Live-Event: Summit Elektrische Automatisierung

"Elektrische Automatisierung – Klassiker und Zukunftstechnologie"
"Electric automation – conventional and future technologies"

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Elektrische Automatisierung – Klassiker und Zukunftstechnologie

3rd Nov 2021

VOLUME, VARIANCE & VELOCITY –
PERFECTLY ORCHESTRATING DATA STREAMS WITH OPC UA FX

Standardization - future-proofing for users

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Proven due to ongoing practical experience

In technology and business, standardization is the unification of components, production methods, units of measurement, processes, structures, types or goods and services.

The arrangement of brake and accelerator pedal has been the same for decades - even the transition from the combustion engine to the e-car has not changed anything.

https://www.youtube.com/watch?v=IbzYAtKwZeo

Peter Lutz – Director FLC @OPC Foundation, explains OPC UA FX

The QR code - originally conceived by DENSO to mark assemblies and components for automotive production logistics at Toyota - has established itself as a public standard worldwide.

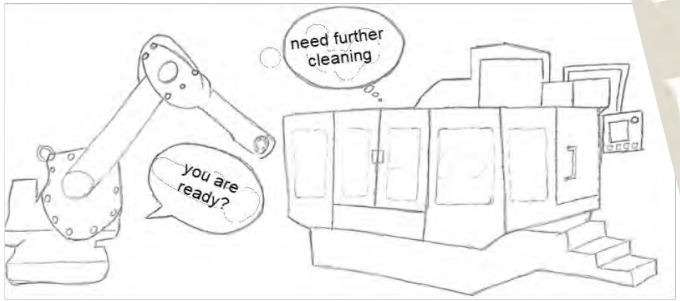
No Industry 4.0 without standards

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Uniform communication in a heterogeneous landscape

Industry 4.0 focuses on the close meshing of production processes, people and "things" (cyber-physical systems). The industrial "Internet of Things" must use a
WORLD LANGUAGE OF PRODUCTION

OPC UA



Open **P**latform **C**ommunications Technology
Unified **A**utomation

The organization behind OPC UA technology

OPC Foundation

OPC FOUNDATION MEMBER

Responsible for development and maintenance

>800 members. The "who is who" of the automation companies is included

Largest ecosystem for industrial interoperability

OPC Foundation – excerpt history of the last years

YEAR	MEMBERS
2016	490
2018 (September)	600
2019	737
2020	803
2021 (August)	840

History - OPC Foundation

The top 3 cloud providers

Google Cloud *year 2020*

Microsoft Azure

aws *year 2021*

Globally leading semiconductor manufacturers

Microchip, intel, Qualcomm, NXP

Large end users

BMW, Volkswagen *year 2018*, L'ORÉAL, Miele, Foxconn, Samsung

Important partner organizations:

OPC 40077, PackML an OMAC standard *year 2019*, PLCopen

Standardization of data models
Companion Specifications

https://youtu.be/odDQ83bzoWE

OPC UA Companion Specifications: vdma.org - VDMA

VDMA

Industry-specific Information Models - > **Companion Specifications**

Well-known companies demand and promote interoperability

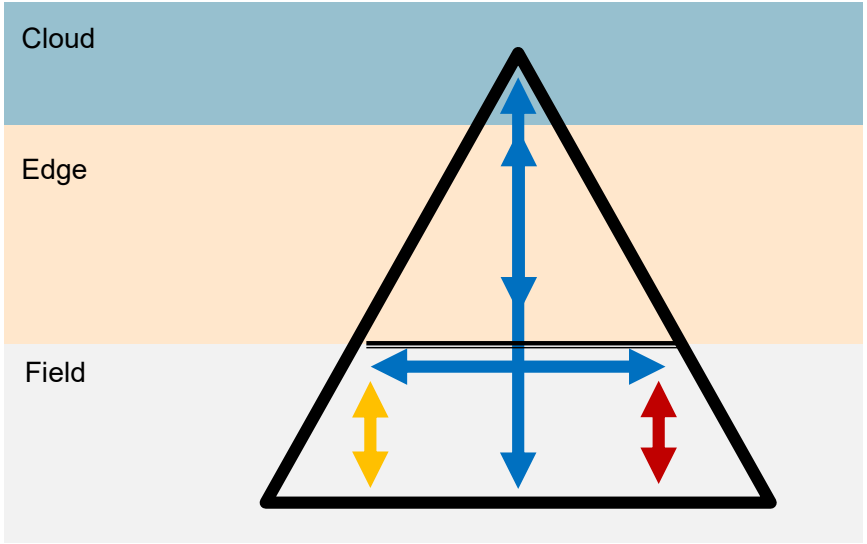
The extension of the OPC UA framework

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

OPC UA FX

extensions for Field eXchange

What is OPC UA FX ?



OPC UA FX also includes OPC UA over TSN !

FX = Field eXchange

OPC UA FX (Field eXchange)
is the name for extensions
to the OPC UA Framework (IEC 62541)
to bring OPC UA to the field level.

OPC UA FX is supporting the various use cases in Factory Automation and Process Automation, including:

- Real-Time
- Motion
- Remote I/Os
- Functional Safety
- Instrumentation

New term OPC UA FX

OPC UA from sensor to cloud

OPC UA (IEC62541) Technology

OPC UA is much more than just a protocol – it's a framework to define and exchange standardized data with included (built in by design) end-to-end security over multiple protocols.

- **OPC UA technology brochure**, available here
- **OPC UA technology videos**, available here

5 short videos (each 6min-15min) provide an excellent starting point to get more information about "OPC UA Concepts", "OPC UA Transport", "OPC UA Security", "OPC UA Profiles" and "OPC UA Discovery"

- **"OPC UA Security deep dive" video**, available here

OPC UA FX Specifications extensions

The vision of the OPC Field Level Communications (FLC) initiative – started in November 2018 – is to bring OPC UA down to the field and extend the existing OPC UA framework to meet all the requirements of industrial automation and to develop one harmonized solution for industrial interoperability in factory automation but also process automation. The extensions include:

CONTROL ENGINEERING

The initial release candidate (RC1), which focuses on controller-to-controller (C2C), consists of four parts (Parts 80-83) that specify how automation controllers exchange process data and configuration data using OPC UA Client/Server and PubSub extensions in combination with peer-to-peer connections and basic diagnostics.

These parts are extensions to the OPC UA framework and are labelled with OPC UA FX (Field eXchange):

- Part 80 (OPC UA FX 10000-80) provides an overview and introduces the basic concepts of using OPC UA for Field eXchange.
- Part 81 (OPC UA FX 10000-81) specifies the base information model and the communication concepts to meet the various use cases and requirements of Factory and Process Automation.
- Part 82 (OPC UA FX 10000-82) describes networking services, such as topology discovery and time synchronization.
- Part 83 (OPC UA FX 10000-83) describes the data structures for sharing information required for offline engineering using descriptors and descriptor packages.

A 40-page technical paper also was published that explains the overall plan and technical approach.

AutomationWorld SUBSCRIBE PRODUCTS FACTORY PROCESS DOWNLOADS NEWSLETTERS

The OPC Foundation announced updates about the status of OPC UA FX during its 2021 OPC Day International online event. According to Peter Lutz, field level communications director at the OPC Foundation, "We are defining two communication profiles to map the OPC UA information models to the underlying network and transport protocols by supporting a UDP IP protocol as a routable, flexible protocol as well as supporting a direct Layer 2 mapping for highly efficient communication inside a machine, such as for distributed I/Os or high-speed motion control."

Peter Lutz, field level communications director at the OPC Foundation.

