MLSysOps: Scalable, Energy-Efficient AI for Urban Infrastructure

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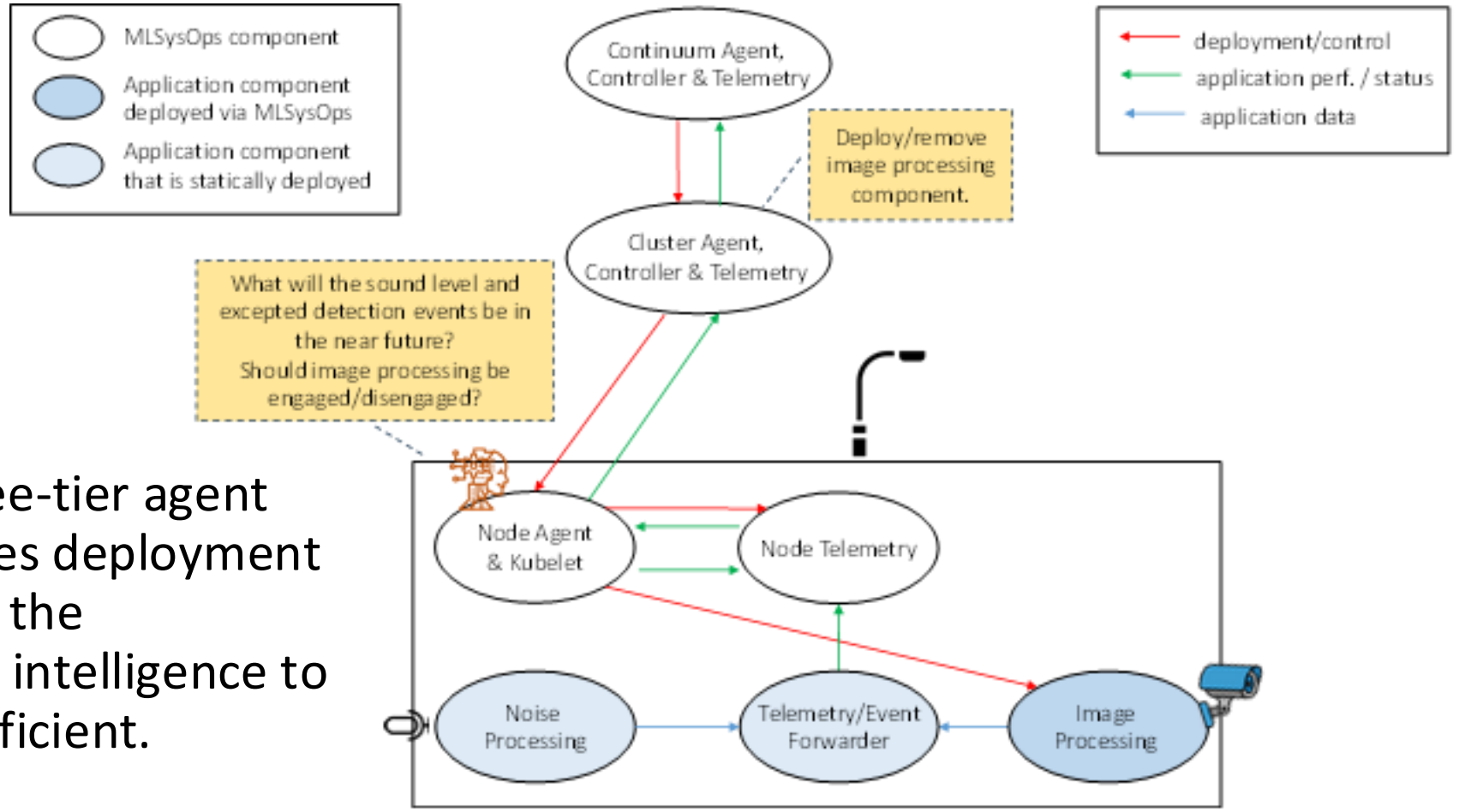
The "Idle Power" Crisis in Smart Cities

High-performance Computer Vision (CV) systems are essential for urban safety monitoring, but they consume unsustainable energy when deployed in "Always-On" configurations at the edge.

