LEAD Futureshop

The Hyperconnected City – the Hague

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 861598

CiVITAS
Cleaner and better transport in cities

THE CIVITAS INITIATIVE IS CO-FINANCED BY THE EUROPEAN UNION

Welcome!

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LEAD

Program Futureshop - The Hyperconnected City

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What is LEAD Project?

March 3rd, 2022

Futureshop: Hyperconnected city / The Hague Workshop

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LEAD: Low-Emission Adaptive last mile logistics supporting on demand economy through Digital Twins

- Rise on-demand logistics = stress last mile delivery systems
- Customer: responsive system for customized products
- Industry: instant delivery
- Cities: possible negative consequences.

Urban planner + city authorities + stakeholder = prediction, evaluation, new business models

- **LEAD**: develop logistic solutions ↔Low emission operations, adaptive model & Digital Twins models

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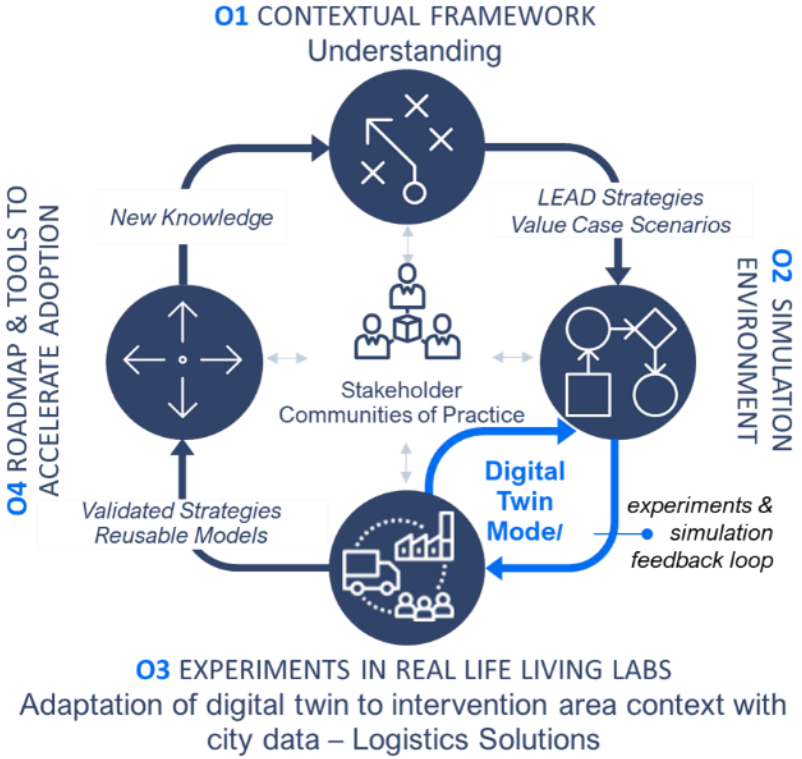
What is LEAD?

- LEAD – Digital Twins creation in 6 cities (TEN-T urban nodes)
- Solutions & use case scenarios



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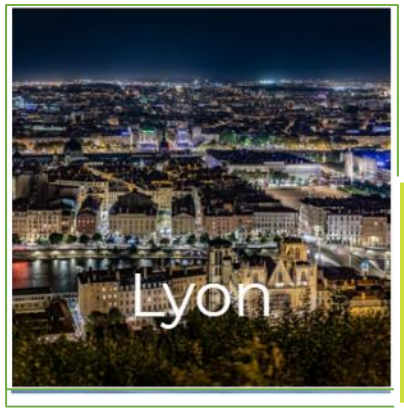
Living Labs

Transforming a Parking Lot to an Urban Consolidation Centre

Integrated last-mile logistics with demand-supply matching platforms

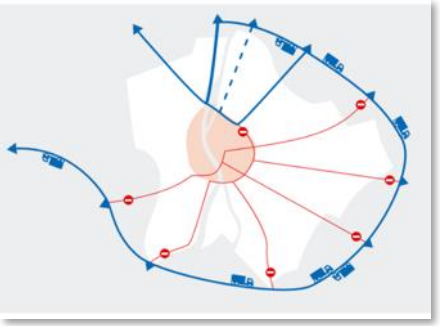
Turning retail stores to electric mobility nodes



Validation of last mile distribution models

Spatial Planning of Inner-City Loading Areas

Green Crowdshipping through the mass transit network



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LEAD

LEAD Strategies

1

Innovative business models

with a view to optimising the performance of last mile logistics (based on volatility of demand, delivery life cycles and costs) in response to the challenges posed by the on demand economy

2

Agile freight storage and distribution

Agile schemes for urban freight storage and last mile distribution, including crowdsourced shipping, capacity sharing, multi-echelon and Physical Internet inspired approaches

3

Low emission delivery vehicles

including Electric Delivery Vehicles (EDVs), hybrid and automated vehicles for freight delivery like cargo-bikes, delivery robots and droids -walkers will also be considered

4

Smart data-driven logistics solutions

for shared, connected and low-emission logistics operations, empowered by an adaptive modelling approach and Digital Twin models, applied in real-life environments

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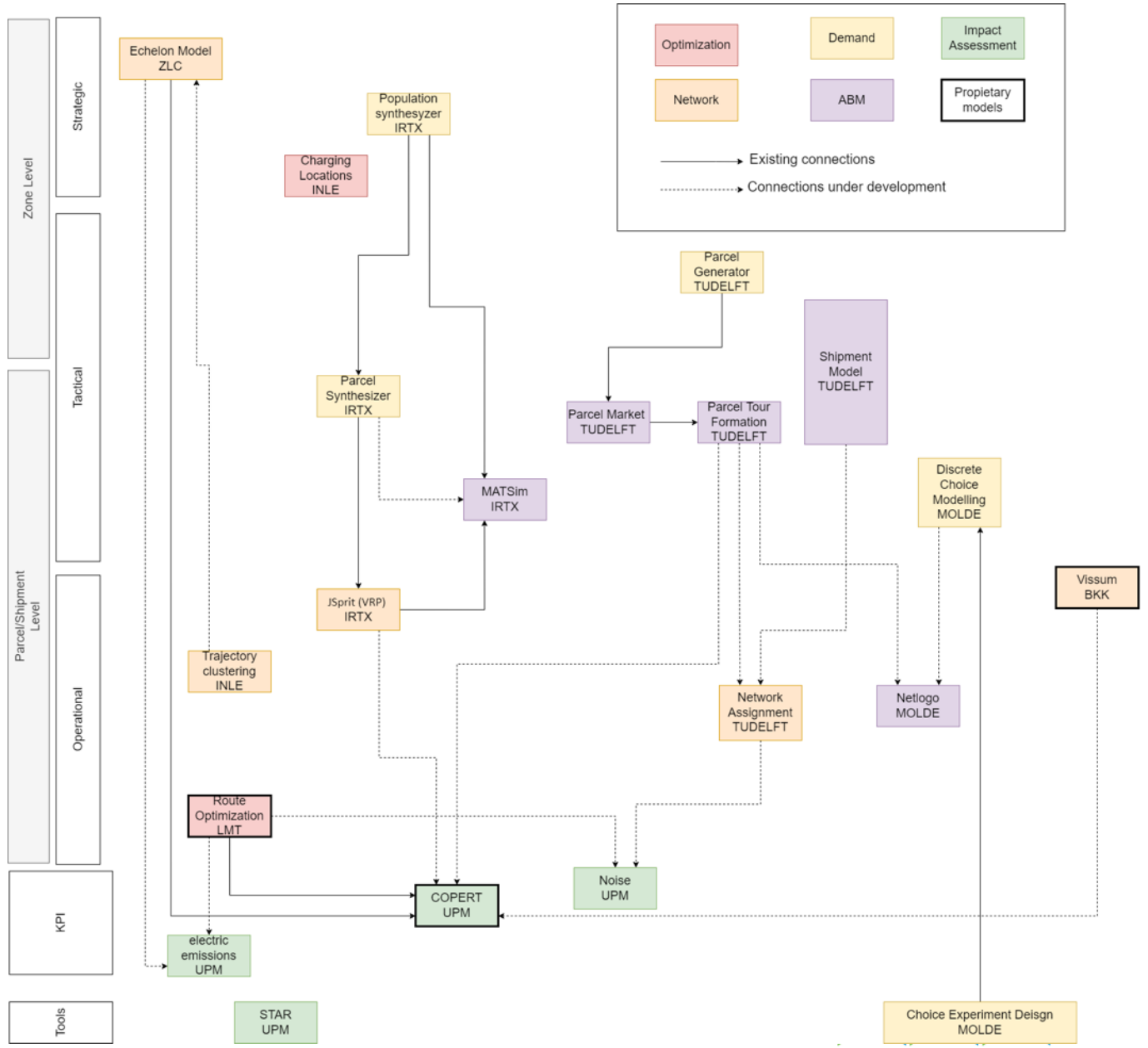
LEAD

LEAD KPIs

Dimension	LEAD KPI Name	Definition	LEAD LLs targets (GA)					
			Madrid	Hague	Lyon	Budapest	Oslo	Porto
Environmental	Energy consumption	Energy savings compared to the “do-nothing” scenario	50%	30%	30%	50%	20%	60%
	GHG emissions	CO2 equivalent emissions savings compared to the “do-nothing” scenario.	50%	50%	50%	50%	50%	50%
	Air quality	Savings of [NOx] compared to the “do-nothing” scenario	50%	50%	50%	50%	50%	50%
		Savings of [PM] compared to the “do-nothing” scenario	50%	50%	50%	50%	50%	50%
		Savings of [VoC] compared to the “do-nothing” scenario	50%	50%	50%	50%	50%	50%
	Noise quality	Reduction of population exposed to noise	30%	30%	30%	30%	30%	30%
Social	Jobs created	Jobs compared to the “do-nothing” scenario	5%	5%	5%	5%	5%	5%
	Quality of the jobs	Qualitative evaluation of the types of jobs created by the LL according to the opinion of the CoP	√	√	√	√	√	√
	Neighbourhoods quality of life	People satisfied with the value case scenario compared with the “do-nothing” scenario in terms of quality of life	√	√	√	√	√	√
	Ideas to promote a more sustainable behaviour	Ideas suggested to promote a more sustainable behaviour	>3	>3	>3	>3	>3	>3
	Cooperative solutions and incentive measures	Cooperative solutions and incentive measures promoted within the framework of the LL and approved by the CoP	>3	>3	>3	>3	>3	>3
Economic	Average delivery cost of the business model	Average delivery cost savings of the business model compared to the “do-nothing” scenario.	0%	0%	0%	0%	0%	0%
	Congestion	1. Changes in the share of shipments that are carried out within the congested hours of the day 2. Congestion contribution of delivery vehicles: Changes in the occupation time of the road.	20%	15%	10%	20%	10%	20%
	Urban storage and parking space	Urban space required for last mile deliveries (storage and parking) in comparison with the “do-nothing” scenario.	10%	10%	10%	10%	10%	-
	Financial internal rate of return of the investment conducted	Financial internal rate of return of the investment conducted to implement the value case scenario.	>6%	>6%	>10%	>6%	>10%	>10%
	Shop/Retails benefits (shippers)	Retail benefits compared to the “do-nothing” scenario (Workshop based).	√	√	√	√	√	√
	Delivery time	Average delivery time compared to the “do-nothing” scenario	5%	5%	5%	5%	5%	5%
	Delivery reliability within the time window	On-time deliveries within the time window compared to the “do-nothing” scenario.	10%	10%	10%	10%	10%	10%

WP2 model library overview

Number	Model name	Model owner
1	VISUM*	BKK/SZE
2	Charging station	INLE
3	Trajectory clustering	INLE
4	Synthetic population	IRTX
5	Parcel synthesizer	IRTX
6	MATSim	IRTX
7	JSprit	IRTX
8	Route optimization*	LMT
9	NetLogo	Molde
10	Discrete Choice Modelling	Molde
11	Choice Experiment Design	MOLDE
12	Parcel generation	TUD
13	Parcel Market	TUD
14	Parcel tour formation	TUD
15	Shipment model	TUD
16	Network Assignment	TUD
17	STAR	UPM
18	COPERT*	UPM
19	NOISE	UPM
20	Electric vehicle GHG emissions estimation	UPM
21	Echelon	ZLC



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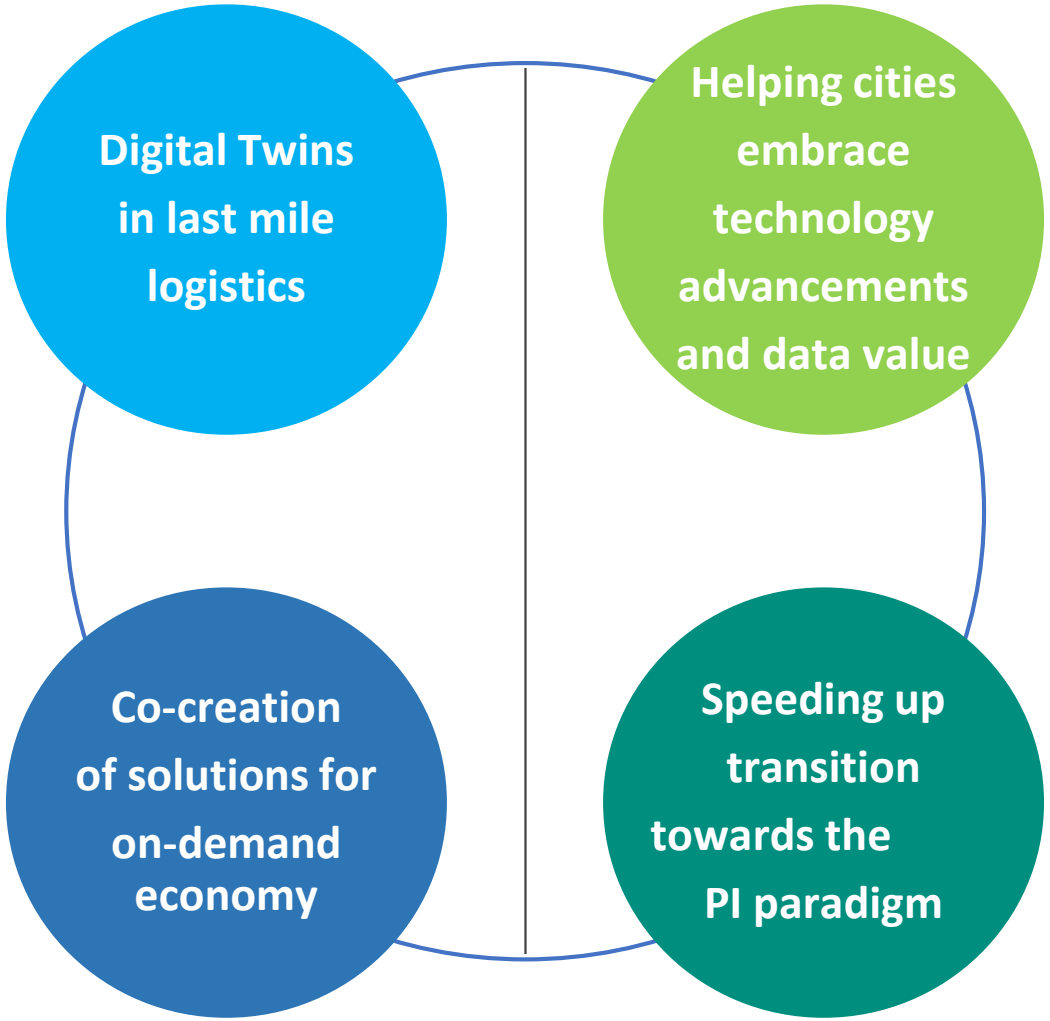
LEAD

LEAD Innovations



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Expected Impacts

Impact 1

- Clear understanding of cost-effective strategies, measures and tools to achieve essentially zero emission city logistics in major European urban centres by 2030.

Impact 2

- New tested, demonstrated practices and solutions for better cooperation between suppliers, shippers and urban/ regions policy makers (planners)

Impact 3

- Clearly provide inputs for the preparation and implementation of SULPs, SUMPs and other planning tools (big data and real-time traffic management)

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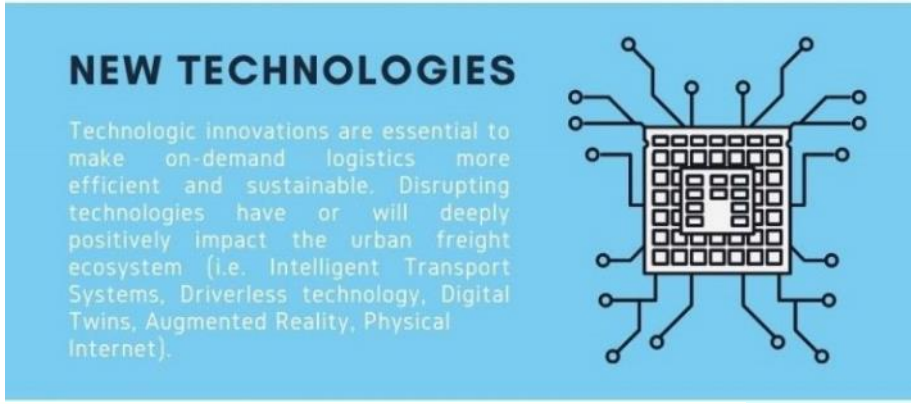
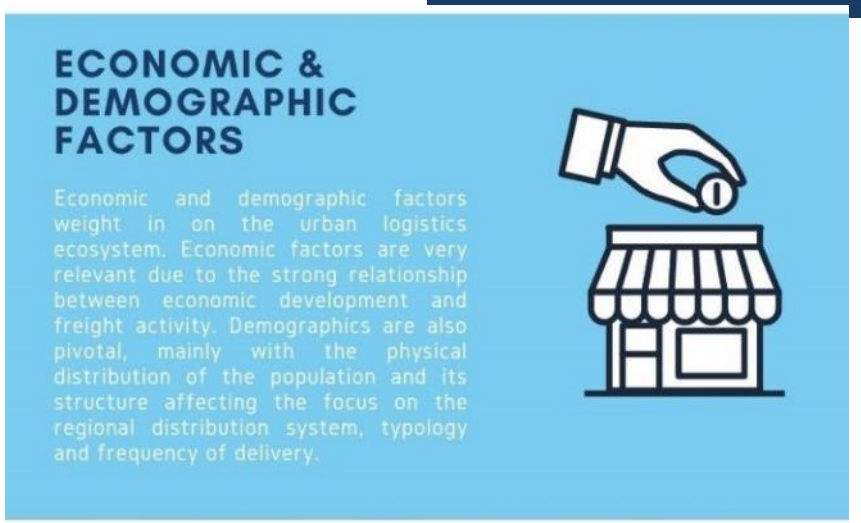
Where do we stand?

- Analysis of City Logistics landscape in the era of on-demand economy
- Communities of Practice
- KPI Definition
- Digital development
- Physical development
- Capacity Building





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10 cities and regions from seven countries have been selected to become members of the LEAD Transferability Platform.

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Partners

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Contact us!

