

# ZEISS Data Hub

**Connect. Listen. Understand.**

**The benefits of OPC UA standard communication on the shopfloor.**



Tiberiu Dobai

20 September 2023

EMO, Hannover



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- 01** Challenge
  - 02** VDMA : Guideline „Industrie 4.0 Interoperability with OPC UA CS“
  - 03** Companion Specification (CS) for Geometrical Measurement Systems (GMS)
  - 04** ZEISS Data Hub
  - 05** Demonstration Dashboard from umati with ZEISS DuraMax
  - 06** Summary
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## 01 Challenge

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## 04 ZEISS Data Hub

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## 05 Demonstration Dashboard from umati with ZEISS DuraMax

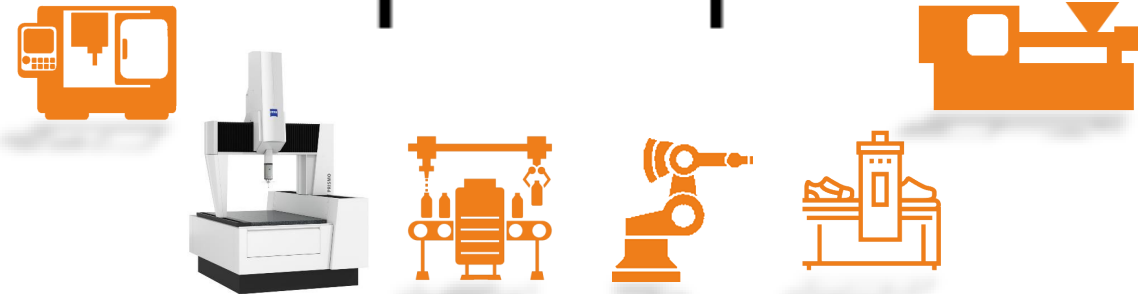
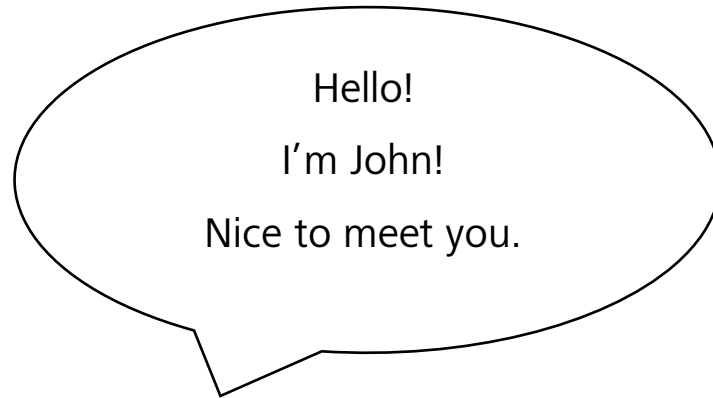
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## 06 Summary

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# Challenge

## Customer situation...



- John @ Manager of a production with different machines

Goal of John:

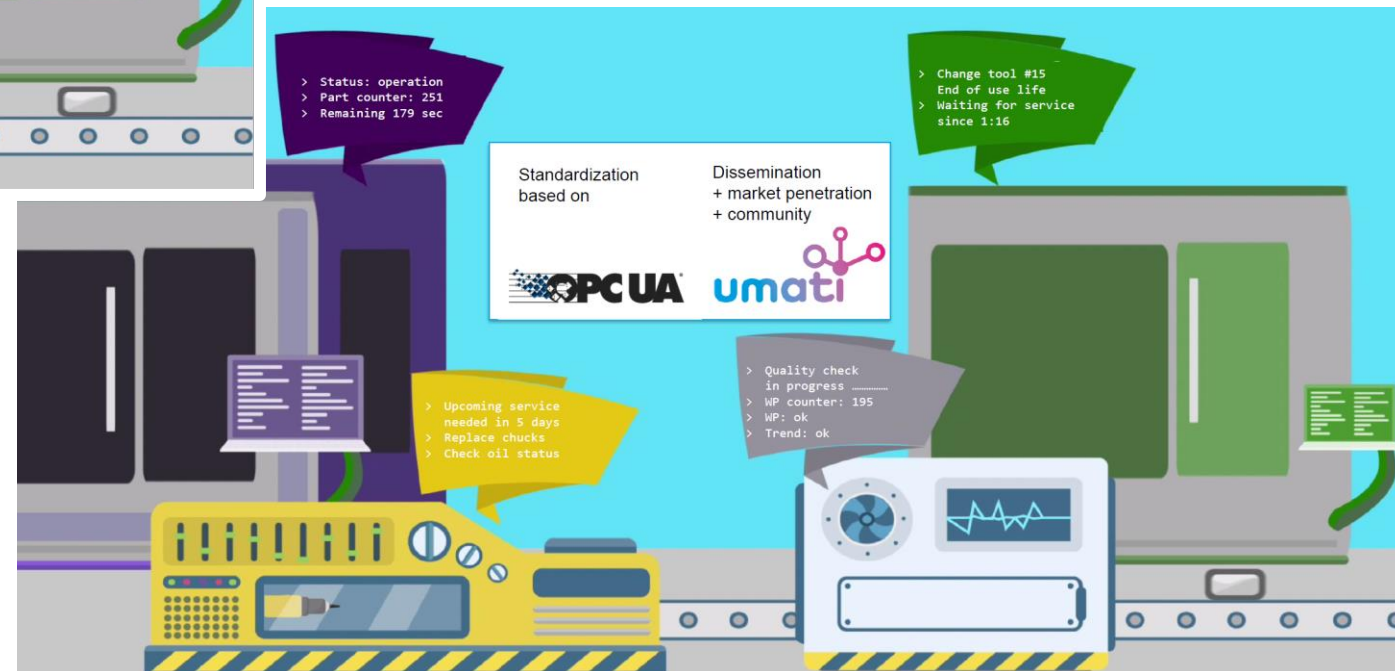
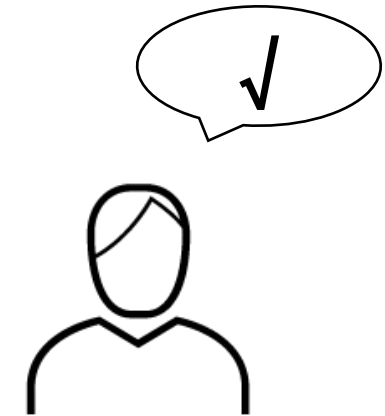
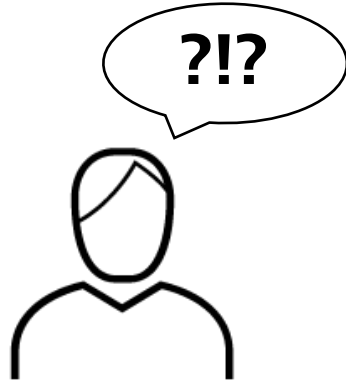
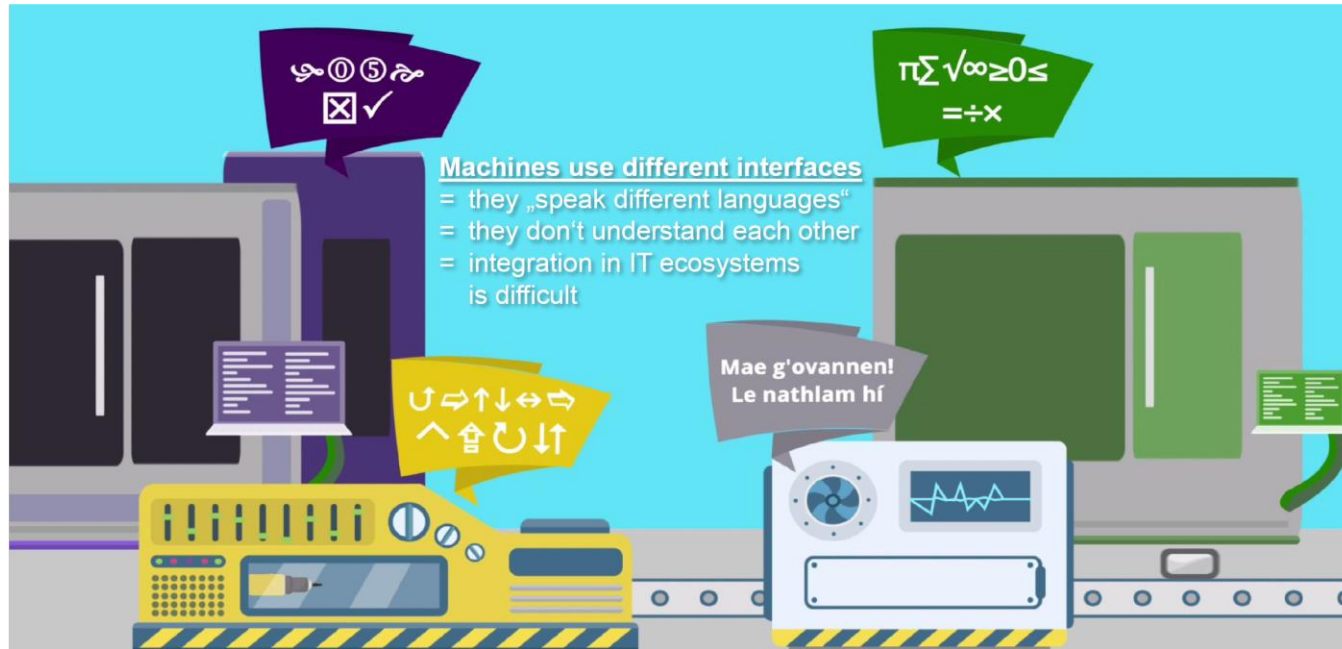
- The usage of available resources must be optimally planned