The challenge for infrastructure operators is clear: how do we maintain comprehensive monitoring coverage whilst dramatically reducing the energy footprint of edge systems?

The Three-Tier Agent Hierarchy Solution

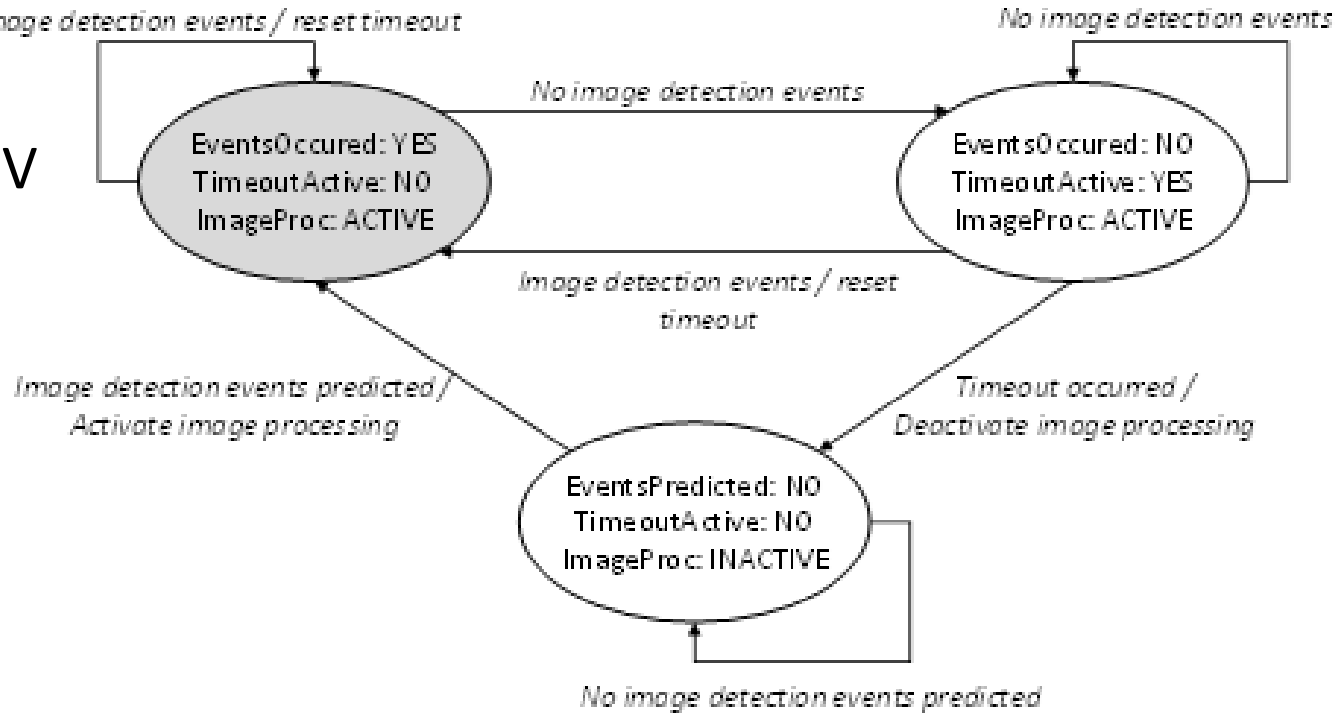


MLSysOps deploys a three-tier agent hierarchy that coordinates deployment and configuration across the infrastructure—enabling intelligence to reside where it's most efficient.