The approach the OPC Foundation is taking here will also reportedly allow for adaptation of the OPC UA communication profiles to future communication standards and technologies, such as 5G. Lutz noted that the OPC Foundation is working with the 5G Alliance for Connected Industries and Automation to support 5G inside the OPC UA framework, in addition to support for wireless communication and future extensions to other wireless standards, such as Wi-Fi 6 and Wi-Fi 7.

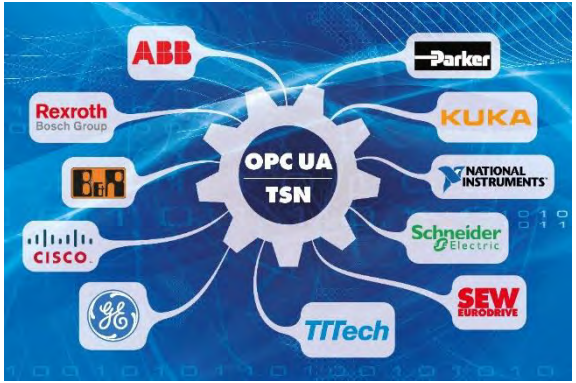
Status of OPC UA FX

The first OPC UA FX specification release has recently been completed and consists of four parts, which are being used to prototype and create test specifications as well as test scripts for the certification tool of the OPC Foundation. Lutz added that these

How all began with Field Level Communications

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

2016



B&R and TTTech have initiated the „Shapers Group“

End of 2018

molex MOXA MURR ELEKTRONIK OMRON PHOENIX CONTACT PILZ Rockwell Automation Schneider Electric SIEMENS TTTech WAGO YOKOGAWA
ABB BECKHOFF rexroth A Bosch Company B&R CISCO hilscher HIRSCHMANN HUAWEI intel kalycito KUKA MITSUBISHI ELECTRIC

*Mission: “To aim for an open, unified, standards-based IIoT communication solution between sensors, actuators, controllers and cloud addressing all requirements of industrial automation.”**

FLC – now integral part of OPC Foundation

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

2018

The **Field-Level Communications Initiative** (FLC) was launched: **27** leading automation companies and technology providers lead the group. A total of **320** experts from **65** OPC member companies are working in various groups

FLC **to extend OPC UA to meet all field-level requirements, such as Real-time, Safety, and Motion**

OPC UA

2019 / 2020

2021 OPC UA FX (Field eXchange) – Release Candidate 1 Completed

Deep dive in OPC UA and in particular FLC

https://youtu.be/DPqPVkWUEAA

2021 / 2022 The first goal of this OPC UA extension is the realization of a standardized horizontal **controller-to-controller (C2C)** communication

Multivendor demos for key trade fairs in Asia, USA and Europe - starting with SPS 2021 in Nuremberg

sps
smart production solutions
Nürnberg, 23. – 25.11.2021

2022 / 2023 followed by the extension of **controller –to-device (C2D)** and also between devices

FLC – now integral part of OPC Foundation

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

2018

FLC

to harmonize the requirements from process and factory automation

OPC UA

2020

OPC Foundation Welcomes Emerson to Its Board of Directors

10/10/2020

Emerson also joins the OPC Foundation Field Level Communications (FLC) initiative to drive a holistic approach to sensor and device level communications across process and factory automation industries.

2021

ARC View OPC UA

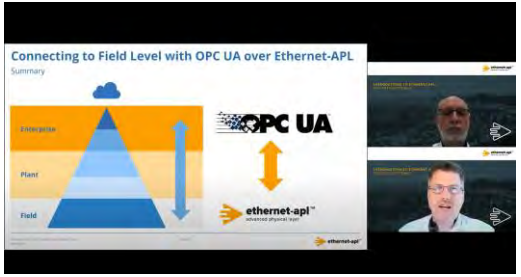
This report provides an executive overview examining the reasons behind the growing importance of OPC UA versus other industrial interoperability technologies, especially for the process industries.

ARC Advisory Group

2021

ACHEMA

at the heart of process engineering



https://youtu.be/K_Yyo37-lXM?t=4

State of the art

The classic automation pyramid

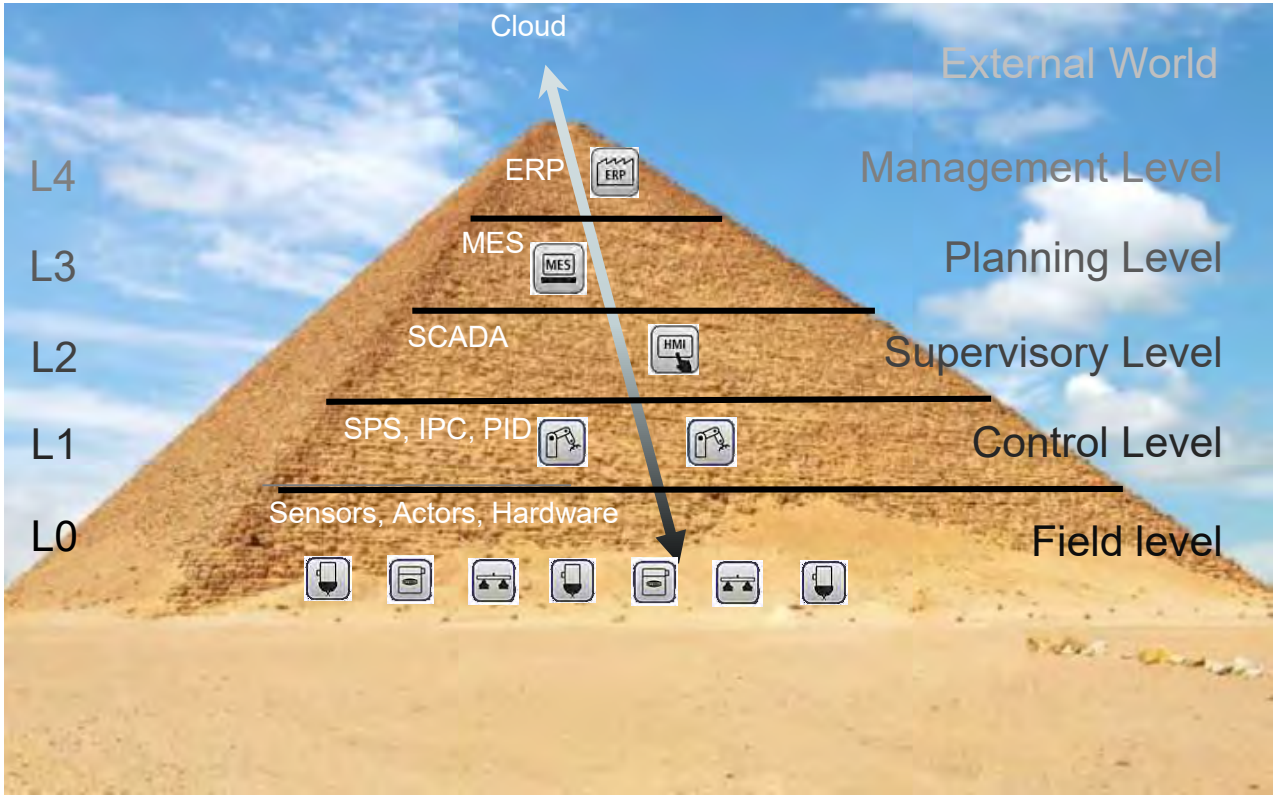
PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Today's world
in production facilities

