

When AutomationML meets OPC UA and Service Oriented Architectures on the Shop Floor – a Team with Huge Potential

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Product Management Industrie 4.0 and Member of OPC Technical Advisory Council



With Material from Dr.-Ing. Miriam Schleipen
(OPC Europe Day 2015)
and Stefan Hoppe

Challenges to Manufacturing Today...



The Market of One

- » Customized offerings
- » Individual requirements
- » Regional preferences



Extreme Variability

- » Productivity
- » Innovative technology
- » Employee Satisfaction



Rapid Innovation

- » Time to market
- » innovative products

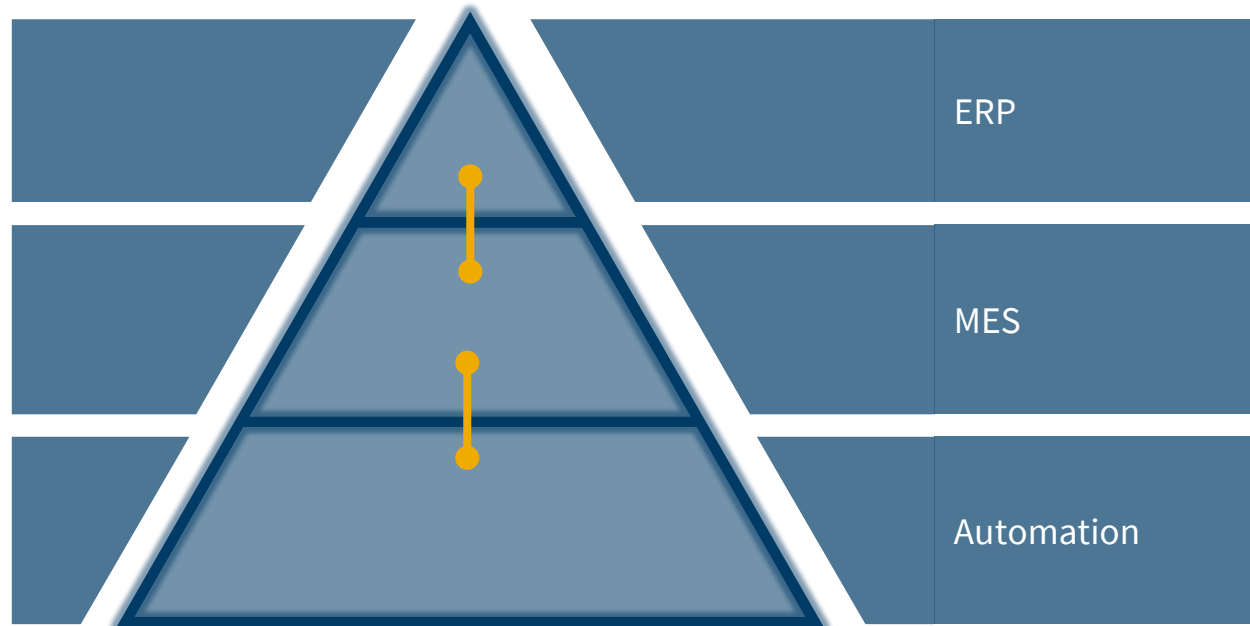
Accelerate the Enterprise Success

Higher Productivity due to Simplification

How to accelerate and grow productivity and profitability in complex business environment? How to run business and production seamlessly integrated?

