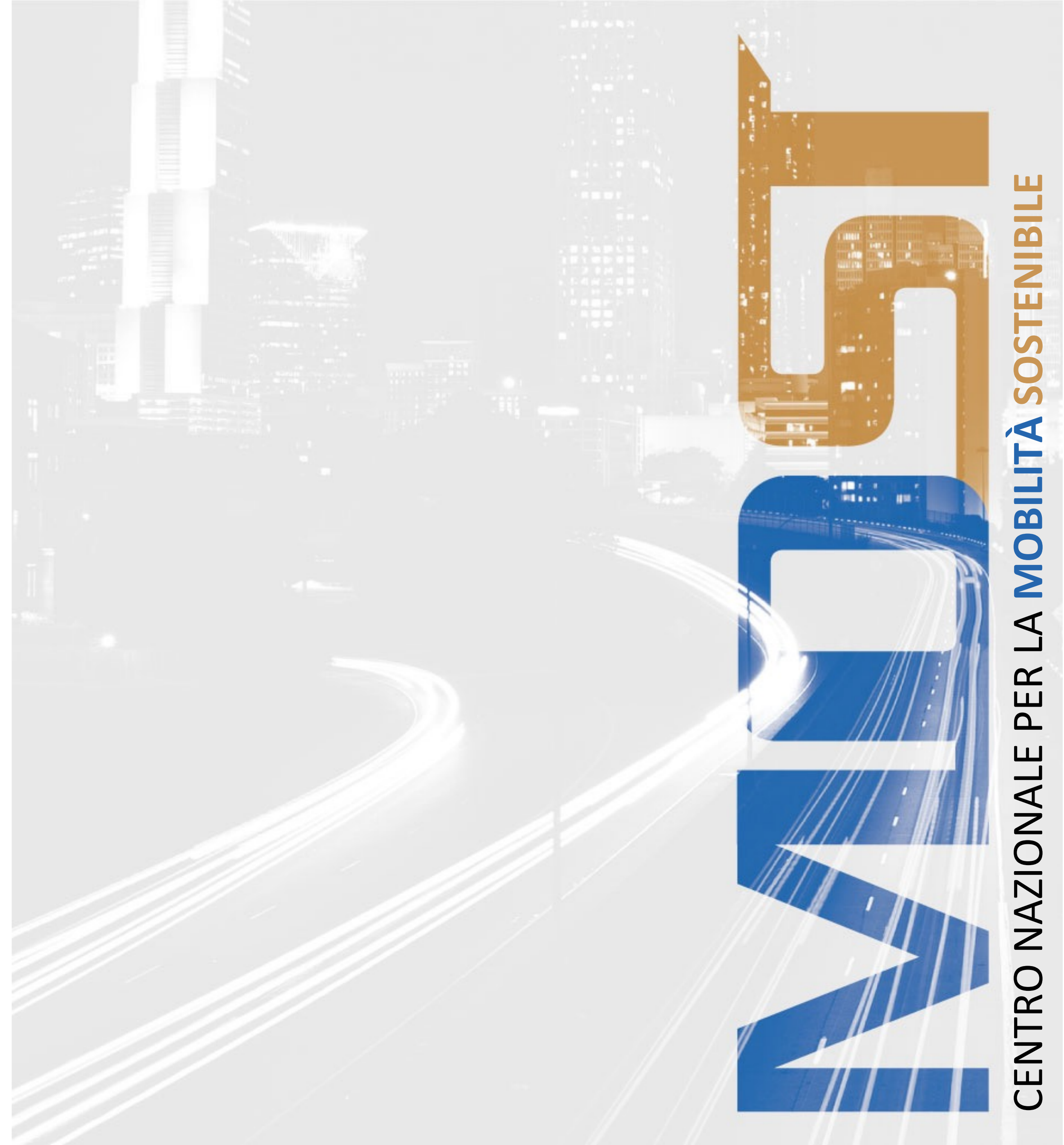


MOST & MASA

13th November 2023

Ongoing activities



MOST: MObilità SosTenibile (sustainable mobility)

Spoke 6 has the overarching objective of creating an ecosystem of research labs and test facilities to foster the deployment and adoption of **Connected and Autonomous Vehicle (CAV)** technologies in 5 domains (i.e. *Urban, Racing/performance, Off-road, Water, Air*)

