

Next Generation Multimodal Network Management Services Space

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Federal Department of Economic Affairs,
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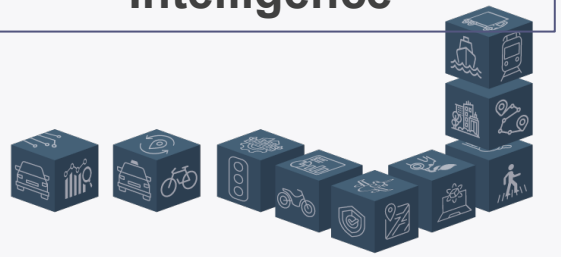
KIOS Center of Excellence at a glance

- Established as a Research unit in **2008** and upgraded to a Center of Excellence (CoE) in **2017** - Collaborates strategically with Imperial College, London
- Operates within the University of Cyprus (at the level of Faculty)
  - **238** people at KIOS CoE
- Develops **research infrastructures** (Testbeds)
  - Test technologies under realistic operating conditions
- Creates **synergies**
  - National and international industrial and governmental organizations



Swiss Confederation

The name “KIOS” was inspired from the Greek Mythology, where **KIOS was the titan of “Intelligence”**



KIOS Technical Focus & Specialization

Intelligent monitoring, control, risk management and cyber/physical security of complex, large-scale, dynamical systems

