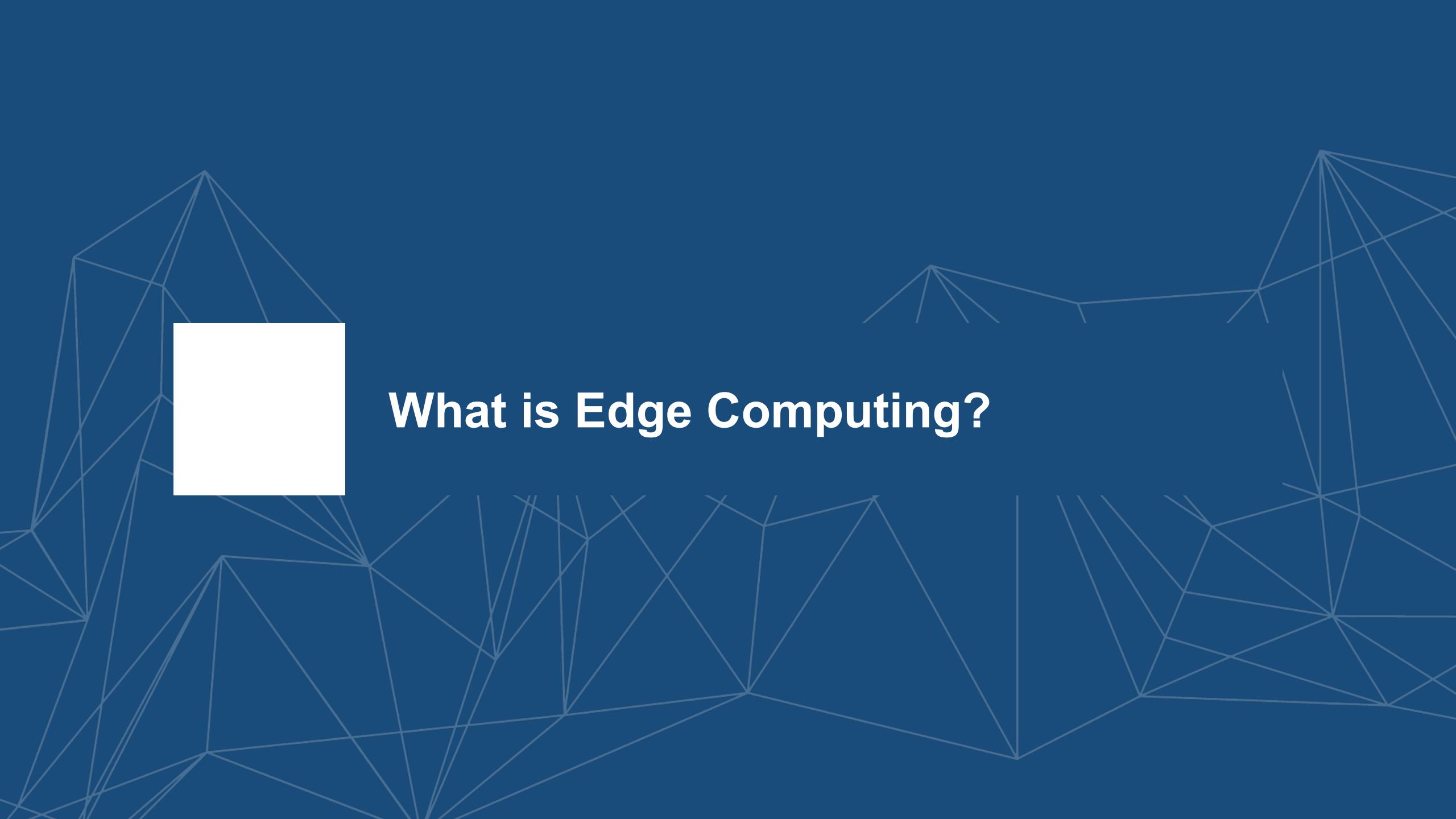


Edge Computing Consortium Europe (ECCE)

5GACIA Meeting on the 3rd of December 2018.

Prof. Dr. Thomas Magedanz, Dr. Alexander Willner

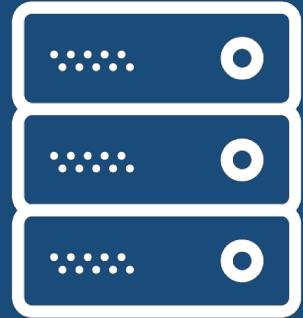


What is Edge Computing?

Edge Computing is a distributed Cloud Computing paradigm.