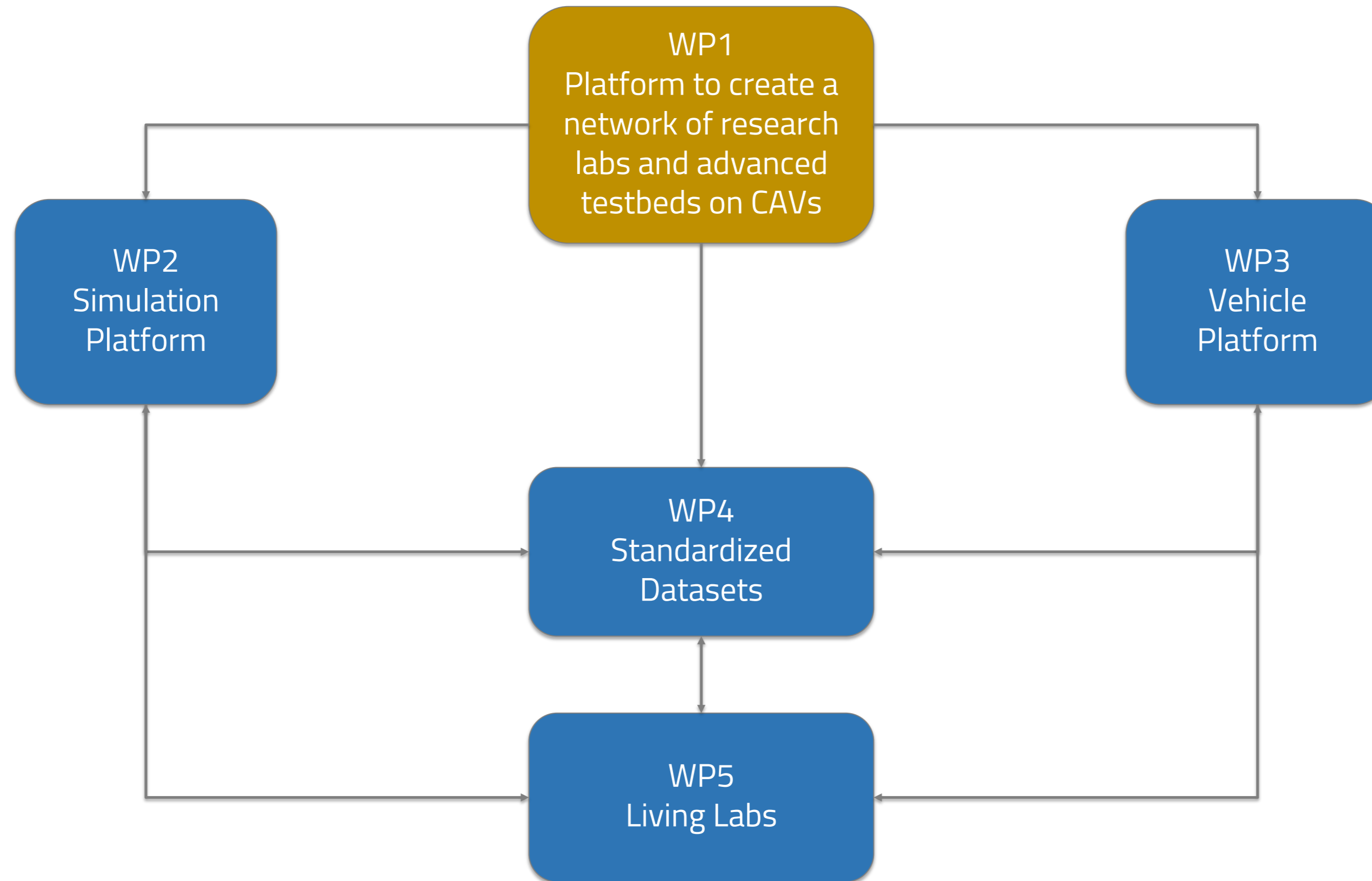
Budget: 19 M€

Period: Q4 2022 – Q3 2025

- 7 Universities
- 11 key industrial players



Work Packages



DOMAINS

URBAN





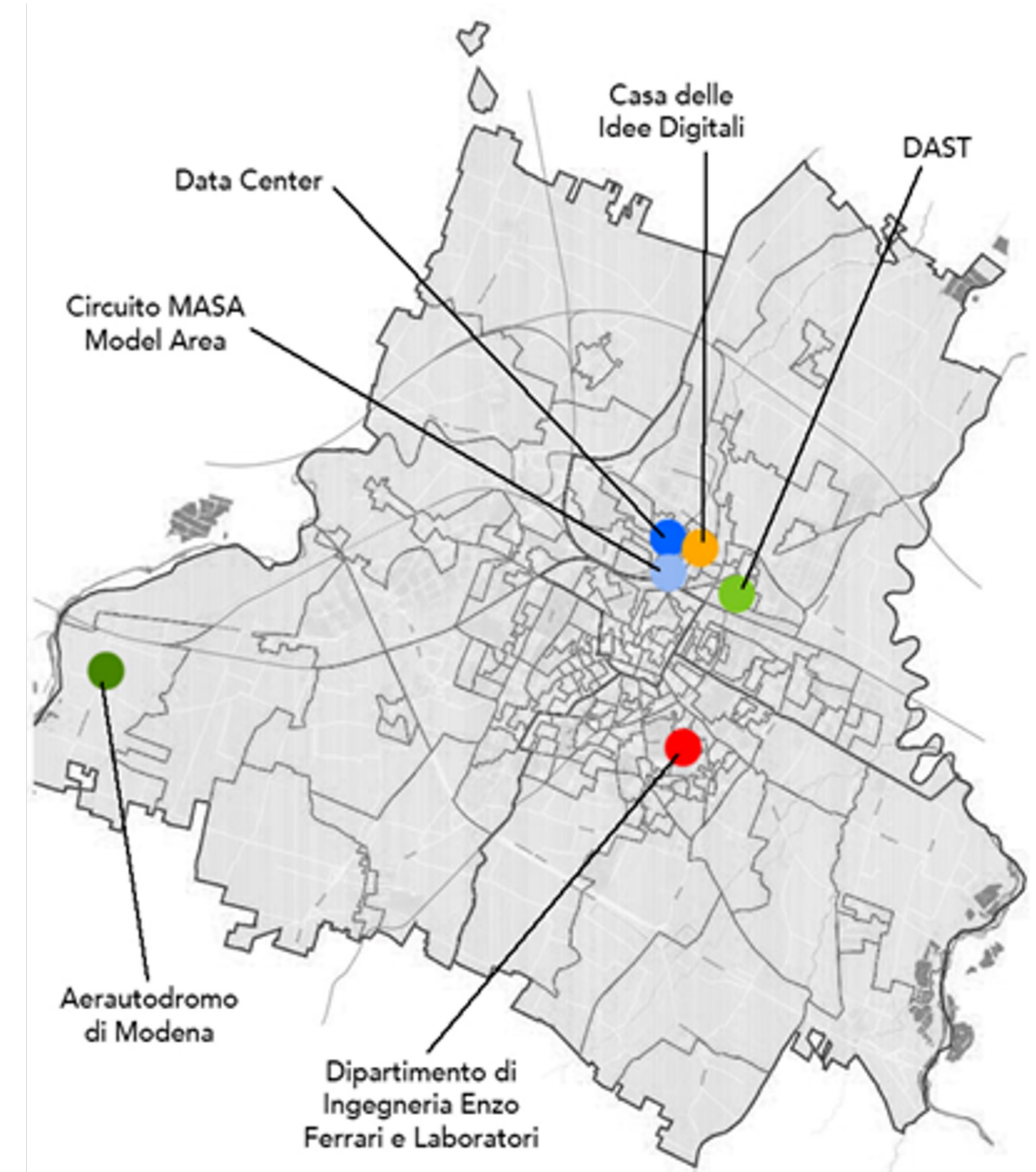
RACING AND PERFORMANCE

LIVING LABS

Living Labs

1) Modena Automotive Smart Area (MASA), 4sq km urban area, wide variety of challenging scenarios to create an urban Living Lab for Connected Autonomous Vehicles (CAVs) testing and collection of datasets in real urban multi-vehicle environment in the city center of Modena.

2) Marzaglia (Modena) racetrack, a 15 sq Km area with a 2 km-long circuit, to be enhanced with technological equipment and V2X infrastructures for Euro NCAP as well as vehicle homologation and performance testing.



Living Lab Plan - MASA

Installation Plan

- Road Side Units (RSUs) for connectivity extension
- Smart cameras for detection, positioning and tracking

Blue line:

- ~30 RSUs and smart cameras
- timing: Q4 2023

Pink line:

- ~15/20 RSUs
- timing: Q1 2024

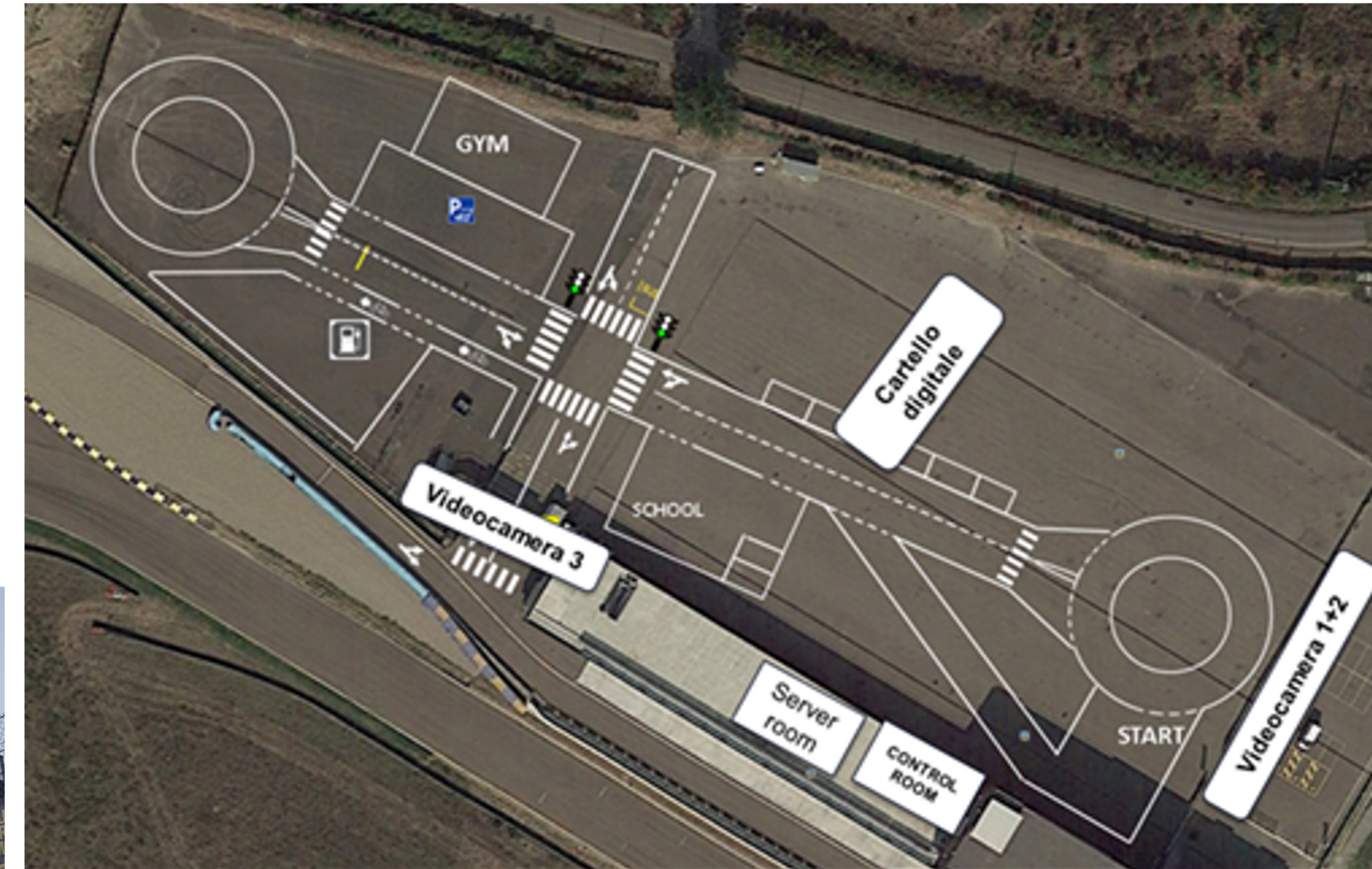


- Connectivity: V2X, DSRC, dedicated low-latency 5G-MEC
- Installation of RSUs and smart cameras to implement challenging urban scenarios, e.g. urban canyon and remote driving
- Collaboration with Modena Municipality to fasten and optimize the installation

Living Lab Plan – Marzaglia Racetrack

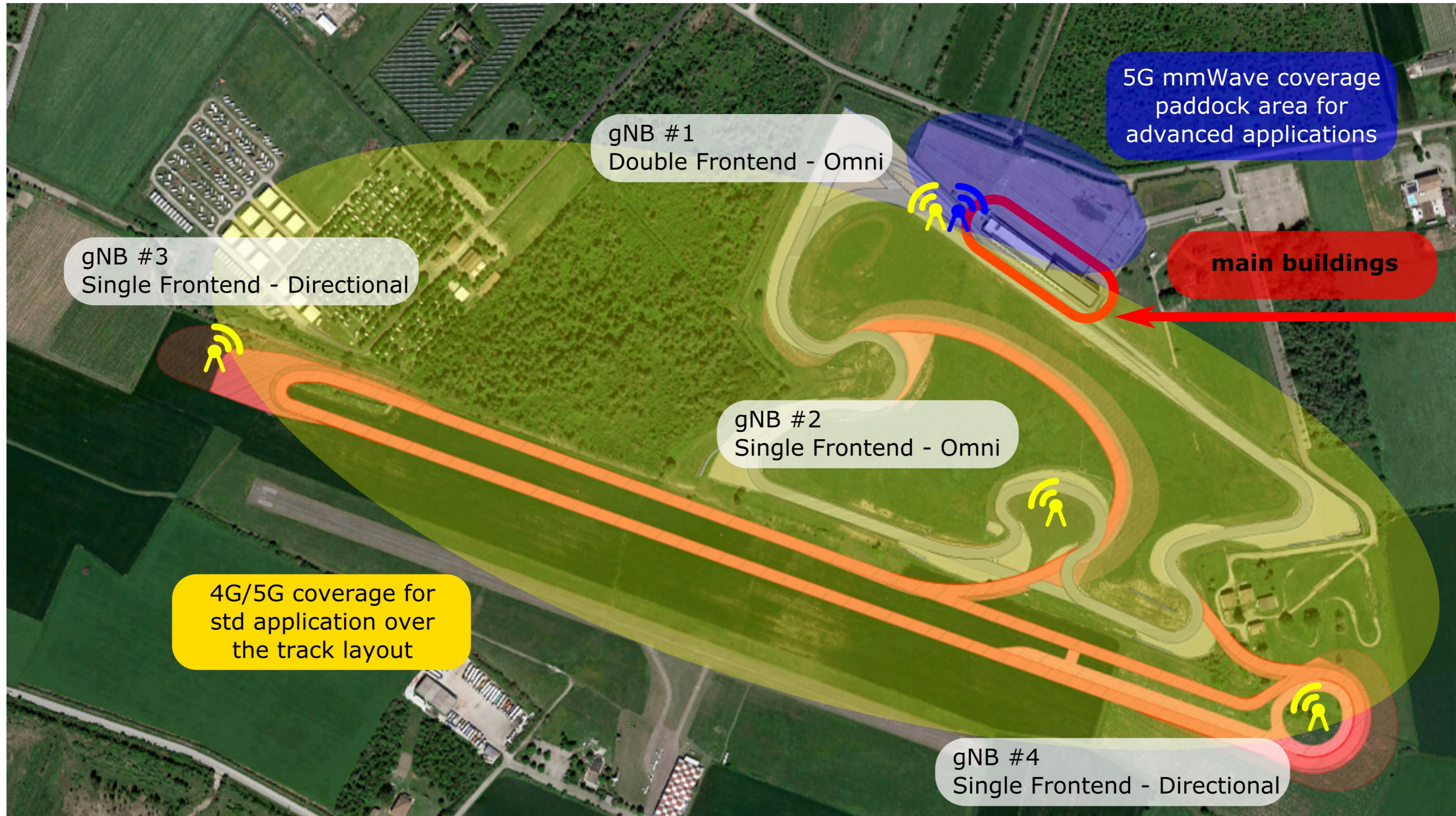
Installation Plan

- ~10 Road Side Units (RSUs)
- ~10 Smart cameras for detection, positioning and tracking
- timing: Q3 2024
- Connectivity: V2X, DSRC, private 5G