Application Areas → Critical Infrastructure Systems



Energy & Power Systems



Smart Water & Environmental Systems



Intelligent Transportation Systems



Telecommunication Systems & Networks



Emergency Management Response

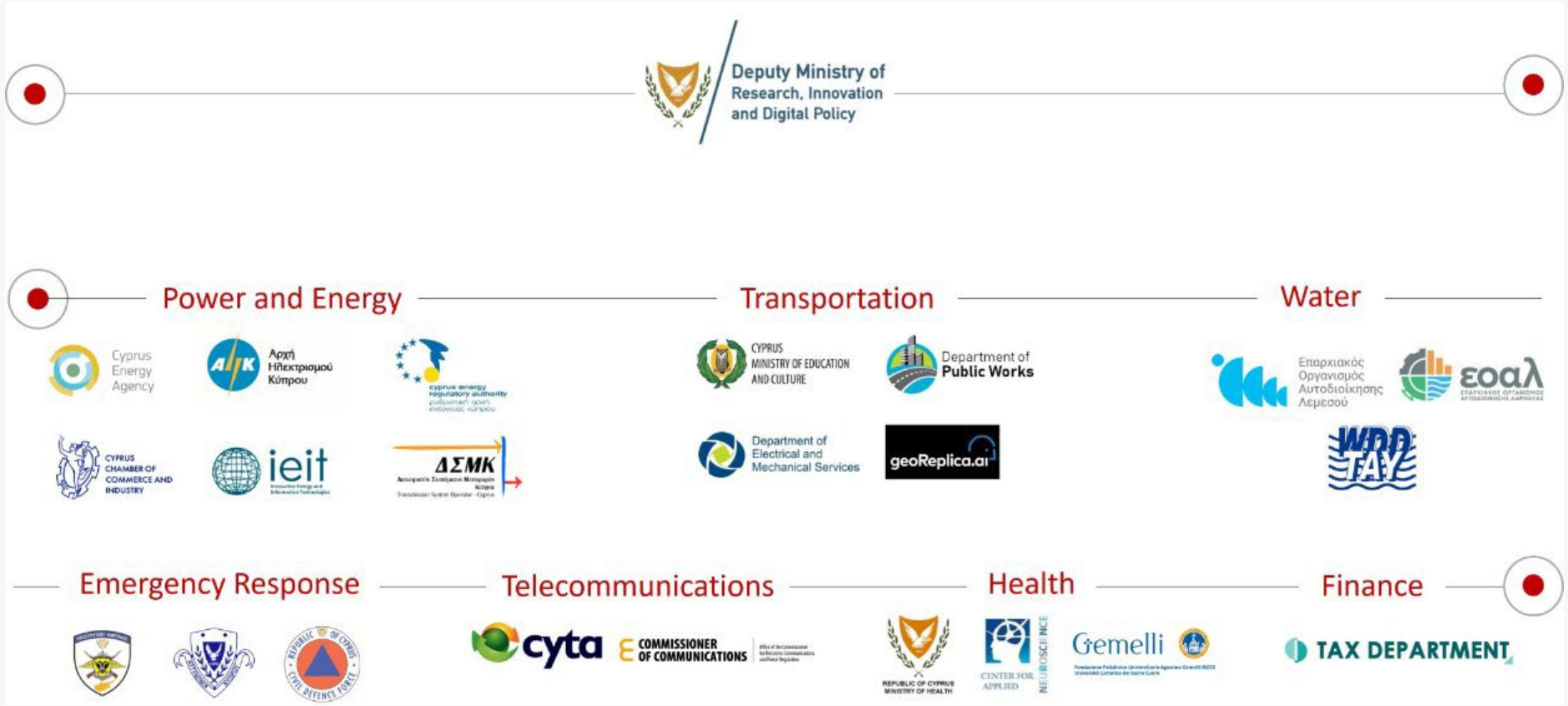


Smart Healthcare Systems



KIOS provides solutions to real-life problems and brings knowhow and tools that make large-scale infrastructures smarter, more efficient, secure, and sustainable

Innovation Hub Partners



Number of projects from 2017 – present : **85**

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Scope of the project

Road traffic

Network congestion

Public transport

Service reliability

Micromobility

First / last mile

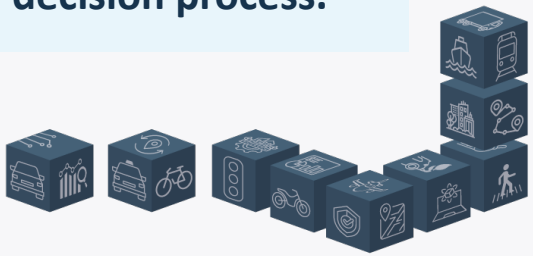
Aerial mobility

New operating mode

Integrated decisions

- Shared data
- Coordinated optimization
- Novel traffic management solutions
- New mobility modes
- Test before invested through reliable and accurate simulations

The challenge is not a traffic management solution— it is the lack of a connected, multimodal decision process.



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Vision of the project

FEDORA connects three spaces into one workflow

A uniform ecosystem for evidence-based, adaptive and resilient multimodal management.

01

DATA SPACE

Interoperable mobility data
Quality, access and sharing

02

OPTIMISATION SPACE

Mobility management services
Network- and user-aware choices

03

SIMULATION SPACE

Future scenarios and testing
Transferability and resilience through real-life and digital twins pilots