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- Sign up for our newsletter

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Program partners

- Program partner
- Pilot city and facilitating role

- Program partner
- Digital twin and analysis

- Program partner
- Connector of stakeholders and platforms

- Logistics partner
- Fulfilment with focus on crowdsourcing

- Logistics partner
- Fulfilment with focus on locker pick-up and delivery

- Logistics partner
- Fulfilment with focus on consolidation and bike delivery

- Logistics partner
- Fulfilment with focus on consolidation and delivery of fresh goods

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MyPup

Cycloon

HubKlup

Nimber

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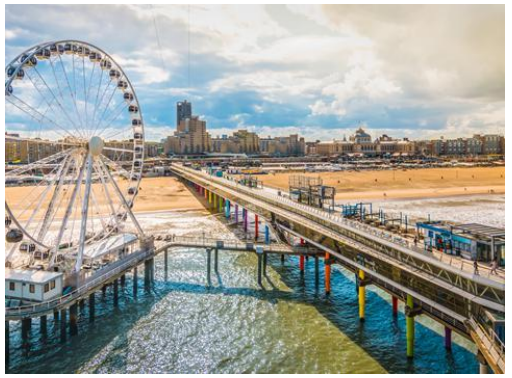
Living Lab

Integrated last-mile logistics with demand-supply matching platforms



The Haque

Central innovation District

The Central Innovation District (CID) is the economic heart of The Hague. A national hub where **90,000 people** earn their money and more than **30,000 study** towards a better, safer and fairer world in a digital age. Over the next twenty years, an enormous amount of investment in this area will converge. **25,000 new homes** will be added for **50,000 new residents**. We expect an addition of **500,000 square meters of office space** and the expected number of **commuters** will double to more than **400,000** per day.

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LEAD

Vision for new mobility for CID

- Multi-user, multi-facility service points for all;
- Logistic hub as guiding physical object;
- Combination of physical and digital mobility platforms.

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Living Lab

Integrated last-mile logistics with demand-supply matching platforms

Problem statement

How to **mix logistic services across platforms** to create a more efficient and sustainable **urban freight system,** by **sharing resources** for carriers and improve offerings for customers.

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Logistic partners

cycloon

nimber

mypup

Project Partners

TU Delft

Den Haag

LEAD

Next2Company

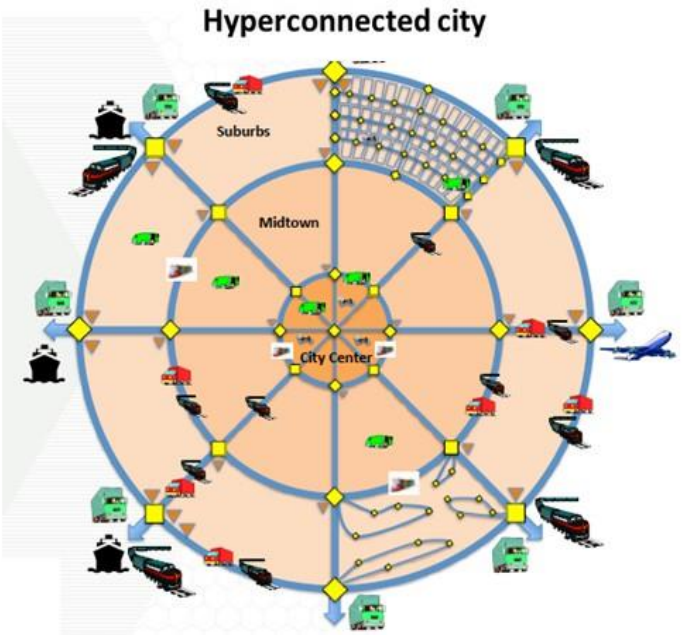
Hyperconnectivity

The hyperconnected city is a city where actors in multiple segments are connected, both physically and digitally, to ensure efficient logistics. It is an open system engaging a multitude of diverse actors who, while aiming for their own goals, contribute to the overall performance of the system.

In operational terms, the city logistics web requires numerous multi-modal logistics and transportation service providers to co-operate to ensure consolidation and synchronization.

Source: Benoit Montreuil

Figure 2: Omni-channel Retail Supply Chain



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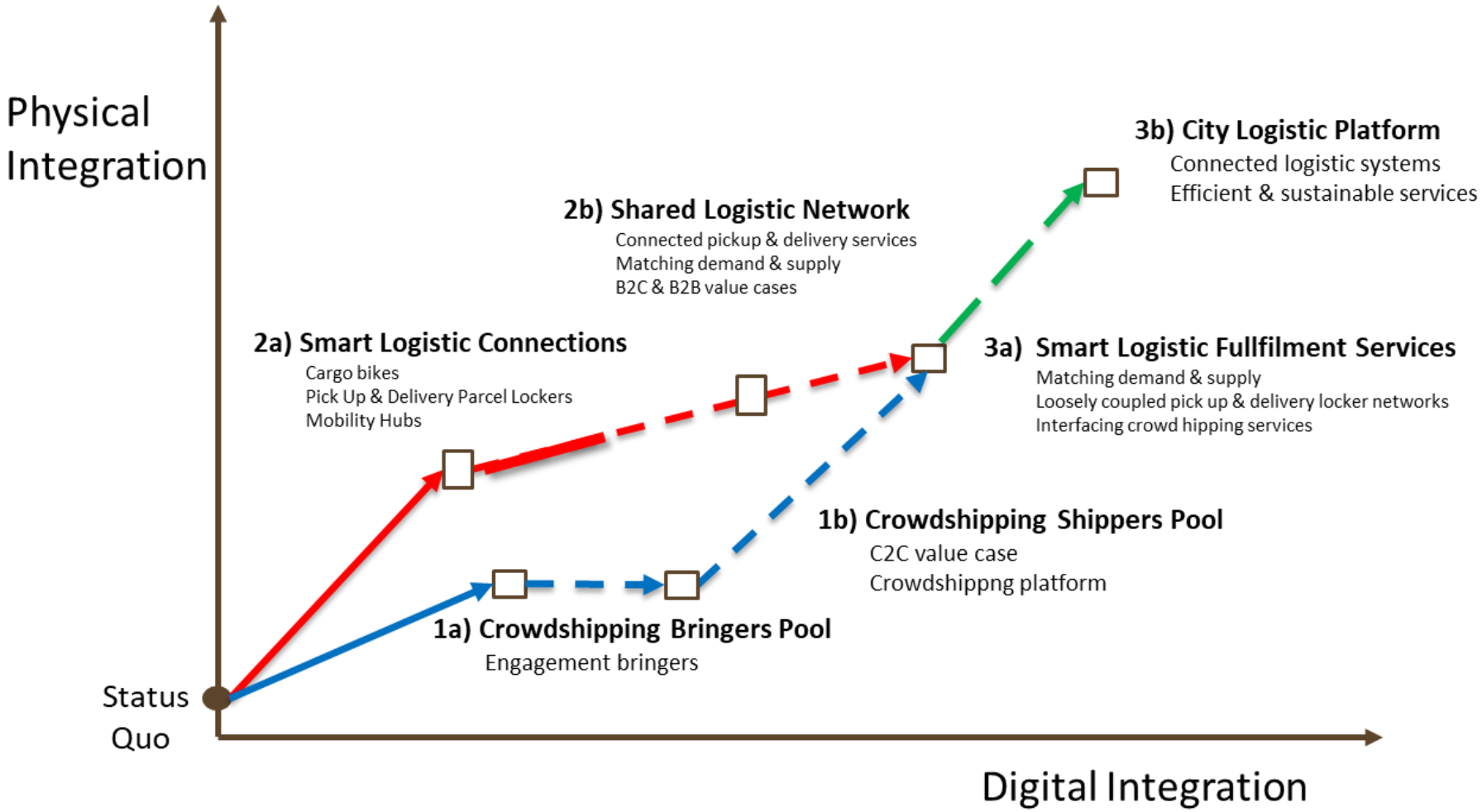
Connected Pickup & Delivery and Crowdshipping Network(s)



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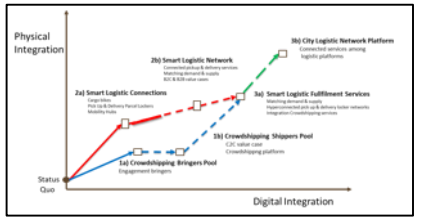
Implementation of value cases



MVP 1

Crowdshipping Services

Configuration of the crowdshipping concept

1ª) Engagement of bringers
- Survey student population
- Registering bringers

1b) Organising supply
- Connecting coalition partners
- Platform C2C shipments

MVP 2

Pick Up & Delivery Locker Networks

Shared logistic networks and smart consolidation

2a) Connectivity of logistic capabilities
- Transport (parcel bikes), lockers, hubs
- Connectivity logistic systems

2b) Implementation value case(s):
- L2L parcel network (B2C) (i.e. Local retail logistics)
- Smart consolidation network (B2B) (i.e. service logistics, fresh logistics)

MVP 3

City Logistic Platform Connectivity

Digital logistic fulfillment platform connectivity

3ª) Loosely Coupled Systems
- Interfacing Cycloon, MyPup, Hubklup and Nimber

3b) Architecture integration platform
- Matching demand & supply
- Connected logistic systems
- Shared resources
- Combined service offering

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Logistic partners

cycloon

nimber

mypup

Project Partners

TU Delft

Den Haag

LEAD

Next2Company

The Physical Internet

The Physical Internet proposes a full consolidation of logistics flows between independent shippers (e.g. storage, trucks, vans, hubs, …) for door to door fulfillment.

Physical Internet proposes to pool resources and assets in open, connected, and shared networks (i.e. connecting existing networks, capabilities and resources) so they can be used seamlessly by network users and partners.

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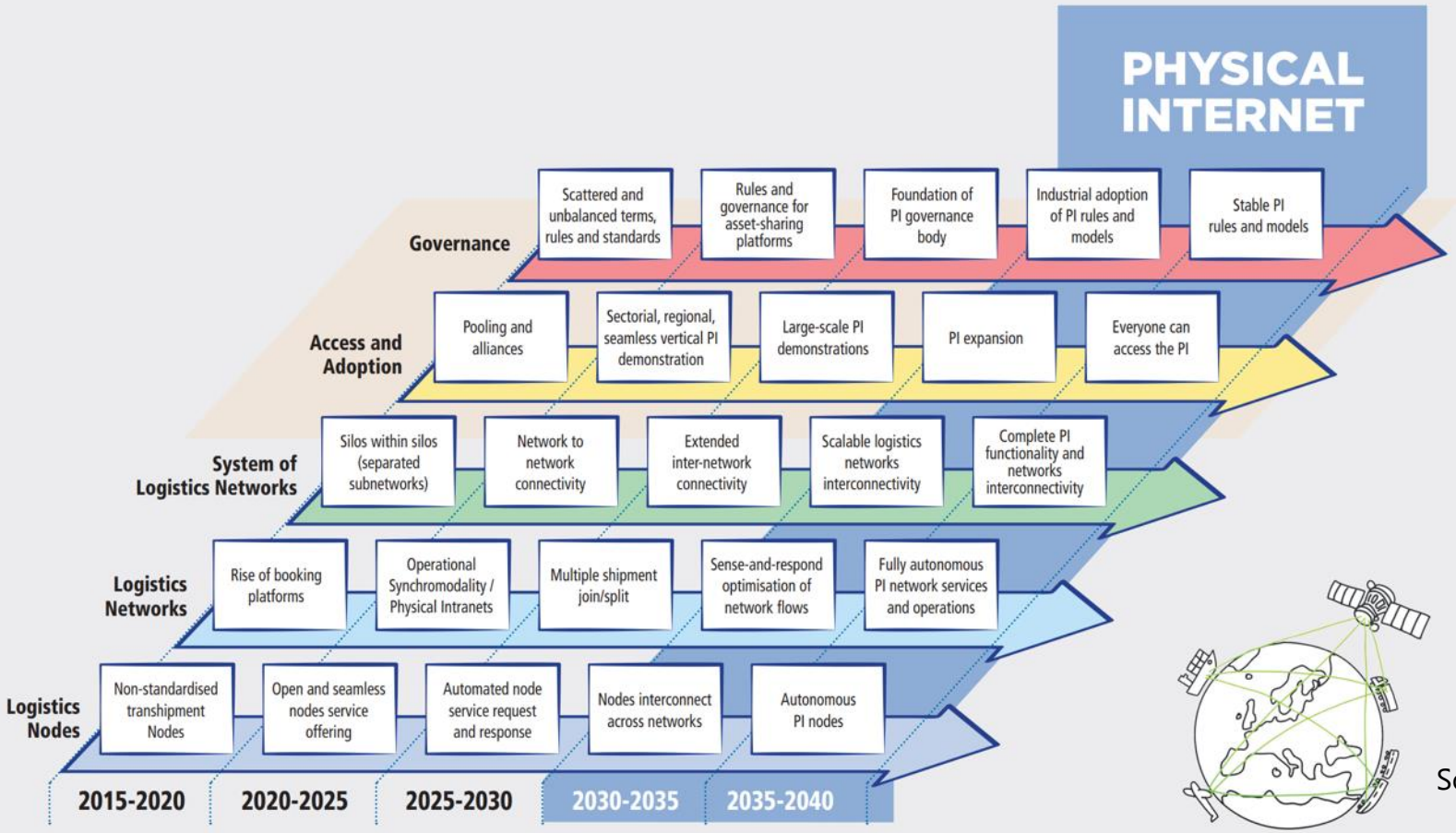
The Physical Internet Roadmap



Source: alice, 2020

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Dialogue

Madrid, Porto, Oslo, Lyon, Budapest The Hague

From a city level perspective:

How to kick start and accelerate the (horizontal) cooperation of independent logistic service providers?

- What are the main dilemma's and how to overcome these hurdles?
- What are the building blocks for open and interconnected logistics services and networks?

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Next…digital twins!

- From general urban digital twins to specific ones (on-demand city logistics)
- Digital Twin as a platform for models
- Specific modelling approach for The Hague
- Discussion: connecting initiatives

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URBAN STRATEGY - DIGITAL TWIN FOR URBAN MOBILITY AND LOGISTICS

A new integral and interactive approach for urban planning

URBAN STRATEGY
INTEGRAL, INTERACTIVE URBAN PLANNING

- Growing need for an **integral approach** on city development
  - Don’t just look at vehicle loss hours / congestion
  - But on the liveability of the city as a whole
  - Concerning accessibility, inclusiveness, safety, air quality, etc.

  - For all modes (car, PT, bike.. But also new modes such as automated driving, shared cars, e-mopeds, etc.)
  - For all domains (mobility, energy, climate, ..)
  - For all possible interventions (infrastructure, housing, user costs, parking costs, etc.)

URBAN STRATEGY
INTEGRAL, INTERACTIVE URBAN PLANNING

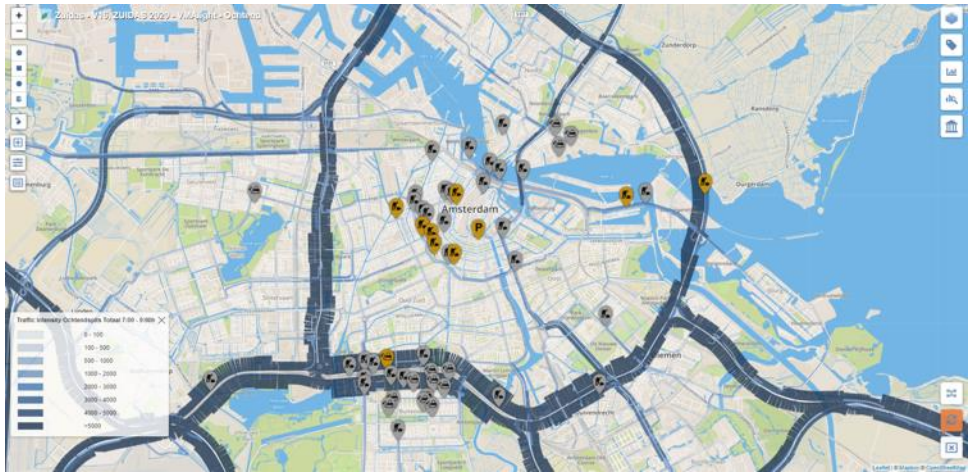
- Problem:
  - Current (4-step) transport models are quite accurate, calibrated, etc.
  - But also quite slow, not usable for computing lots of variants (or optimisation)
  - And hard to adjust (e.g. addition new modes)

- (Part of) solution:
  - Enabling technology: Urban Strategy
  - A layer ‘on top of’ a transport model
  - Accelerated using high performance computing
  - Easily adjustable

WHAT IS URBAN STRATEGY

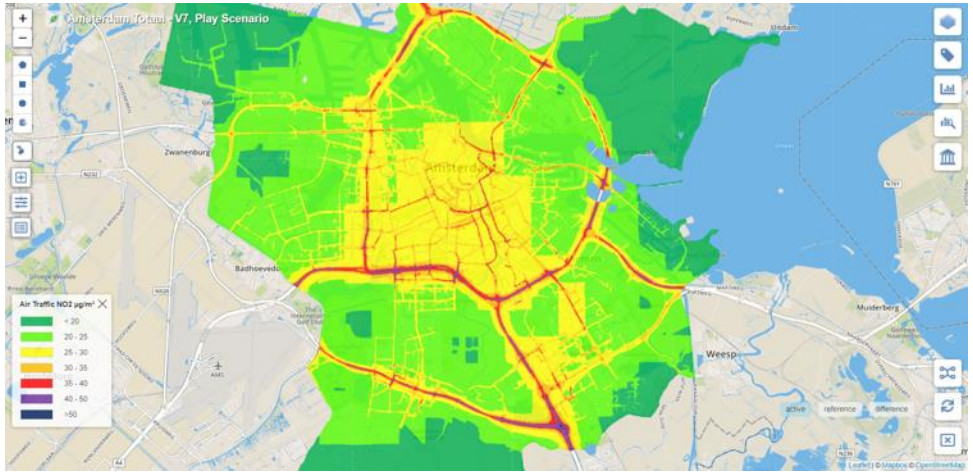
INTERACTIVE MULTI-MODAL PLATFORM FOR URBAN PLANNING & MONITORING

USER INTERFACE & INTERACTION



TRAFFIC (ASSIGNMENT)

AIR QUALITY



INDICATORS

TNO innovation for life

URBAN STRATEGY MODULES – MODELLING USER BEHAVIOUR

Data
Policy
Behaviour change
Model

Input from US-users

Area specific

Global

Housing construction, extra jobs & facilities

Changes in number of trips (trip generation & destination choice)

