

# ハノーバーメッセの会場で見えた産業用IoTの動向 ～IoT・AI技術の製造業への活用と展望～

ベッコフオートメーション株式会社

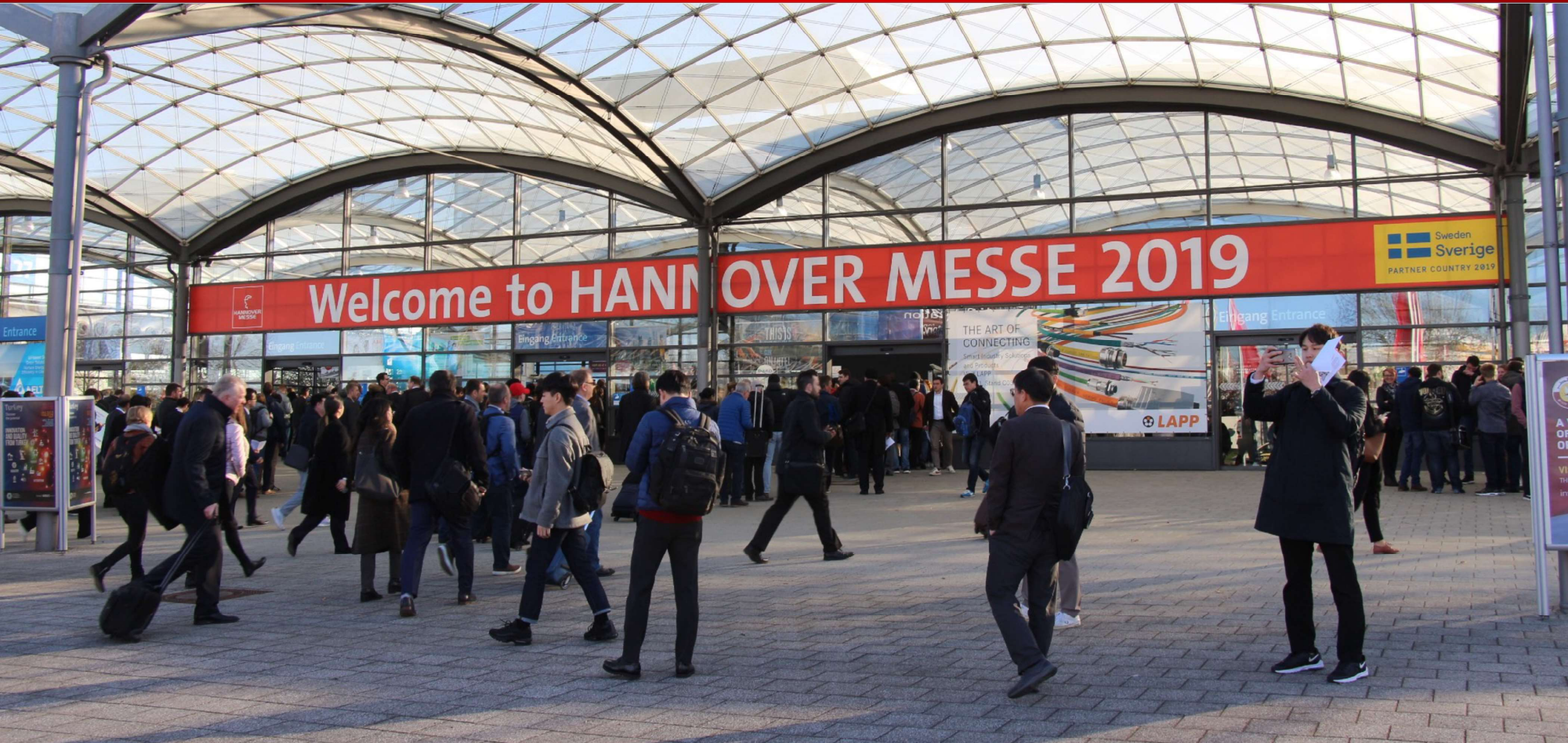
代表取締役社長

川野 俊充

**BECKHOFF**

ハノーファーメッセ2019: 4月1日～4月5日

BECKHOFF



# 2019年パートナー国：スウェーデン

BECKHOFF



# Beckhoff Automation Booth Party 2019

**BECKHOFF**



# Beckhoff : EtherCAT開発元のPC制御専門メーカー

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# 1980年創業：小さなガレージに大きな野心

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# ミッテルシュタント：ドイツの中堅企業

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本社

Verl, Germany

従業員数

4,300 (+10%)

技術者数

1,400



# 現地法人・代理店で77カ国を網羅

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# 生産財の制御機器として幅広く採用

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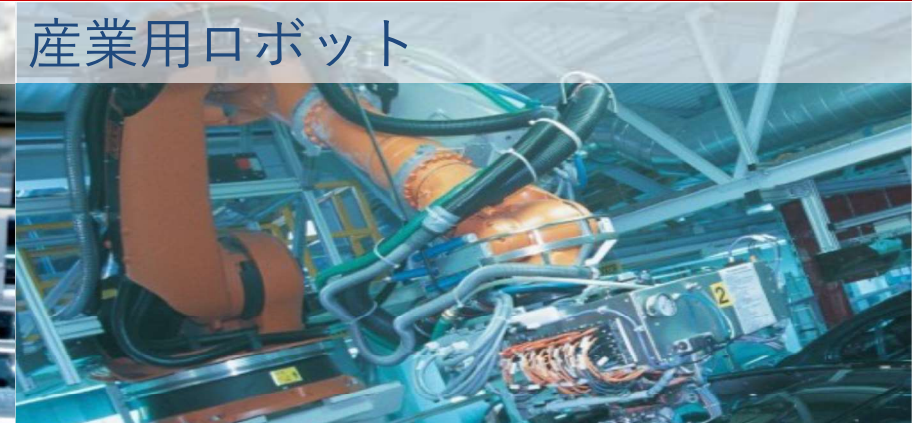
包装機器