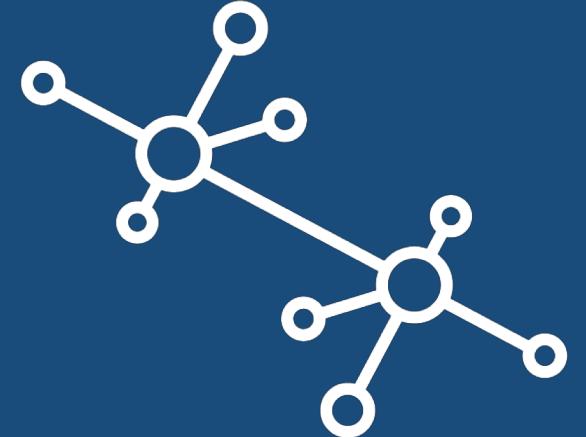
MAINFRAME
Centralized
1960 – 1970



CLIENT-SERVER
Distributed
1980 – 2000

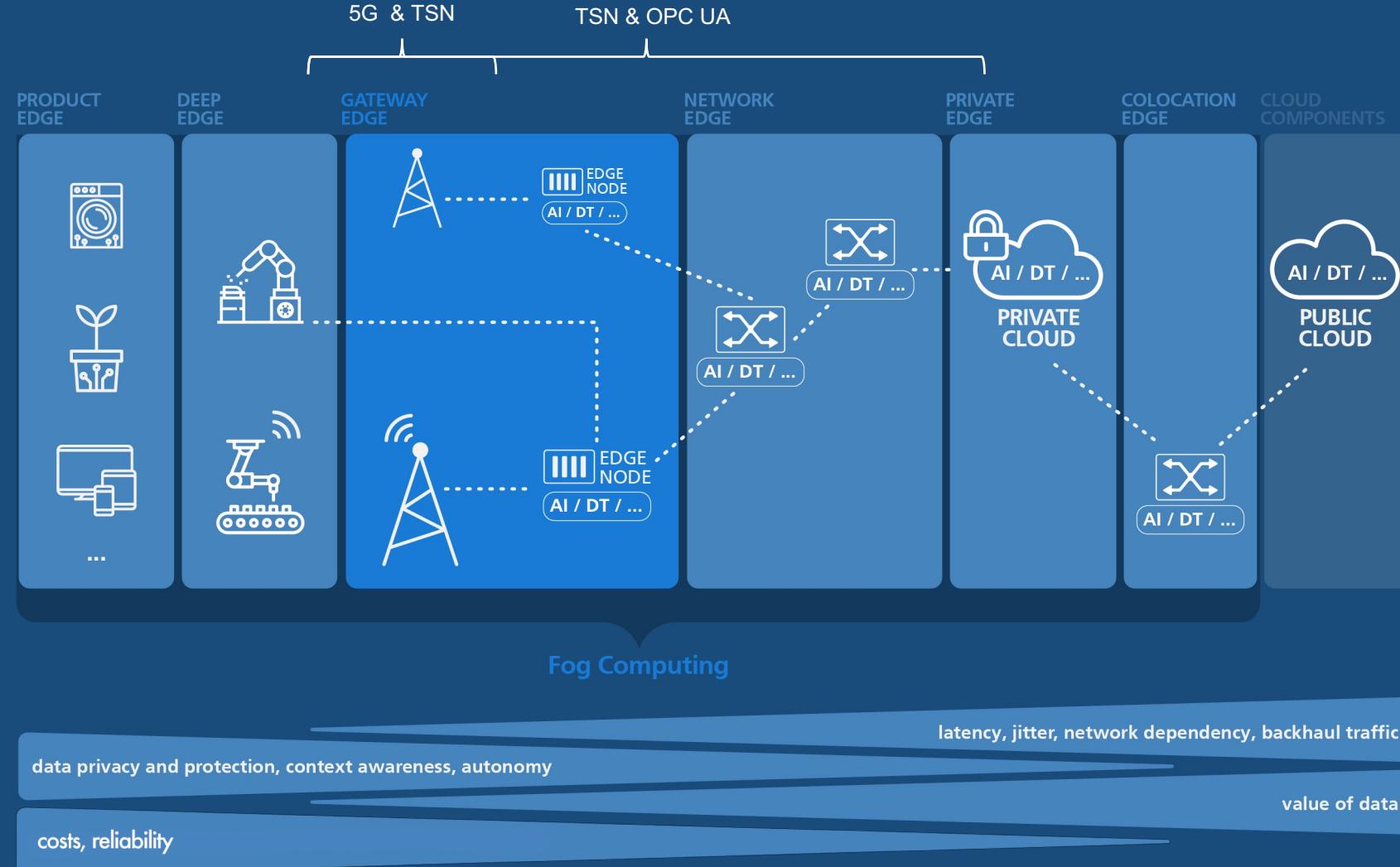


CLOUD
Centralized
2005 – 2020

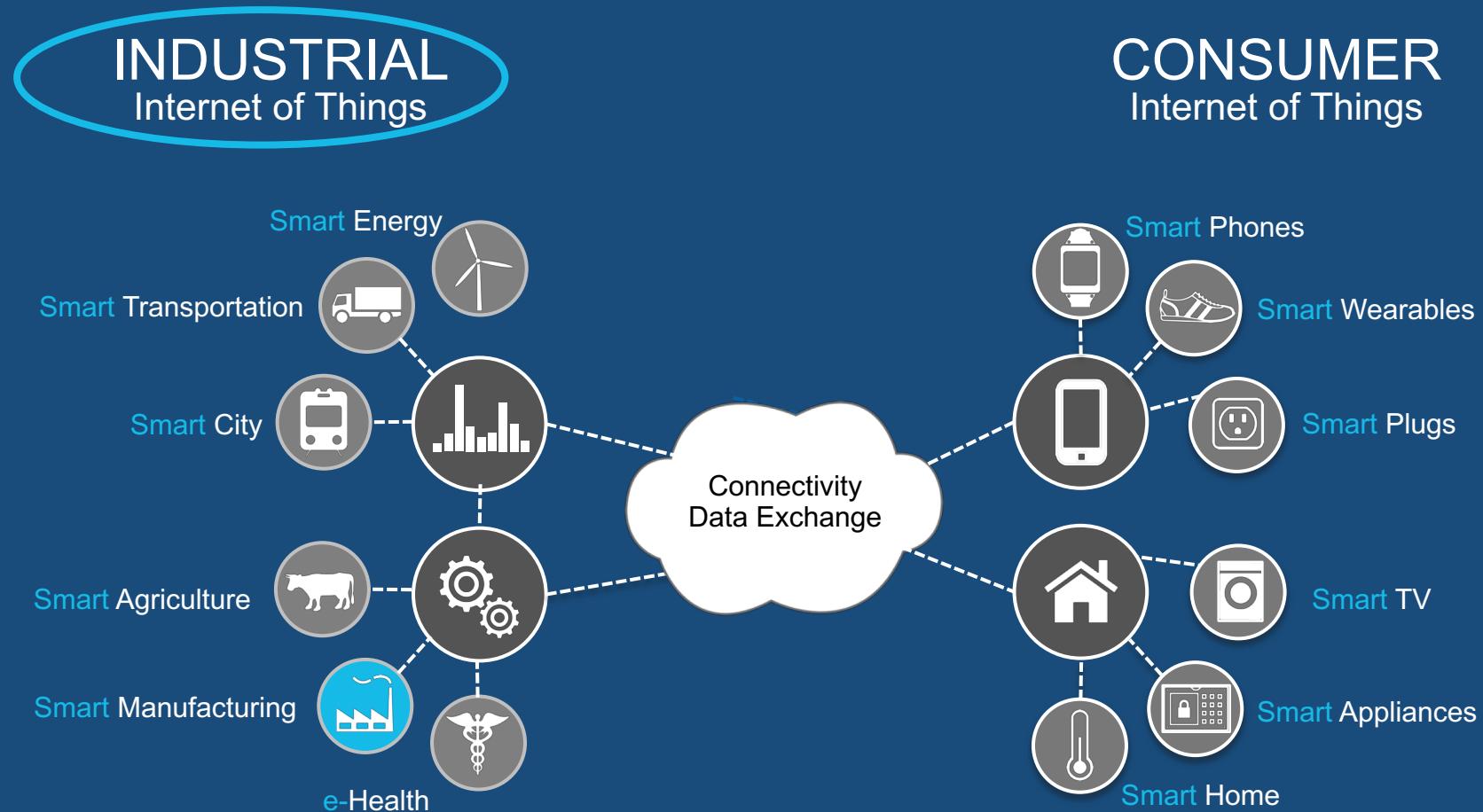


EDGE INTELLIGENCE
Distributed
2020 – ...

Various Areas of Edge Computing (it's not only MEC)



Various Application Domains with Specific Requirements.



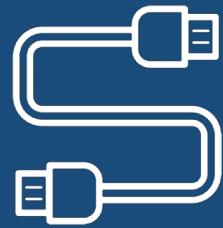
The Edge Computing market
is estimated to be worth 19 Billion EUR by 2023*

* take this with a grain of salt.



Motivation of the ECCE

Convergence of OT and IT on many Levels



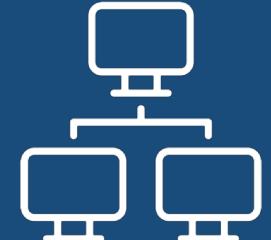
Connectivity



Communication



Data



Programmability

**From Fieldbus to
Industrial Ethernet to
IEEE TSN and 5G**

**From Fieldnet
Protocols to OPC to
IEC 62541 (OPC UA)**

**From Fieldnet Models to
OPC Model to OPC UA
Companion Specs**

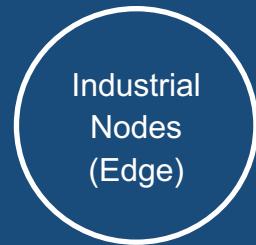
**From Programmable
Logic Controllers to
Edge Computing**

Towards Software-based Networks in Industrial Domains

tomorrow



next

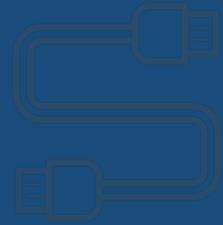


finally



Goal: dynamically programmable, interoperable industrial infrastructures

Missing Common Standards and Industrial Requirements in EC



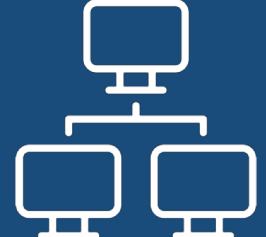
Connectivity



Communication



Data



Programmability

TSN / 5G
Industrial Ethernet &
Industrial Wireless

OPC UA
Standards-based
Interfaces

OPC UA Digital Twins
Distributed Linked
Data Management

**From Programmable
Logic Controllers to
Edge Computing**

Analog to 5GACIA: ECCE is a joint OT/ICT Initiative

- Who takes care that the interests of the industrial domain are adequately considered in standardization & regulation? (we often see a focus on mobile network operators or generic IT)
- How do we ensure that the ongoing EC developments are understood by and transferred to the industrial domain? (we often see proprietary EC approaches by different vendors)
- Who identifies special certification needs, takes care of seamless migration paths and a seamless integration?
- How can we establish a common language & understanding between the telecom world and the industrial world?
- Who initiates and coordinates practical evaluation & testbed activities and larger-scale industrial trials?



Value Proposition, Vision, Mission, Goals, Roadmap

ECCE Value Proposition Statement

The ECCE aims at saving research and development efforts by providing technology stacks for Edge Nodes based on existing, matched standards and components to small, medium and large enterprises for the rising Edge Computing market in smart manufacturing and other Industrial IoT domains.

Vision & Mission

- **Vision:** An open, standards-based, interoperable, industry-driven, secure and international Edge Computing eco system that takes European particularities into account to enable future Software-based networks.
- **Mission:** Drive adoption of the Edge Computing paradigm in industrial markets by discussing, evaluating and evangelizing technological, regulatory and business view points. Focus on utilizing, recommending and contributing to existing technologies, standards and initiatives to ensure that industrial needs and requirements are optimally addressed in member products.