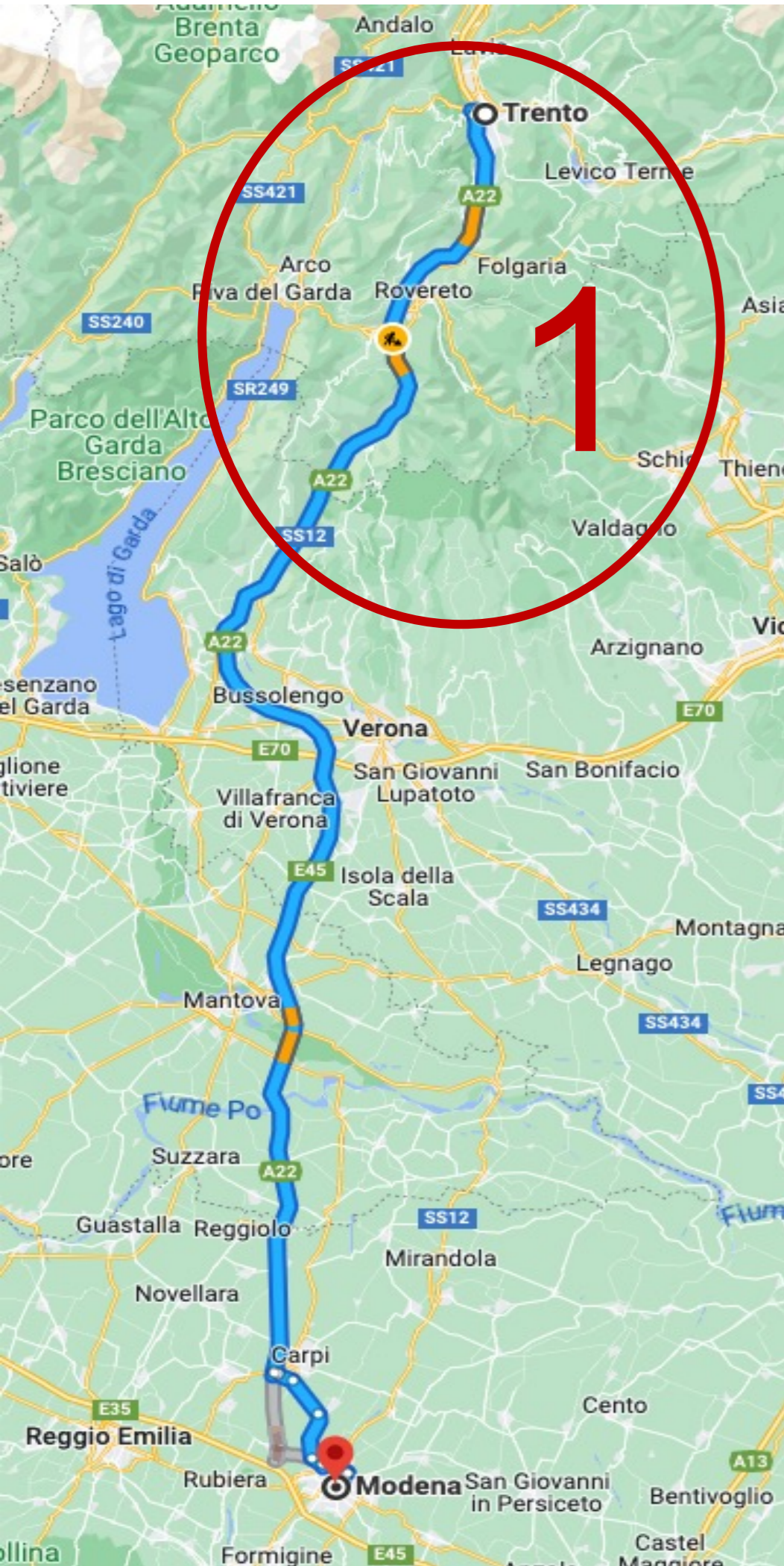


- 90-seat conference room
- 30.000 sq m replica of urban setting
- Roundabouts, cross sections, traffic lights, cycling lane, zebra crossing
- Traffic signs & variable road signals
- Open air testing dedicated parking

Living Lab Plan – Marzaglia Racetrack



Living Lab Plan – Autostrada del Brennero



Ongoing dialogue with A22 Autostrada del Brennero (Brennerautobahn) for 2 additional installations:

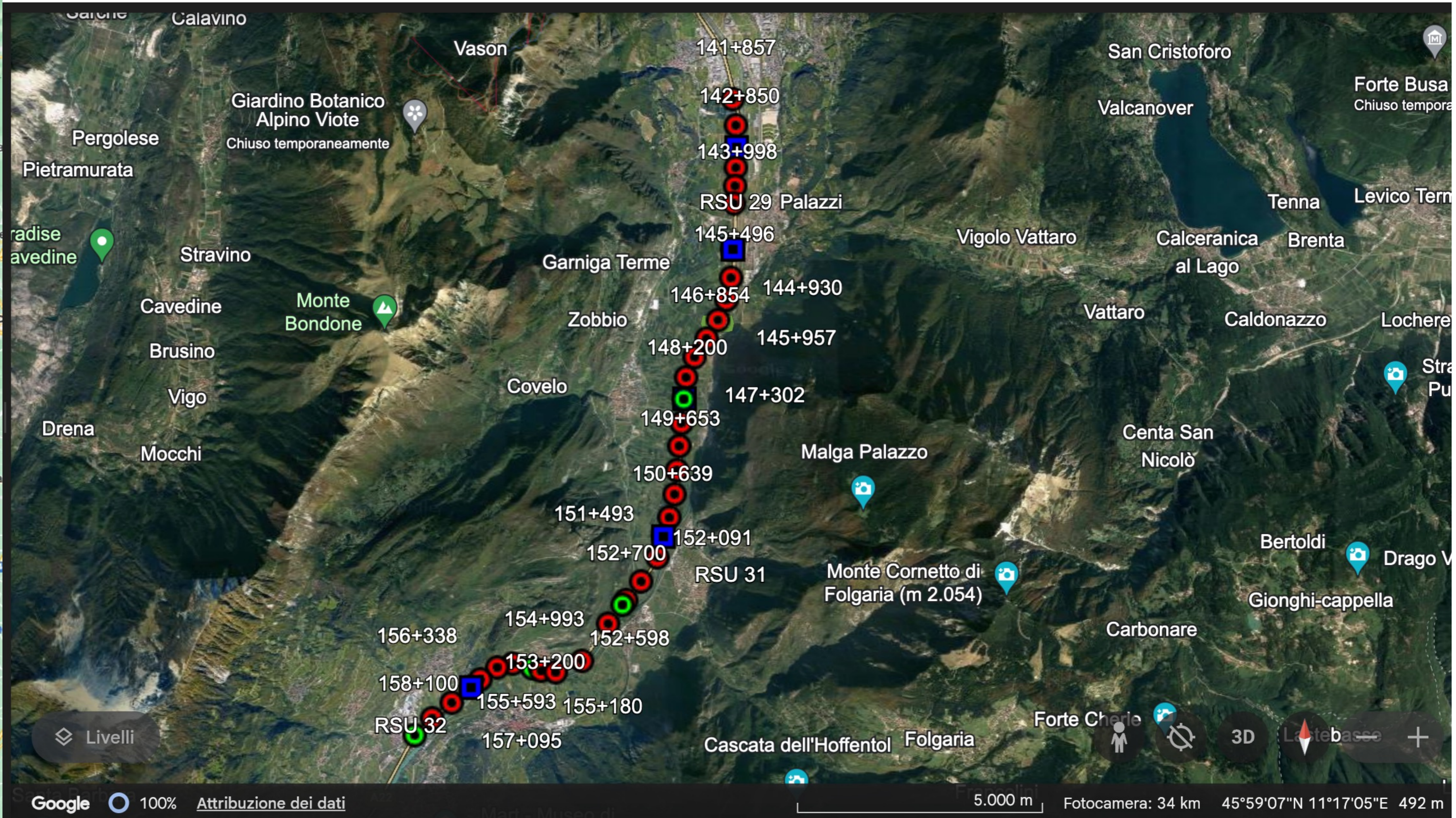
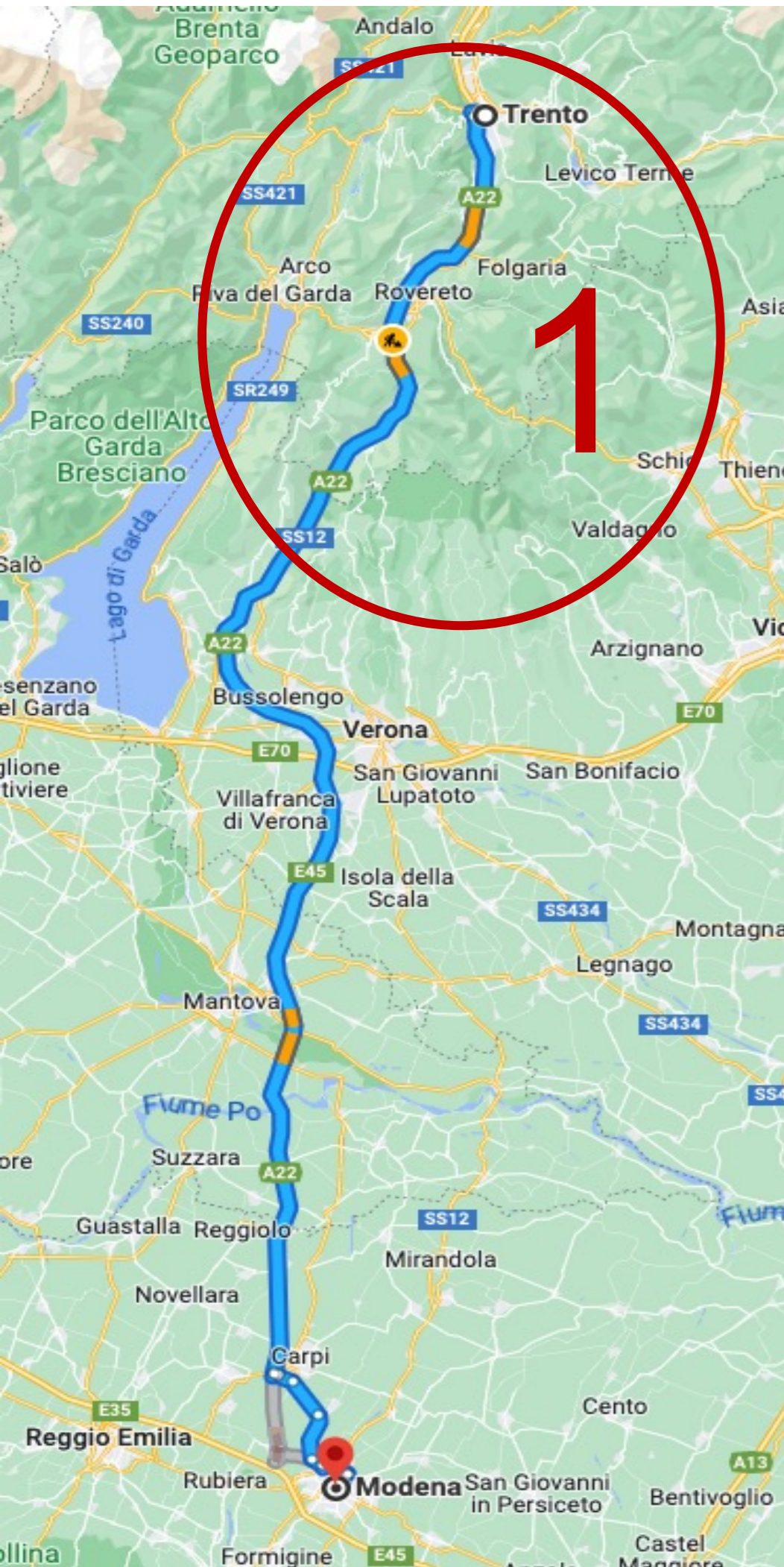
- 1) one densely infrastructured in the Trento area
- 2) one less densely infrastructured in the Campogalliano area