Demand module

Attractiveness transport mode, parking costs

Changes in mode choice

New Mobility Modeler

Changes in infrastructure

Changes in route choice

US Traffic, Public Transport, Air & Noise

Model input

Traffic model: network-data & OD-matrices

Travel times

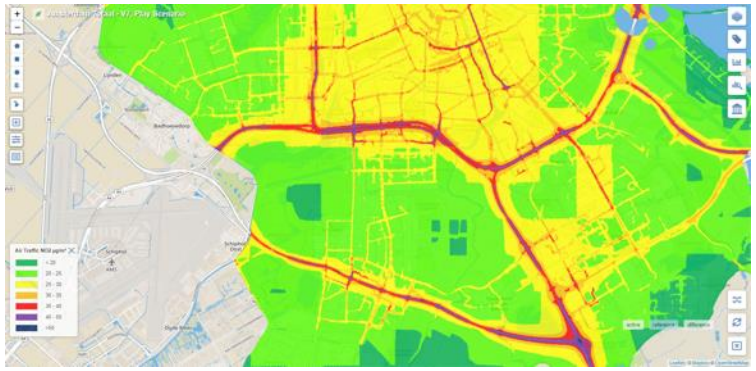
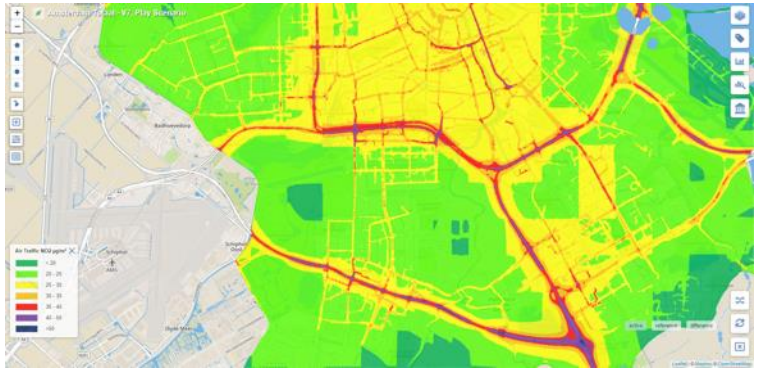
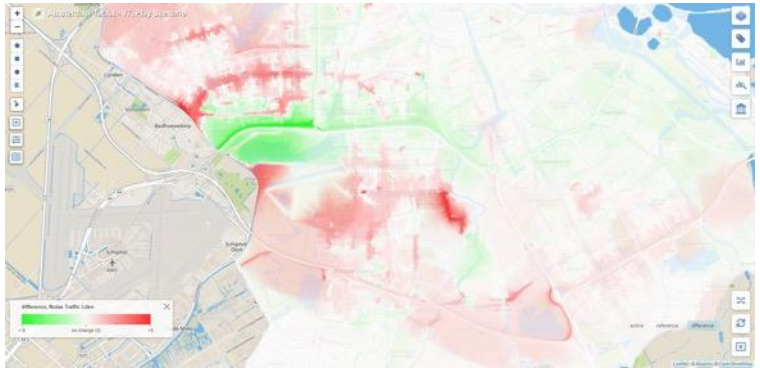
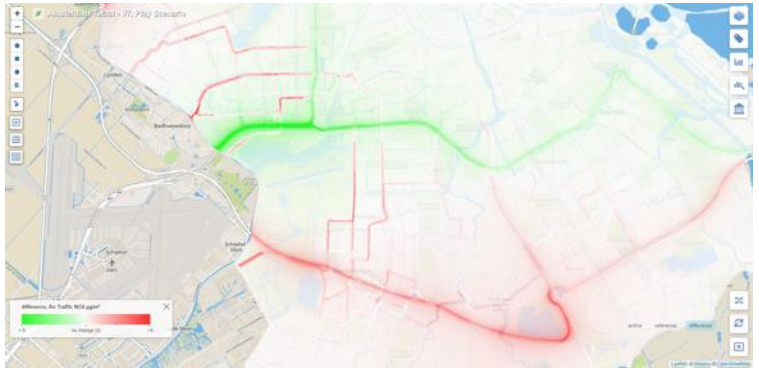
Individual trips & population data

Model output

Traffic flow, noise, air quality

Modal split

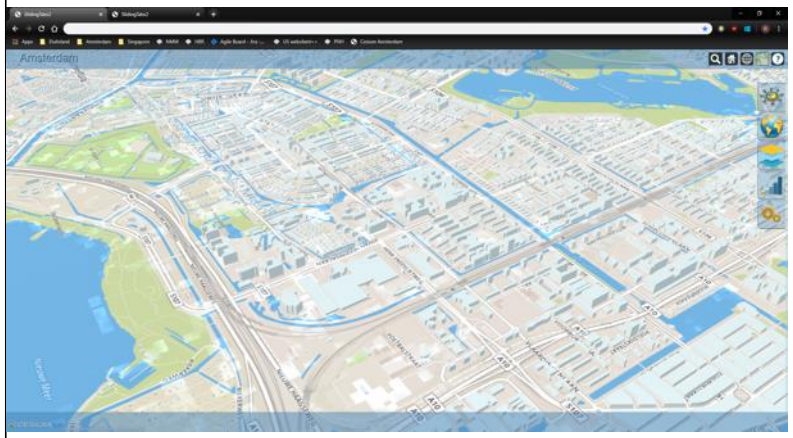
SCENARIOS: COMPARE DIFFERENT INTERVENTIONS

	NOISE POLLUTION	AIR QUALITY	TRAFFIC
BEFORE			
AFTER			
DIFFERENCE			

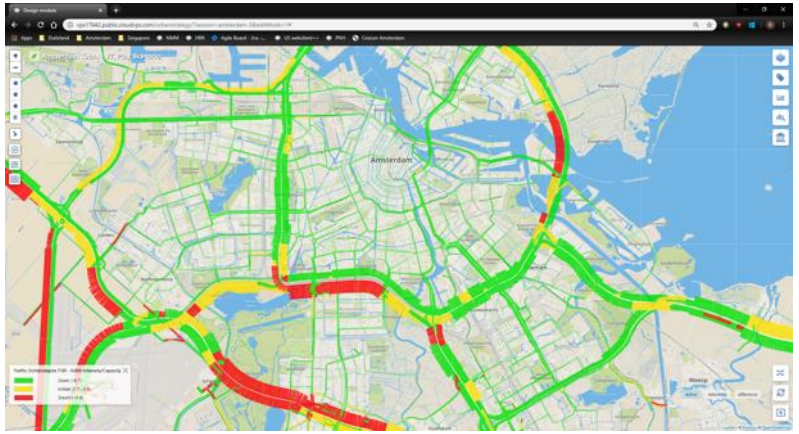
VISUAL: ASSIST COMMUNICATION – CO CREATION

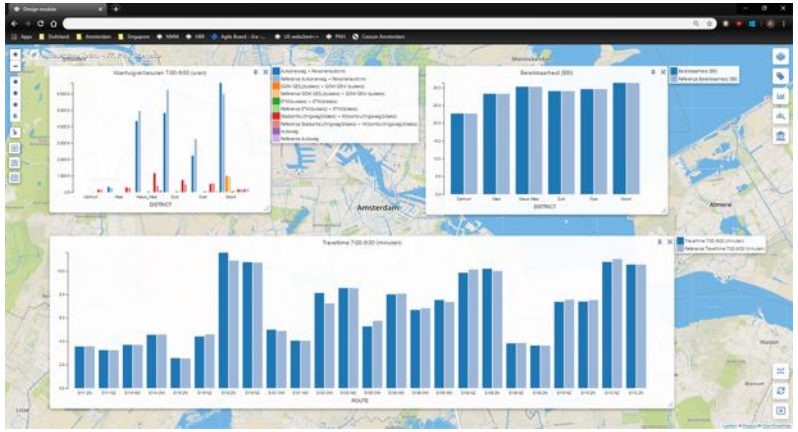
WEBINTERFACE

3D VIEW

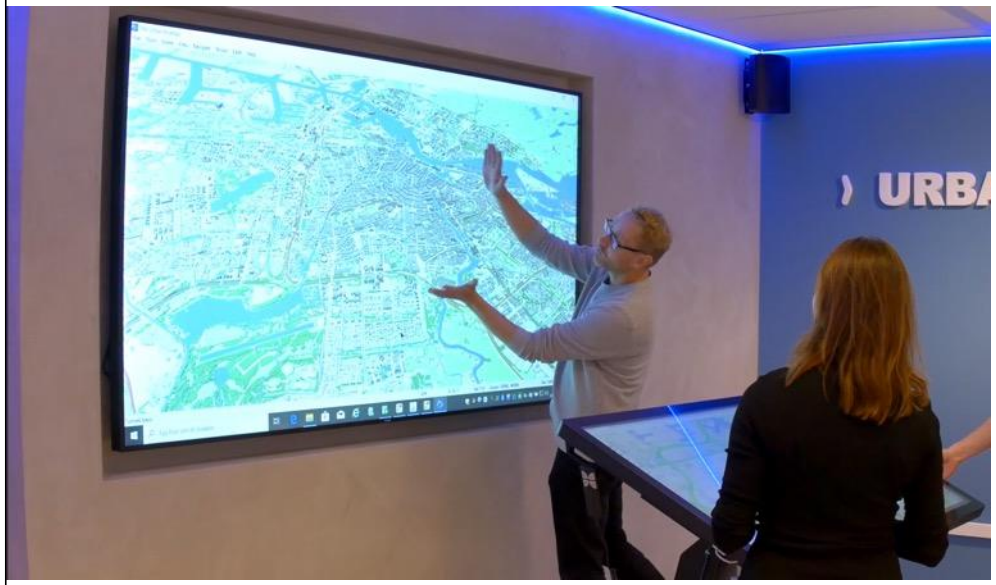


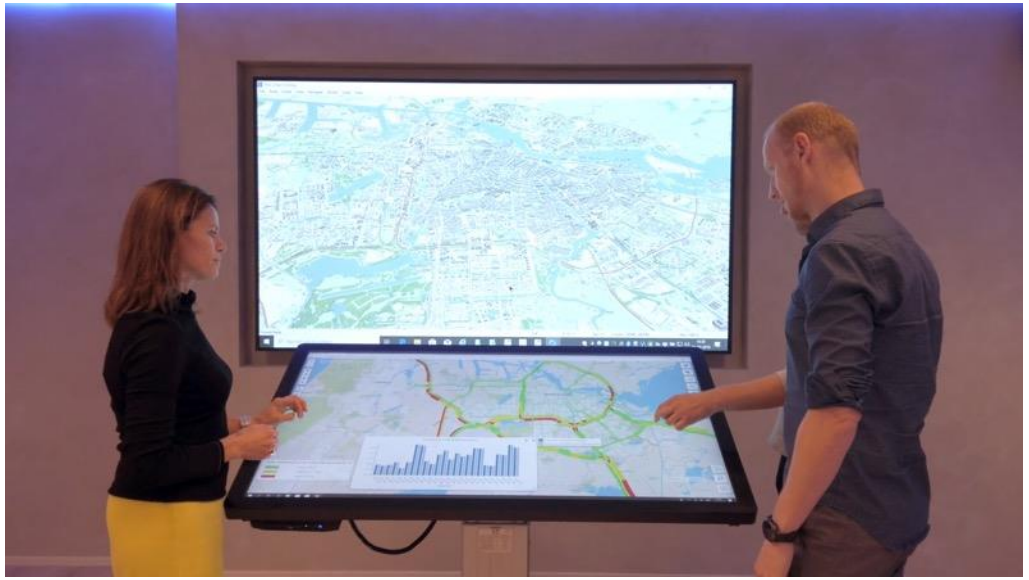
2D MAP VIEW

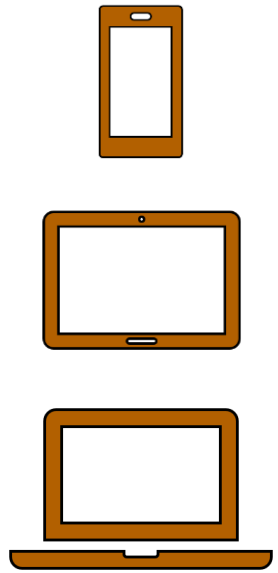




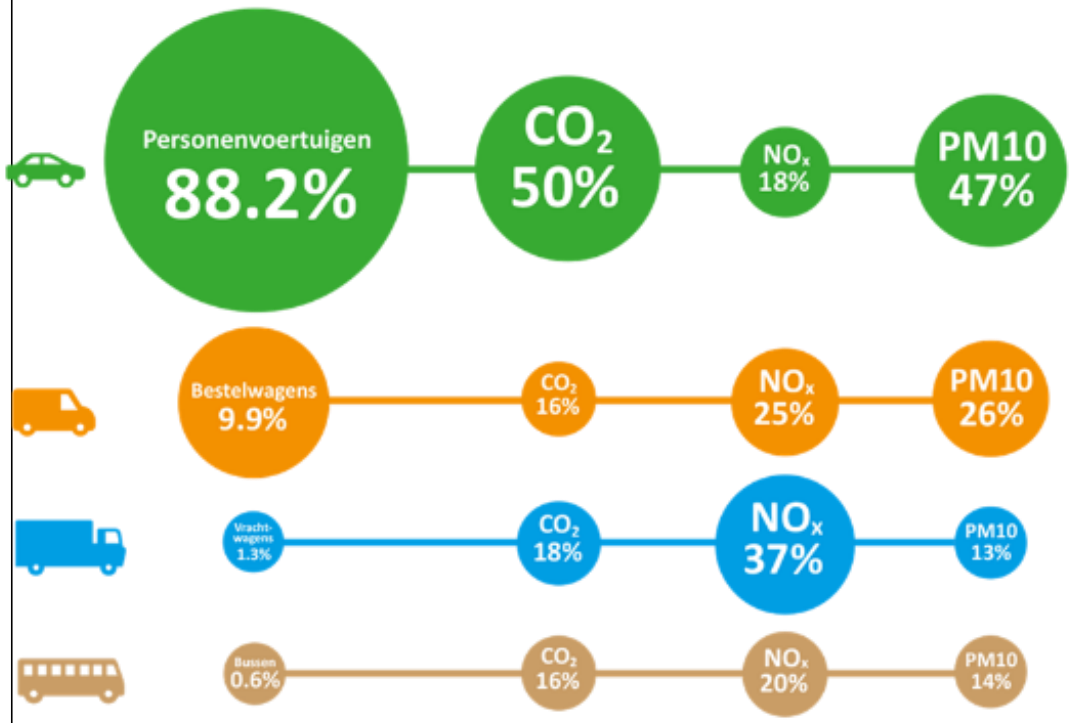
WORKSHOPS – MULTU DEVICE







CITY LOGISTICS – DECOMPOSITION



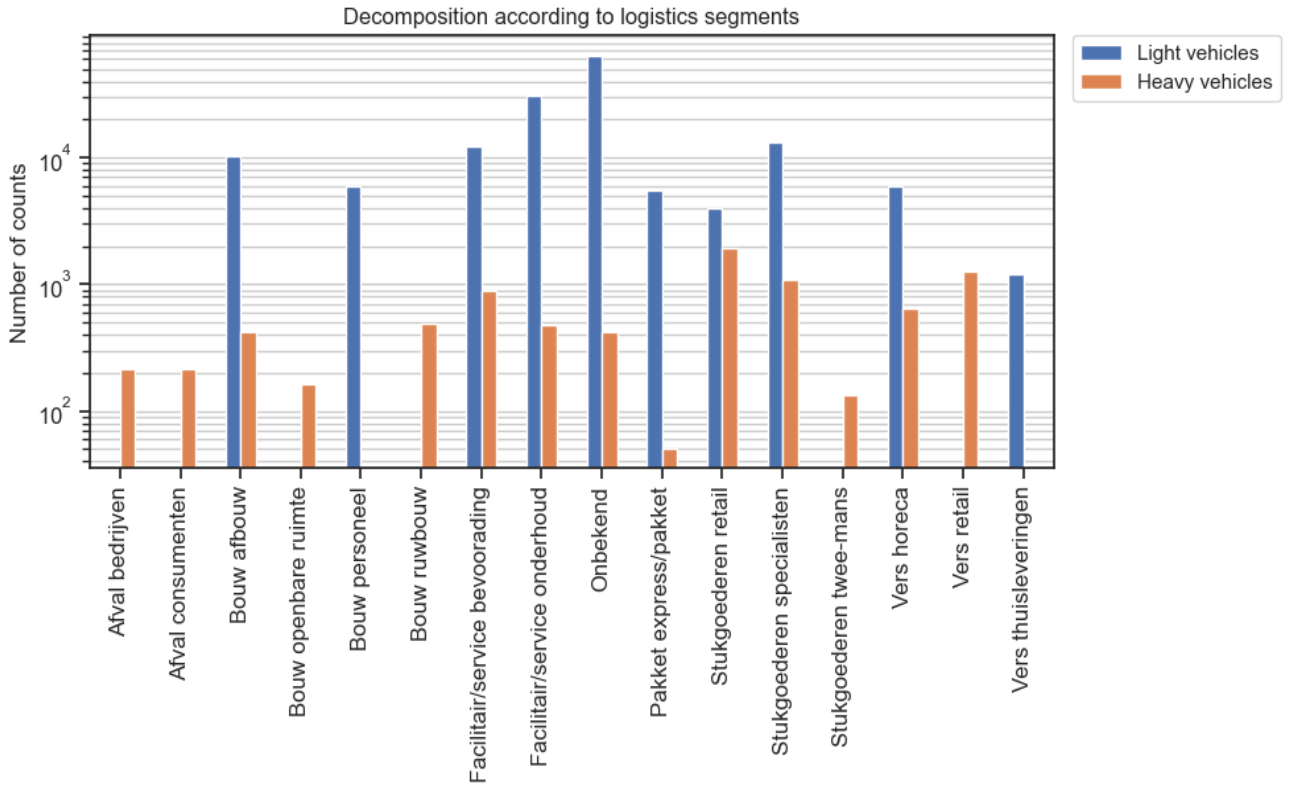
TNO: Rotterdam City Centre, 2015

Topsector Logistiek, 2021

CITY LOGISTICS – DECOMPOSITION

LOGISTICAL SEGMENTS

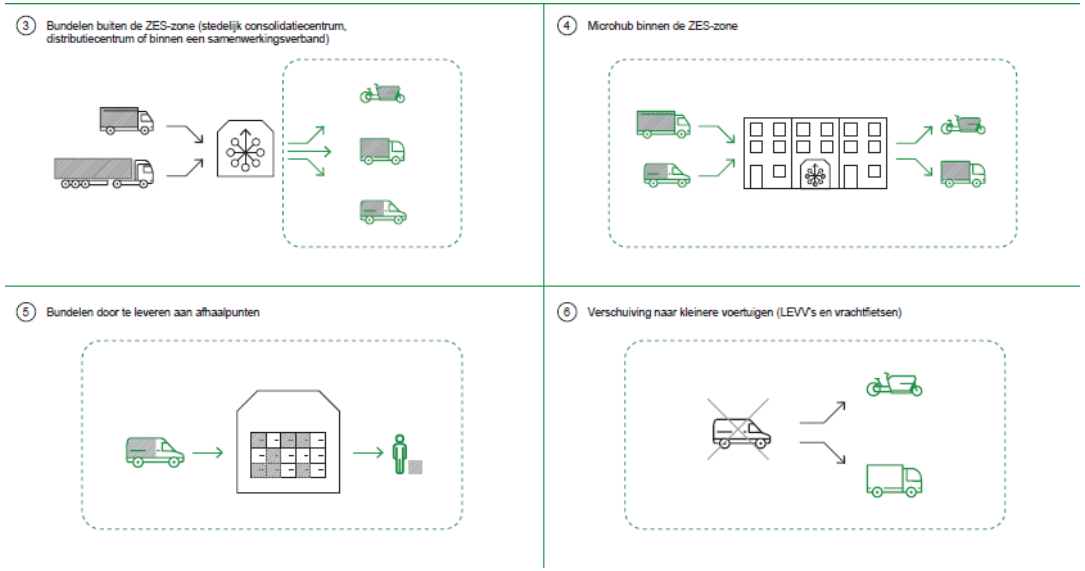
- Logistical segments with distinctive characteristics with regard to vkm, #stops, vehicle type, O/D, etc.
- Decomposition
  - Vehicle type
  - Business category / Logistical segment
  - O/D
- To determine the size, diversity and impact



