Partner Profile Report – Smart Edge Lab

Target Call: HORIZON-CL4-2026-05-DIGITAL-EMERGING-02 (RIA)

Next-Generation AI Agents for Real-World Applications in the Apply AI sectors

1. Executive Summary

Smart Edge Lab is a university research group focusing on end-to-end QoS/SLO assurance for the cloud–edge continuum, with a strong emphasis on real-time monitoring, analytics-driven localization of QoS bottlenecks, and closed-loop corrective actions. For DIGITAL-EMERGING-02, we position ourselves as the consortium partner that transforms AI-agent research into measurable, deployable outcomes in a real-world "Apply AI" scenario: autonomous service assurance for Telco Edge Cloud and federated cloud-edge infrastructures.

Our contribution is not to compete with frontier AI labs on publication prestige, but to provide the sector grounding, validation environments, benchmarking methodology, and operational control-loop integration necessary to demonstrate credible progress and impact against SLOs and AI energy optimization (e.g., latency, throughput, availability) under realistic network and compute dynamics.

2. Strategic Fit to the Call

DIGITAL-EMERGING-02 targets AI agents that can plan, reason, use tools/APIs, and collaborate as multi-agent systems, while demonstrating measurable progress via KPIs and benchmarking in real-world application sectors. Smart Edge Lab's research aligns naturally with this scope because our systems already implement the core loop required for agentic autonomy: observe (telemetry collection) → reason (analytics and localization) → act (mitigation via scaling or shifting).

We propose to anchor the project's real-world validation in Telco Edge Cloud / cloud-edge continuum operations, where SLO violations arise from fluctuating workloads, heterogeneous resources, and partially black-box components. This provides an evaluator-friendly narrative: AI agents are assessed not only by model metrics, but by tangible improvements in service quality and operational efficiency.

3. Lab Profile and Core Capabilities

3.1 End-to-end SLO-driven service assurance

We work on ensuring QoS across the full service chain by defining SLOs and detecting deviations in real time. Our pipeline integrates data from edge devices and the network to create a system-level view of performance.

3.2 Distributed observability and real-time analytics

We deploy lightweight monitoring agents on edge nodes and network devices. Collected telemetry is processed by real-time analytics to detect anomalies and characterize traffic and load conditions.

3.3 QoS bottleneck localization under uncertainty

A key differentiator is our matching/localization approach that identifies QoS-critical segments even when measurements are noisy, workloads are time-varying, and parts of the infrastructure behave as black boxes.

3.4 Closed-loop mitigation and energy-aware decision-making

We close the loop by applying corrective actions such as workload shifting and elastic scaling to prevent temporary QoS fluctuations from evolving into persistent SLO violations. In parallel, we extend decisions with energy-awareness, ranking execution sites by energy cost and renewable availability, and using predictive control to improve proactive mitigation.

4. Proposed Role in the Consortium

Smart Edge Lab can lead or co-lead work packages that translate AI-agent capabilities into measurable operational outcomes. We propose a work package structure that is coherent with our expertise and complements strong AI-agent partners.

4.1 WP-A: SLO Benchmarking & Evaluation Framework (Lead/Co-lead)

Objective: provide the consortium-wide evaluation backbone to quantify progress and ensure reproducibility. This work package defines SLO metrics, KPI dashboards, and standardized protocols to compare agent variants against baselines.

- Define evaluator-friendly SLOs and KPIs (e.g., time-in-violation, time-to-mitigation, overhead, energy–SLO trade-offs).
- Deliver a reproducible benchmark suite with scenario library and controlled event generation using digital-twin emulation.
- Provide localization scoring methodology and ground-truth generation for QoS-critical segment identification.

4.2 WP-B: Agentic Closed-Loop QoS Control for Cloud–Edge Continuum (Lead/Task lead)

Objective: integrate AI-agent decision-making into a practical observe–reason–act control loop for service assurance.

- Implement integration pipeline from observability to agent reasoning modules and actuation targets.
- Provide standardized agent ‘tool’ APIs to trigger corrective actions (scale, shift workloads, steer traffic, update policies).
- Integrate localization outputs into action selection to improve effectiveness under partial observability.

4.3 WP-C: Energy-Aware Agent Policies (Task lead)

Objective: extend agent policies to jointly optimize service quality and energy efficiency, increasing the relevance for sustainable computing.

- Incorporate energy cost and renewable availability signals into policy objectives.
- Support workload steering/placement and deferral strategies under SLO constraints.
- Evaluate energy–SLO trade-offs in controlled scenarios and (where available) pilot deployments.

5. Concrete Technical Tasks (ready-to-assign)

The following tasks can be assigned directly to Smart Edge Lab within the project plan. They are designed to be modular and to interface cleanly with the AI-agent research components delivered by other partners.

- T1 – Observability deployment: deploy lightweight monitoring agents on edge nodes and network devices; implement telemetry ingestion into real-time analytics.
- T2 – QoS root-cause localization: implement matching/localization algorithms to identify QoS-critical segments under noisy measurements and black-box conditions.
- T3 – Agent tool APIs: design and implement standardized actuation interfaces for scaling, workload shifting, traffic steering, and policy updates.
- T4 – Digital twin & scenario library: develop end-to-end emulation with controlled event generation to stress-test agents and ensure reproducibility.
- T5 – Predictive scaling/control: integrate short-horizon forecasting and predictive controllers to proactively prevent SLO violations.
- T6 – Benchmarking & reporting: execute baseline vs agent variants; produce KPI reports and reproducibility packages for consortium-wide use.

6. Proposed KPIs and Evidence Strategy

To align with the call's emphasis on measurable progress, we propose a KPI set that evaluates agentic systems in operational terms. These KPIs support both scientific evaluation and industrial relevance.

- KPI-1 SLO violation reduction: percentage reduction in time-in-violation compared to reactive baselines.
- KPI-2 Time-to-mitigation: median time from anomaly detection to stabilization after corrective actions.
- KPI-3 Localization accuracy: precision/recall for identifying QoS-critical segments across benchmark scenarios.
- KPI-4 Overhead: CPU/memory/network overhead introduced by monitoring and agent actions at the edge.
- KPI-5 Energy–SLO trade-off: energy savings or renewable utilization increase without increased SLO violations.

7. Collaboration Readiness and Engagement Model

We are ready to collaborate in a joint leadership model where a specialized AI-agent partner leads frontier agent innovations, while Smart Edge Lab leads the evaluation backbone and operational integration. This split minimizes risk and improves proposal credibility by ensuring that 'AI agent progress' is validated with rigorous benchmarks and realistic service scenarios.

8. Contact

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