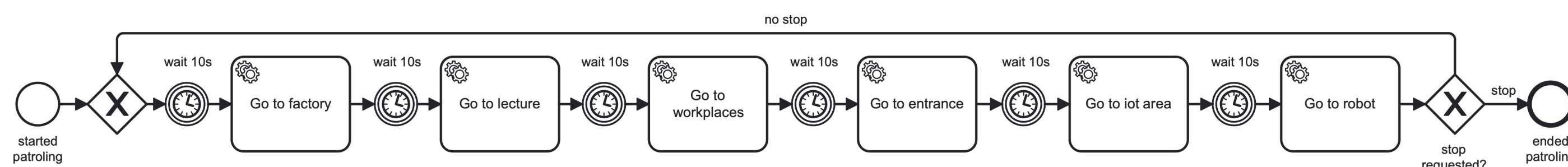


Autonomous Mobile Robots with Business Process Management Systems at the Edge

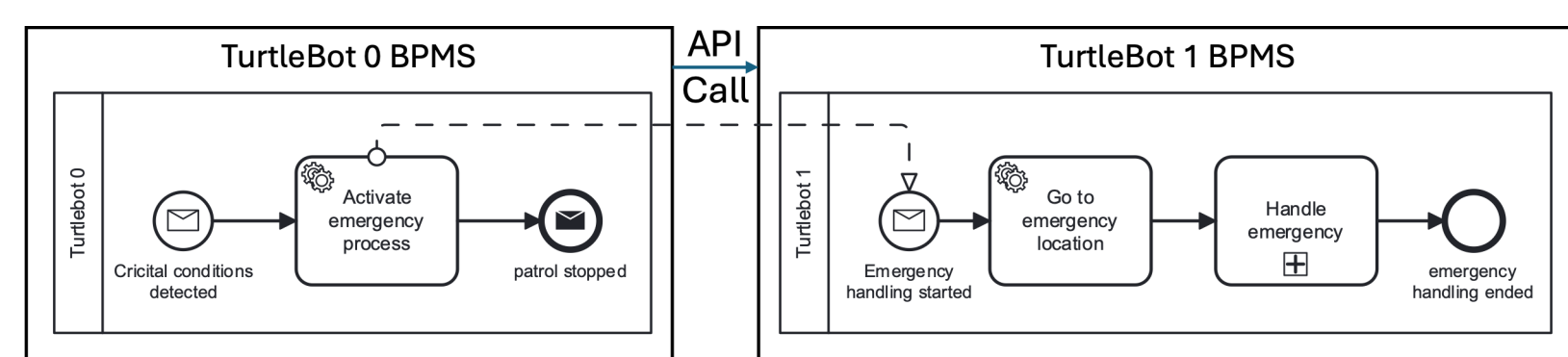


Experience Report: Using BPMS for orchestration and coordination of ROS2-based robots