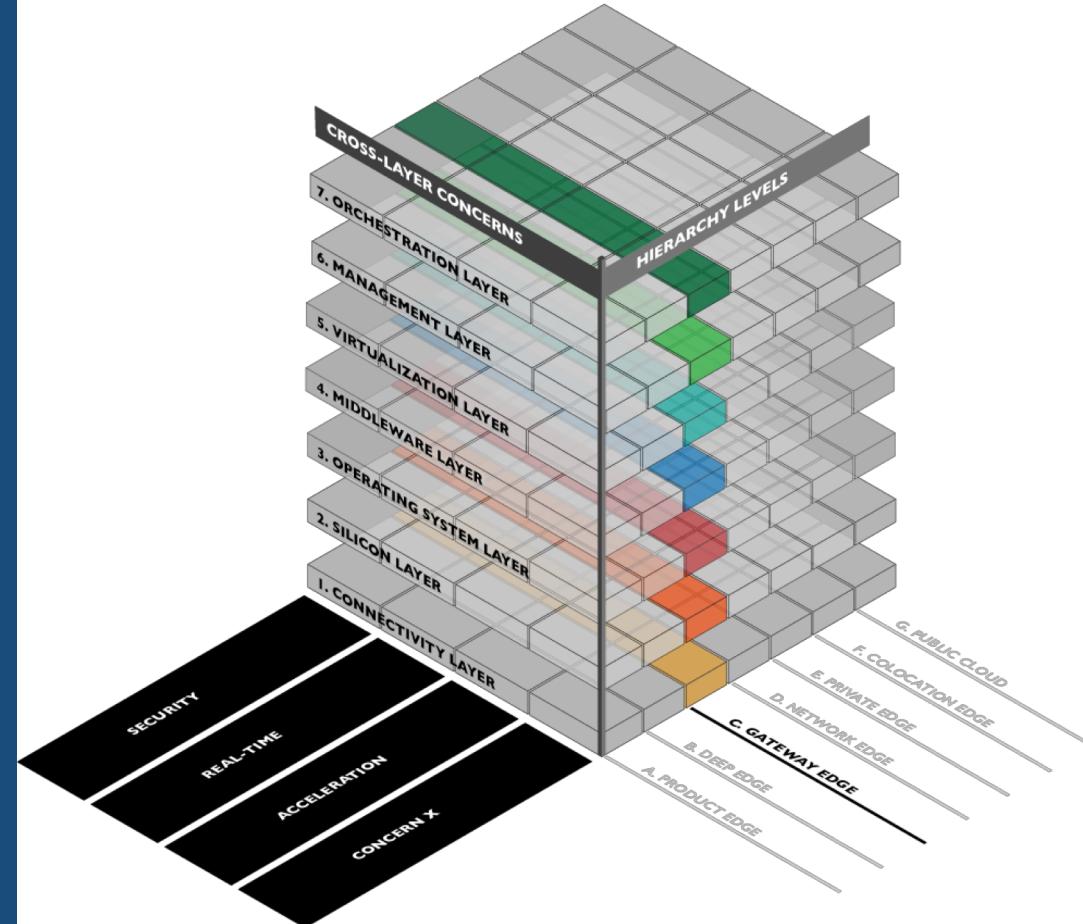
Goals

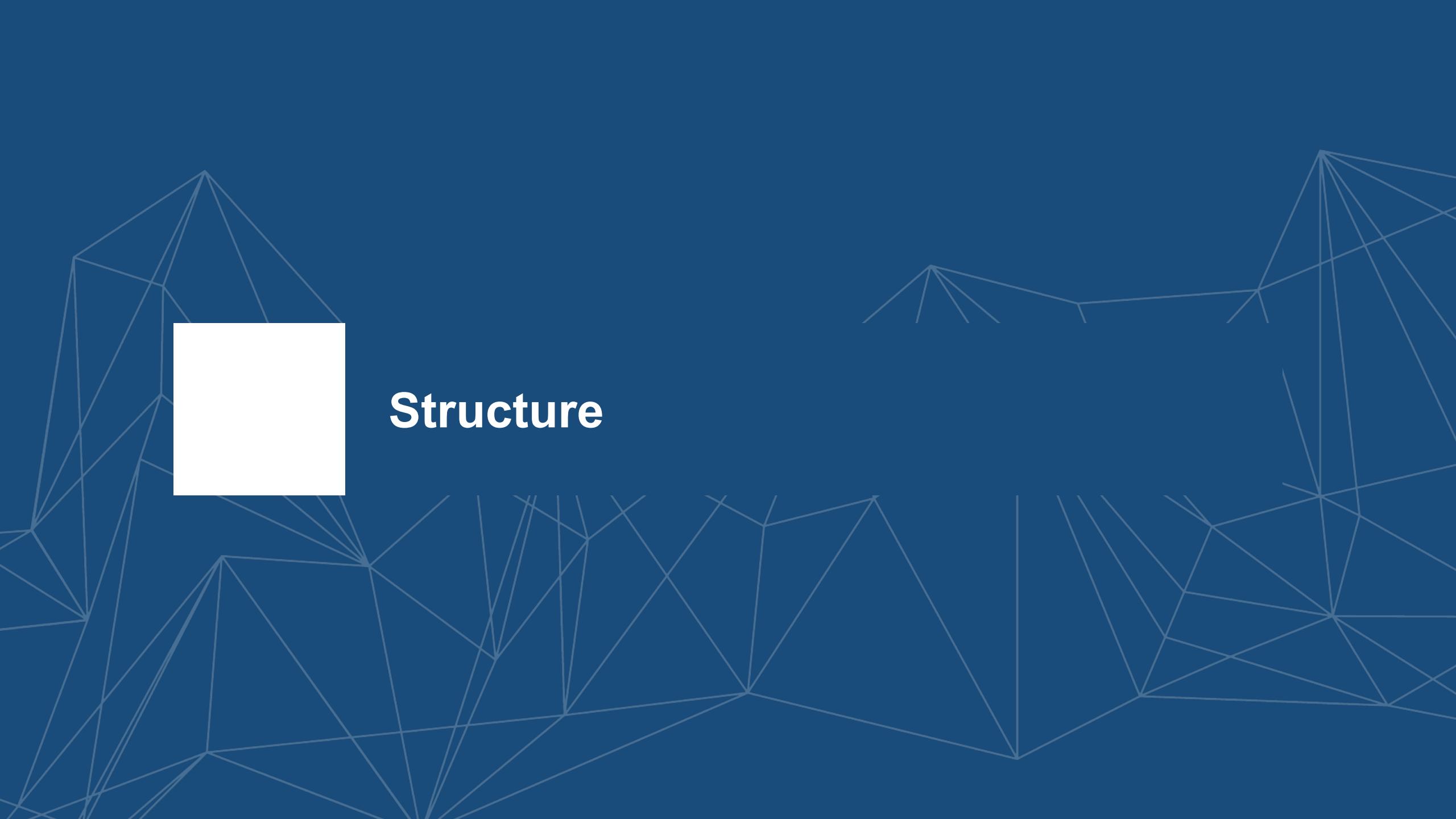
- **Goals**

- Specify a Reference Architecture Model for Edge Computing (RAMEC4.0) including terminology
- Identify potential standards and provide recommendations
- Identify open source implementations of these standards and compose reference Edge Nodes
- Evaluate approach within multiple pathfinder projects (within existing or new testbeds)
- Organize plug-fest / testing events
- Standardize gaps within related SDOs
- Federate with major initiatives (such as 5GACIA)