Stringent separation
of the different
process levels

Exchange of information
only between neighboring levels,
Specialization

L0-L1, L1-L2, L2-L3, L3-L4, L4-L5



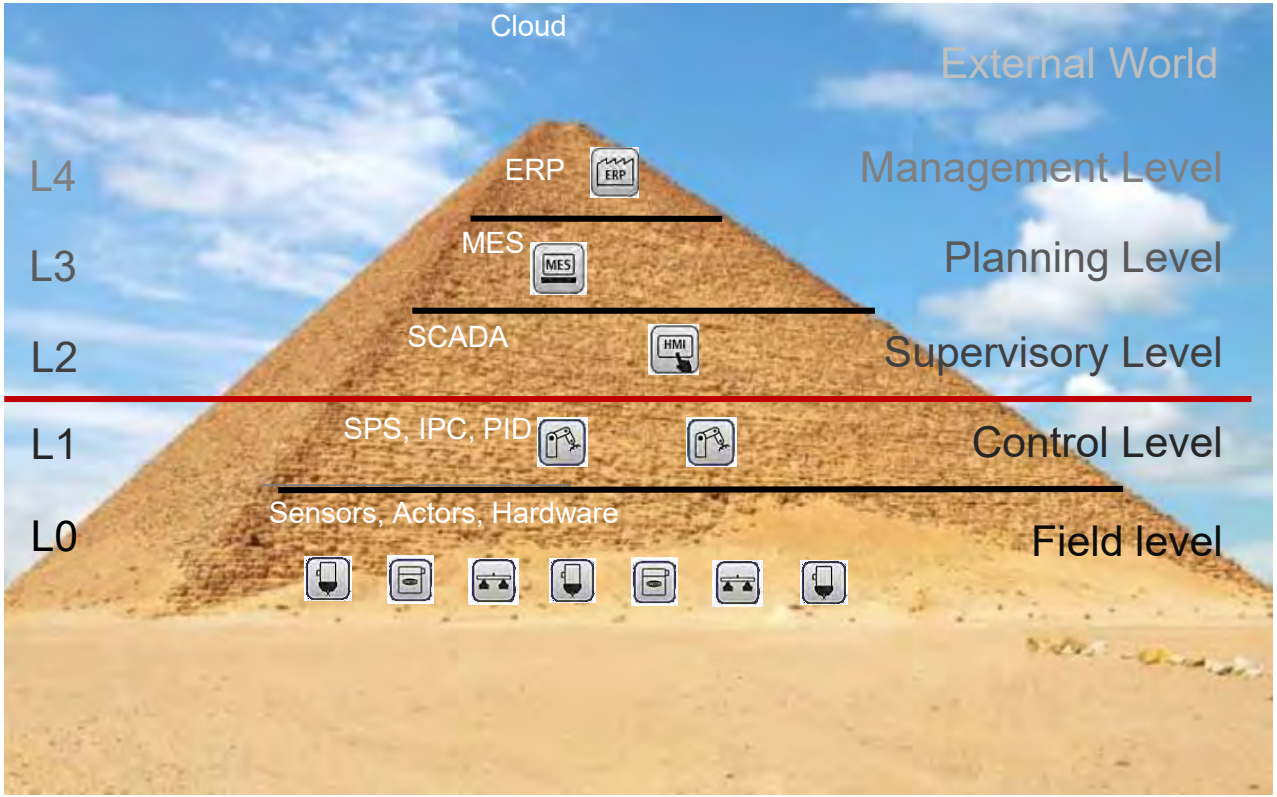
The classic automation pyramid

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Today's world
in production facilities

Two separate worlds
and networks

IT and OT



The classic automation pyramid

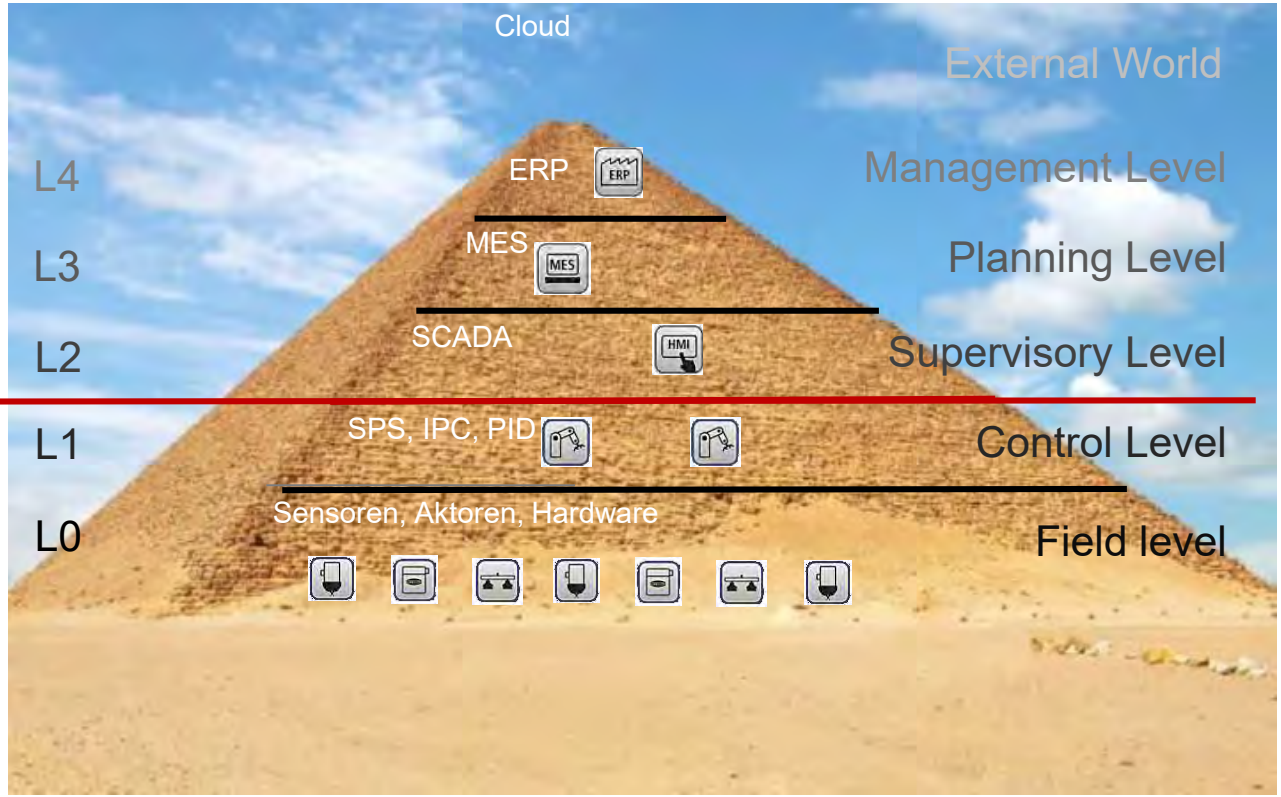
PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Today's world
in production facilities

