



Research & Innovation Roadmap

for the Cognitive Computing Continuum

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The need for a Cognitive Computing Continuum Research & Innovation Roadmap



Ensure EU excellence, leadership and technology sovereignty in the Computing Continuum

Bridge academic/research ecosystem with industry innovation ecosystem

Help consolidate research & innovation priorities from various communities relevant to the Computing Continuum

Foster international synergies and cooperation activities (EU-Japan-South Korea)



Challenges and opportunities for a European Computing Continuum



- **Fragmented European cloud market, diverse ecosystems such as EuroHPC**
 - Need to collaborate with multiple providers to match the quality and breadth of services offered by leading global cloud providers
- **Chip design and manufacturing capabilities in Europe (RISC-V)**
 - New instruction set and hardware architectures
- **Ensure European capacity for AI development**
 - Ensure that we can develop AI based on European values
- **Convergence of IT and OT**
 - Chance to establish a new cloud-edge paradigm
- **Telco and cloud are converging**
 - Position the telco industry in relation to future edge infrastructure, and the cloud ecosystem
- **Can the power grid keep up with all the new data centers?**



- **Technology Priorities for the Cognitive Computing Continuum**
 - Research & innovation priorities to **support the EU cloud-edge industry and ecosystem.**
 - Shape a **forward-looking** and **bold long-term vision** (5-10 years).
 - Bringing fundamental research to innovation.
 - **Complement** industrial roadmaps and innovation carried out by the **EU Cloud Alliance** and the new **IPCEI-CIS.**
 - **Important input** for the **Horizon Europe Work Programmes** and the **next EU Commission.**



First Public Draft Version of the Roadmap

- **What to expect in the first public draft of the Roadmap**
 - **Four main topics** (aligned with the four IPCEI-CIS Workstreams):
 - AI for Cloud-Edge
 - Cloud-Edge for AI
 - Telco Cloud-Edge
 - Cloud-Edge Use Cases
 - **Additional sections** of the Roadmap will also **cover key transversal topics** (aligned with focus areas under the Cloud-Edge WG of the EU Cloud Alliance):
 - Sovereignty & Open Source, Sustainability, Interoperability, Cybersecurity.
 - Also **identified other interesting areas**, that might become specific sections in future versions of the Roadmap:
 - Neuromorphic, quantum computing, space edge, hyper-decentralized edge...



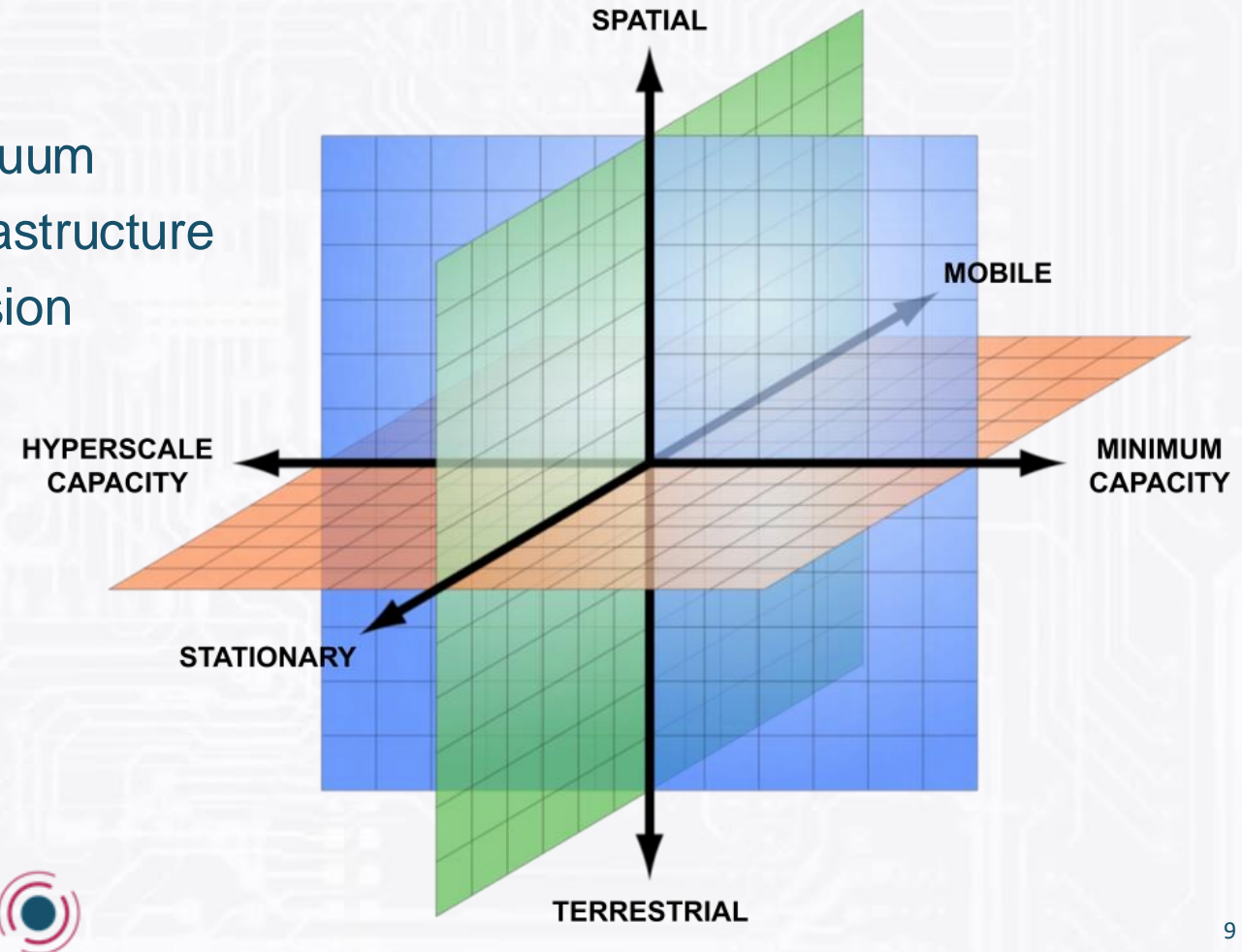
- **AI for Cloud-Edge: *Orchestration and Managing a Multi-Provider Continuum.***
 - “Cross-layer” Optimization in a Multi-provider Cloud-Edge Continuum.
 - Large Language Models and AI for Debugging and Root Cause Analysis.
 - AI for an Energy-efficient, Green, and Energy-system-aware Continuum.
 - Efficient Resource Allocation for "Continuum-native" Workloads.
 - Stateful Serverless Computing Across the Cloud-Edge.
 - Distributed AI for Safety-critical Applications
- **Cloud-Edge for AI: *Enabling and Facilitating AI Applications Across the Continuum.***
 - Integrating RISC-V Hardware in the Cloud-Edge.
 - Open Compiler Infrastructure and Lightweight Virtualization for Heterogeneous Hardware.
 - Integrating (Euro)HPC in the Continuum.
 - Federated Computation for Foundation Models.
 - Confidential Computing and Data Privacy & Security in AI Services.
 - LLMOps and GenAIOps.
 - Data Spaces for AI



- **Telco Cloud-Edge:** *Telco as One of the Main Tenants and Infrastructure Providers.*
 - Open Radio Network Access (O-RAN)
 - Resilient On-prem 5G/6G Edge-Cloud for Industry 4.0 and Beyond
 - AI and Generative AI to Optimize Network Resources and Operational Efficiency
 - Seamless Data Connectivity Across Different Networks
- **Cloud-Edge Use Cases:** *Requirements from Next-Gen Use Cases and Applications.*
 - Software-Defined Vehicles
 - Decentralized Spatial Computing for AR/VR Technologies
 - Satellite Communication for Edge Applications
 - Cyberspace and Physical Space Fusion



- **Other Topics of Potential Interest:**
 - Integration of Neuromorphic Systems
 - Space Edge (Satellites)
 - Towards a Hyper-Decentralized Continuum
 - Integration of Quantum Computing Infrastructure
 - Quantum and Classical Computing Fusion



Timeline for the Roadmaps

- **Timeline for the Roadmap**
 - The **first draft** version has been publicly released.
 - First official release by **end of 2024 / early 2025**, and then annually updated.
- **Your feedback is vital...!**
 - Contributions from both industry and research is crucial for the production and improvement of this deliverable over time.
 - The NexusForum.EU CSA will put in place a number of mechanism for active engagement!

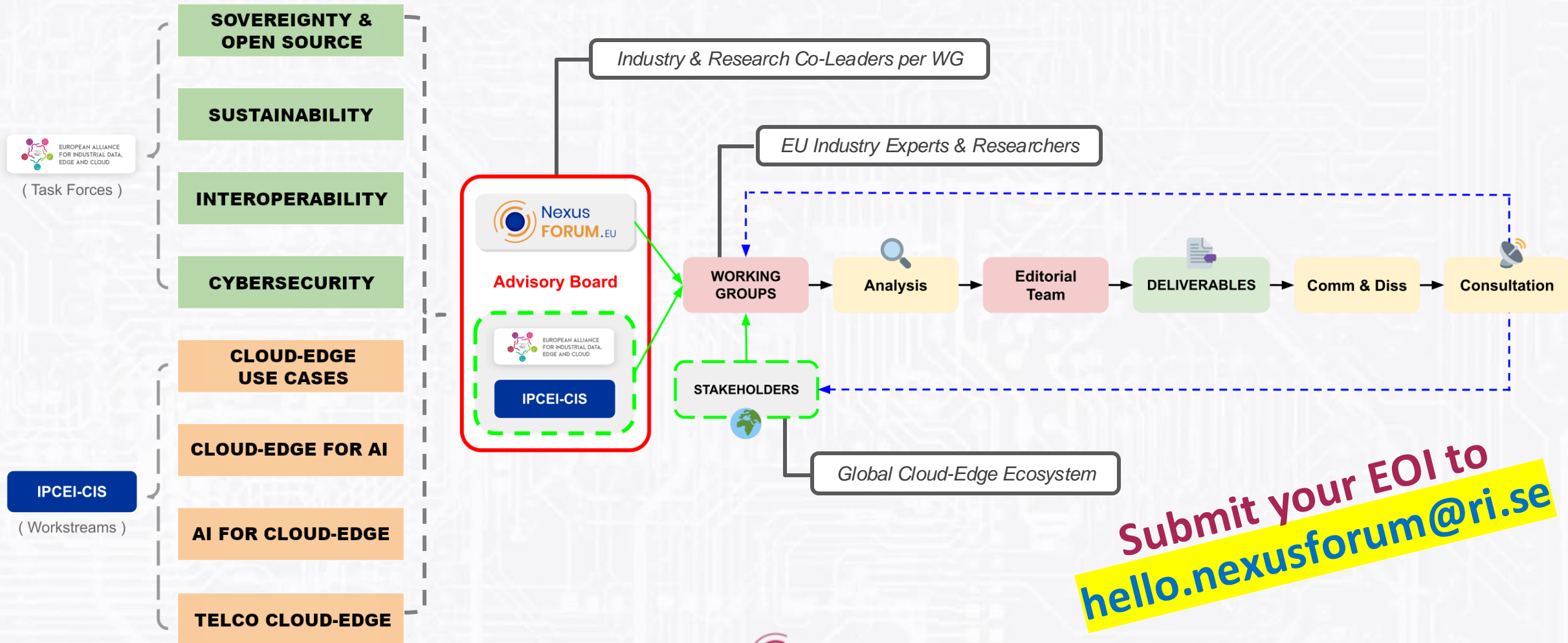


- **Thematic WG:**
 - Based on the main sections of the **Technological Roadmap**.
 - Aligned with existing initiatives (i.e. **EU Cloud Alliance & IPCEI-CIS**).
 - Aimed at collecting early contributions and feedback from relevant **EU industry experts and researchers**.
- **Geographic WG:**
 - Based on strategic links with non-EU countries (**Japan & South Korea**)
 - Aimed at promoting international R&D collaboration (e.g. based on upcoming **HE association agreements**).



Industry–Research (Thematic) Working Groups

NexusForum.EU WORKING GROUPS:



Submit your EOI to
hello.nexusforum@ri.se



Many thanks to our WG Industry Co-leaders!



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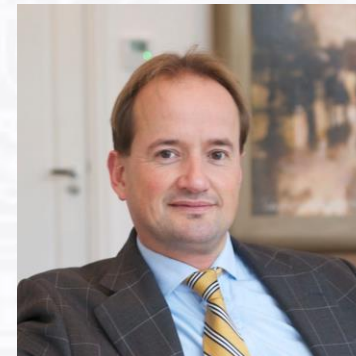
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