC UA Pub/Sub specification pending (currently prototyping phase)
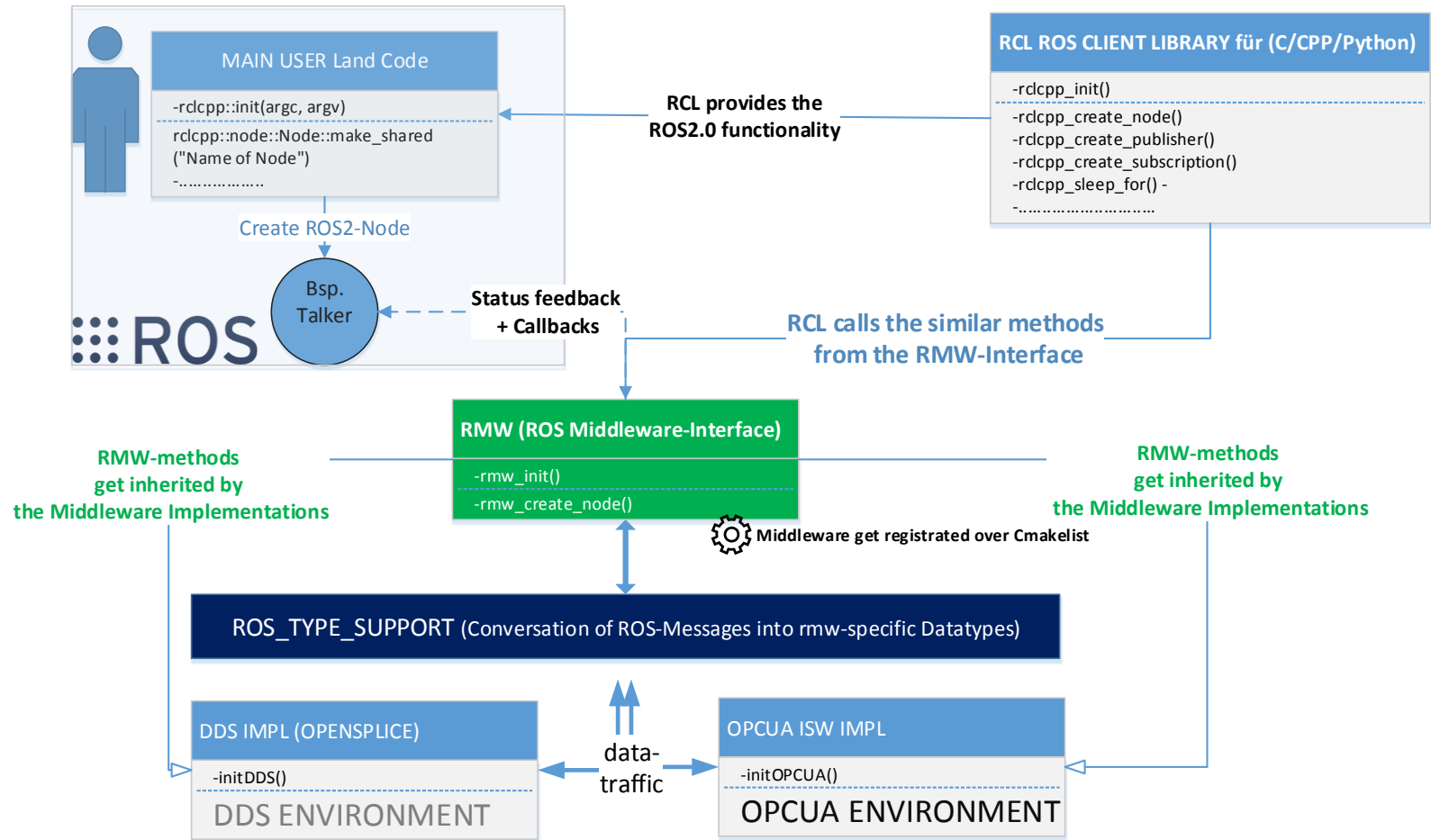