Installation Plan

- ~10 Road Side Units (RSUs)
- ~10 Smart cameras for detection, positioning and tracking
- timing: Q4 2024
- Connectivity: V2X, DSRC



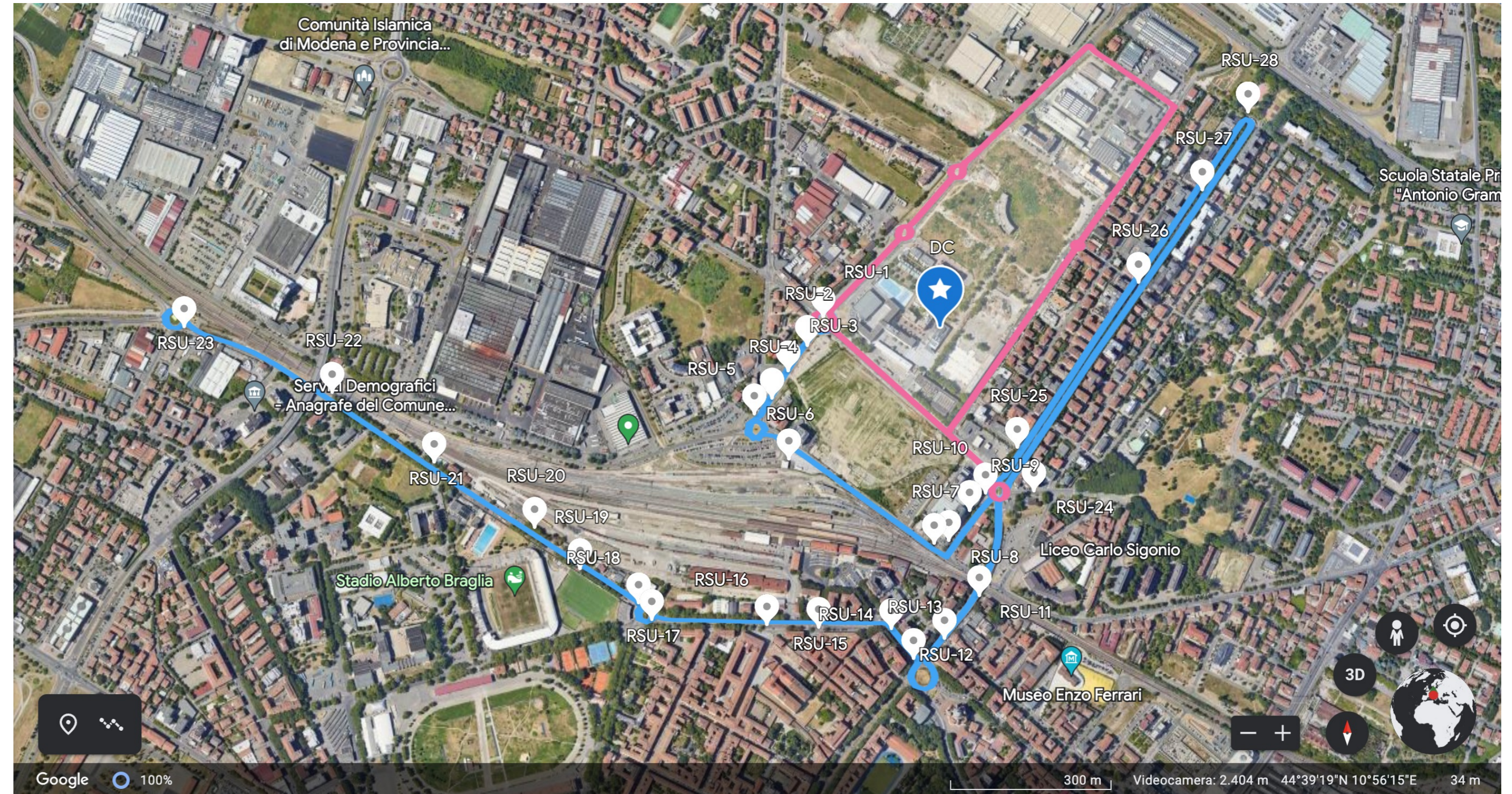
Living Lab Plan – Autostrada del Brennero



MASA preliminary Testing:

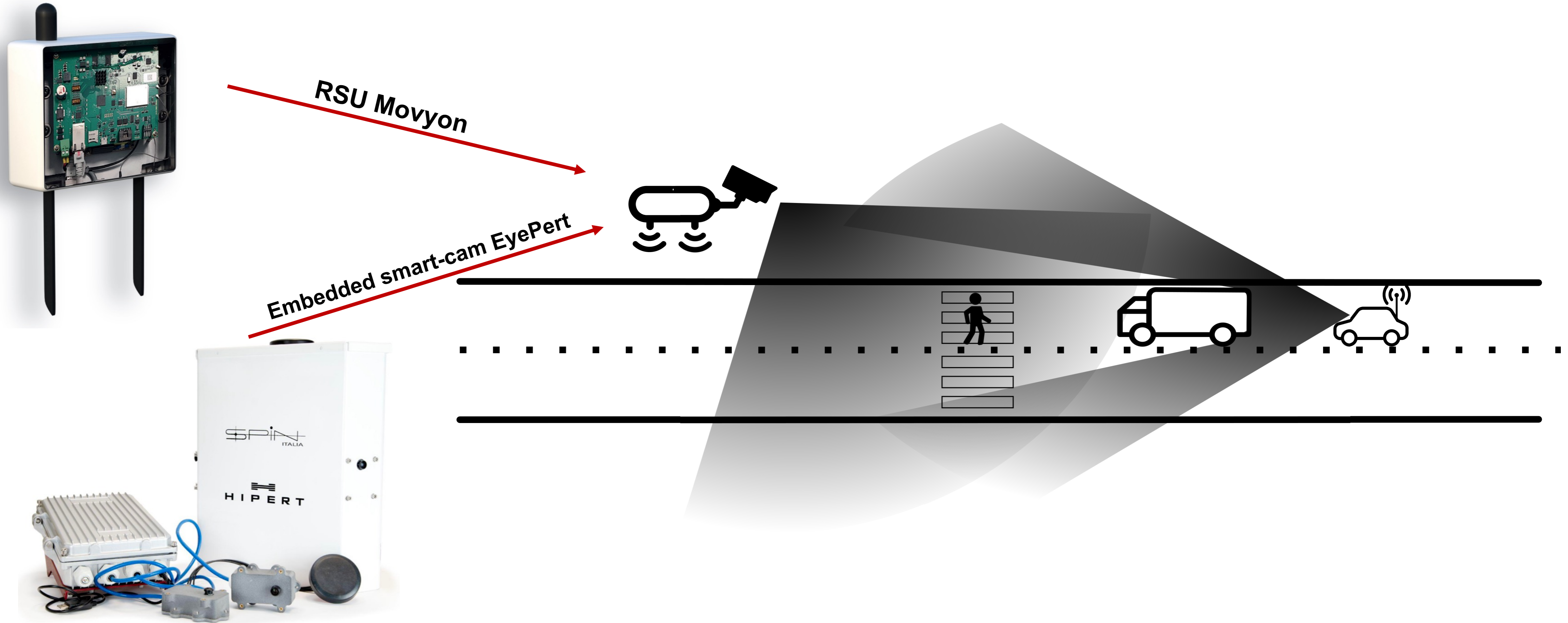
Network performance stress
test in dedicated spots

3 spots tested in August '23

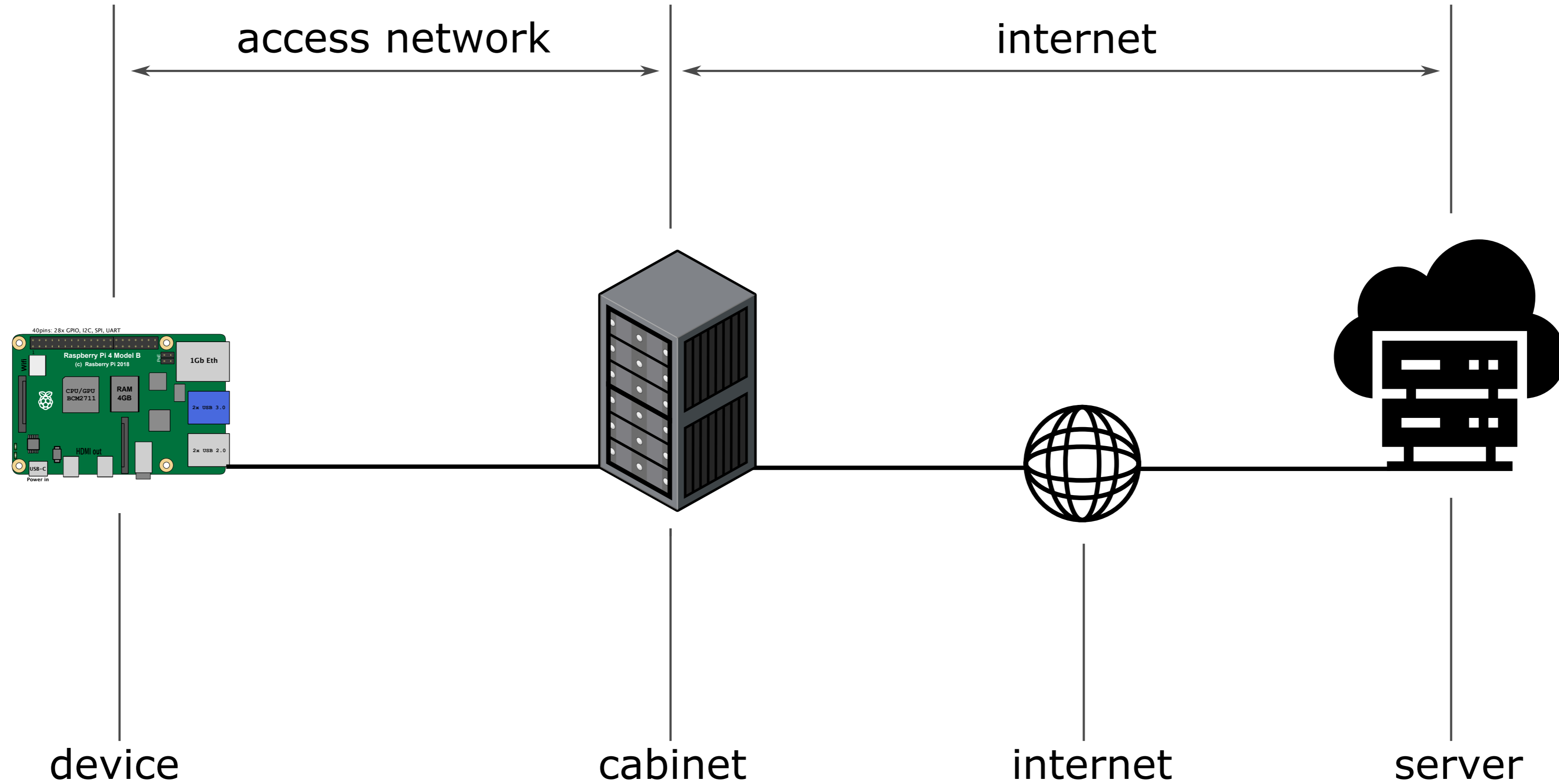




MASA possible testing scenario



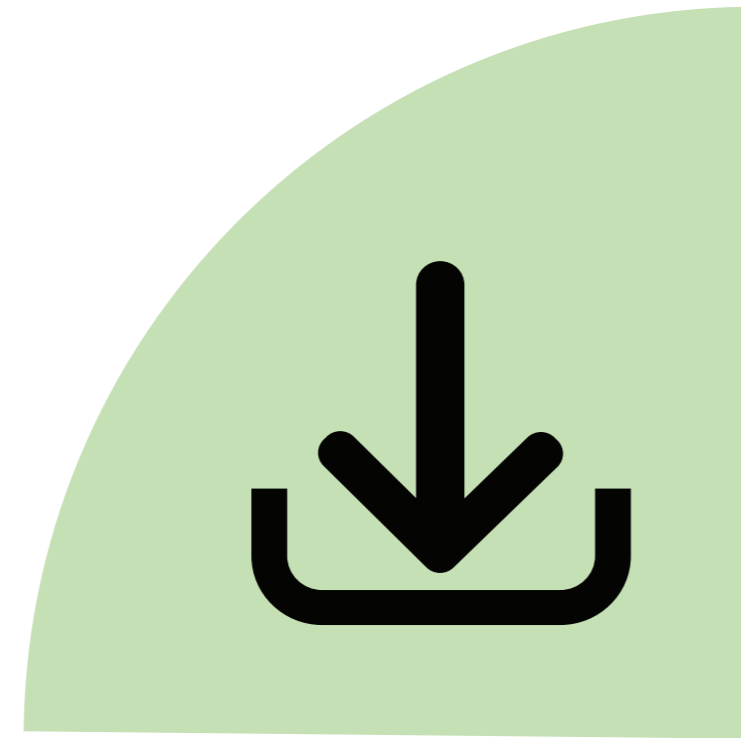
MASA topology under test



A suite of 4 networking test with Flent [1]

