

European Industry Partnerships Meeting

5th of November 2019, Brussels

Dr.-Ing. Alexander Willner, EECC / Fraunhofer FOKUS

01

Welcome

Goal Today

Take up the cudgels for
software-based industrial infrastructures.



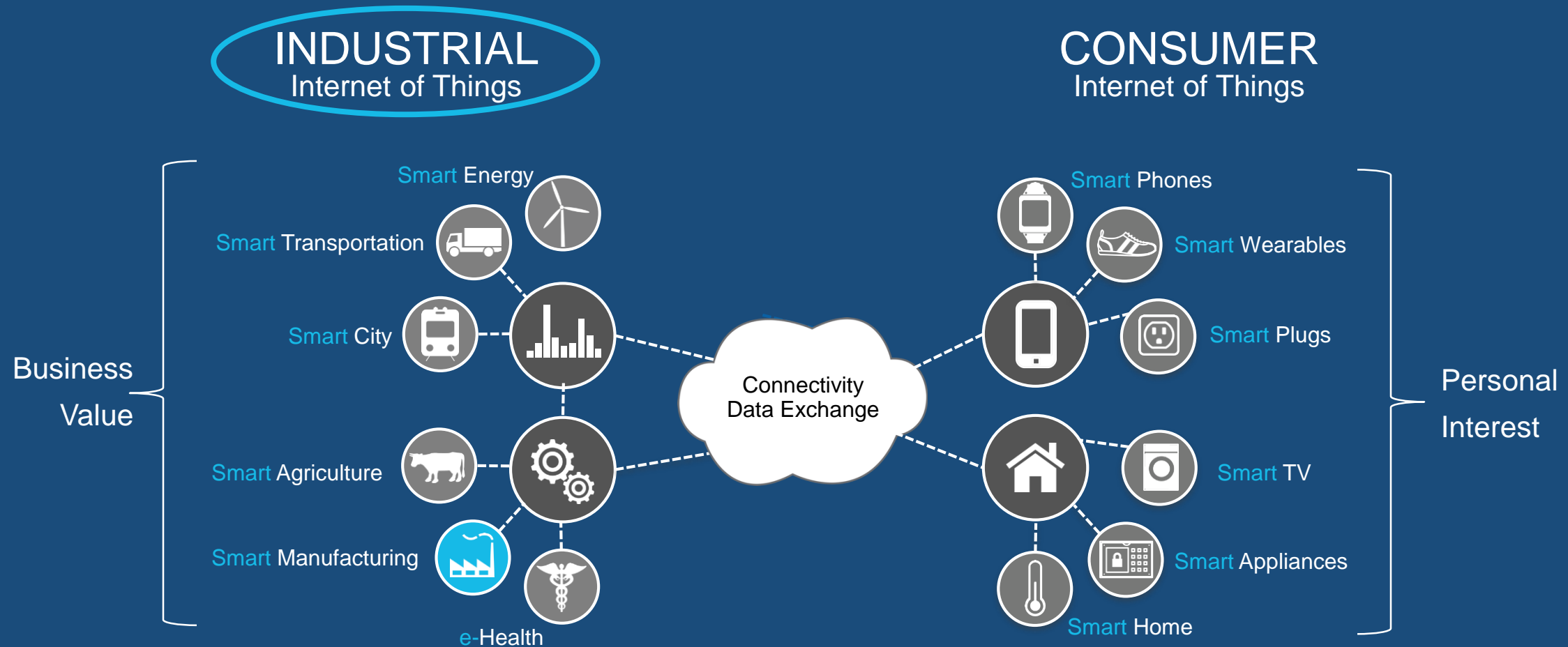
02

Context Industrial IoT (IIoT)

What is Industrial IoT?*

As a scientist, I like to define things. Fortunately, the following slide is in line with most other slides I've seen today.

IIoT: The Use of Internet of Things Technologies in Industrial Domains



Source: Based on Texas Instruments and Moor Insights & Strategy's report Segmenting the Internet of Things (IoT)