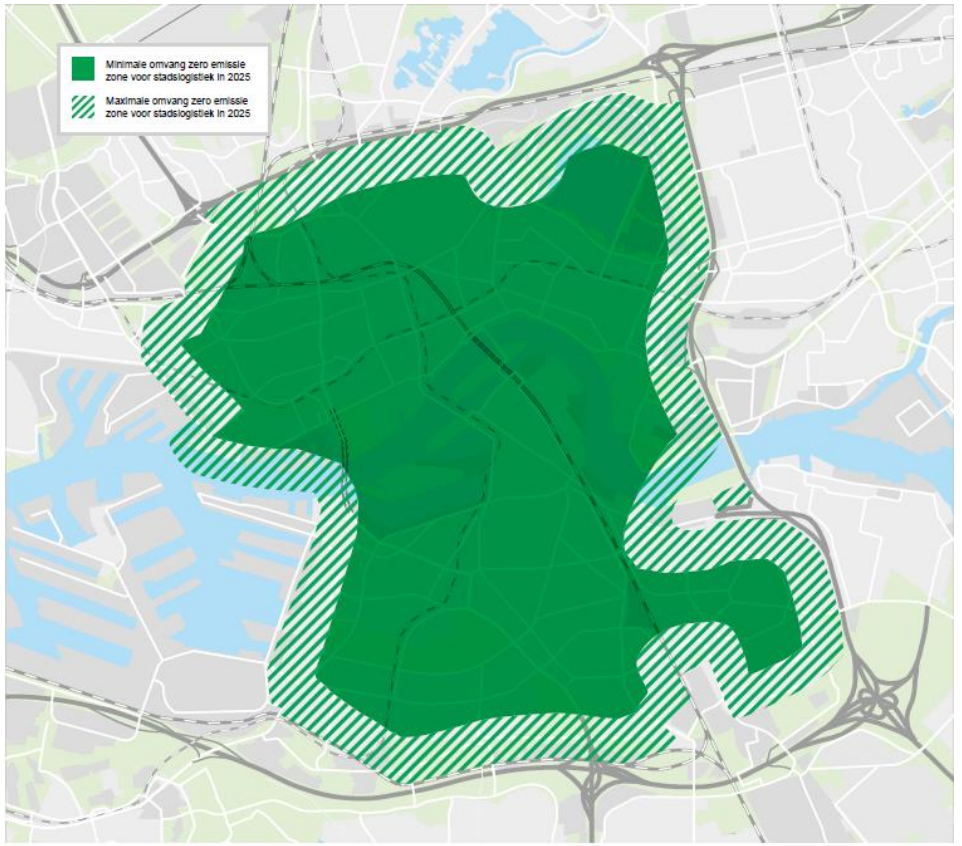
TNO, 2021

CITY LOGISTICS – TARGETED MEASURES

- Effects of tailoared policies to reduce emissions and vehicle kilometres, for instance:
  - Zero emission zone
  - Modal shift to cargobikes for fresh deliveries
  - Local effects of a microhub for parcel deliveries



Municipality of Rotterdam, 2020



Expected zero emission zone in the City of Rotterdam.


THANK YOU FOR YOUR ATTENTION
BRAM.KIN@TNO.NL
TNO innovation for life

Program Futureshop - The Hyperconnected City

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13:00 – 13:10	Welcome	TU Delft
13:10 – 13:20	What is the LEAD Project?	EMT Madrid
13:20 – 13:30	LL The Hague- Partner intro	Partners The Hague
13:30 – 13:50	LEAD Value Cases	Next2Company
13:50 – 14:40	Dialogue	All
14:40 – 14:55	Coffee	
14:55 – 15:10	Urban Strategy: a generic Digital Twin	TNO
15:10 – 15:30	**Digital Twin Platform for on-demand urban logistics**	**Inlecom**
15:30 – 15:50	Case of The Hague	TuDelft
15:55 – 16:45	Discussion: Digital Twin & Decision-making	All
16:45 → 17:00	Closing & Networking	

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Digital Twin Platform

The Hague workshop: Futureshop: Hyperconnected city, March 3th, 2022

Dimitra Politaki, INLECOM

dimitra.politaki@inlecomsystems.com

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Why Digital Twins in last mile logistics?

Digital Twins serve as an impact assessment environment for:

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LEAD Platform Design

Authorities & Business Users

Interface – Dashboard of Decision Support System (DSS)

What -if scenarios - Logic - Cognitive Engine

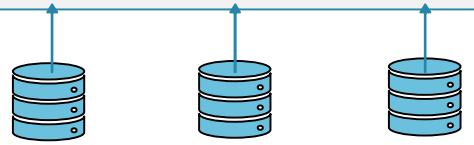
APIs

Digital Twin Generic Models Library

Externalities

Echelon | COPERT | Parcel Generator | Parcel Market | Parcel Scheduling | ….

Data Ingestion



DATA

DDDAS

RESPONS

Living Labs (Digital Twin)

MADRID, BUDAPEST, HAGUE, LYON, OSLO, PO

SENSING

(CITY PLATFORMS, GEO DATA, OPERATIONAL SYSTEMS)

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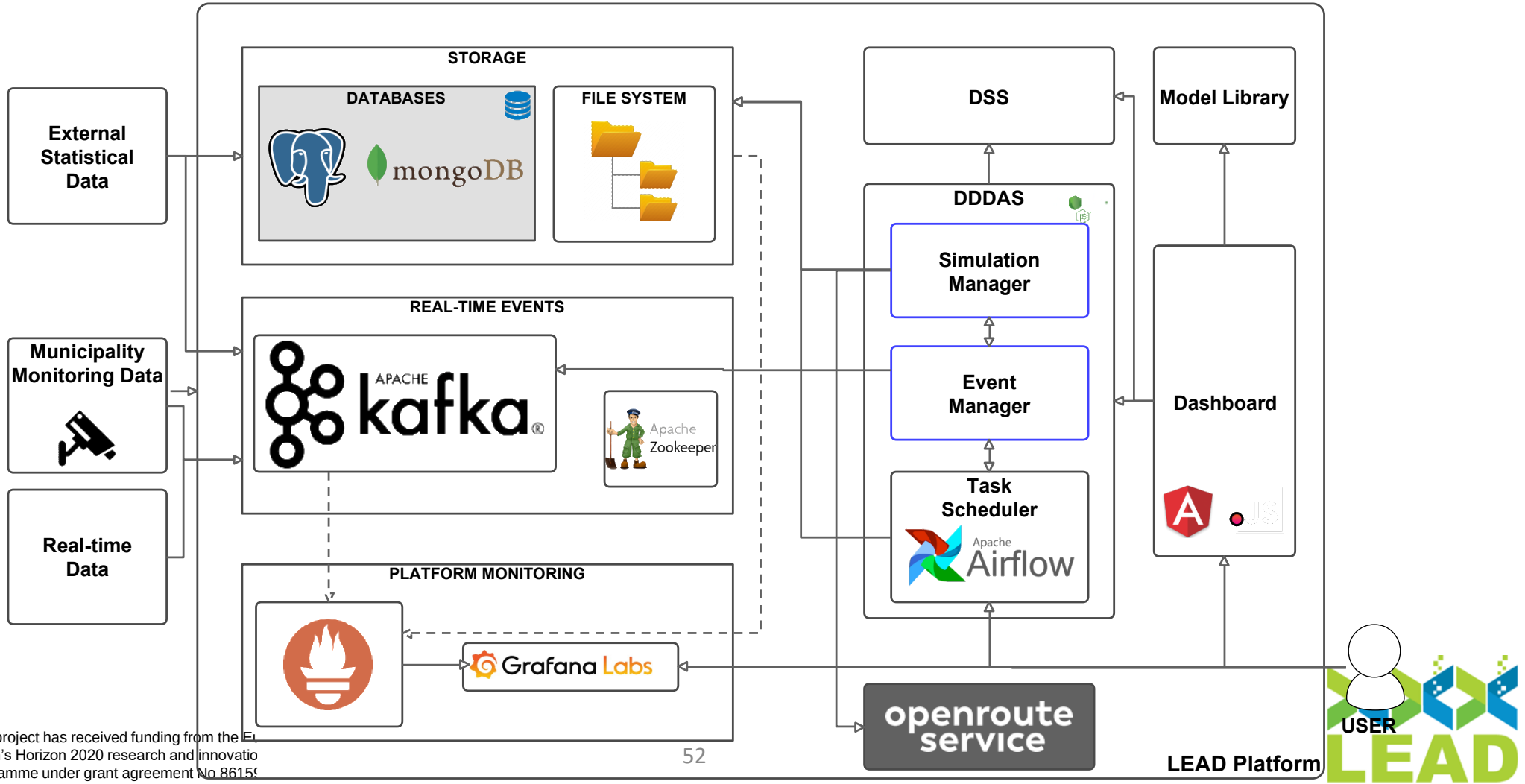
LEAD Platform Components – Technologies Employed



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The Hague Living Lab

- **Living Lab focus**

  Integrated last-mile logistics with demand-supply matching platforms

- **Digital twin models**
  - Parcel Generator
  - Parcel Market
  - Parcel Scheduling
  - 2 connectors

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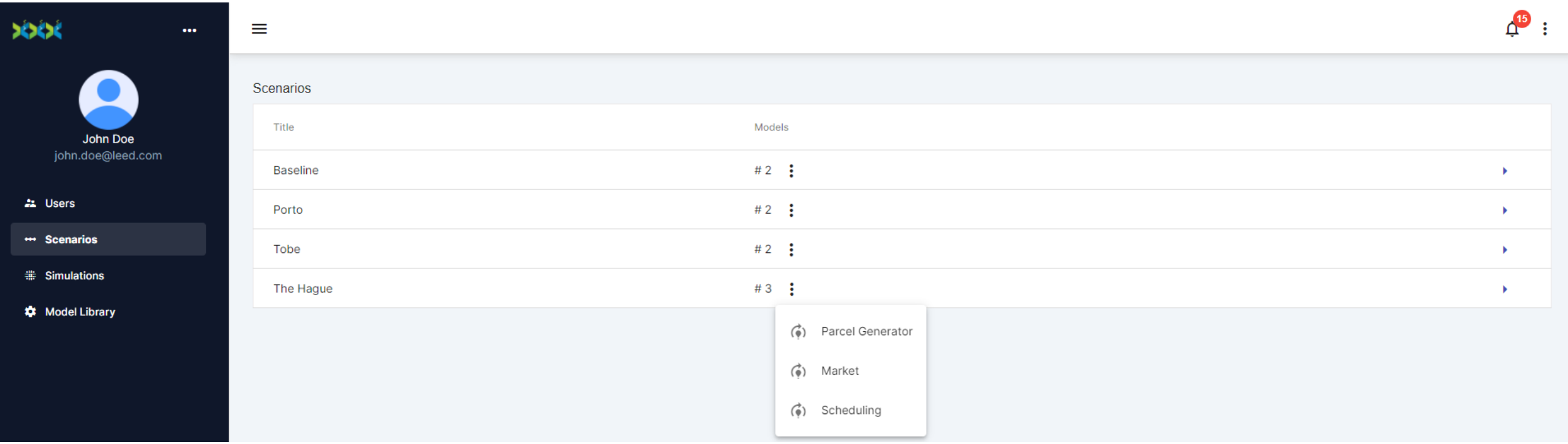
Desicion Support System - Scenarios list and related models



Containerised models
Model 1: Parcel Gen Model 2: Parcel Market Model 3: Parcel Scheduling

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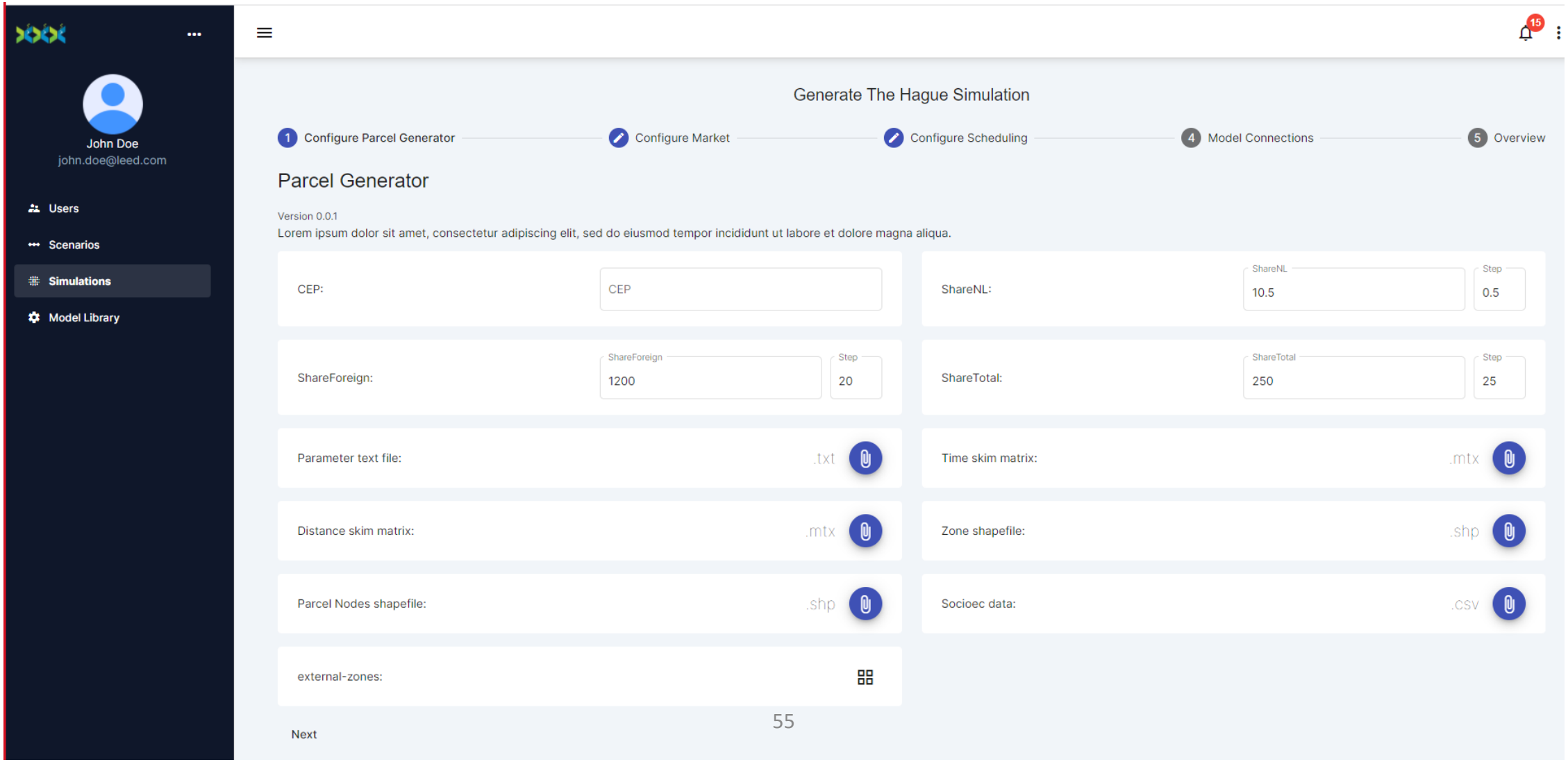
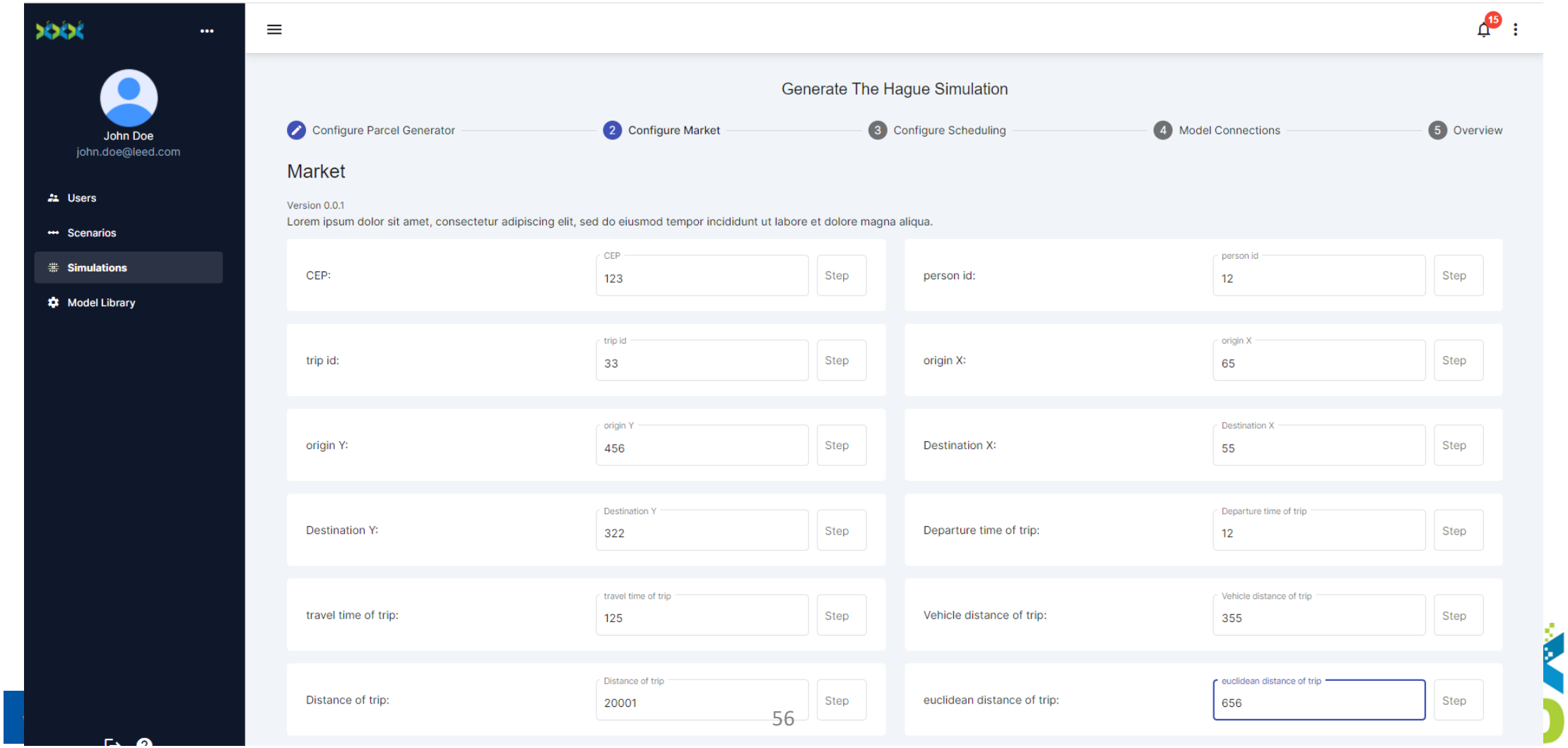
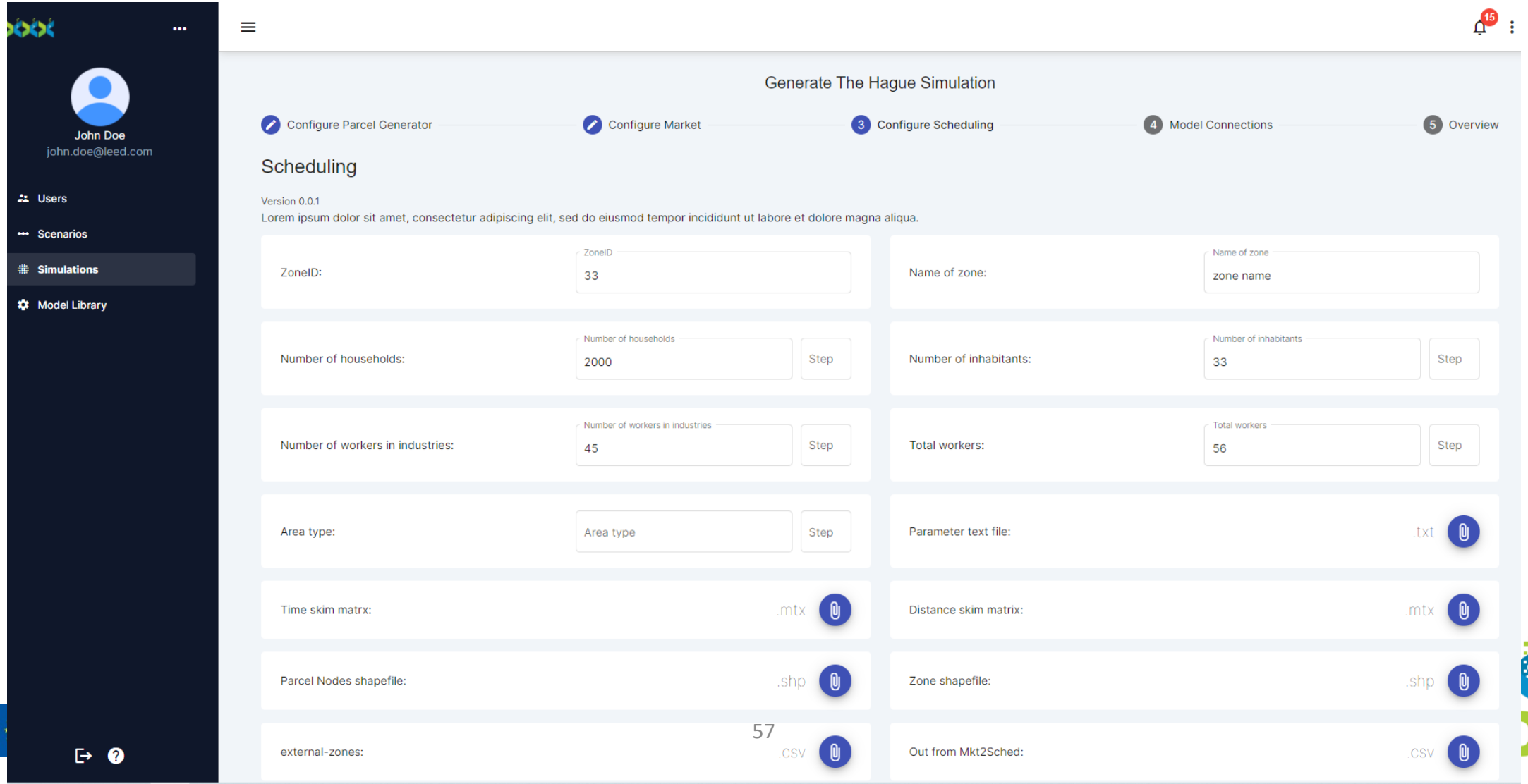
Parcel Generation model configuration – parameters' input