窓枠製造装置



産業用ロボット



タイヤ製造



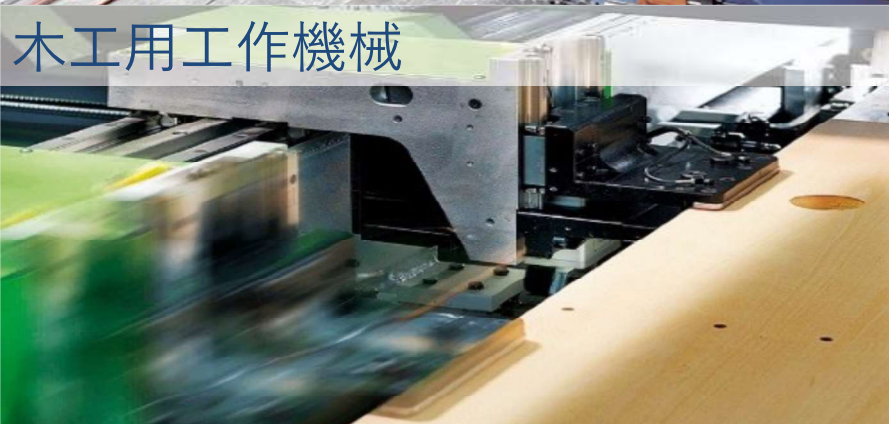
射出成形機



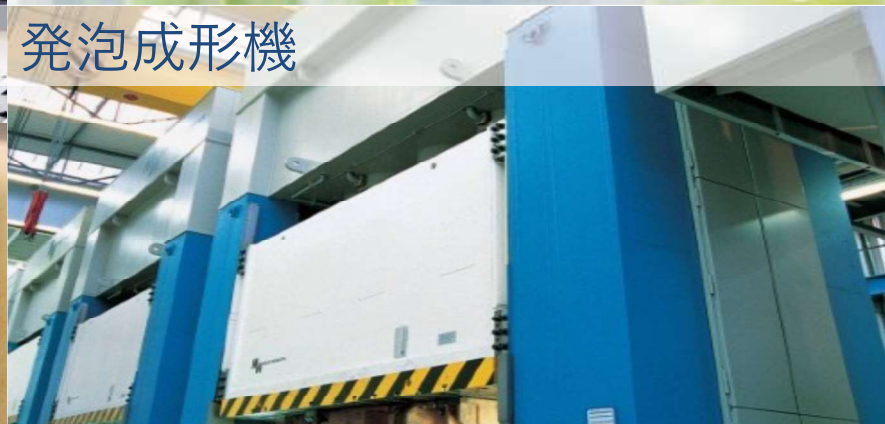
工作機械



木工用工作機械



発泡成形機



デジタル印刷機

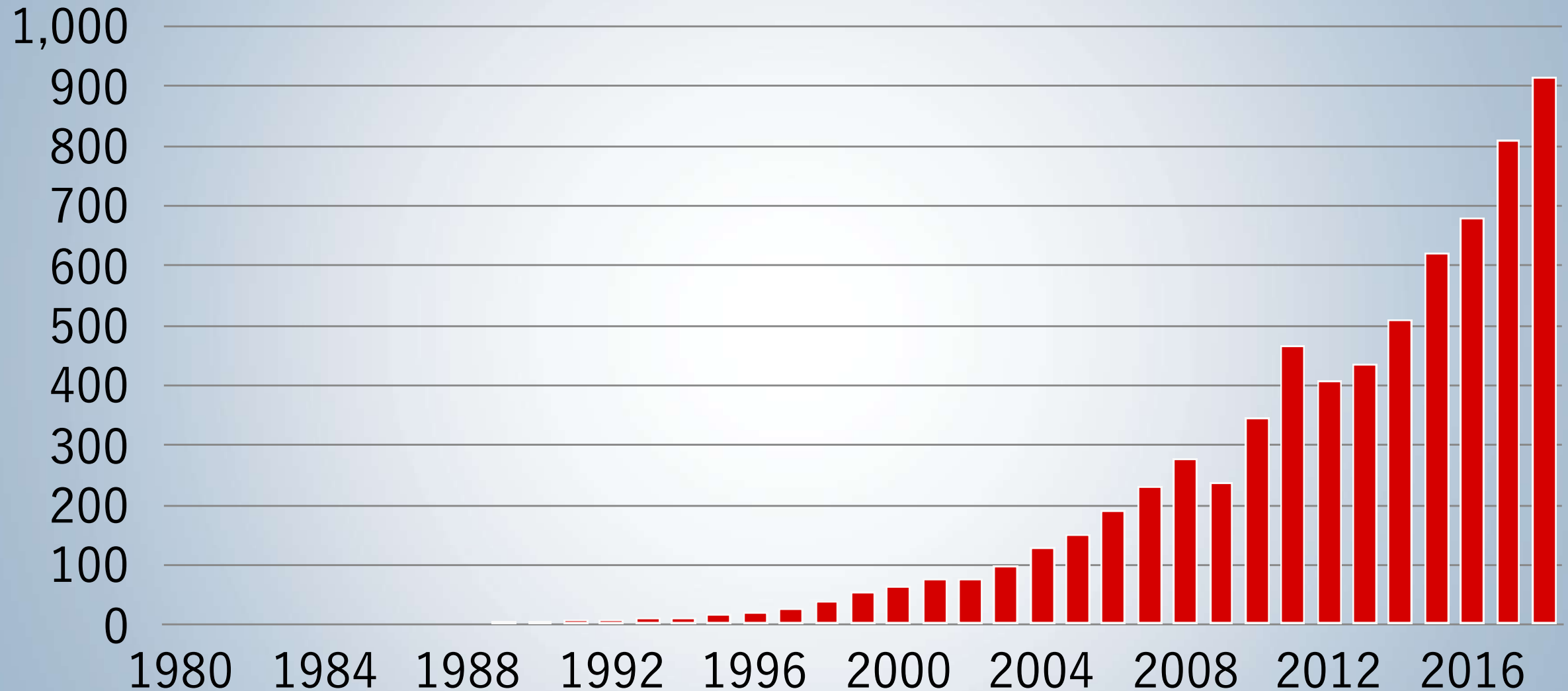


# 2018年 売上高 916M EUR

BECKHOFF

million €

2000年からのCAGR 16%



# ベッコフオートメーション株式会社

BECKHOFF

本社所在地

横浜市みなとみらい

事務所開設

2011年3月14日

2017年

名古屋オフィス9月14日開設



# 創業オーナー：Hans Beckhoff

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# 頭脳を模倣したPC制御アーキテクチャ

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知能・個性

触覚

聴覚

動作

視覚

小脳

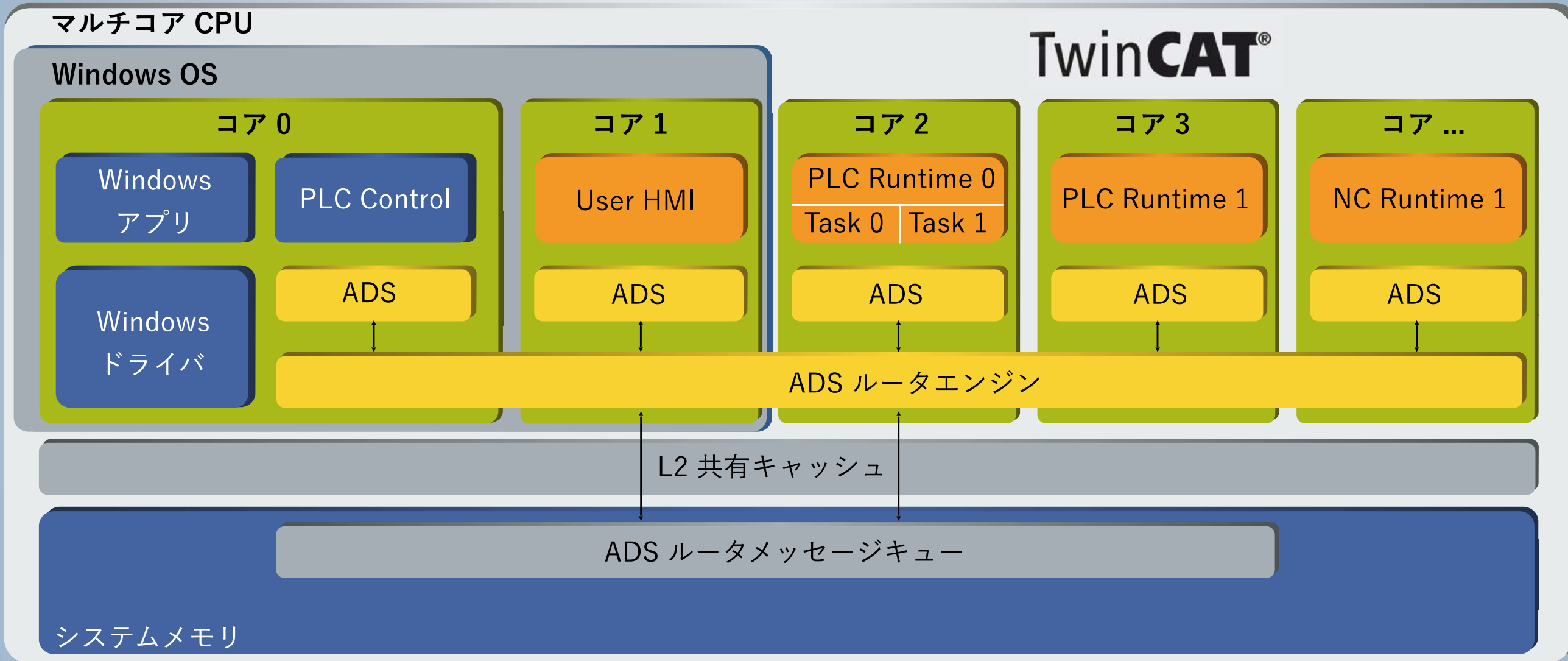
脳幹



VERSION 3

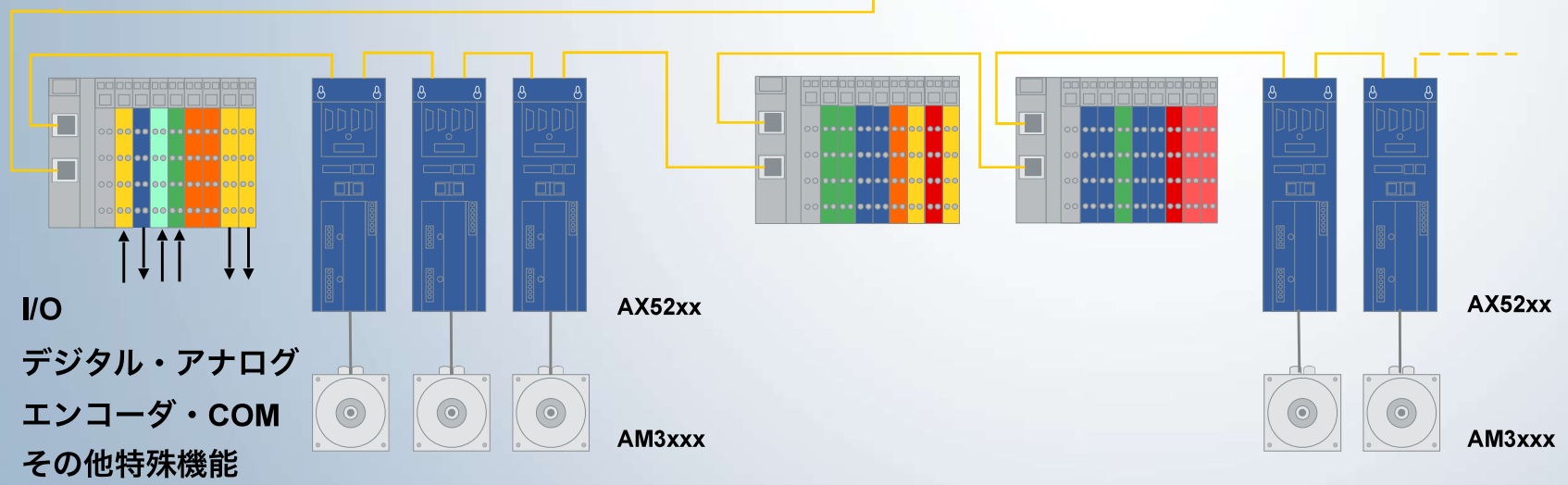
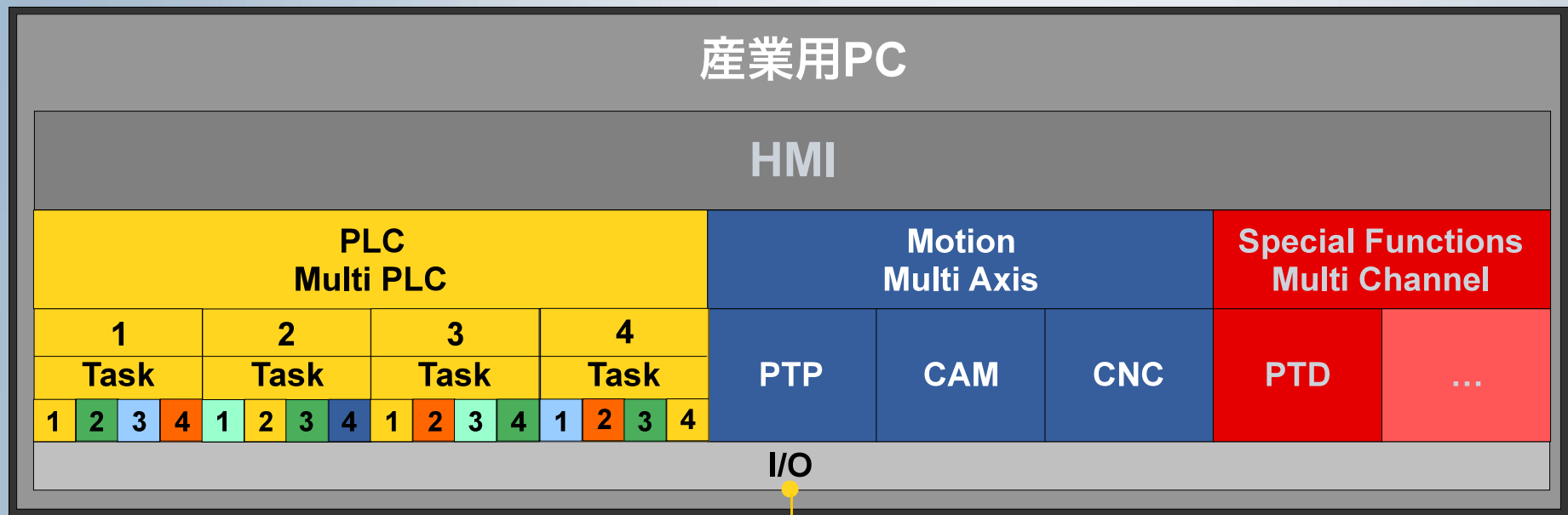
# マルチコアCPUで複数のコントローラをひとつに

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PLC, NC, Motion Control, HMIを異なるコアに分散

# PC制御：ソフトウェアの機能モジュールを単一のWinPCに実装



# Visual Studio: 全ての開発者が単一のIDEで開発可能

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The screenshot displays the Visual Studio IDE interface for developing Beckhoff TwinCAT and PLCopen applications. The interface is divided into several panes:

- Left Pane (Solution Explorer):** Shows the project structure for 'ORiN\_TC3\_Demo1' and 'TC3-ORIN DEMO'. A blue callout box highlights the 'システム設定' (System Settings) folder.
- Center Pane (Form Designer):** Displays a graphical user interface (GUI) for a motor control application. It includes components like 'I/O Unit', 'Motor Driver Unit', and 'Actual Velocity'. A blue callout box labeled 'GUI' points to the interface elements.
- Right Pane (Code Editor):** Shows the 'PROGRAM MAIN' code. A table lists variables and their data types, and a code block is visible below.

Scope	Name	Address	Data type	Initializat
1	VAR fbTp01		TP	
2	VAR fbTp02		TP	
3	VAR bLed	%Q*	BOOL	
4	VAR fbMC_Power		MC_Power	
5	VAR stAxis		AXIS_REF	
6	VAR fbMC_MoveAbsolute		MC_MoveAbsolute	
7	VAR iState		INT	100

```
1 fbTp01(in := NOT fbTp02.Q, pt := T#100MS);
2 fbTp02(in := NOT fbTp01.Q, pt := T#100MS);
3
4 bLed := fbTp01.Q;
5
6 fbCtu := fbTp01.Q,
7
8 RESET:= fbCtu.Q,
9
10 PV:= 8,
11
12 CV=> iCurrentValue);
13
14 CASE iCurrentValue OF
15
16 1: bE12008_01 := FALSE;
17    bE12008_02 := FALSE;
18    bE12008_03 := FALSE;
19    bE12008_04 := FALSE;
20    bE12008_05 := FALSE;
21    bK12809_01 := FALSE;
22    bK12809_02 := FALSE;
23    bK12809_03 := FALSE;
24
25 2:
26    bE12008_01 := FALSE;
27    bE12008_02 := TRUE;
28    bE12008_03 := FALSE;
29    bE12008_04 := FALSE;
30    bE12008_05 := FALSE;
```

Large blue callouts with the text 'TwinCAT®' and 'PLCopen®' are overlaid on the code editor.