Needed data and information:

- Data about the condition of the machines
  - E.g.: alarms, warnings, collision, environment data, data about the current process, etc.
- Data to be able to track the machine utilization and productivity
  - E.g.: Status information of the machine, the application, the job, process events, contextual data of the process and the part, etc.

# Challenge

## Current status in the plant



Source: Dr. Alexander Broos, VDW: OPC UA and umati 2021

# Challenge

Customer situation...



Manufacturers'  
production systems

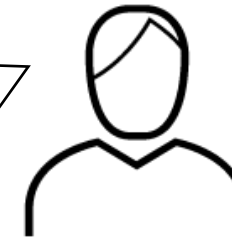
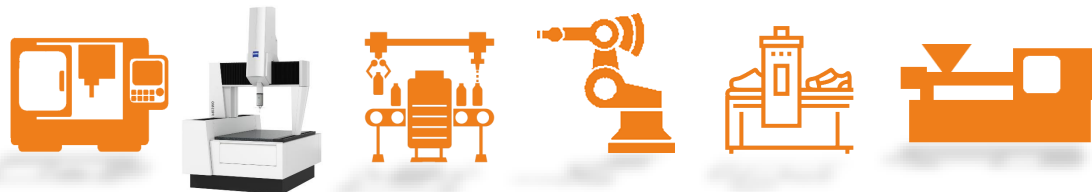
MES... ERP...  
Dashboard... etc.

**Customer use cases = Customer added value**

- "What is the utilization of machine X?"
- "Why is throughput of line A higher than B?"
- "What has caused the failure of work center 10?"
- "When to plan a maintenance window for Z?"
- "When is the CMM available next?"
- "Where can I dispatch order 123?"
- ...

