OI4 KNOWLEDGE CAMP 2024

Digital twin engineering and usage at digiZ-AA innovation center

Dr. Arnd Menschig
ZEISS Industrial Quality Solutions
SCALE it Cooperative

27.02.2024
MULTIVAC, Wolfertschwenden

Agenda

Agenda

ZEISS Industrial Quality Solutions

Together: Carl Zeiss Industrielle Messtechnik & Carl Zeiss GOM Metrology

Zeiss Group

8.233 mEUR

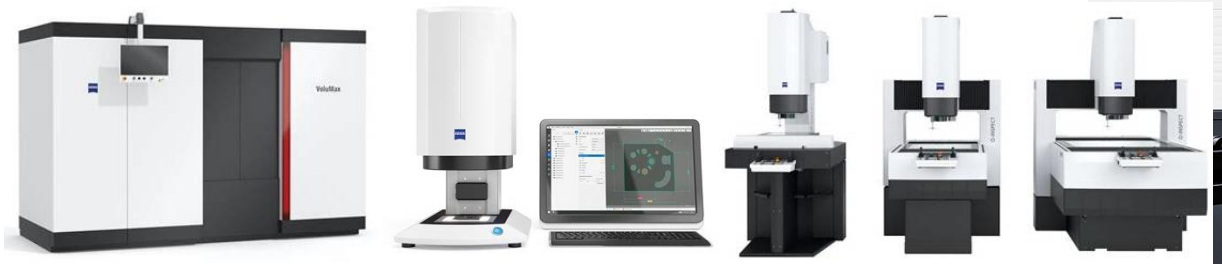
Sales Revenues

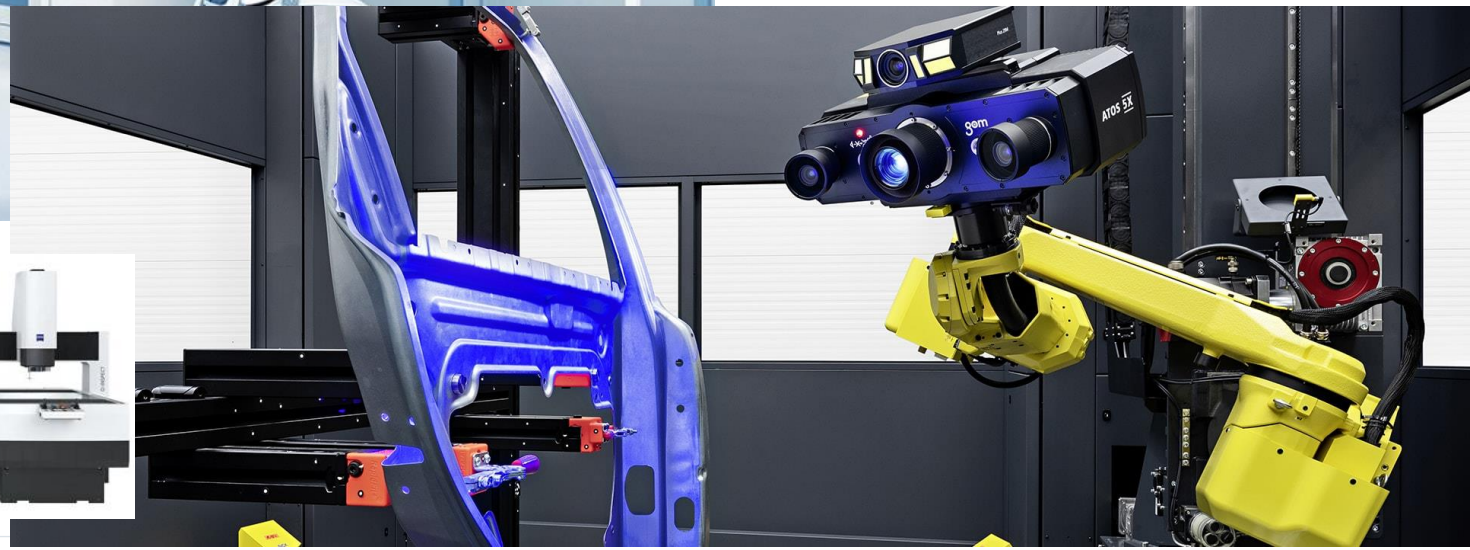
+19% 2022/23

42.586

Employees (HC)

+10% 2022/23



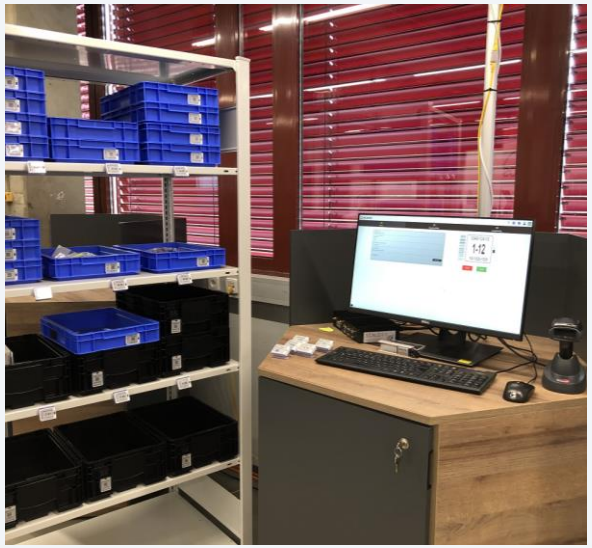


digiZ Innovation Center

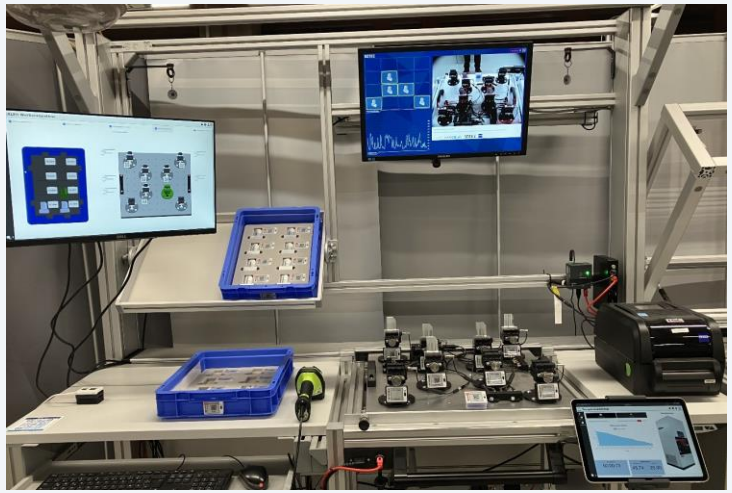
Digitization: Detect | Discover | Develop | Experience

LOCATION AALEN
Industry 4.0 as a Venue / TestLab

LOCATION HEIDENHEIM
Mixed Reality / 3D



LOCATION SCHWÄBISCH GMÜND
Smart Factory



- SOFTWARE
- SENSORICS
- E-LABELING
- US / IR / 5G communication
- ARTIFICIAL INTELLIGENCE

digiZ Innovation Center
Strong Partner Network

The project is funded by:

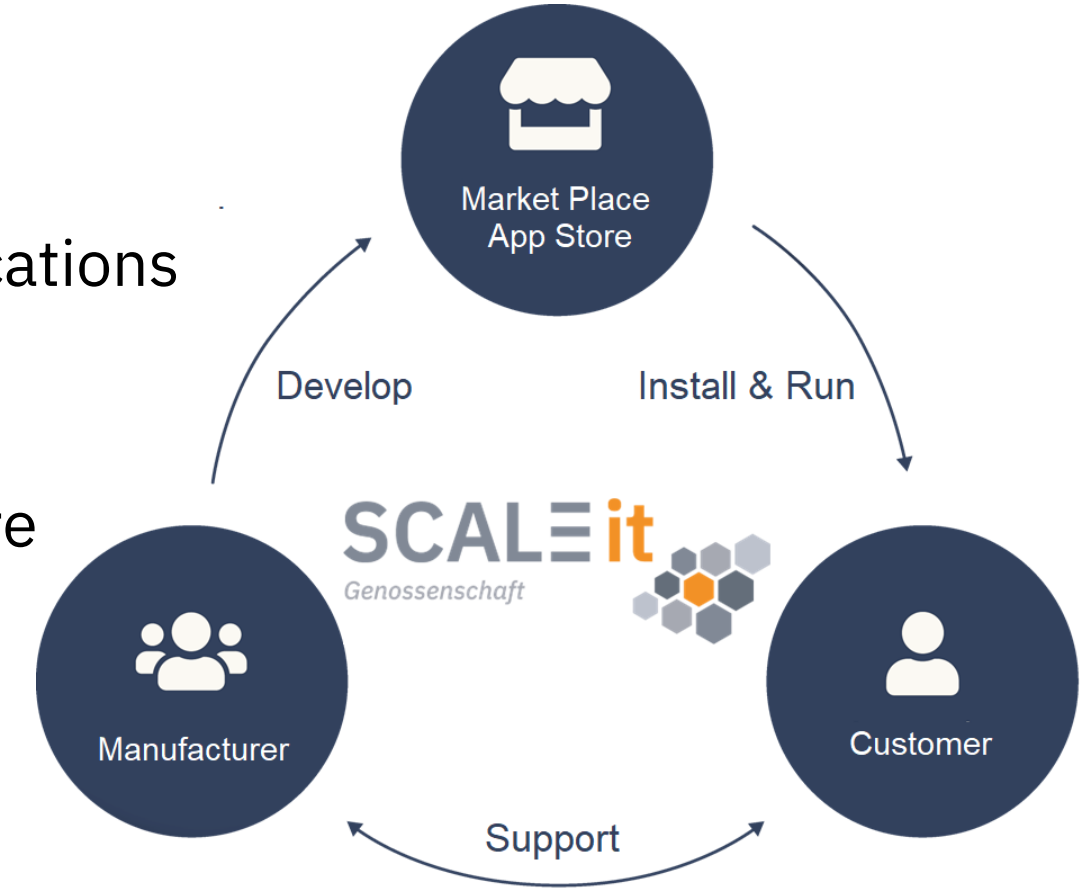
SPONSORED MEMBERSHIP APPLICATION

We hereby apply for sponsored membership in the association Open Industry 4.0 Alliance:

SCALE it cooperative

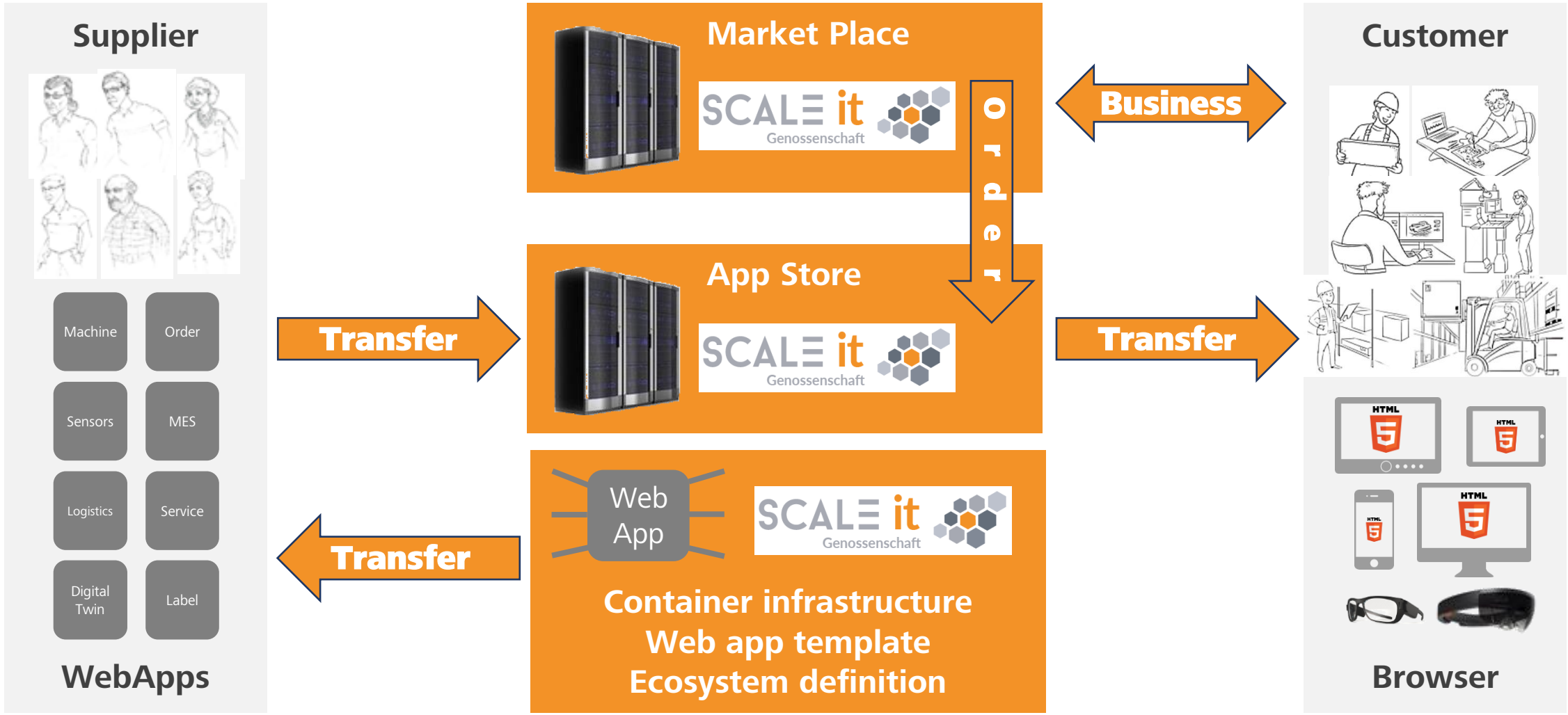
Vision | Mission | Values

- Open & fair business model
- Marketplace as sales channel for hardware, software and supporting services
- Support for the development of YOUR applications based on open-source technology
- Uniform interfaces reduce YOUR costs
- User-friendly plug & play apps from app store
- Specialists in front-end, logic, connectivity, hardware and application work together.
- The cooperative offers complete solutions.
- Everything from a single source



SCALE it cooperative

Knowledge | Products | Business



➢ Coordinated app ecosystem from different manufacturers

SCALE it cooperative
Members | Promoters

AMPECT
arcos informationssysteme gmbh
ATR SOFTWARE
BLACKPIN PROTECTED MOBILE TEAMWORK
COMPAILE
conclurer
digiraster
endiio
EurA
FUNKE ENGINEERING besser produzieren
Goldschnitt UX · UI · USABILITY
HEXDEV
ICS
innofocus
IT strategen
JH·COMPUTERS perfect fitting IT
Lothmann Beratung GmbH&Co.KG
maier GROUP
MiLaSys
P-A-Systems
PlanB.
Ultrasonic light light up your process
YUMA TECHNOLOGIE
ZDE ZENTRUM FÜR DIGITALE ENTWICKLUNG

Baden-Württemberg MINISTERIUM FÜR WIRTSCHAFT, ARBEIT UND TOURISMUS
Bundesministerium für Wirtschaft und Klimaschutz
digiZ ostwürttemberg
microTEC Südwest
seele

