

TSN Testbed in Augsburg

Labs Network Industrie 4.0 e.V.
and
BMWi Competence Center 4.0 Augsburg

Mittelstand-
Digital 



Mittelstand 4.0
Kompetenzzentrum
Augsburg



Fraunhofer
IGCV

2017

unrestricted

Introduction to LNI 4.0 e.V. and BMWi Competence Center 4.0 Augsburg

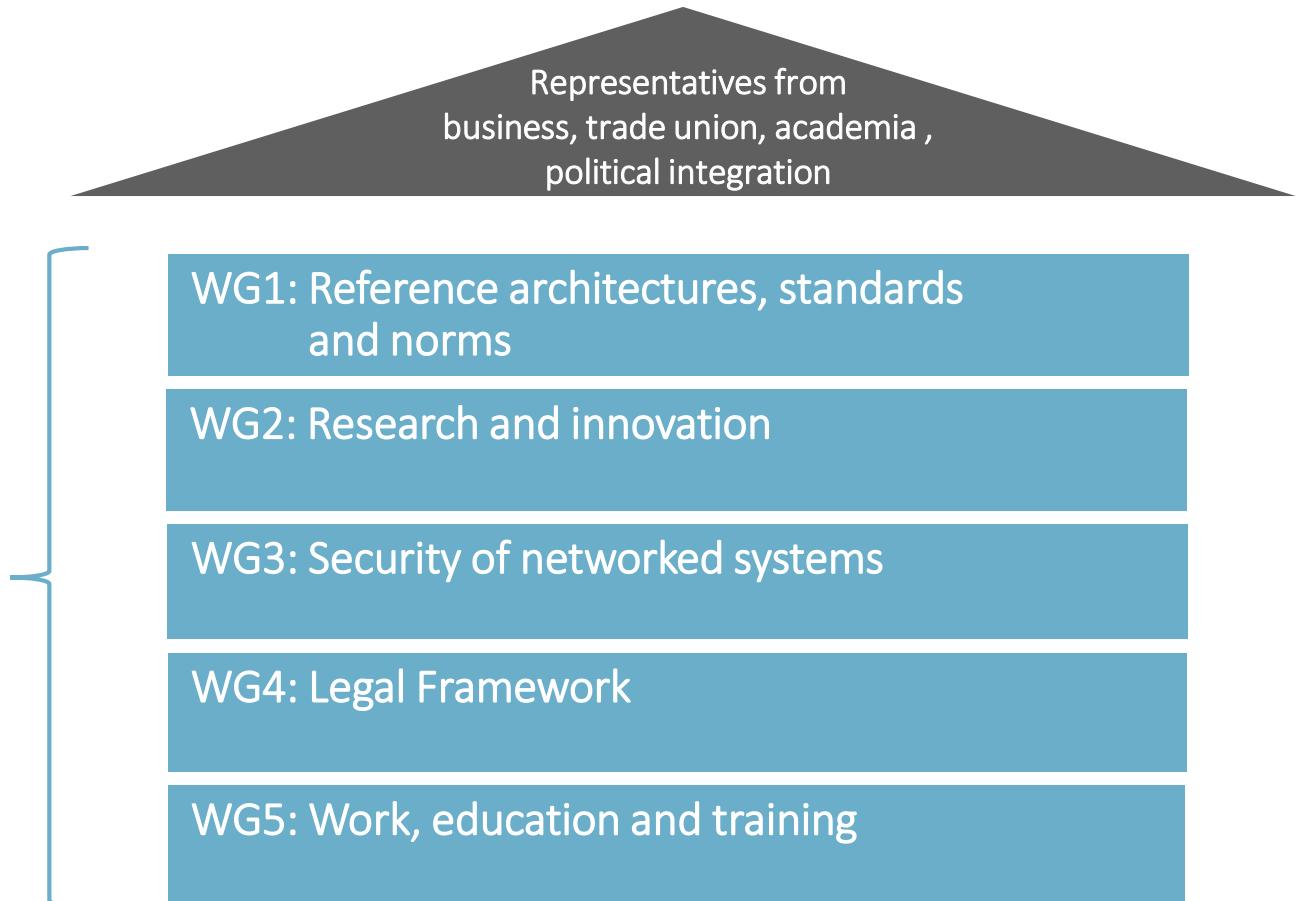
Plattform Industrie 4.0



Working groups



- 400 participants
- Relevant stakeholders in Germany



LNI4.0 founders

Our network feels connected to the entire German industry!



