



**National Federated
Compute Services**
NetworkPlus

**Autumn Conference
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Federated Edge-HPC Architectures for AI workflows in Privacy-sensitive and Real- time Domains

Presenter: Dr Theodoros Spyridopoulos





Project team

Project Lead

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Co-leads

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Project Team Members

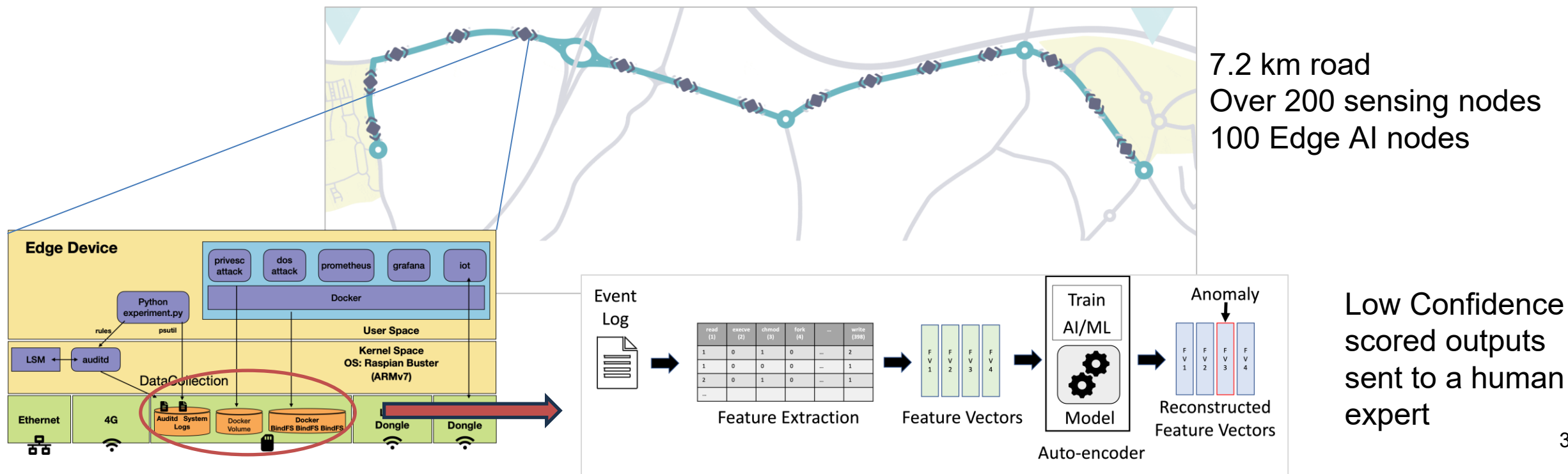
Prof Omer Rana (Cardiff University)
Prof. Rajiv Ranjan (Newcastle University)
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Motivation

SYNERGIA - Secure by design End to end platform for large scale resource constrained IoT Applications (£2.2M UKRI-funded, Nov 20 - Oct 22)

- Intrusion/Anomaly Detection at the IoT Edge Using **Federated Learning**





Motivation

Real-time decision-making and privacy-preserving resource-heavy computation

- ***Healthcare*** – Federating local TREs with HPC; Example: Synthetic data generated locally (e.g. at TRE level) used to train large models on HPC
- ***Transport systems simulations*** – Federating local Digital Twins with HPC; Example: Localised combined higher-level Multi-agent simulations; Real-time traffic modelling (100K–500K vehicles)
- HPC provides large-scale processing power; requires **integration with local/edge infrastructure**.
- Can we use workflow tools (e.g. Pegasus) to design **workflows on heterogeneous systems**?
- Need to explore **feasibility of Edge–HPC federation**.



Aims

- Evaluate federation between national HPC (Isambard AI) and local Edge infrastructures.
- Build a **user/stakeholder community** in healthcare and transportation.
- Develop and test **workflows** across the Edge–HPC continuum.
- Identify **technical and policy barriers** to federation.

Workshops participation form





Pillars of the Project

Community Pillar

- Engage healthcare & transport stakeholders ++ (Edge AI HUB partners, DARE UK projects etc.)
- Generate user narratives to inform design.
- Organise 3 workshops for co-design.

Technology Pillar

- Build testbed integrating Edge and HPC (Cardiff and Newcastle Edge infrastructure; ISAMBARD AI)
- Validate **AI workflows** across heterogeneous systems
- Explore privacy-preserving and decentralised approaches.