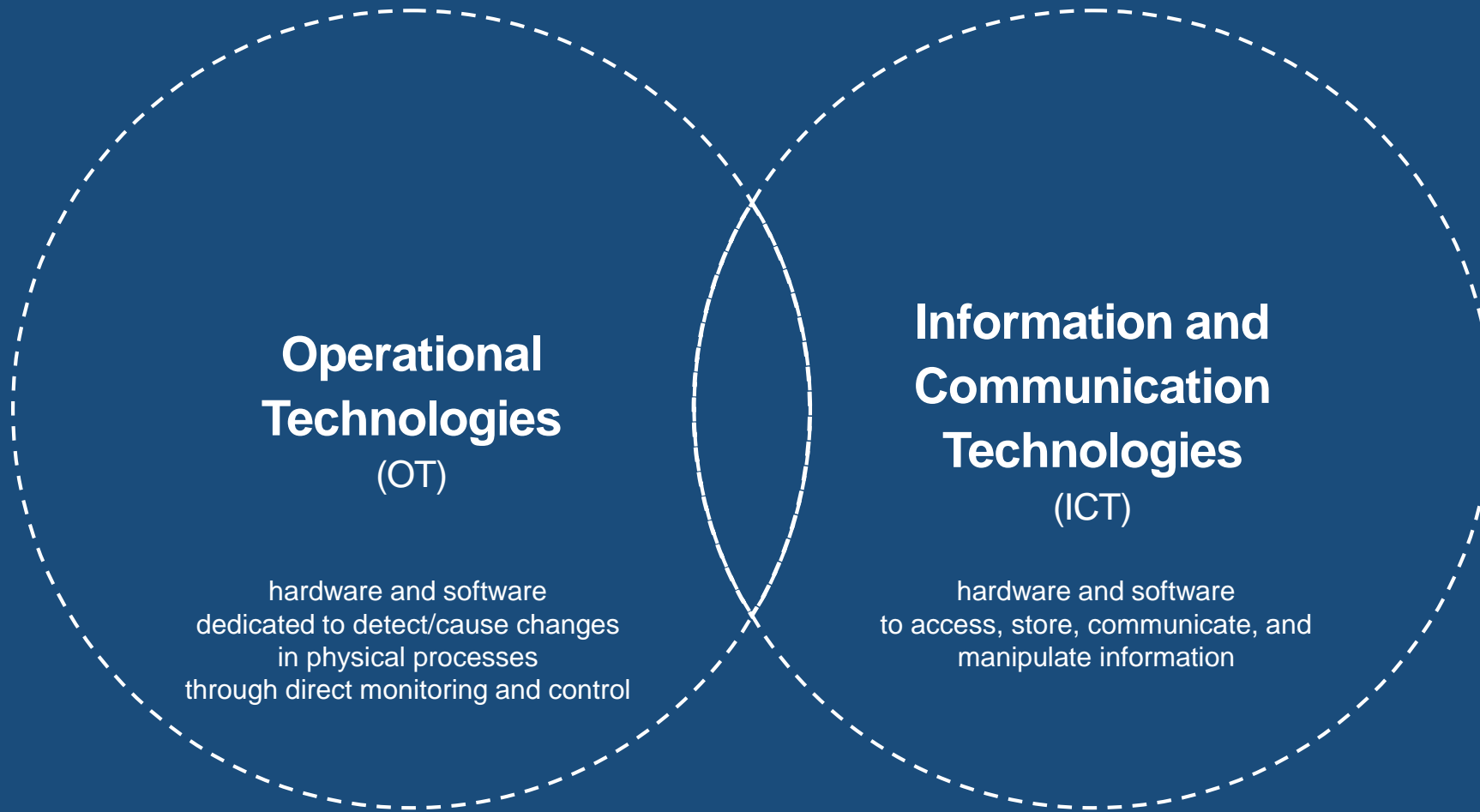


03

Challenge Industrial Requirements

What do all IIoT domains have in common?

IIoT as the convergence of OT and ICT



Industrial (communication) systems must be
reliable, fast, deterministic, autonomous, safe, secure, interoperable, ...



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Existing Work

Evolution towards the “New Stack”

What has happened the last 60 years?

Evolution towards the “New Stack”



Connectivity

From: Current Loop

To: TSN / 5G



Communication

From: Analog Signals

To: OPC UA



Data

From: Proprietary Models

To: OPC UA Comp. Spec.



Programmability

From: Hard Wired

To: Edge AI

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Evolution Software-based Industrial Infrastructures