世界最大の産業用イーサネット協会：5,300社の会員企業

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**EtherCAT<sup>®</sup>**  
Technology Group

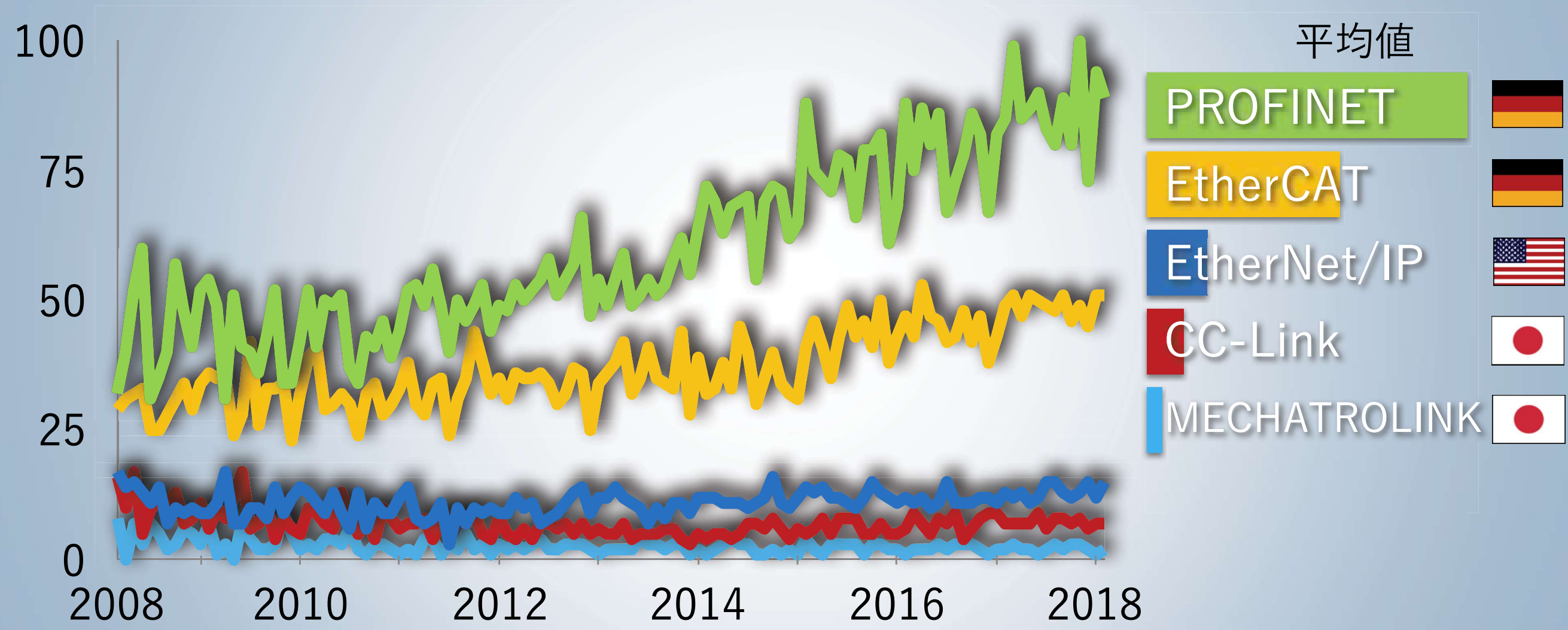
6大陸：58カ国のメンバー



# ドイツ勢が存在感を示す産業用イーサネット



## 各種産業用イーサネットのGoogle Trends比較



Source: Beckhoff Automation based on Google Trends data (2018/3/5)

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EtherCAT  
Technology Group

TOYOTA

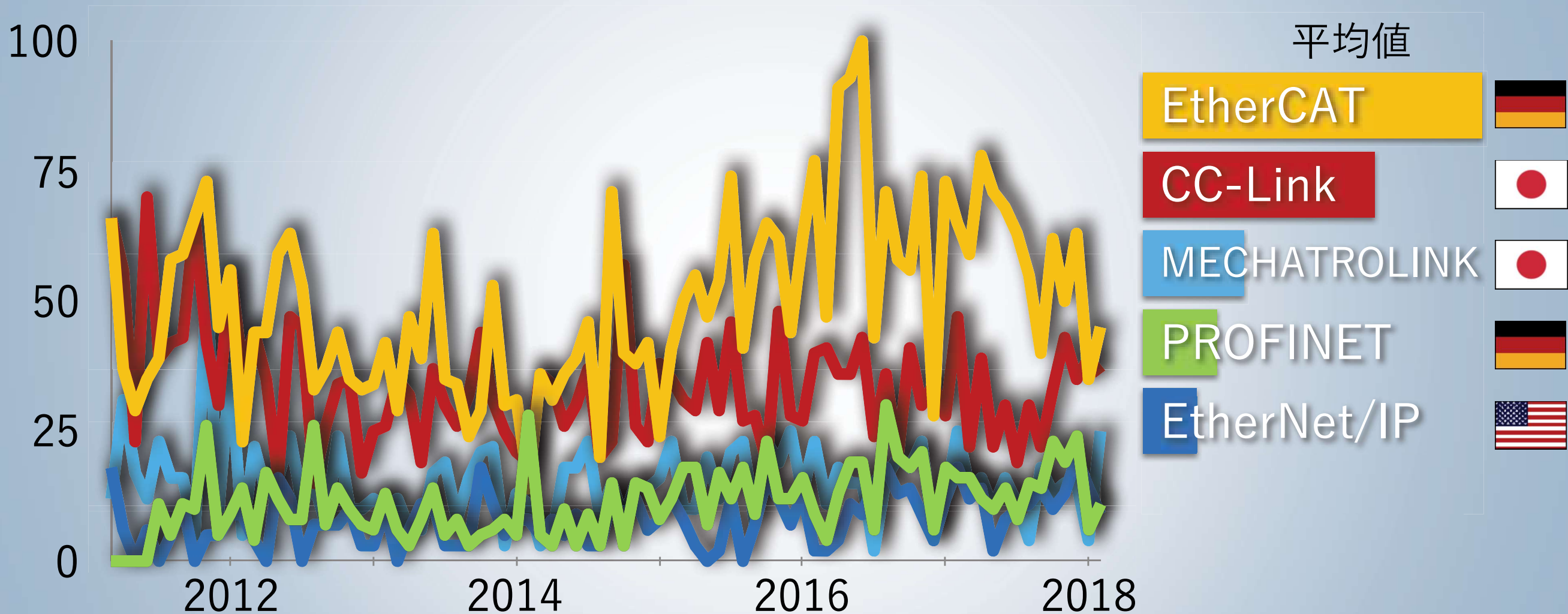
EtherCAT®

etherCAT and 2 separate power supplies on just 4 wires  
chained power supply through EtherCAT P device  
material and assembly costs  
installation space

# 国内でも注目高まるEtherCAT

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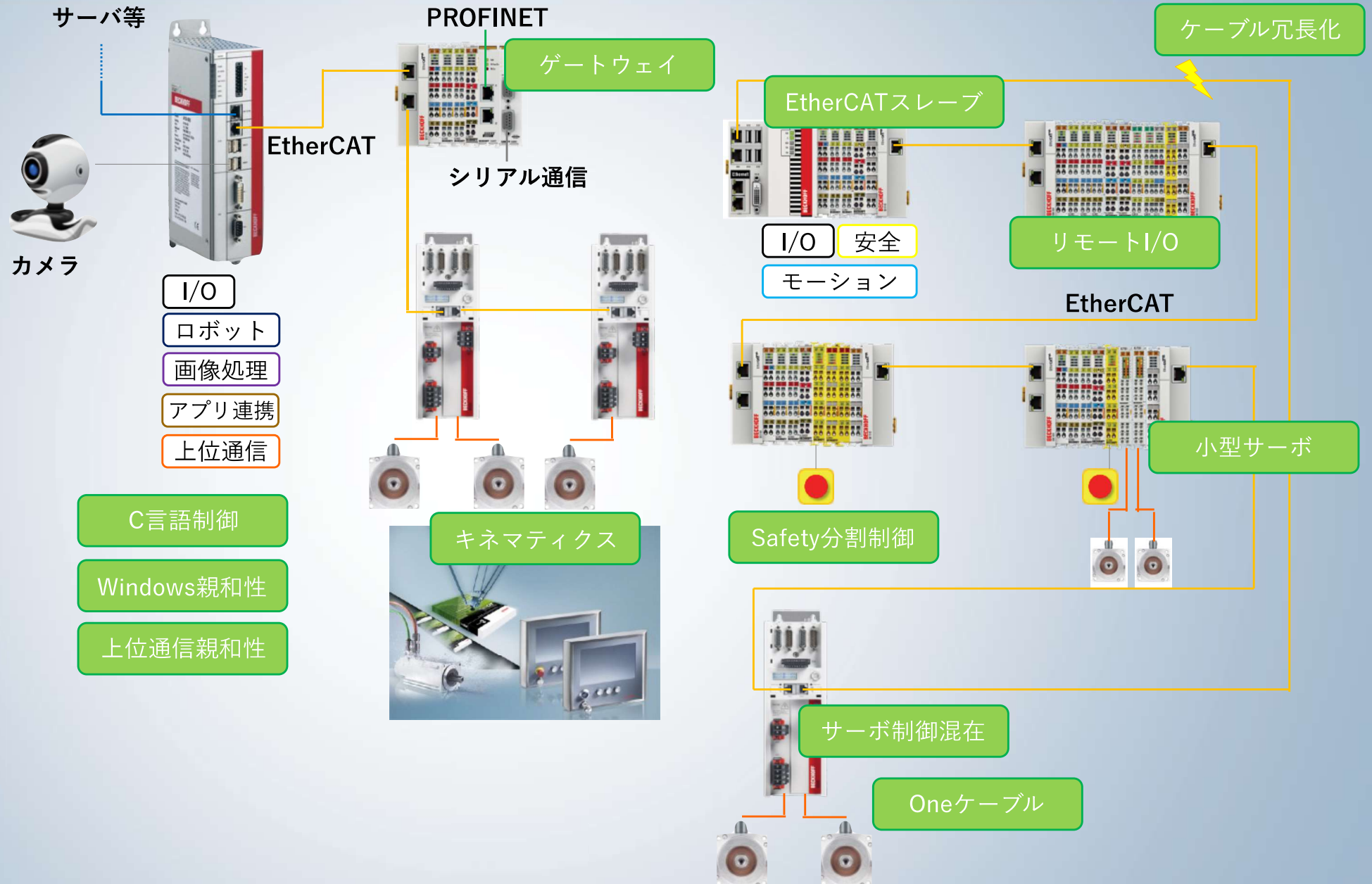
各種産業用イーサネットのGoogle Trends比較（国内）



Source: Beckhoff Automation based on Google Trends data (2018/3/5)

# TwinCAT/ EtherCAT : 単一PCで同期制御・同期計測

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EtherCAT®

# Integrated Industry - Industrial Intelligence

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- エッジ・クラウドソリューション出揃う
- xR: Hololens2への期待集中
- IoT: プラットフォーム乱立
- AI: 事例はまだ予防保全・画像処理が多い
- 既設設備のIoT化手段のニーズ高い
- 標準化は静かに進行中