Connectivity

Production with  
different machines

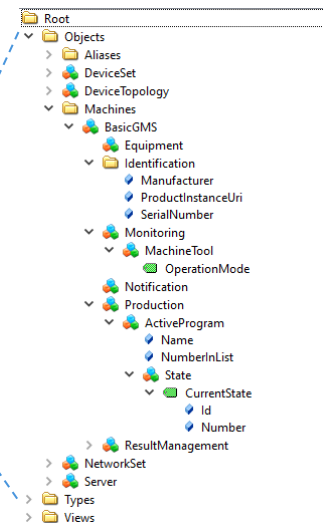


Customer network

OPC UA Client

OPC UA Server

Data



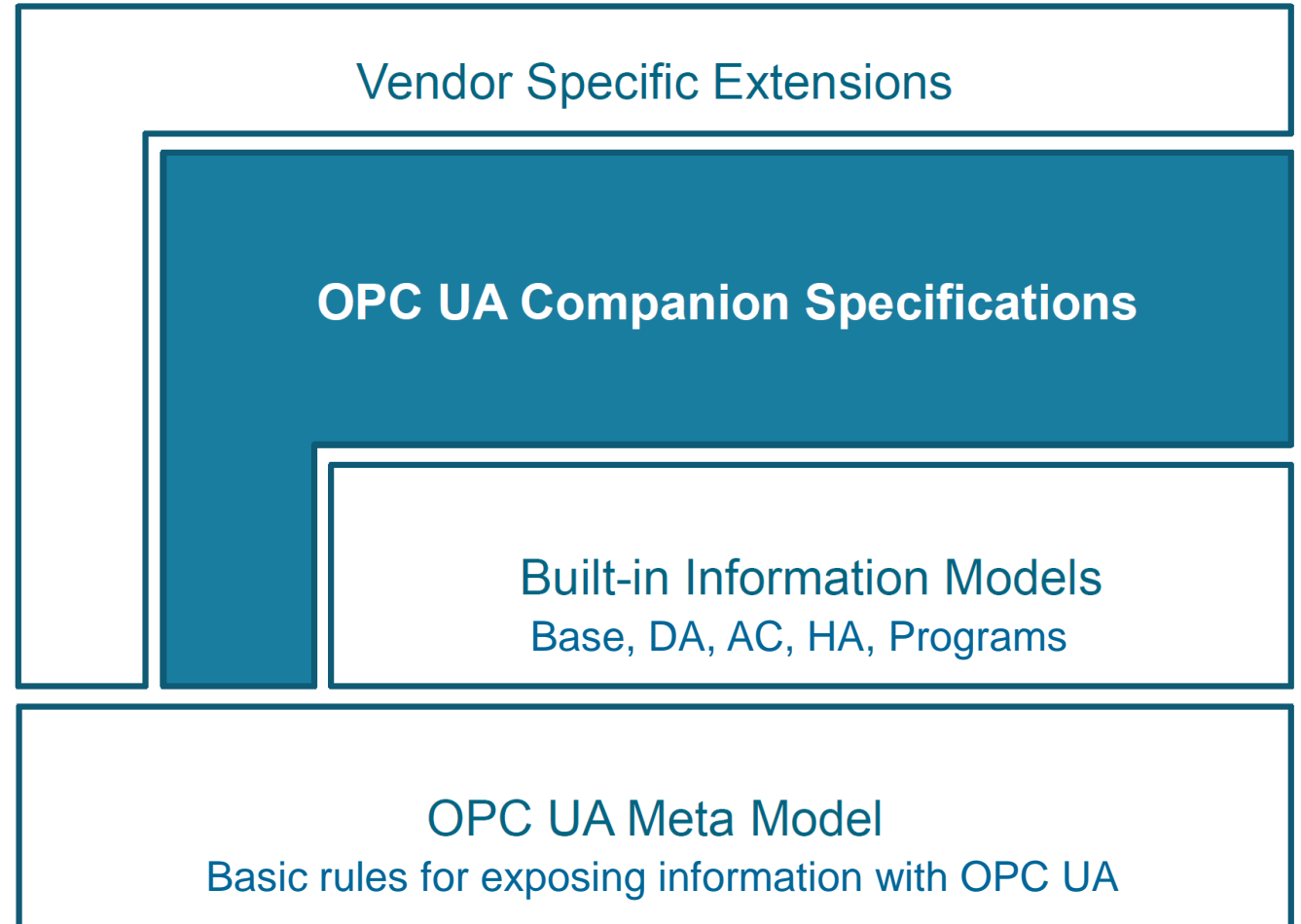


# Challenge

Solution for the situation in the plant



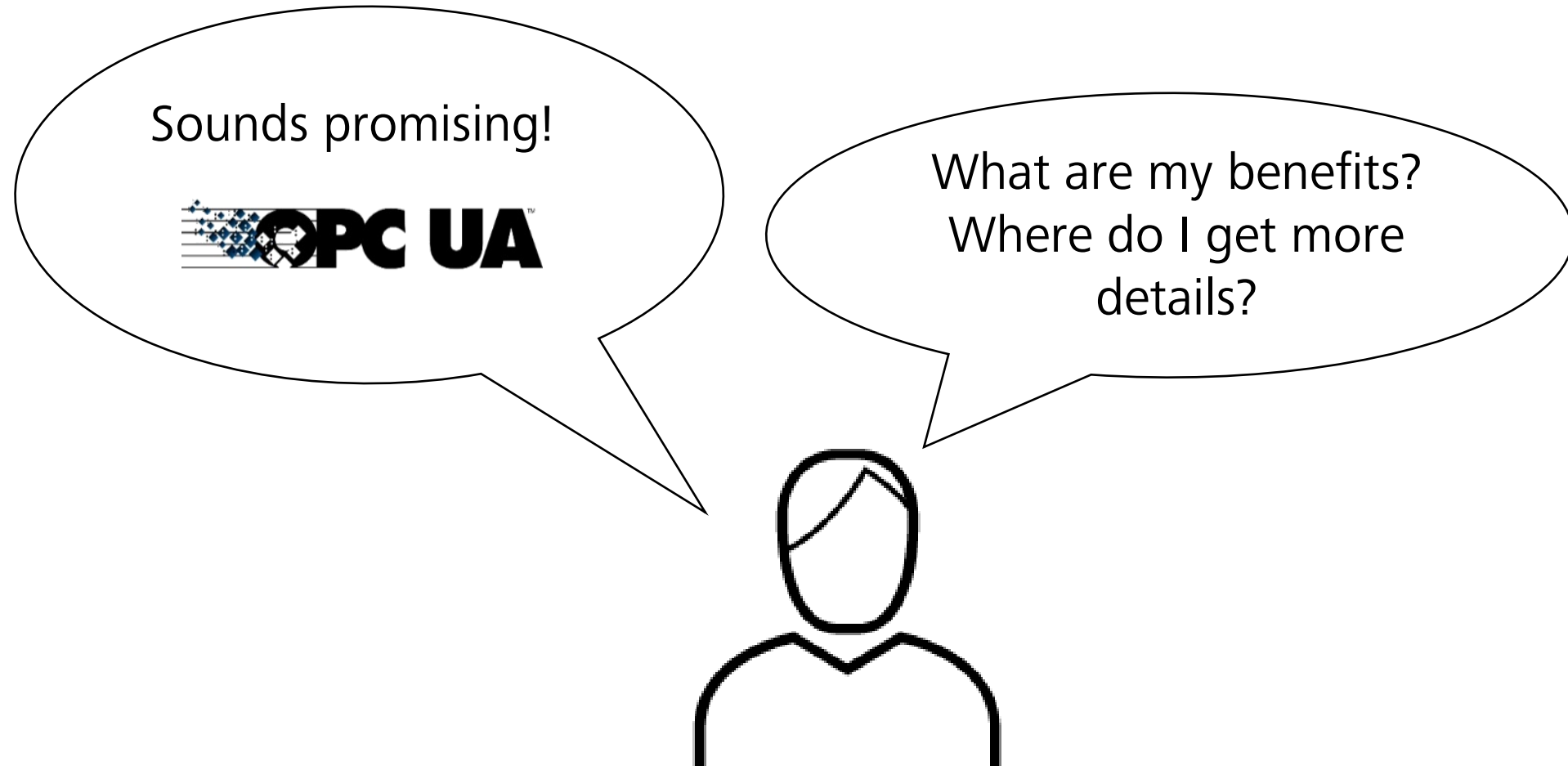
- **OPC (Open Platform Communications) UA (Unified Architecture)** is a standard for data exchange as a platform-independent, service-oriented architecture.
- **IEC 62541** standard series defines basics and communication principles
- **Companion Specifications** define application-related information models based on "Use Cases"



DA=Data Access, AC=Alarm and Conditions, HA=Historical Access

<https://opcfoundation.org/wp-content/uploads/2016/05/OPC-UA-Interoperability-For-Industrie4-and-IoT-EN-v5.pdf>

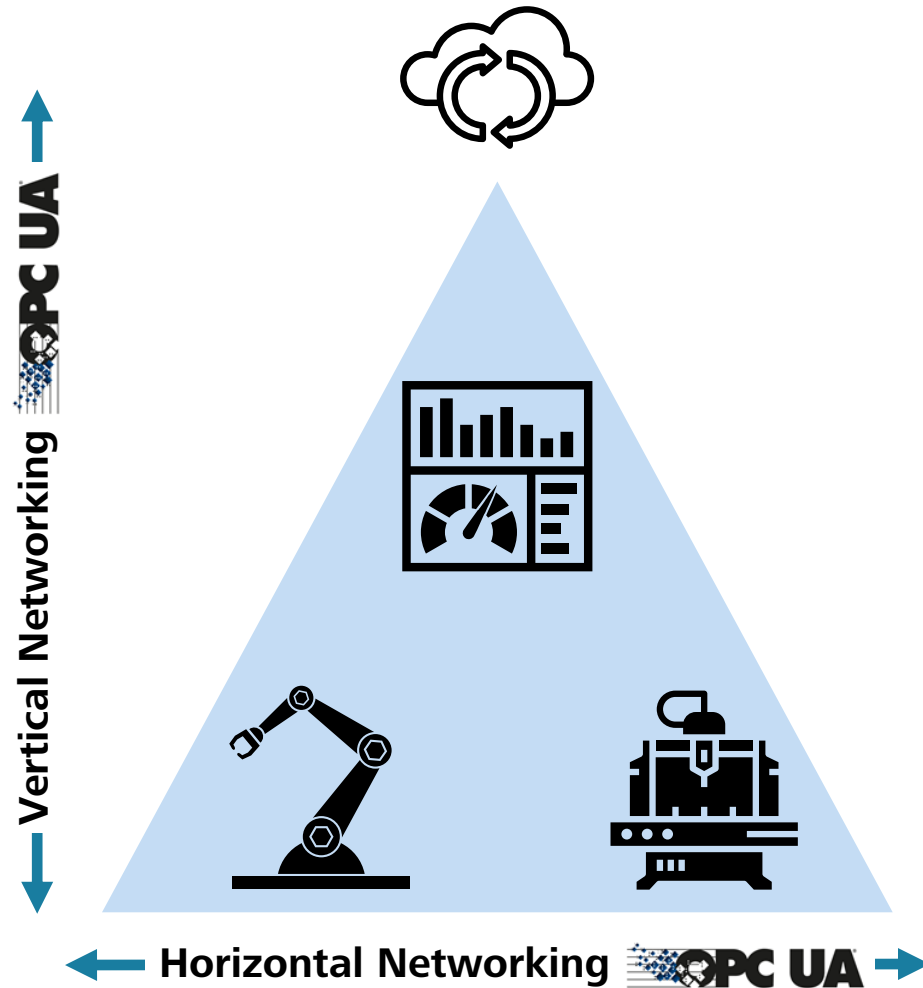
Source: VDMA: Department Length Measurement Infotag, Webkonferenz am 1. Juli 2020





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# OPC UA as the established interoperability solution for machine data from field to cloud!