IT – Information Technology

no IT/OT convergence

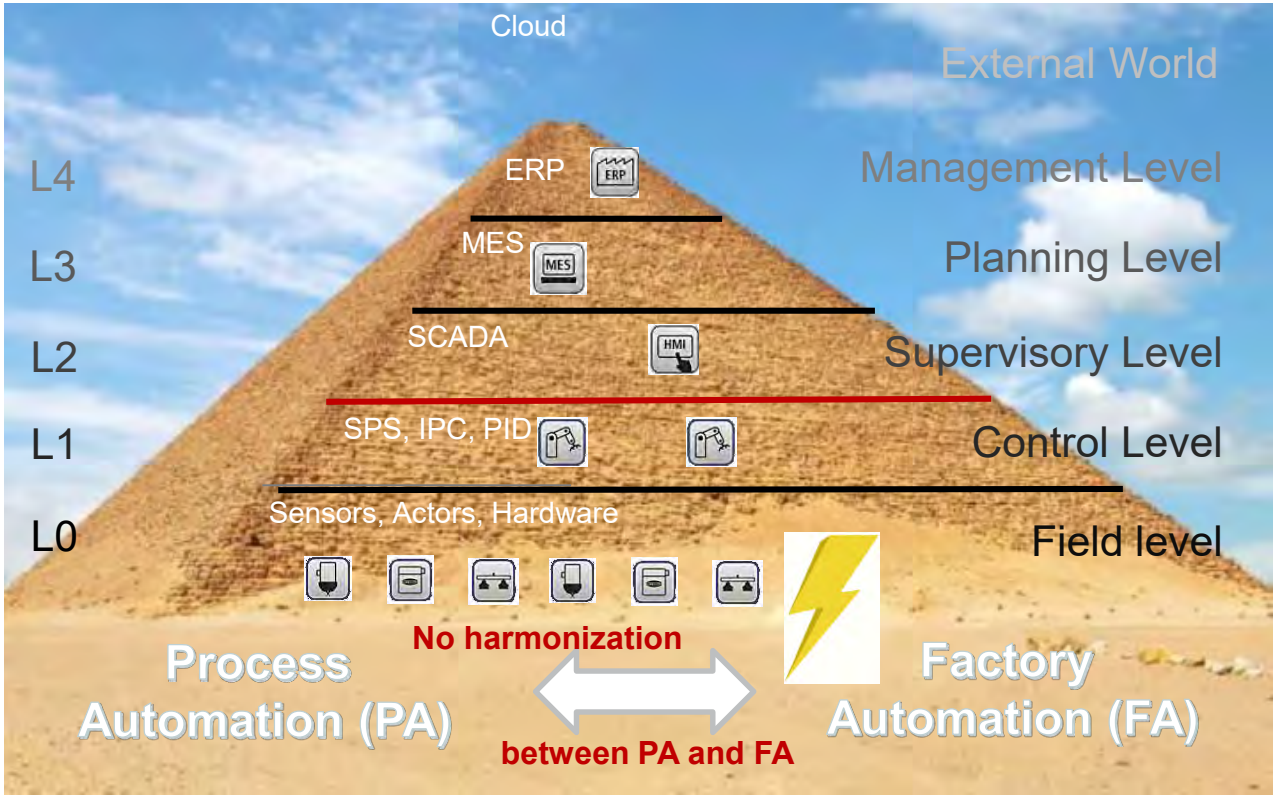
OT – Operational Technology



The classic automation pyramid

Today's world
in production facilities

Two world´s of their own
PA and FA

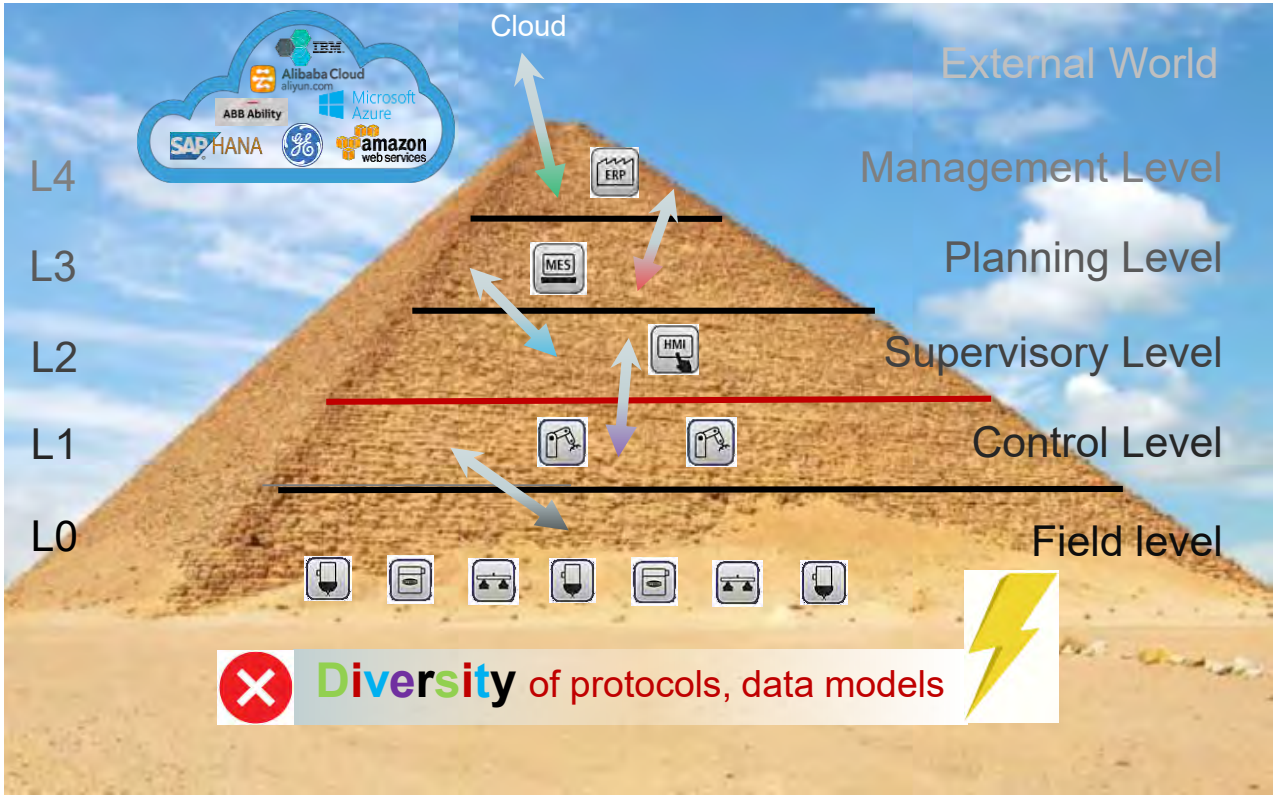


The classic automation pyramid

Today's world
in production facilities

A from incompatible solution with own ecosystem
Especially in field level

CC-Link IE PROFINET EtherNet/IP
ETHERNET POWERLINK sercos the automation bus EtherCAT