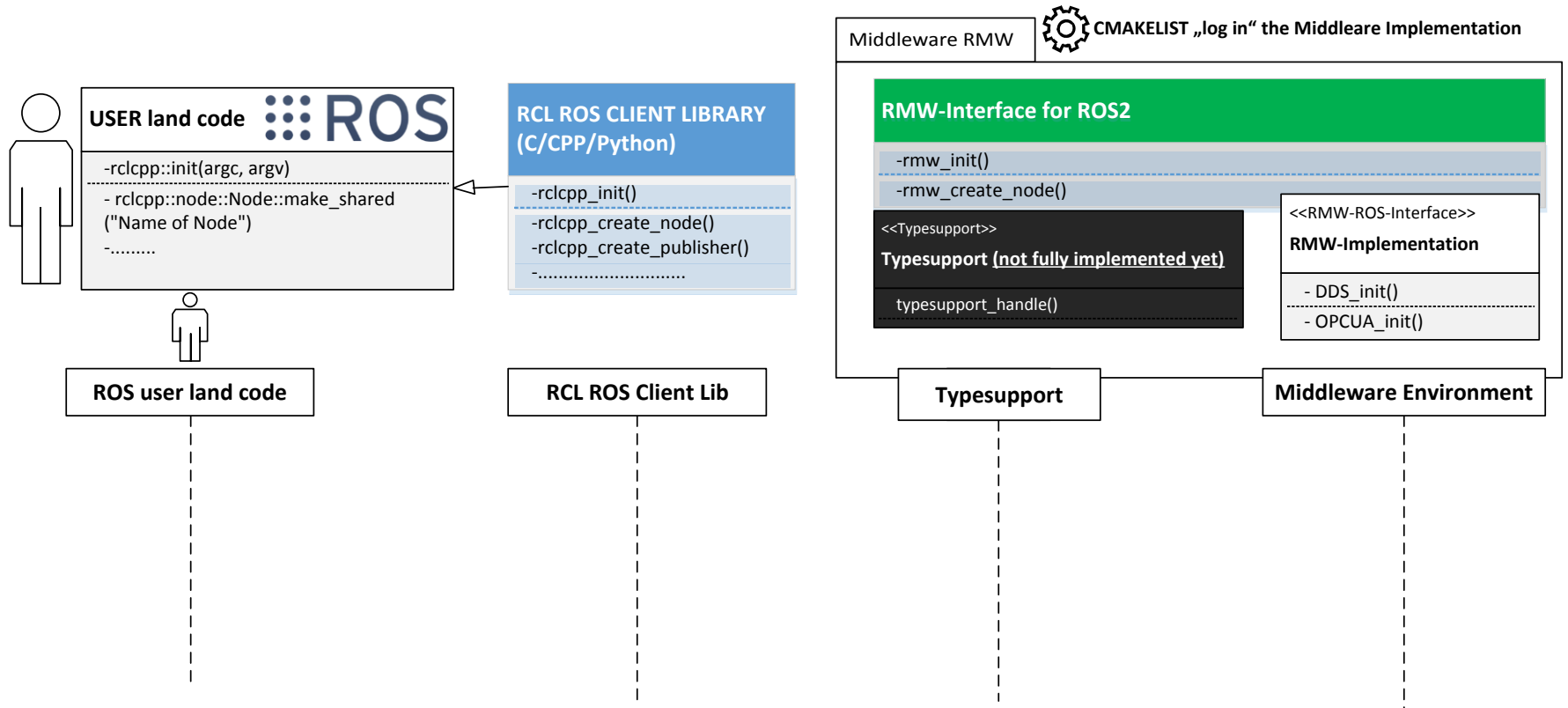
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Status
ROS 2.0 and OPC UA