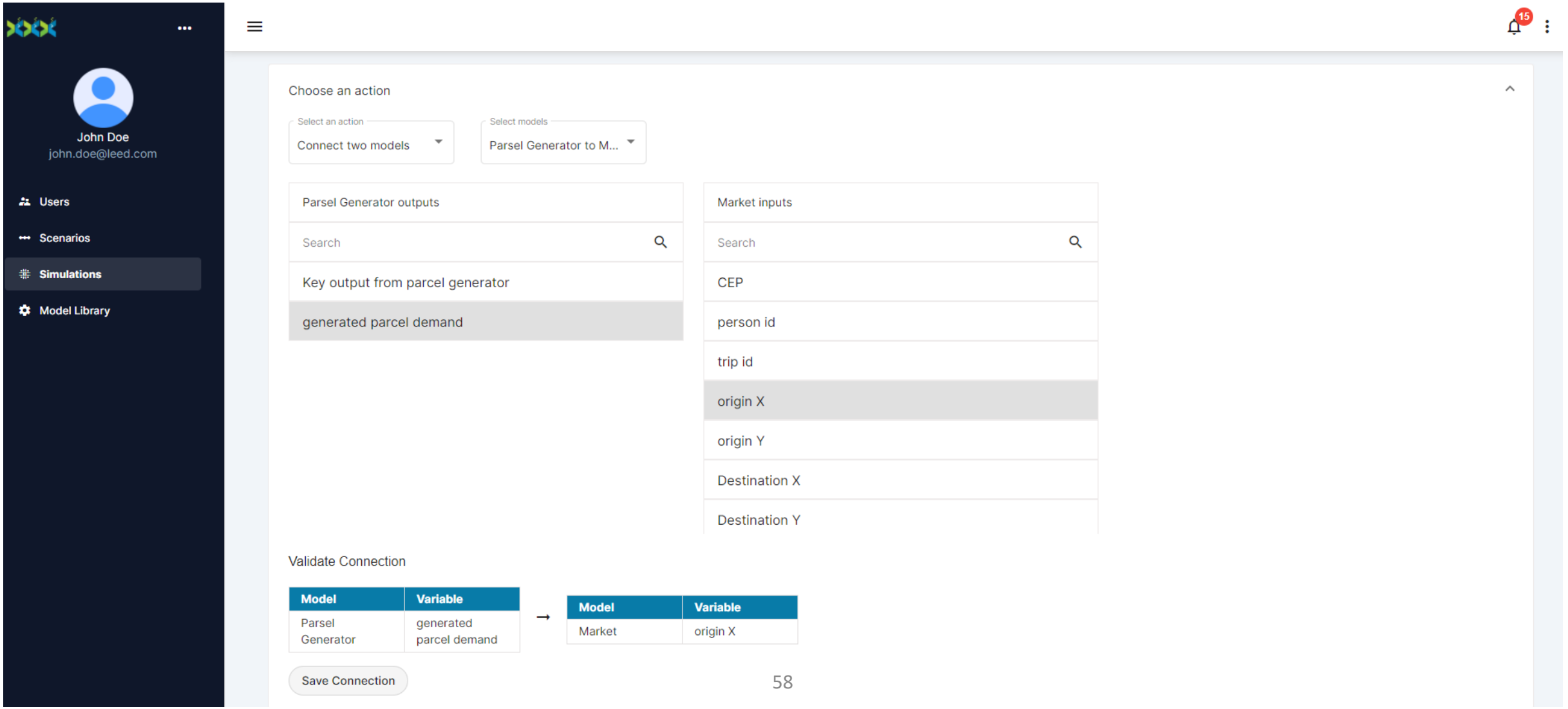
Parcel Market model configuration



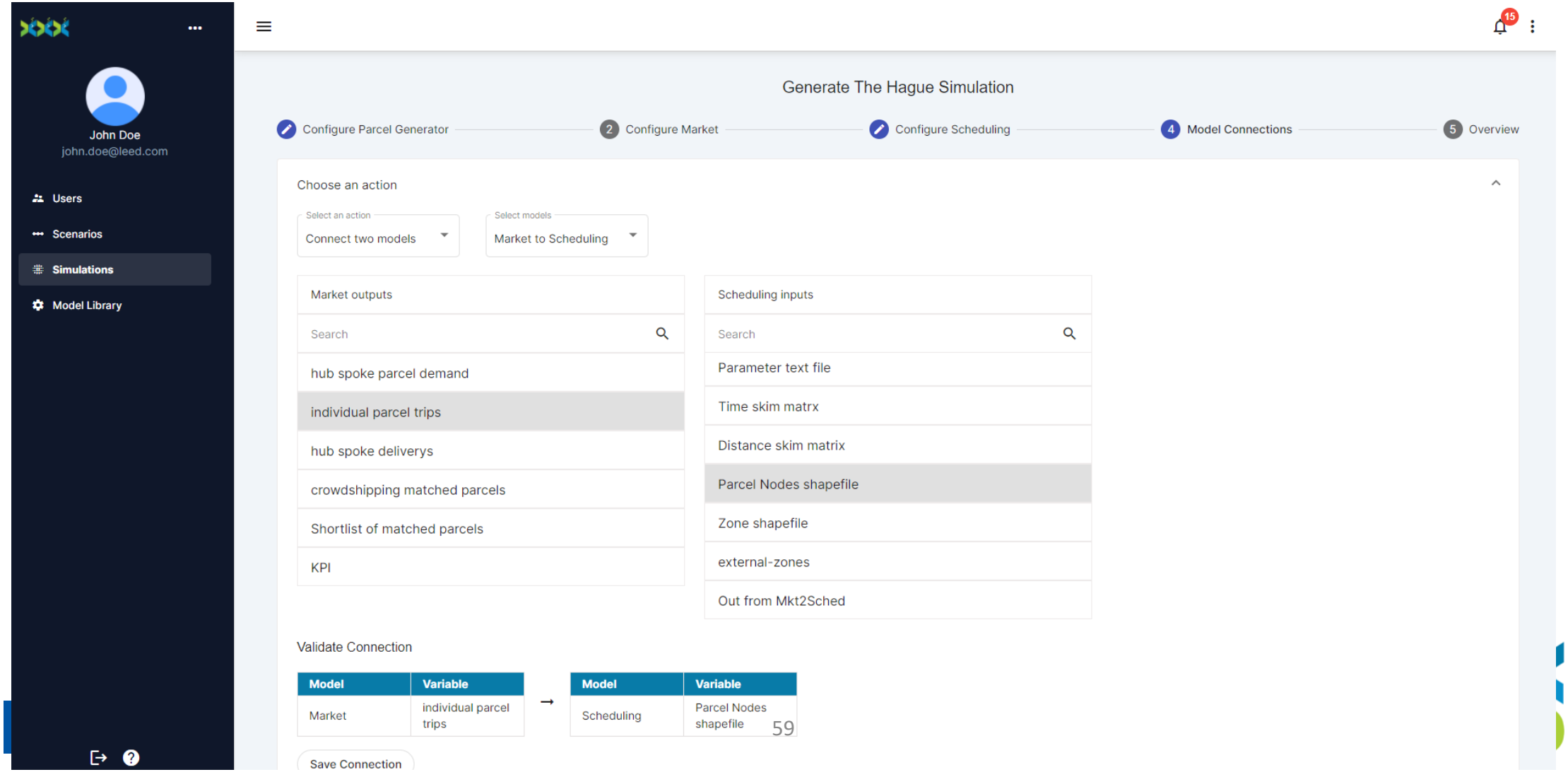
Parcel Scheduling model configuration



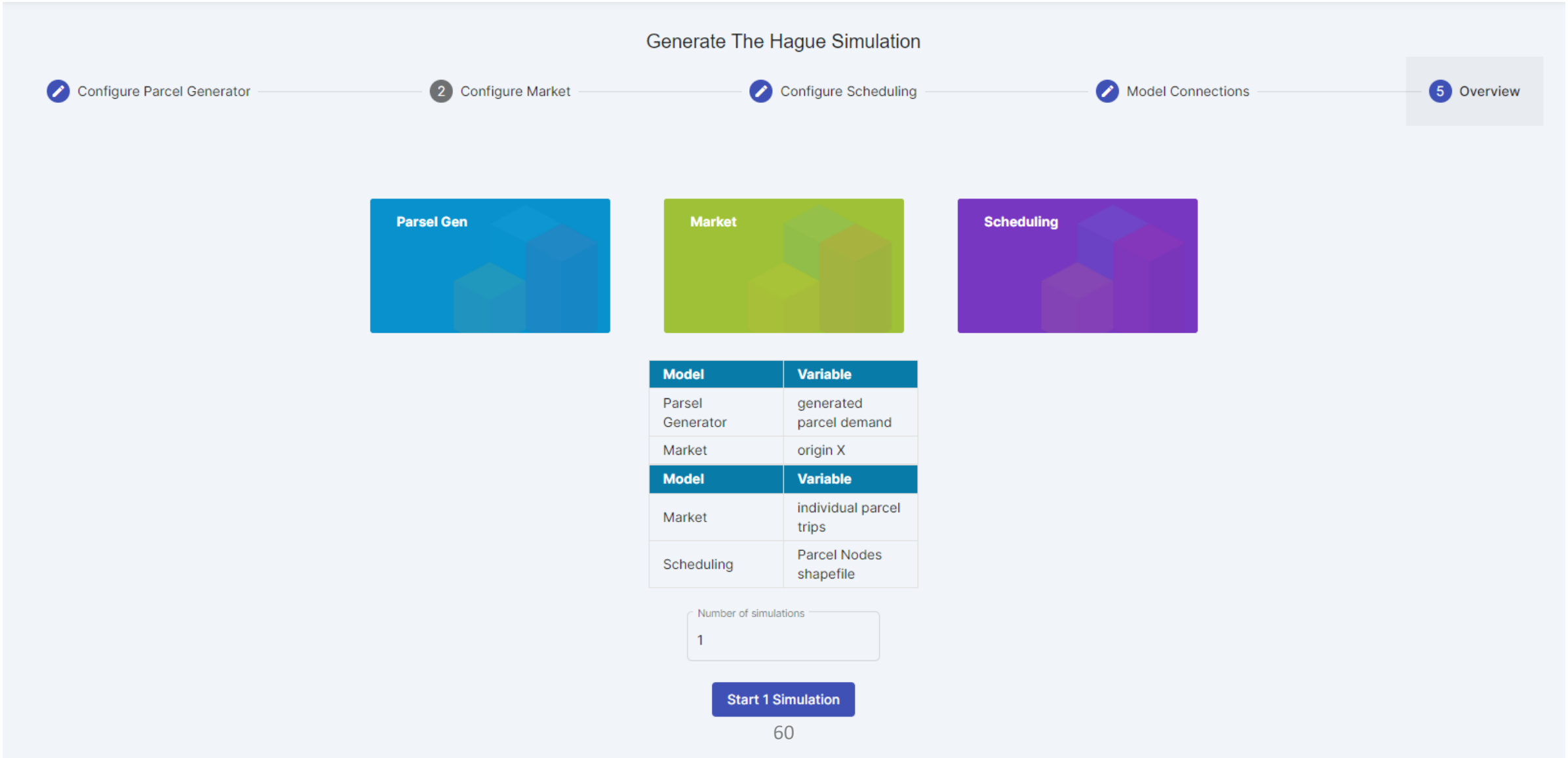
Connecting Models



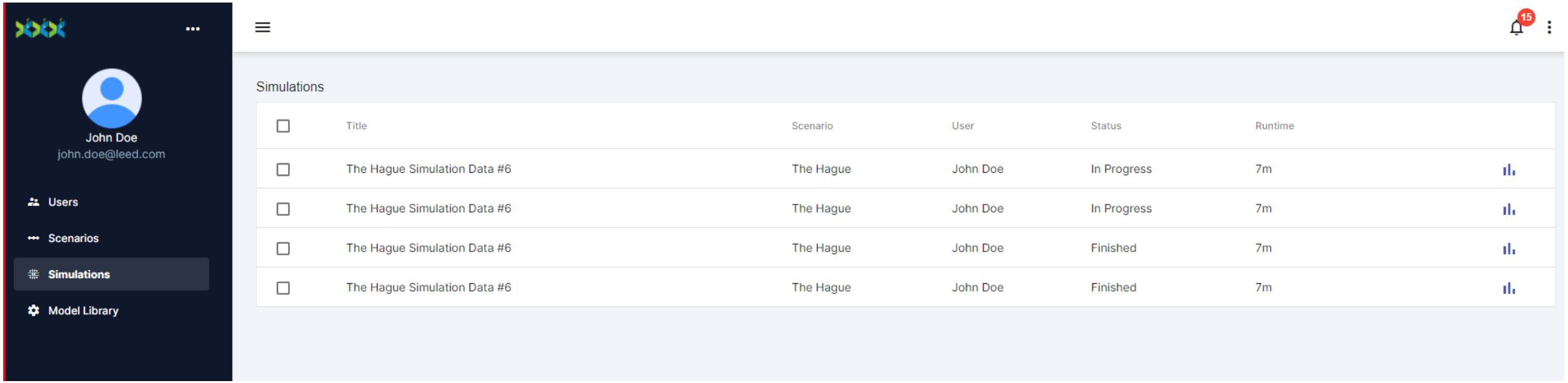
Connection Model 2 & Model 3



Overview of models' connections



Executed Simulations



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Scenario Outputs (per simulation)

Union's Horizon 2020 research and innovation programme under grant agreement No 861598

More results..

