

IPIC 2024

10th International
Physical Internet Conference
May 29-31, 2024 | Savannah, GA USA

Welcome Day 3

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IPIEC 2024

10th International
Physical Internet Conference
May 29-31, 2024 | Savannah, GA USA

Plenary Session F-1: Toward Physical Internet Enabled Hyperconnected City Logistics

Louis Faugere, Sr. Applied Scientist, Amazon, USA (Moderator)

9:00-9:30am | Cumberland Ballroom

Unlocking the Future of Last Mile Delivery: Automated, Smart, Secure & Sustainable Solutions Right to Your Doorstep

David Ruth, CEO, MOTO GO Systems, USA

9:30-10:00am | Cumberland Ballroom

Toward Hyperconnected City Logistics - On-Demand Synchromodal Urban Delivery Service Project in Bordeaux, France

Olivier Labarthe, Kedge Business School, France

10:00-10:40am | Cumberland Ballroom

Panel Discussion

Louis Faugere, Eric Ballot, Rod Franklin, Olivier Labarthe, David Ruth (Panelists)

10:40-11:00am Break

IPIC 2024

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Unlocking the Future of Last Mile Delivery: Automated, Smart, Secure & Sustainable Solutions Right to Your Doorstep

**Enhanced Smart and Secure Parcels for PI Metropolitan,
Localize Fulfilment of Goods!**



David Ruth

CEO & Founder Motogo

Toward Hyperconnected City Logistics On-Demand Synchromodal Urban Delivery Service Project in Bordeaux, France

Olivier LABARTHE

Urban Logistics Living Lab.

The Centre of Excellence for Supply Chain Innovation & Transportation (CESIT)