Open source



Security



Two transport mechanism with various protocols



Scalable



Global acceptance



Semantic information models

Source: VDMA | HMI 2023 | Added value through OPC UA with Companion Specifications

## Industrie 4.0 Kommunikation mit OPC UA Leitfaden zur Einführung in den Mittelstand



in Kooperation mit:



## Utility

- » Continuation of the very successful VDMA guideline strategy
- » Clear positioning on OPC UA
- » Tailored to small and medium-sized VDMA companies
- » Lowering the barriers and hurdles to the development of I4.0 communication networks



## Content

- » Profit: Why introduce OPC UA in the company
- » Migration path: How to introduce OPC UA

## Focus of update

- » Goal: Adaption to the new developments
- » Core: Addition of OPC UA for Machinery

Industrie 4.0 Interoperabilität durch  
OPC UA mit Companion Specifications  
Mehrwerte für Stakeholder des Maschinen- und Anlagenbaus



## Focus

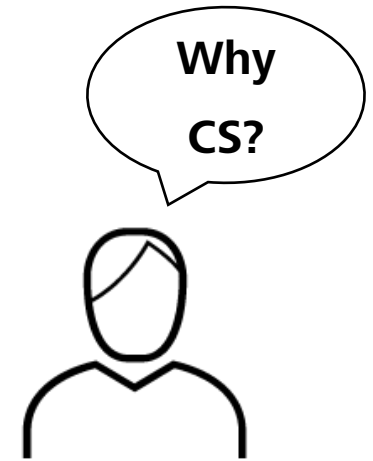
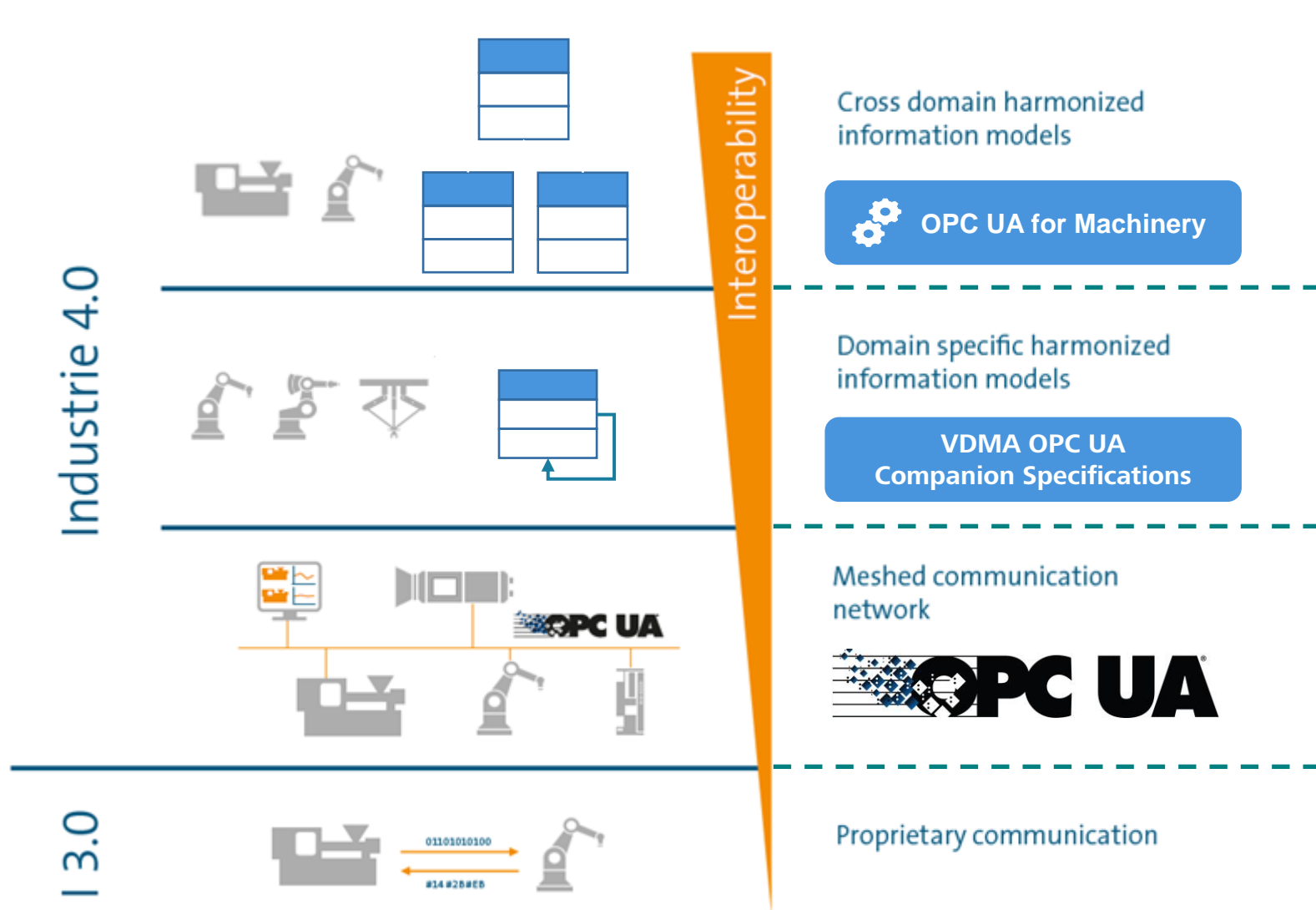
- » Represent the usability of OPC UA and Companion Specifications for scenarios of continuous and discrete manufacturing
- » Show benefits for OEMs, end users and system integrators, depending on the role at the stakeholder e.g. procurement



## Structure

- » Introduction and motivation
- » OPC UA & OPC UA CS → Use language analogy
- » Development phases of a CS → Reduce reservations of participation
- » Scenarios
- » Stakeholders and their benefits
- » Compatibility of interoperability approaches → OPC UA & AAS & Data Spaces

# OPC UA with Companion Specifications to the highest level of interoperability



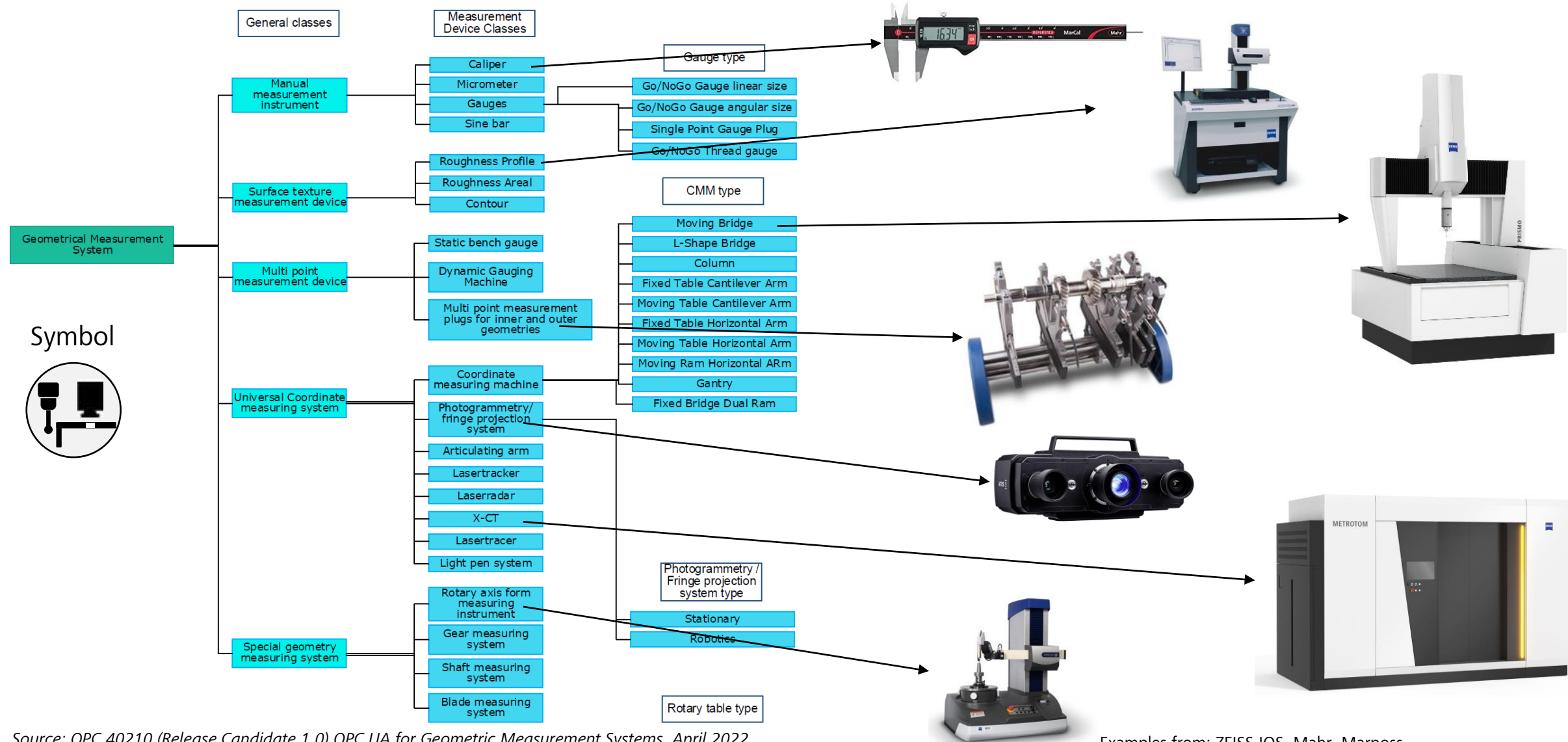
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# Geometrical Measurement System (GMS) and Examples