# 5Gへの期待高まる

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# シーメンス：多様なパートナー企業

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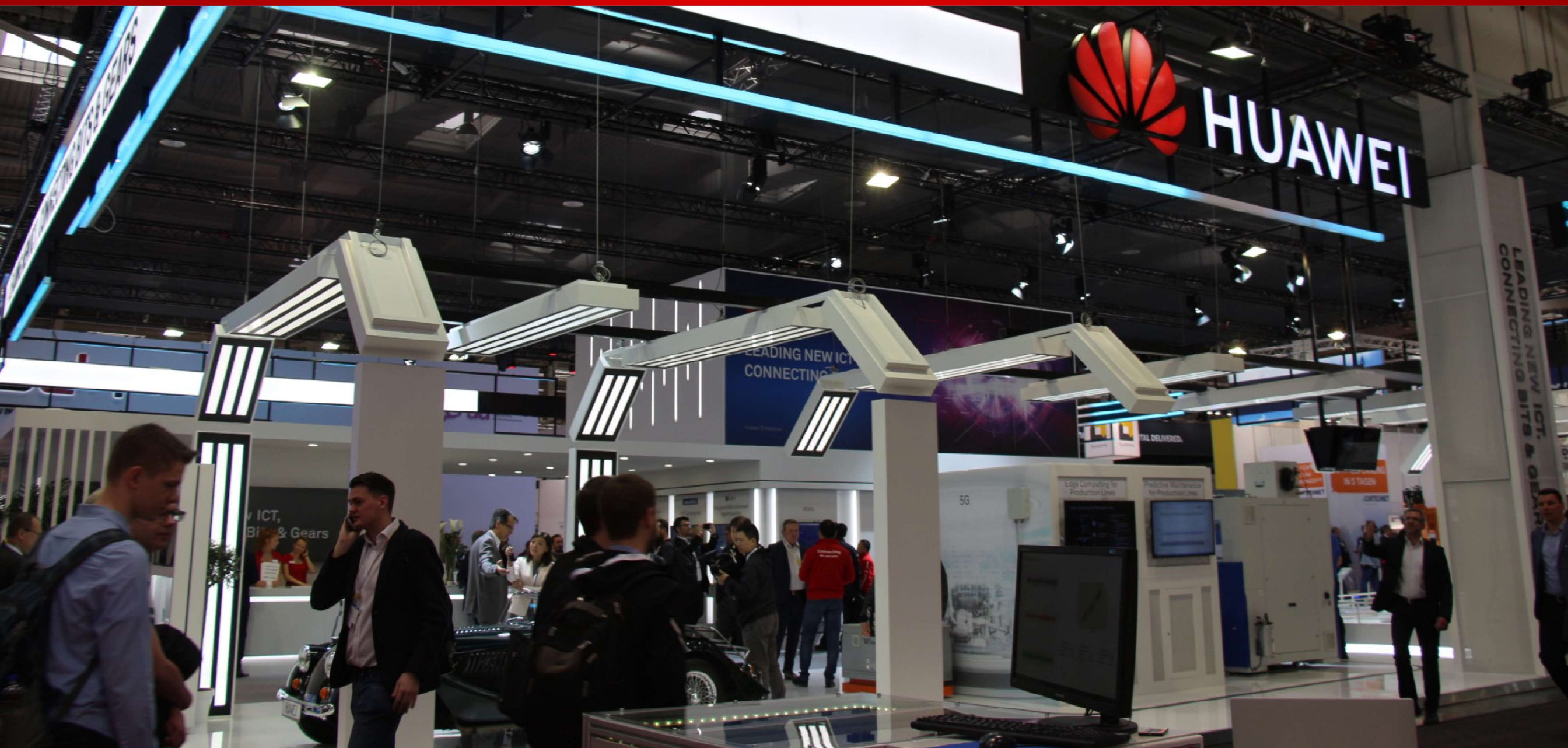
# SAP : 企業を超えたコラボレーション

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# ファーウェイ：5Gインフラの産業用途への展開

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# フェニックスコンタクト：PLC Appオンラインストア

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# シスコシステムズ：OT/ITネットワークを統合管理

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 Microsoft

 Microsoft

Intelligent Manufacturing  
Manufacturing a better future

Reimagine  
Manufacturing

SCAD

ing Motion with Six Degrees of Freedom

 XPlanar



# IVI: コネクテッドインダストリーズオープンフレームワーク

BECKHOFF



Under the patronage of  
Bundesministerium für Wirtschaft und Energie  
Exclusive Partner  
arm  
FIWARE  
HCL  
ORACLE Cloud  
SAP

## Forum Industrie 4.0

Simple and Easy to implement a connected world

Operations in a office and a factory are connected seamlessly by means of data connections with liability

Design Office  
Supplier  
Customer Center  
Machine Shop floor  
Automation  
Maintenance Service

Batch transfer  
Data is distributed in a form of encrypted file. This is not real-time basis, but reliable.

Simple protocol  
Same as a good office, data is sent without handshake process.

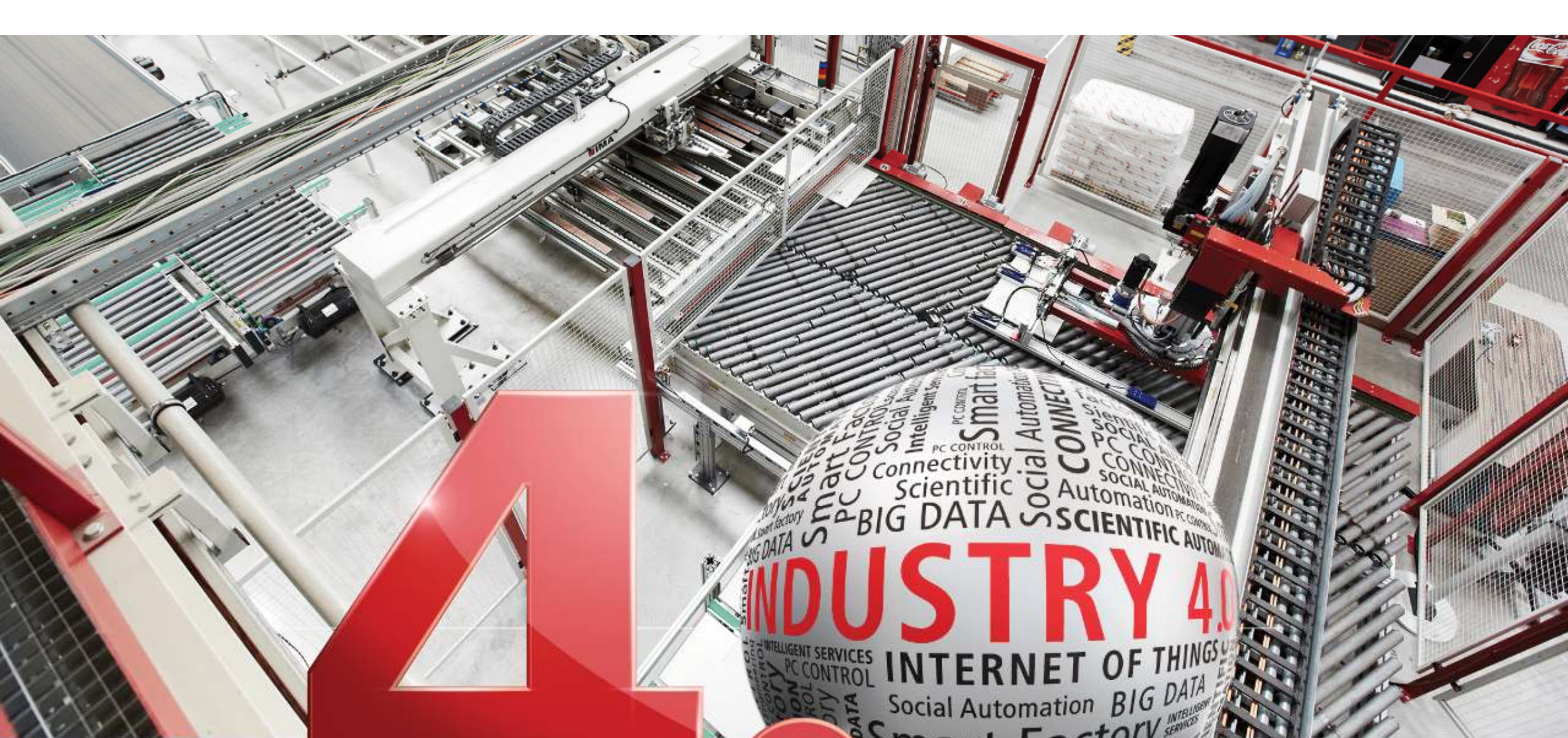
peer to peer  
Data is not stored in the Internet, so that security management is feasible.

IVI

In cooperation with  
INDUSTRIE 4.0  
VDMA  
ZVEI  
Deutsche Messe  
Associated Partner  
ri  
Media Partner  
etz  
SPS  
vdi nachrichten

HANNOVER MESSE  
HOME OF INDUSTRIAL PIONEERS





**4**

**INDUSTRY 4.0**

Smart Factory  
PC CONTROL  
Social Automation  
Intelligent Services  
Connectivity  
Scientific  
BIG DATA  
Social CONNECTIVITY  
SCIENTIFIC AUTOMATION  
INTERNET OF THINGS  
Social Automation  
BIG DATA  
Smart Factory  
SCIENTIFIC AUTOMATION  
Integrated Engineering  
Intelligent Services  
Smart Factory



# ドイツの戦略的国策

## Industrie 4.0



# インダストリー4.0プラットフォーム提言書

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# 充実した産官学のクラスタ活動

BECKHOFF



It's owl: Intelligent Technical Systems OstWestfalenLippe

予算 5 億ユーロ最大規模のクラスタ



# ハーレーダビッドソン：マスカスタマイゼーション

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BUILD YOUR OWN >> 2015 ROAD KING

Change Bike Model Save My Bike Builds

**Make it your own** Close x

H-D1™ Customization - design your one-of-a-kind bike with dealer-installed options. Save your bike, print it out and get to an H-D® dealer. It's time to stop dreaming and start building.



**View Current Bike Summary**

MSRP **\$18,449.00** Click to Hide

Base MSRP	\$18,449.00
Factory-Installed Options	\$0.00
Dealer-Installed Options	\$0.00
MSRP	\$18,449.00
<small>(Excludes dealer installation service fees)</small>	
Estimated Monthly Payment	\$369.59
<small>(Actual terms and payments, if any, may vary.)</small>	

9-Spoke Cast Rear Wheel - 16" Black Ice

Undo Redo Start New Bike

Style

Wheels Paint Engine Trim

Fit Function Performance Options Bike Details

Dealer-Installed Dealer-Installed Dealer-Installed Dealer-Installed Dealer-Installed Dealer-Installed Dealer-Installed

BUILD YOUR OWN >> 2015 ROAD KING

Change Bike Model Save My Bike Builds

**Make it your own** Close x

H-D1™ Customization - design your one-of-a-kind bike with dealer-installed options. Save your bike, print it out and get to an H-D® dealer. It's time to stop dreaming and start building.



**View Current Bike Summary**

MSRP **\$18,899.00** Click to Hide

Base MSRP	\$18,449.00
Factory-Installed Options	\$450.00
Dealer-Installed Options	\$0.00
MSRP	\$18,899.00
<small>(Excludes dealer installation service fees)</small>	
Estimated Monthly Payment	\$378.61
<small>(Actual terms and payments, if any, may vary.)</small>	