- Promote results on public events and trainings

RAMEC Version 1

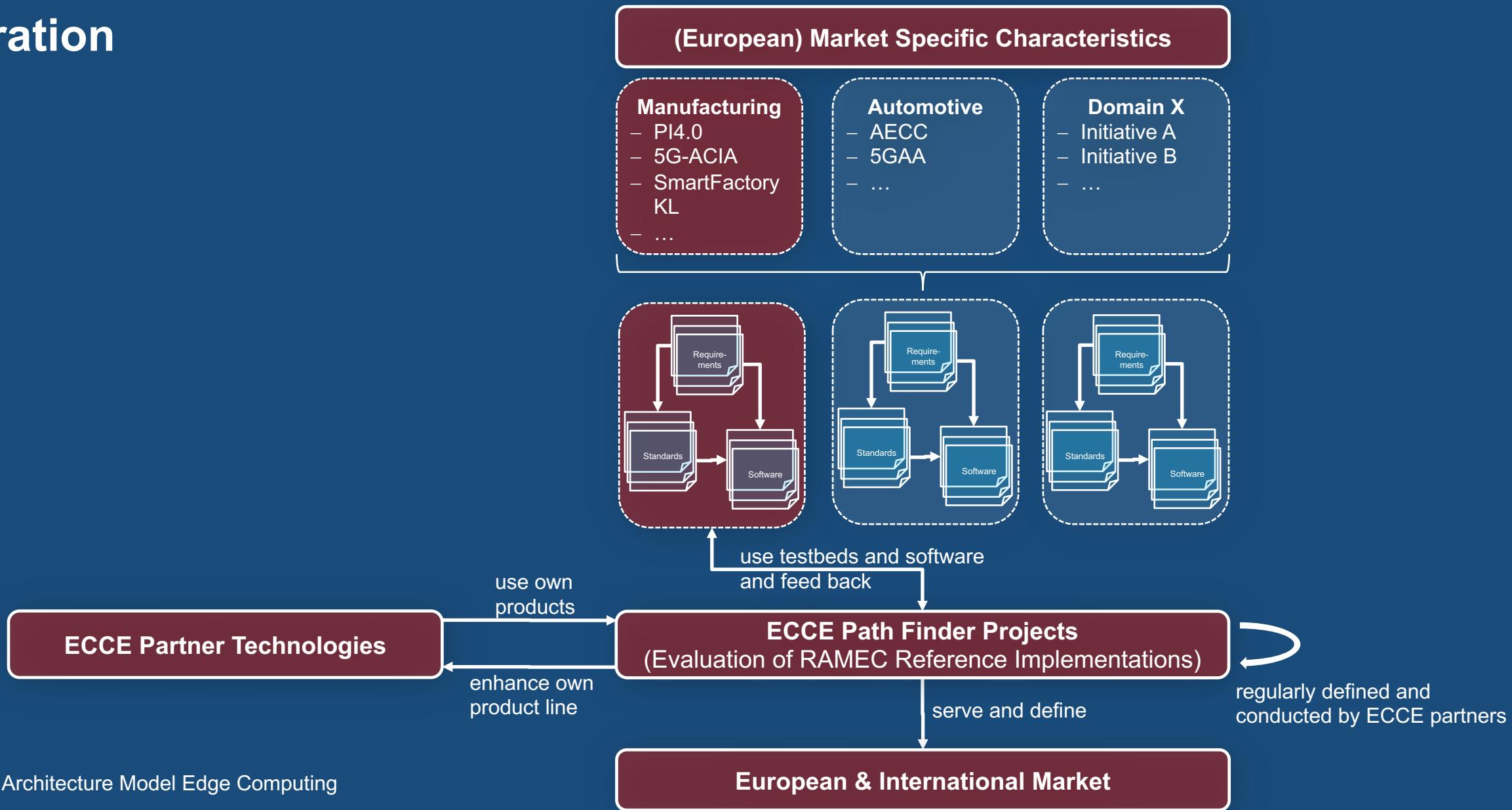
- **Hierarchy Levels:** see slide 4 (focus on the gateway)
- **Layers**
 - Connectivity: e.g. IEEE TSN or 5G
 - Silicon: e.g. ARM64, x86-64
 - OS: e.g. IEC 23360-x:2006 (Linux Standard Base)
 - Middleware: e.g. IEC 62541 (OPC UA)
 - Virtualization: e.g. Open Container Initiative
 - Management: e.g. Kubernetes IoT Edge
 - Orchestration: e.g. Kubernetes
- **Cross-Layer Concerns**
 - Security: e.g. Trusted Platform Module
 - Real-Time: e.g. FPGA Module
 - Acceleration: e.g. AI Module