Context

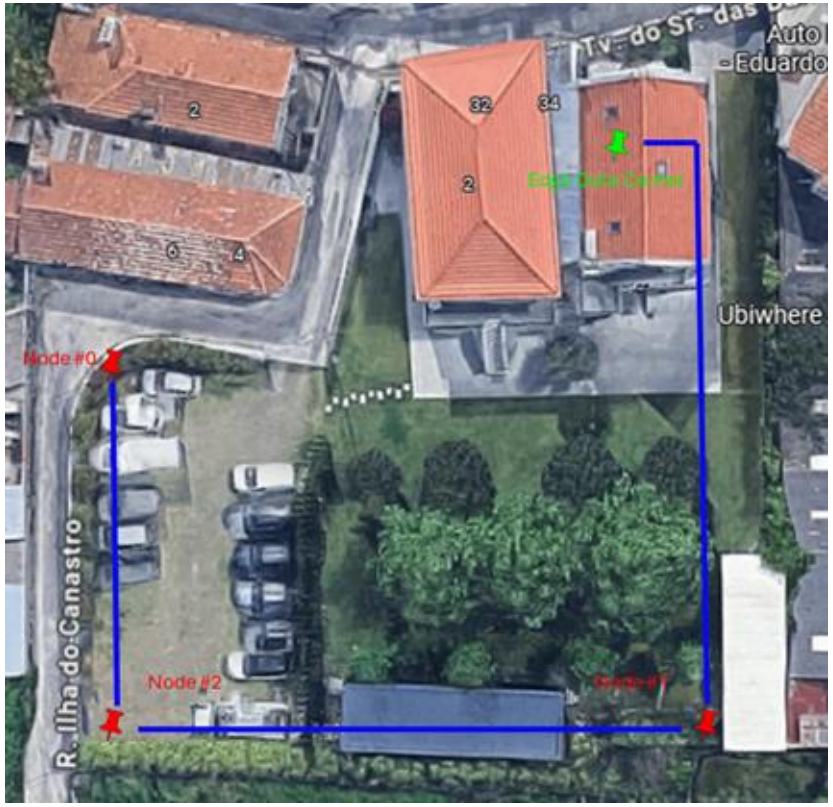
Intelligent Activation Mechanism

The system uses acoustic sensors as first-line detectors, triggering image processing only when necessary - dramatically reducing unnecessary CV activation.