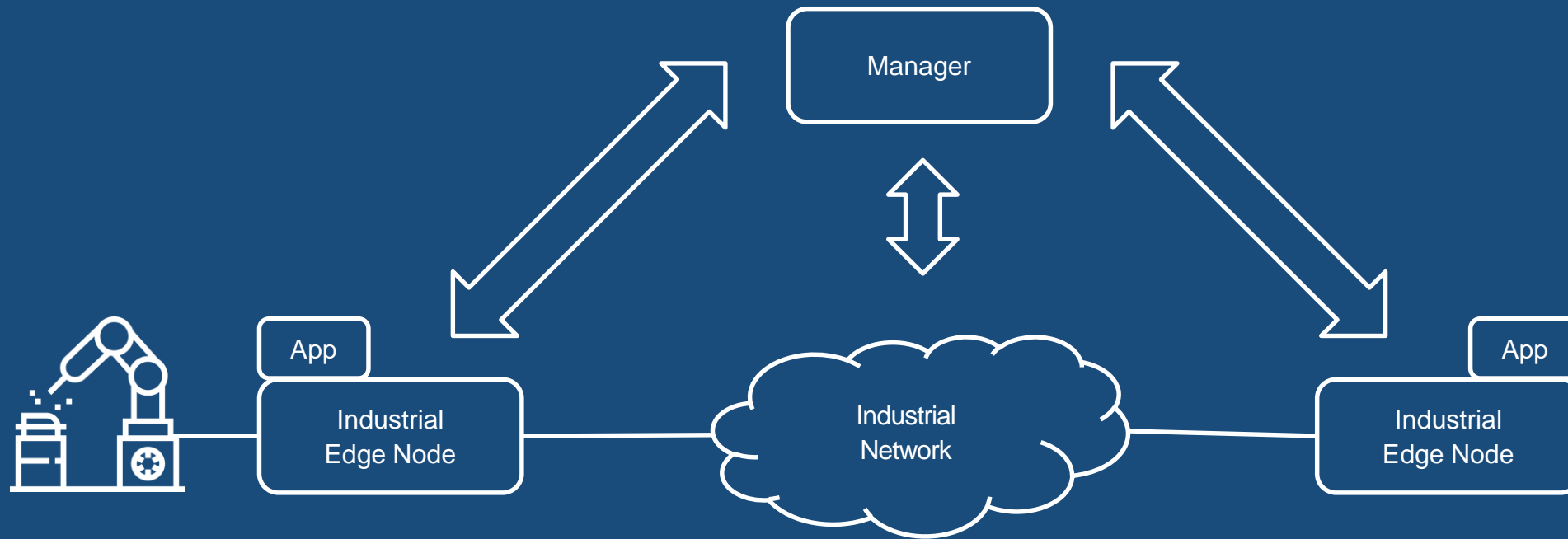
Software eats the Industry*

* e.g. the OT / ICT convergence in the telecommunication sector (POTS, ISDN, VoIP, OTT, ...)