Superior Blue Start New Bike

Style

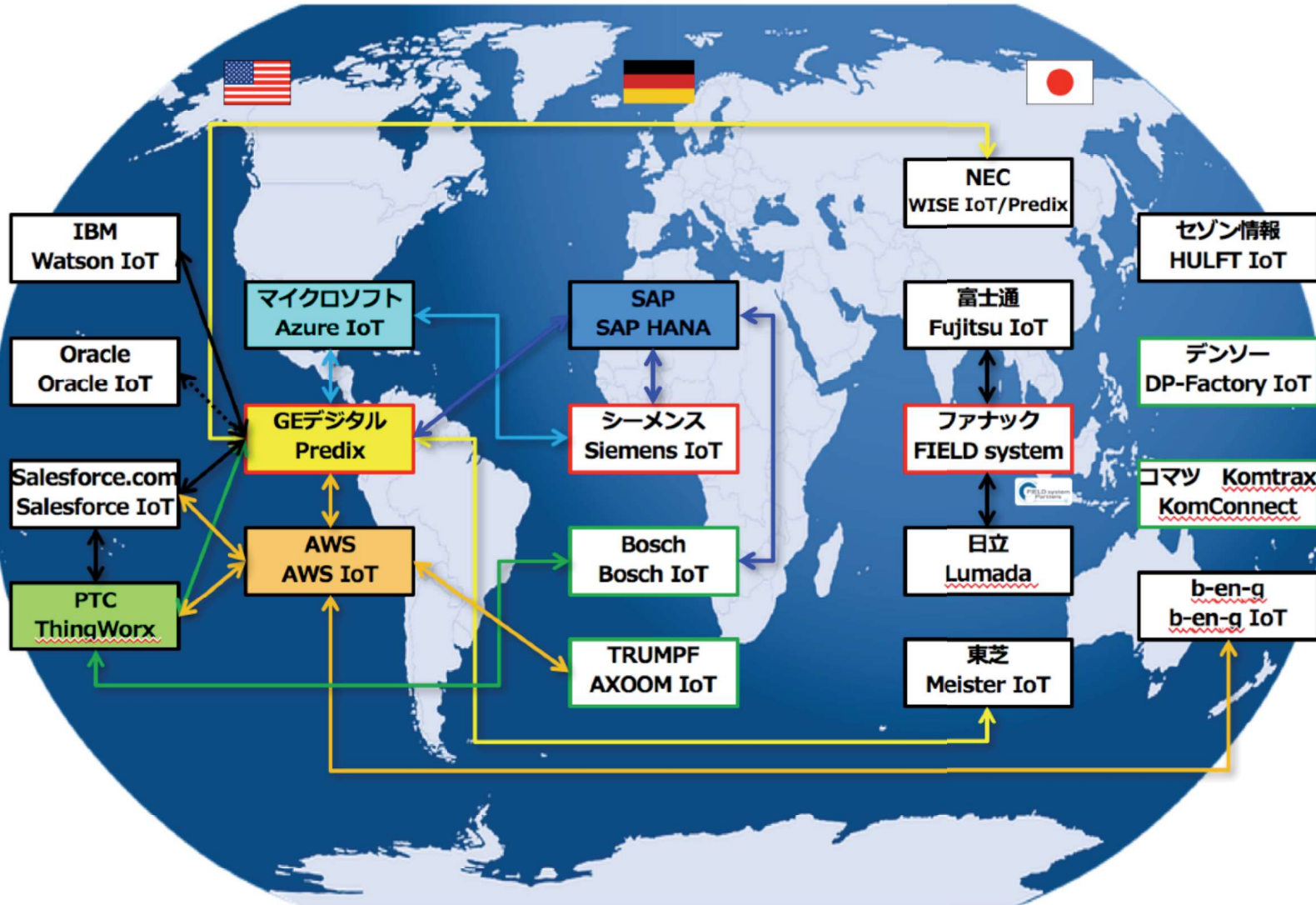
Wheels Paint Engine Trim

Fit Function Performance Options Bike Details

Factory-Installed Factory-Installed Factory-Installed Factory-Installed Factory-Installed Factory-Installed Factory-Installed

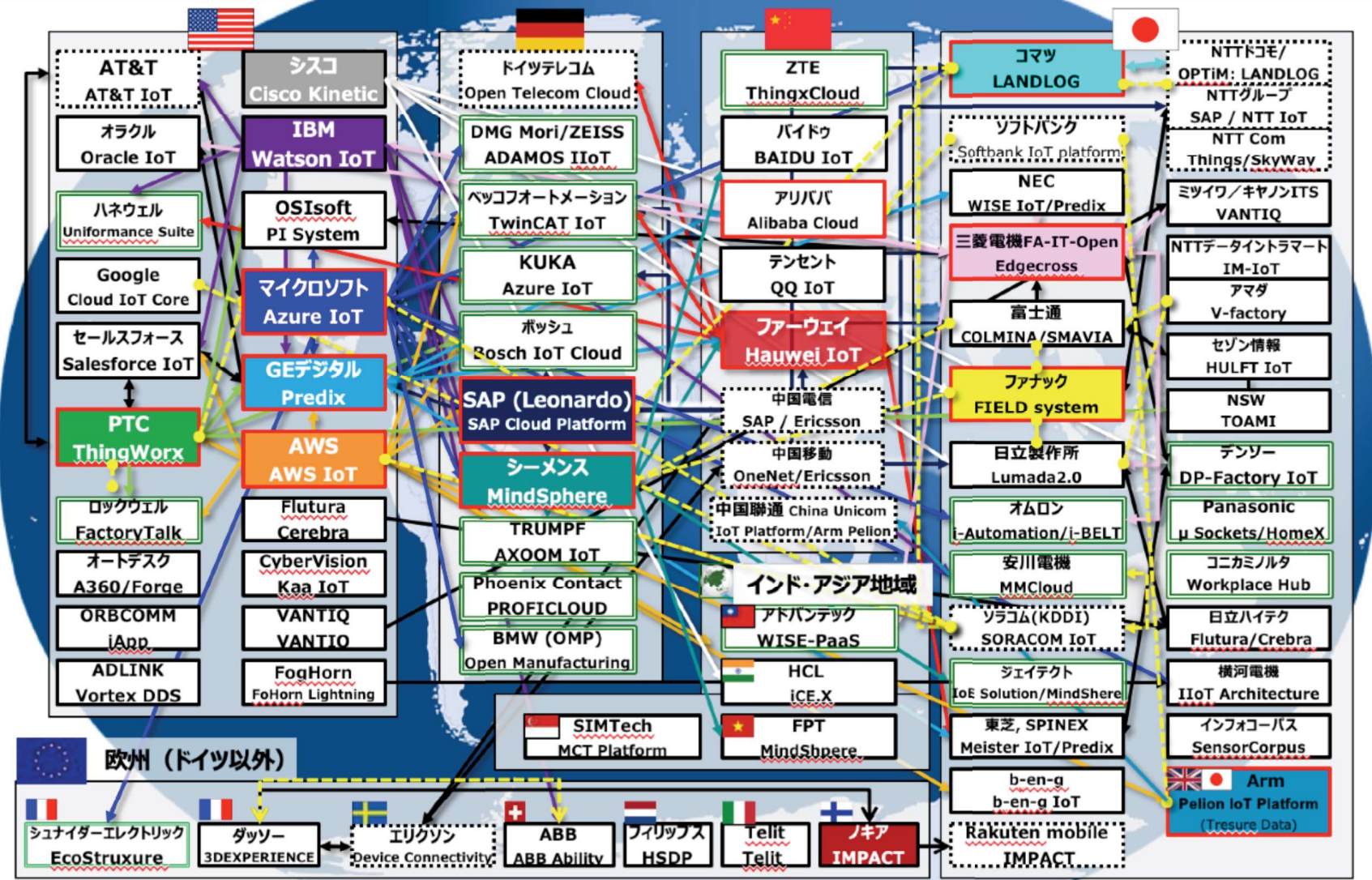
# IoTプラットフォーム百花繚乱：戦国時代の始まり

## 5. IoTプラットフォーム 米独日主要ベンダ関連図(参考) 製造業系



# IoTプラットフォーム百花繚乱：戦国時代の始まり

IoTプラットフォーム動向：主要ベンダ相関図 2019年4月版  
 ※この図の読み方について：<http://www.sbbit.jp/article/cont1/33530>



出典：  
フロンティアワン

# 実践戦略：インダストリー4.0

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2015年8月31日：日本語版公開

BECKHOFF



ZVEI:  
Die Elektrobranche

## インダストリー4.0 実現戦略

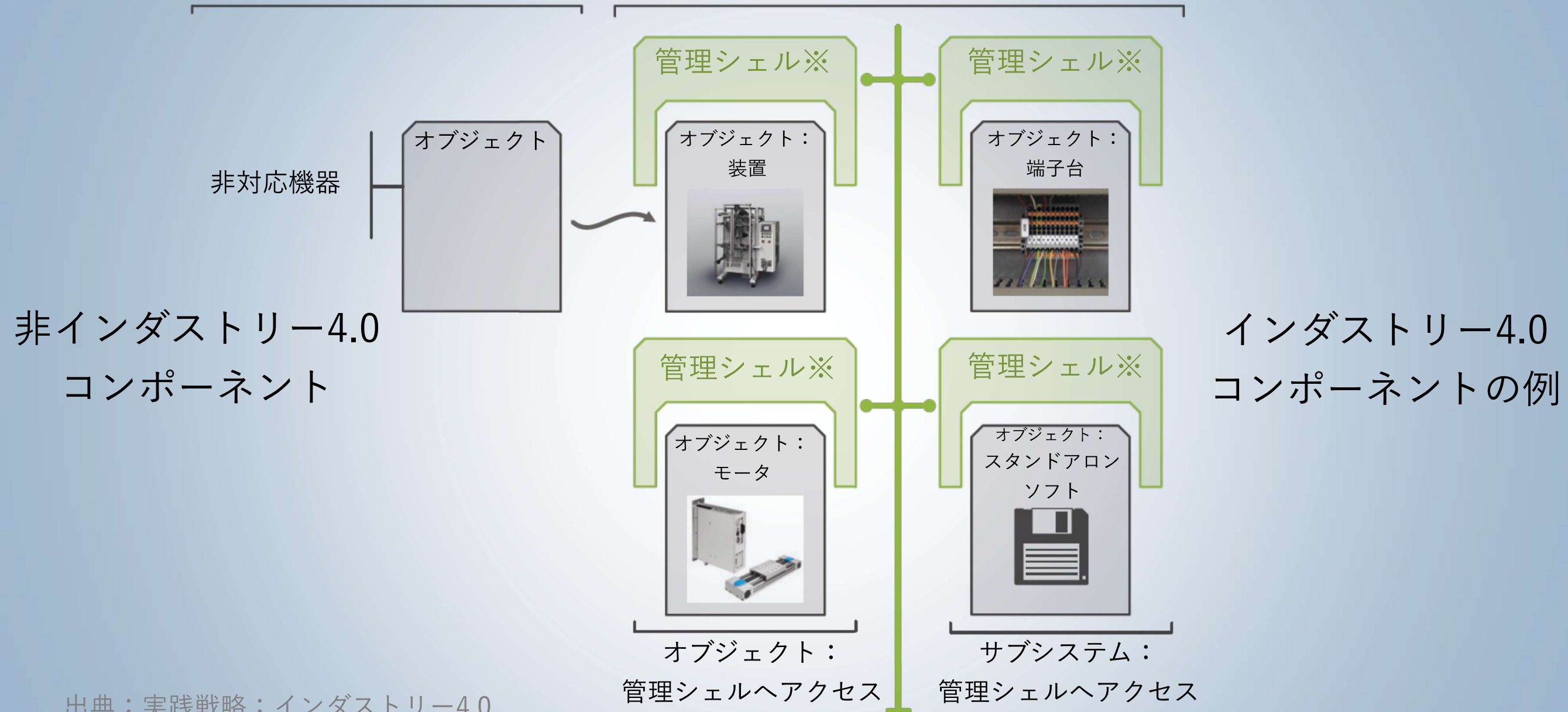
プラットフォーム・インダストリー4.0調査報告

2015年4月

JETRO

# インダストリー4.0コンポーネント

BECKHOFF



# 1<sup>st</sup> World Interoperability Conference

Networking with OPC UA Standardization groups

**01 April**  
**2019**

12:00 pm to 15:30 pm  
Hall 19 - room New York  
Hannover Messe

Registration  
[www.opcfoundation.org/wic2019](http://www.opcfoundation.org/wic2019)



## „World Interoperability Conference“

**353 registered attendees**

- **Host:**
  - **Hannover Messe & OPC Foundation & VDMA & FieldComm Group**
- **32 Organizations & groups presenting**
- **Agenda**

12:00 noon	Keynotes
13:30 h	Thematic Round 1
14:15 h	Thematic Round 2
15:00 h	Thematic Round 3
15:30 h	End of the event

Hosting Organizations:

Representing: Conference Host, Industrial Interoperability, Manufacturing Industry, Process Industry

### Presenting Organizations

Logos of presenting organizations: aim, <AutomationML>, CEMAFON, DEXPI, DIN, EUROMAP, EUMABUS, FOTGROUP, FIELDCOMM GROUP, IEC, IEC61850, IEC61970, ISE61400-25, INTERNATIONAL DATA SPACES ASSOCIATION, ISA, ISA-95, LNI4.0, MDIS, MTConnect, NAMUR, OMAC, OPC FOUNDATION, THE Open GROUP, PLCopen, umati, VDMA, VDW, ZVEI.