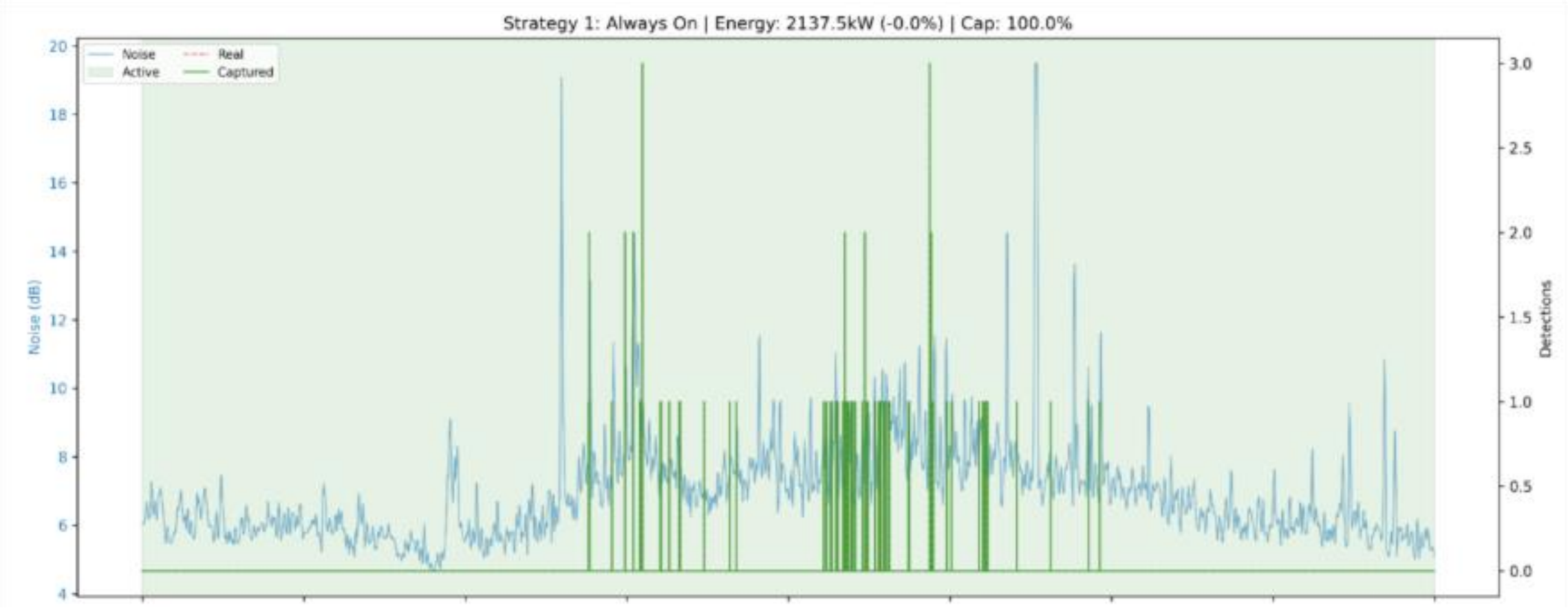
Testbeds

Cluster 1 – private testbed

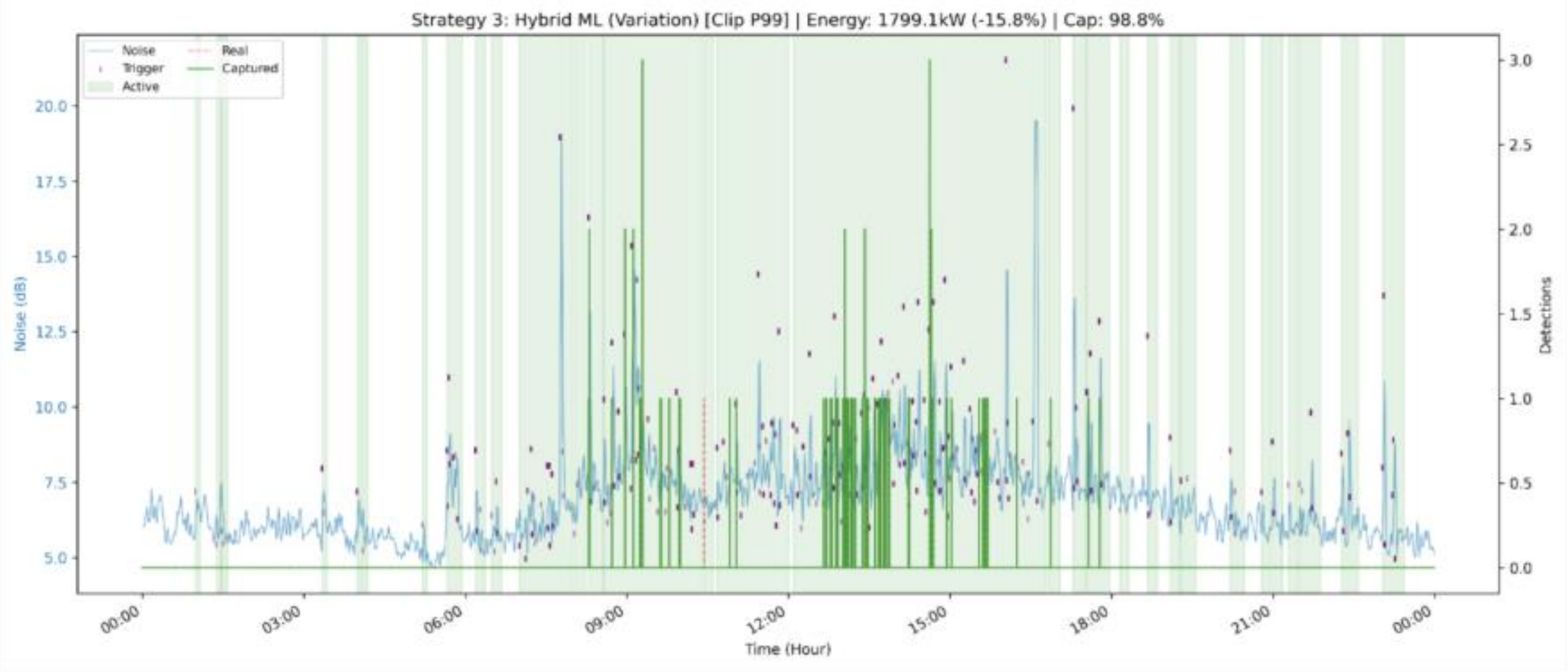