Need for **SMART SIMPLIFICATION**

(1) Top Floor to Shop Floor



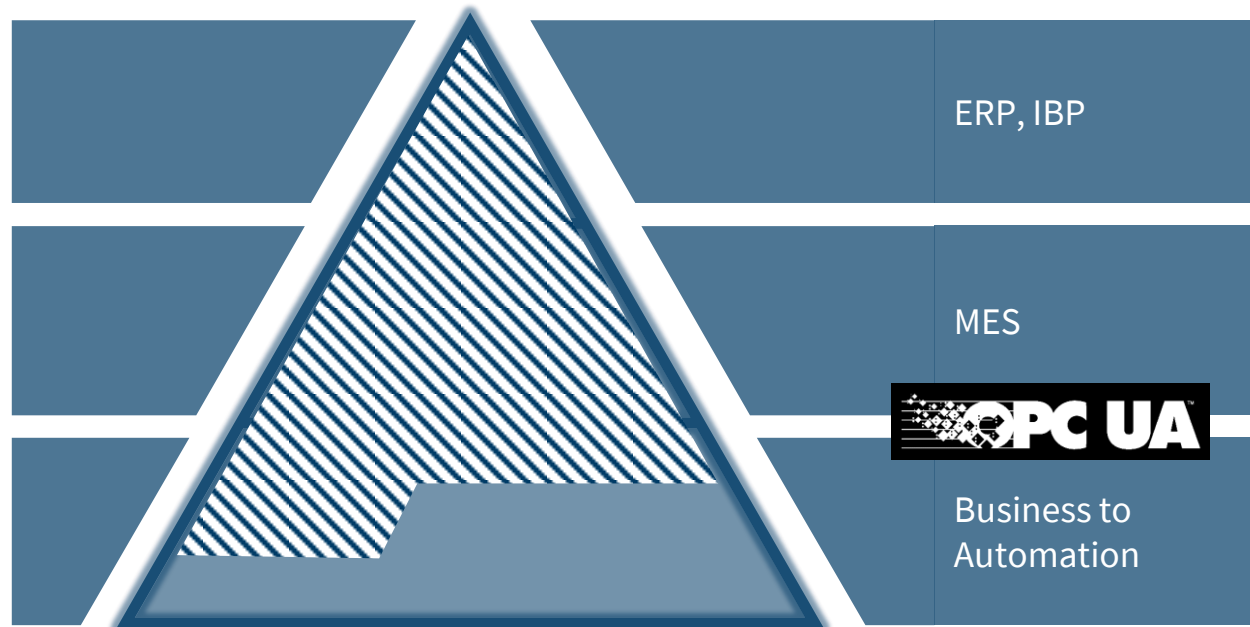
Accelerate the Enterprise Success

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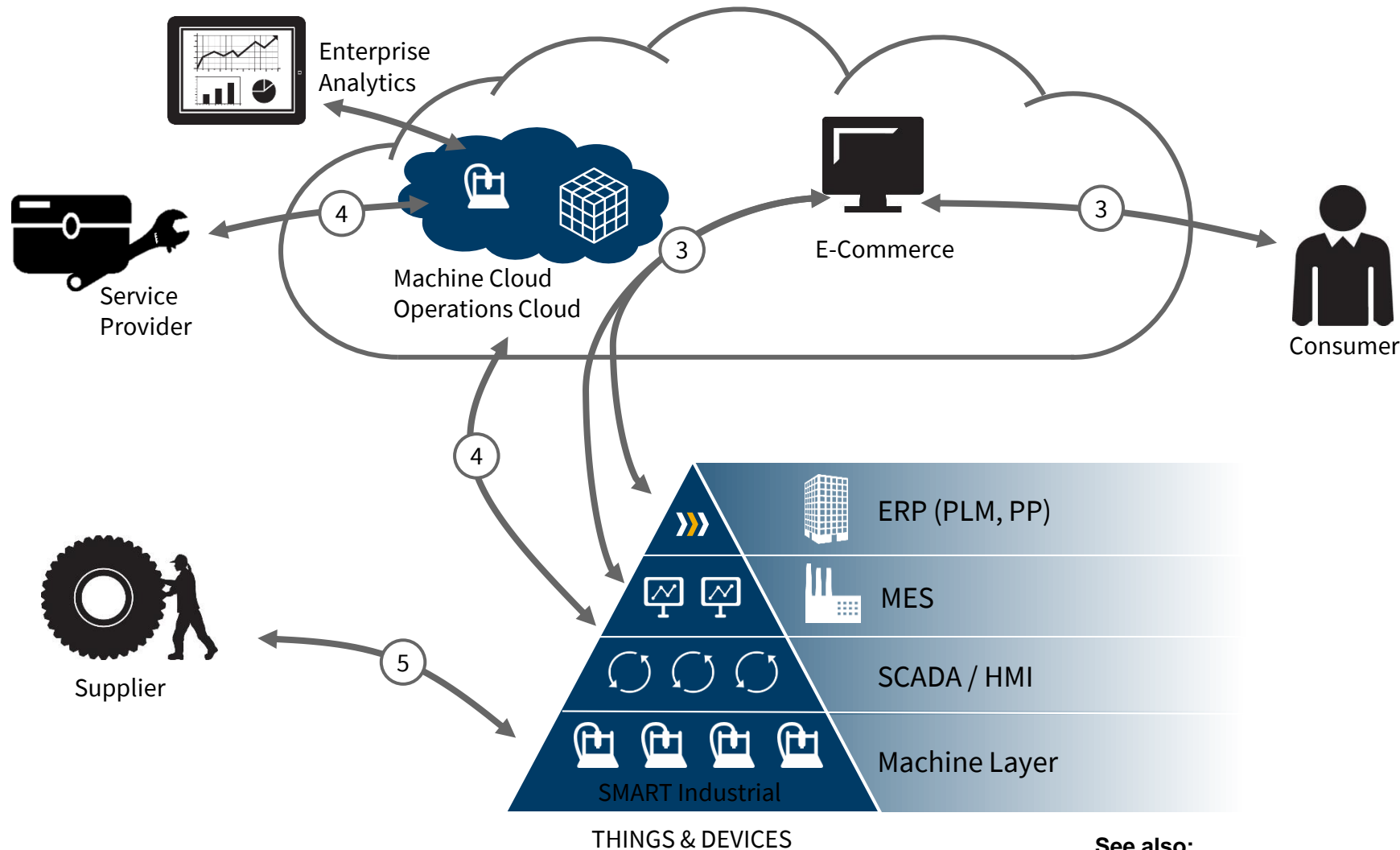
How to accelerate and grow productivity and profitability in complex business environment? How to run business and production seamlessly integrated?

Need for **SMART SIMPLIFICATION**

- (1) Top Floor to Shop Floor
- (2) Customer to Operations
 - » SIMPLIFY
 - » HARMONIZE
 - » REDUCE



Further Scenarios of Connectedness



5 Scenarios

- 1 Shop Floor to Top Floor
- 2 Machine to Machine
- 3 e-commerce Integration
- 4 Machine / Operations Cloud
- 5 Direct Replenishment

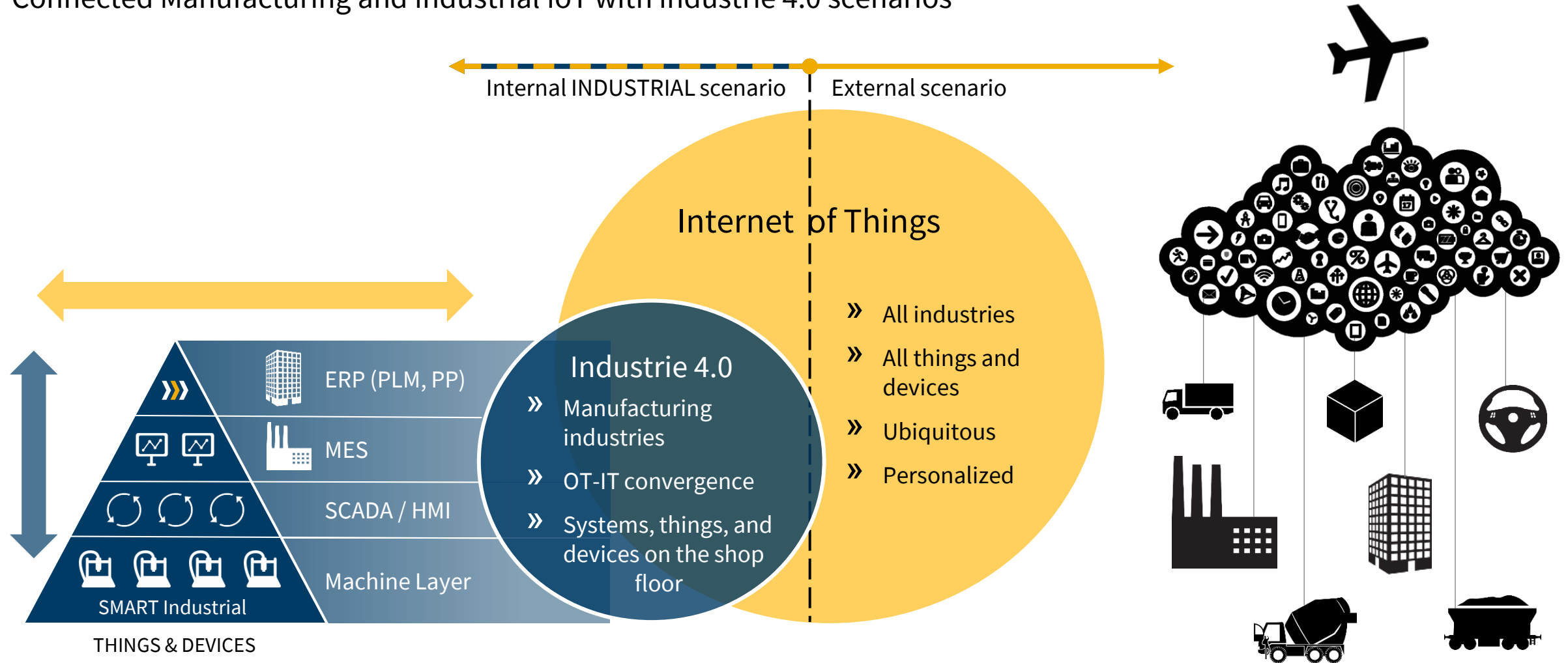
See also:

http://www.it-production.com/index.php?seite=einzel_artikel_ansicht&id=63440

Trends Impacting Connected Manufacturing

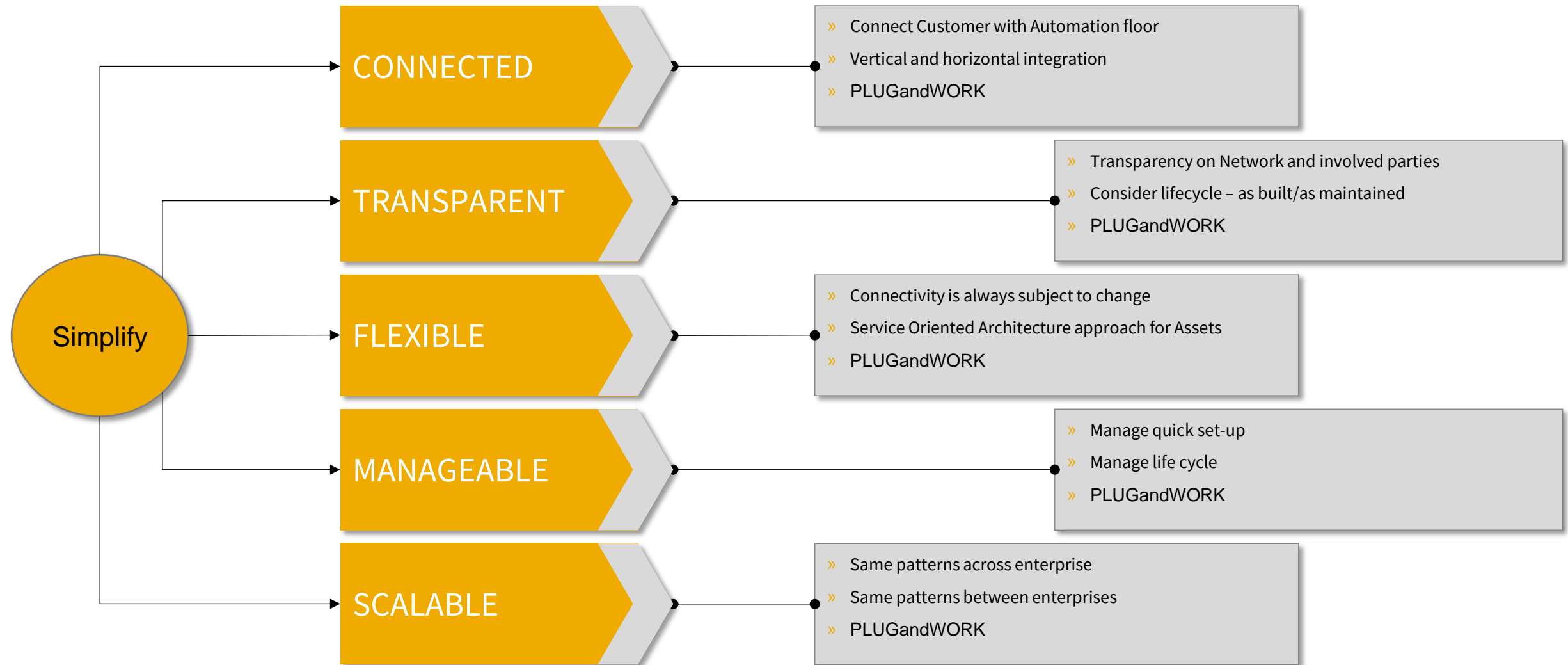
Internet of Things and Industrie 4.0

Connected Manufacturing and Industrial IoT with Industrie 4.0 scenarios



Envisioned Future Themes of Digital Transformation

View for Manufacturing



Solve by Teaming up

What?

<AutomationML/>

Semantic description of production plant



Communication and management of
data models including security

How?