Towards Software-based Industrial Infrastructures

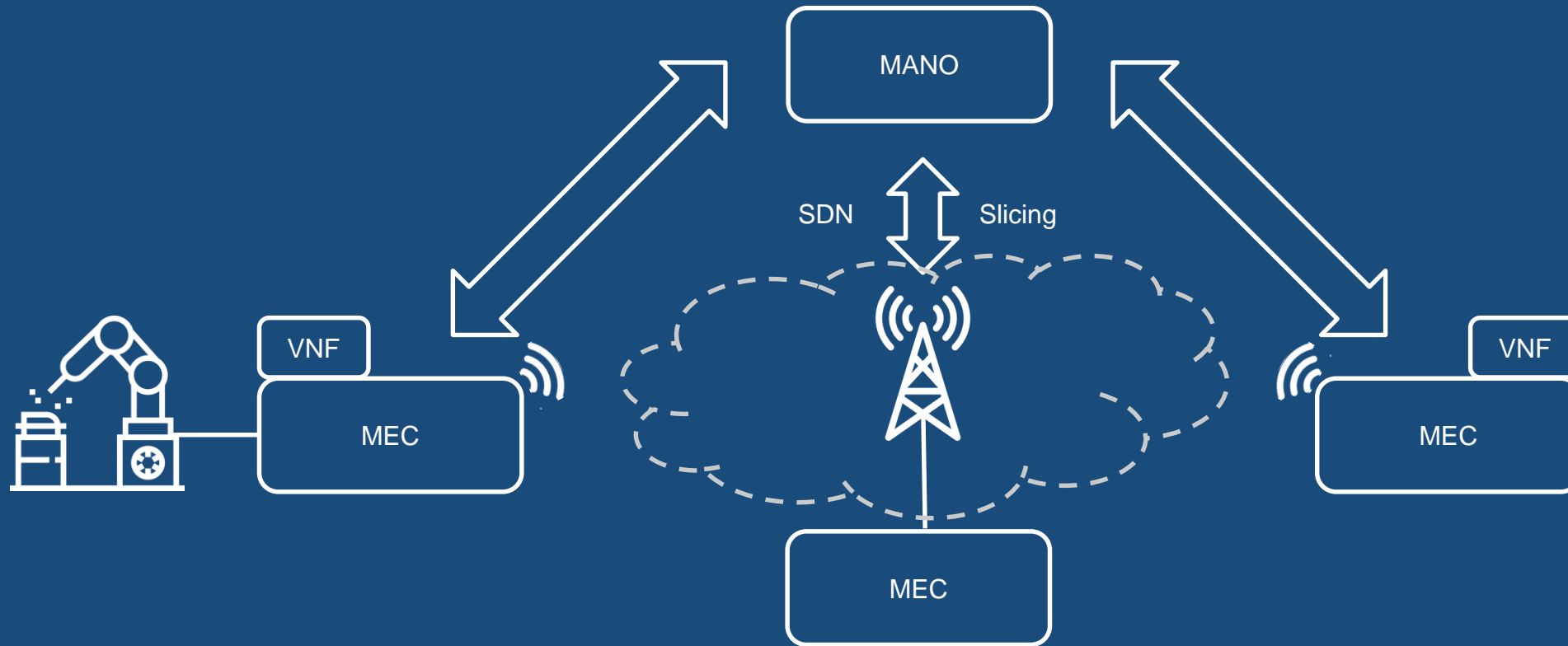


(Over-)Simplified Overall Architecture



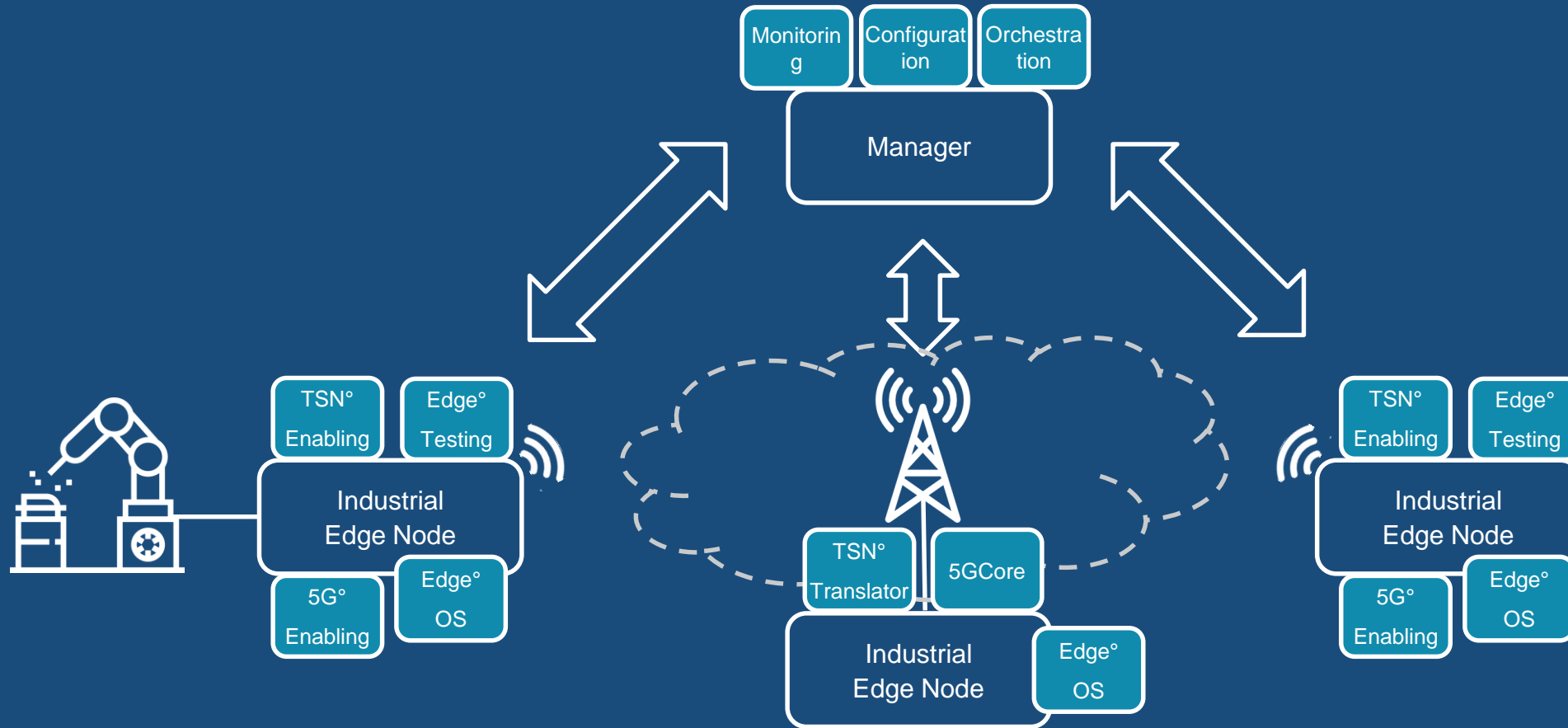
● ————— single time domain or synchronized time domains with scheduled RT traffic (with redundancy) ————— ●

Simplified Overall Architecture (Wireless Focus)