MAIN USER Land Code

- rclcpp::init(argc, argv)

rclcpp::node::Node::make_shared
("Name of Node")

- ....

Create ROS2-Node

Bsp. Talker

RCL provides the ROS2.0 functionality

RCL ROS CLIENT LIBRARY für (C/CPP/Python)

- rclcpp_init()
- rclcpp_create_node()
- rclcpp_create_publisher()
- rclcpp_create_subscription()
- rclcpp_sleep_for() -
- ....

Status feedback + Callbacks

RCL calls the similar methods from the RMW-Interface

RMW (ROS Middleware-Interface)

- rmw_init()
- rmw_create_node()

RMW-methods get inherited by the Middleware Implementations

RMW-methods get inherited by the Middleware Implementations

Middleware get registrated over Cmakelist

ROS_TYPE_SUPPORT (Conversation of ROS-Messages into rmw-specific Datatypes)

DDS IMPL (OPENSPLICE)

- initDDS()

DDS ENVIRONMENT

data-traffic

OPCUA ISW IMPL

- initOPCUA()

OPCUA ENVIRONMENT

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Status
Workflow architecture

Status
Workflow architecture

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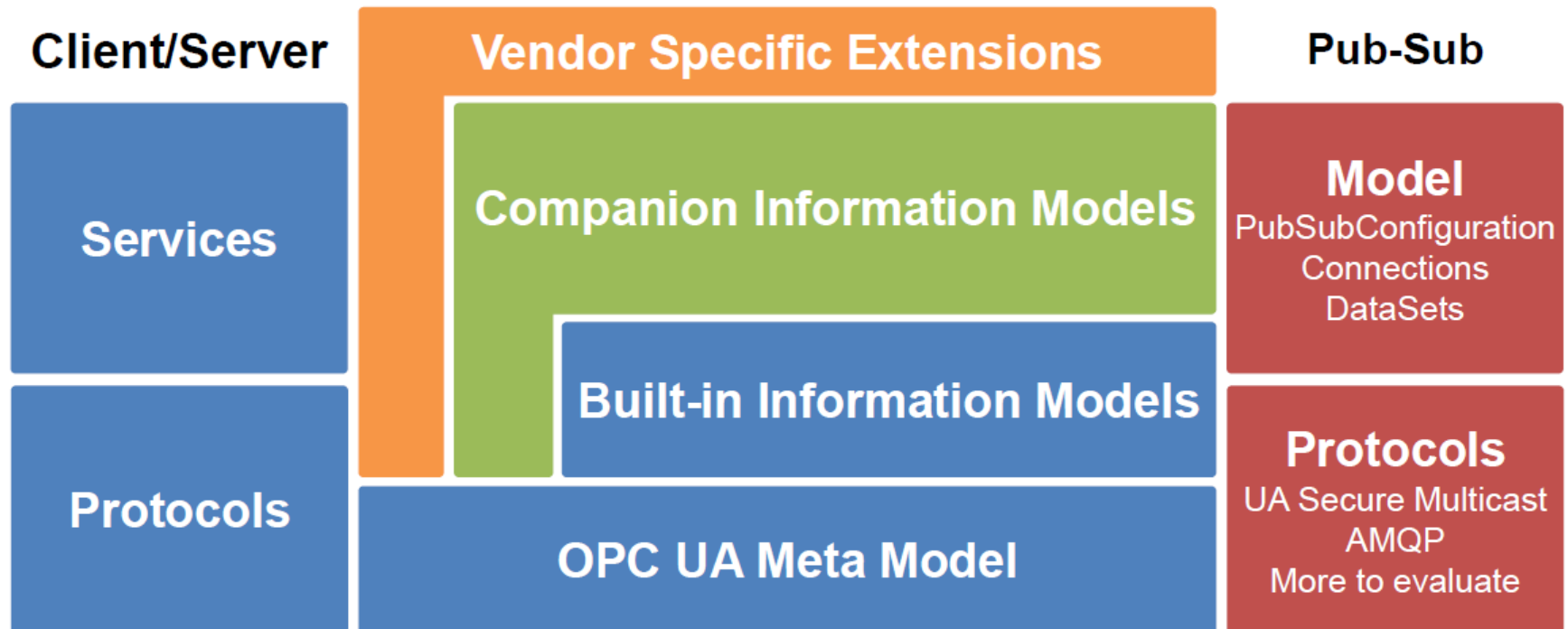
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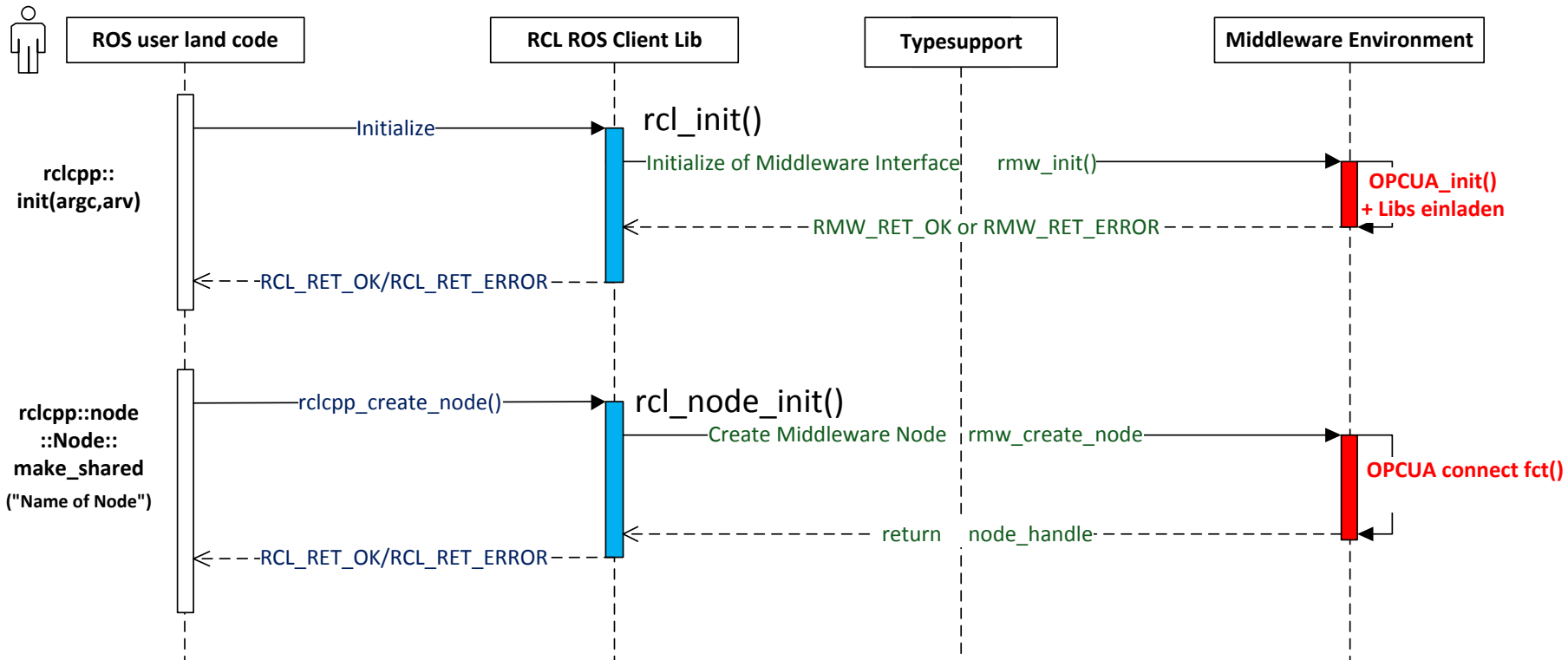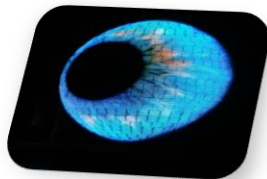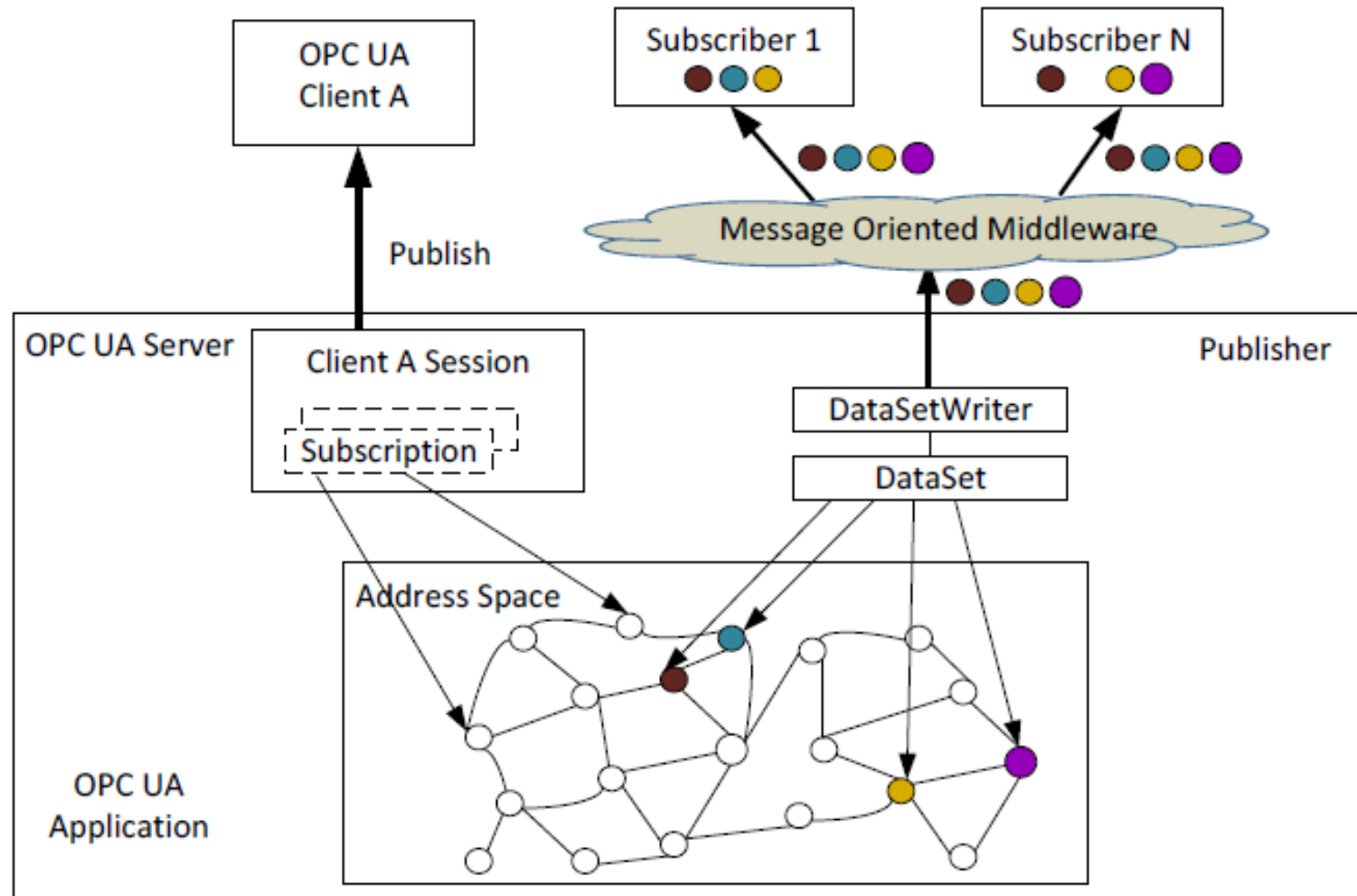
Outlook
OPC UA Roadmap

- OPC UA Publish/Subscriber Communication Model

- Release of Companion Specification planned for end of this year

- First prototypical implementations already available
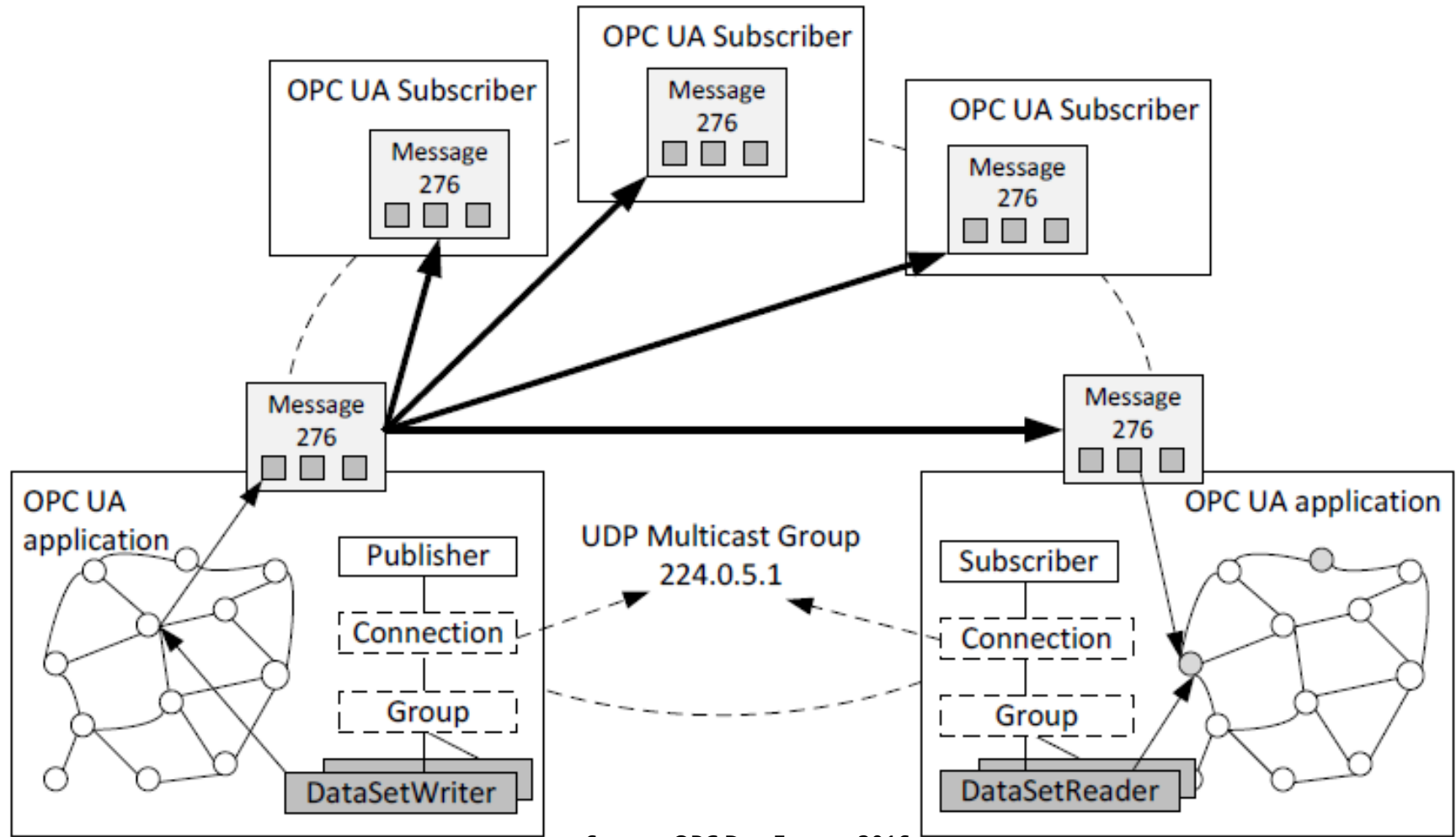

Source: OPC Day Europe 2016

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Outlook
OPC UA Pub/Sub

Source: OPC Day Europe 2016

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Outlook
Pub/Sub with UDP Mulitcast