2 Players are already on the pitch

<AutomationML/>

IEC 62714

Plant Planning

Functional engineering

- Commissioning

Geometry and Kinematic format COLLADA

Top level format

CAEX IEC 62424

Plant Topology Information

Mechatronics

Networks

Devices

Attributes

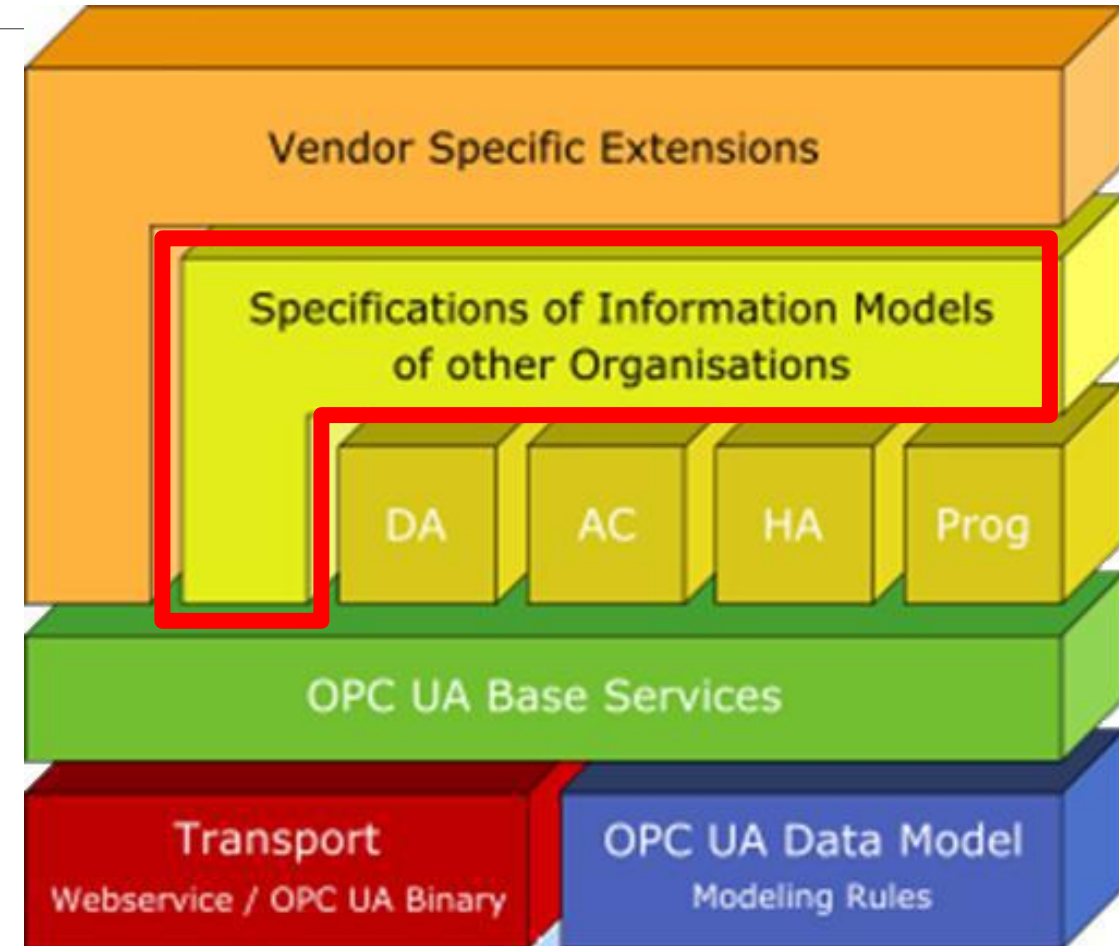
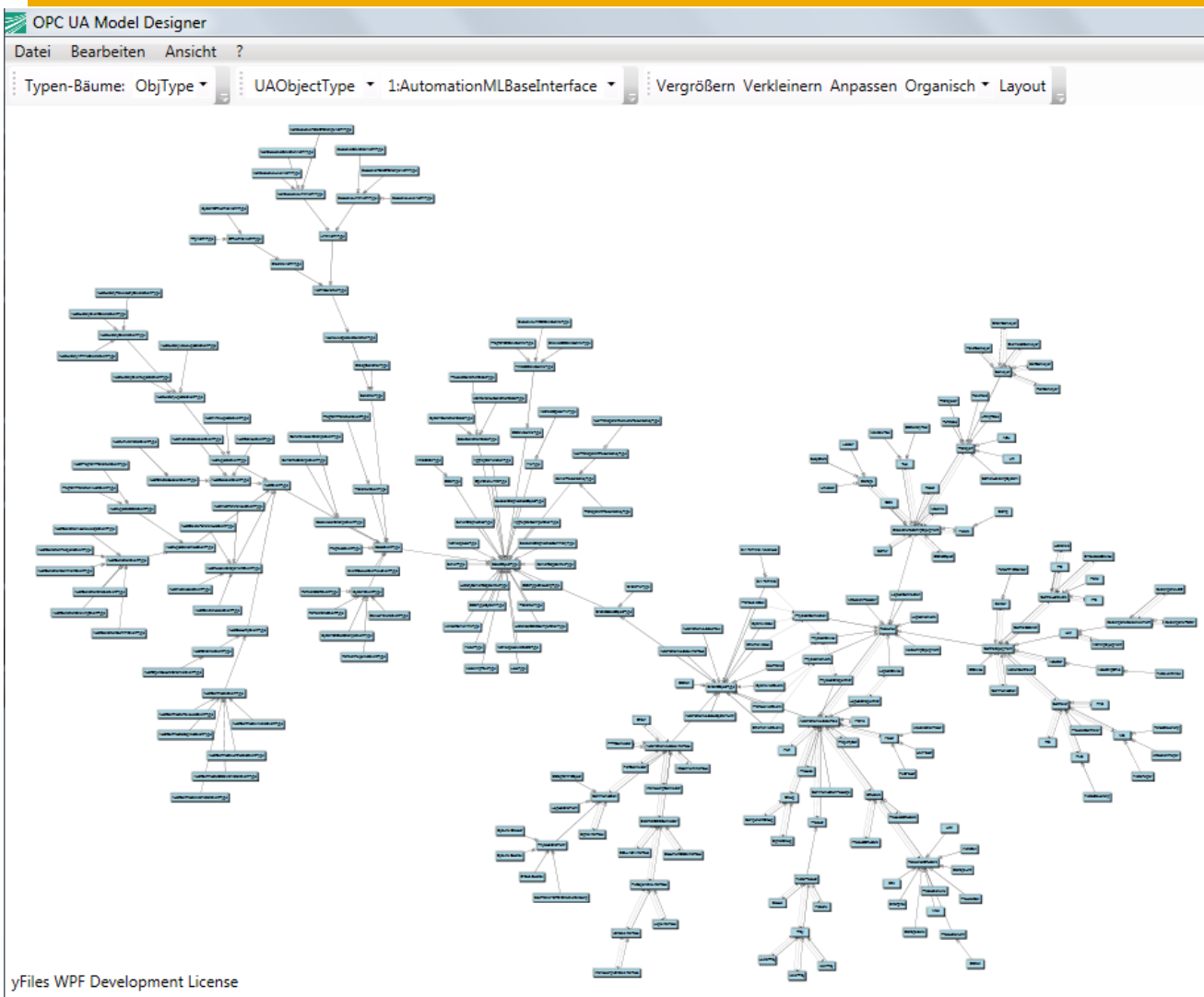
Logic
format
PLCopen
XML