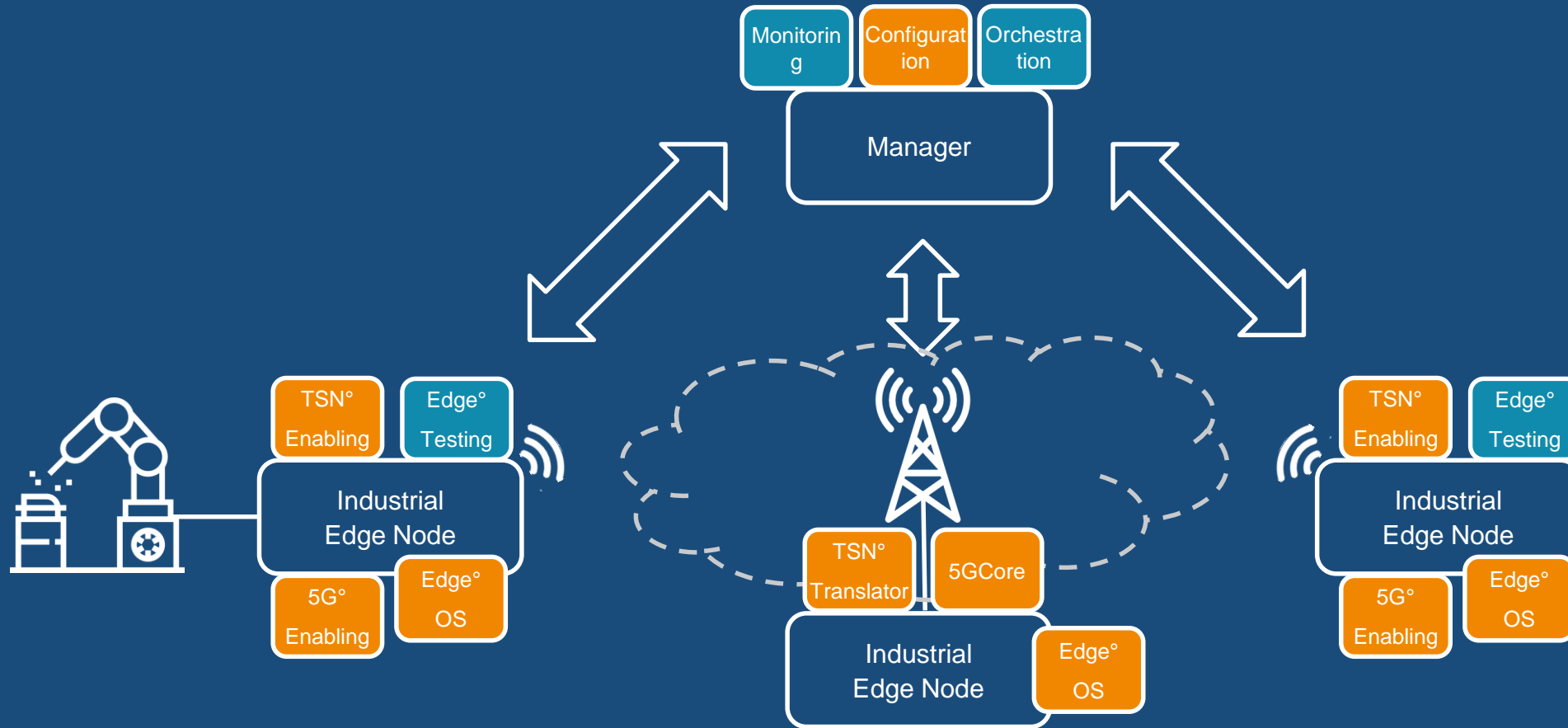


● ————— single time domain or synchronized time domains with scheduled RT traffic (with redundancy) ————— ●

Various software components and research needed (selection)



One Scenario: Towards a SA Core Network for TSN over 5G for URLLC



● ————— single time domain or synchronized time domains with scheduled RT traffic (with redundancy) ————— ●

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Objective

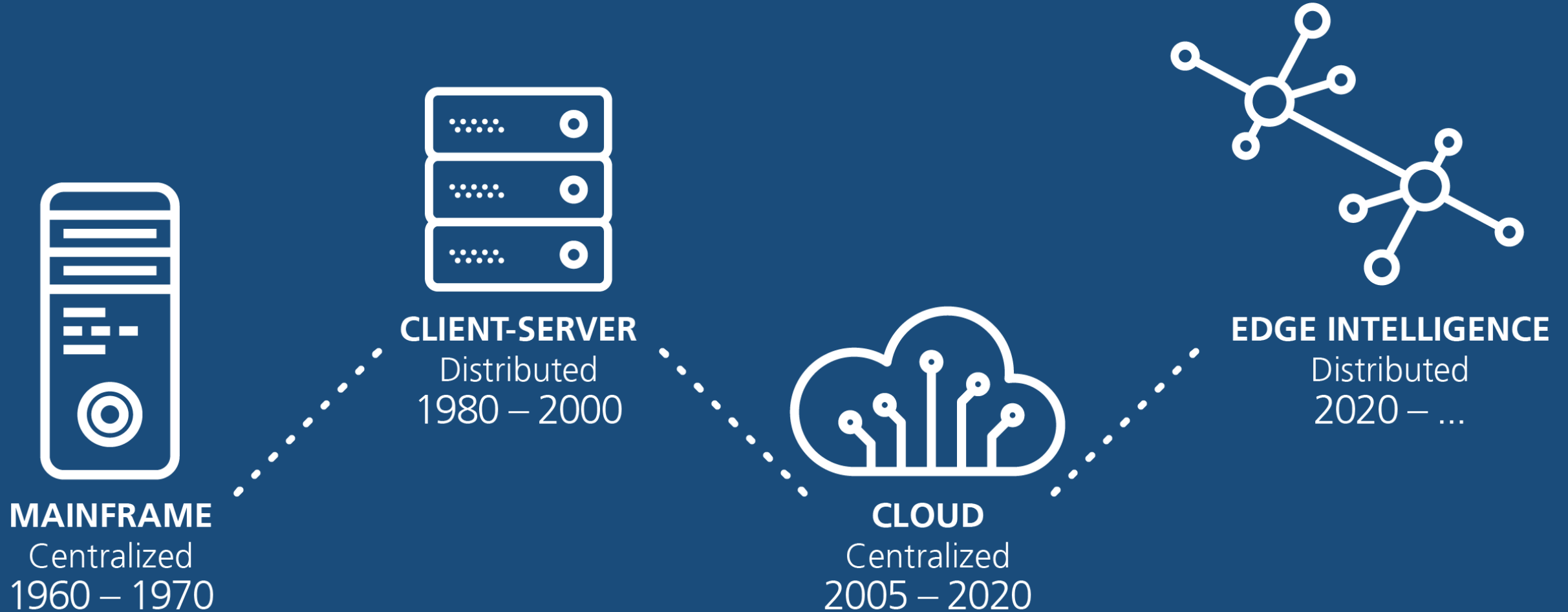
Accelerate Research, Innovation, Adoption

The Edge Computing market
is estimated to be worth 26 Billion EUR by 2024*

* take this with a grain of salt.