(derived from ISO GPS=Geometrical Product Specifications)\*

\* (See [https://www.iso.org/standard/54022.html](#))

\*(See <https://committee.iso.org/home/tc213> )



Source: OPC 40210 (Release Candidate 1.0) OPC UA for Geometric Measurement Systems, April 2022

Examples from: ZEISS IQS, Mahr, Marposs



# OPC UA for Geometrical Measurement Systems (GMS)

## Development and status



The project was supported from

- **Hexagon MI**
- **Jenoptik IM**
- **Mahr**
- **Marposs**
- **Mitutoyo Europe**
- **OPG Messtechnik**
- **Wenzel Metrology**
- **ZEISS IQS**

The projects was managed by the **Institute for Control Engineering of Machine Tools and Manufacturing Units** (Institut für Steuerungstechnik und Werkzeugmaschinen = ISW) of university Stuttgart, Germany.

**Kick-Off-Meeting** happened im September **2019**

<https://wzm.vdma.org/viewer/-/v2article/render/45704250>

The draft of the **Companion Specification** was released April **2022**

<https://www.vdma.org/viewer/-/v2article/render/47597927>

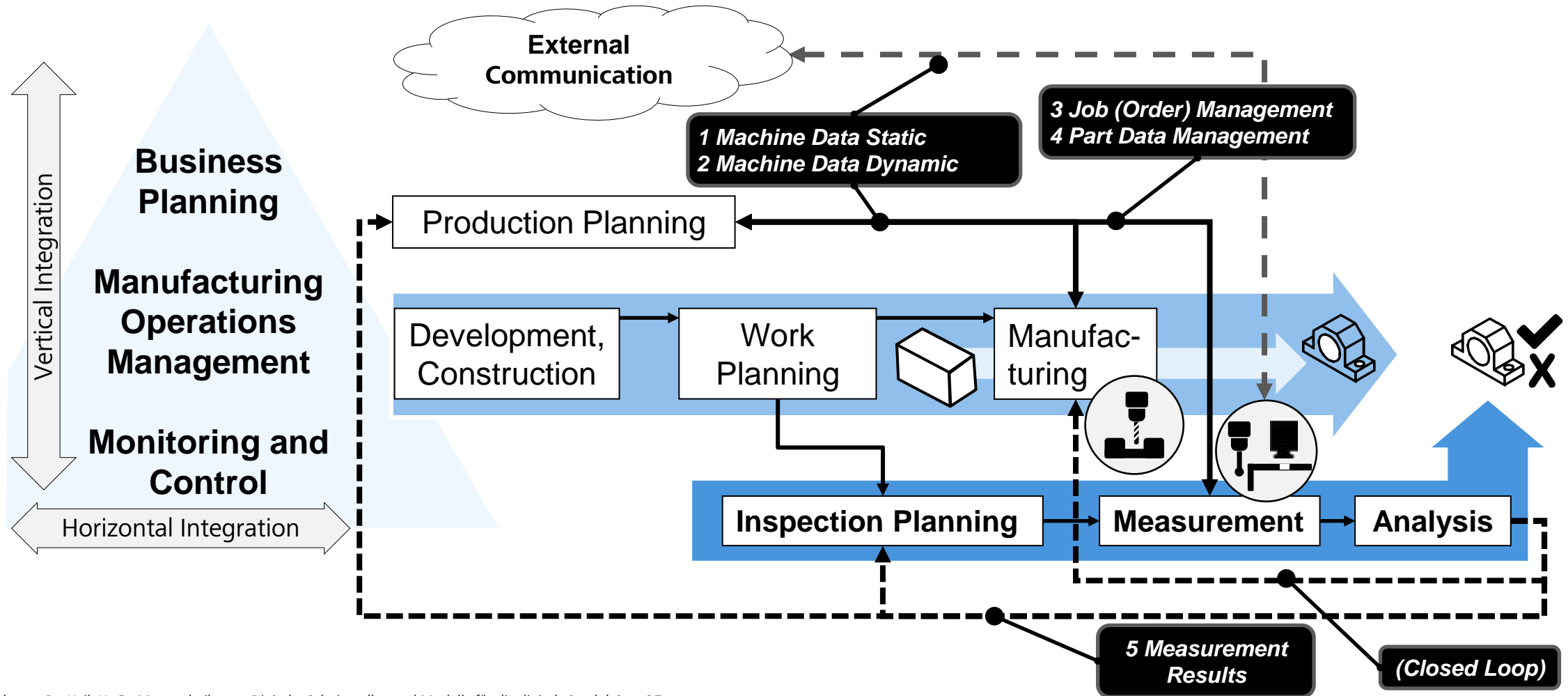
**Version 1.0 released May 2023**

<https://reference.opcfoundation.org/GMS/>

VDMA Specification <i>Draft</i>		April 2022
	VDMA 40210	
ICS 17.040.30; 35.240.50		
Comments by 2022-06-01		
<b>OPC UA for Geometric Measurement Systems</b> OPC UA für Geometrische Messsysteme		
<div>VDMA 40210:2022-04 is identical with OPC 40210 (Release Candidate 1.0)</div>		
<b>Application Warning Notice</b> <p>This draft with date of issue 2022-02-25 is being submitted to the public for review and comment. Because the final VDMA Specification may differ from this version, the application of this draft is subject to special agreement.</p> <p>Comments are requested</p> <ul style="list-style-type: none"><li>– preferably as a file by e-mail to <a href="mailto:hans-guenter.heil@vdma.org">hans-guenter.heil@vdma.org</a></li><li>– or in paper form to VDMA e.V. Mess- und Prüftechnik, Lyoner Straße 18, 60528 Frankfurt.</li></ul>		
Document comprises 62 pages		
VDMA		

© All rights reserved to VDMA e.V., Frankfurt/Main – Modification, amendment, editing, translation, copying and/or circulation only with permission in writing from VDMA e.V. Draft VDMA 40210:2022-04

# Integration of Geometrical Measurement Systems into Digital Production and OPC UA Use Cases



Source: Imkamp, D., Heil, H. G.: Messtechnik goes Digital – Schnittstellen und Modelle für die digitale Produktion, QZ Qualität und Zuverlässigkeit, Carl Hanser Verlag, München Jg. 66 (2021), Nr. 5, S. 40-43.

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# ZEISS Data Hub

What is the  
ZEISS Data Hub?