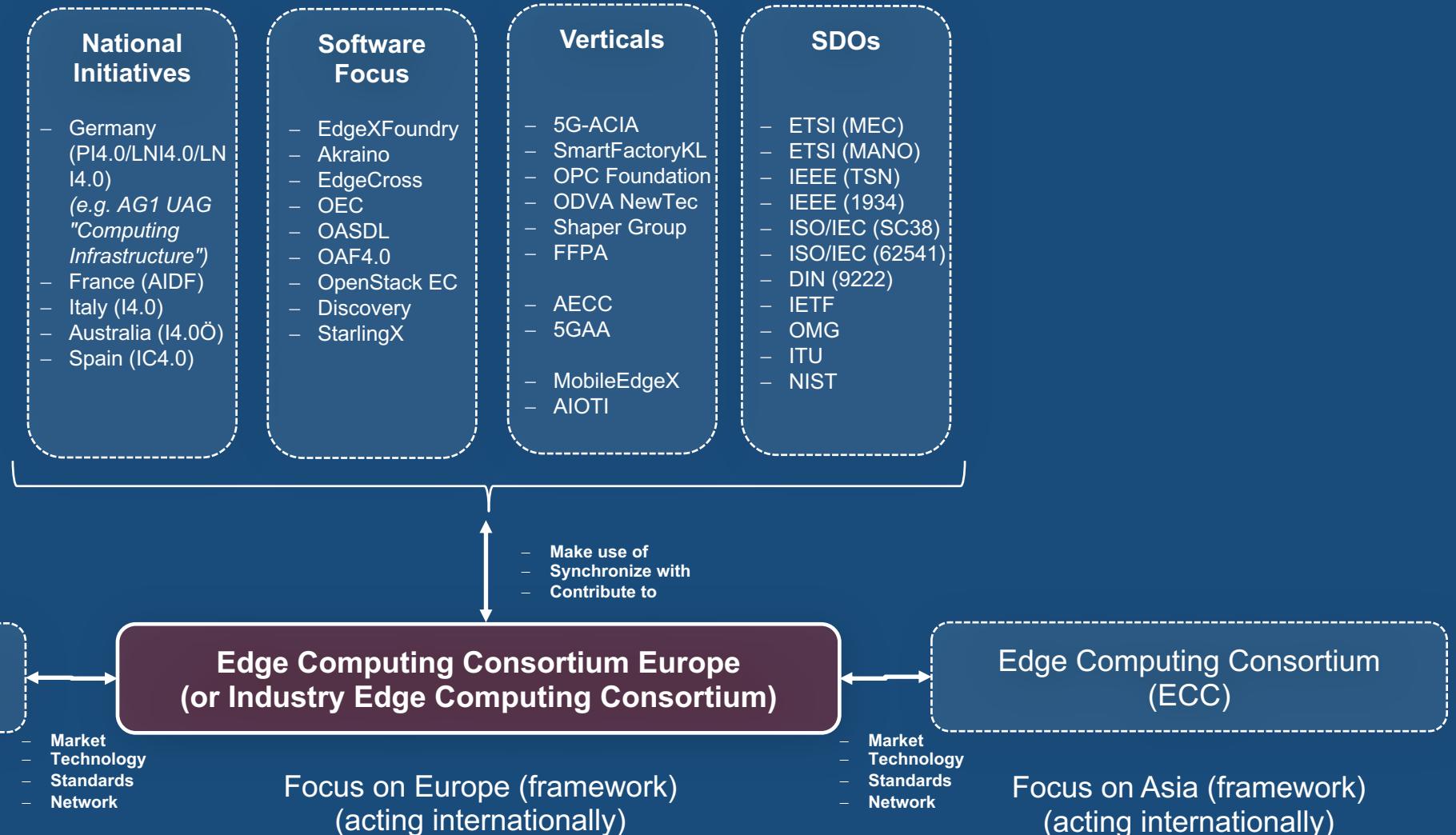


Structure

Operation



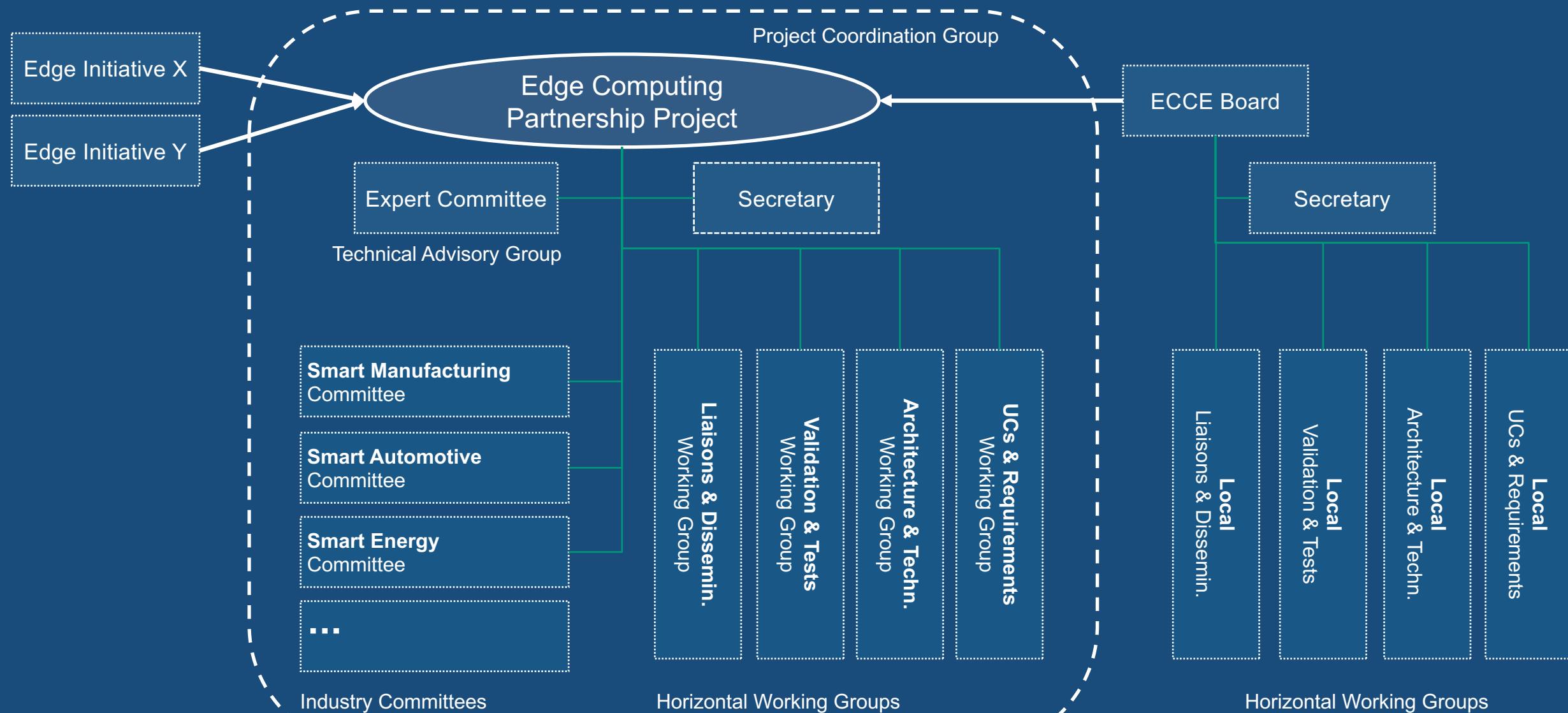
Collaboration



Structure & Assignments (ongoing)



Outlook: Global Edge Computing Partnership Project (ECPP)





Next Steps

Roadmap



Supported by



JOIN VIA
ECCONSORTIUM.EU

The logo for Edge Computing Consortium Europe (eCc) features the letters "eCc" in a large, white, stylized font. The "e" and "Cc" are interconnected by a horizontal line that extends to form a network-like structure with glowing white nodes at the ends, set against a dark blue background.

EDGE COMPUTING
CONSORTIUM EUROPE



Roadmap



identified 60+ potential initiatives/SDOs
identified 80+ potential partners

Official Press Release to be Published this Week



Edge Computing Consortium Europe

Joint efforts to support the foundation of the Edge Computing Consortium Europe (ECCE)

December 2018 – Analog Devices, Arm, Bombardier, B&R Automation, Fraunhofer Institute for Open Communication Systems (FOKUS), German Edge Cloud (GEC), German Research Center for Artificial Intelligence (DFKI), Harting IT, HUAWEI, Intel, IBM, KUKA, National Instruments, Renesas, Schneider Electric, Software AG, TTTech, and further partners announced today their support of the planned formation of the Edge Computing Consortium Europe (ECCE) and its further refinement of the objectives ahead of a launch in 2019. The ECCE aims at saving research and development efforts by providing technology stacks for Edge Nodes based on existing, matched components to small, medium and large enterprises for the rising Edge Computing market in smart manufacturing and other Industrial IoT domains.

The Edge Computing paradigm describes an approach to execute certain services closer to devices and thereby supplements centralized Cloud Computing solutions. Amongst others, such an architecture can enhance data privacy and lower network latency. The global Edge Computing market is estimated to be worth 3 to 18 Billion EUR until 2023 and an international Edge Computing eco system that takes European particularities into account would benefit all industrial application domains.