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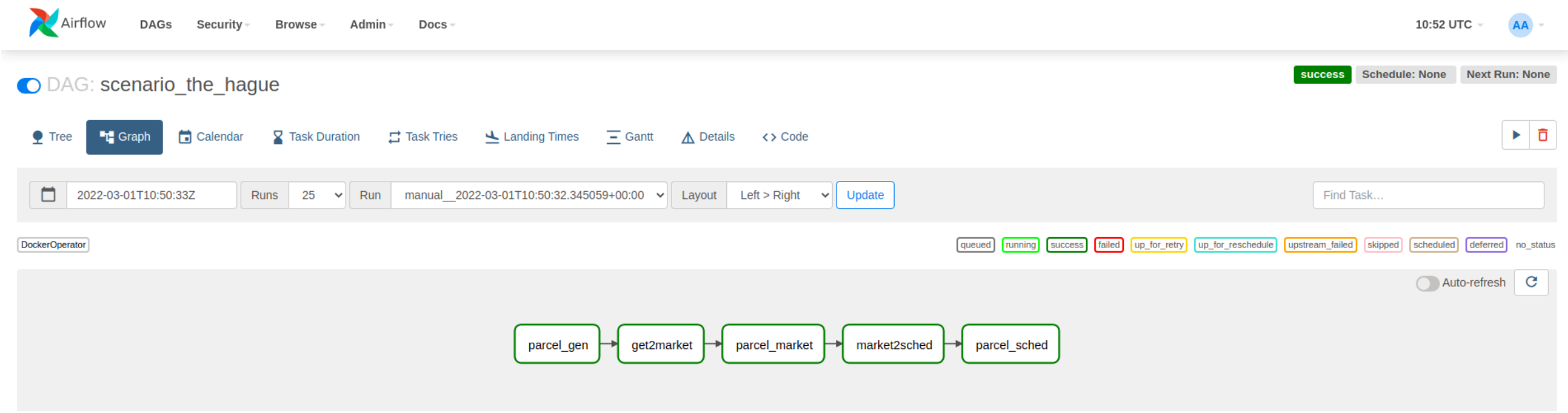
Scheduler – Directed Acyclic Graphs (DAG)



Each DAG represents a scenario

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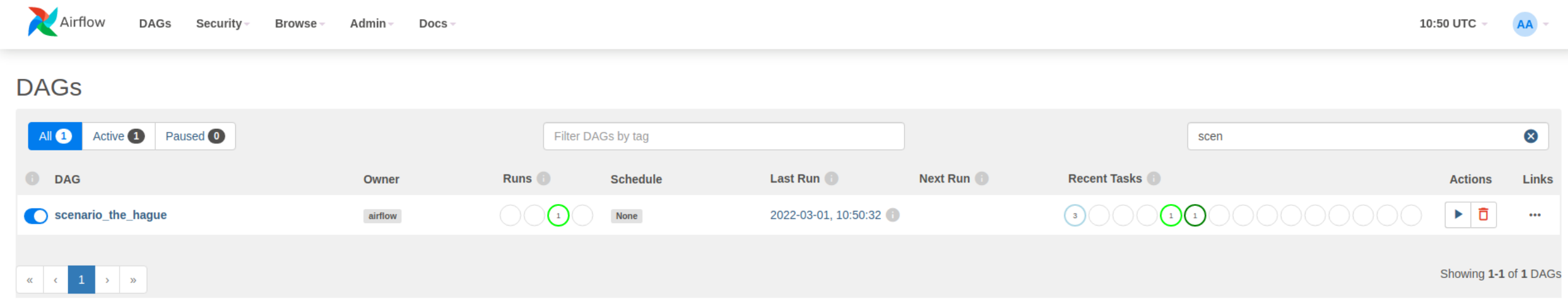
Models' execution status



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Key take-aways

Open LEAD DT platform

Scalability (not only LLs)

Sequence of models

Data fusion

Models Reusability

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Thank you!

Dimitra Politaki, INLECOM

dimitra.politaki@inlecomsystems.com

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Program Futureshop - The Hyperconnected City

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Futureshop The Hague
Modelling approach

Rodrigo Javier Tapia, r.j.tapia@tudelft.nl , TUDelft
03/03/2022

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THE CIVITAS INITIATIVE IS CO-FINANCED BY THE EUROPEAN UNION

Outline

Recap

The system

Mass-GT

Parcel Market modelling

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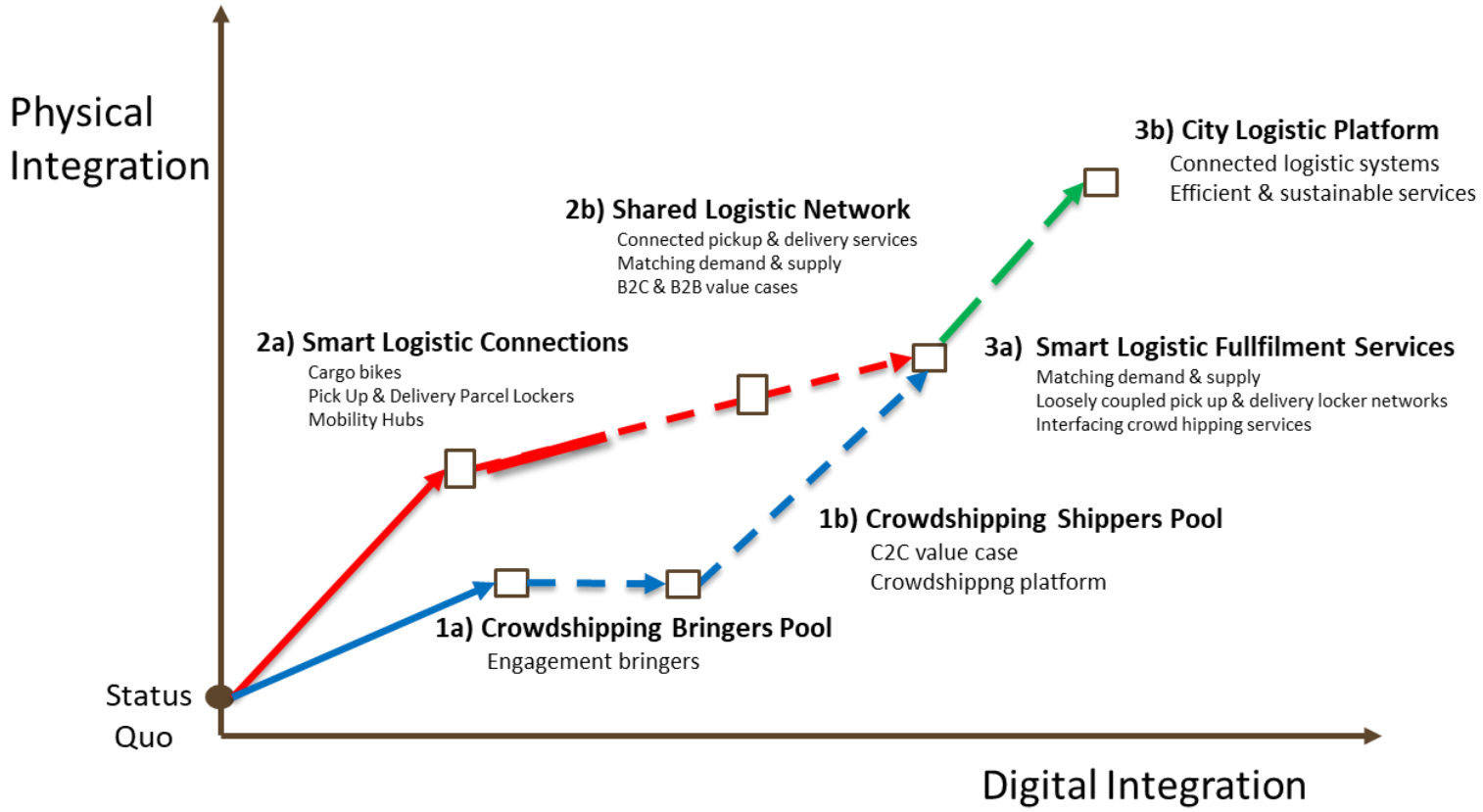
Recap - The Hague LL



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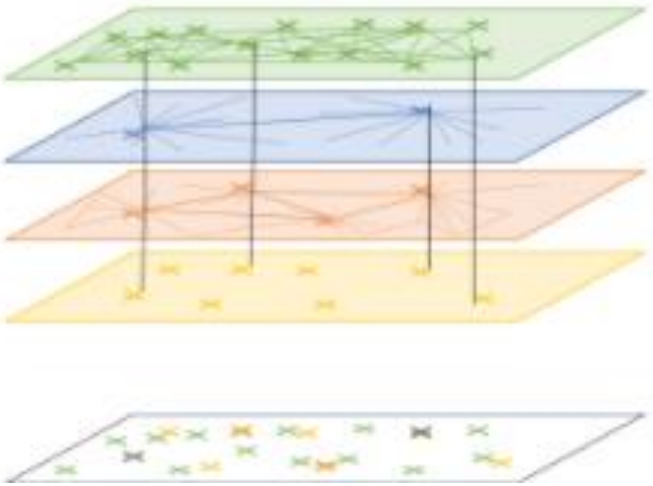
Recap – P.I. and “hyperconnectivity”



Crowdshipping

Conventional (DHL/PostNL)

Cycloon (as part of fietskoeriers.NL)

Fietskoeriers Den Haag

Hyperconnected (multimodal)

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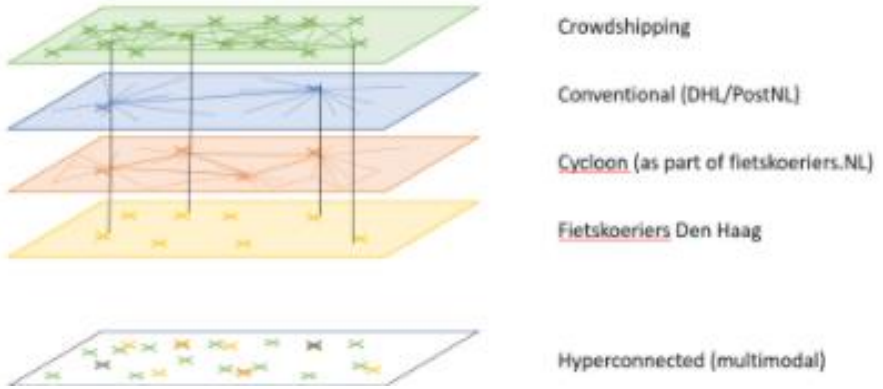
Digital Twin Modeling

- Main objective: simulate Hyperconnectivity
- Specific LEAD interventions
  - Crowdshipping
  - Connection between LSPs

- Low twinning rate
  - Depots location
  - Logistic providers in the market with market shares
  - Network LoS
  - Parcel demand parameters



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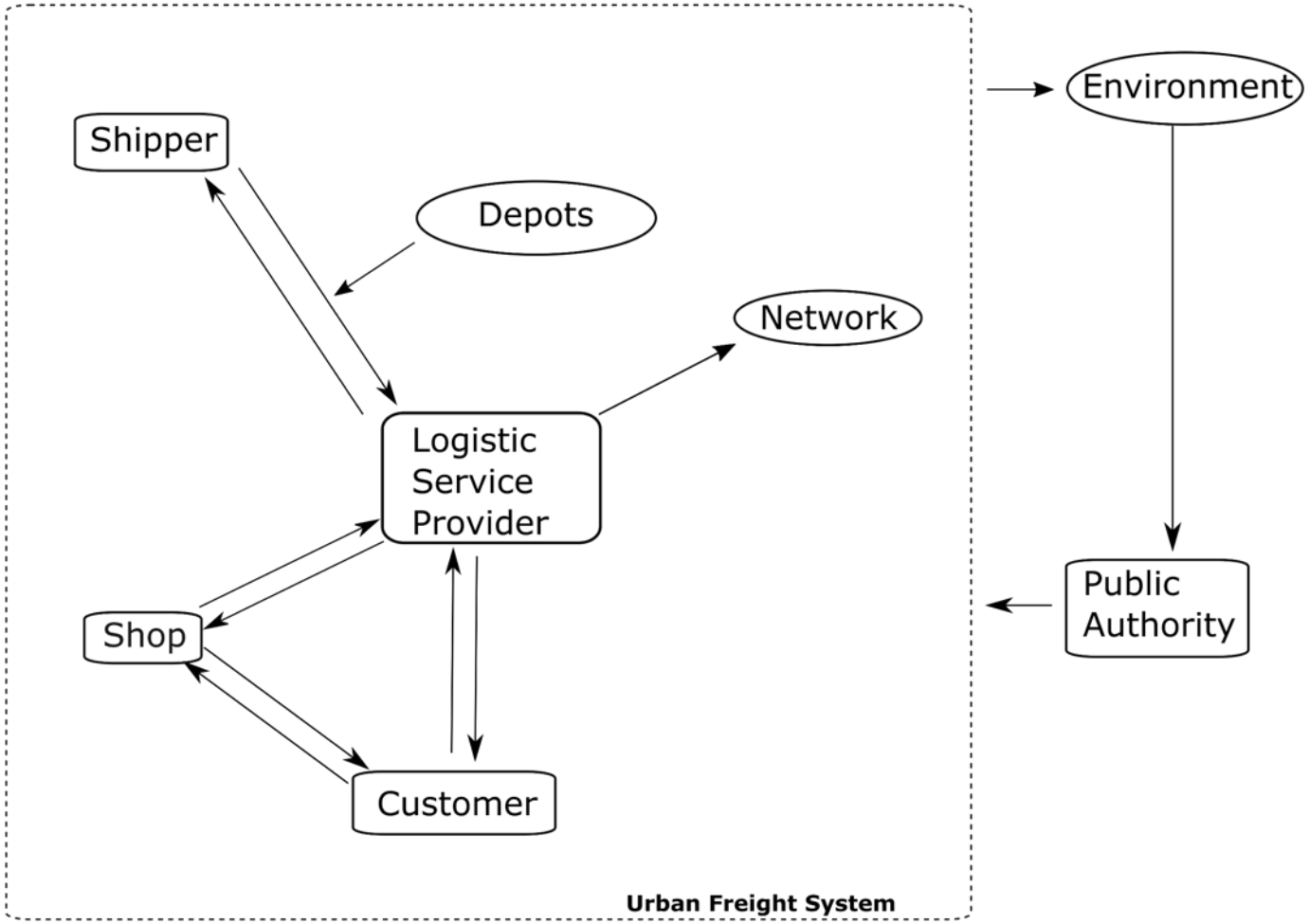
Agents in freight modelling



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Research objective of MASS-GT

The MASS-GT research project aims at developing a more comprehensive behavioral multi-agent microsimulation framework for strategic freight transport demand

Key design principles:

- Evidence based (data!)
- Agent-based: to represent the heterogeneity in city logistics: producers, consumers, carriers, public administrators
- Shipment-based: more behavioural realism
- Layered approach: Strategic and Tactical logistic decisions are simulated in different layers

To manage complexity during model development we follow an incremental development process.

- In H2020 project HARMONY an improved release (v4) of the MASS-GT model is developed
- LEAD is building on what has been developed, with more focus on parcel deliveries

Shipment & parcel demand

- Producer/supplier choice
- Shipment size & vehicle type

Scheduling

- Tour formation
- Time-of-delivery choice

Network module

- Route choice
- Emissions

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LEAD

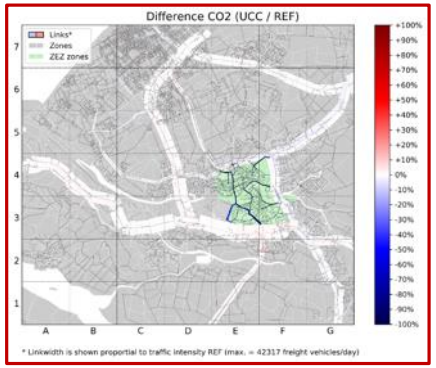
Mass-GT Harmony

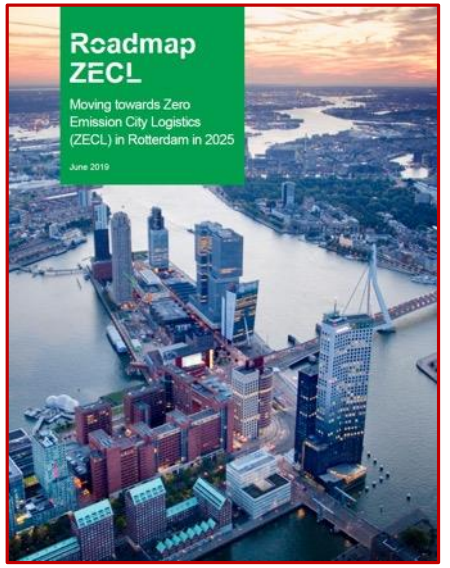
The project scope of HARMONY is to develop a Tactical Freight Simulator for the assessment of new technologies and services.

Use cases include:

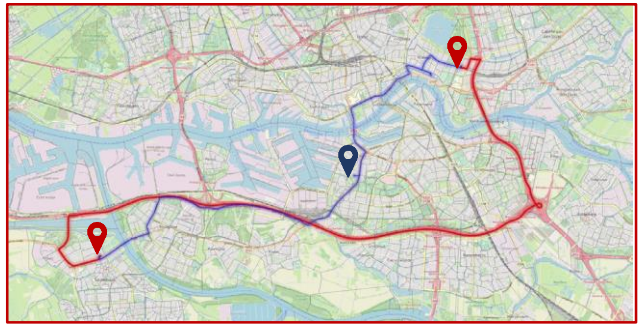
- ❑ Zero –emission zone
- ❑ Heatmaps and carbon footprinting
- ❑ Crowd-shipping
- ❑ Micro-hubs and cargo bikes
- ❑ Land use planning of logistic and industrial sites

Zero-emission zone for Rotterdam:

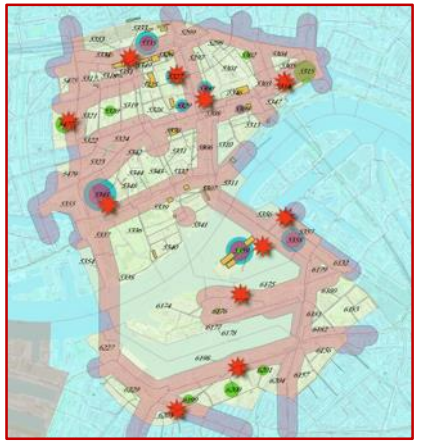




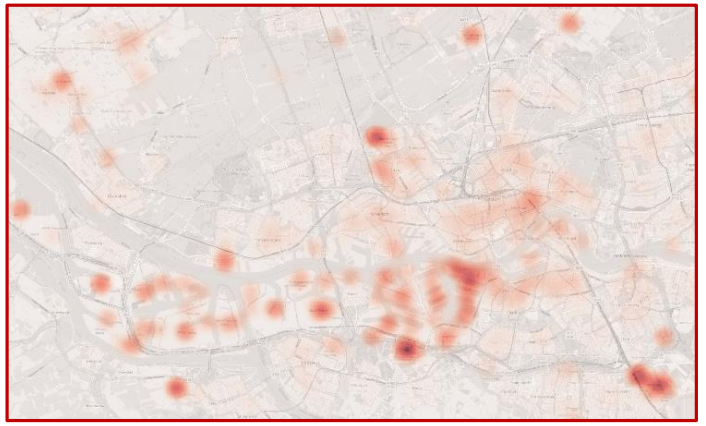
Crowdshipping tourpattern:



Micro-hub locations:



Heatmaps of loading locations:



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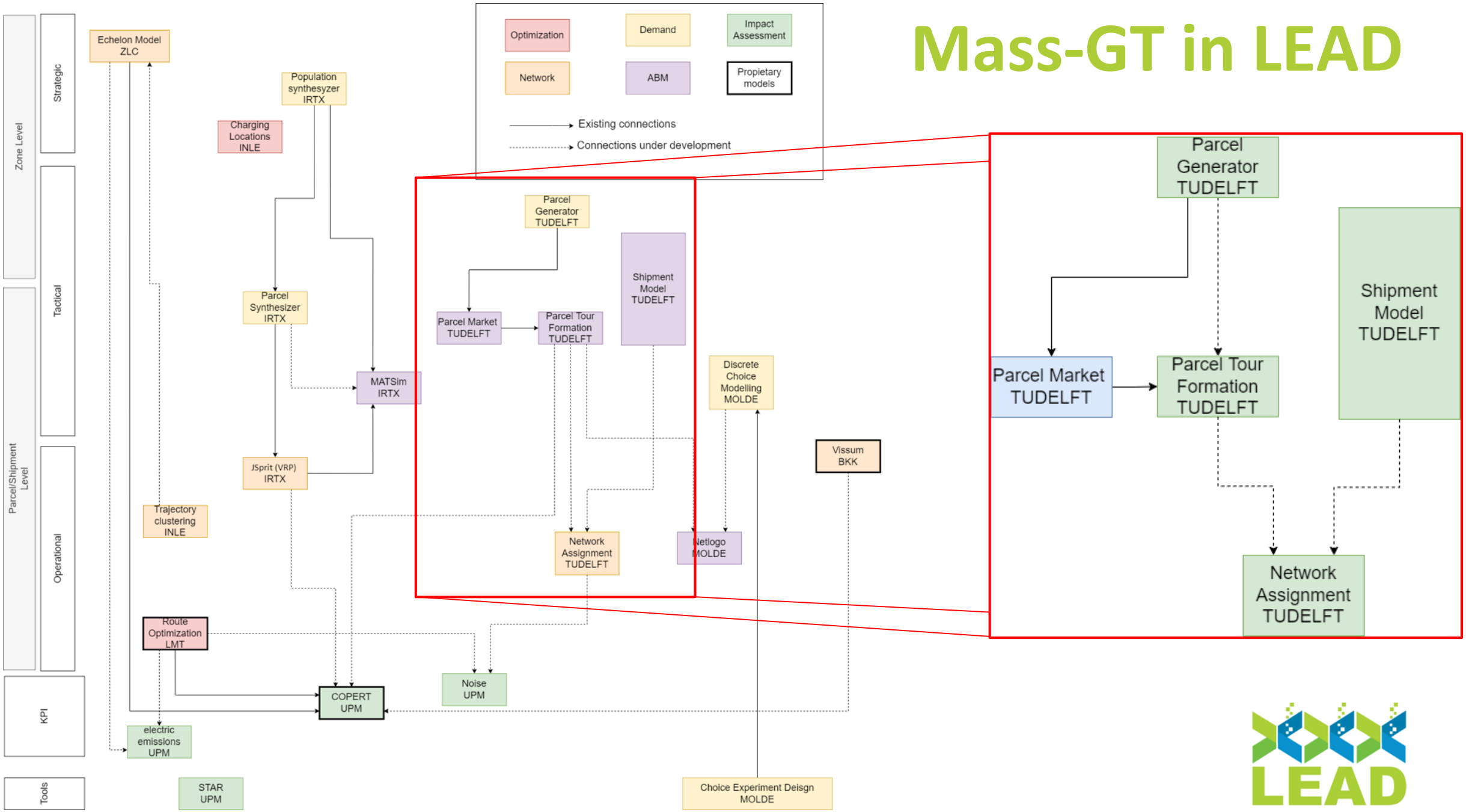
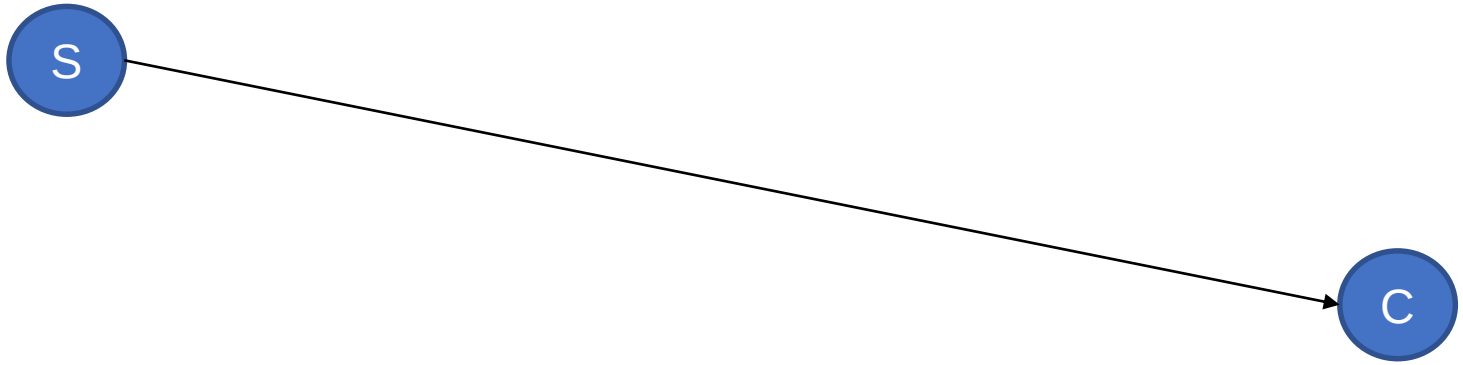
Mass-GT in LEAD



Hyperconnectivity, an agent perspective



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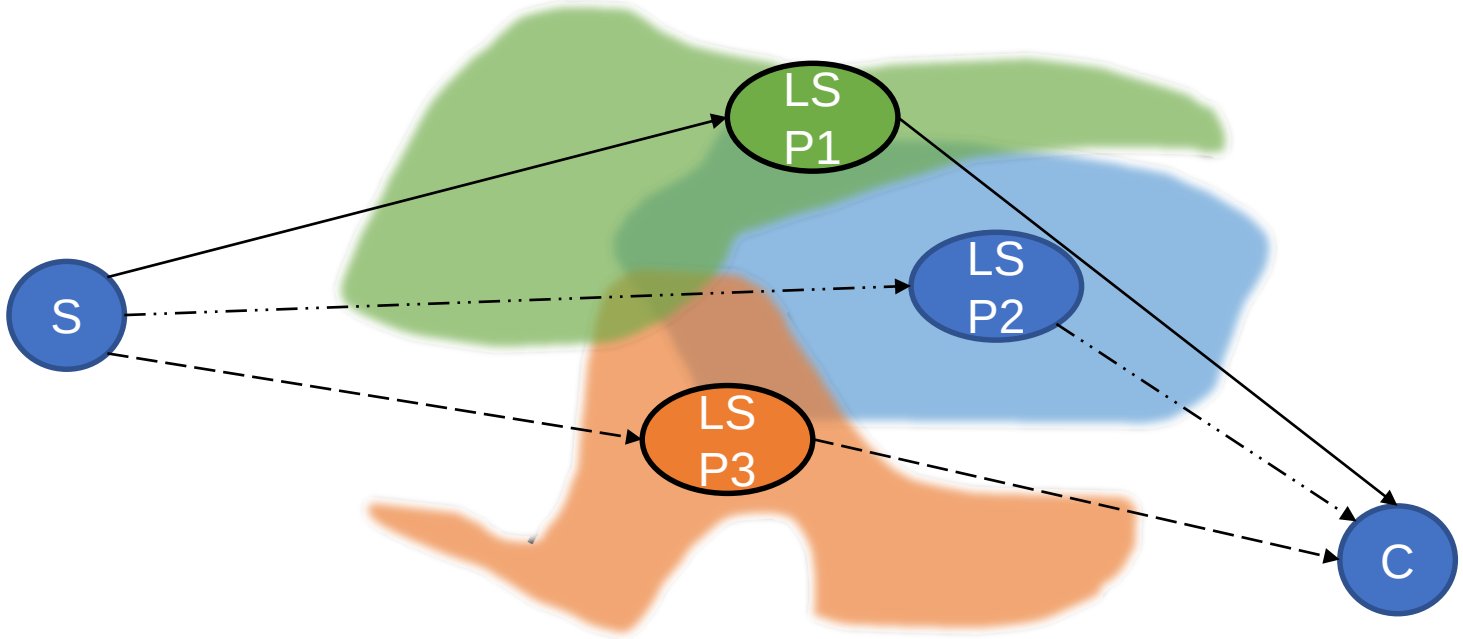
Hyperconnectivity, an agent perspective



mypup

cycloon

nimber

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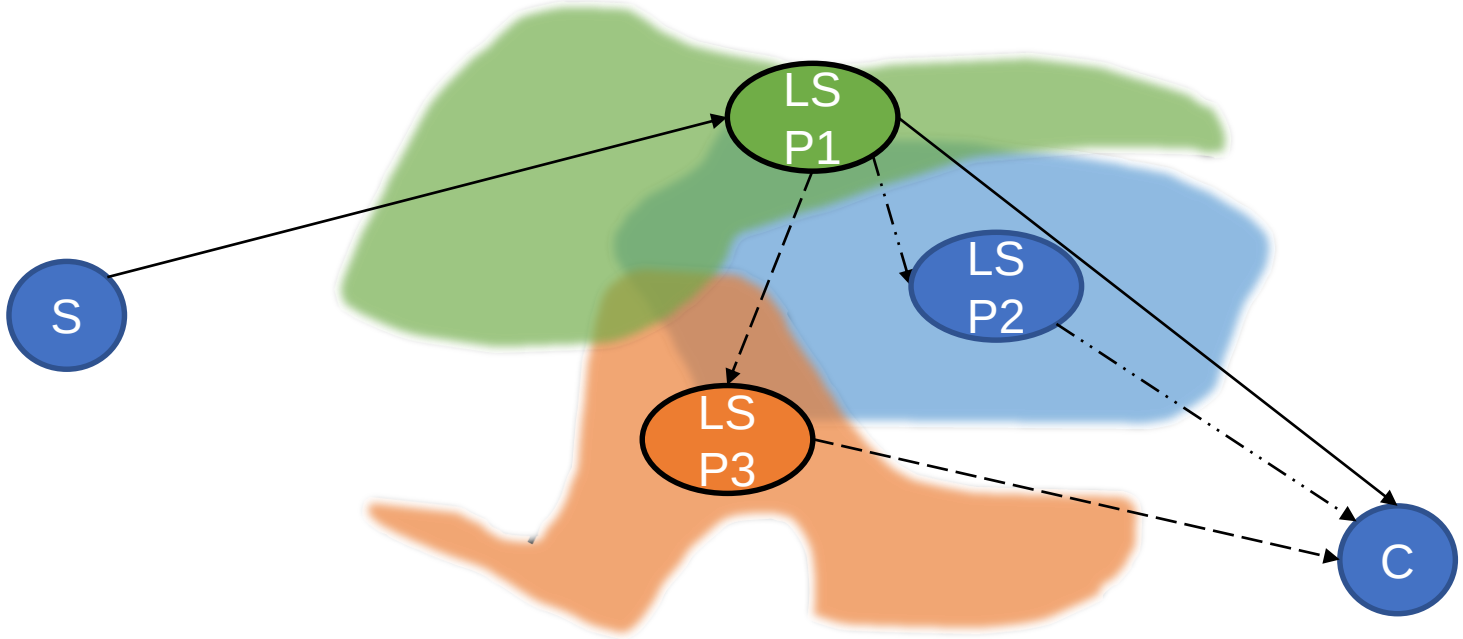
LEAD

Hyperconnectivity, an agent perspective



mypup

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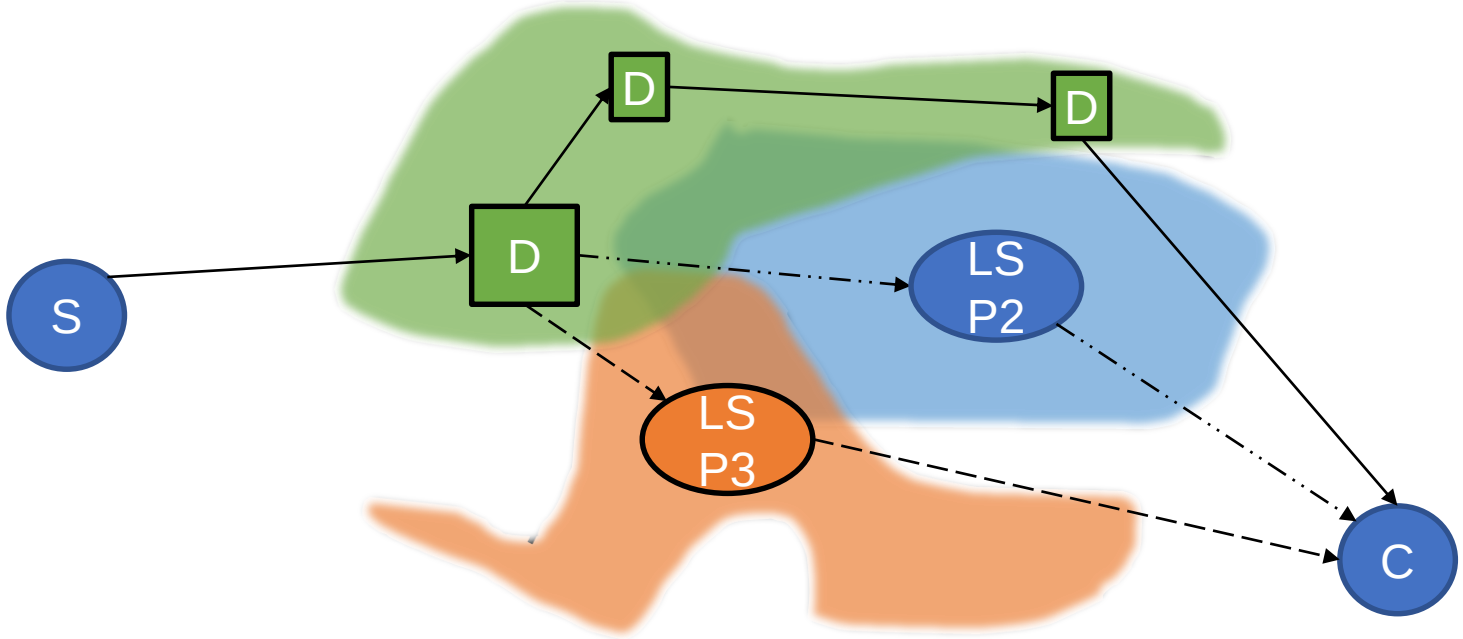
LEAD

Hyperconnectivity, an agent perspective



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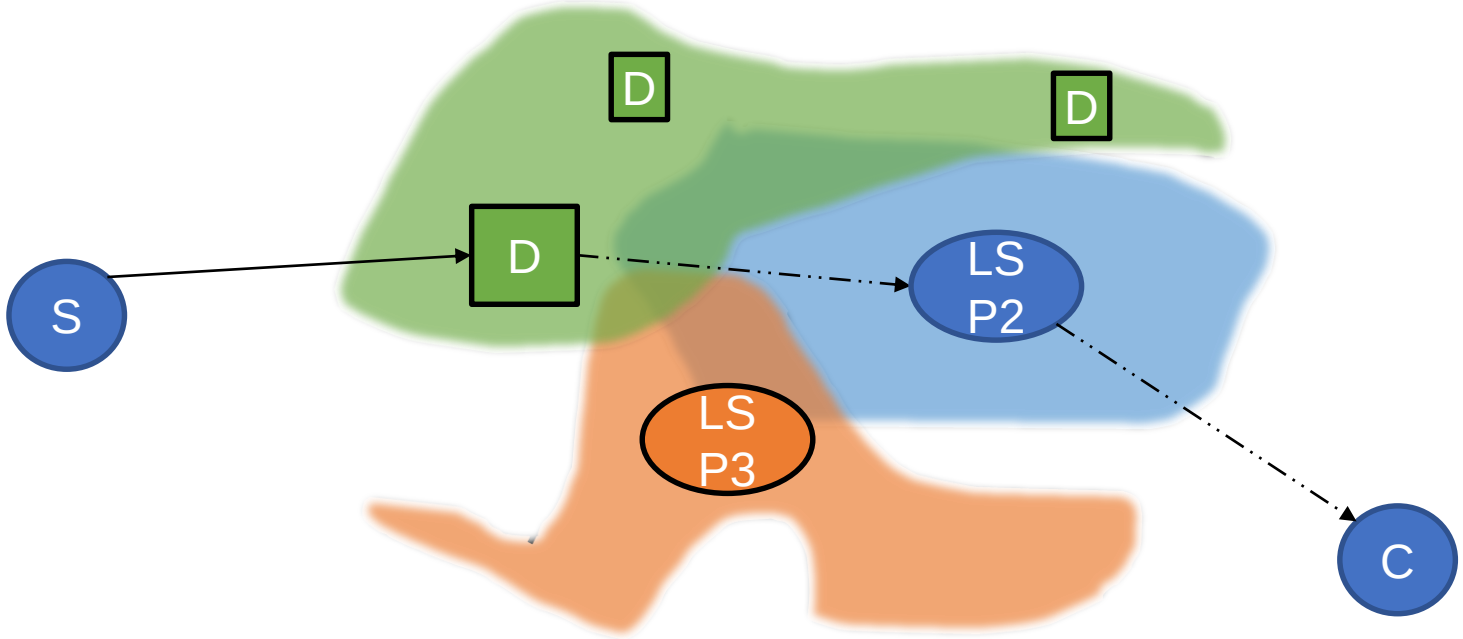
Hyperconnectivity, an agent perspective



mypup

cycloon

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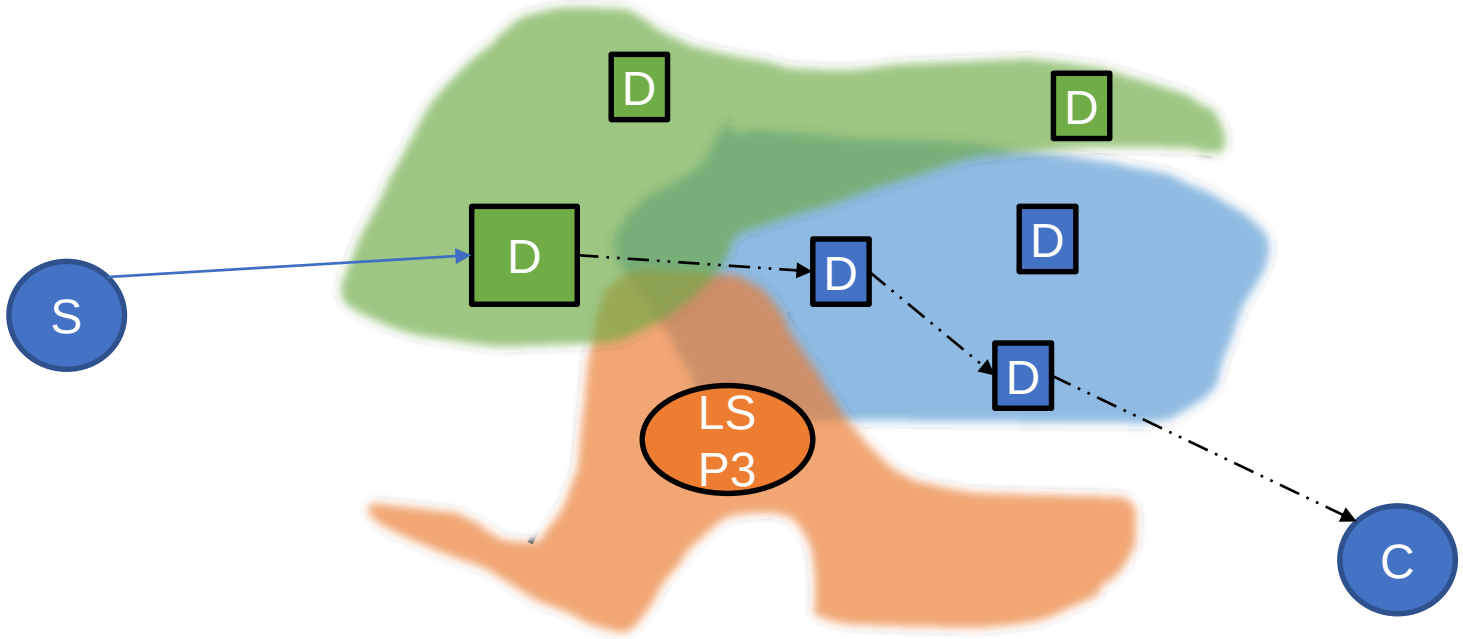
LEAD