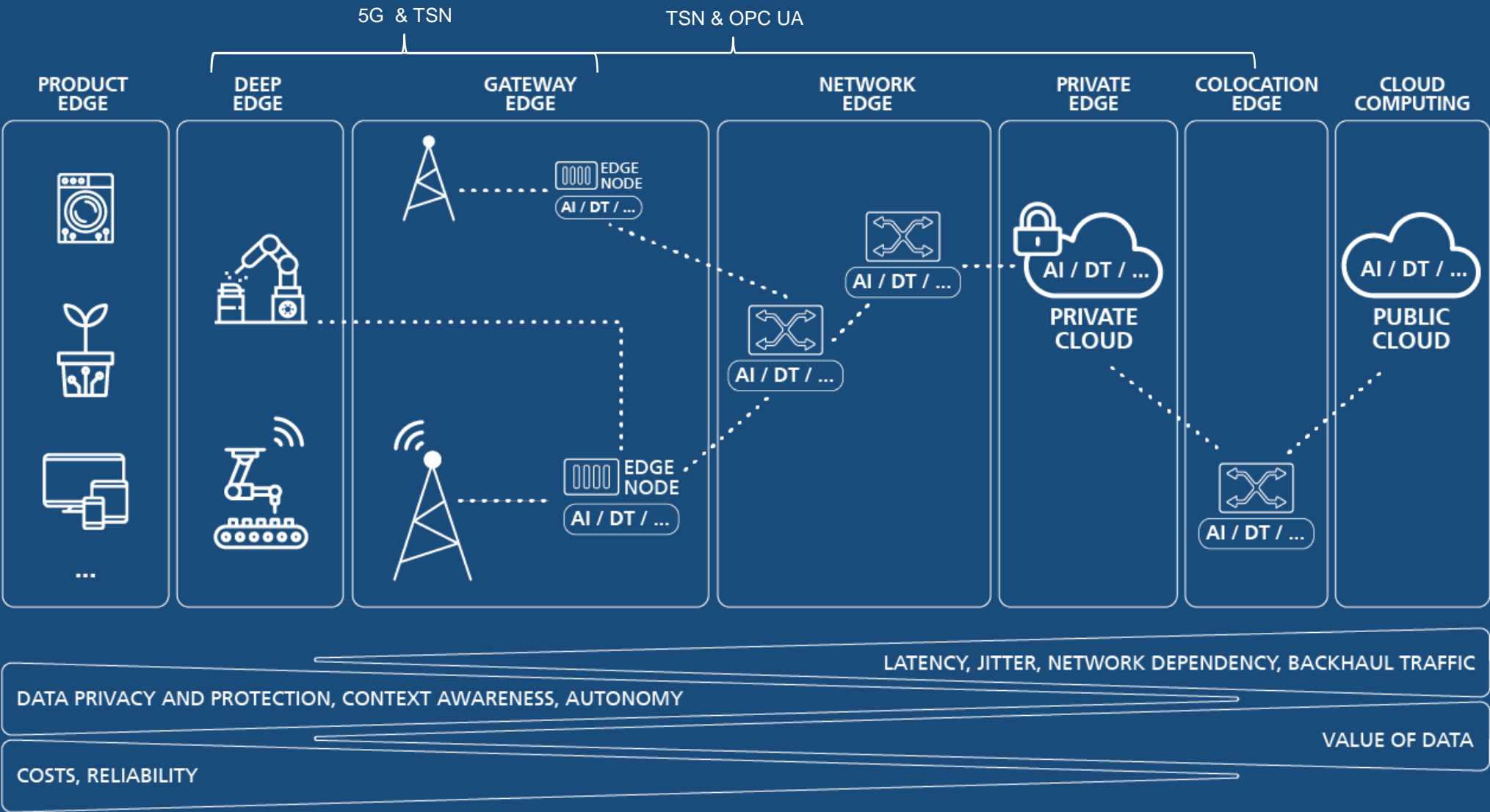
Source: Grand View Research (2019): „Edge Computing Market Size, Share & Trends Analysis [...] Forecasts, 2019 – 2025”