The planned Edge Computing Consortium Europe (ECCE) aims at supporting small, medium-sized and large enterprises in Europe and all around the world to adopt related technologies and in particular with a focus on the augmentation of Operational Technologies (OT) with Information and Communication Technologies (ICT). Its mission is to drive adoption of the Edge Computing paradigm within the manufacturing and other industrial markets. It will emphasize on utilizing and contributing to existing solutions, standards and initiatives to ensure that industrial needs and requirements are optimally addressed in member products.

Therefore, goals of this initiative include the specification of a Reference Architecture Model for Edge Computing (ECCE RAMEC), the development of reference technology stacks (ECCE Edge Nodes), the identification of gaps and recommendation of best practices by evaluating

approaches within multiple scenarios (ECCE Pathfinders), and the synchronization with related initiatives/standardization organizations and the promotion of the results.

The consortium welcomes collaboration with more partners who are engaged in the action of digitalization verticals. For more information refer to the ECCE homepage at <https://ecconsortium.eu>.

Quotes:

Mohamed Awad, Vice President of Marketing, Infrastructure Line of Business, Arm, UK

"As we move to a world with a trillion connected devices, the magnitude of data is growing significantly and the Arm® Neoverse™ ecosystem is uniquely positioned to deliver on the diverse set compute requirements of the infrastructure. From the edge to the core datacenter, ecosystem collaboration in relevant industry initiatives, such as the ECCE, are fundamental to supporting the performance, security, and scalability required."

Stefan Schönegger, Vice President Product Strategy and Innovation, B&R, Germany

"We are fully convinced that Edge Computing will be essential for the factory of the future. Processing of data at the proximity of data sources will ideally complement IoT solutions based on public clouds. B&R is committed to quickly extend our Edge portfolio and provide a full scale, OPC UA and TSN based, Edge offering to the market. The ECCE is helping to align our activities with a rich ecosystem of valuable partners, which helps to accelerate adoption and drive innovation."