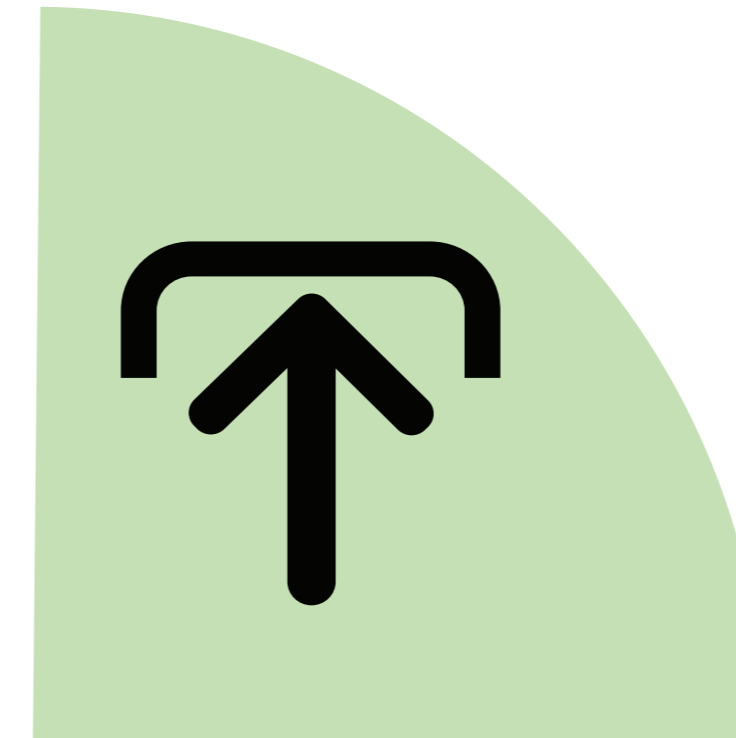
Bulk Download

1 TCP Download
1 ICMP in parallel
PING RTT
only TCP BW (no TCP RTT)
AQM check (PING over time)



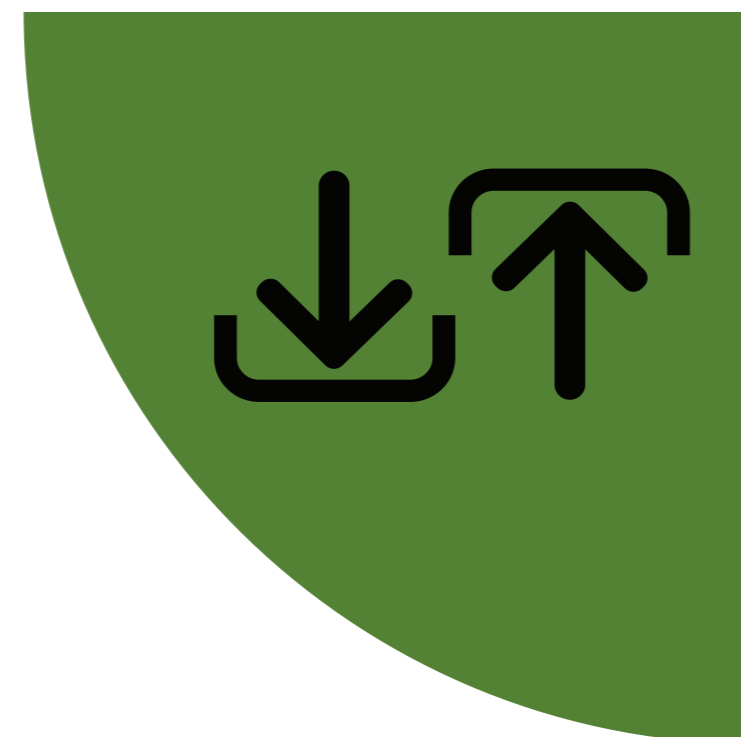
Bulk Upload

1 TCP Upload
1 ICMP in parallel
PING RTT
TCP RTT&BW
AQM check + pFIFO



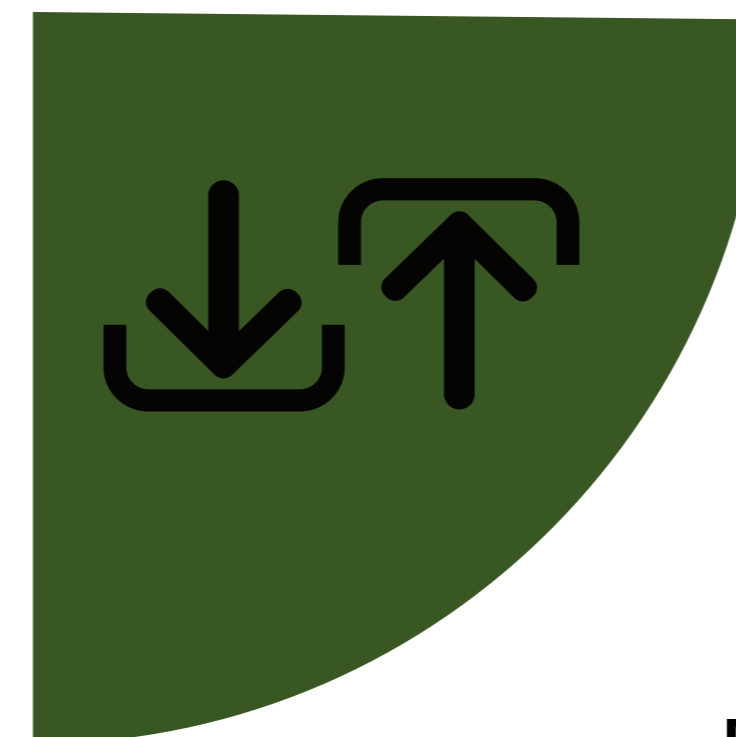
RRUL Best Effort

4 TCP/UDP Up/Down
1 ICMP in parallel
PING RTT
TCP RTT&BW per-flow
Packet Scheduling check

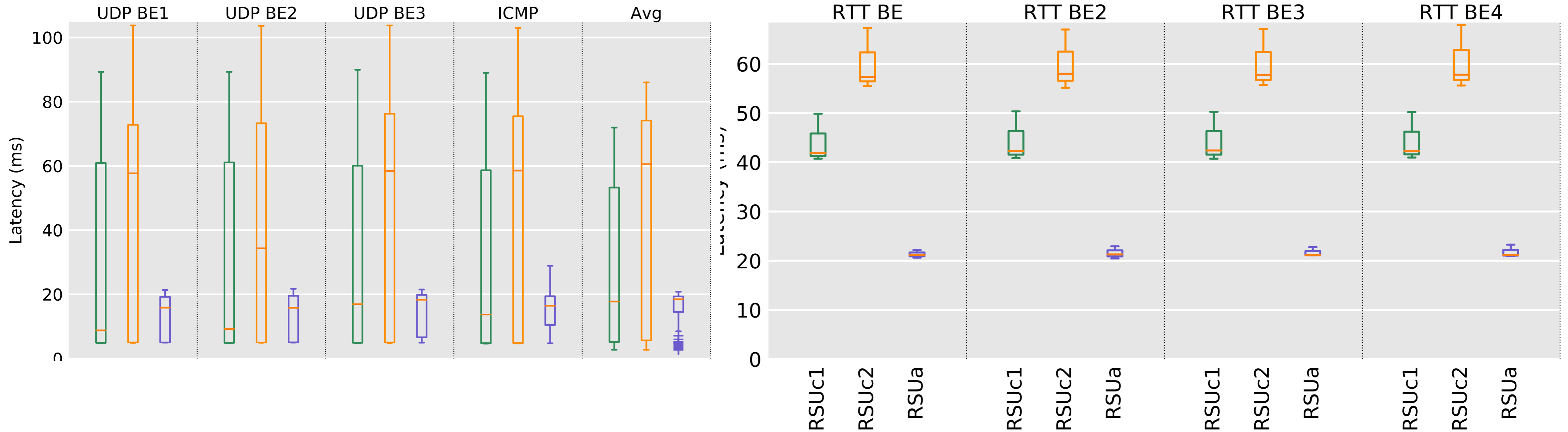


RRUL QoS

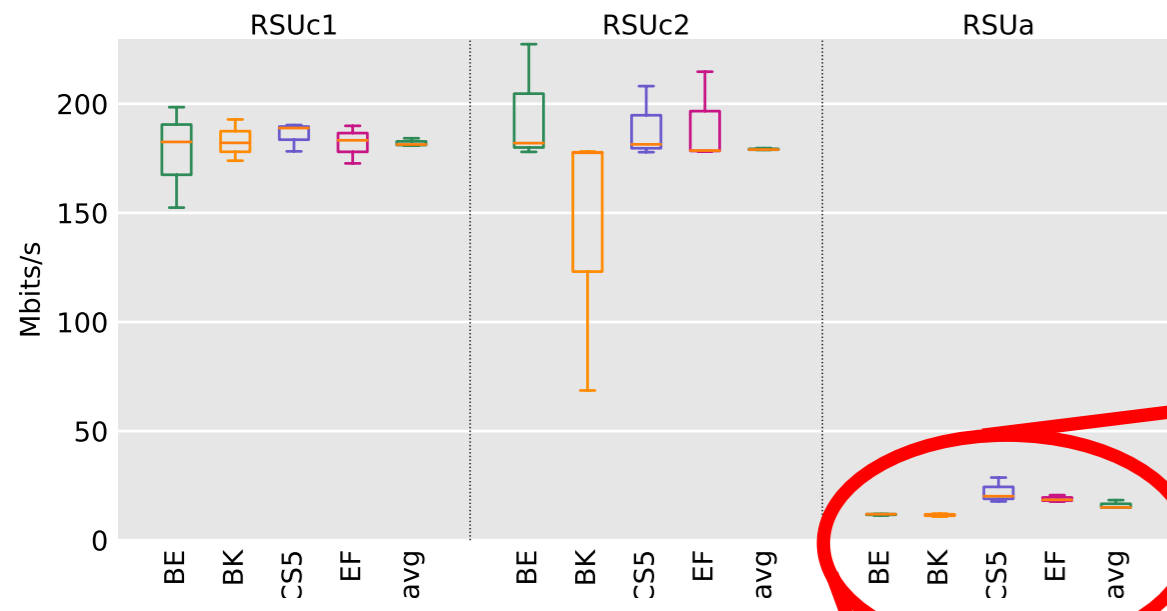
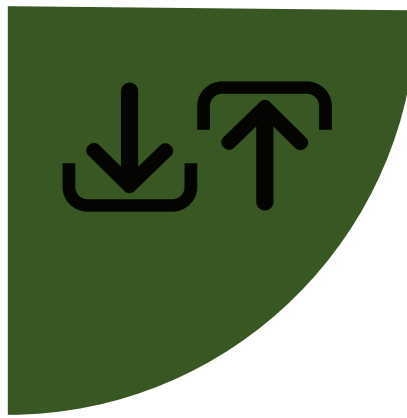
4 TCP/UDP Up/Down marked