OPC UA FX vision & mission

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

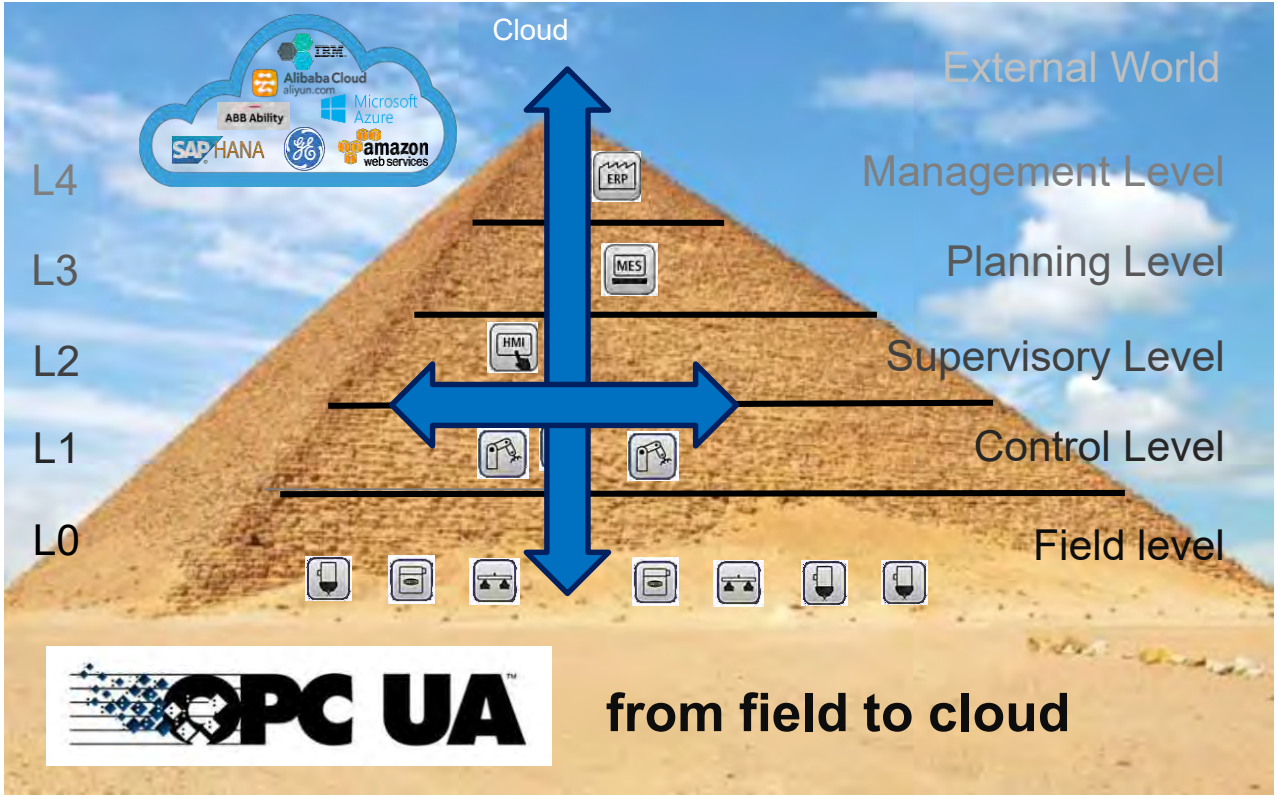
Semantic interoperability, standardized data models

&

IT/OT convergence

&

Harmonization between Process Automation PA and Factory Automation FA



OPC UA now sustainably removes these hurdles

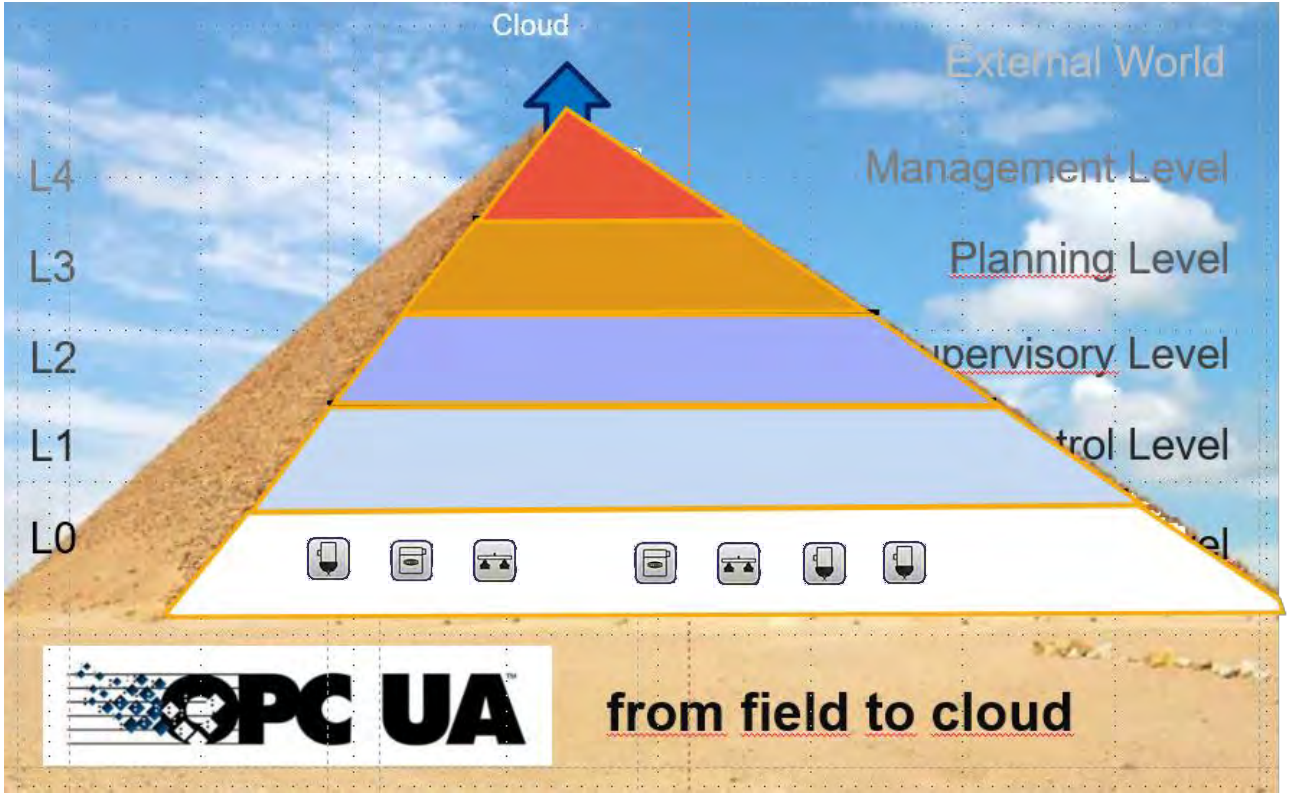
Semantic interoperability, standardized data models