Edge Computing: A Distributed Cloud Computing Paradigm

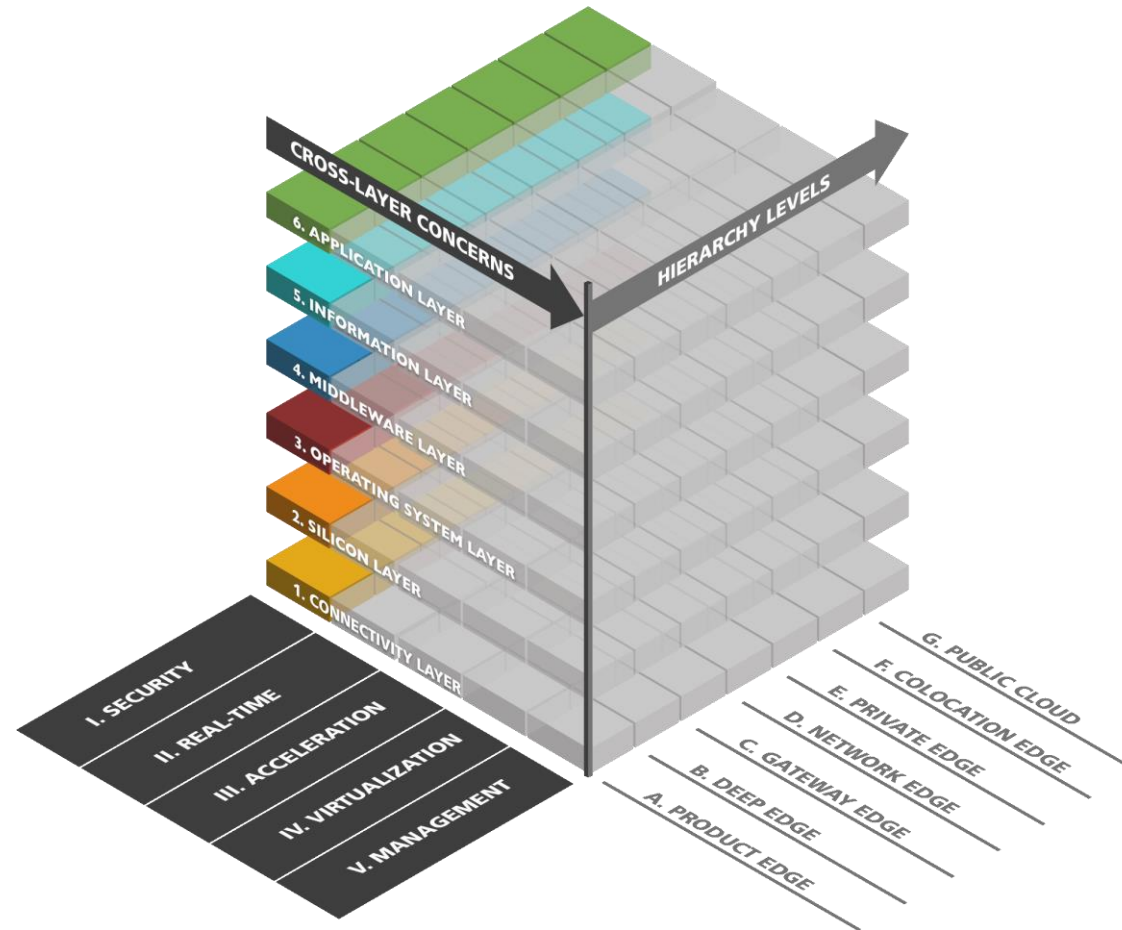


Based on: Peter Levine: Return to the Edge and the End of Cloud Computing

Edge Computing: A Distributed Cloud Computing Paradigm



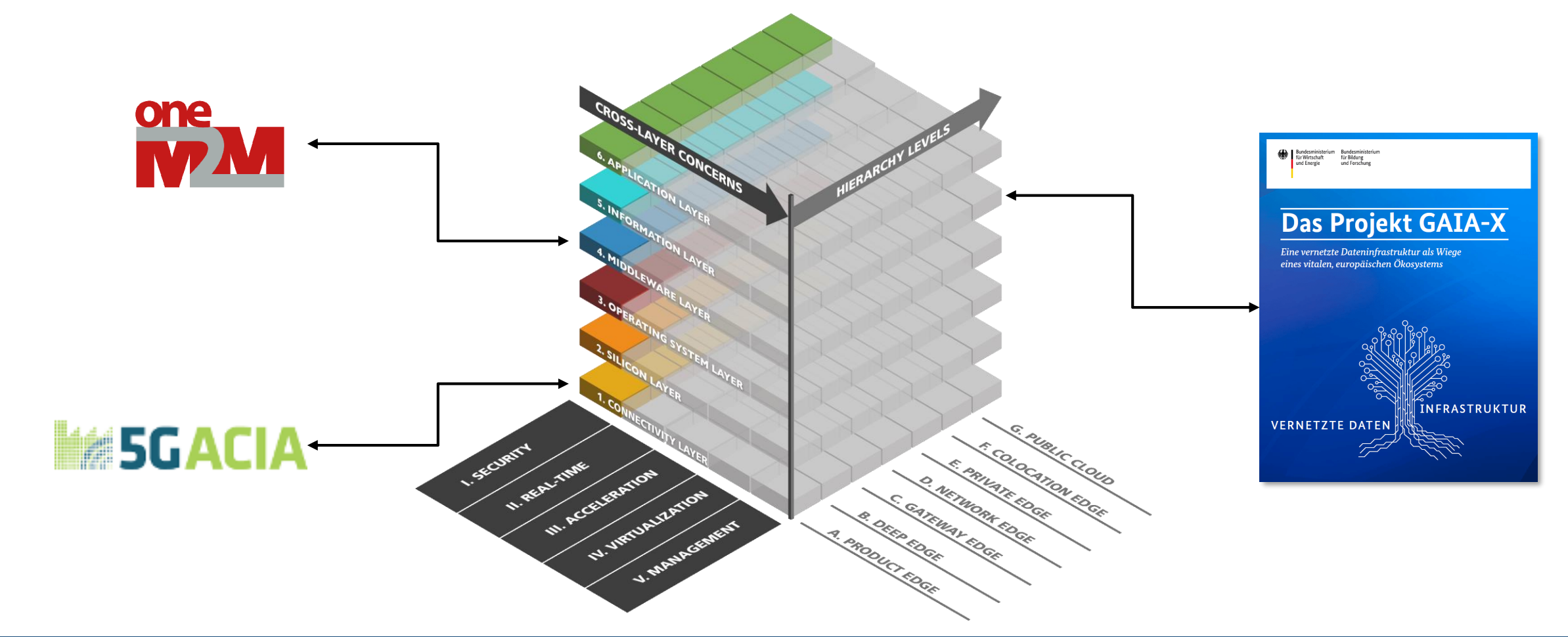
Edge Computing: Multi Dimensional Problem Space



Similar to the Smart Grid Architecture Model (SGAM) and Reference Architecture Model Industry 4.0 (RAMI4.0), the preliminary Reference Architecture Model Edge Computing (RAMEC) is NOT a technical system architecture but an orientation guide.