1 ICMP in parallel
PING RTT
TCP RTT&BW per-flow
Packet Scheduling + QoS check



Results (RRUL Best Effort)

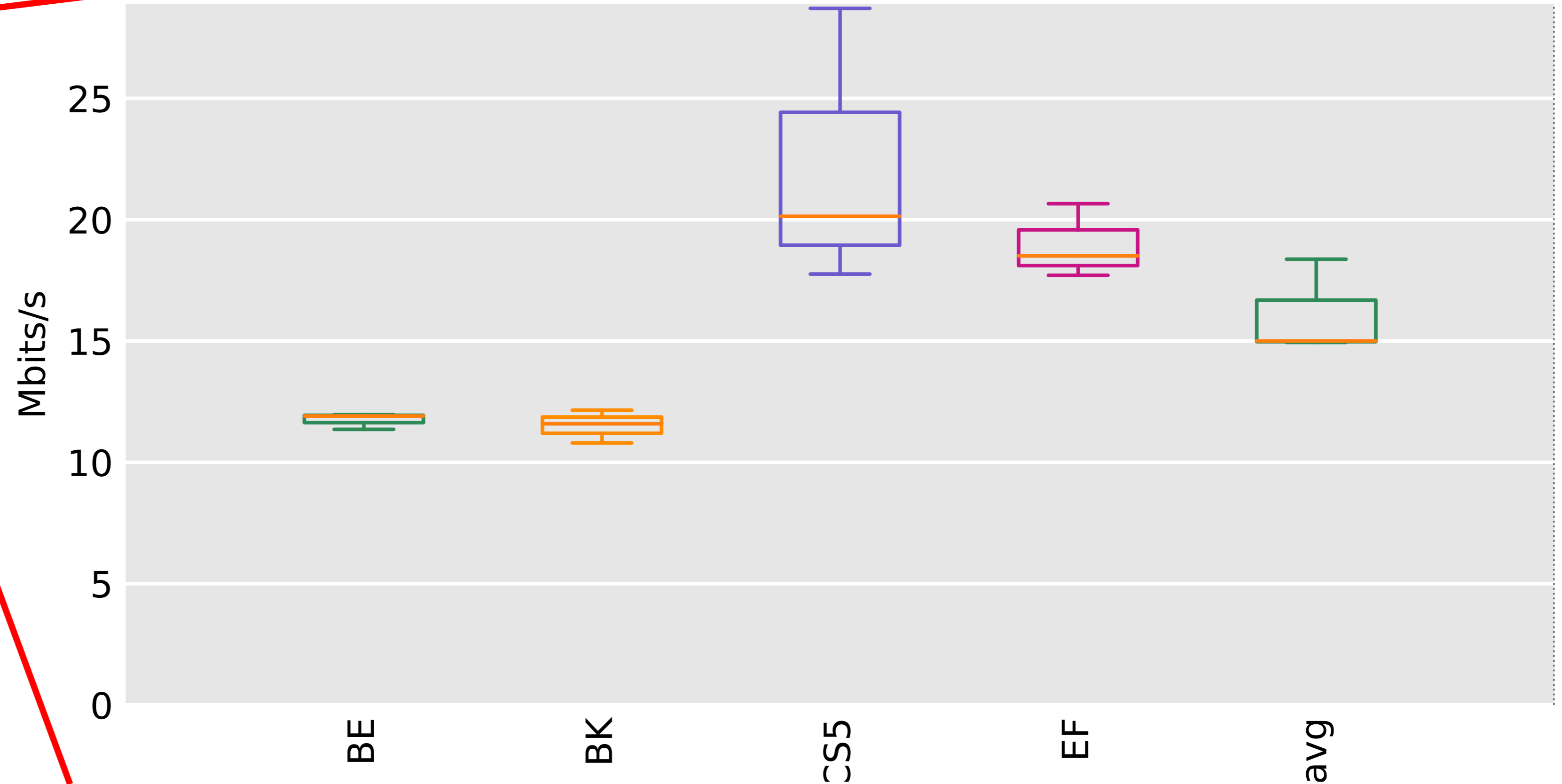


- RSUc2 does not schedule: UDP BE2 35ms vs the others at 60ms (as the TCP RTT)
- RSUc1 does schedule instead: UDP/ICMP latency avg is 20ms while TCP RTT is 40ms
- RSUa clearly schedules



Zoom-in on Acantho results

This is a QoS scheduling



MOST

CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

Via Durando, 39

20158 - Milano (MI)

e-mail: segreteria@centronazionalemost.it



CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE