Joint workshop by EPoSS and
INSIDE Industry Associations

The Future of Innovation in Edge AI

Online, April 04, 2025

Notes from the Workshop
*Part I: Webinar Summary*
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1. Introduction: Shaping Europe's Edge AI Vision

The webinar, organized by the European industry associations **EPoSS** and **INSIDE**, both part of the **Chips Joint Undertaking**, set the stage for strategic dialogue on the future of Edge AI in Europe. These associations work to shape research and innovation agendas, support policy alignment with European priorities, and foster collaboration between stakeholders from industry, academia, and public institutions.

The EPoSS EdgeAI working group, established in 2021, has made significant progress since its inception. A major milestone was the publication of its first white paper, which attracted considerable attention across stakeholder groups. This positive reception led to a closer collaboration with the INSIDE industry association since 2022 to define strategic goals that enhance the technological autonomy of European enterprises. The group's efforts also aim to deliver a clear, unified message to the European Commission and related stakeholders and contribute directly to the <u>Electronic Components and Systems Strategic Research and Innovation Agenda (ECS SRIA)</u>.
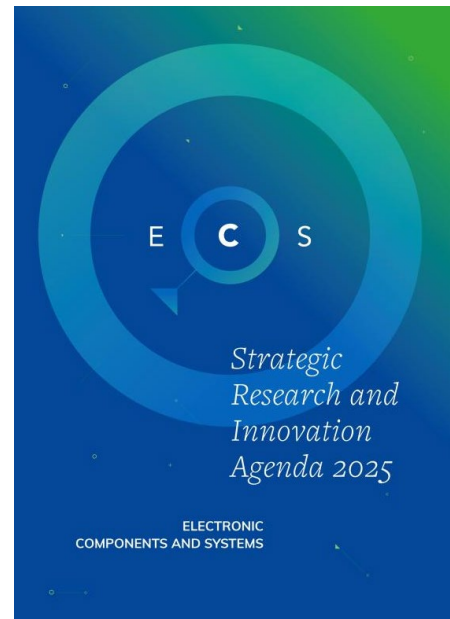
2. Working Group Objectives and Strategic Role

The Edge AI working group focuses on:
- **Creating and connecting** ecosystems for faster Edge AI adoption
- **Fostering collaboration** across the AI value chain – from chip vendors to system integrators
- **Generating market impact** by identifying and promoting high-potential applications

It brings together **hardware and software developers, researchers, tool providers, and AI practitioners** in a multidisciplinary environment. A key part of its mission is to define **enabling technologies** and **use cases**, while also identifying dependencies, risks, and strategic investment opportunities.

3. Context: A Transforming AI and Computing Ecosystem

Today's AI ecosystem is evolving at breakneck speed. The emergence of **foundation models** and **large language models (LLMs)** has triggered a major shift, not just in cloud environments, but increasingly at the edge. These models, pre-trained on vast datasets, are capable of performing tasks they were never explicitly designed for – a property that opens exciting new doors for **edge computing**, but also introduces substantial challenges related to **compute power, data access, and energy efficiency**.

The edge computing landscape is now defined by a **cloud-edge-IoT continuum**, in which devices of varying capability – from ultra-lightweight sensors to powerful edge servers – are being asked to run increasingly sophisticated AI models.
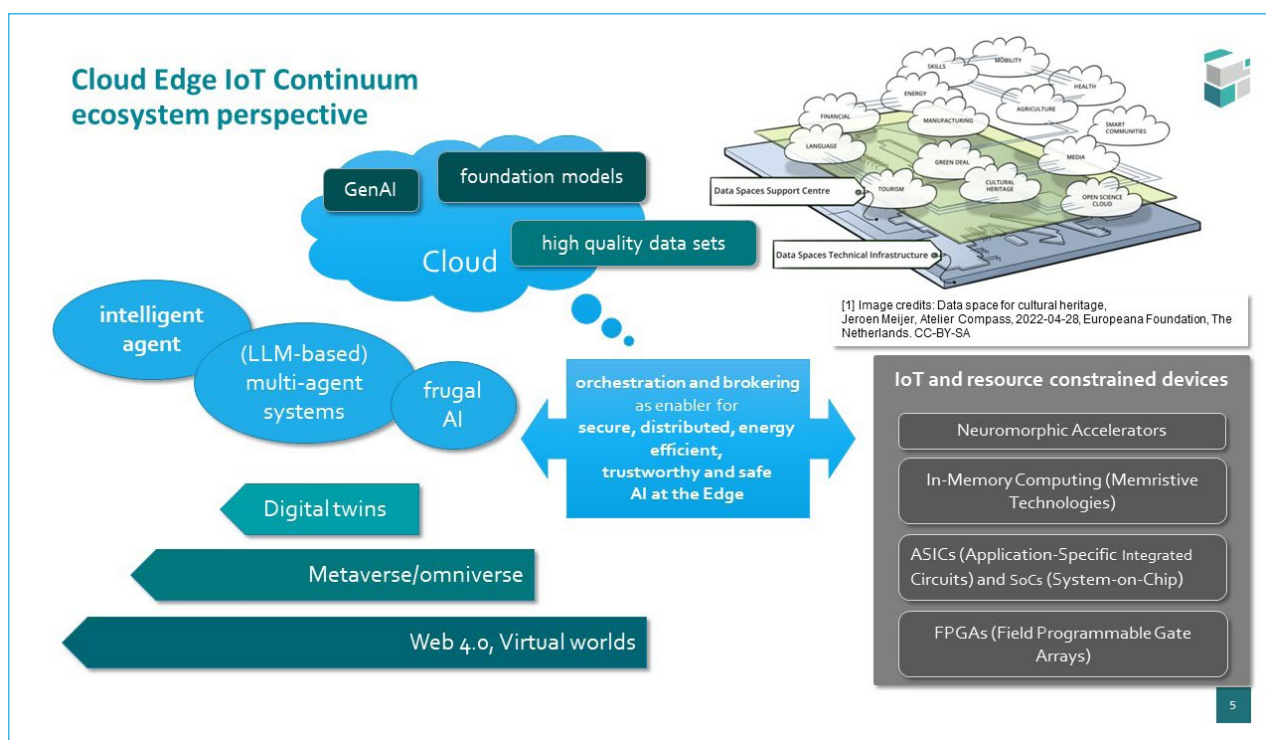
To build robust AI solutions at the edge, high-quality datasets are indispensable. Lightweight, energy-efficient multi-agent systems are becoming increasingly necessary. Additionally, advanced knowledge representations – including spatial and contextual information – are vital for enabling intelligent agents to function effectively in Industry 4.0 and Virtual Worlds and Web 4.0.