**OPC UA**  
The Industrial Interoperability Standard

**Engineering**

- <AutomationML/>
- ISA ISA 95
- PLCopen
- International Data Spaces
- DIN
- Openfog
- IT
- Industries
- Process Automation
- THE Open GROUP
- DEXPI
- NAMUR
- PIA Group
- POT GROUP

**IO Level**

- EtherCAT
- ODVA
- IO-Link
- CI A
- PI
- POWERLINK
- CLPA
- sercos international

**Energy**

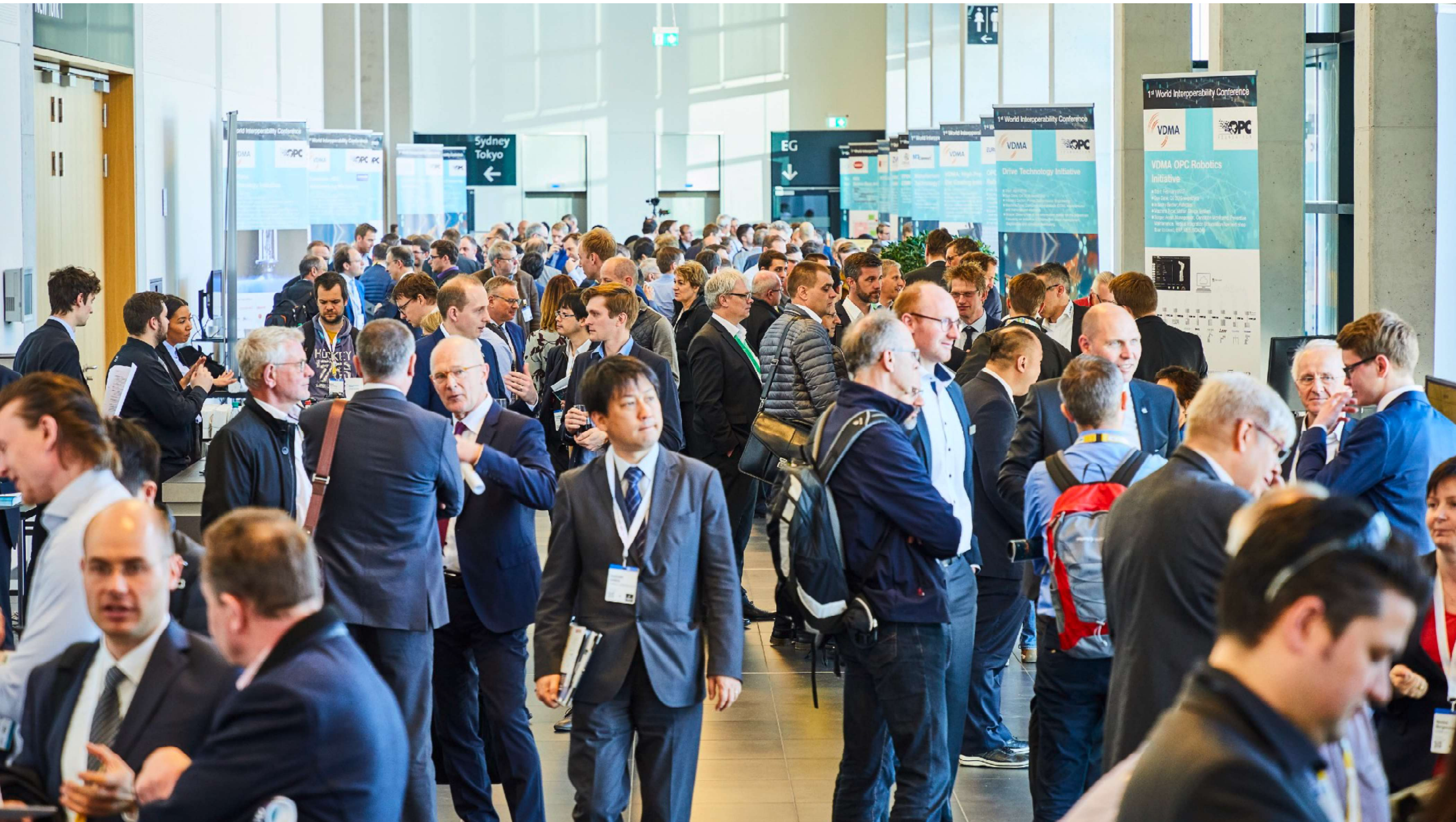
- W3C
- energestics
- IEC
- INDUSTRIE 4.0
- Consortia
- LNI 4.0
- IV

**Factory Automation**

- VDMA (171)
- ZVEI
- aim
- CENAFON
- EUMABUS
- EUROMAP
- VDW
- OMAC
- umati
- WFA
- MT Connect

**OPC FOUNDATION**

**1st World Interoperability Conference**  
Networking with OPC UA  
Standardization groups  
07 April 2016



# OPC Foundation

<https://opcfoundation.org>

- ▶ Vision
  - Secure & reliable
  - Vendor, platform, and domain agnostic
  - interoperability from sensor to enterprise and beyond
- ▶ Global Profile
  - Non profit organization (founded 1995)
  - Companies from Automation & IT
  - Internationally Recognized: OPC UA is IEC62541

## Deliverables

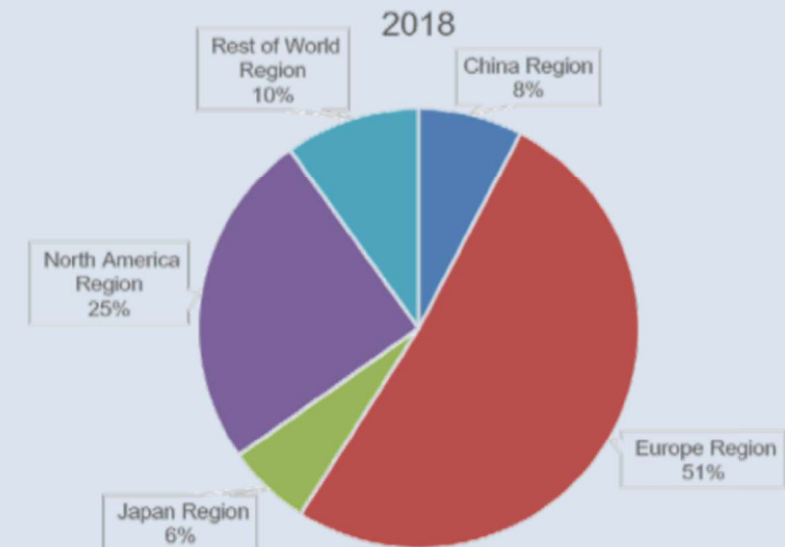


- Specifications: openly available
- Tools and code examples for faster, easier adoption (AnsiC/C++, C# .NET Standard, Java)
- Certification: OPC Labs open to everyone

- ▶ Ecosystem with toolkits and education

## Organizational Overview

**Membership:** 672 (April 1<sup>th</sup>, 2019)



## 2019 Board of Directors

Microsoft	Honeywell	Rockwell,
SAP	Yokogawa	Schneider,
Siemens	ICONICS	ABB
Beckhoff	Ascolab	

# History: Humans had to learn how machines think and work

DATA TABLE 5
WORD0 = 0x5128
WORD1 = 1111000010101001
WORD2
WORD3
WORD255

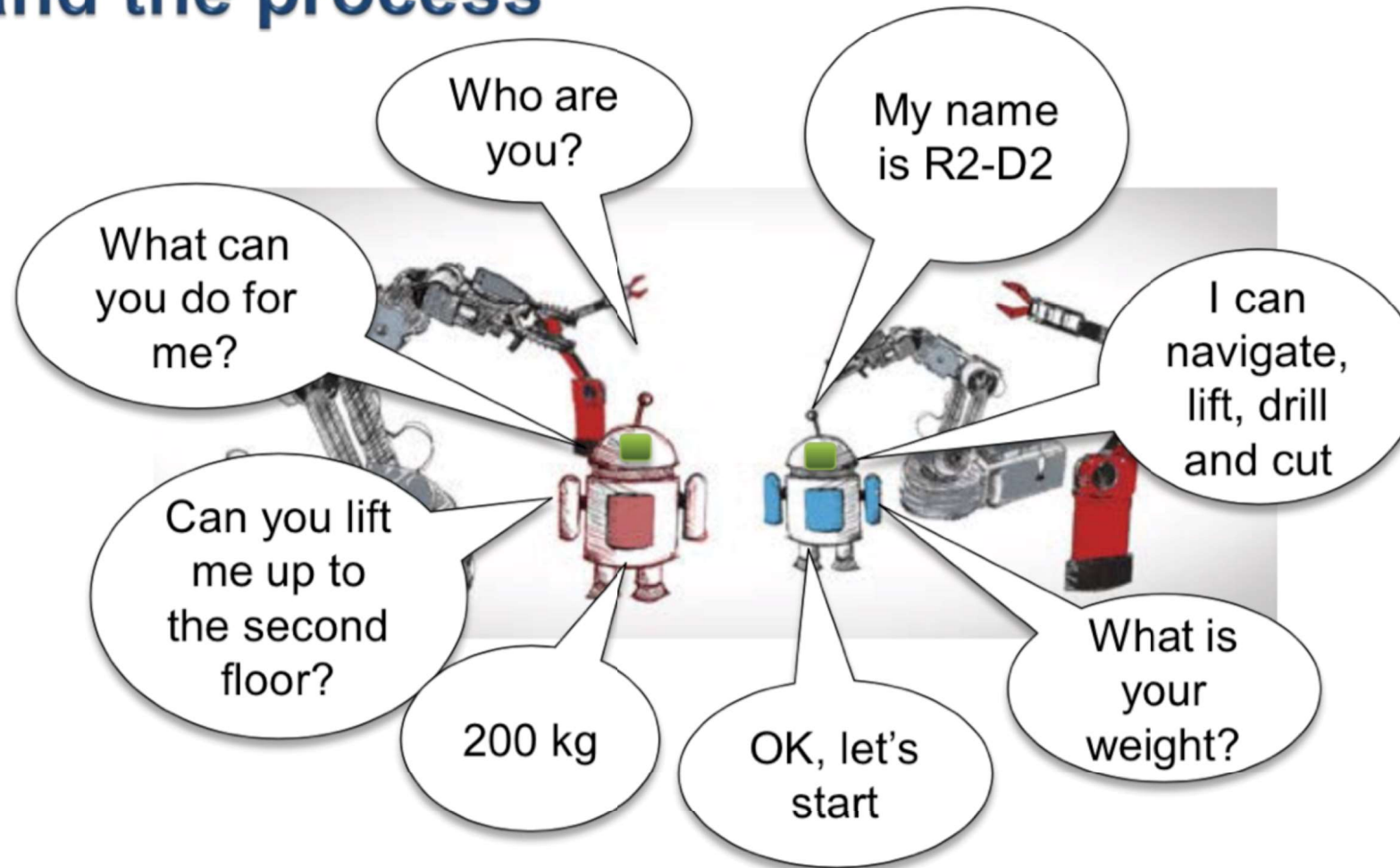


- Huge documentation efforts
- Different parameters for different vendors
- High efforts for humans to understand



Instead:  
Machines should help humans  
in “their language”!  
Self-description reduces  
engineering

# Today: Machines help humans to easier understand the process



The self-description reduces configuration effort and supports quick understanding of information.