Semantic referencing

Further aspects in other XML format

```

graph TD
    D1[D1] --- H[ ]
    D2[D2] --- H
    H --- Dn[Dn]
    style H width:0px,height:0px
  
```

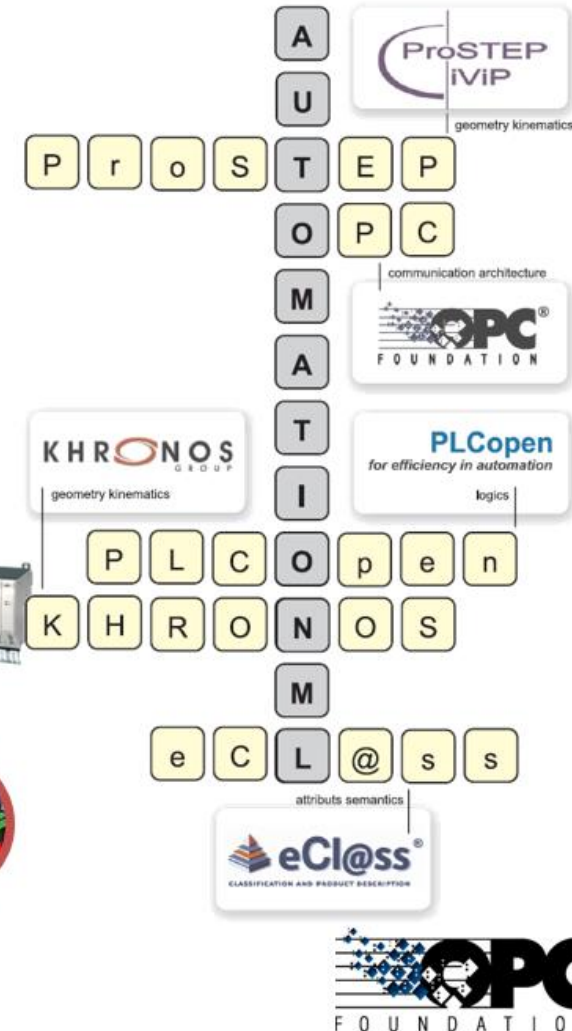
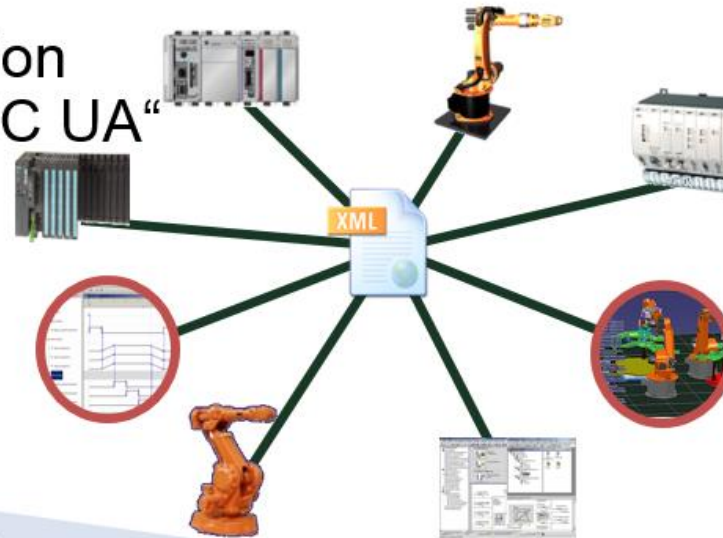


Source: OPC Day Europe, Mathias Damm, 2013

Dr.-Ing. Miriam Schleipen

Common goal of AutomationML & OPC UA

- ▶ Lossless and semantically unique exchange of engineering data along the tool chain
- ▶ „Online AutomationML model“
- ▶ Integration/modelling of OPC UA engineering/configuration data in AutomationML
- ▶ → Goal:
Companion Specification
„AutomationML for OPC UA“



OPC Day Europe 2015

Dr.-Ing. Miriam Schleipen

Solve by Teaming up

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How?

Consider a third player ...