Hyperconnectivity, an agent perspective



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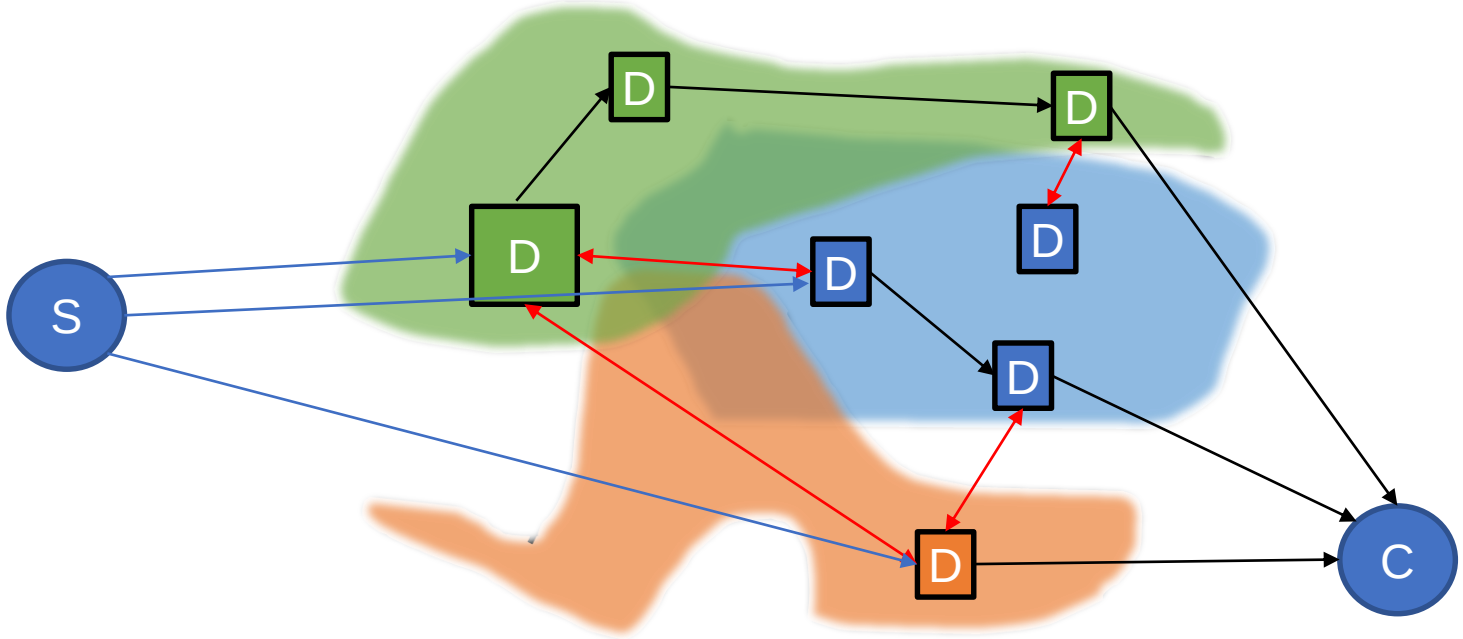
Hyperconnectivity, an agent perspective



mypup

cycloon

nimber

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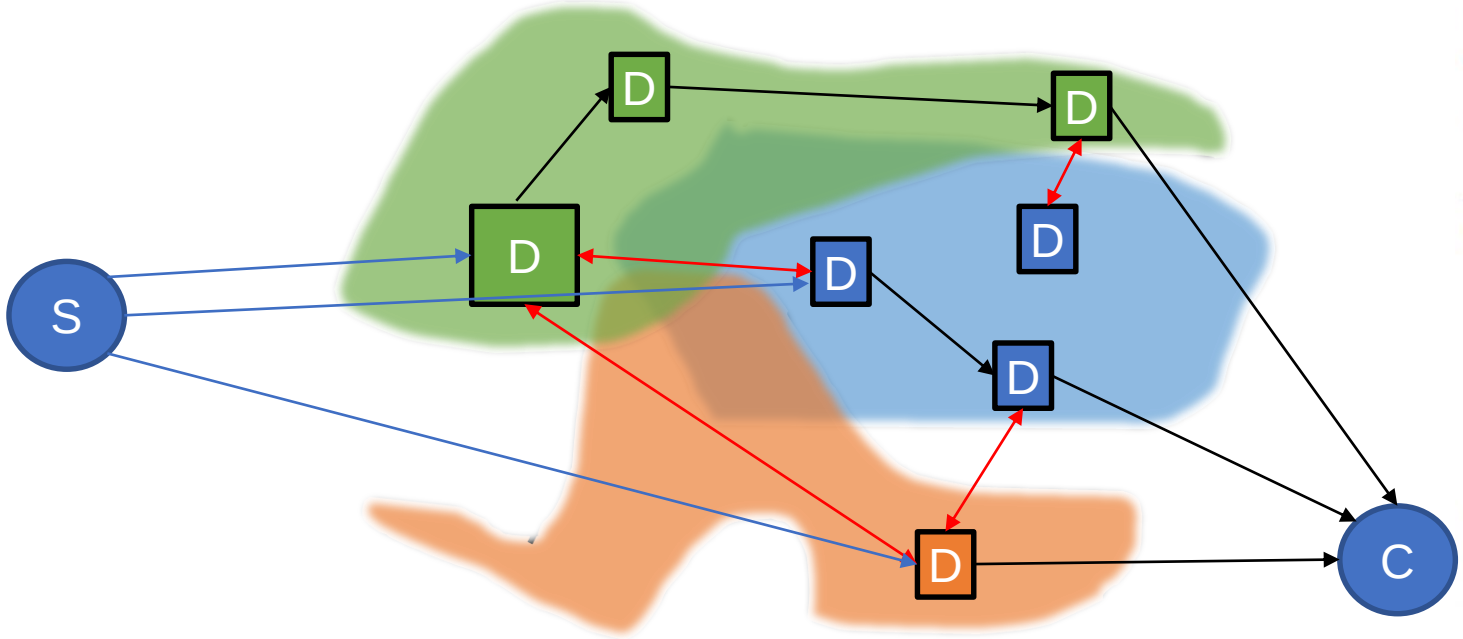
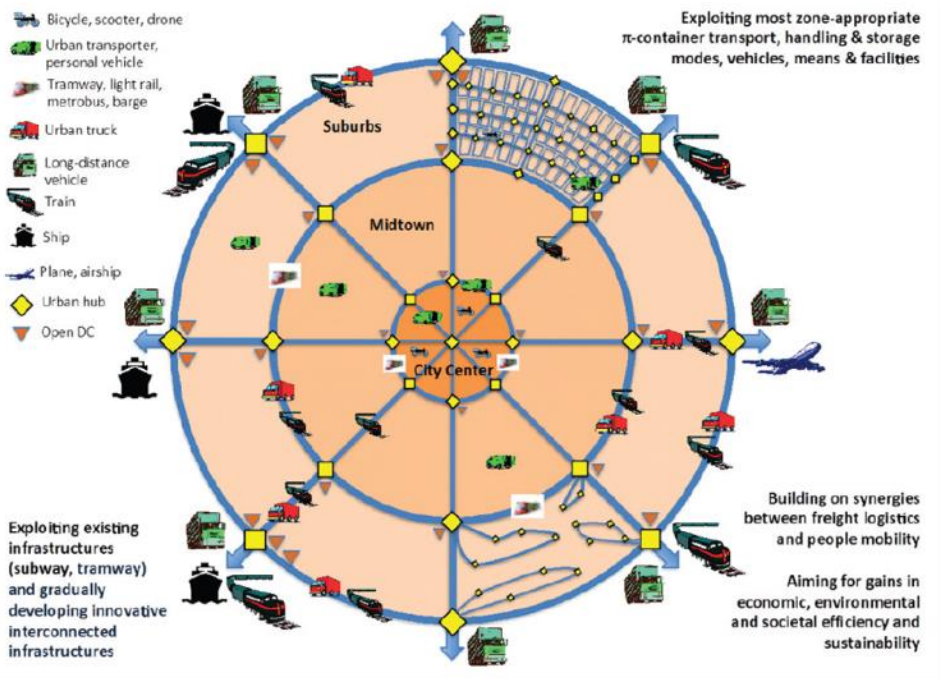
LEAD

Hyperconnectivity, an agent perspective





Crainic & Montruil, 2016

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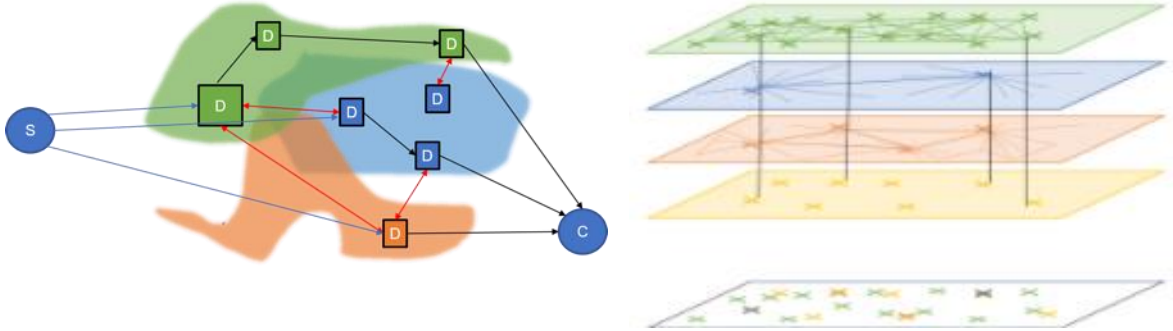
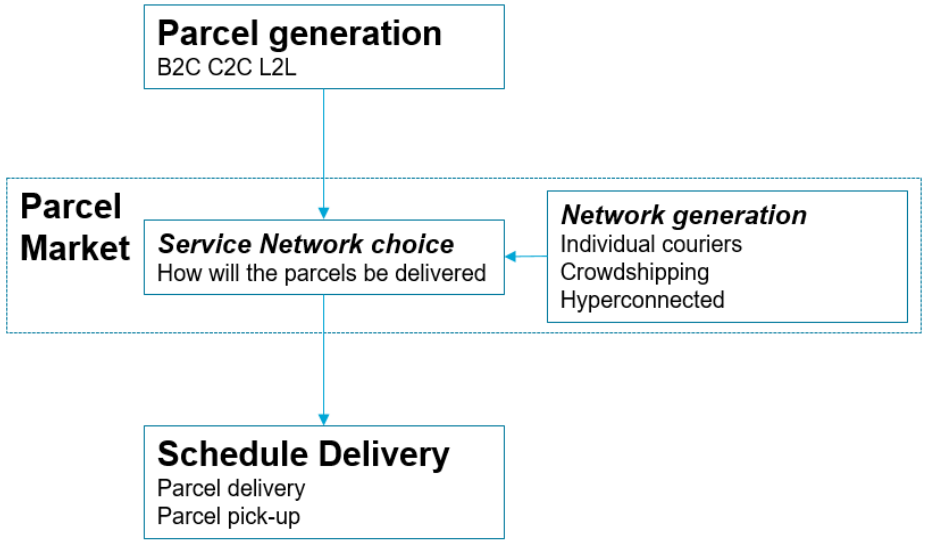
Parcel Market



- Decide the fulfilment of the parcel delivery
- Main actions:
  - Network generation
    - Traditional Couriers
    - Crowdshipping
    - Other LSPs
    - Hyperconnection
  - Choice of service network
    - Deterministic
    - Probabilistic through modal split models



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Parcel Market: Crowdshipping

- Innovations
  - Crowdshipping in a hyperconnected city context
  - Fair comparison between crowdshipping and other options
  - Linkage between activity based models for passengers and logistics
- Possible approaches:
  - Supply driven: Bringer is the main agent
  - Demand driven: Sender is the main agent
  - Here: mixture!
- Passenger trip data: Albatross model (possible: MATSIM)
- Behavioural approach:
  - Why send a parcel? → Willingness to send
  - Why pick up a parcel? → Willingness to bring

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Next steps

- Visualisation
- Estimation of delivery cost
- Parcel lockers implementation
- Detail of logistic segments per company

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Program Futureshop - The Hyperconnected City

Time	Subject	By…
13:00 – 13:10	Welcome	TU Delft
13:10 – 13:20	What is the LEAD Project?	EMT Madrid
13:20 – 13:30	LL The Hague- Partner intro	Partners The Hague
13:30 – 13:50	LEAD Value Cases	Next2Company
13:50 – 14:40	Dialogue	All
14:40 – 14:55	Coffee	
14:55 – 15:10	Urban Strategy: a generic Digital Twin	TNO
15:10 – 15:30	Digital Twin Platform for on-demand urban logistics	Inlecom
15:30 – 15:50	Case of The Hague	TuDelft
15:55 – 16:45	**Discussion: Digital Twin & Decision-making**	**All**
16:45 → 17:00	Closing & Networking	

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Workshop discussion

- How can DTs help in decision making for different agents?
- How can a logistics DT be integrated in a broader urban DT?

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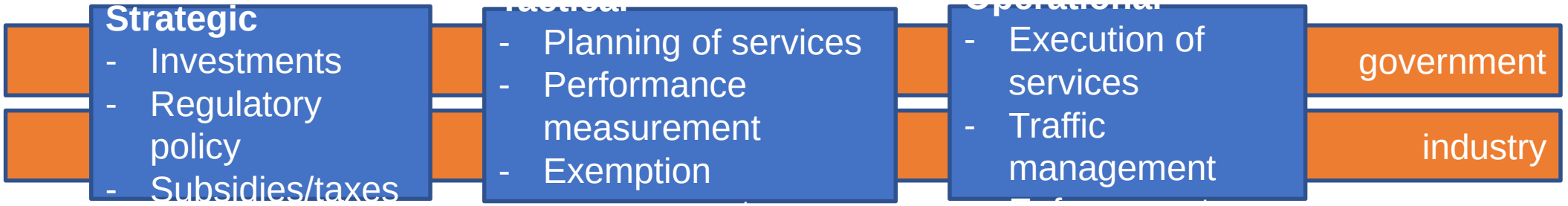
How can DTs help in decision making for different agents?



Typical city DT territory
- Long cycles (decade)
- Input: statistics, surveys
- Output: scenarios

Experimental DT territory
- Shorter cycles (year/months)
- Input: scenarios, observations
- Output: diagnosis, design

Unknown DT territory
- Short cycles (days/hours)
- Input: KPIs from sensors
- Output: action/actuation

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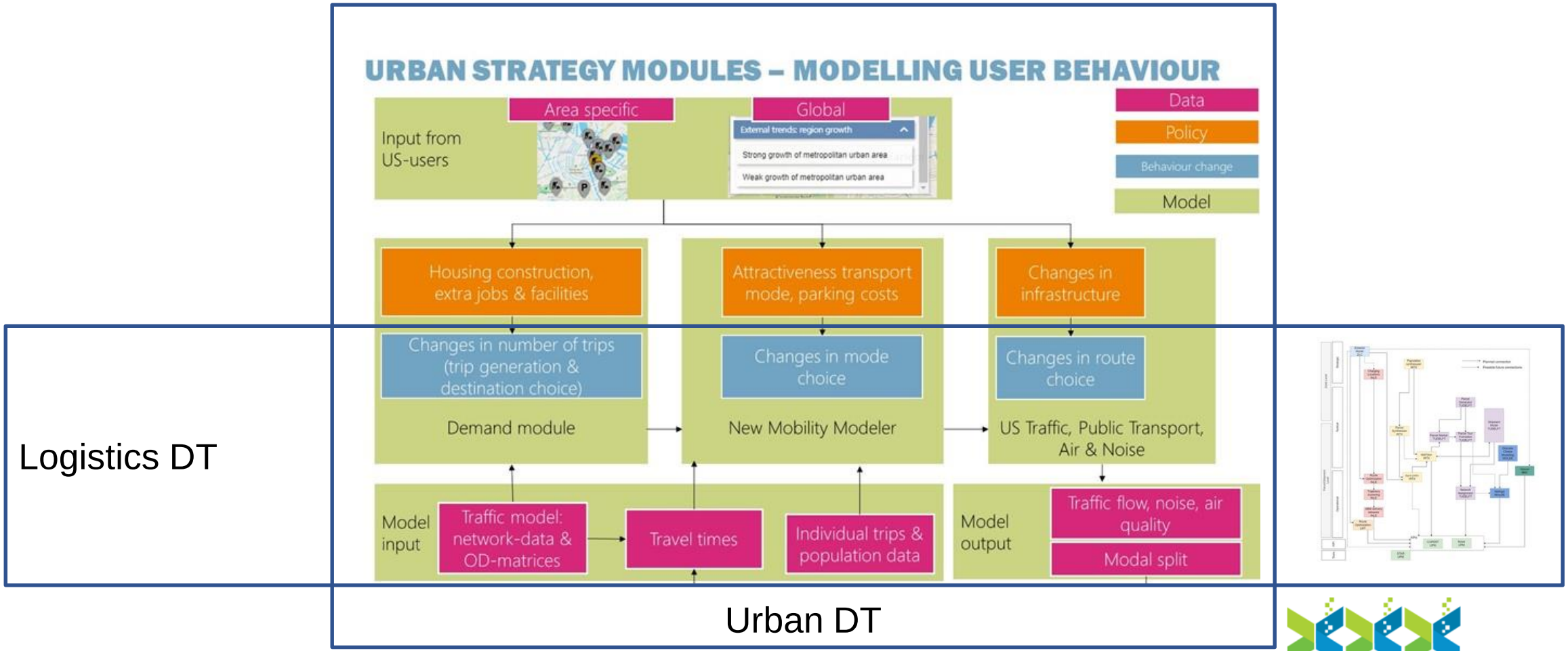
How can a logistics DT be integrated in a broader urban DT?



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Tomorrow we have a city walk

Time	Subject	Who
9:15 – 9:30	Welcome, at CityHall	Jan van der Meer
9:30 – 9:50	City walk	Sven Mittertreiner
9:50 – 10:20	Presentation + Q&A Hubklup, at Grote Markt	Hubklup
10:20 – 10:40	City walk (cont.)	Sven Mittertreiner
10:40 – 11:20	Presentation + Q&A at Cycloon (Coffee)	Cycloon
11:20 – 11:50	Walking back to CityHall	Sven Mittertreiner
11:50 -12:20	MyPup Presentation + QA at CityHall	MyPup
12:20 – 12:30	Closing	*Sven and Rodrigo*

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