Too complex to work on this alone.

Examples from today: GAIA-X, 5G ACIA, oneM2M. However, there are hundreds more...



Step 1: get industry input
(building an international eco system)

Supported by (November 2018)



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EDGE COMPUTING
CONSORTIUM EUROPE

Step 2: get community input

(building open technology stacks and standards)

Started to get in contact with ~ 50% of the 100+ identified groups

– 3GPP (5G)	– DMTF for Open Virtualization Format (OVF)	(IIC)	– Multi Stakeholder Platform (MSP)	– Open Process Automation Forum (OPAF)	– Associations (AiF)
– 5G Alliance for Connected Industries and Automation (5G ACIA)	– Eclipse 4Diac / BaSyx / ioFog / IoT	– Industrial Technology Research Institute (ITRI)	– National Institute of Standards and Technology (NIST)	– Open Source Automation Development Lab (OSADL)	– VDI/VDE GMA 7.20 / 7.21 / 7.21 UAG Computing Infrastructure
– 5G Automotive Association (5GAA)	– Edge Computing Consortium (ECC)	– Interessengemeinschaft Automatisierungstechnik der Prozessindustrie (NAMUR)	– New Zealand IoT Alliance	– OpenStack Edge	– Verein Deutscher Ingenieure / Verband der Elektrotechnik Elektronik Informationstechnik (VDI/VDE)
– Alliance for the Internet of Things Innovation (AIOTI)	– EdgeCross	– International Electrotechnical Commission (IEC) 62541 (OPC UA) / 61131 / 61499	– Object Management Group (OMG)	– Plattform Industrie 4.0 Österreich	– Verein deutscher Maschinenbau-Anstalten (VDMA)
– Alliance Industrie du Futur	– ETSI MANO / MEC	– International Telecommunication Union (ITU) Q.5001 / SG11	– ODVA NewTec	– Plattform Industry 4.0 (PI4.0)	– Verein Deutscher Werkzeugmaschinenfabriken (VDW)
– Alliance of Industrial Internet (All)	– European Processor Initiative (EPI)	– Internet Engineering Task Force (IETF) IIoT-SFC-Edge-Computing	– oneM2M	– Przemysł 4.0	– Zentralverband Elektrotechnik- und Elektronikindustrie (ZVEI)
– Automotive Edge Computing Consortium (AECC)	– Falling Wall	– Institute of Electrical and Electronics Engineers (IEEE) 1934 / TSN	– OPC Foundation / FLC / I4AAS	– Rail Way Automation (RWA)	
– AUTomotive Open System ARchitecture (AUTOSAR)	– FIWARE Foundation / FogFlow	– ISO/IEC 62541 / PDTR 23188 / SC38	– Open Container Initiative (OCI)	– ROS Industrial	
– AVNU Alliance	– Flexible Factory Partner Alliance (FFPA)	– Kinetic Edge Alliance	– Open DeviceNet Vendor Association (ODVA)	– ServerReady	
– Azure IoT Edge	– GAIA-X	– LF Akraio / Core Infrastructure Initiative (CII) / Edge / Edge Virtualization Engine (EVE) / EdgeXFoundry / Kubernetes KubeEdge	– Open Edge & HPC Initiative (OEHI)	– Smart FactoryKL	
– Bitkom	– GSM Association (GSMA)	– LFI Akraio / Core Infrastructure Initiative (CII) / Edge / Edge Virtualization Engine (EVE) / EdgeXFoundry / Kubernetes KubeEdge	– Open Edge Consortium (OEC)	– Standardization Council Industrie 4.0 (SCI)	
– Central Office Re-architected as a Datacenter (CORD)	– Heterogeneous System Architecture (HSA)	– Linaro / Ledge	– Open Industry 4.0 Alliance	– StarlingX	
– Cloud Foundry Foundation	– I-KOREA 4.0	– LNI Testbed Edge Configuration / TSN MobicEdgeX	– Open Manufacturing Platform (OMP)	– Taiwan Smart Machinery	
– Cloud Native Computing Foundation (CNCF)	– IC4.0 (Spain)		– Open Network Automation Platform (ONAP)	– Telecom Infra Project (TIP): Edge Application Developer Group / Edge Computing Group	
– DIN NA043-01-38AA / ISO/IEC SC38 / SPEC 92222	– Industrial Communication for Factories (IC4F)		– Open Platform for NFV (OPNFV)	– The Discovery Initiative	
	– International Data Space (IDS)		– Open Platform Forum (OPF)	– The German Federation of Industrial Research	
	– Industrial Internet Consortium				

List is still in progress and incomplete.

Edge Computing Synchronization Meeting (October 2019)



Step 3: provide input to research & innovation activities
(jointly shape European research roadmap)

European Industry Partnerships - Lighthouses to Thrive in the New Digital Age (November 2019)





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Co-Founder

Focus



Connectivity

(TSN/5G)



Communication

(OPC UA)



Data

(Digital Twin)



Programmability

(Edge Computing)