The good news:
It's simple and just a question of mindset

Service Oriented Architectures

April 25 – 29, 2016
Hannover, Germany



STÄUBLI

BECKHOFF

cab

asentics

stratasys

PROGLOVE

Honeywell

KAESER KOMPRESSOREN

OPC UA

SAP Co-Innovation Lab

Open Integrated Factory – Generation 2016

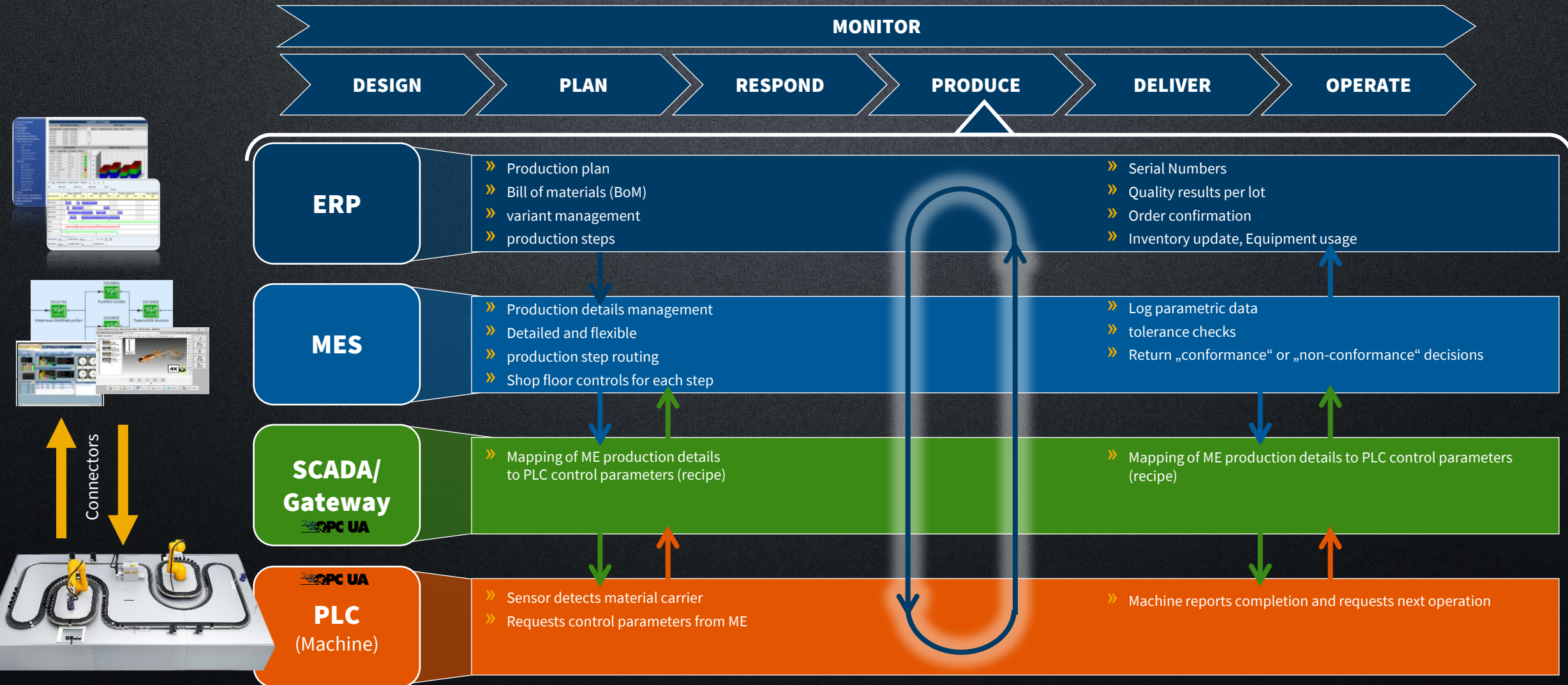
Industrie 4.0 : LIVE and REAL



Partners
contributing

A Connected Manufacturing Architecture

The Connected Plant in the Extended Supply Chain



Example



...

XTS M → GTW : "Mover with SFC 123 arrived at Pos Y4"

GTW → XTS B: "Move SFC 123B to Pos B4"

XTS B → GTW: "Mover with SFC 123B arrived at Pos B4"

GTW: (Get Lock for Rob B)

GTW → Rob B: "Do Job #3 – Handle SFC123"

Rob B → GTW: "Job #3 – Handle SDF123 done"

GTW → XTS B: "Release Mover" (move on)

GTW → XTS M: "Move SFC 123 to Pos 5"

XTS M → GTW: "Mover with SFC 123 arrived at Pos 5"

GTW → Cam: "Take Photo [Par: expected color blue]"

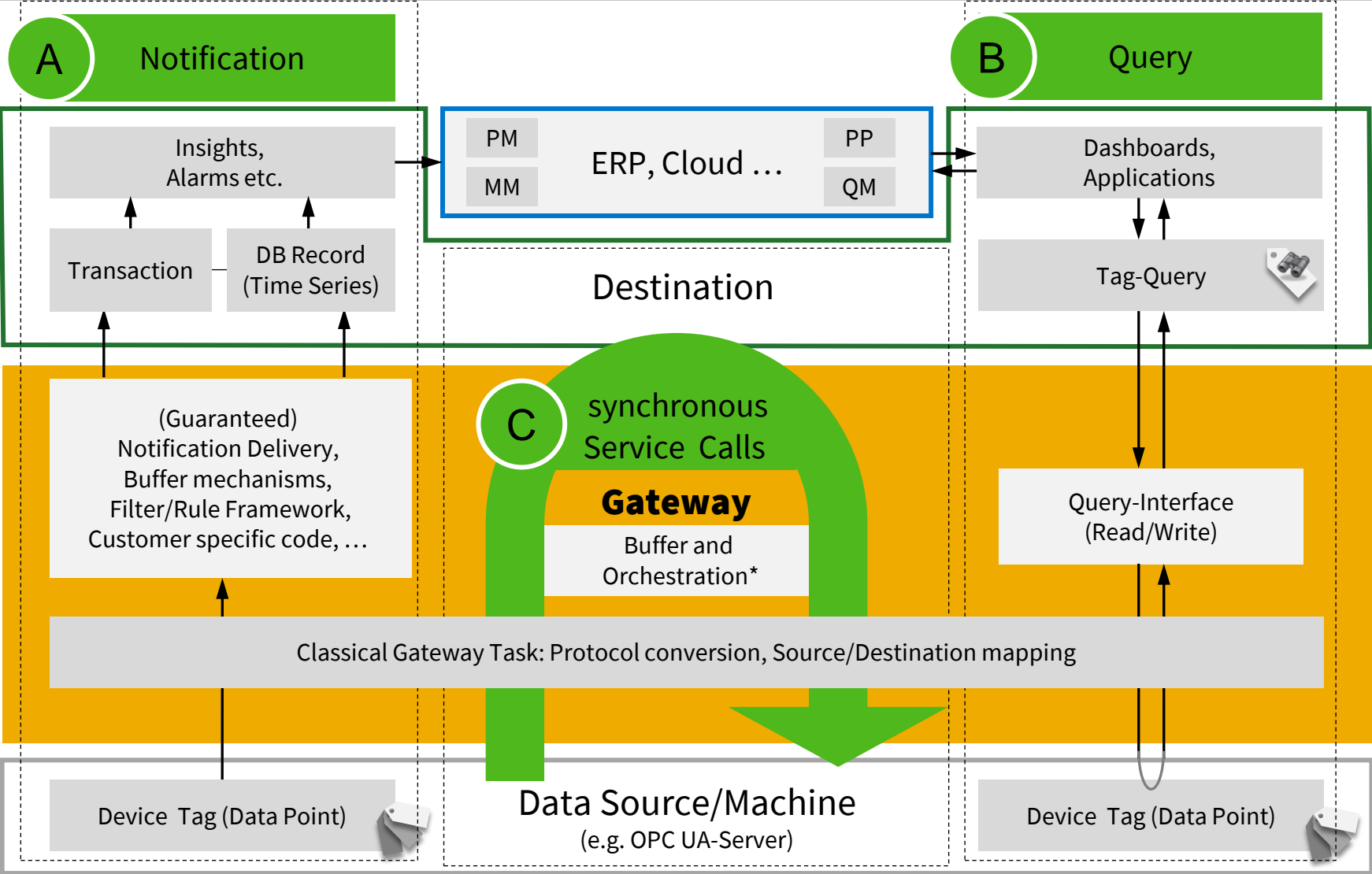
Cam → GTW: "Camera result: [not blue, URL to .jpg ...]"