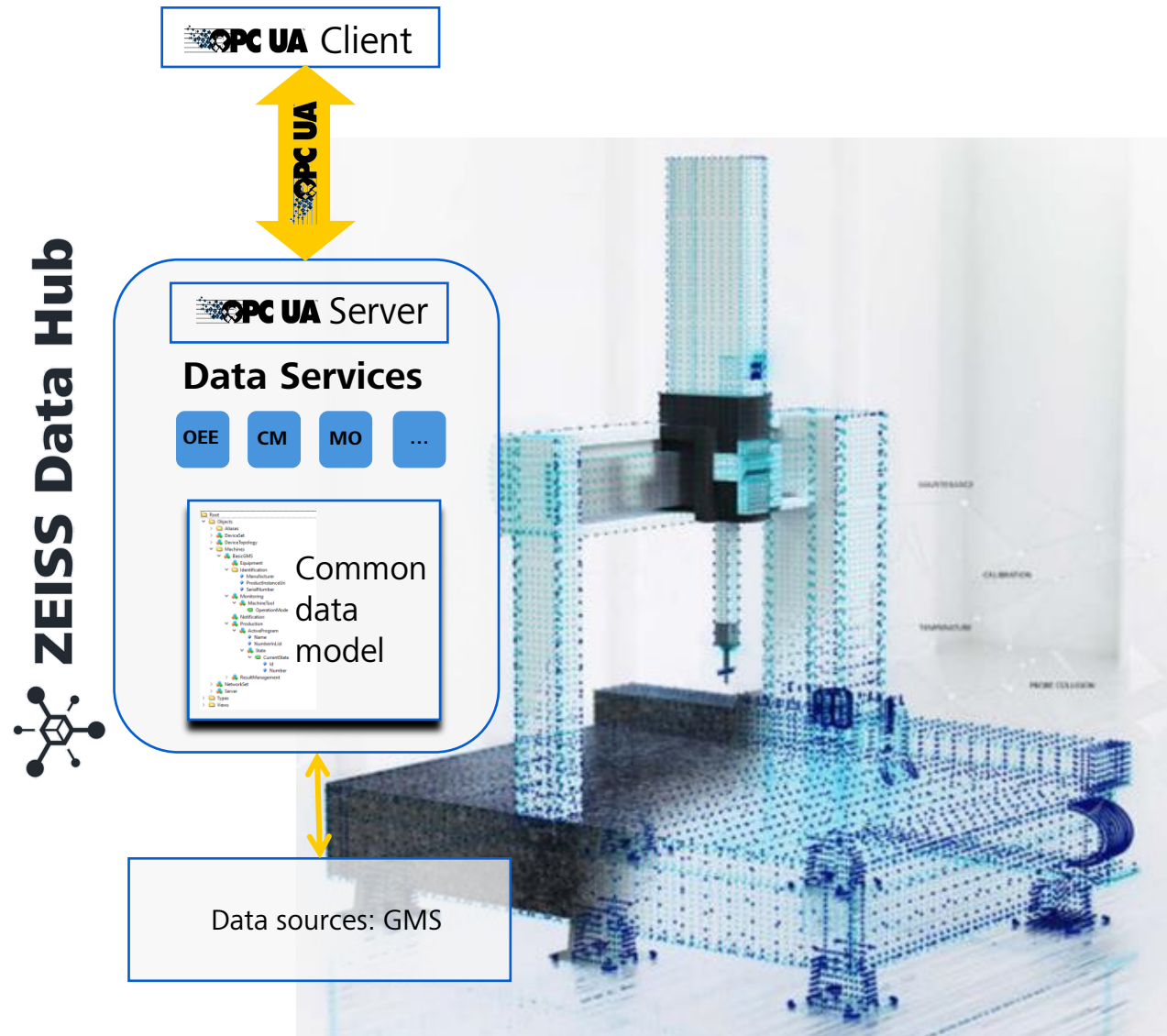


### A typical customer use case

- The timestamp of the machinery states **NotAvailable**, **Executing**, **NotExecuting**, **OutOfService** is tracked in the control system.
- Based on these data, the utilization of the machine is computed.
- The customer can optimize the production plan accordingly.

# ZEISS Data Hub

## Technical Facts



	Node	Description
Machine Identification	#\Identification\SerialNumber	ZEISS machine serial number
	#\Identification\Manufacturer	Value: ZEISS
	#\Identification\ProductInstanceUri	Value: currently not yet set
Machine Monitoring	#\MachineryBuildingBlocks\MachineryItemState	Values: NotAvailable, NotExecuting, Executing, OutOfService
	#\MachineryBuildingBlocks\MachineryOperationMode	Value: None
	#\Monitoring\MachineTool\OperationMode	Values: 0 = Manual, 1 = Automatic, 5 = Other
Measuring Task	#\Notification\Messages\Alert\ErrorCode	Machine error codes
	#\Production\ActiveProgram\Name	Name of the inspection program
	#\Production\ActiveProgram\State\CurrentState	Values: Aborted, Ended, Initializing, Interrupted, Running
	#\Production\ActiveProgram\NumberInList	not used
Measuring Results	#\ResultManagement\Results\Result\ResultEvaluation	Values: 0 = Undefined, 1 = OK, 2 = NotOK, 3 = NotDecidable
	#\ResultManagement\Results\Result\ResultState	Values: 0 = Undefined, 1 = Completed, 2 = Processing, 3 = Aborted, 4 = Failed
	#\ResultManagement\Results\Result\PartID	ID of the part in inspection