Source: OPC Day Europe 2016

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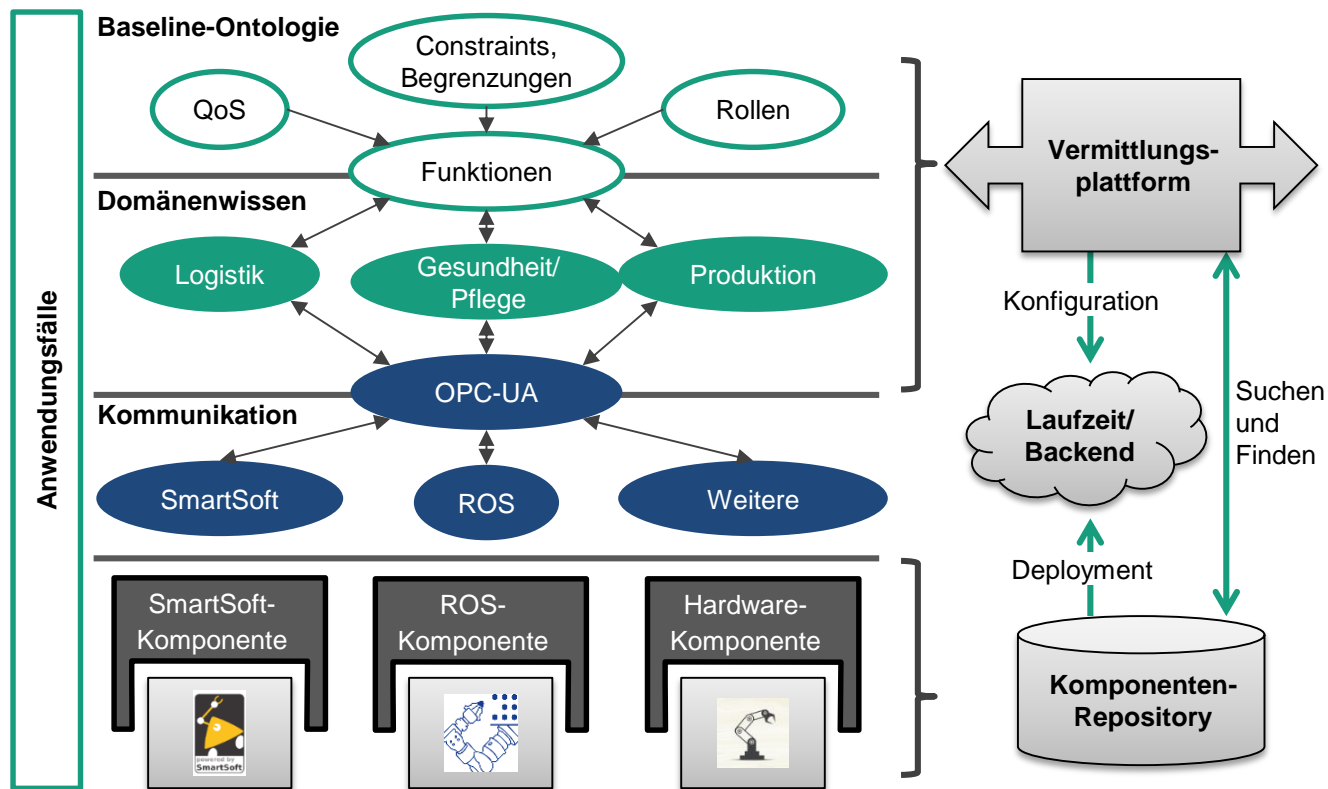
Outlook
Public funded project – SeRoNet

- OPC UA as main communication layer in service robotic networks
- OPC UA based Services

Source: IPA (SeRoNet Proposal)

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Your Contact at ISW

Wir steuern Zukunft

Innovativ. Interdisziplinär. Wissenschaftlich.

Thank you very much!

Any questions?

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Industrial Control Engineering

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