Log non-conformance

...

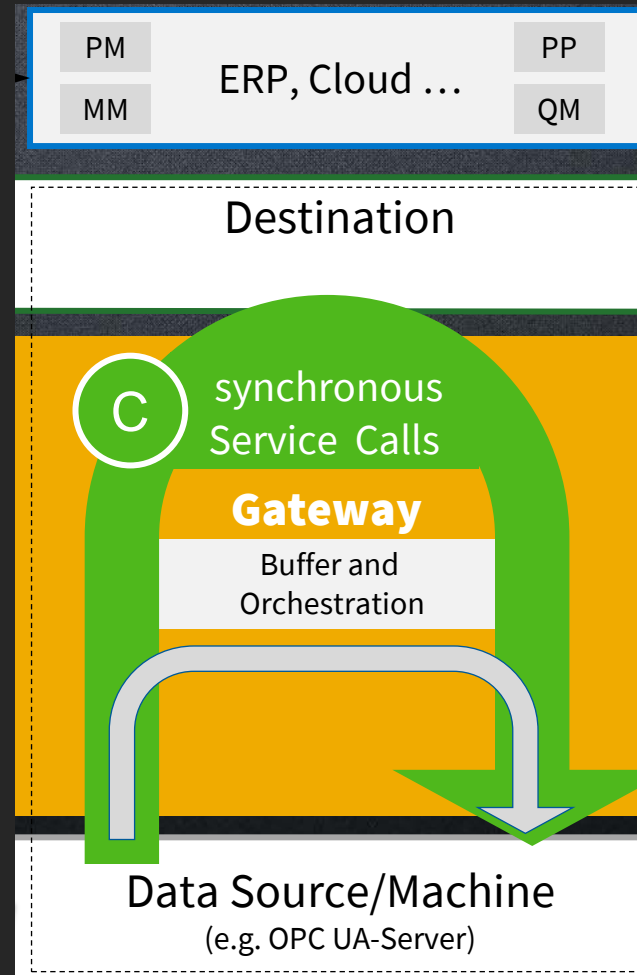
Automation specific communication patterns

expedient
machine
communication
protocol:



Low latency/High Speed Manufacturing – buffer data, enable shortcuts

- (1) Read ME data in advance:
 - » Next Production Order(s) incl.
 - » Routing steps
 - » Set-Points
- (2) Gateway buffers this data
- (3) Machine requests data
- (4) Gateway responds from buffer
- (5) Gateway manages posting to ME asynchronous