# Key Benefits of ZEISS Data Hub

## Data Service *System Monitoring*



Smart plug-and-produce solution

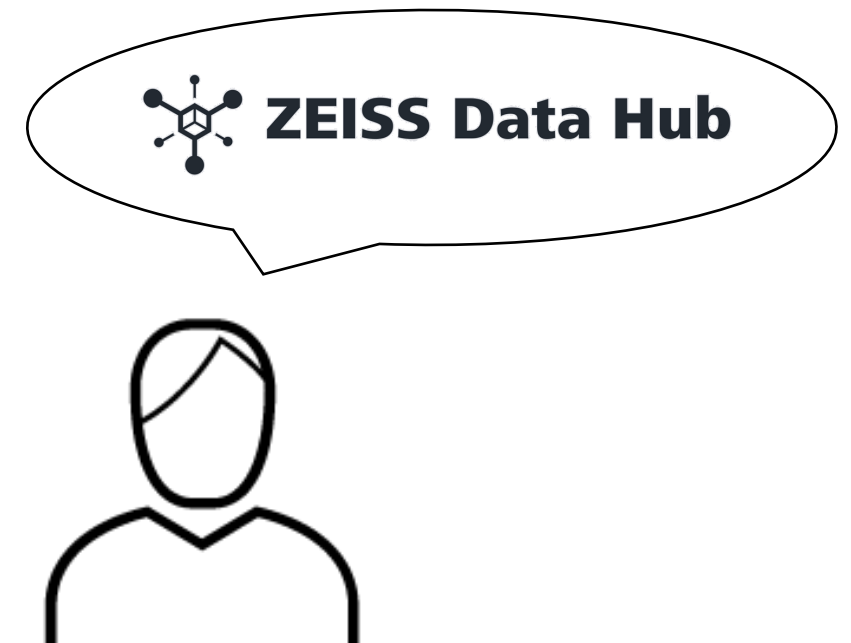
*Data are ready to use*

Hardware-agnostic connection

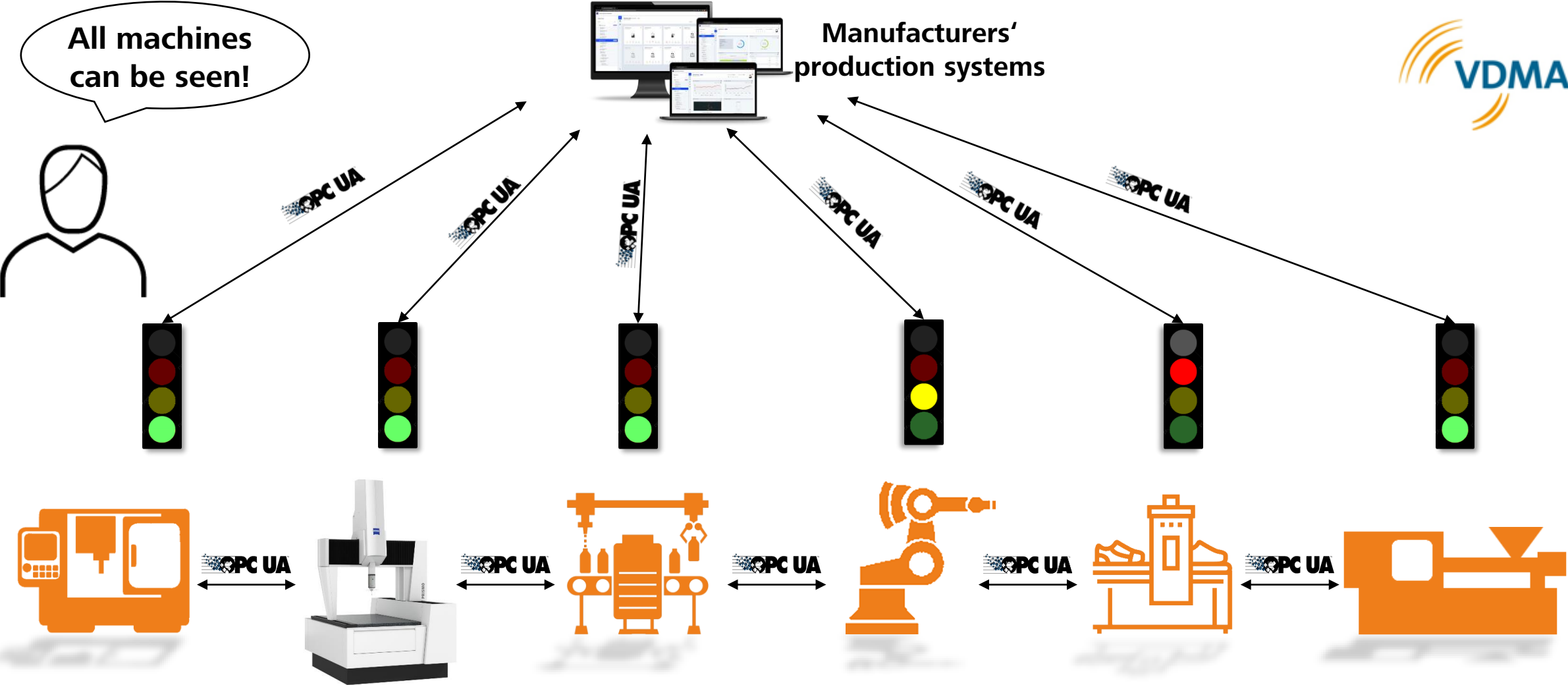
*One unified system interface*

Enables optimization  
of machine utilization

Reduces total cost of ownership



# Benefits of OPC UA



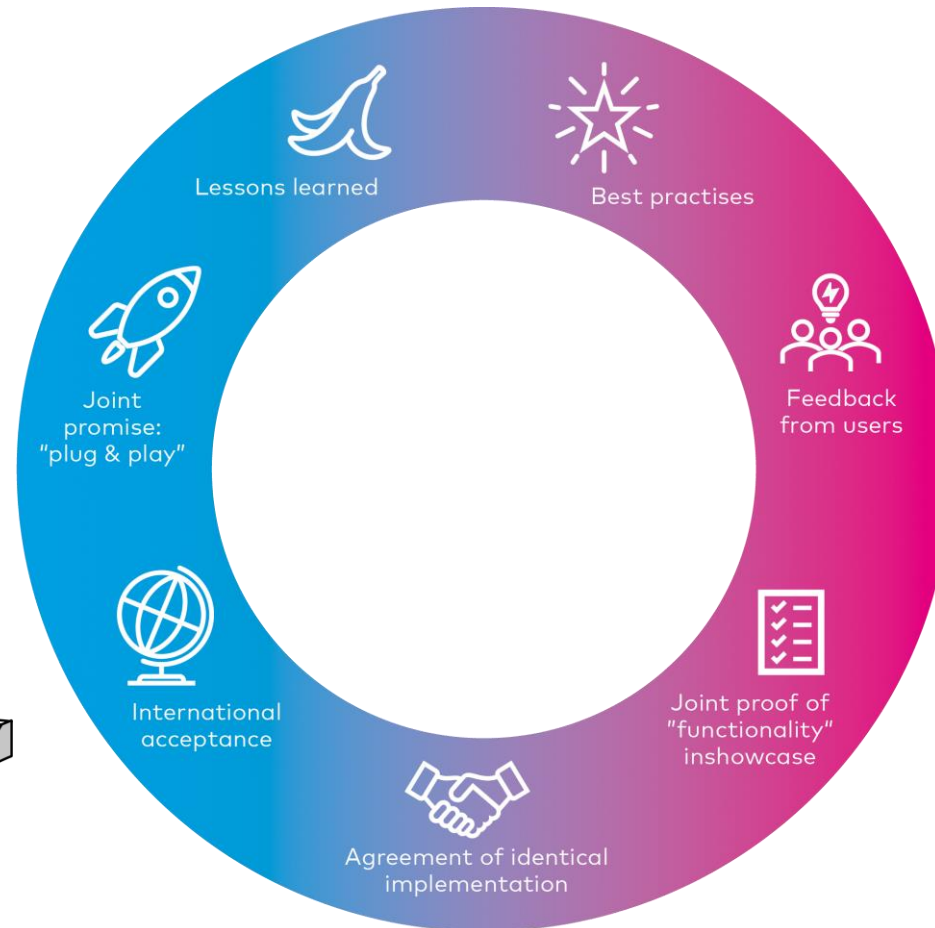
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# Bringing machine builders and users together