&

IT/OT convergence

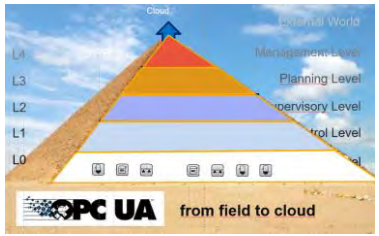
&

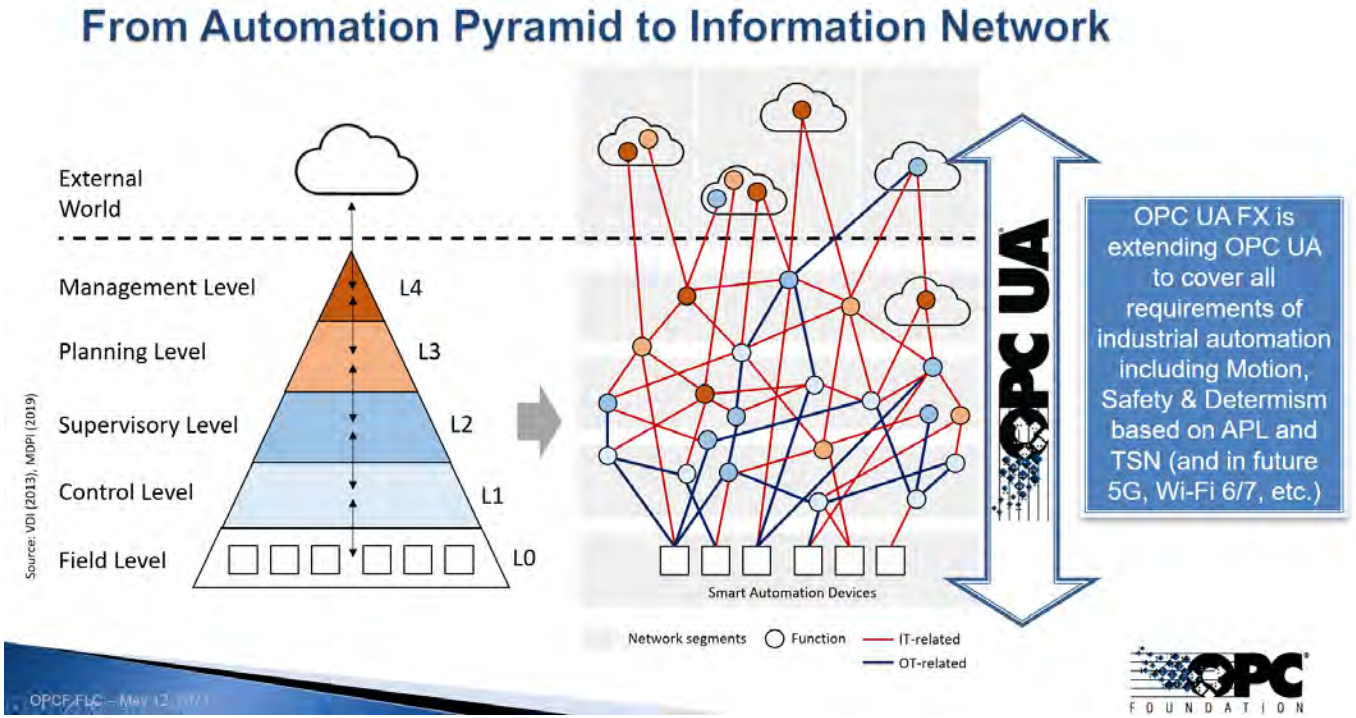
Harmonization between Process Automation PA and Factory Automation FA



Transition to an information network

OPC UA enables convergence of OT and IT

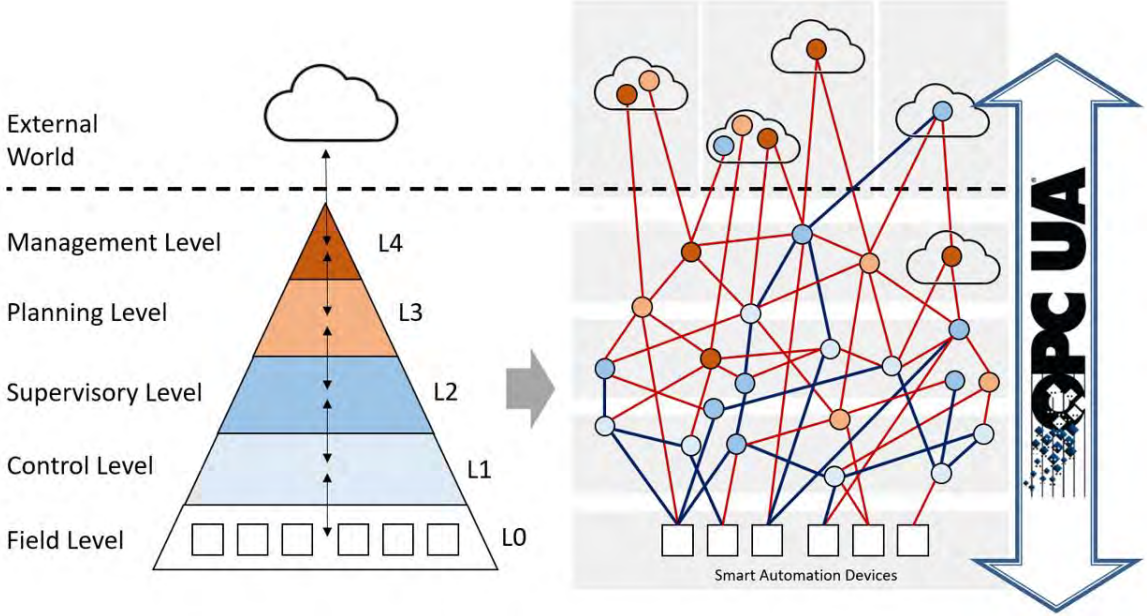




VOLUME, VARIANCE UND VELOCITY

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Convergence of IT and OT – more data becomes useful information



VOLUME

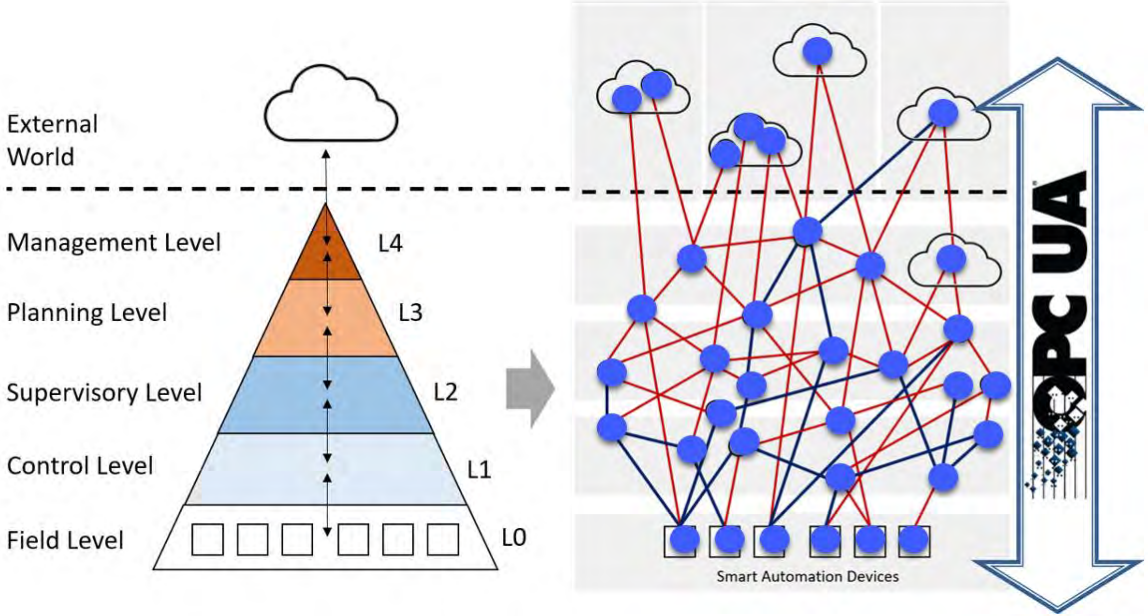
Autonomous production is becoming a reality, enabling companies to create self-controlled, self-regulated and optimized material flows and manufacturing areas.