Dr. Klaus Mittelbach
Treasurer



Thomas Hahn
Chairman



Giesecke & Devrient

Axel Deininger
Vice Chairman



Hartmut Rauen



Dr. Hans Jörg Stotz



Prof. Dr. Peter Post



Wolfgang Dorst



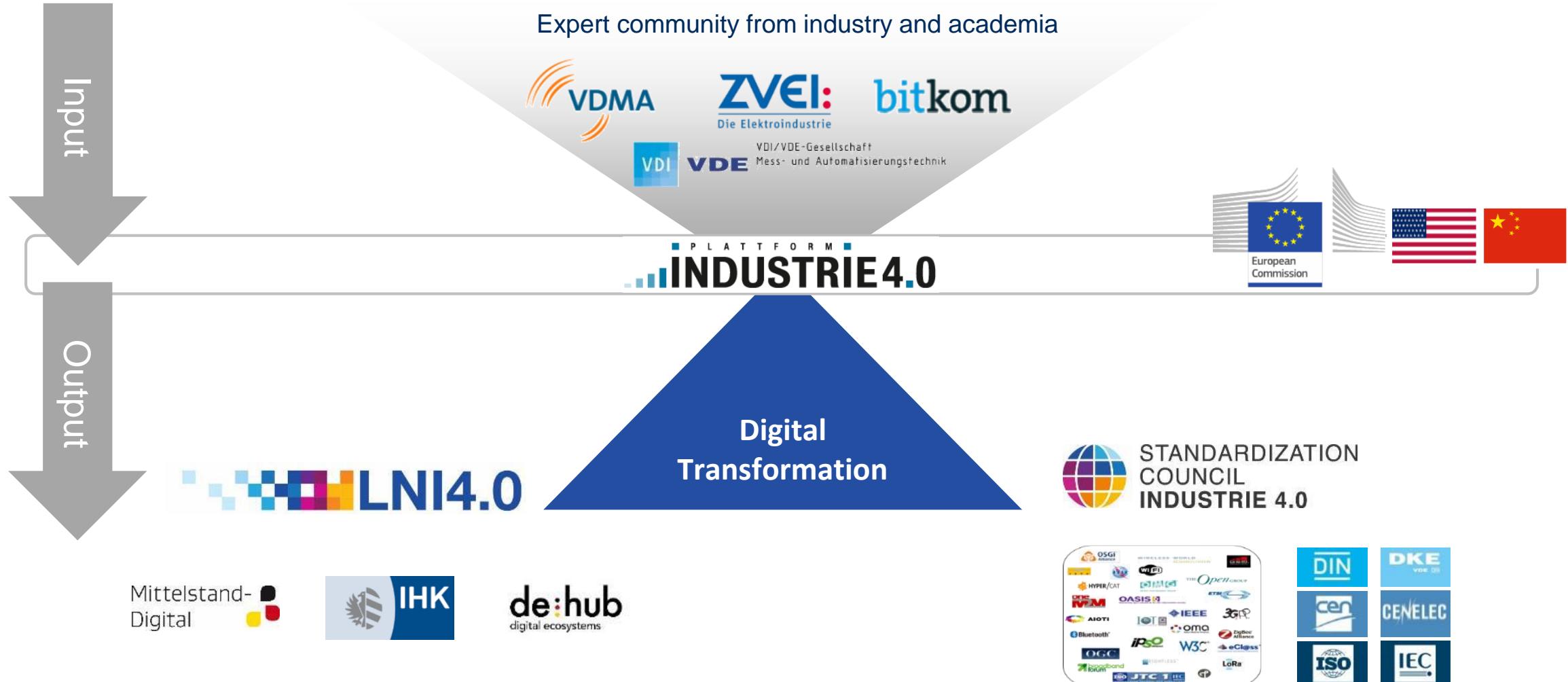
Dr. Heinrich Arnold



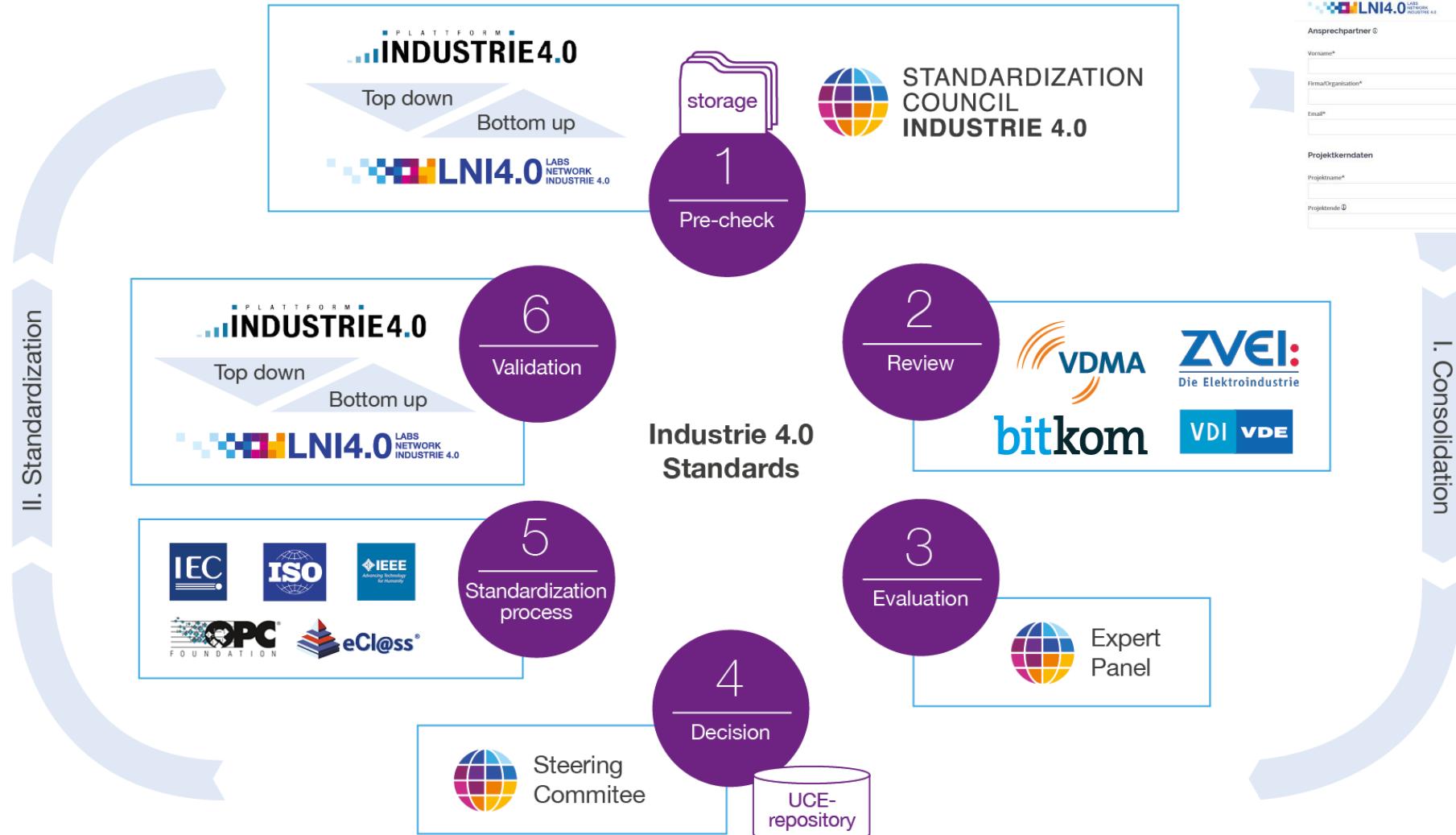
In cooperation with:



Industrie 4.0 Stakeholders



Process for Standardization

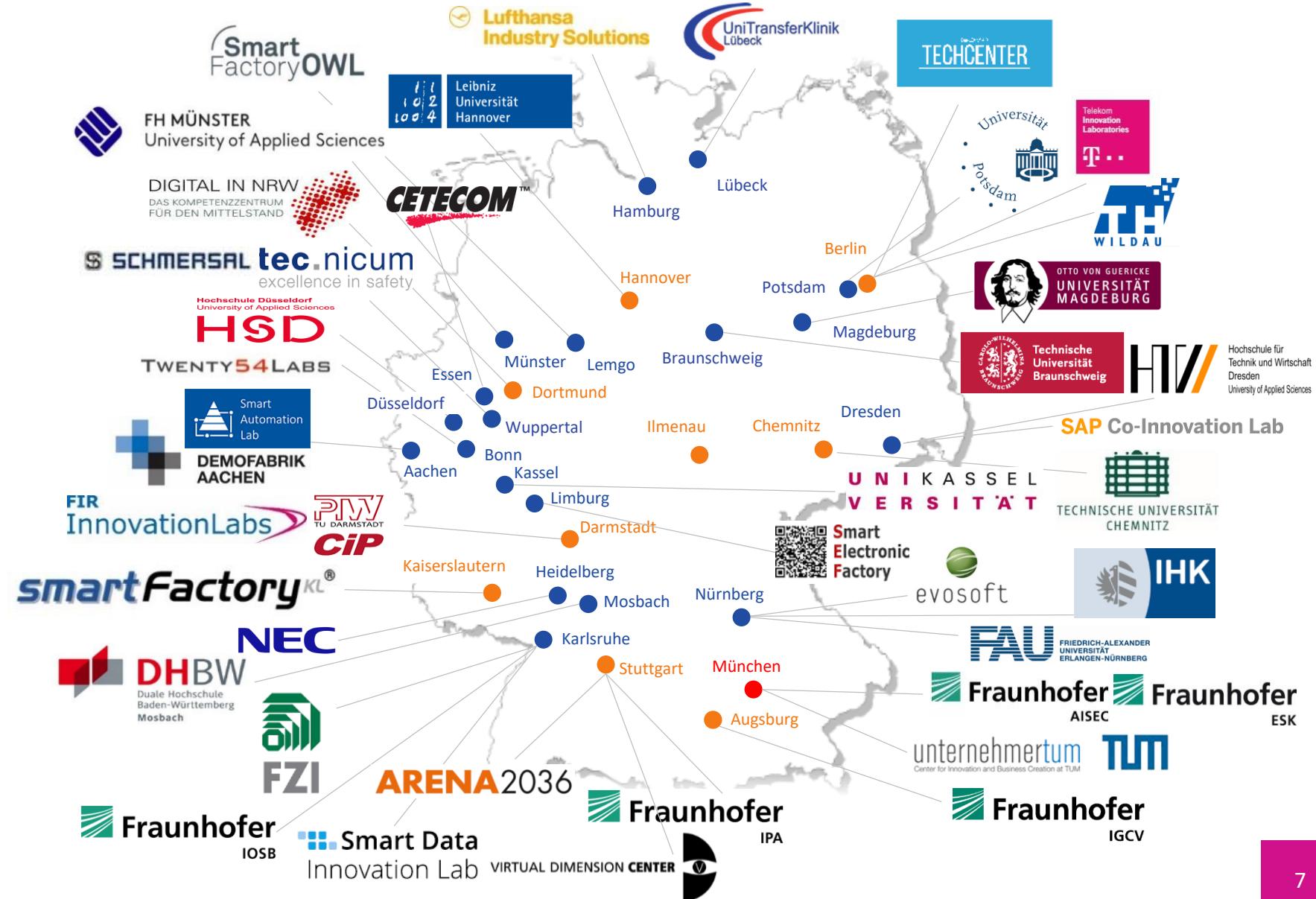


Testlabs

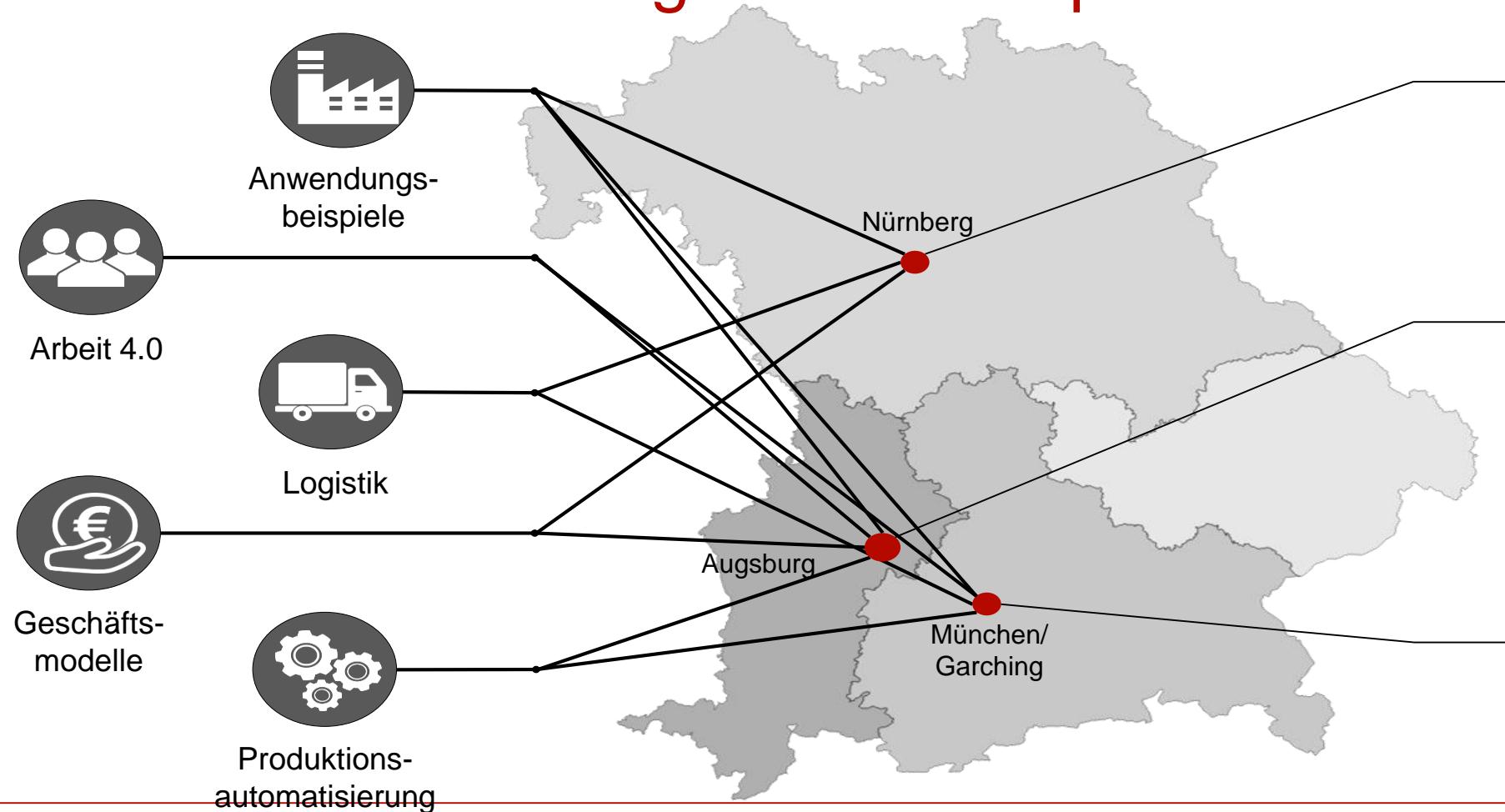
- 30 test lab cooperation
- High availability
- Regional distribution
- Local contacts
- Broad technology mix
- [VDMA labs](#)
- International cooperation



- Mittelstand 4.0 – Kompetenzzentren
- Digital Hub Zentren
- Mittelstand-Digital
- de:hub**
digital ecosystems



Partner und Aufteilung der Schwerpunktthemen



 **Fraunhofer**
IIS

 **Fraunhofer**
IGCV

 **cluster
mechatronik
& automation**

 Institut für Werkzeugmaschinen und
Betriebswissenschaften
Lehrstuhl für
Fördertechnik Materialfluss Logistik




Industrial TSN Testbed

Testbed: Initiative of German Plattform Industrie 4.0 WG 1

Mittelstand 4.0-Truck and Shopfloor

- Ability to customize the truck with TSN Testbed and different usecases