FEDORA federated services → measurable decisions and pilot evidence



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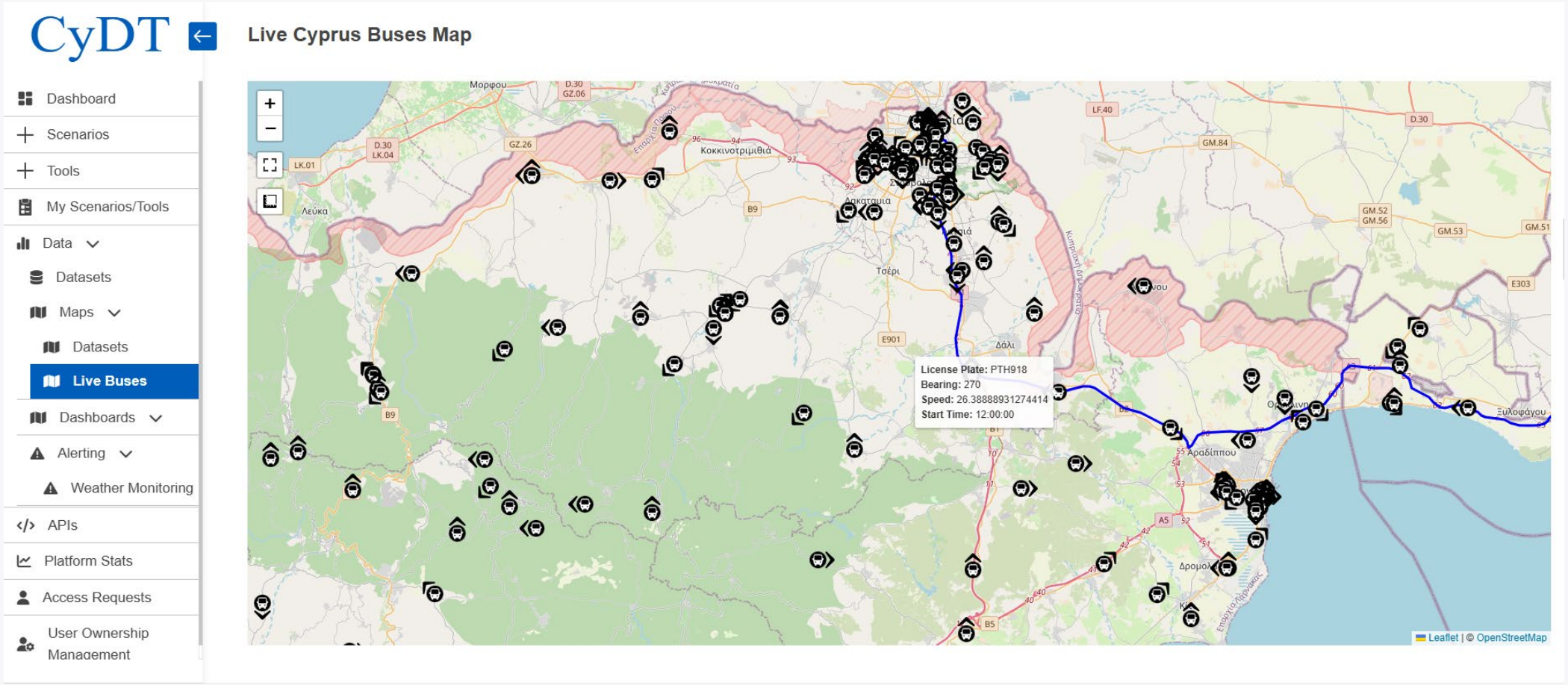
Cyprus Digital Twin