# Devices / machines will differentiate e.g. by additional features ... but not interface...

## Commercial printers

- Different vendors
- Standardized connectors  
USB / Ethernet
- Support profiles "I am a printer"



- Differentiate by functionality
  - All-in-once scan/fax/print?
  - Double side printing?
  - Colour? Combined or separate?
  - Print speed
  - Print costs
  - Easy to handle and interact

## Industrial devices / machines

- Different vendors
- Standardized connector: OPC UA
- Support profiles "I am an RFID reader"
- Build in security



- Differentiate by functionality
  - Reduce engineering costs
  - Support standards
  - Easy network integration
  - Costs
  - Throughput of machine

INTERNATIONAL DATA SPACES ASSOCIATION



THE Open GROUP

DEXPI  
Data Exchange in the Process Industry

<AutomationML/>



PLCopen®  
for efficiency in automation



Engineering

IT

Industries

Process Automation



PLATFORM INDUSTRIE 4.0

Consortia



Energy



The Industrial Interoperability Standard

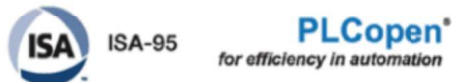
Factory Automation



IO Level



<AutomationML/>

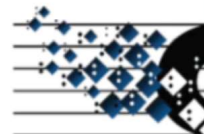


Engineering

INTERNATIONAL DATA SPACES ASSOCIATION



IT



The Indu

VDMA represents the breadth of the manufacturing industry  
VDMA has more than 3200 member companies

- |   |   |  |   |
|---|---|--|---|
| » Agricultural Machinery                                | » Fire Fighting Equipment                           | » Metallurgical Plants and Rolling Mills | » Robotic + Automation                        |
| » Air Conditioning and Ventilation                      | » Fluid Power                                       | » Metallurgy                             | » Security Systems                            |
| » Air Pollution Control                                 | » Food Processing Machinery and Packaging Machinery | » Micro Technologies                     | » Software and Digitization                   |
| » Air-handling Technology                               | » Foundry Machinery                                 | » Mining                                 | » Surface Treatment Technology                |
| » Building Control and Management                       | » Gas Welding                                       | » Plastics and Rubber Machinery          | » Textile Care, Fabric and Leather Technology |
| » Cleaning Systems                                      | » Hydro Power                                       | » Power Systems                          | » Textile Machinery                           |
| » Compressors, Compressed Air and Vacuum Technology     | » Integrated Assembly Solutions                     | » Power Transmission Engineering         | » Thermal Turbines and Power Plants           |
| » Construction Equipment and Building Material Machines | » Large Industrial Plant Manufacturing              | » Precision Tools                        | » Thermo Process Technology                   |
| » Drying Technology                                     | » Lifts and Escalators                              | » Printing and Paper Technology          | » Valves                                      |
| » Electrical Automation                                 | » Machine Tools and Manufacturing Systems           | » Process Plant and Equipment            | » Waste Treatment and Recycling               |
| » Electronics, Micro and Nano Technologies              | » Machine Vision                                    | » Productronic                           | » Wind Energy                                 |
| » Engine Systems for Power and Heat Generation          | » Materials Handling and Intralogistics             | » Pumps + Systems                        | » Woodworking Machinery                       |
| » Engines and Systems                                   | » Measuring and Testing Technology                  | » Refrigeration and Heat Pump Technology | » OPC UA CS Release (Candidate)               |
|   |   | » Robotics                               | » OPC UA CS under development                 |
|   |   |  | » Awareness existent                          |

VDMA | Dr. Reinhard Heister

Seite 10 | July 7, 2018

Consortia



Energy



Factory Automation



# Today's position of OPC UA inside the VDMA



- » Agricultural Machinery
- » Air Conditioning and Ventilation
- » Air Pollution Control
- » Air-handling Technology
- » Building Control and Management
- » Cleaning Systems
- » Compressors, Compressed Air and Vacuum Technology
- » Construction Equipment and Building Material Machines
- » Drying Technology
- » Electrical Automation
- » Electronics, Micro and Nano Technologies
- » Engine Systems for Power and Heat Generation
- » Engines and Systems

- » Fire Fighting Equipment
- » Fluid Power
- » Food Processing Machinery and Packaging Machinery
- » Foundry Machinery
- » Gas Welding
- » Glass Industry
- » Hydro Power
- » Integrated Assembly Solutions
- » Large Industrial Plant Manufacturing
- » Lifts and Escalators
- » Machine Tools and Manufacturing Systems
- » Machine Vision
- » Materials Handling and Intralogistics
- » Measuring and Testing Technology

- » Micro Technologies
- » Mining
- » Plastics and Rubber Machinery
- » Power Systems
- » Power Transmission Engineering
- » Precision Tools
- » Printing and Paper Technology
- » Process Plant and Equipment
- » Productronic
- » Pumps + Systems
- » Refrigeration and Heat Pump Technology
- » Robotics
- » Security Systems
- » Software and Digitization

- » Surface Treatment Technology
- » Textile Care, Fabric and Leather Technology
- » Textile Machinery
- » Thermal Process Industry
- » Thermal Turbines and Power Plants
- » Valves
- » Waste Treatment and Recycling
- » Wind Energy
- » Woodworking Machinery

OPC UA CS Release (Candidate)

OPC UA CS under development

Awareness existent

# Today's position on OPC UA in the VDMA organizational units



- » Agricultural Machinery
- » Air Conditioning and Ventilation
- » Air Pollution Control
- » Air-handling Technology
- » Building Control and Management
- » Cleaning Systems
- » Compressors, Compressed Air and Vacuum Technology
- » Construction Equipment and Building Material Machines
- » Drying Technology
- » Electrical Automation
- » Electronics, Micro and Nano Technologies
- » Engine Systems for Power and Heat Generation
- » Engines and Systems

- » Fire Fighting Equipment
- » Micro Technologies

- » Surface Treatment Technology
- » Textile Care, Fabric and Leather Technology
- » Textile Machinery
- » Thermal Process Industry
- » Thermal Turbines and Power Plants
- » Valves
- » Waste Treatment and Recycling
- » Wind Energy
- » Woodworking Machinery
- » OPC UA CS Release (Candidate)
- » OPC UA CS under development
- » Awareness existent

- » Measuring and Testing Technology

## Rapid increase of new OPC UA CS working groups

- » More than 15 VDMA sector units under discussion
- » Over 17 VDMA sector units in active implementation
- » About 23 OPC UA CS working groups
- » Over 350 companies are involved
  - » ME, ET, IT, Automotive, ...

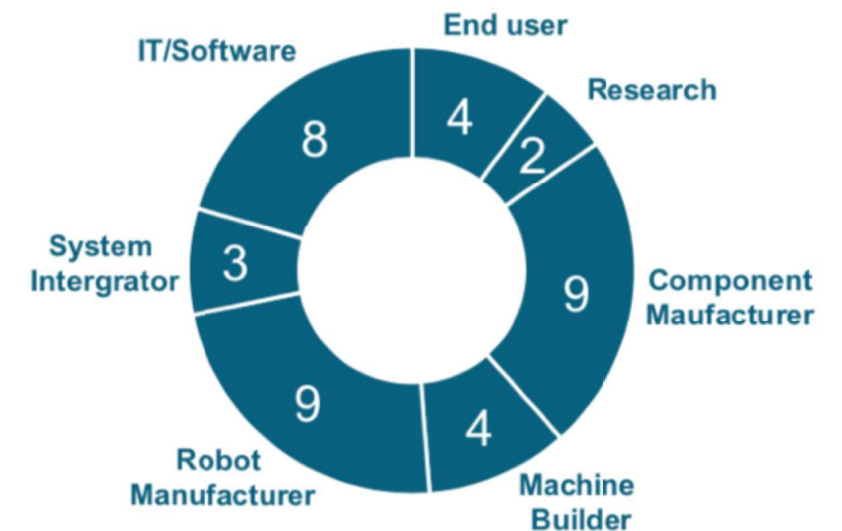
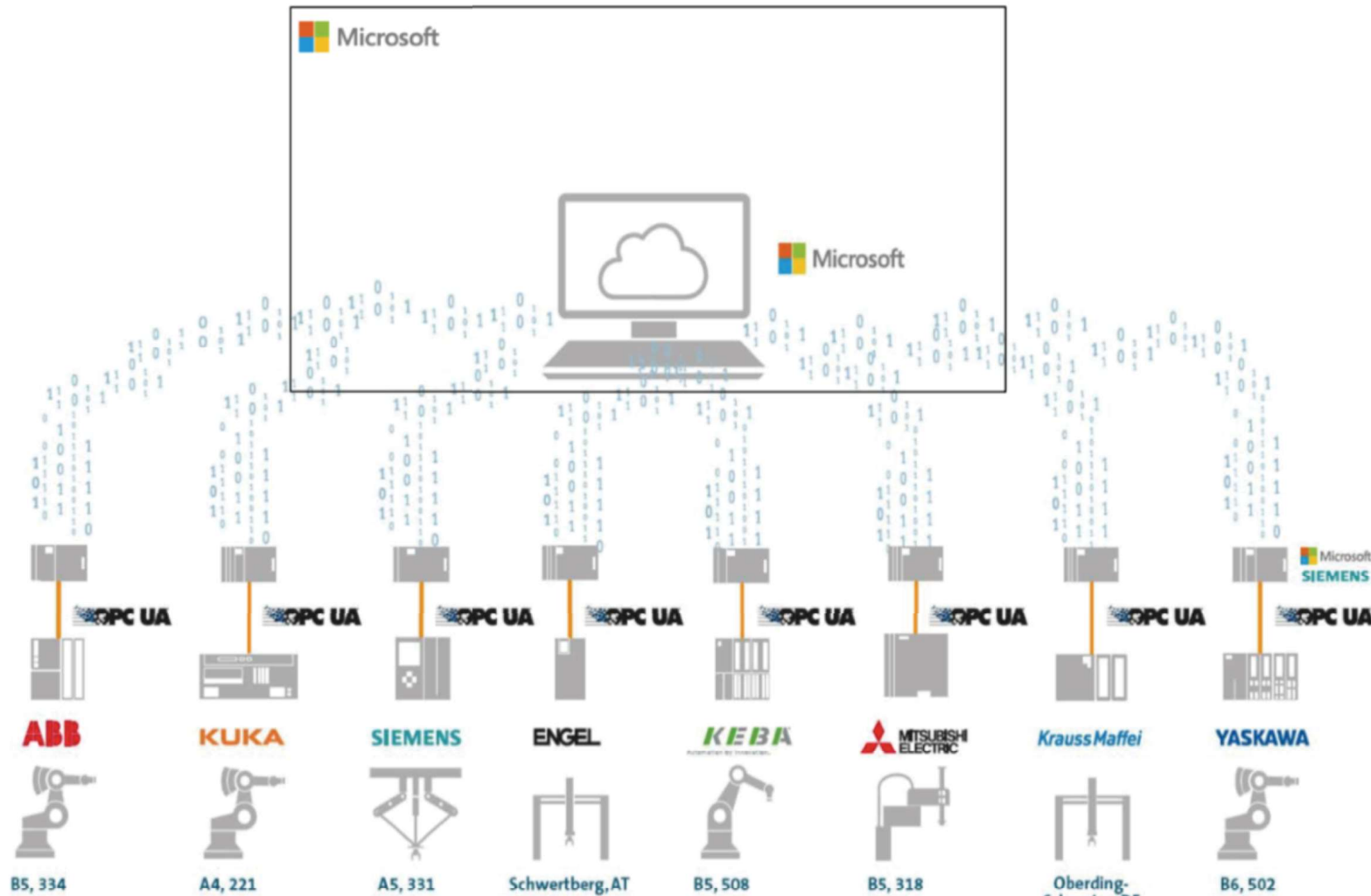
# OPC UA Companion Specifications are implemented

## - Demonstrator VDMA OPC Robotics Initiative



### Applications of this demonstrator

- » Asset management
- » Condition monitoring
- » Preventive Maintenance
- » Vertical integration
  - Information flow from shop floor to cloud
  - ERP, MES, SCADA