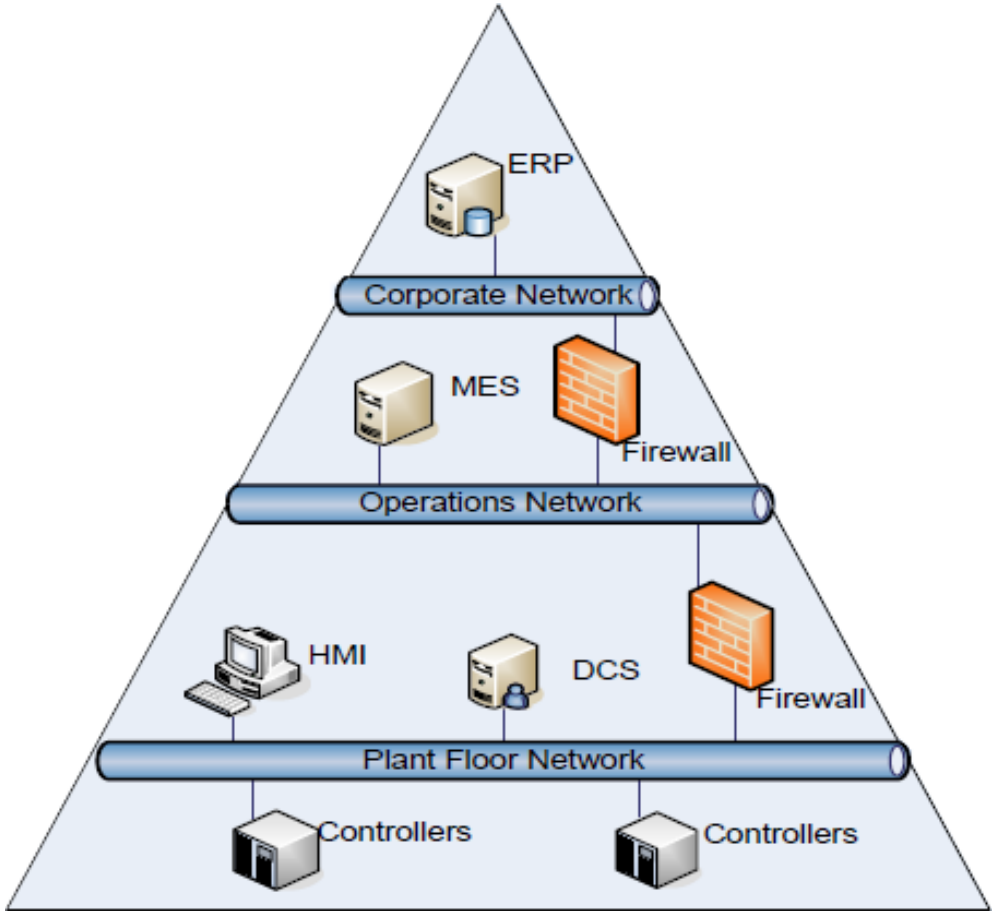
PROJECT PARTNERSHIP APPLICATION

We hereby apply for project partnership in the association Open Industry 4.0 Alliance:

OPEN INDUSTRY 4.0 ALLIANCE

Agenda

Industry 4.0 Architecture
Network Structure



Quelle: OPC Unified Architecture, Stefan Hoppe, 2014

Green Zone

Corporate Network (connecting corporate services
e.g. administration, development, ERP, …)

Yellow Zone

Operations Network (connecting operations services
e.g. production planning, MES, localization, …)

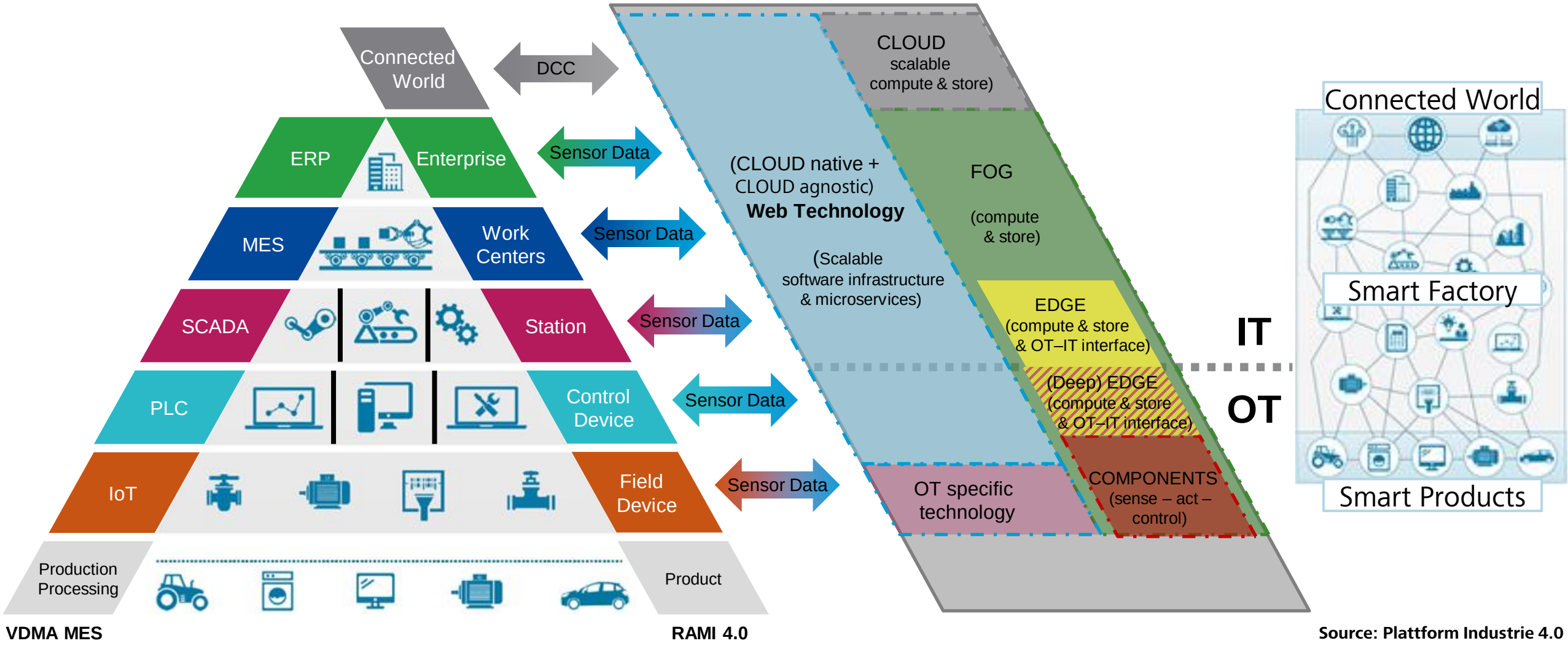
Red Zone

Plant Floor Network (connecting plant floor services
e.g. sensors, devices, machines, distributed control, HMI, …)

➢ Network architecture of a company in the three-zone concept

Industry 4.0 Architecture

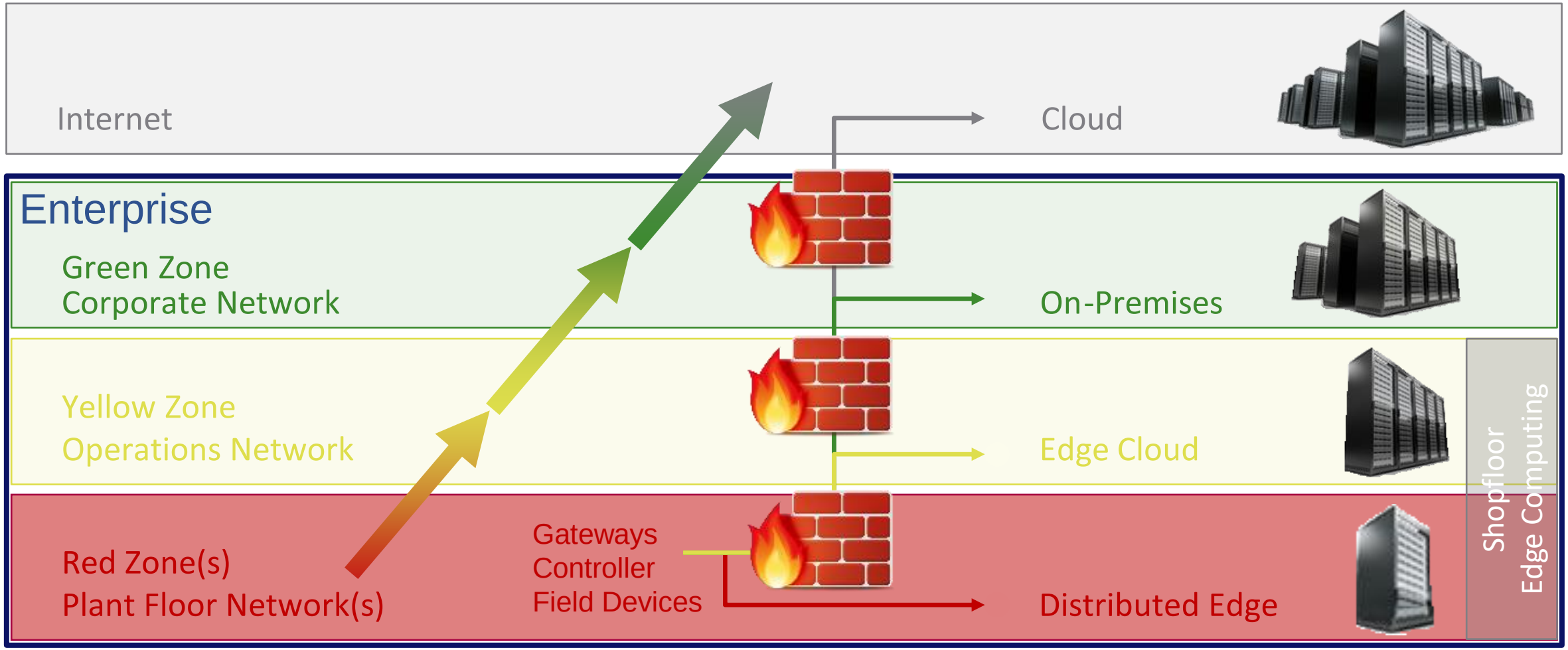
Industry 4.0 Architecture: Software Infrastructure for Metrology



➢ Transition from the automation pyramid to the Industry 4.0 platform

Industry 4.0 Architecture

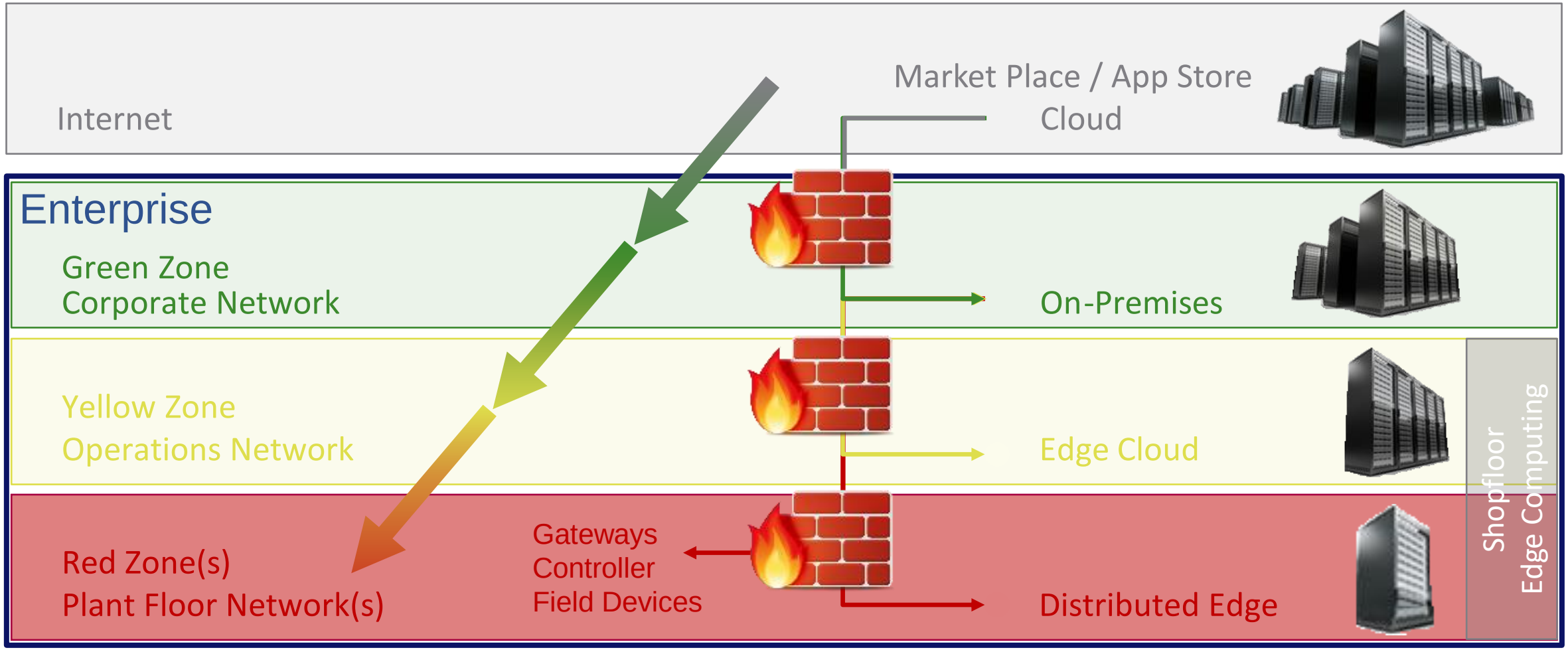
Network Architecture: Provisioning of Data out of Sensor Networks



➢ No direct transition from sensor to the public cloud

Industry 4.0 Architecture

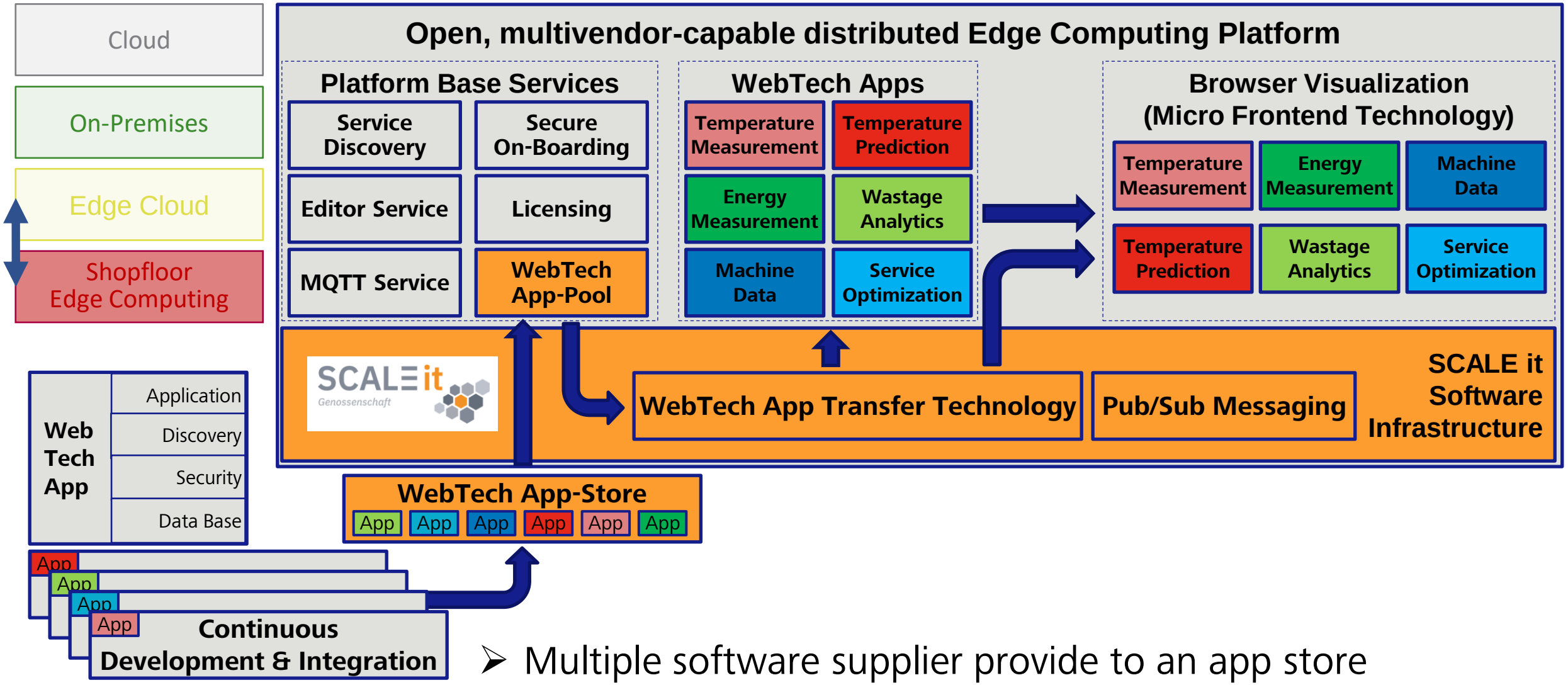
Network Architecture: Provisioning of Software to the Shopfloor



➢ Carry out test scenarios, set parameters and solve security issues

Industry 4.0 Architecture

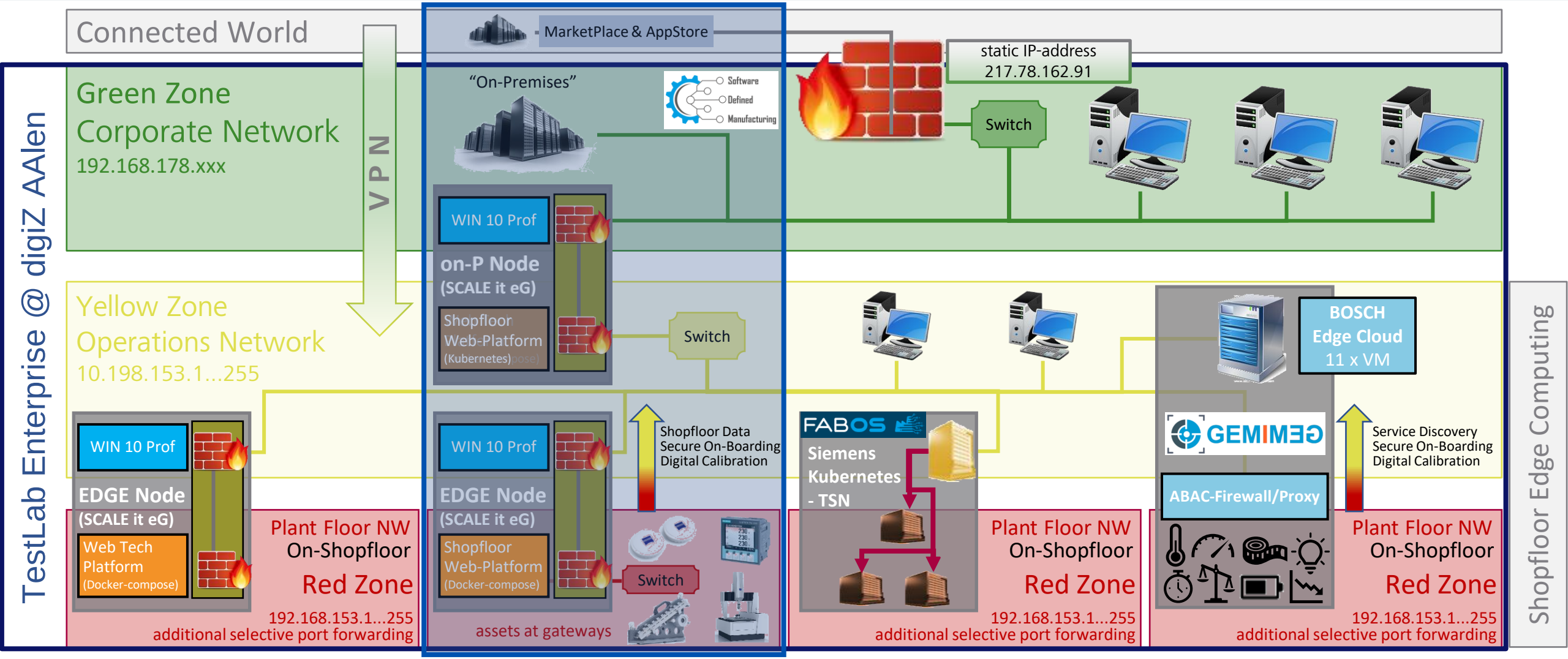
Ecosystem Architecture: Provisioning of Software to the Shopfloor



➢ Multiple software supplier provide to an app store

Industry 4.0 Architecture

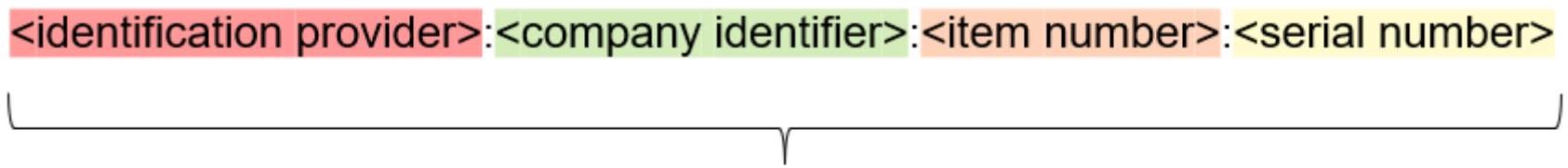
Ecosystem Architecture: Realization of Industry 4.0 TestLab Enterprise



➢ Used by demonstrators of different joint venture projects and SCALE it members

Agenda

Uniform data provisioning
Global unique asset identification



globalAssetId

Unambiguous global instance identification assigned by the manufacturer

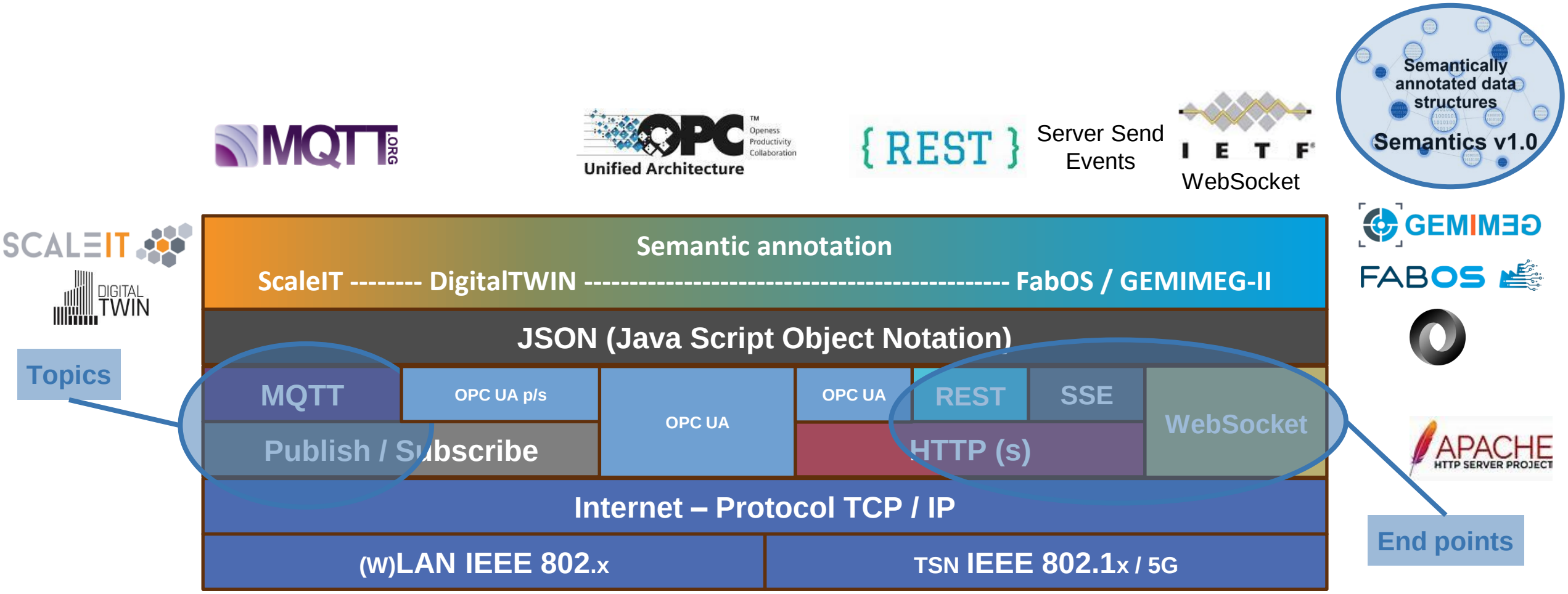
Example (ZEISS IMT facility Aalen):

gs1:4054977:6261409141030:17100147

➢ Different identification providers possible, e.g. also URL, IO-Link, etc.

Uniform data provisioning

Provisioning of data within ethernet networks using de-facto standards



➢ Semantic annotation using SI units, IEC CDD definitions and semantics v1.0

Uniform data provisioning

Uniform topic approach

<PreTopic>/<globalAssetId>/<PostTopic>

<PreTopic> = <enterprise>/<workCenter>/<station>/<controlDevice>/<fieldDevice>
<globalAssetId> = Das Asset, zu dem die Nachricht zugehörig ist.
<PostTopic> = <dataCategory>/<dataSubCategory>

Examples:

CoSA Gateway

"enterpriseX/workCenterA/_/cosaGateway/_/gs1:4054977:6261409141030:17100147/equipmentData/digitalNameplate"
"enterpriseX/workCenterA/_/cosaGateway/_/gs:4054977:6261409141030:17100147/softwareData/softwareNameplate"
"enterpriseX/workCenterA/_/cosaGateway/_/gs1:4054977:6261409141030:17100147/alarmAndEventData/states“

Sensor system FD1 at CoSA Gateway

"enterpriseX/workCenterA/_/cosaGateway/FD1/gs1:4054977:6261409141131:17100321/equipmentData/digitalNameplate "
"enterpriseX/workCenterA/_/cosaGateway/FD1/gs1:4054977:6261409141131:17100321/equipmentData/calibrationData"
"enterpriseX/workCenterA/_/cosaGateway/FD1/gs1:4054977:6261409141131:17100321/processData/measuringValue"
"enterpriseX/workCenterA/_/cosaGateway/FD1/gs1:4054977:6261409141131:17100321/alarmAndEventData/states"

➢ Definition according to RAMI 4.0 using global asset identification

Uniform data provisioning

Semantically annotated data structures - basic structure

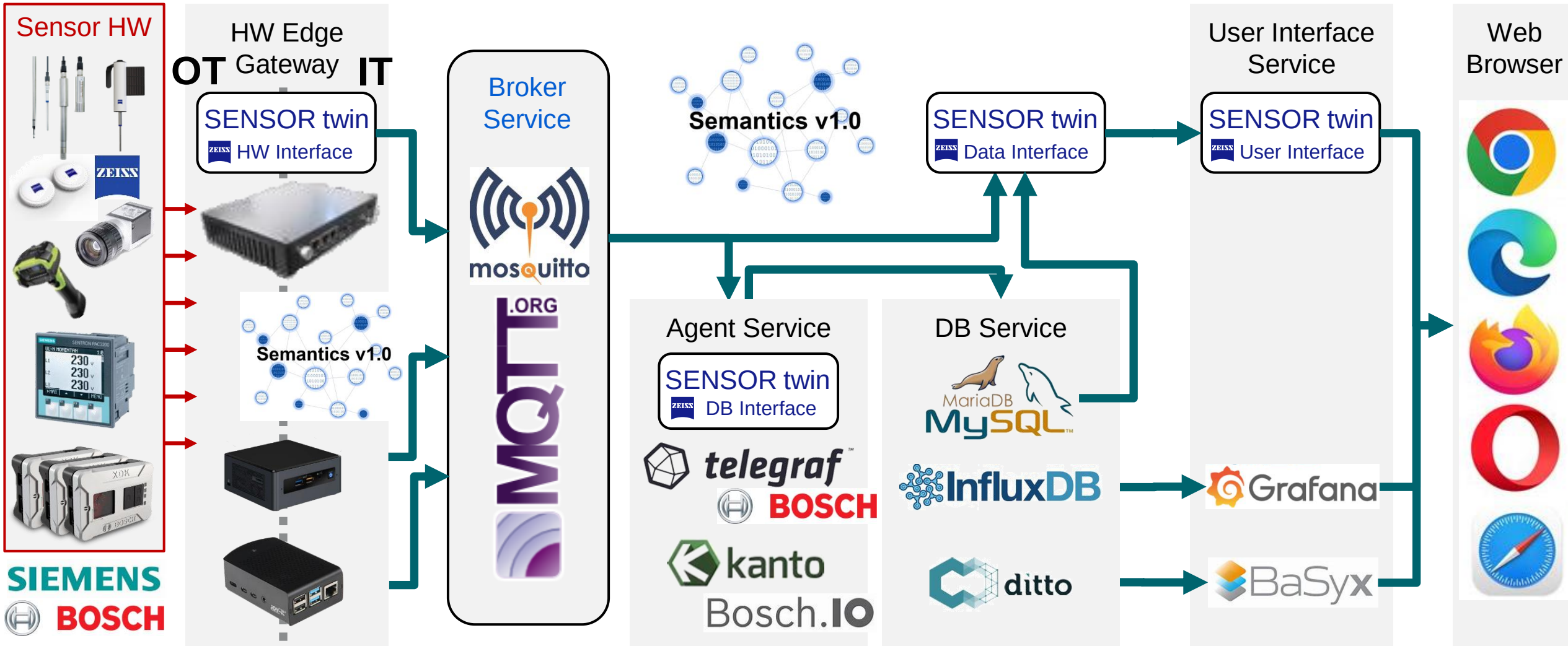
```
{
"semantic": // details of used semantics

{
"type":"<string>",          // scope of definition, e.g. sensors
"version":"<string>",       // versioning standard: major.minor.patch
"specification":"<string>“ // responsible organization
},
"security":
{
"publisher":
{
"id":"<string>",          // globalAssetId
"name":"<string>",
"location":"<string>“     // positionId
},
"receiver":               // optional
{
"id":"<string>",          // optional, globalAssetId
"name":"<string>"         // optional
},
"timestamp":"<string>", // UTC ISO 8601 (e.g. 2021-08-20T10:35:00+00:00)
"signature":"<string>"  // optional, hash (not yet defined)
}, ...
"data":
{
"id":"<string>",          // globalAssetId
"timestamp":"<string>",   // UTC ISO 8601
"category":"<string>",    // equipmentData, softwareData, ...
"content":
{
...
}
}
}
```

- Details within content open to further alignment, e.g. AAS SM data

Uniform data provisioning

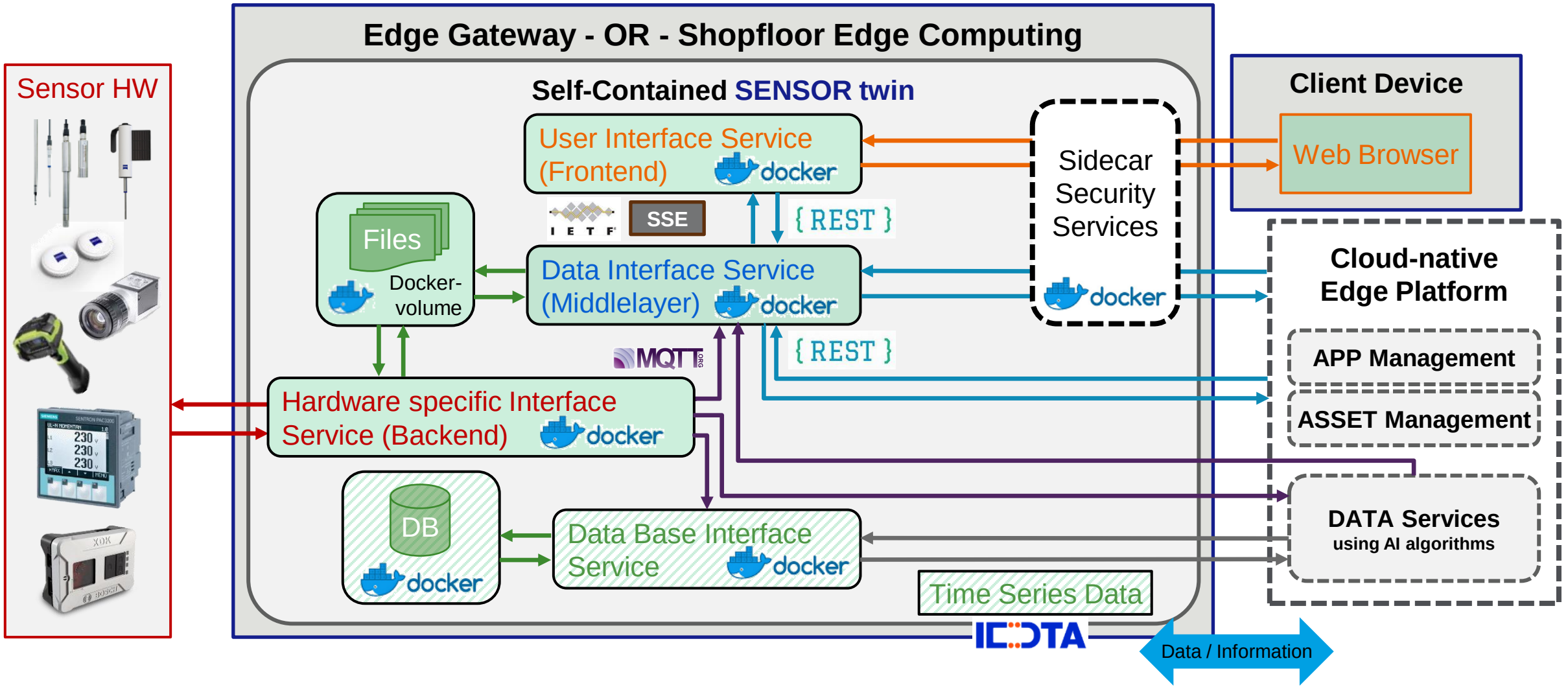
Sensor pipeline - data exchange using semantics



- Common understanding of data according to Semantics v1.0

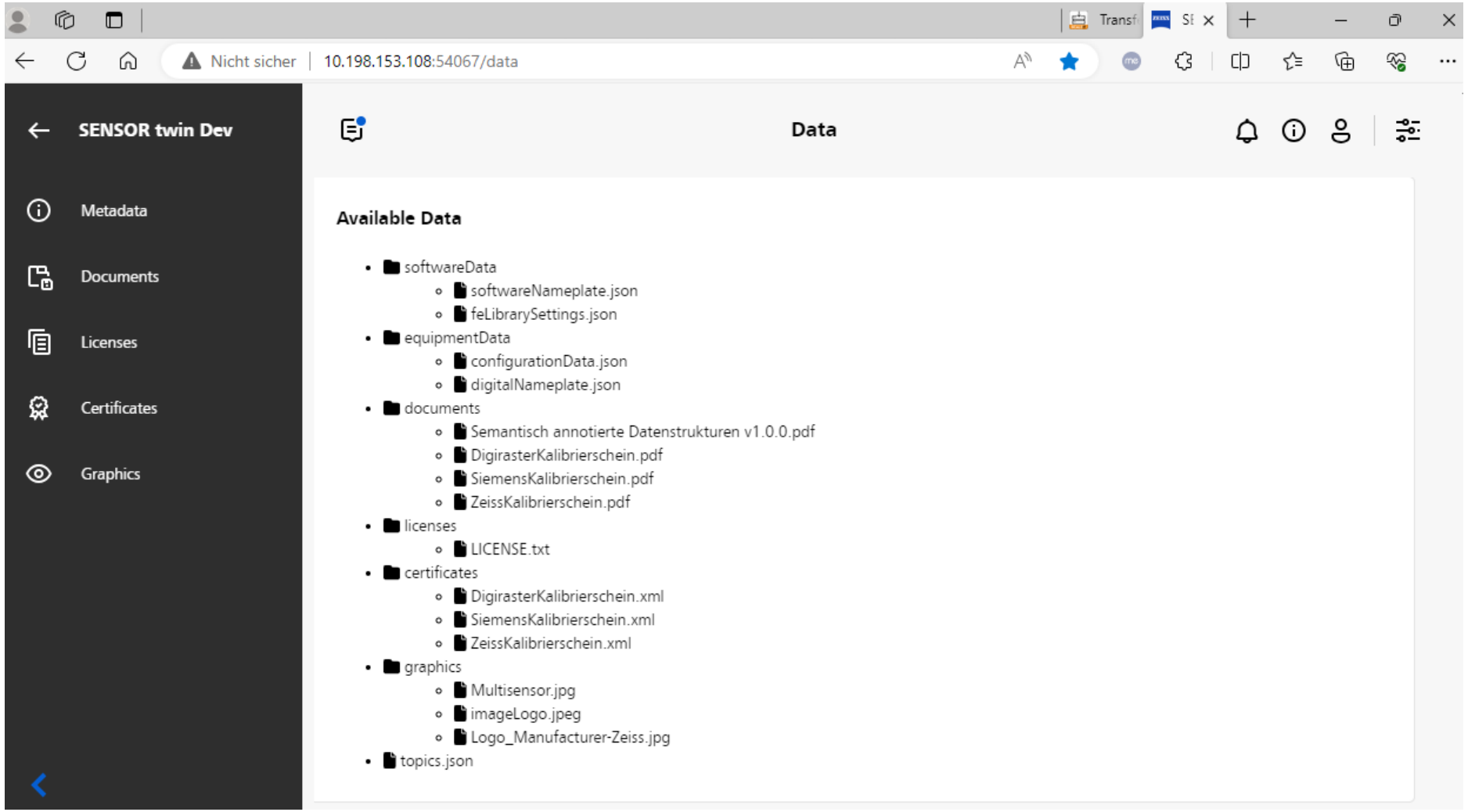
Agenda

Digital twin building
WebTech Sensor Twin realized in Micro Service Architecture



- Micro service architecture opens new business models for cooperation

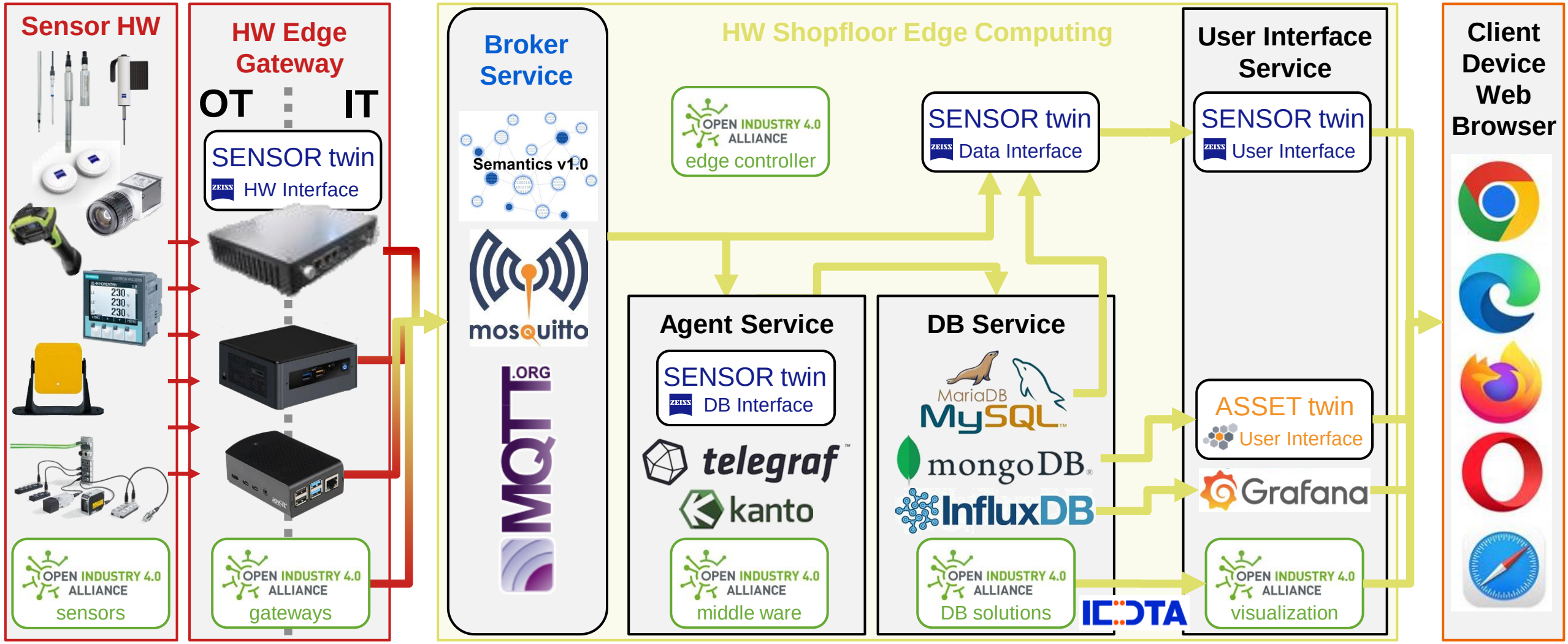
Digital twin building
WebTech Sensor Twin Data



➢ Data delivered during deployment of sensor twin software to the customer

Digital twin building

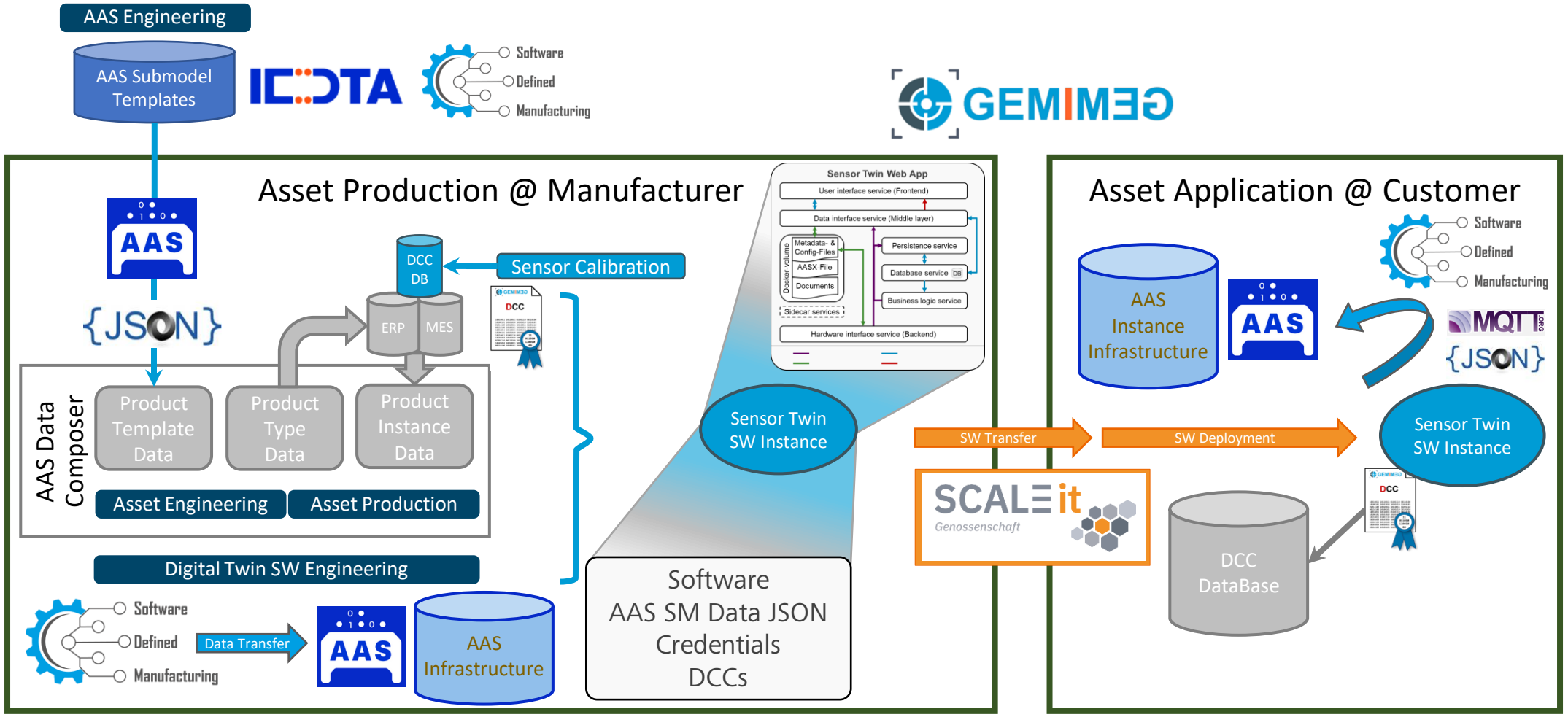
Data exchange using semantics and digital twin



➢ Demonstrator idea at digiZ-AA in cooperation with Open Industry 4.0 Alliance

Digital twin building

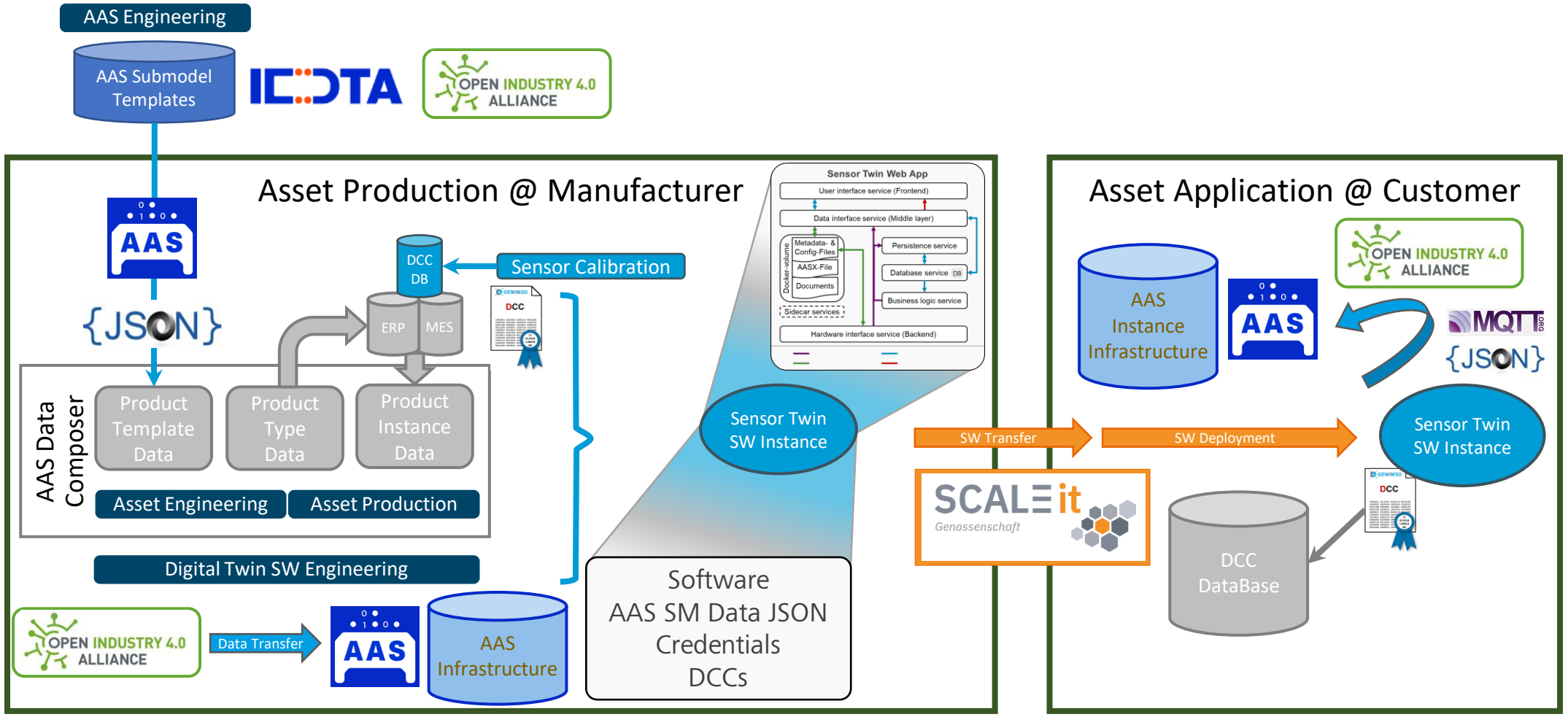
Future proofed data formats, semantics and AAS



➢ Demonstrator idea at digiZ-AA in cooperation with SDM4FZI project partners

Digital twin building

Future proofed data formats, semantics and AAS



➢ Demonstrator idea at digiZ-AA in cooperation with Open Industry 4.0 Alliance

Summary

01	Introduction	
02	Industry 4.0 Architecture	Three-zone concept, cloud agnostic web technology, ecosystem architecture
03	Uniform data provisioning	Ethernet, MQTT, REST, JSON, SI units, IEC CDD definitions and semantics v1.0
04	Digital twin building	Micro service architecture, asset administration shell

Seeing beyond