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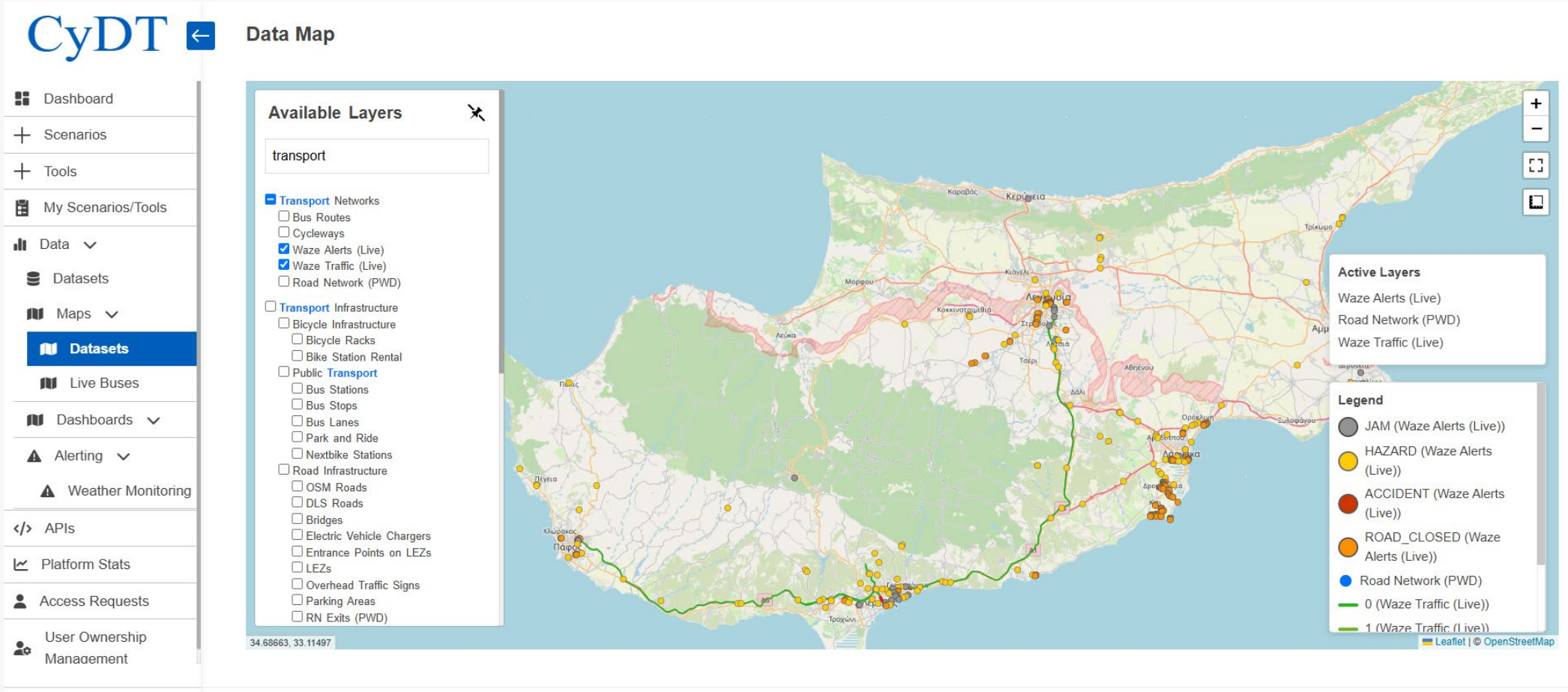
Cyprus Digital Twin



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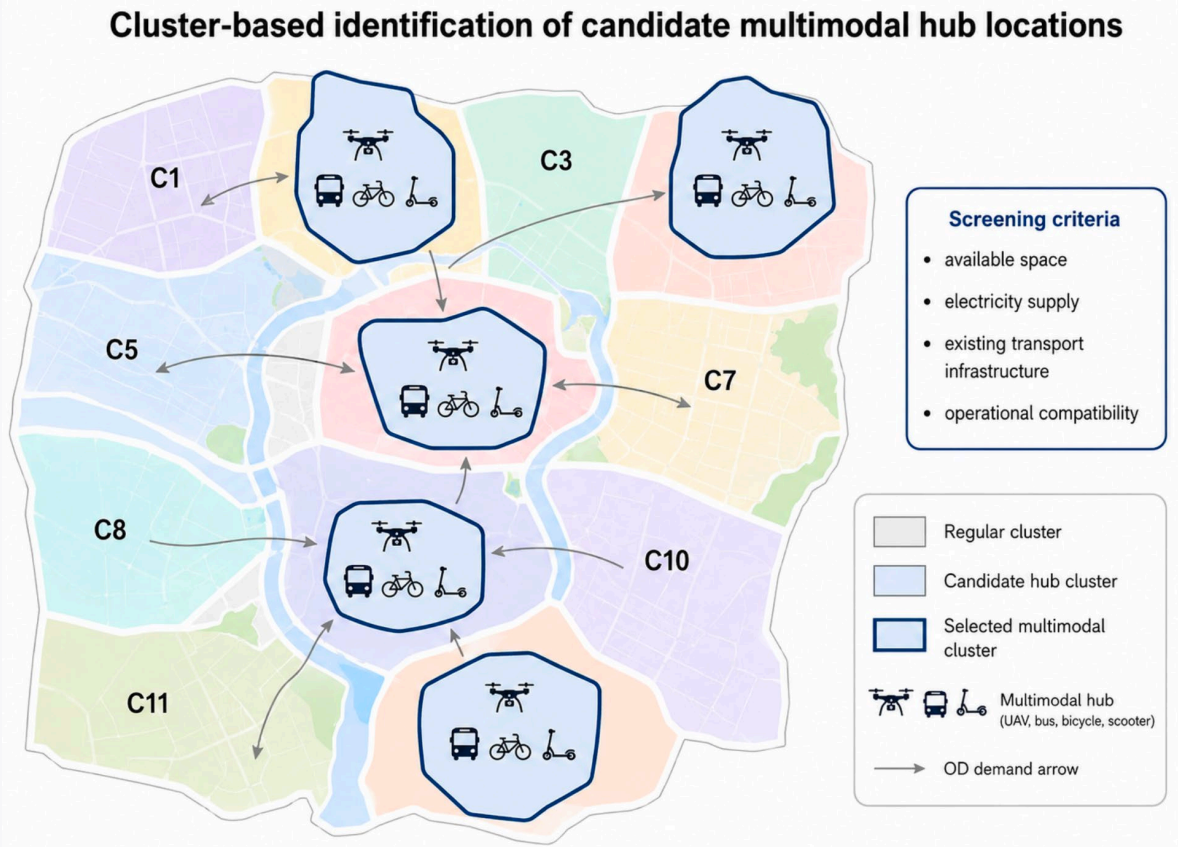
Multimodal hub location and services Opt

- **Problem statement**

- Which candidate clusters should become active multimodal hubs?
- Which existing candidate hubs should be upgraded?
- Which modes and how many service units should be available at each selected hub?
- How should all OD demand be routed through the multimodal cluster network?



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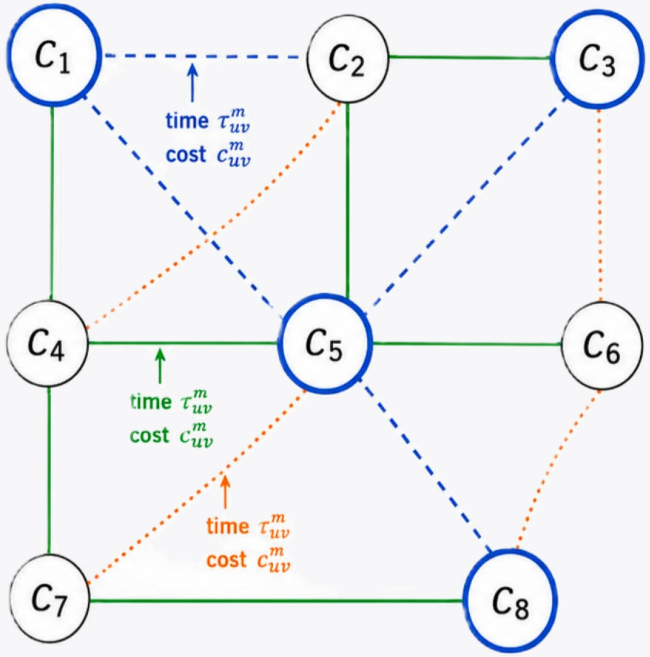
Multimodal hub location and services Opt

- **Concept**

Cluster OD demand

D_{ij}

	C1	C2	C3	C4	C5	C6	C7	C8
C1	–	d_{12}	d_{13}		⋯			d_{18}
C2	d_{21}	–	d_{23}		⋯			d_{28}
C3	d_{31}	d_{32}	–		⋯			d_{38}
C4	⋮	⋮	⋮		⋮			⋮
C5	d_{i1}	d_{i2}	d_{i3}		⋯			d_{i8}
C6	⋮	⋮	⋮		⋮			⋮
C7	d_{81}	d_{82}	d_{83}		⋯			–
C8								



Decision links and infrastructure

- active link z_{uv}^m
- UAV pads + chargers
- bus bays + chargers
- bike docks
- scooter docks with battery swap

MIP objective

- minimize operating cost
- minimize aggregate travel time
- serve all OD demand
- satisfy area / power / mode-capacity constraints

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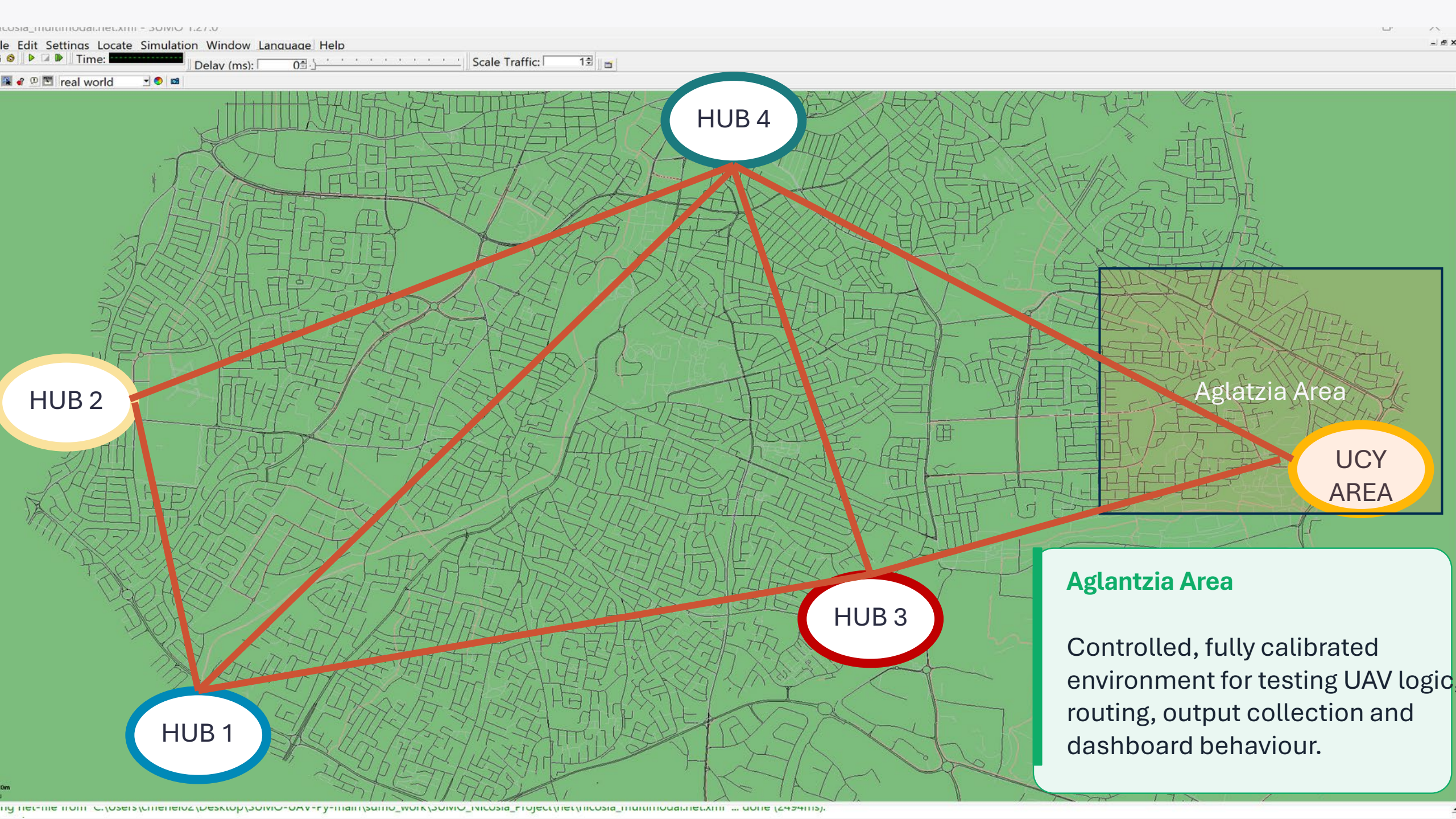

Aglantzia Area

Controlled, fully calibrated environment for testing UAV logic, routing, output collection and dashboard behaviour.

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Thank you!

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