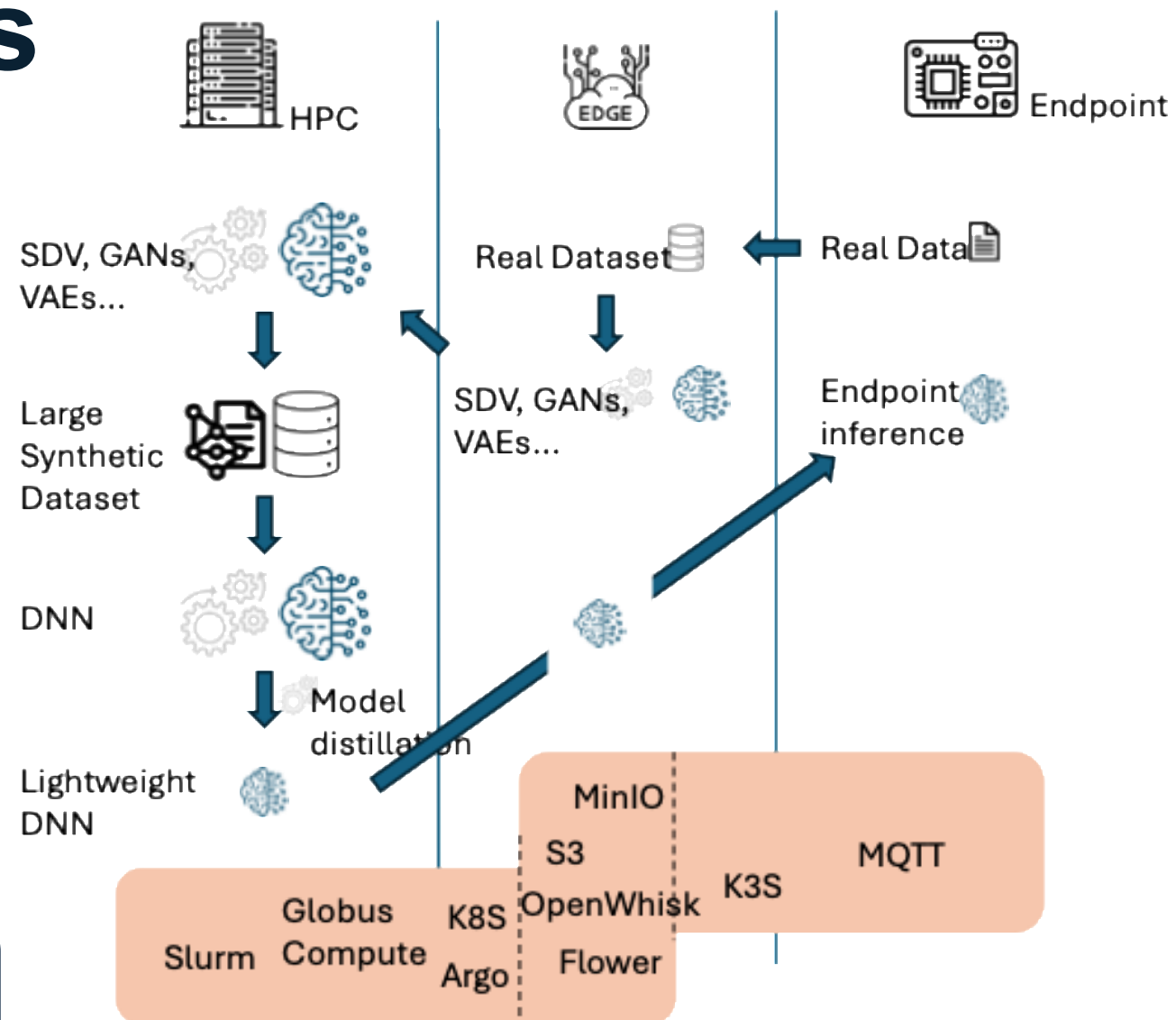
Example Workflows

Edge: Privacy-preserving training (e.g. synthetic data generation).

HPC: High-performance model training on aggregated/synthetic data.

Edge/Endpoint: Model distillation for real-time inference on constrained devices.

Transform into a scientific workflow
(Pegasus/Argo or similar workflow
orchestrators) ready to be deployed on
HPC/EDGE/Endpoint



Community Engagement Activities

3 workshops
Newcastle, Cardiff

November 2025*

January 2026

March 2026

Workshops participation form



Thank you