- Visit of trade fairs, conferences and on-site training courses for SMEs



TSN partners (22)



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for a better world™



AHEAD OF WHAT'S POSSIBLE™



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PERFECTION IN AUTOMATION
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THE SPIRIT OF SAFETY



Sensor Intelligence.



Group



Overall TSN Testbed Goal



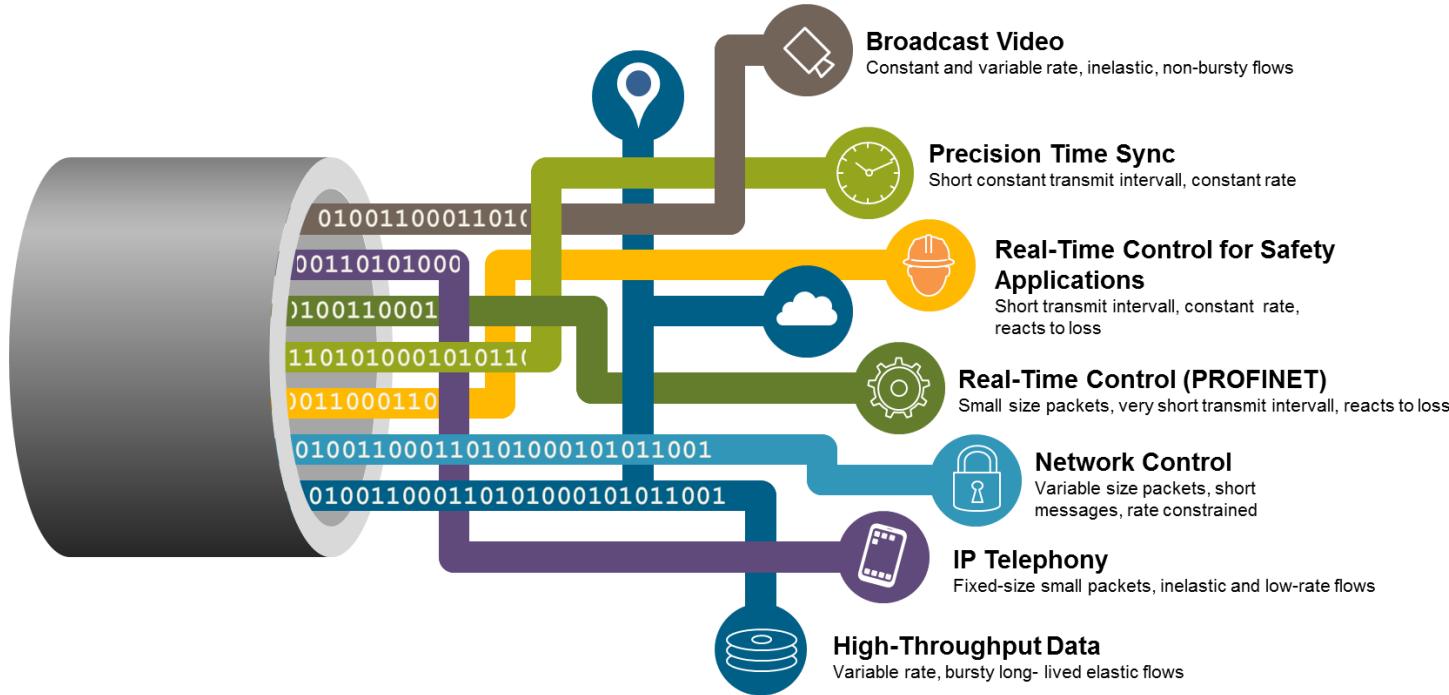
- Purely industrial testbed to host several usecases
- Continuous plug-festival
- TSN product development of each company in protected environment on neutral ground (BMWi Competence Center 4.0 Augsburg)
- TSN testbed creates input and validation for standardization (SCI4.0)
 STANDARDIZATION COUNCIL INDUSTRIE 4.0
- Usecases covered: controller to controller communication over OPC UA @ TSN

TSN Testbed Organization



- Group 1: Robotics
- Group 2: Controllers
- Group 3: Network, Architecture
- Group 4: Cloud

TSN Technology



Synchronization

Low Latency

Robustness

High Availability

- TSN several IEEE standards
IEEE 802.1ASbt, IEEE 802.1Qbu, IEEE 802.1Qbv, IEEE 802.1Qca,
IEEE 802.1CB, IEEE 802.1Qcc

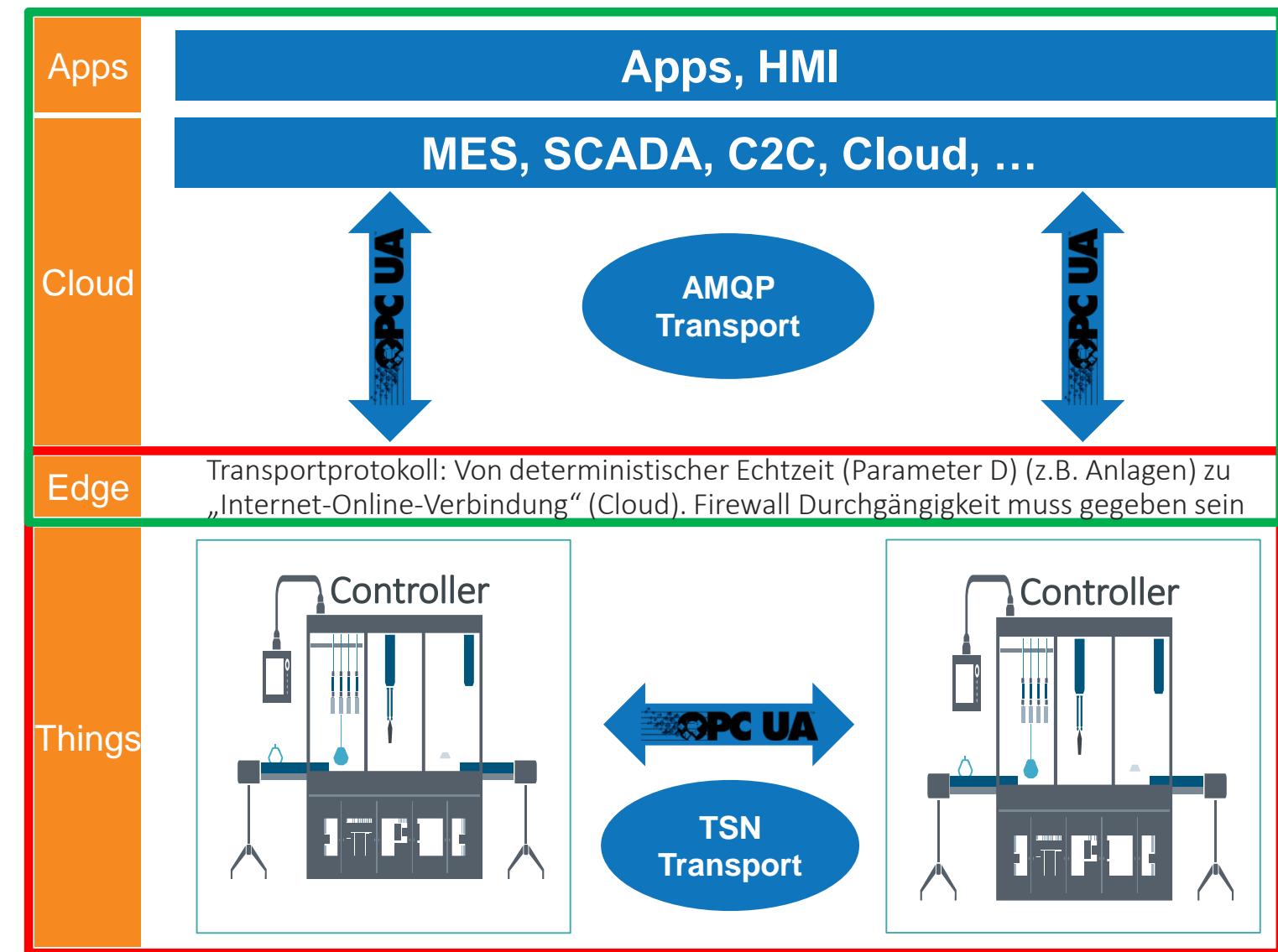
TSN using OPC UA

Two aspects:

- **Horizontal**
(Controller to Controller):
OPC UA for communication
- **Vertical**
(Controller to
MES, Cloud, C2C...)

TSN: „...a collection of features in IEEE 802.1xxx that focus on latency as the primary performance metric.“

Source: IEEE P802.1Qcc



TSN Configuration Models

System Configuration IEEE 802.1

LNI Testbed

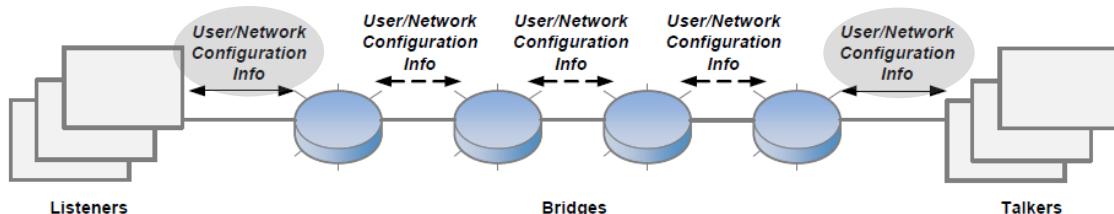


Figure 99-1 — Fully Distributed Model

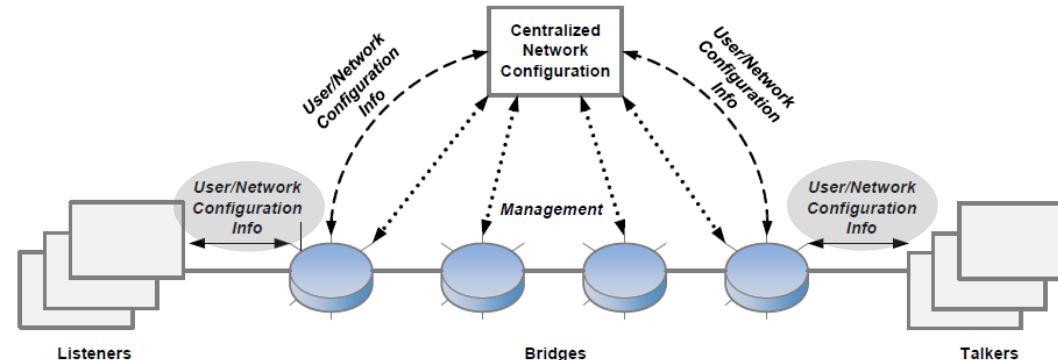


Figure 99-2 — Centralized Network / Distributed User Model

IIC Testbed

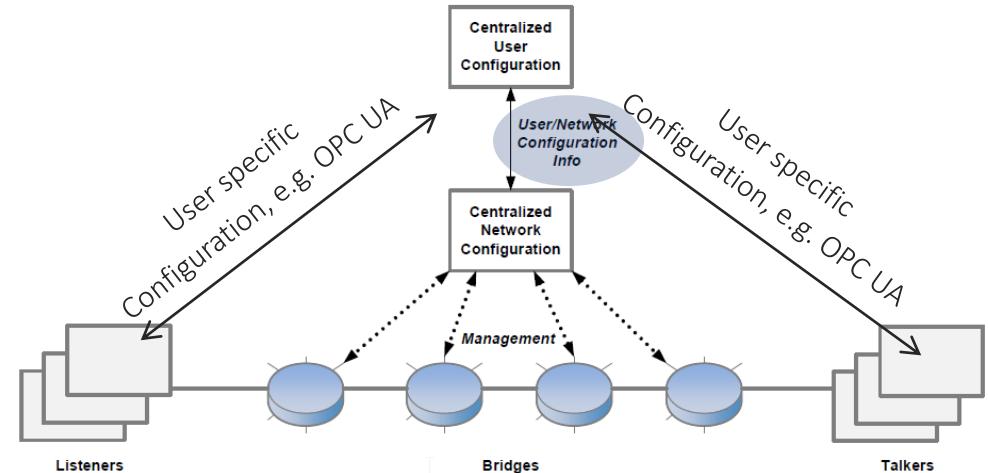


Figure 99-3 — Fully Centralized Model

Fully Distributed Model, or
Centralized Network / Distributed User Model :
UNI interface located at network edge to hide internal network.

UNI = User-Network Interface

Fully Centralized Model:
UNI interface located between CUC and CNC

Target TSN Configuration 1 (Augsburg Testbed)

Centralized network, distributed user model with UNI

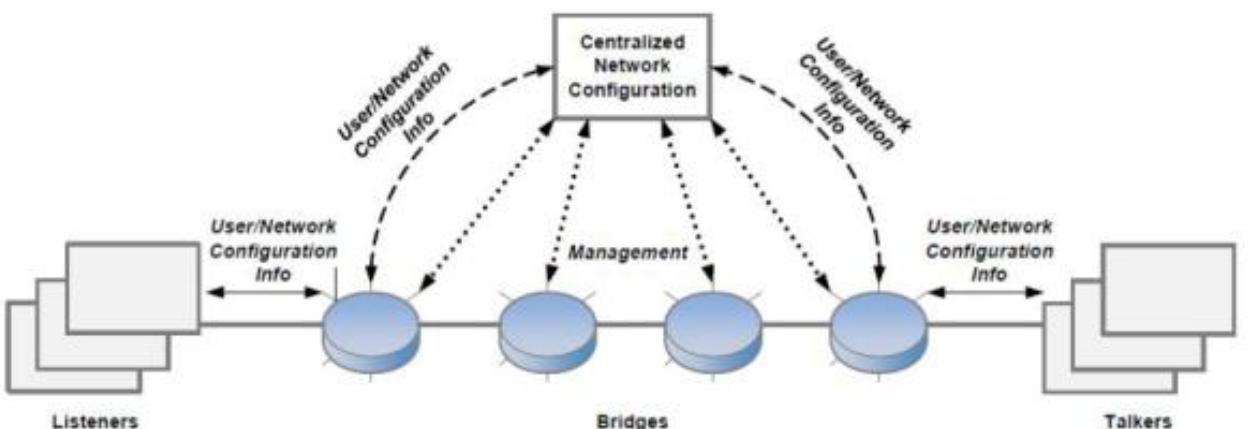


Figure 99-2 — Centralized Network / Distributed User Model

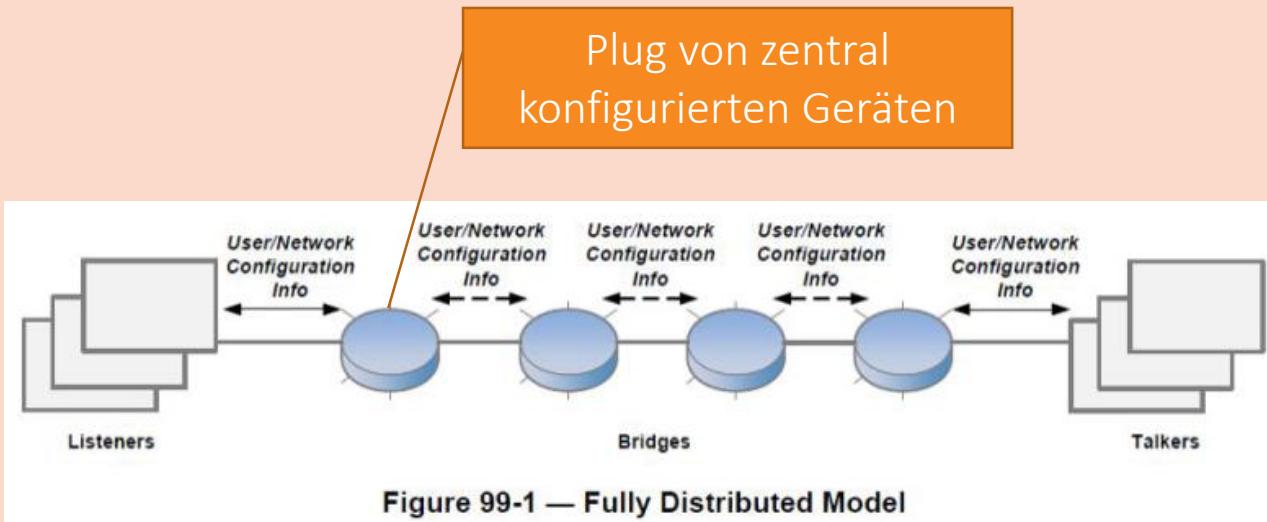
Centralized network, distributed user model with UNI

- Plug&Play**
- Applications can be unknown
 - No config of network
 - ad-hoc connections
 - Central component necessary
 - Large industrial networks with many config

UNI = User-Network Interface

Target TSN Configuration 2 (Augsburg Testbed)

Fully distributed model with User Network Interface



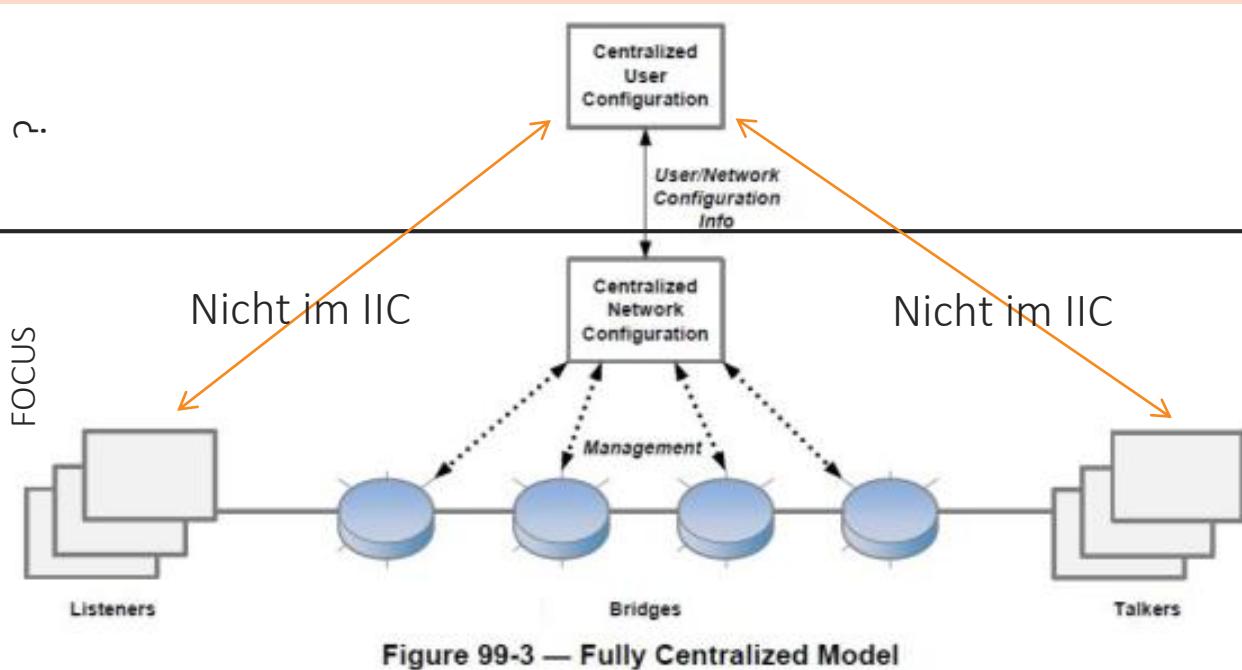
Fully distributed model

- Applications can be unknown
- No config of network
- ad-hoc connections
- Central component NOT necessary
- Small industrial networks with little config

UNI = User-Network Interface

TSN Config Models (IIC Testbed)

Fully centralized model

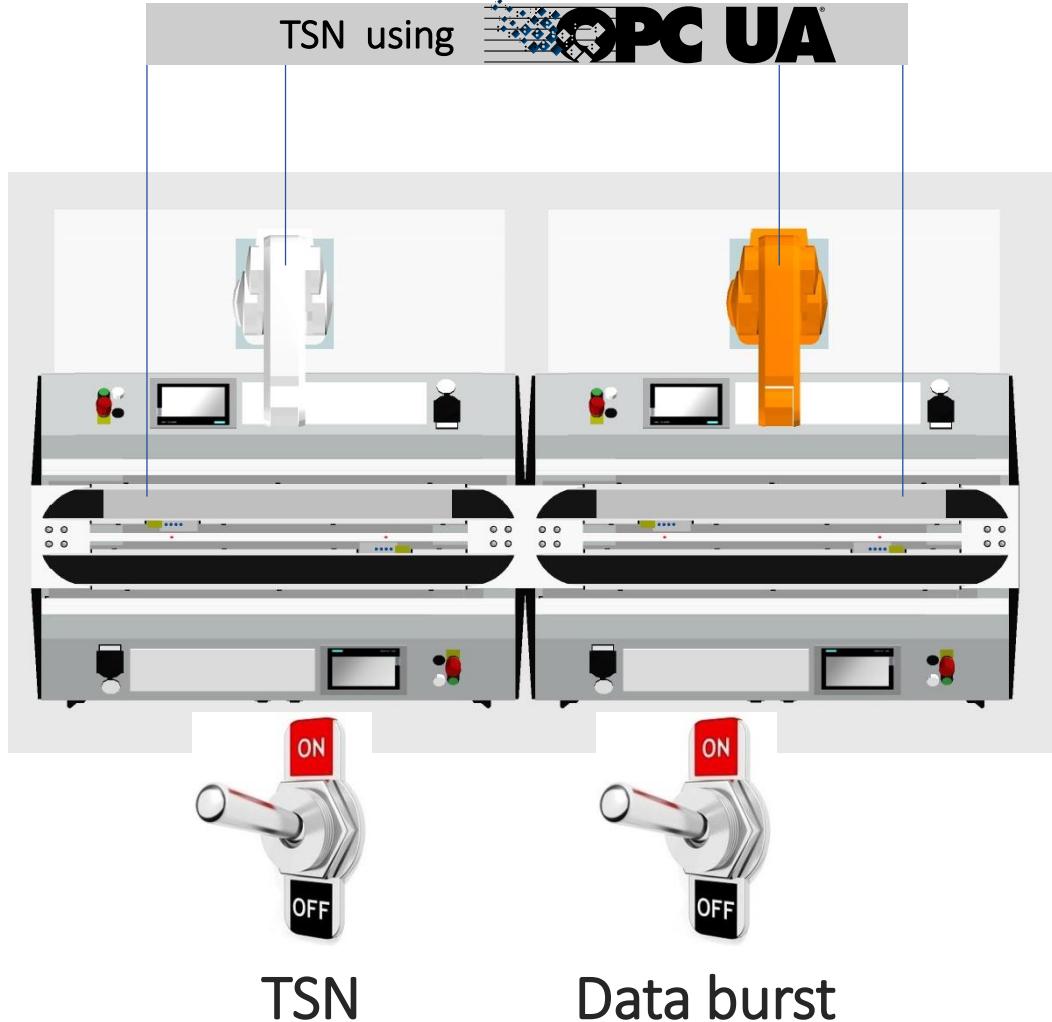


Fully centralized model

- Alle Applikationen müssen vorher bekannt sein
- Projektierung/Konfiguration des Netzwerkes notwendig
- Unterstützt keine ad-hoc-Verbindungen
- Zusätzliche zentrale Komponente benötigt

UNI = User-Network Interface

First TSN Usecase (Mechanics)



LNI4.0 Test Project Example

VALIDATION OF THE CONCEPT OF INDUSTRIE 4.0 COMPONENTS

Solution approach

- Implementation of the administration shell for Industrie 4.0 components.
- Using openAAS to validate selected RAMI4.0 concepts in an existing environment.
- Browse through the relevant openAAS objects and their contents.

Project procedure

- Combines a physical flexible transportation system (Multi-Carrier-System) and a virtualized production plant.
- Both are connected to a cloud to analyze usage and energy consumption data.
- Several use cases will result in appropriate standardization activities.
- Presentation of the results at the 2017 Hannover Fair.



FACILITATE TEST SCENARIOS



PLATTFORM
INDUSTRIE4.0



STANDARDIZATION
COUNCIL
INDUSTRIE 4.0



SIEMENS



PHOENIX CONTACT



SAP



T...



Conclusion TSN Testbed



- Industrial Testbed driven by Industrie 4.0-Usecases
- Plug&Work @ TSN (decentral configuration concept)
- SME can access testbed without obstacles (member fees,...)
- Direct access to SCI 4.0 and associations (VDMA, ZVEI, BITKOM,...) which take care internationally (IEEE,...)
- Synergy effects with already ongoing LNI4.0 usecases
- Liaison with OPC Foundation is planned
- Link to PNO and IIC given by partners

Thank you!

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