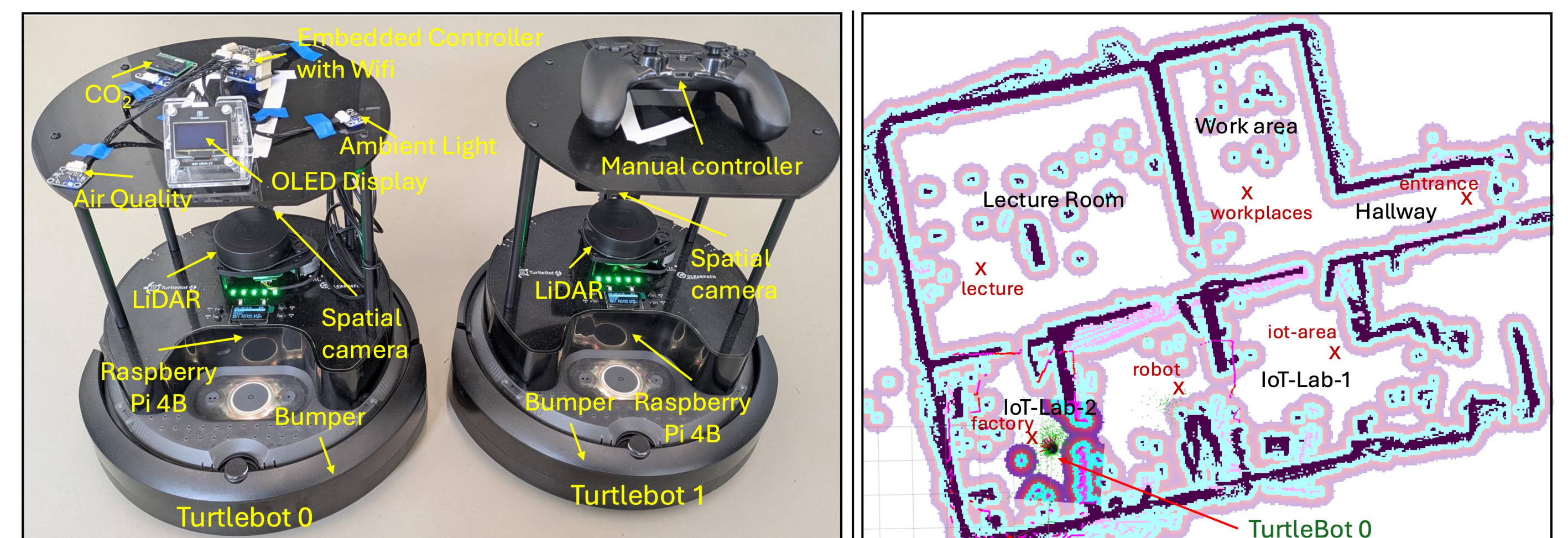
Process 1: Robot patrol



Process 2: Robot coordination

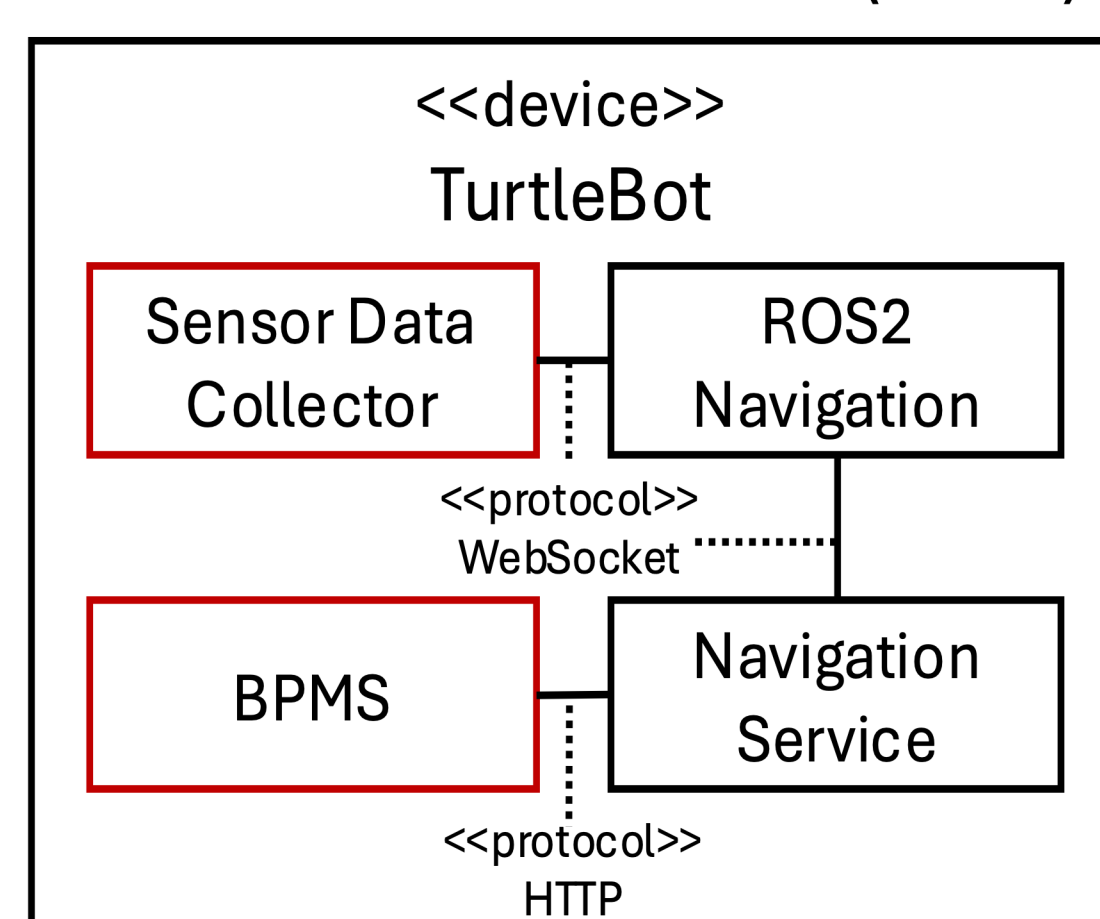


Autonomous mobile robots with computing, navigation, and external sensors



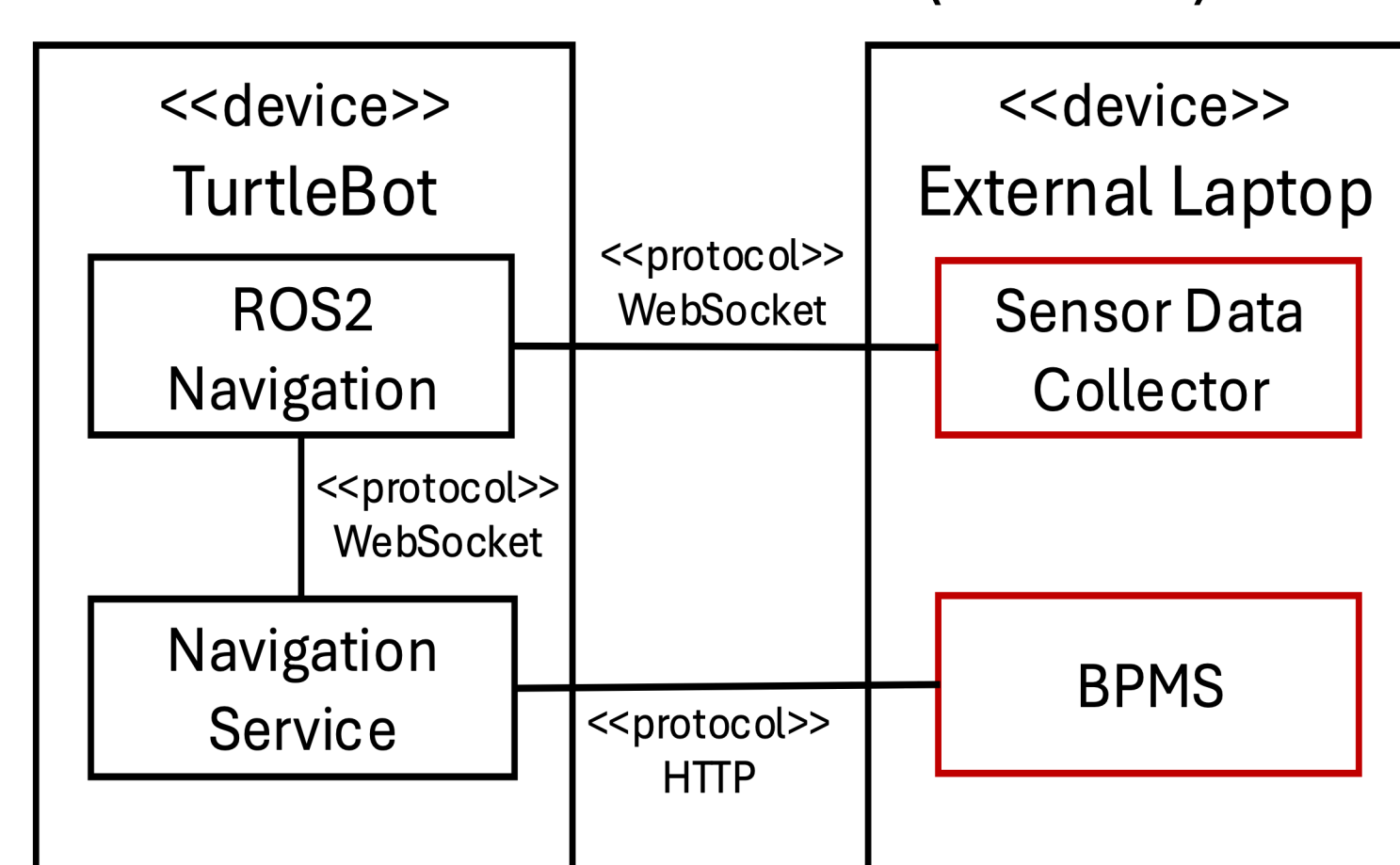
Goal: Comparison of BPMS architecture variants

Architecture Variant 1 (local)



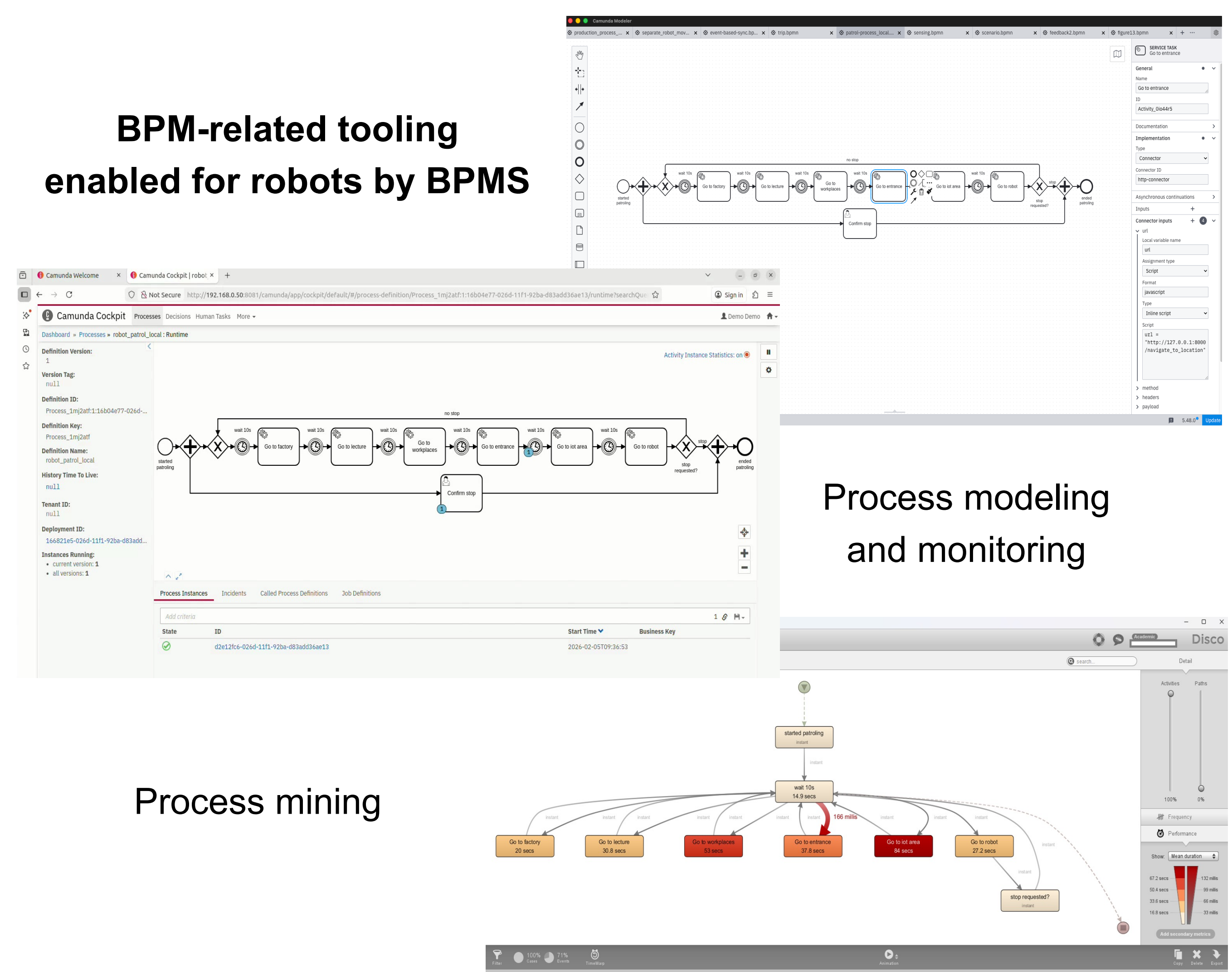
All components run on Raspberry Pi 4 (4 GB RAM, 1.5 GHz ARM v8 CPU, WiFi, Ubuntu 22.04, ROS2 Humble, battery)

Architecture Variant 2 (remote)



Components run on Raspberry Pi 4 and on external laptop (Intel Core i7, 1.8 GHz, 16 GB RAM, LAN, Ubuntu 22.04, ROS2 Humble, steady power supply)

BPM-related tooling
enabled for robots by BPMS



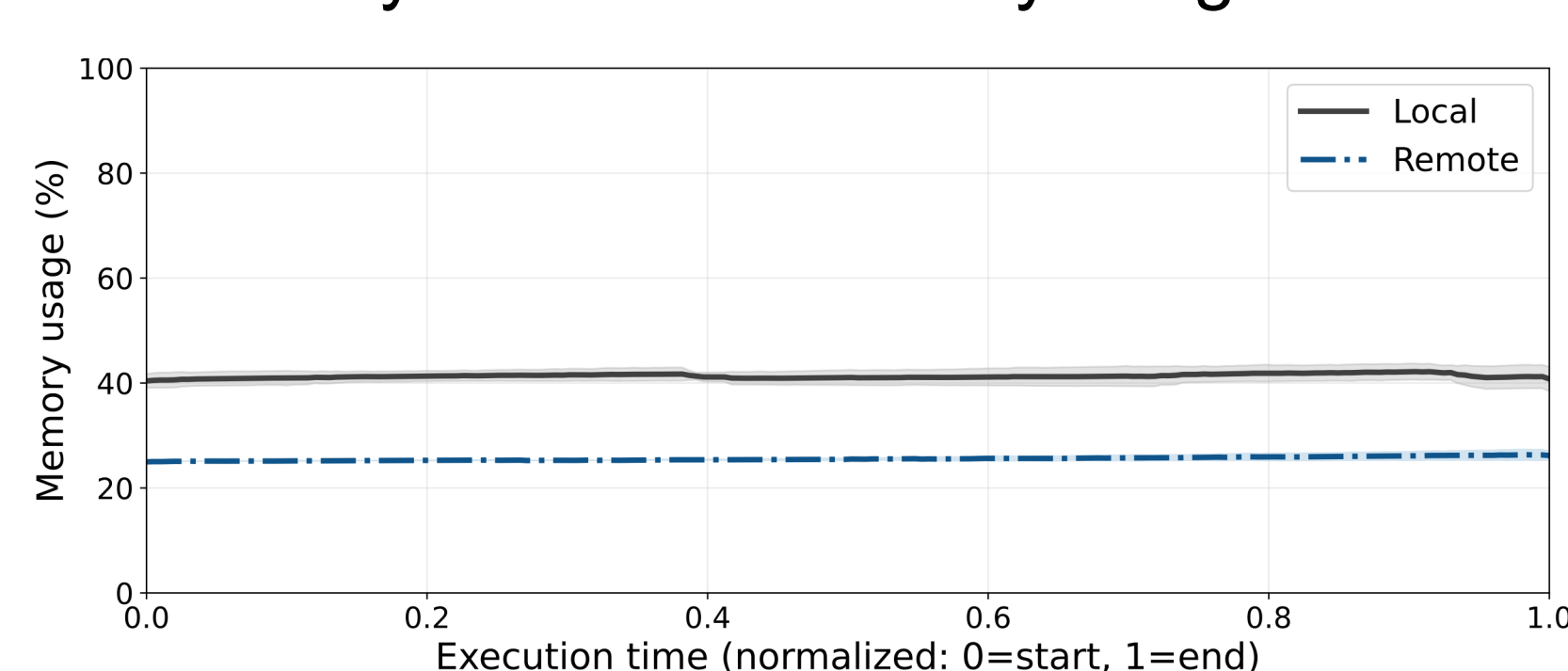
Process mining

Resource usage comparison: local vs remote

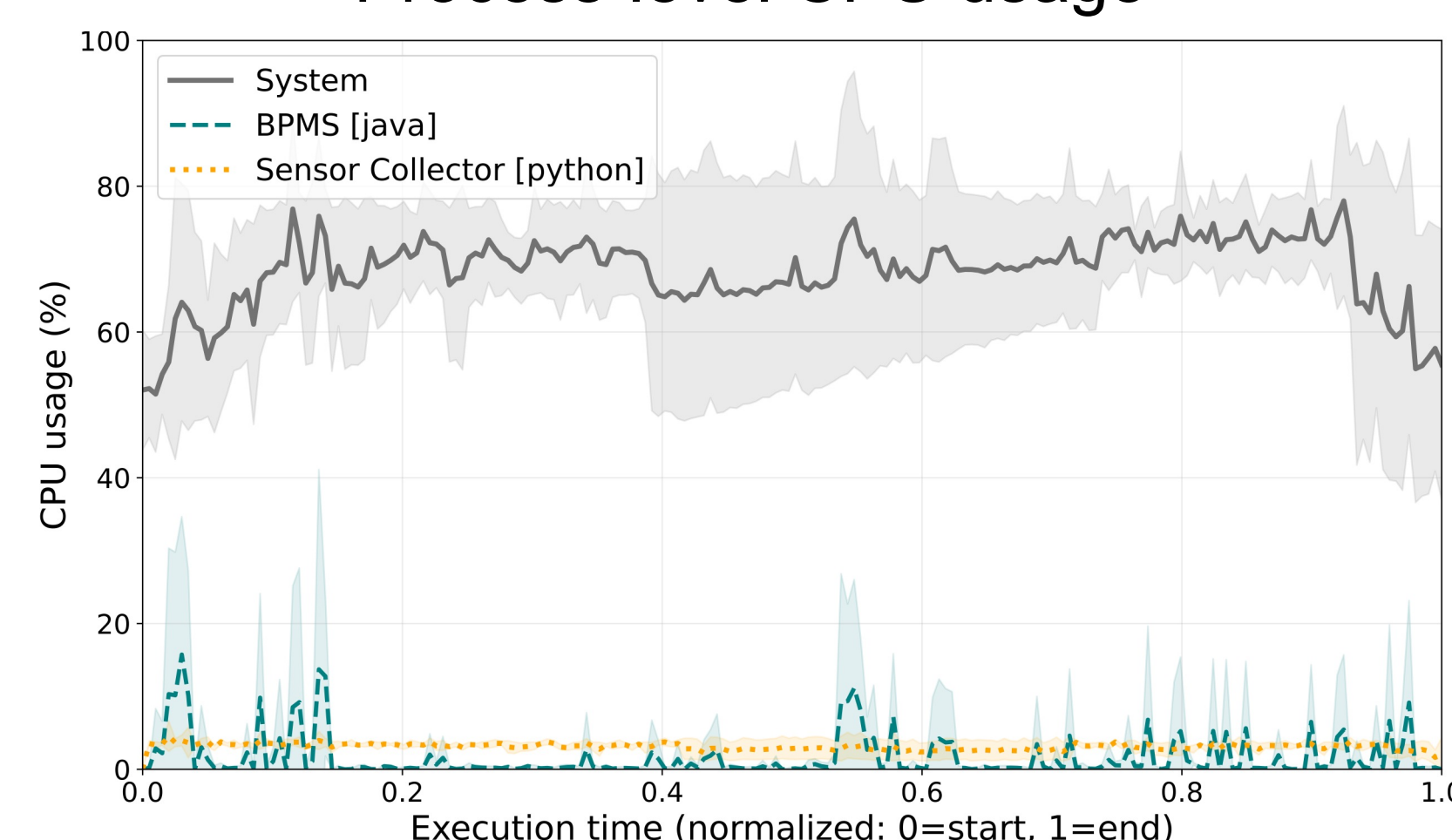
Table 1: Experiment overview by deployment variant (local vs remote) with total distances and runtimes, data volume, and event counts.

Variant	Runs	Runtime [h]	Rounds	Distance [m]	Nav events	Sensor log [MB]
local	5	0.90	18	422.55	261	8.04
remote	7	1.81	13	229.66	266	8.01
all	12	2.71	31	652.21	527	16.05

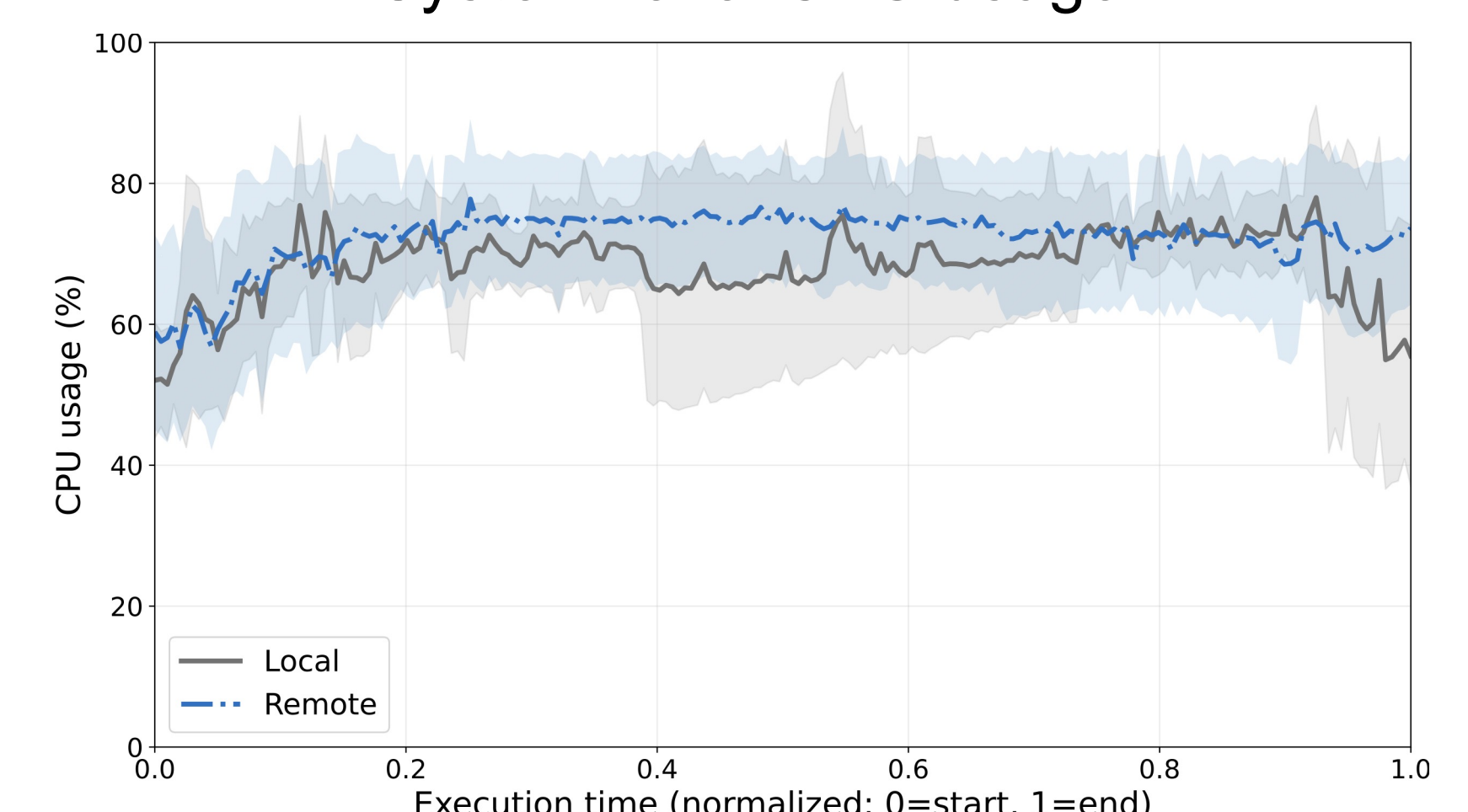
System-level memory usage



Process-level CPU usage



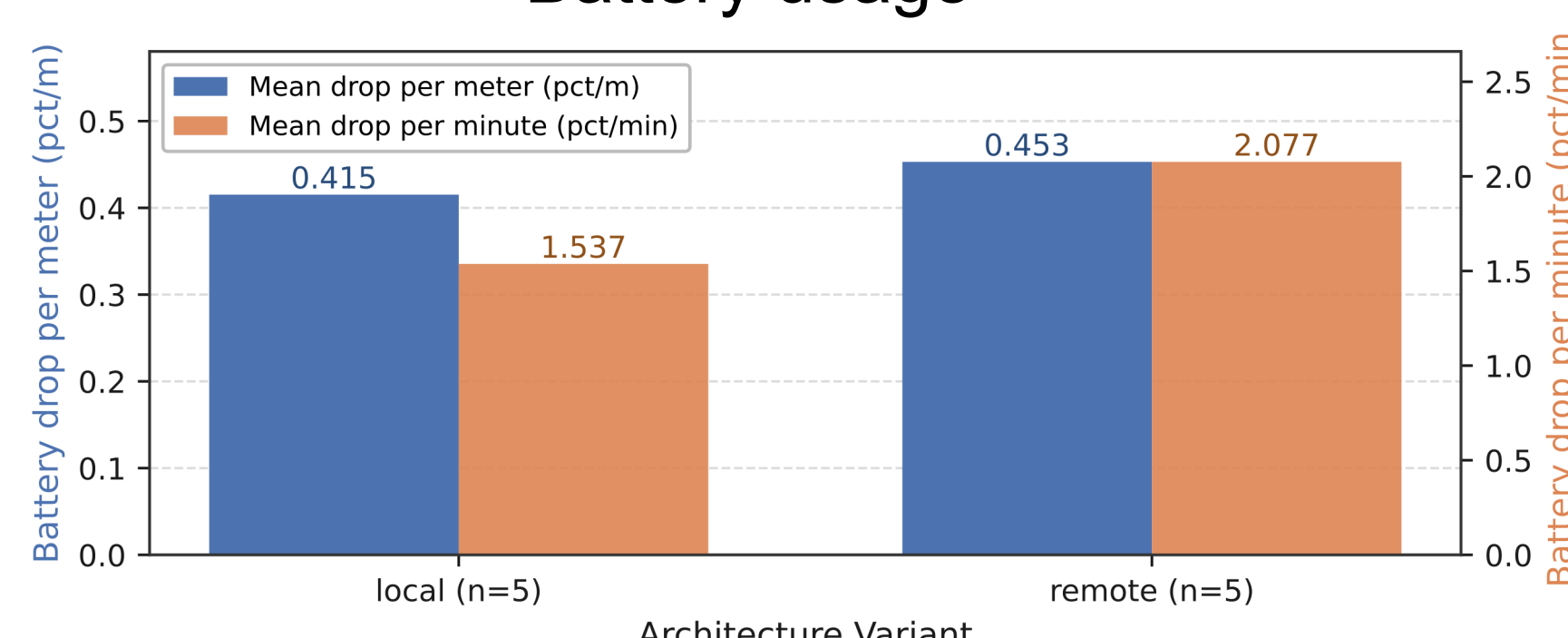
System-level CPU usage



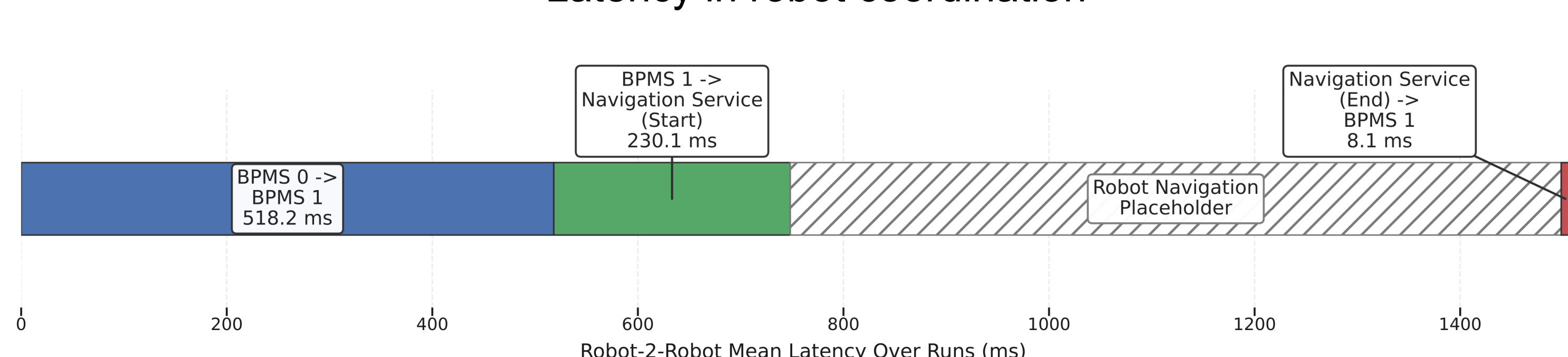
Observation. Edge deployment of the BPMS increases memory usage, but this remains stable and within available system capacity.

Observation. Deploying a BPMS at the edge introduces only marginal CPU overhead in a resource-constrained robotic environment.

Battery usage



Latency in robot coordination



Observation. Under the evaluated workload, local BPMS deployment results in lower battery consumption compared with a remote client-server setup.

Observation. When configured correctly, running the BPMS and calling services locally outperforms remote BPMS and service calls in terms of latency.



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