



**National Federated
Compute Services**
NetworkPlus

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Federated Edge-HPC architectures

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Project team

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Motivation and Aims

Real-time decision-making and privacy-preserving resource-heavy computation (healthcare, transport)

- Explore the feasibility of federating HPC/AIRR – Edge computing resources
- Identify enablers and barriers towards the federation
- Inform NFCS roadmap

Community Pillar

- HPC and Edge computing stakeholders
- Use stakeholders' input to inform Edge-HPC workflows and testbed design

Technology Pillar

- Build a testbed integrating HPC/AIRR - Edge computing resources
- Validate **AI workflows** across heterogeneous systems
- Explore privacy-preserving and decentralised approaches



Activities

Workshops at Newcastle (2-3 December)

Meetings with HPC engineers

Edge-HPC Workflows Taxonomy



Findings

Barriers

1. **Wall-time limits** are mandatory
2. Batch-centric **scheduling** model
3. **Heterogeneous hardware** landscape
4. Some institutions **oppose using containers** for security reasons.
5. **Kubernetes** is emerging (e.g. TREs; isolated services, slinky) but not core to HPC; no production Slurm–Kubernetes integration yet; legacy HPC systems avoid it
6. **Workflow engines** are largely absent in academic HPC contexts
7. Most academic HPCs do **not support real-time streaming workloads**
8. **Service-level automation** conflicts with “real-person-only” account policies
9. Lack of HPC-scaling **awareness**



Findings

Enablers

- **Identity federation** – HPC-Edge federation can benefit from project-scoped access control
- Some institutions provide **IaaS**; HPC-Edge federation can leverage open-stack provisioning and project-isolated infrastructure (Federation could target TRE-like models)
- **Secure container execution**



Outcomes – from HPC Landscape

Tier 1 - National

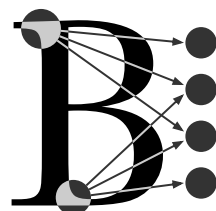


AIRRs



DAWN

Tier 2 - Regional



Cambridge Service for Data-Driven Discovery (CSD3)

DIRAC

Tier 3 - Institutional



University managed

- Durham University** (Hamilton)
- Imperial College London** (RCS)
- University of Bristol** (BlueCrystal 5)
- Cardiff University** (Hawk)
- University of Leeds** (ARC)
- UCL** (Kathleen, Myriad)
- Newcastle** (Rocket, Comet)



Outcomes – to HPC Landscape 2.0

Tier 1 - National

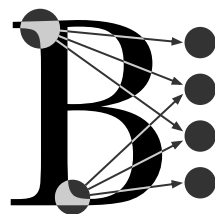


AIRRs



DAWN

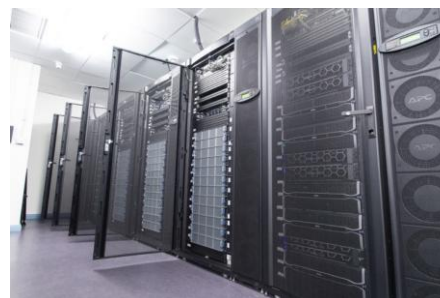
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Tier 4 - Private



Privately owned systems

- Often not Slurm-based for streaming use cases
- Custom schedulers
- Real-time data streaming workflows (e.g. green energy providers)
- Resembles cloud-native orchestration



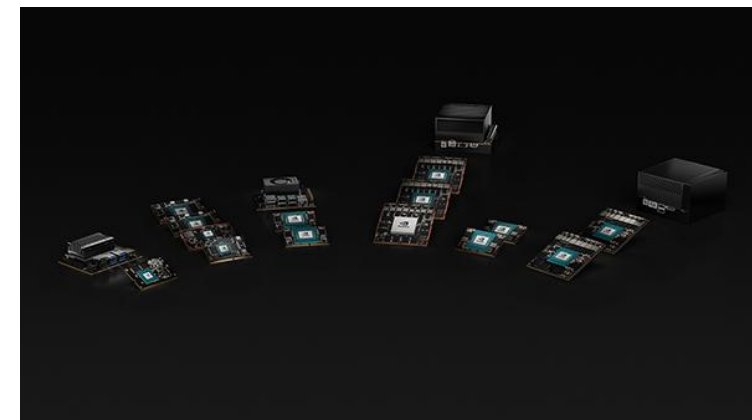
Edge Computing



Enterprise



Industrial

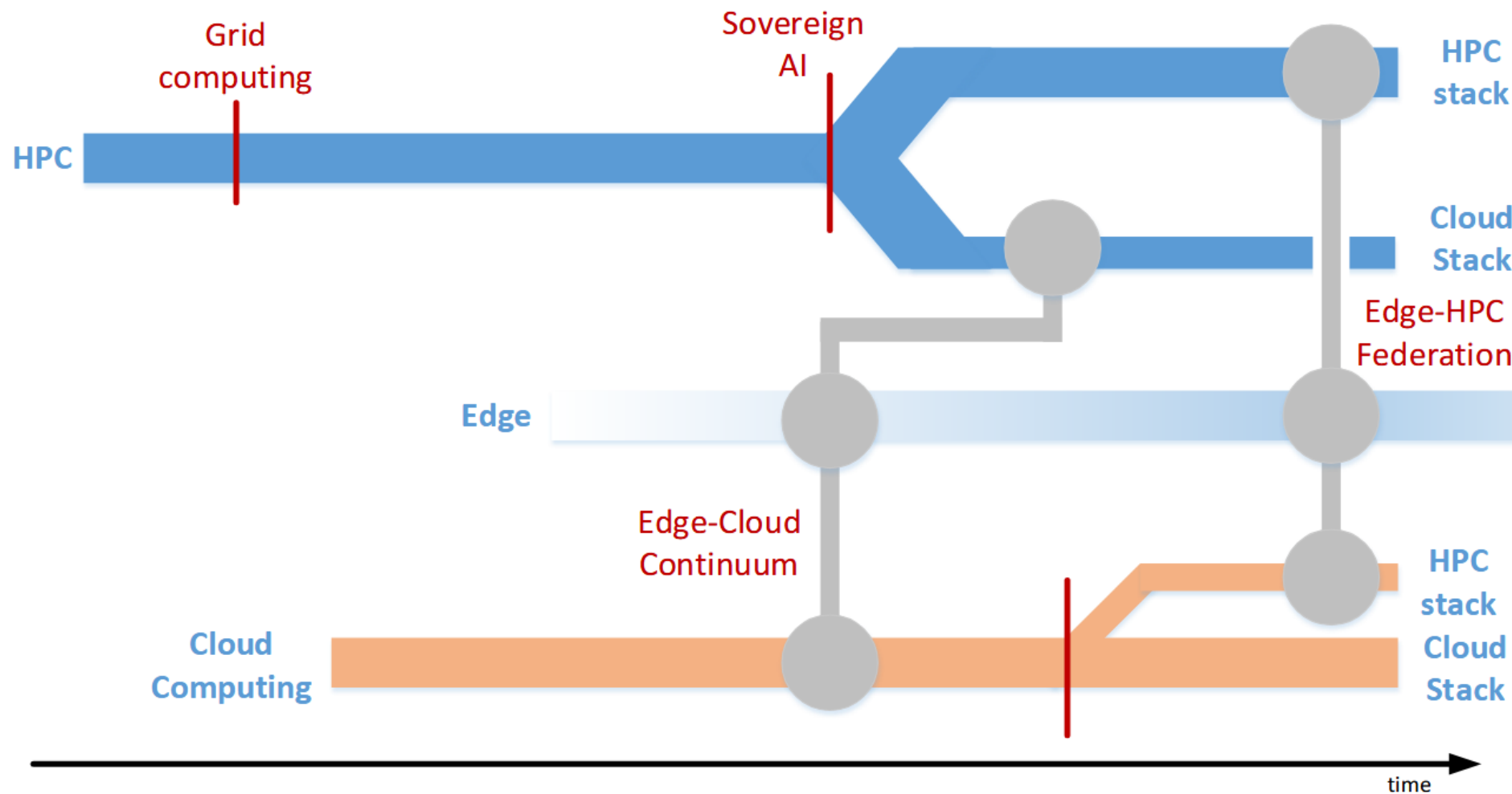


Embedded



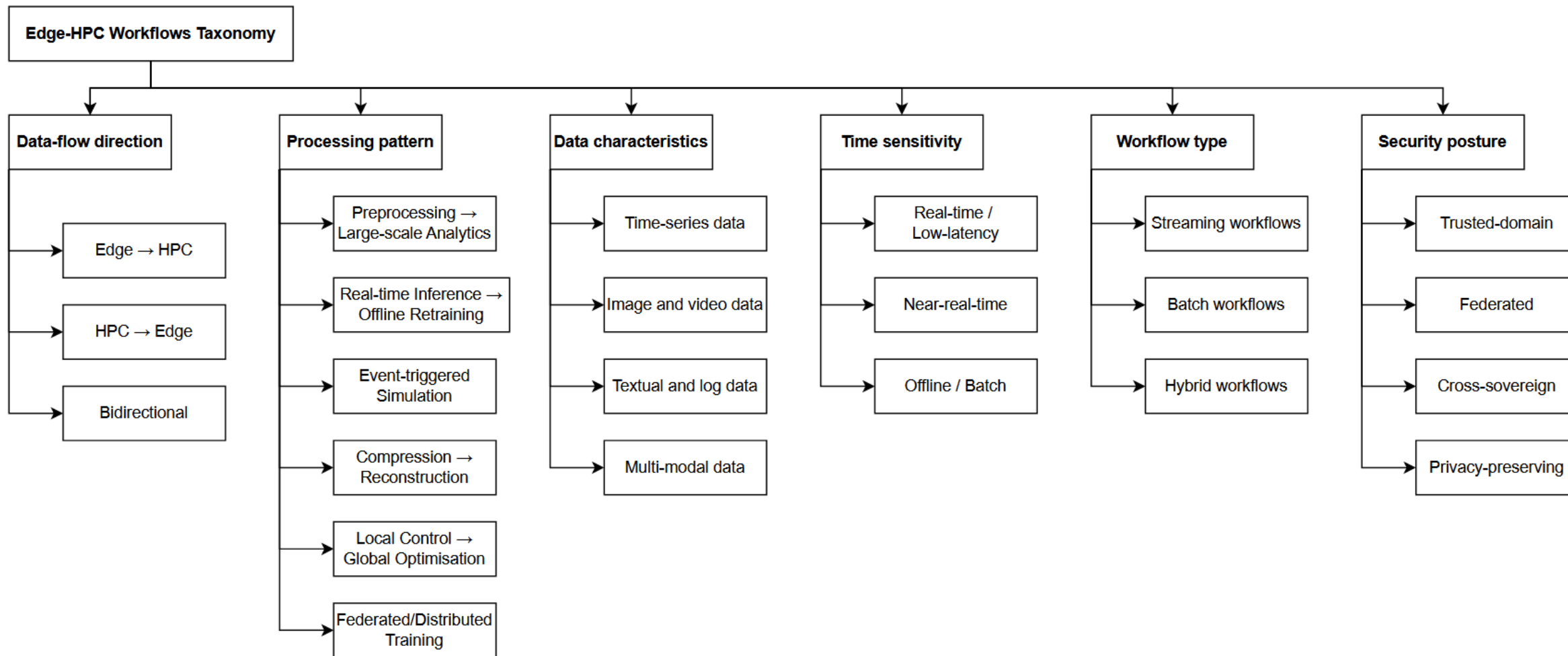


Evolution of Edge/Cloud/HPC

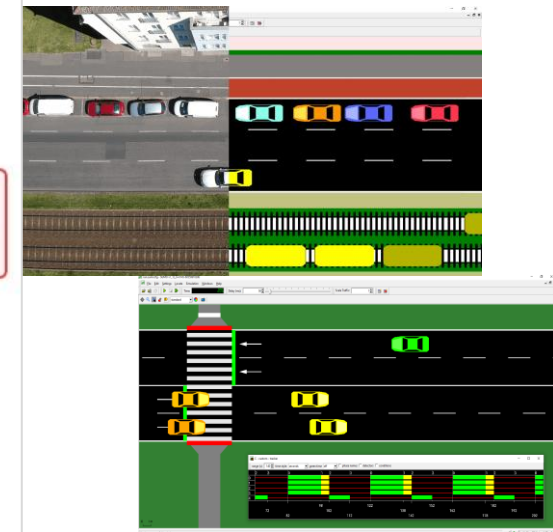
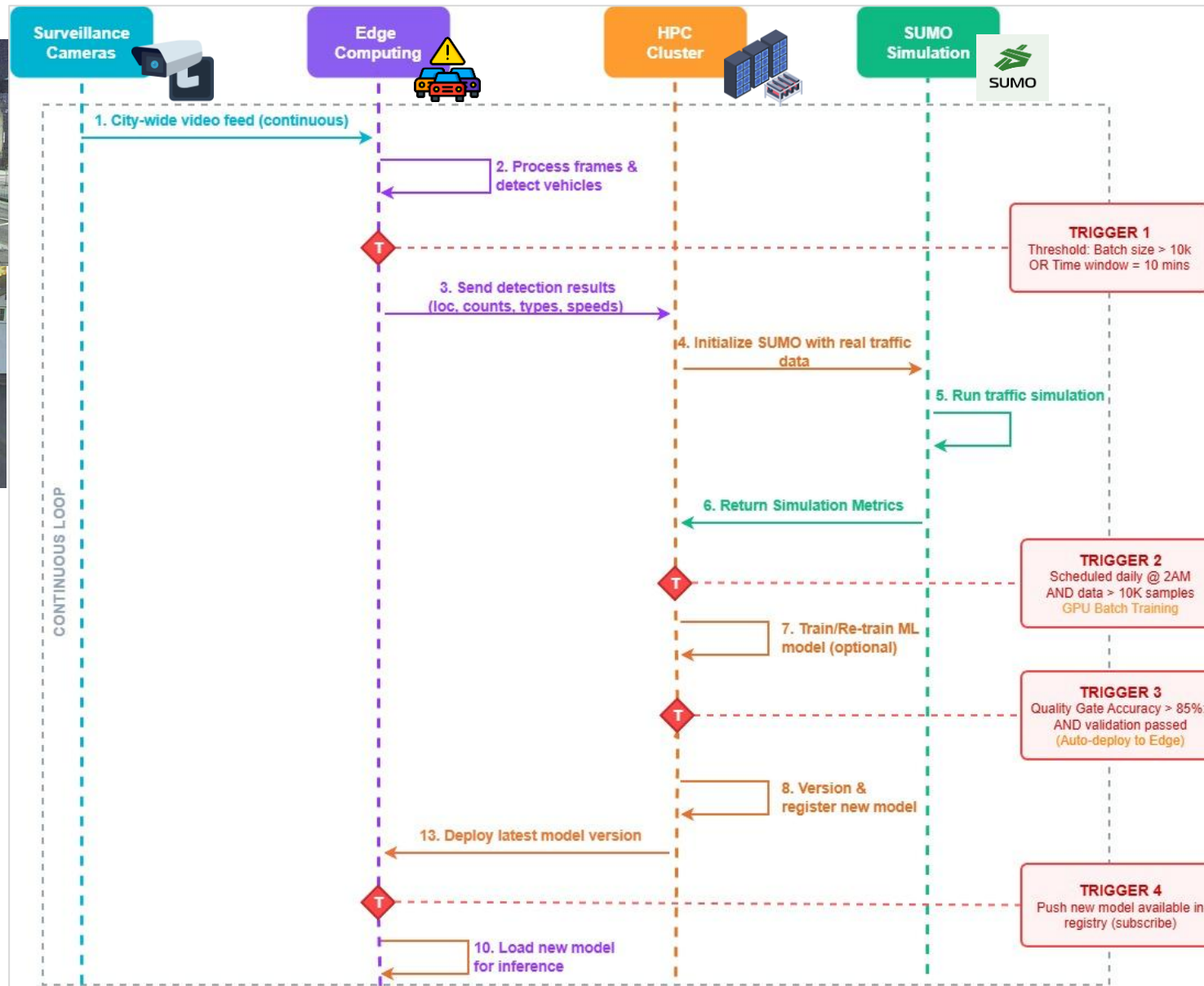
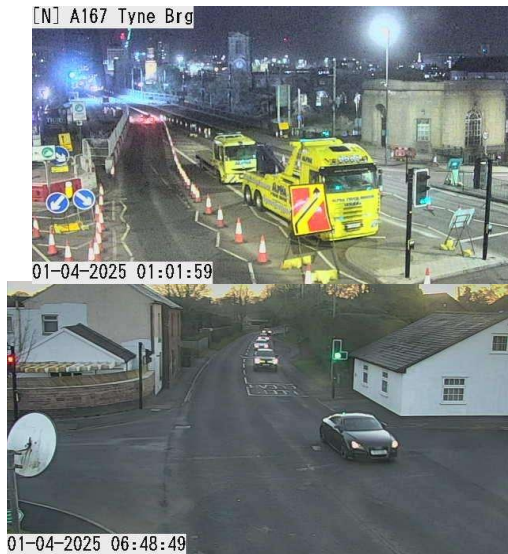




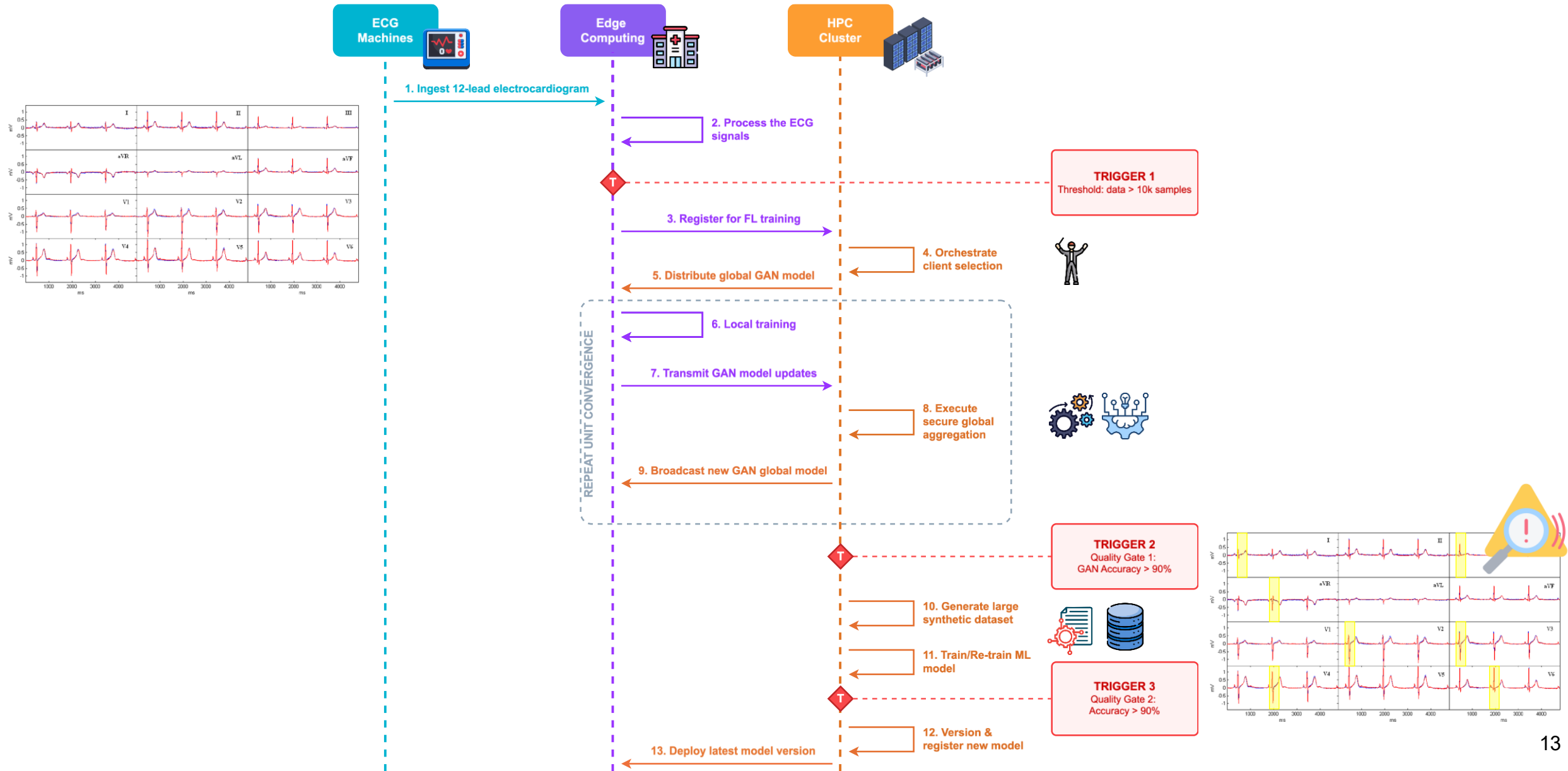
Edge-HPC Workflow Taxonomy



Transport scenario



Healthcare scenario





Next steps

- Testbed development and workflow testing
- Paper on Edge-HPC workflows
- Workshop in Cardiff



Thank you