picture: OPC Foundation

VOLUME, VARIANCE UND VELOCITY

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Convergence of IT and OT



VOLUME

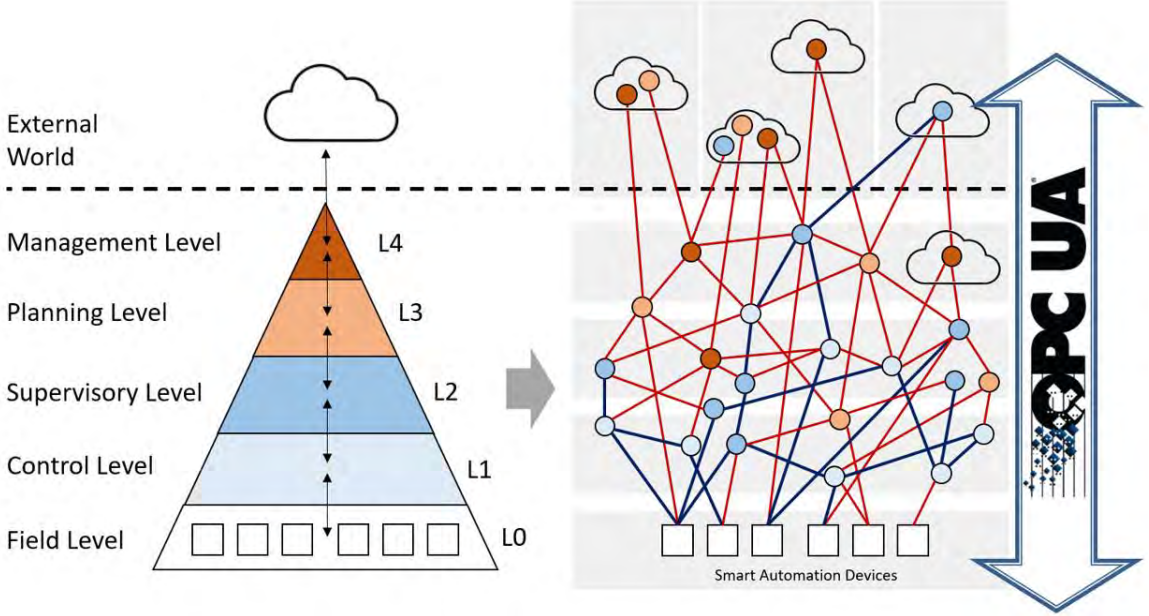
For this, more and more meaningful data must be identified, made accessible and put into an overall context.

OPC UA FX : collect extensive data from the network simultaneously and provide it as information

VOLUME, VARIANCE UND VELOCITY

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Convergence of IT and OT



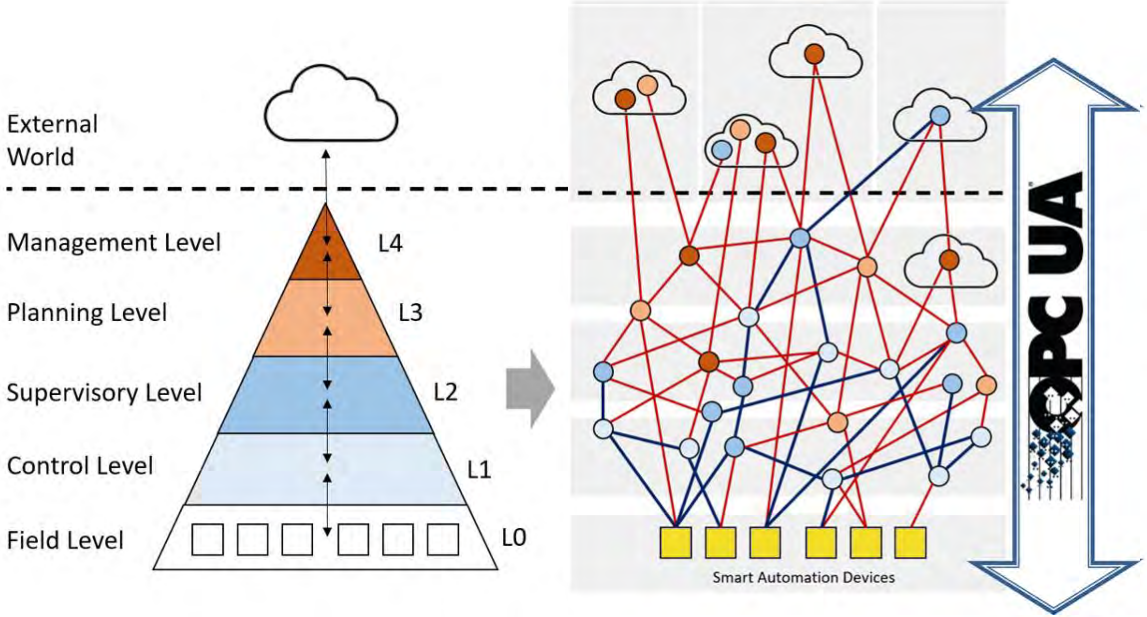
VARIANCE

different intelligent devices and software units throughout the network generate production-relevant data.

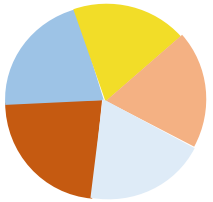
VOLUME, VARIANCE UND VELOCITY

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Convergence of IT and OT



VARIANCE



In particular, the integration of smart sensors / actors from the field level (OT) is becoming increasingly important

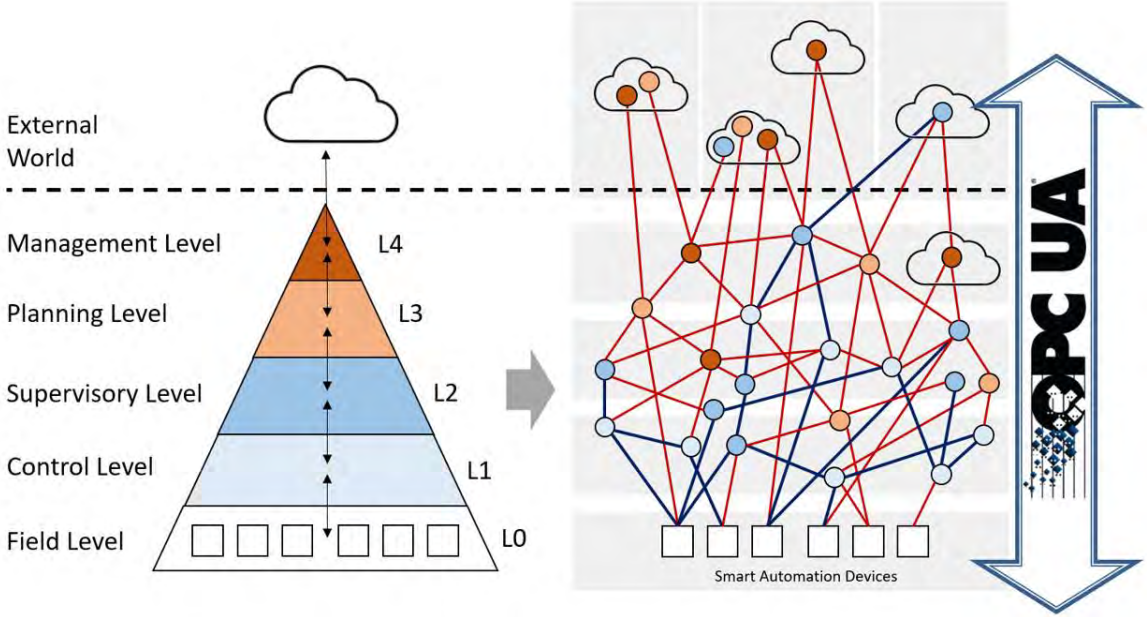
for more transparency and better decision-making in the machine and in the production network.