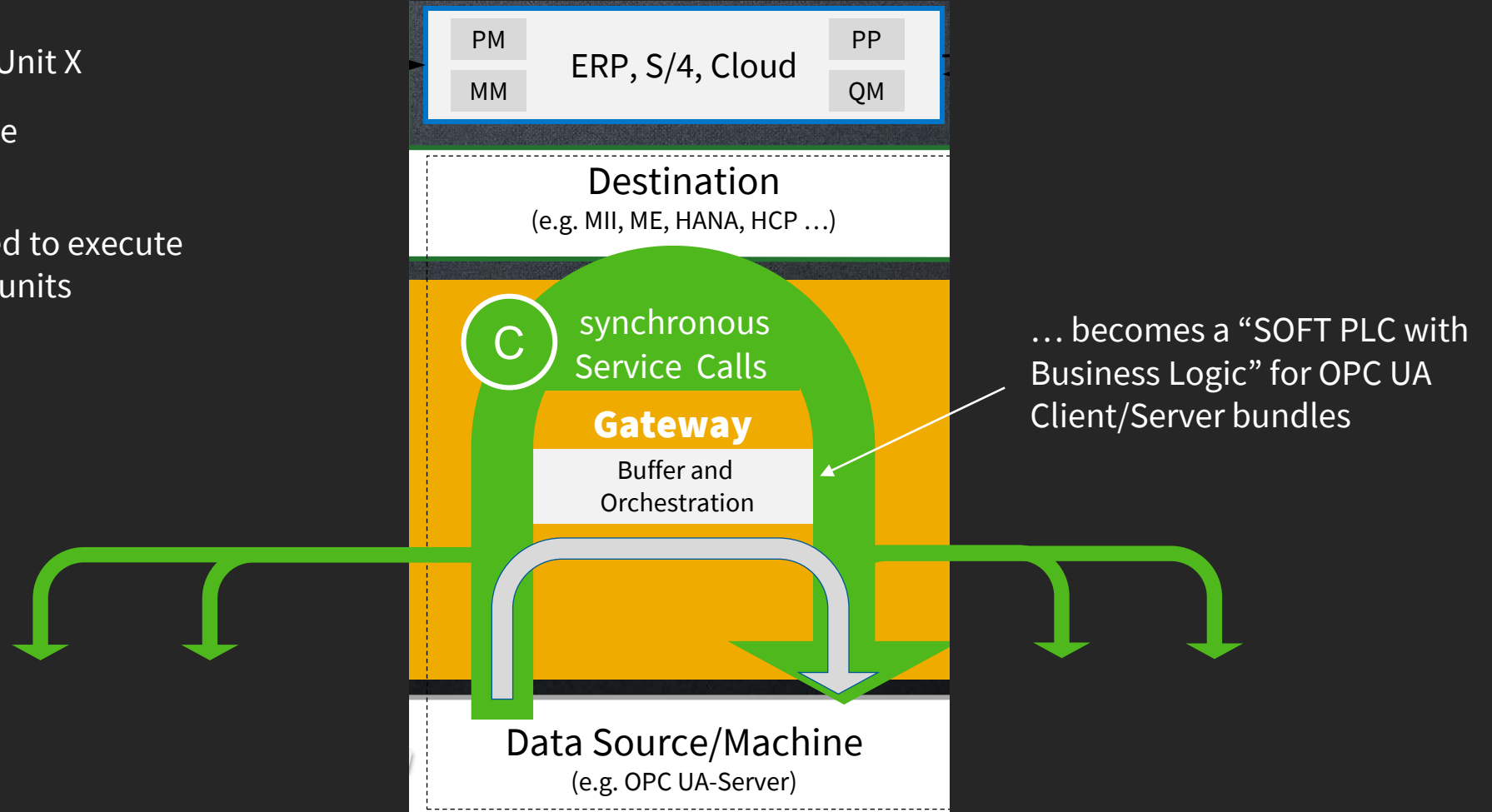


**Response from buffer
< 20 Milliseconds
(depends on scenario)**



Service Oriented Architecture (SOA) approach for machine unit orchestration

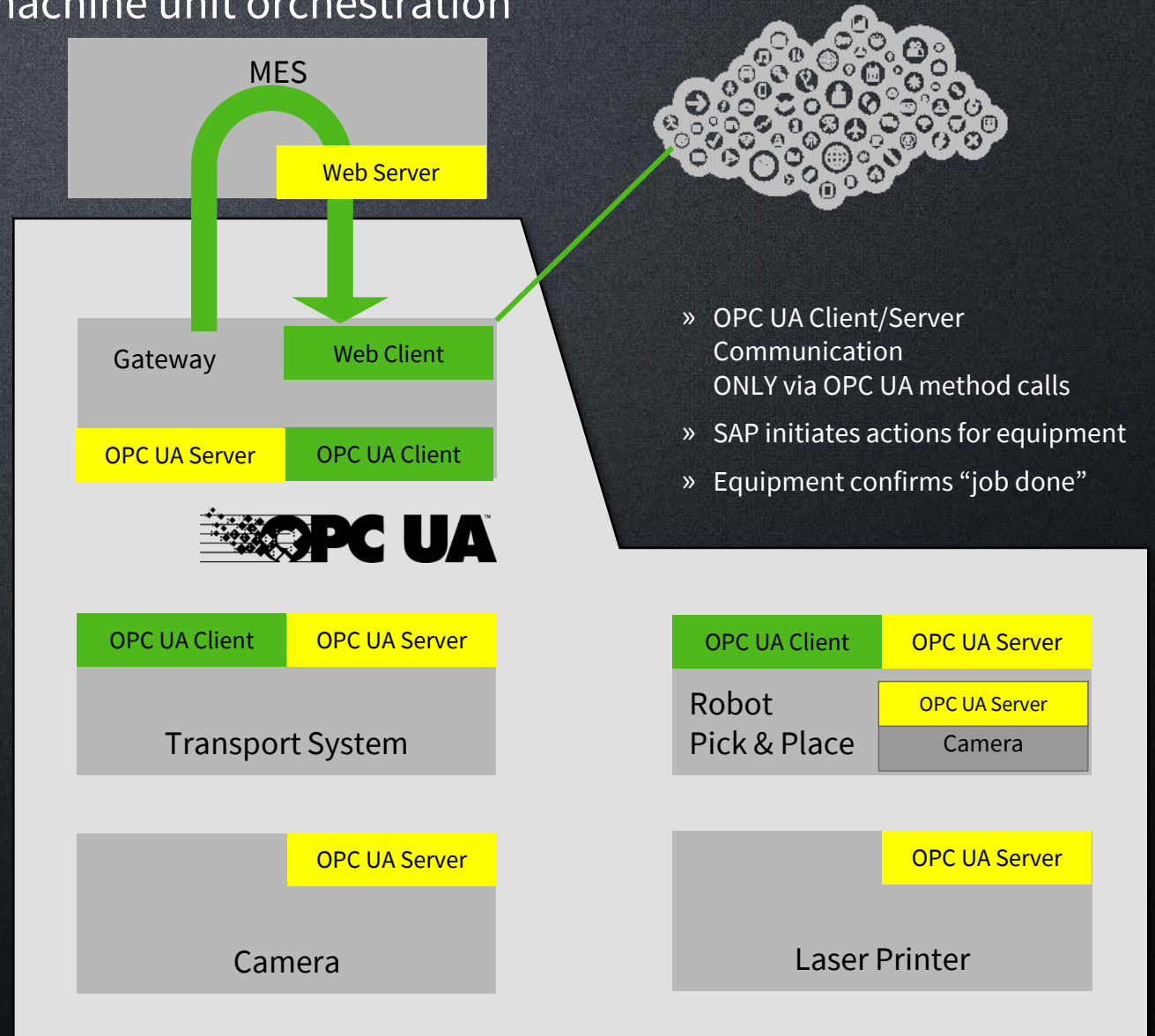
- (1) Event occurs on Machine Unit X
- (2) Machine Unit Y needs to be notified/triggered
- (3) Gateway can be configured to execute communication between units



Technical Basis

Service Oriented Architecture (SOA) approach for machine unit orchestration

- (1) Each machine unit is independent
 - » In a departure from convention, the units are not linked to each other by a single program inside a single PLC
 - » Each unit comes with its own controller
- (2) Units are talking to each other on the basis of OPC UA
 - » From business perspective (production order details like routing and recipe/set-points) the units are orchestrated by a Gateway (Vertical Integration)
 - » From technical perspective, some machine units – here Camera and Robot - exchange information directly (Horizontal Integration)
- (3) Units are OPC UA Client and OPC UA Server at the same time
 - » A server can offer tags, events and methods
 - » A client can consume/react on tag changes and events and can call methods
- (4) Units publish their capabilities
 - » a Service Oriented Architecture with regards to hardware is possible



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Service Oriented Architecture and
mindset for production plant
assets



Thank you

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Industrie 4.0 and Connected Manufacturing

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