Cluster 2 – public testbed

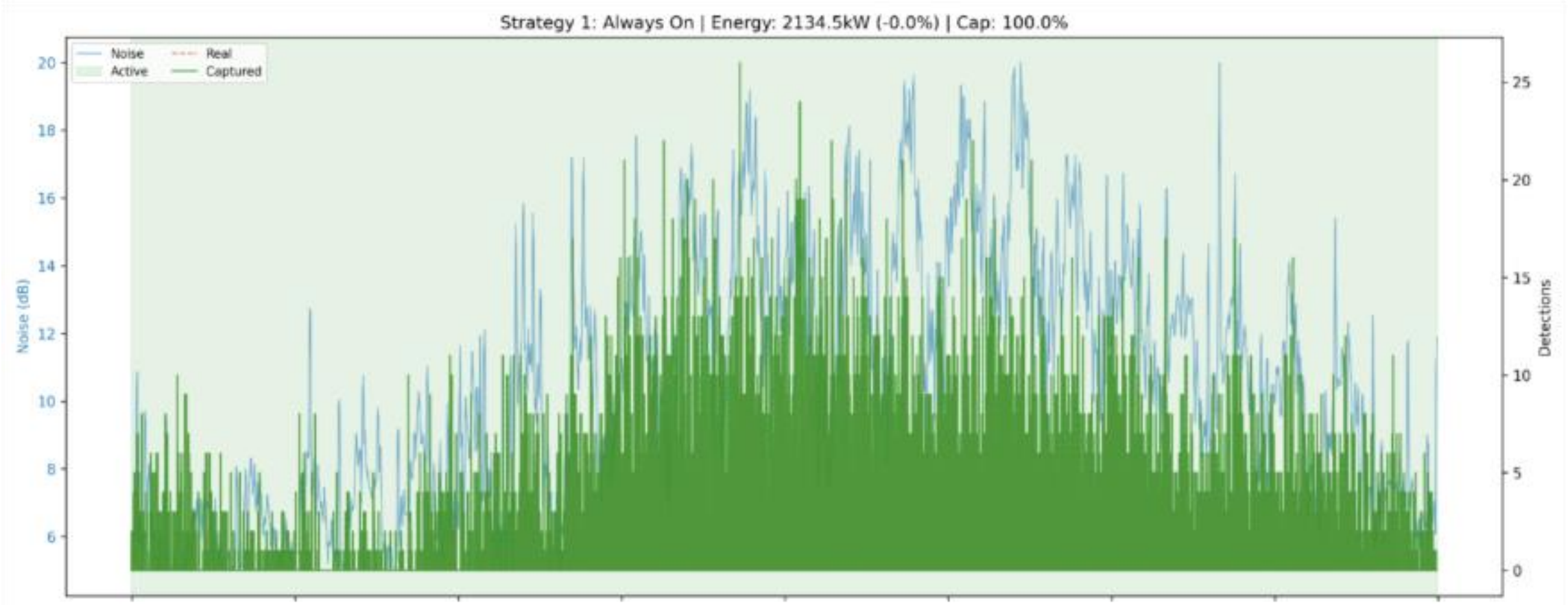
Results: Baseline Performance , private testbed



