



# **D3.1 – Roundtable on Edge AI functional and non-functional requirements**



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## Revisions

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## Acronyms and definitions

Acronym	Meaning
FR	Functional requirements.
NFR	Non-functional requirements.
NoE	Network of Excellence.

## ***Executive Summary***

Deliverable D3.1 (Roundtable on Edge AI functional and non-functional requirements) is an outcome of task T3.1 (Edge AI technologies and applications requirements) in work package WP3 (European Strategic Agenda and Road Mapping for Edge AI Research and Innovation) of the dAIEDGE project. The actual deliverable is the expert workshop, arranged as a roundtable on edge AI functional and non-functional requirements, which took place on April 11th, 2024, in Dresden, Germany. This document is a short summary of the successful event.

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# 1. Introduction

## 1.1. Background and rationale

This deliverable D3.1 (Roundtable on Edge AI functional and non-functional requirements) is an outcome of task T3.1 (Edge AI technologies and applications requirements) in work package WP3 (European Strategic Agenda and Road Mapping for Edge AI Research and Innovation).

This document summarises the successful expert workshop arranged as a roundtable on edge AI functional and non-functional requirements on April 11<sup>th</sup>, 2024, in Dresden, Germany. The workshop was organised by dAIEDGE<sup>1</sup> in collaboration with the Chips JU EdgeAI<sup>2</sup> project as a first roundtable that allows for open discussions among the participants, structured the activities for the following events, and provided a platform for requirements gathering, discussions, exchanging ideas, concepts, and future trends to develop a roadmap for the next generation of AI at the edge.

Edge AI interfaces with many other scientific disciplines and addresses topics of common interest as a multidisciplinary domain. These include cognitive edge AI, neuromorphic edge AI, and swarm intelligence, and they require a focus on architectures, energy efficiency, contextual computing, computational collaboration, virtualisation, miniaturisation, and edge continuum processing towards federated, distributed, and parallel computing.

# 2. Roundtable on edge AI functional and non-functional requirements

## 2.1. Agenda and sessions

On April 11<sup>th</sup>, 2024, the Horizon Europe dAIEDGE Network of Excellence (NoE) project organised a "Roundtable on Edge AI functional and non-functional requirements", which took place in Dresden. The event was planned and implemented by dAIEDGE in collaboration with the Chips JU EdgeAI project and other leading European projects (ANDANTE, CLEVER, REBECCA). As seen in the agenda (Figure 1), the event was divided into four main sessions and discussions on future steps.

- Session 1: Edge AI Concepts and Challenges.
- Session 2: Edge AI Functional and Non-functional Requirements.
- Session 3: Key Drivers, Trends, Challenges and Barriers (Pitch Presentations).
- Session 4: Edge AI Strategic Research Agenda.

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<sup>1</sup> dAIEDGE website: <https://daiedge.eu/>

<sup>2</sup> EdgeAI website: <https://edge-ai-tech.eu/>



## Edge AI Functional and Non-functional Requirements Workshop

11 April 2024 Dresden, Germany

**09:00 - 10:30 Session 1: Edge AI Concepts and Challenges** (Moderators: Ovidiu Vermesan – SINTEF, Alain Pagani, DFKI)

- *Presentation of the Network of Excellence*
- *Overview of edge AI: Definition, importance, and current state.*
- *Purpose of the Roadmap: Objectives and intended audience.*
- *Current state of edge AI technology*
  - *Technological advances - Future technology stack*
  - *Market demands*
  - *Regulatory and privacy concerns*
  - *Ecosystem and collaboration*

**10:30 - 11:00 Coffee/Tee Break**

**11:00 - 12:30 Session 2: Edge AI Functional and Non-functional Requirements**

- *Framework for addressing edge AI requirements.*
- *Edge AI non-functional requirements definition and approaches*
- *Edge AI functional requirements definition and examples*

**12:30 - 13:30 Buffet Lunch**

**13:30 - 14:30 Session 3: Key Drivers, Trends, Challenges and Barriers (Pitch Presentations)**

- *Technical challenges*
- *Standardisation, interoperability*
- *Trustworthiness, explainability/interpretability, ethical issues, regulations*
- *HW/SW, frameworks, platforms, connectivity, models, generative AI, transformers*

**14:30 - 15:00 Session 4: Edge AI Strategic Research Agenda**

- *Research and innovation focus areas.*
- *Priorities.*
- *Milestones*

**15:00 - 15:30 Future steps discussions** (Moderators: Ovidiu Vermesan – SINTEF, Alain Pagani, DFKI)

**15:30 End**




Figure 1 – The agenda for the event.



## 2.2. Summary of the event

The workshop provided a platform for exchanging ideas, concepts, and future trends to develop a roadmap for the next generation of AI at the edge, and attracted researchers from various institutions such as CSEM, DFKI, Dresden University, FORTH, Fraunhofer IIS, IMST GmbH, KU Leuven (CiTiP), SoftwareCube, SINTEF, and University of Lübeck. The moderators were the project coordinators Alain Pagani (DFKI<sup>3</sup>) representing the dAIEDGE project and Ovidiu Vermesan (SINTEF<sup>4</sup>) representing the EdgeAI project (Figure 2).

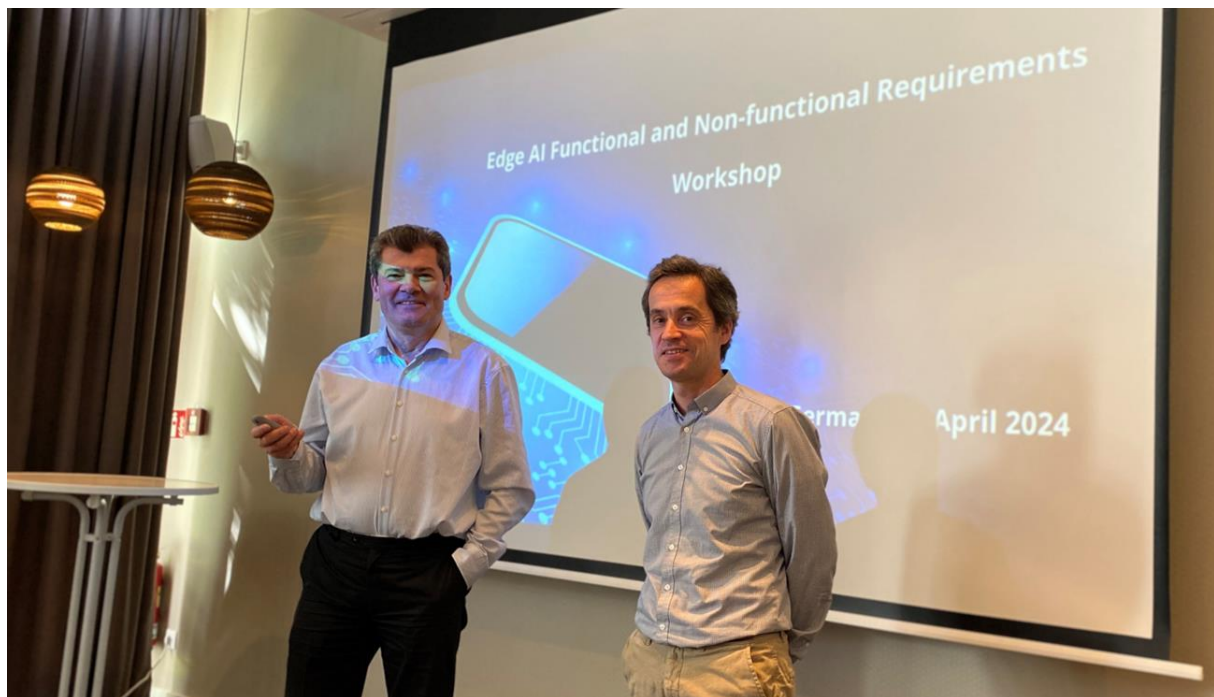


Figure 2 – The project coordinators from EdgeAI (Ovidiu Vermesan, SINTEF) and dAIEDGE (Alain Pagani, DFKI).

The dAIEDGE project coordinator, Alain Pagani (DFKI), introduced the Network of Excellence (NoE) concept and objectives, followed by Ovidiu Vermesan (SINTEF), who presented the project goals and the definition and concepts of edge AI and its continuum. Further, the participants presented themselves, their interests, and their point of view on challenges.

The workshop opened with an overview of the taxonomy and methodological aspects of collecting functional and non-functional requirements for edge AI. Key edge AI roadmap topics were identified to synthesise the current state of research, standardisation, emerging trends, future visions, and innovation demands for next-generation edge AI concepts. The aim was to structure the concepts and prepare the activities for building an edge AI strategic research agenda.

Edge AI must interface with many other scientific disciplines and address topics of common interest as a multidisciplinary domain. These include, among others, topics such as cognitive edge AI, neuromorphic edge AI and swarm intelligence, and require a focus on architectures, energy

<sup>3</sup> DFKI website: <https://av.dfki.de/>

<sup>4</sup> SINTEF website: <https://www.sintef.no/en/>

efficiency, contextual computing, computational collaboration, virtualisation, miniaturisation, and the edge continuum processing towards federated, distributed and parallel computing. The edge AI roadmap and the edge AI strategic research agenda will support the EC and the European edge AI stakeholders in defining priorities and identifying uncovered gaps.

Regarding key drivers, trends, challenges and barriers, the theme was introduced by Ovidiu Vermesan (SINTEF), and several pitches were presented by the participants:

- Philippe Dallemagne (CSEM, Switzerland) – addressing important trends, challenges, gaps and barriers in edge AI and presenting the state-of-play of the strategic research agenda developed for the Chips JU by the EPoSS, INSIDE and ANEAS industry associations.
- Abdelghani Bourenane (Sant'Anna, Italy) – about intelligence in 6G networks, security focus, effectiveness of federated learning, AI/edge computing in optimizing intrusion detection, (Chips JU CLEVER project).
- Rashed Al Koutayni (DFKI, Germany) – about edge AI requirements for computer vision, accelerate the design process by providing end-to-end integrated framework (FPGA), learning process vs inference process, latency, power consumption, memory consumption, accuracy (HE dAIEDGE).
- Akshaya Bindu Gowri (Fraunhofer EAS/ISS, Germany) – Deep Insight project approach, vibration sensors and unbalance measures/detection on rotating shafts, training on simulated data and inference in real world, labelling of real data challenges.
- Dr. Martin Neumann-Kipping (Fraunhofer EAS/ISS, Germany) – EdAPT project approach, in-lab validation of smart sensor system.
- Lydia Belkadi (KUL, CiTiP, Belgium) – Ethical & Legal Requirements for Edge AI (HE dAIEDGE).



*Figure 3 –Event participants representing different leading European projects.*

One of the highlights was the panel discussion on edge AI's functional and non-functional requirements. The experts defined, discussed, and analysed these requirements, including trustworthiness ethical and legal considerations. The aim was to align these AI-based technologies

and applications across the entire micro-, deep-, and meta-edge continuum and work together with other European initiatives and associations to overcome the fragmentation in AI research in Europe.

The discussions at the end of the roundtable outlined the aim of providing a detailed framework of functional and non-functional requirements, which are expected to influence the future development and deployment of edge AI technologies.

The event was a significant step forward in exploring the future of edge AI. The participants and their respective projects, planned to extend the cooperation and continue collaborating as part of the European edge AI ecosystem to drive innovation and contribute to developing advanced and innovative edge AI technologies and applications.

The information about the event was published on the project websites under dAIEDGE news<sup>5</sup> and EdgeAI events<sup>6</sup> as illustrated in Figure 4.

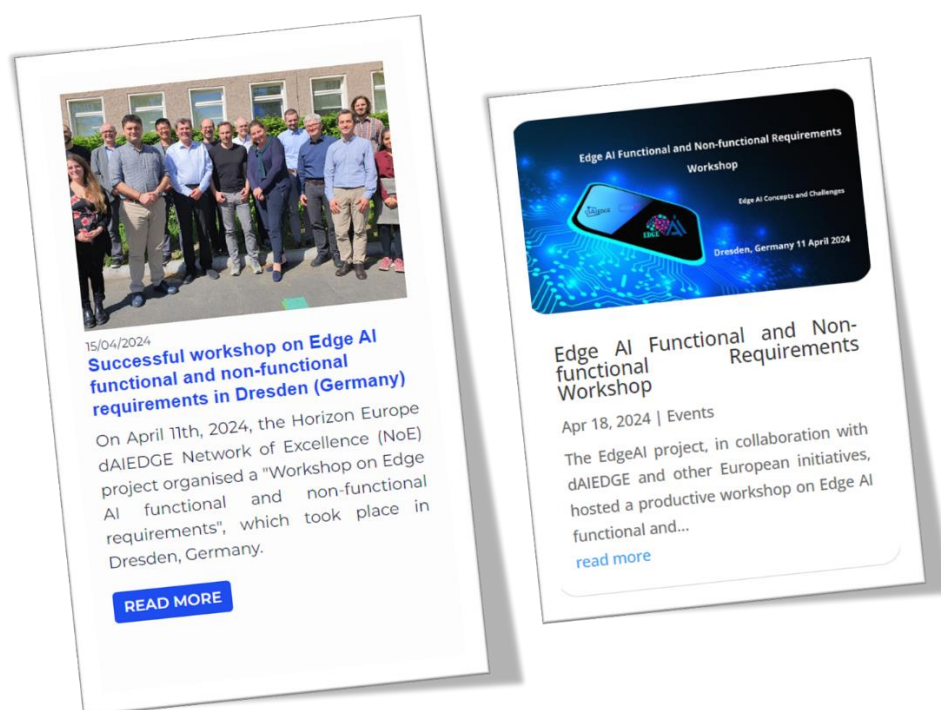


Figure 4 - Reported under News and Events at the dAIEDGE and EdgeAI projects websites.

### 2.3. Next steps

This workshop is the first in a series of events that dAIEDGE organises in collaboration with Chip JU Edge AI and other leading European projects. The roundtable on edge AI functional and non-functional requirements is the key milestone to discussing with the edge AI stakeholders and structure the activities that will provide the first document on edge AI functional and non-functional

<sup>5</sup> dAIEDGE news: <https://daiedge.eu/news/successful-workshop-edge-ai-functional-and-non-functional-requirements-dresden-germany>

<sup>6</sup> EdgeAI events: <https://edge-ai-tech.eu/regworkshop/>

requirements and open the venue for the following events to prepare the roadmap and the edge AI strategic research agenda.

The future events will provide a platform for discussing ideas, concepts, and trends for the next generation of edge AI technologies and applications.

The next step is to prepare the paper on edge AI, focusing on both functional and non-functional requirements. The aim is to outline a comprehensive framework that anticipates future trends and challenges in the deployment of edge AI technologies. The paper will detail the requirements for effective implementation and consider broader implications, including scalability, security, and ethical considerations. It will also highlight the importance of balancing functional capabilities with non-functional imperatives such as security, privacy, and ease of integration.

The paper is expected to serve as a comprehensive guide for researchers, developers, and practitioners involved in designing and deploying next-generation edge AI systems, ensuring that these technologies are performant, efficient, dependable/trustworthy, ethical, scalable, and sustainable.



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