4. Technological Building Blocks: Towards General AI
The technological toolkit for Edge AI is expanding rapidly, including:
- **Neuromorphic Accelerators**
- **In-Memory Computing** (using memristive technologies)
- **FPGAs** (Field-Programmable Gate Arrays)
- **ASICs and SoCs** (Application-Specific and System-on-Chip designs)
- **Frugal AI**: lightweight, power-efficient models tailored for embedded systems
- **Digital Twins, Metaverse/Omniverse**, and **Web 4.0** integration
- **Multi-agent systems** based on LLMs
- **Orchestration and brokering** technologies enabling secure, distributed, energy-efficient AI

High-quality datasets, efficient architectures, and reliable interconnects are now foundational. These elements support **intelligent agents** that function within complex, interconnected ecosystems – essential for domains like smart cities, industrial automation, and autonomous vehicles.

5. The Path to General Artificial Intelligence (GAI)

A conceptual framework discussed in the webinar – introduced by OpenAI CEO Sam Altman – maps the **evolution of AI** across five layers:

While reaching level five remains uncertain (estimates range from 10 to 50 years), the members of the Edge AI working group that **edge AI systems must evolve alongside this trajectory**, incorporating elements of reasoning, autonomy, and innovation even within constrained devices.

6. Europe's Strategic Position: Challenges and Opportunities

Despite having strong industrial players like **NXP, Infineon,** and **STMicroelectronics,** Europe faces significant challenges in keeping pace with global AI leaders such as **NVIDIA**, particularly in the area of **LLM infrastructure, training capacity, and deployment at the edge**.

Notable concerns include:
• **Limited access to advanced semiconductor nodes (e.g., 2–3nm processes)**
• **Dependence on non-European cloud and compute infrastructures**
• **Fragmented AI tooling and software support at the edge**

However, these challenges also create room for **strategic collaboration**, especially in building European foundation models, co-developing reference architectures, and investing in shared training infrastructure.

7. Discussion Framework: Guiding Questions for the Future

To drive targeted dialogue, the following **guiding questions** were posed during the webinar:
• What **constraints and limitations** currently hinder edge AI?
• How might edge AI evolve along the **five levels of General AI**?
• How can the objectives of the **Edge AI Working Group** be realized through joint action?

These questions helped structure the speaker sessions and the **final industry panel discussion**, which included perspectives from **Davis Sawyer (NXP), Danilo Pau (ST), Hans-Jörg Vögel (BMW),** and **Wolfgang Ecker (Infineon)**.

8. Key Takeaways from the Panel Discussion
- **Cooperation first, competition later**: European stakeholders must unite around shared goals before differentiating through competition.
- **Semiconductors need markets**: High-end fabrication only makes sense if supported by viable, scalable markets in Europe and globally.
- **Cross-layer co-design is essential**: From neural network architectures to hardware platforms, optimization must happen across the full stack.
- **Generative AI is disruptive – and urgent**: Europe must invest now or risk falling behind permanently in this fast-moving field.
- **Strategic alignment on reference architectures and open ecosystems** is vital for building a competitive and resilient AI infrastructure in Europe.

9. Moving Forward: A Call to Action
To accelerate progress, the Edge AI Working Group recommends:
- Developing **European roadmap** for Edge AI
- Establishing **public-private partnerships** for hardware and software development
- Supporting **cross-domain use cases** – from mobility to manufacturing to healthcare
- Strengthening **training infrastructure** to support edge deployment of large-scale models
- Advocating for **open, standards-based ecosystems** to reduce fragmentation and vendor lock-in

10. Conclusion
The Edge AI webinar underscored a critical moment in Europe's digital evolution. While global competition intensifies, Europe has the talent, institutional strength, and industrial foundation to shape a distinct and sustainable path forward.

Through coordinated efforts – anchored in collaboration, shared vision, and technical excellence – Europe can lead in building the next generation of **trustworthy, efficient, and intelligent systems** at the edge.