OPC UA FX : making all data sources uniformly accessible

VOLUME, VARIANCE UND VELOCITY

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Convergence of IT and OT



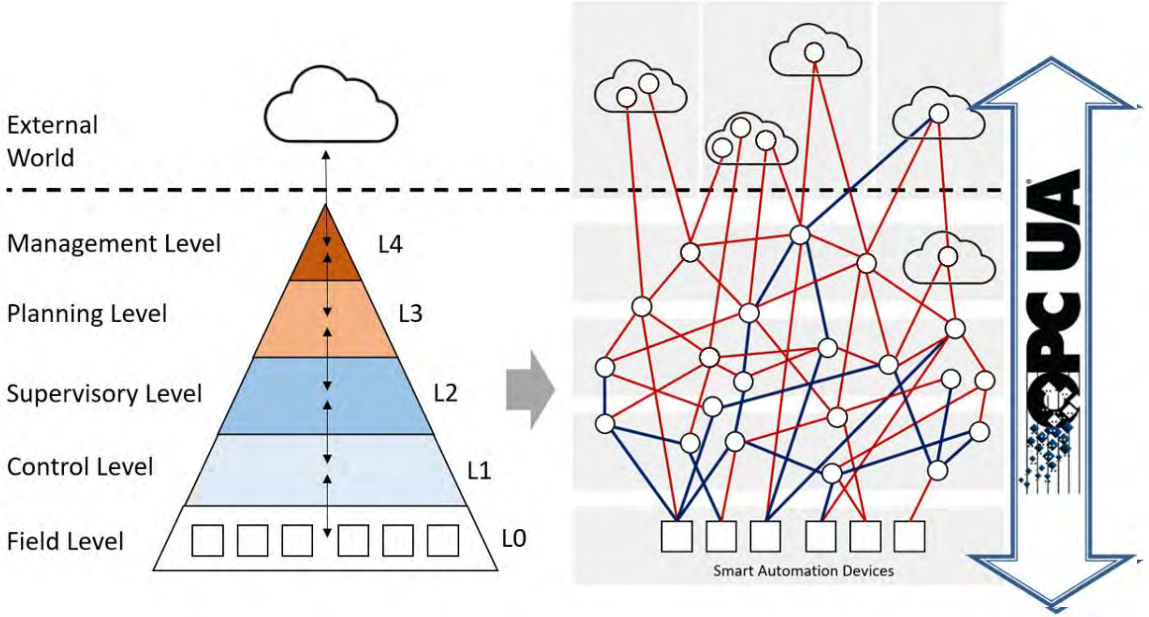
VELOCITY

Information must be exchanged between a wide variety of network participants (Cyber-Physical Systems). However, priorities need to be established.

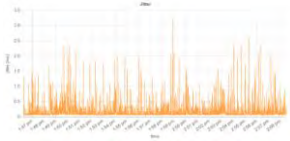
VOLUME, VARIANCE UND VELOCITY

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

Convergence of IT and OT



VELOCITY



At the field level, determinism plays a major role.

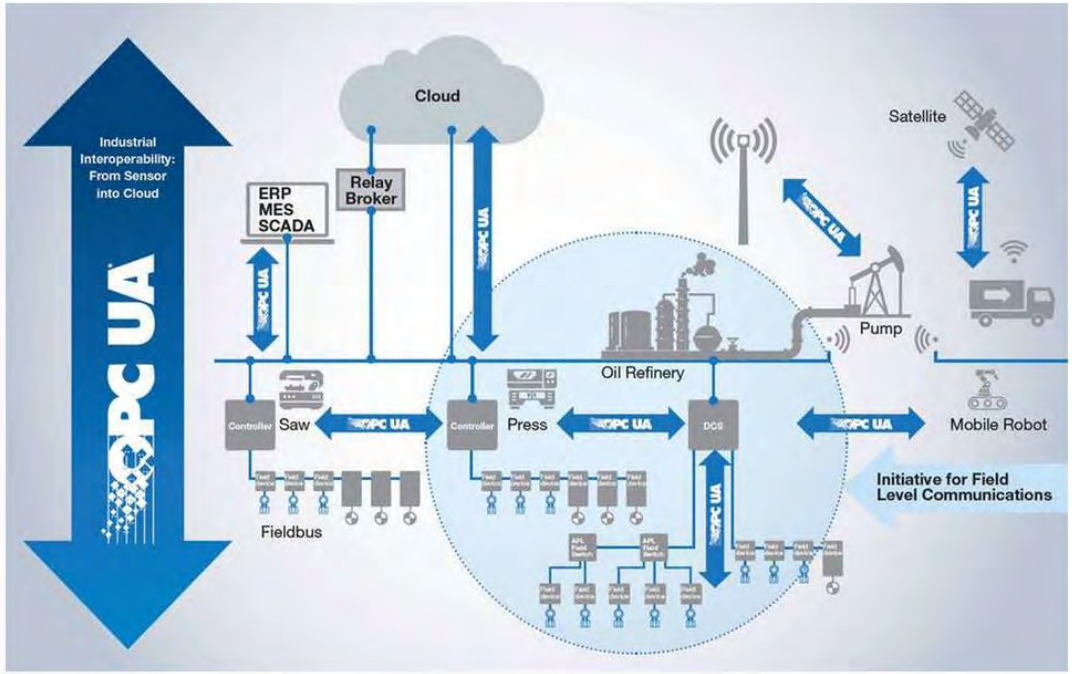
e.g. MOTION technology and FUNCTIONAL SAFETY need assured latency in the ms range and below.

At the edge or in the cloud, it's all about the continuous analysis of data streams that allow quality-relevant variables to be predicted over minutes, days, weeks and months.

A single harmonized OPC UA solution for all

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

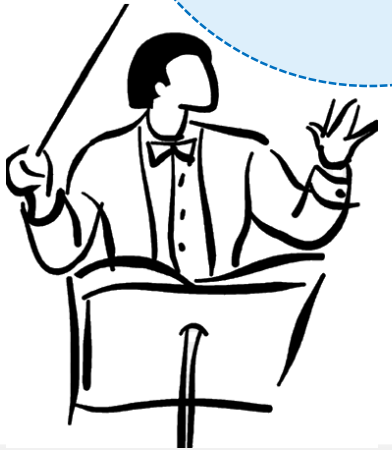
An end-to-end OPC UA-based solution from the field to the cloud



picture: OPC Foundation

With **OPC UA FX**,
the OPC UA extensions for
Field eXchange,

all these data streams can be orchestrated perfectly and simultaneously.



Transition to an information network

Classical-hierarchical structured information levels no longer fit the **increased demands for networking** and direct information exchange of CPS - (Cyber-Physical Systems)

If every thing "tweets" with everyone, then a worldwide accepted base technology for communication is needed, vendor and platform independent - **with built-in security !**

The **field level** with its specific features such as drive technology, real-time (determinism), functional safety (protecting people from hazards) must be **fully supported.**

Transition to an information network

OPC UA with its extensions for the field level, called **OPC UA FX (Field eXchange)**, is the breakthrough in the worldwide standardization of industrial communication.

World-renowned industry players support OPCF's field-level communications initiative, called FLC

In total, more than 320 technical experts from more than 65 OPC Foundation member companies are active in the various technical working groups.

OPC UA supports the future information network that scales vertically and horizontally from the field to the cloud and supports **IT/OT convergence** and **semantic interoperability**

The future is IT automation - with OPC UA

Bild: OPC Foundation

the current OPC UA framework combines further "cutting edge" technologies such as TSN - **Time Sensitive Networking** and **ethernet-apl** (Advanced Physical Layer) with the know-how of the world's leading automation companies

Bild: B&R

B&R fully relies on the **extended OPC UA framework**
We will equip all new products with this technology - series products in 2022.

VOLUME, VARIANCE UND VELOCITY

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

PERFECTLY ORCHESTRATING DATA STREAMS WITH OPC UA FX

Thank you for your attention !

My appeal to you:

Back the right horse and demand OPC UA FX now !

Elmar Zimmerling
Product Manager Industrial IoT Network Solutions
Elmar.Zimmerling@br-automation.com

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

PERFECTION IN AUTOMATION