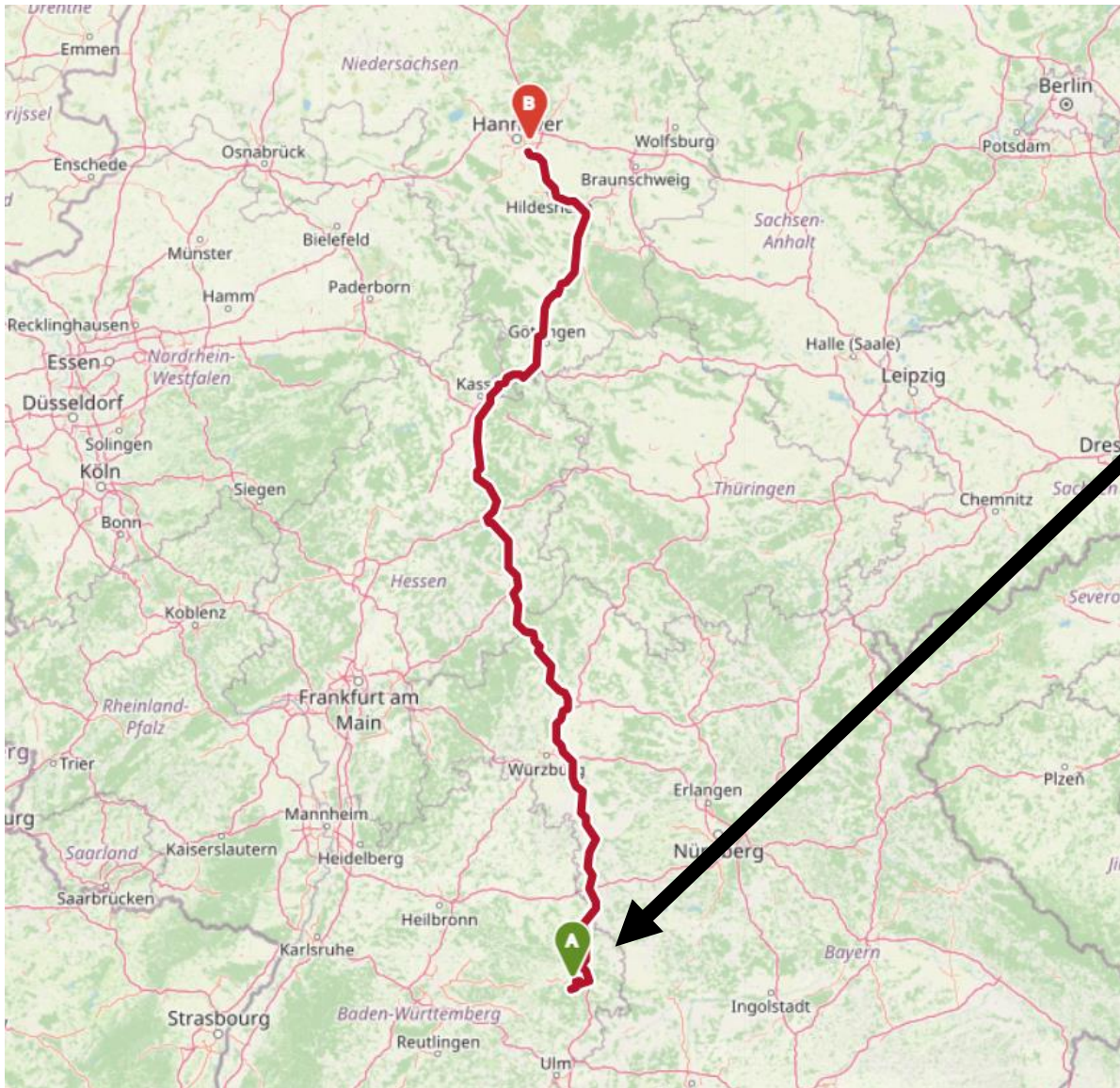
- umati (**universal machine technology interface**) is a community of mechanical and plant engineering companies and its customers for the distribution and use of open interface standards based on OPC UA.
- umati is a common initiative from VDW and VDMA and is open to participants from industry, research, organizations and networks from all over the world.

**Machine builders**  
Associations,  
working groups



**Users**  
Various  
sectors,  
multiple  
machinery

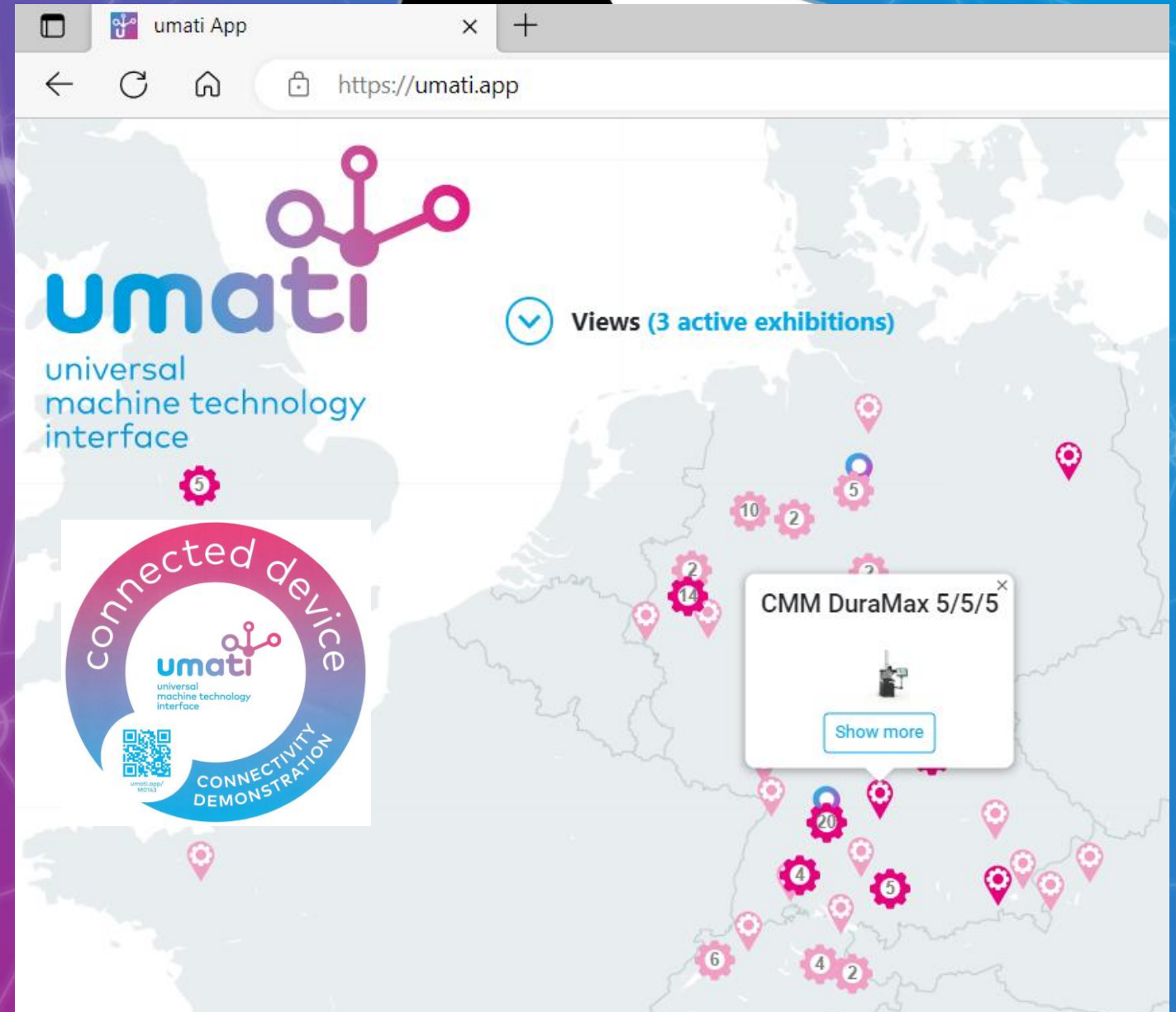
# DuraMax at ZEISS's Headquarter in Oberkochen, Germany



Source: <https://openstreetmap.de/>



See for yourself  
<https://umati.app>



# ZEISS's Duramax on the umati Dashboard

## Use Cases



### 1 Machine Data Static

#### Identification

**Manufacturer**

Carl Zeiss IMT (Shanghai) Co., Ltd

**ProductUri**

<https://www.zeiss.com/metrology/products/systems/coordinate-measuring-machines/production-cmms/duramax.html>

**Serial Number**

146522

**Software Version**

38.12

**Build Year**

2018

**Device Class**

CoordinateMeasuringSystem

**Location**

N 48.780464 E 10.100363

**Model**

CMM DuraMax 5/5/5

**Product Code**

636510-9905-000

#### Tools

#### Active Program

**Name**

Pruefplan 3 demo

**State Id**

138

Running

3 Job (Order) Management  
4 Part Data Management

#### Monitoring

Geometrical Measuring System

**Operation Mode**

Automatic

**Power On Duration**

19440

0.0 %

### 2 Machine Data Dynamic

Source: umati



# Hall 6 Both B66

## ZEISS on the EMO



Source: <https://visitors.emo-hannover.de/>

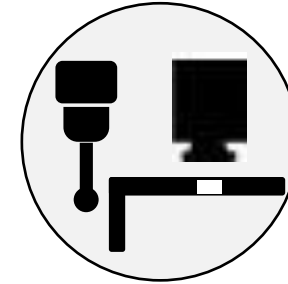
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## Connect. Listen. Understand.

The benefits of OPC UA standard communication on the shopfloor.



- Plug-and-produce GMS systems



- Hardware agnostic connection via



- Interoperability due to Companion Specification

- Use case related data services



**ZEISS Data Hub**

# Hall 6 Both B66

Thank you for your attention



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Seeing beyond