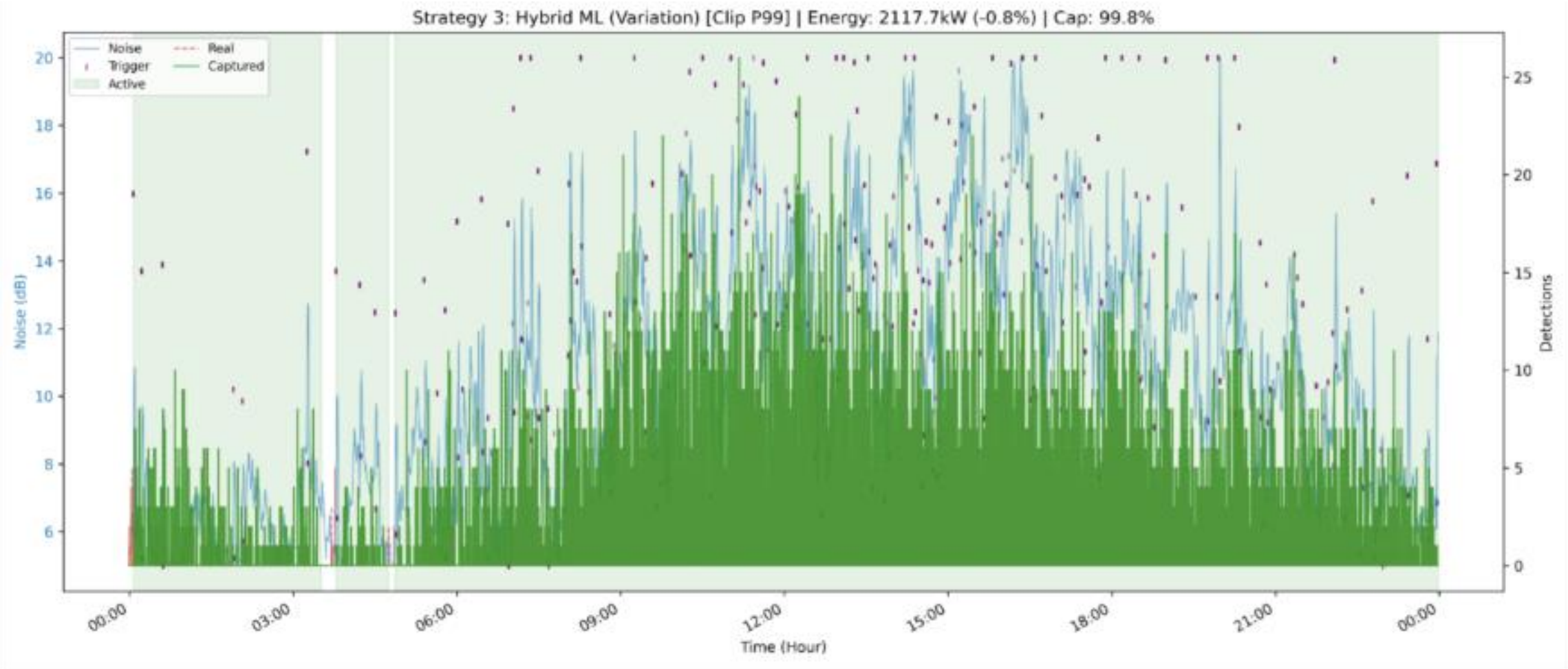
Results: ML-Based Performance , private testbed



Results: Baseline Performance , public testbed



Results: ML-Based Performance, public testbed



Summary

- MLSysOps validated end-to-end in Smart city application.
- ML-based CV engagement led to savings on the private testbed of up to 40% on , with average savings of around 20%.
- Results on public testbed led to less energy savings due to usage profile, but ML engagement ensured high capture rates.