Prof. Dr. Thomas Magedanz, Director Software-based Networks, Fraunhofer Institute FOKUS, Germany

"Europe is driving the innovation of major 5G industrial vertical domains, such as manufacturing and automotive. The availability of high performance, reliable and open edge computing platforms represents a key foundation for the establishment of a rich ecosystem for edge computing based industry solutions. This new European Edge initiative will fill the gap between existing industry initiatives and will enable German and European industrial partners to meet their business requirements enabled by edge computing in a faster and more economical way."

Sebastian Ritz, CEO German Edge Cloud (a Friedhelm Loh Group company), Germany

"The German Edge Cloud and Rittal as early promoters of the edge cloud computing paradigm for the industrial sector actively supports the planned Edge Computing Consortium Europe. Edge Computing is a key enabling technology for the digital transformation of the industrial sector and vital for Germany's and Europe's future competitive position, especially in areas like industrial AI, which require edge computing. The proposed best practice approach of the ECCE will help guiding companies in adopting edge computing in a hands-on manner."

Prof. Dr. Martin Ruskowski, Head of Innovative Factory Systems (IFS), German Research Center for Artificial Intelligence (DFKI GmbH), Germany

"The paradigm of edge computing is assuming shape in an increasing speed. However, our current industrial production has specific requirements as we have to deal with brown-field applications and existing real-time controllers and supervisory computers. In order for edge computing to be widely adopted in industry, a common reference model based on existing solutions such as the Plattform Industrie 4.0 RAMI or the

SmartFactory-KL reference architecture is the necessary basis. The DFKI with its application partner SmartFactory-KL supports the ECCE as an industry-driven initiative to create a common understanding and architecture for edge computing."

Dr. Jan Regtmeier, Director Product Management, HARTING IT GmbH & Co KG, Germany

"IIoT is the future of efficient industrial manufacturing. The possibilities of today's computing are incredible. However, cloud alone is not the answer to all questions. Without the edge and edge computing, there is no data for condition monitoring and preventive maintenance. HARTING believes in the idea of edge computing. We have setup a hybrid edge / cloud architecture in our own connector production facilities. Data becomes "smart data" right at the edge."

Swift (Shaowei) Liu, President of Huawei Network Solutions R&D Department, China

"Edge computing is the important foundation for the construction of the Industrial Internet. It is a key technology for achieving digitalized, networked, and intelligent society. Huawei will work with companies in Europe and around the world, together with related industries and standardization organizations to promote the establishment of ECCE. The edge computing industry cooperation platform will promote the implementation of edge computing technologies and standards and the promotion of outstanding industrial achievements, and work together to promote the vigorous development of edge computing in Europe."

Rahman Jamal, Global Technology & Marketing Director, National Instruments, US

"A core capability of the National Instruments platform has always been open and interoperable connectivity with products from other vendors. We are proud of the role we are playing in general and by participating in the ECCE in particular to make OPC over TSN a premier offering for synchronized, deterministic communication; assuring that our customer can create interoperable test, measurement and control systems."

Niels Trapp, Global head of marketing, Industrial Automation, Renesas Electronics, Japan

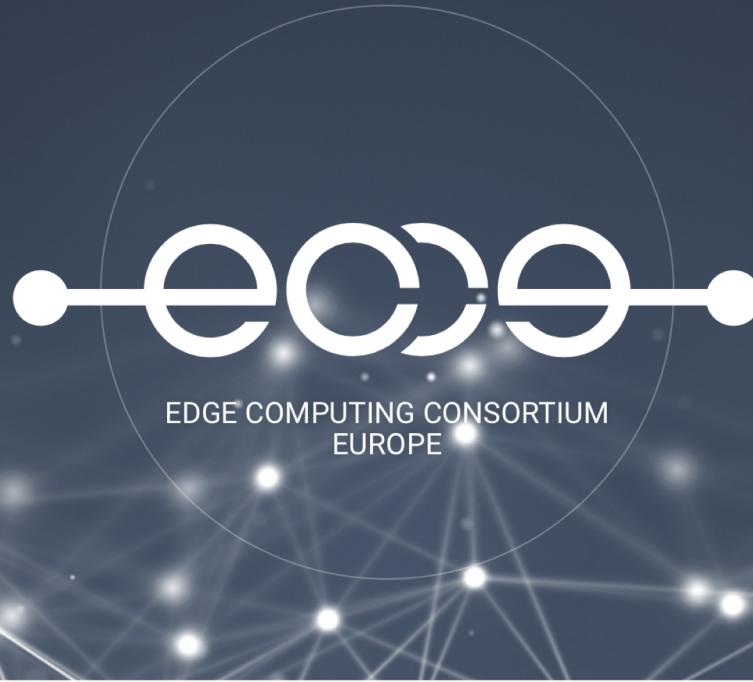
"Renesas see a strong demand for edge computing equipment in the factory floor in order to further accelerate the implementation of digitization of the manufacturing industry. Industry 4.0, IIoT and other initiatives provide already a comprehensive operating models and testbeds of new technologies such as TSN and OPC UA. An initiative to specifically consider a role of edge computing under these operating models is required and necessary to position edge application properly and make equipment easy to integrate into brownfield and greenfield."

Fabrice Jadot, Chief Technology Officer, Schneider Electric, France

"EcoStruxure is providing all means for Edge Computing to provide additional capabilities including the ability to predict problems before a fault occurs. Traditionally, machine learning runs exclusively in the cloud, but in many IoT scenarios that isn't good enough as there are a number of advantages or even constraints requiring the application to execute as close as possible to the field events. Whilst most of industrial controllers that exist in the market are reactive, their evolution is to become proactive and capable of including predictive analytics at the edge."

Frank Schiewer, SVP Alliance & Channel, Software AG

"We couldn't be more excited to join the Edge Computing Consortium Europe. This initiative is an outstanding exchange platform of leading IoT players who will influence the future of edge computing and set common standards for all. As a market leader in Industrial IoT solutions, with



ECCE Call for Action

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