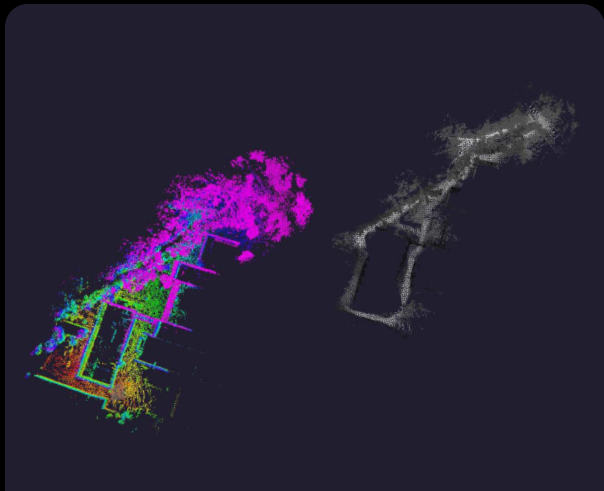


SUCCESSFUL R&I: MARCH 6 2025, DUSSELDORF

G-COPCOM

Generative **C**oncept-based **P**erception,
Control and **M**anipulation

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Generative **C**oncept-based **P**erception, **C**ontrol and **M**anipulation (**G-COPCOM**)

Challenges

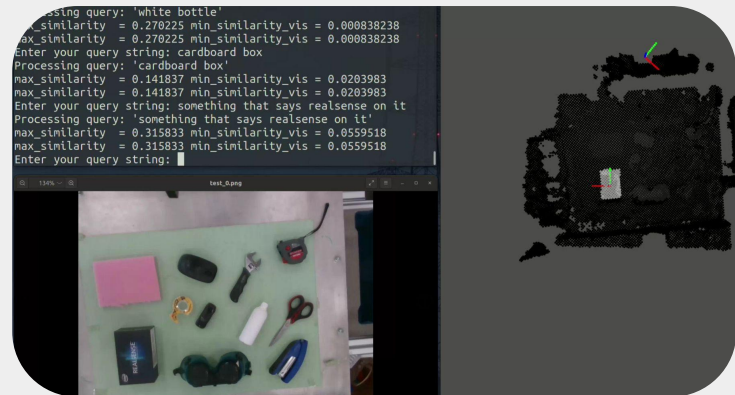
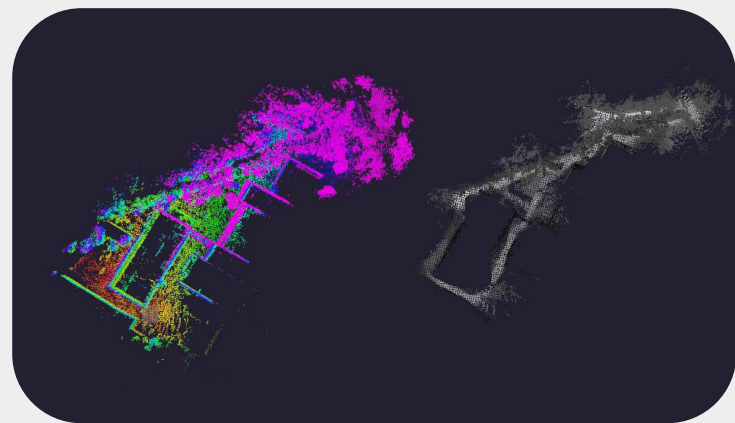
- **Manufacturing:** robotic systems manually programmed to perform repetitive tasks; require specialist knowledge,
- **UGV and UAVs:** need close human oversight due to limited on-board autonomous decision making
- **Agrifood, forestry, service industry, ...:** Human-robot collaboration needs intuitive control, trust
- Keeping European industries globally competitive in the face of **demographic challenges:**
 - **Generative AI** in spatial data workflows
 - Grow **domestic robotics supply chain**



Generative Concept-based Perception, Control and Manipulation (G-COPCOM)

Objectives

- **Generative AI** (LLM, VLM, Open-set semantics) *on the Edge* for intuitive, NL-driven robotics in manufacturing and consumer facing sectors
 - *USE CASE: text/voice interactive industrial robotics*
- UGV, UAV, USV, UUV advances in agrifood; forestry; energy & mobility infrastructure monitoring and repair through novel sensors, actuators, software and AI-enabled autonomy
 - *USE CASE: autonomous robotic agents in the field*
- Leverage Open-set perception & mapping technologies beyond robotics – integrate GenAI into EO, construction site surveying, energy & transport infrastructure workflows
 - *USE CASE: spatial vector databases for GenAI integration*



Generative **C**oncept-based **P**erception, **C**ontrol and **M**anipulation for (**G-COPCOM**)

Expected Outcomes

- Trustworthy and robust **generative AI** for improved manufacturing, with intuitive, language-grounded human interactivity
- Development and Deployment of General Purpose AI (GPAI) agents with **seamless adaptation to dynamic environments on UxVs**, capable of fluid collaboration with humans in various task domains
- Increased productivity in **surveying, monitoring, maintenance** workflows through **GenAI integration** in perception and decision making

Technical Goals:

HARDWARE

- ✓ UGV, USV, UUV, UAV platforms
- ✓ Sparse Tensor Accelerators
- ✓ Enhanced RGB-D, LiDAR
- ✓ High-DOF Effectors, Manipulators
- ✓ New Sensor Modalities in Robotics

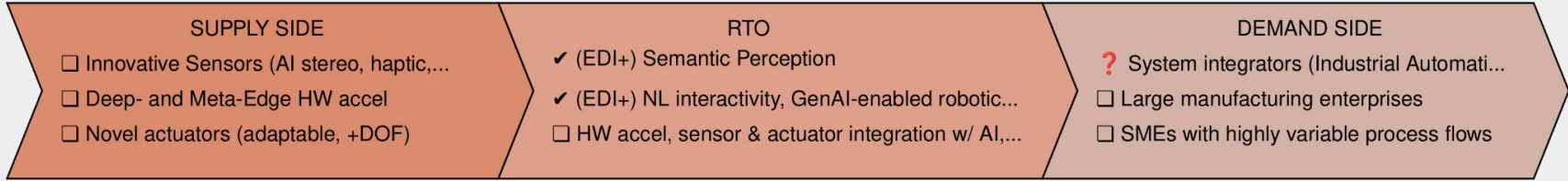
SOFTWARE & AI

- ✓ Navigation, Localization, SLAM
- ✓ Open-set Semantic Mapping
- ✓ Natural Language Interactivity
- ✓ GenAI Control Policies
- ✓ LLM Integration w/ Spatial Data

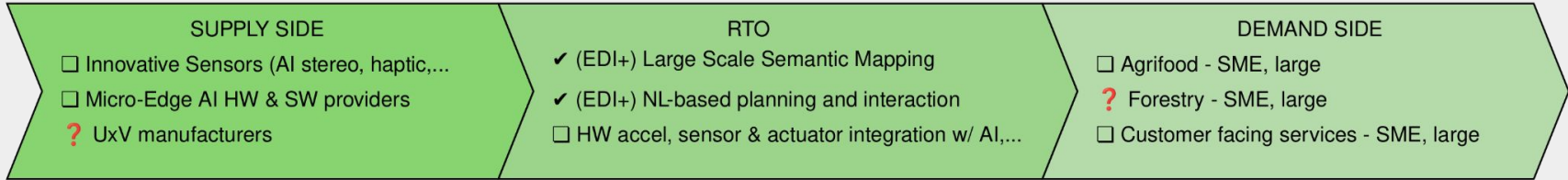
SYSTEMS OF SYSTEMS

- ✓ Intuitive, adaptable complex manipulation for manufacturing
- ✓ Agrifood, Forestry UGV, UAV, Large Scale Swarms
- ✓ Remote monitoring and repair of energy, transportation infrastructure
- ✓ Integration of GenAI capabilities into EO, Construction Surveying

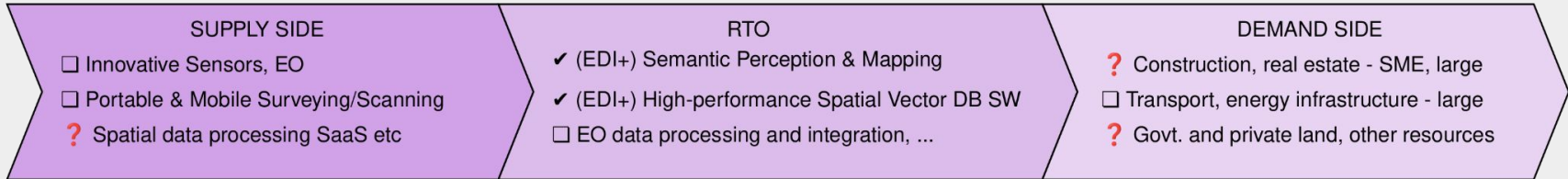
INDUSTRIAL MANIPULATION USE CASE



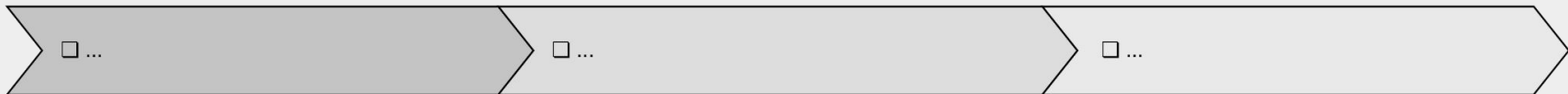
AUTONOMOUS ROBOTICS USE CASE



SURVEYING, MONITORING & MAINTENANCE USE CASE



BYOUC (BRING-YOUR-OWN-USE-CASE)



LEGEND: Looking for partners ✓ (some of the) Contributors already found ? Discussions with (some of the) partners already underway

Generative **C**oncept-based **P**erception, **C**ontrol and **M**anipulation (**G-COPCOM**)

Potential Topics

- Robust and trustworthy Generative AI for Robotics and industrial automation (RIA)
- Advanced sensor technologies and multimodal sensor integration for multiple application domains
- Empowering AI/generative AI along the Cognitive Computing continuum
- *On-site innovative robotics and automated solutions and techniques for more sustainable and less disruptive building construction and renovation*

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