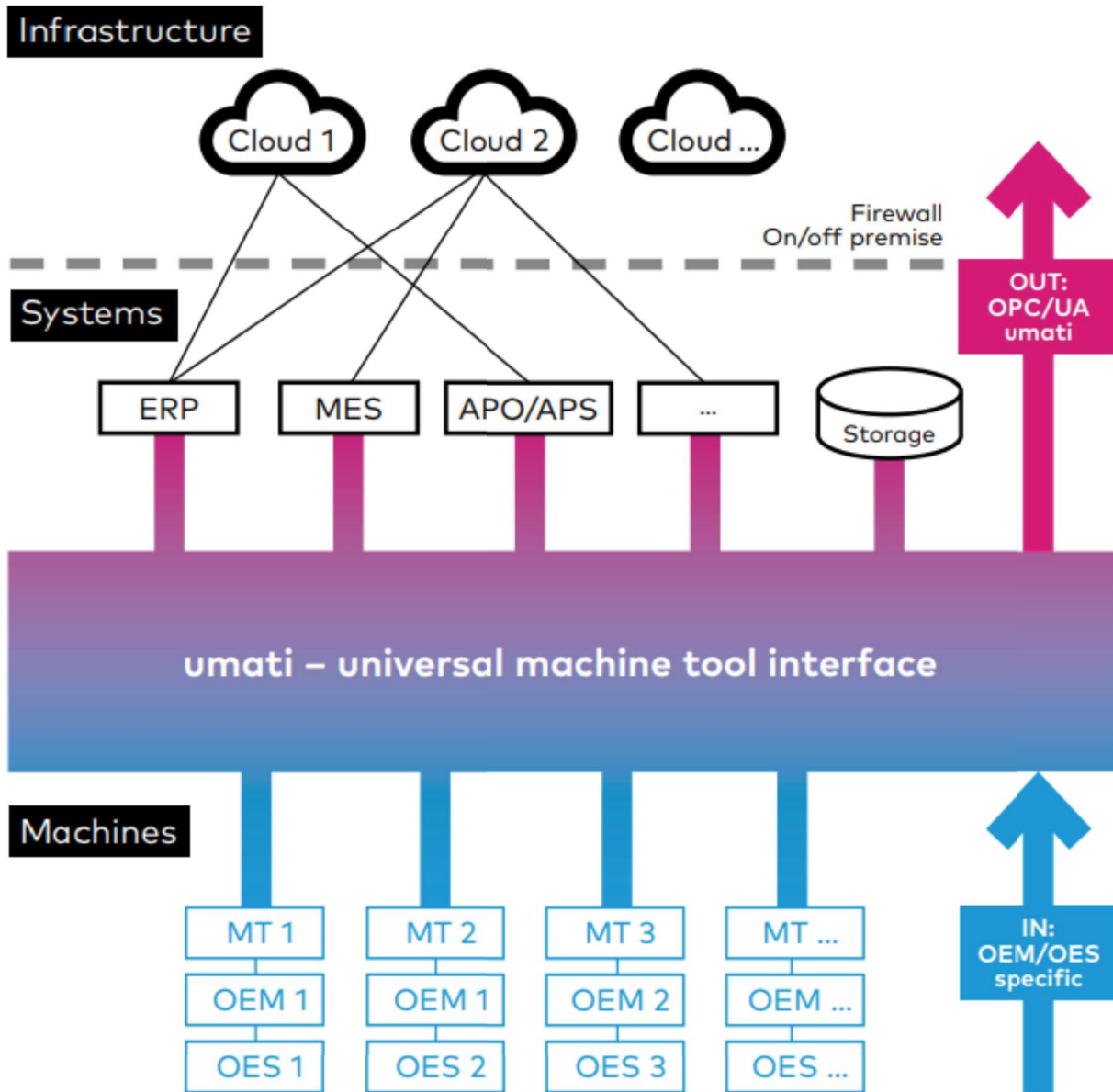




universal  
machine tool  
interface

# umati: 工作機械への接続方法の標準化

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- 工作機械と生産管理ツールが通信するためのデータ規格
- umati に対応する工作機械はどんなシステムからでもデータ収集が可能
- オープンな世界標準規格  
OPC-UAがベース



# VDWがEMO 2019にて仕様を発表予定

BECKHOFF



**Contact:**

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Builders' Association  
Corneliusstraße 4  
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The Institute for Control Engineering of Machine Tools and Manufacturing Units (ISW) of the University of Stuttgart is one of the leading research centers in the field of control engineering – from planning to the tool. The ISW does interdisciplinary research in technologies for the future production and automation. For the industry we are for almost 50 years an innovative and reliably partner for ambitious challenges, from the first idea to the end product.

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HELLER

HEIDENHAIN

LIEBHERR

Pfiffner

rexroth  
A Bosch Company

SIEMENS



# EMO



## Hannover

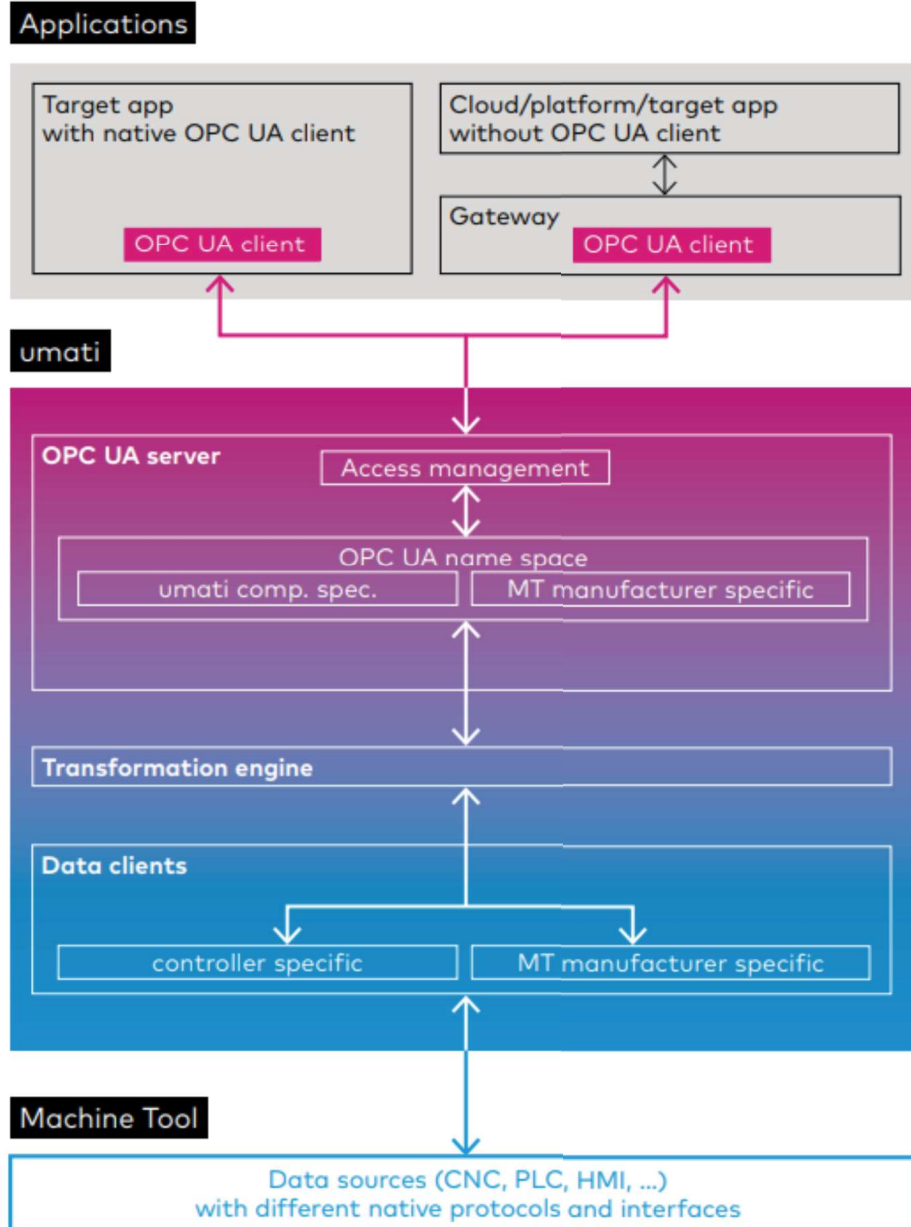
The world of metalworking

*Smart technologies driving tomorrow's production!*



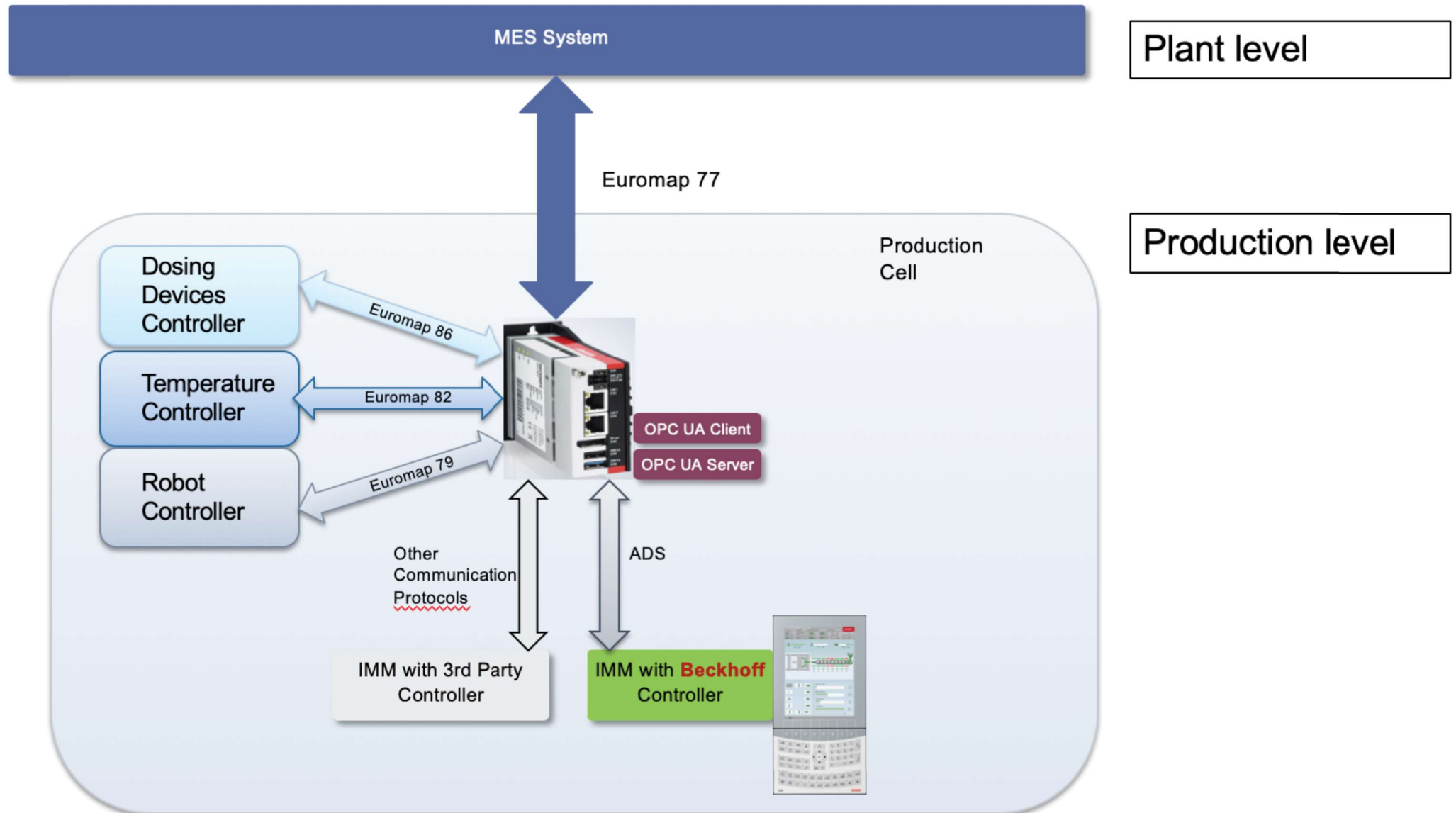
# 標準化により「工作機械 umati 対応端末」も登場予定

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# 樹脂成型機：EUROMAP対応ゲートウェイ登場

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# 工場機器が「IT周辺機器」になる

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- エッジ・クラウドソリューション出揃う
- xR: Hololens2への期待集中
- IoT: プラットフォーム乱立
- AI: 事例はまだ予防保全・画像処理が多い
- 既設設備のIoT化手段のニーズ高い
- 標準化は静かに進行中

**BECKHOFF**