KEDGE Business School, Bordeaux, France

May 31st, 2024

BORDEAUX METROPOLE, FRANCE



Bordeaux Métropole : 28 municipalities



Population: 830 000
(Bordeaux: 256 000)
+15% in 10 years

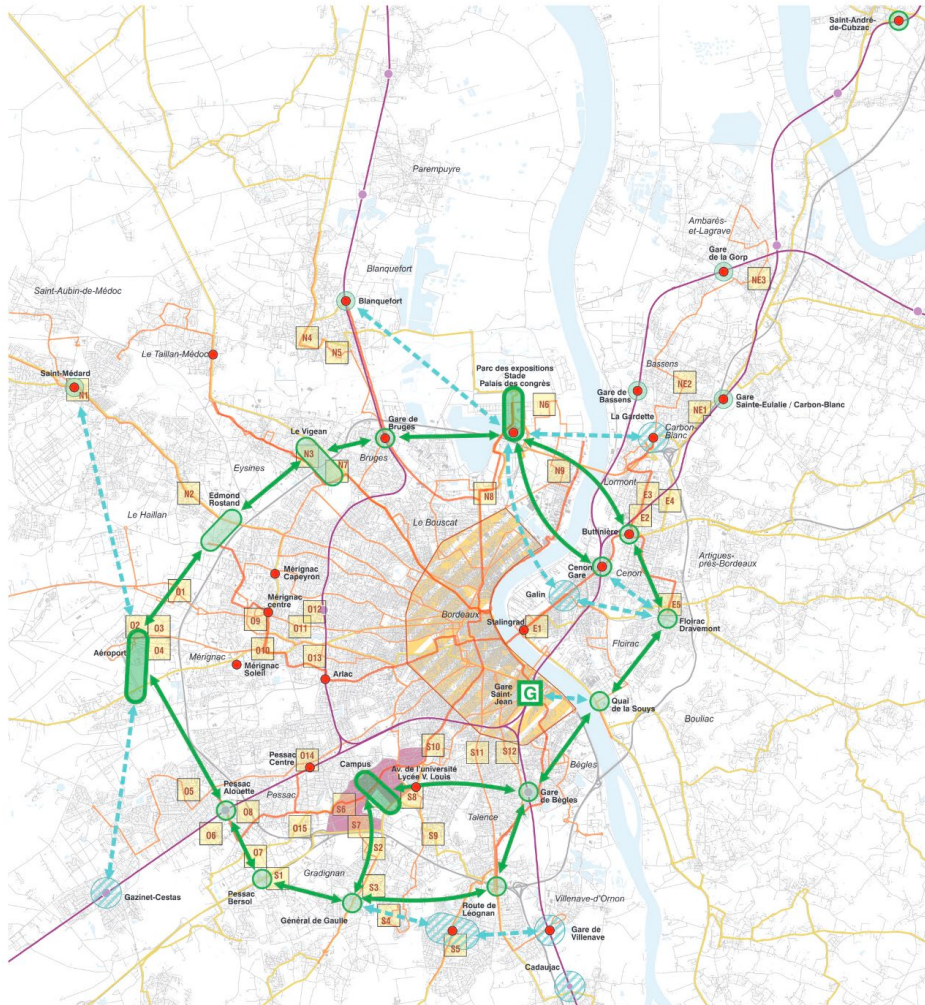
France's 4th largest metropolis

Area : 578 km²



MOBILITY CHALLENGES

A network centred on **people mobility**



Source : a'urba, Bordeaux Métropole, 2024

A **negative perception** of urban logistics

Freight transport is the responsibility of **private operators**, local authorities are not a “public operator”.

Local authorities play a regulatory, planning and facilitating role : traffic and parking, road planning, economic development.

Reducing **congestion**

Improving **air quality**

Making **public spaces** safer

Eliminating **negative externalities** (noise)

Ensuring **deliveries** access



11am – city center



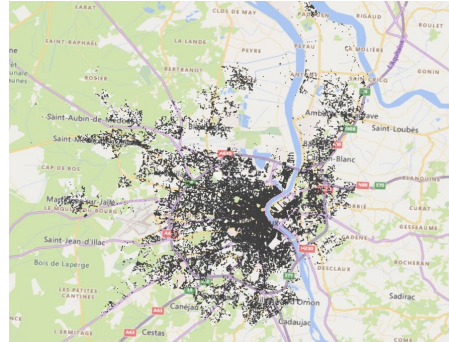
A "wall of trucks" on the Bordeaux ring road

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AN EXPERIMENTAL TERRITORY



**Micro-hubs,
2003**



**Urban freight survey,
2012-13**



**Tram freight pilot,
2015**



**Delivery by night,
since 2016**



**Delivery by drone pilot,
2018**



**Cargo bikes,
since 2020**

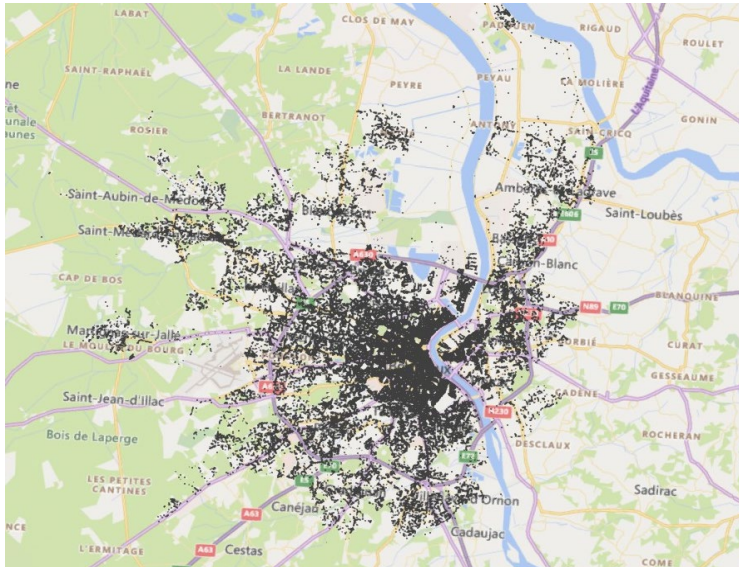


**Waterway delivery pilot,
2021-22**



**Low emission zone survey,
2023**

A TERRITORY OF DATA



Source : Urban Freight Survey, Bordeaux, 2013

94,000 operations (picking & deliveries) everyday
70,000 B to B (economy generating logistics flows)
24,000 B to C (home delivery, lockers, click & collect...)



2%



37%



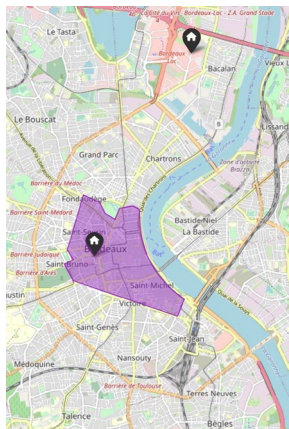
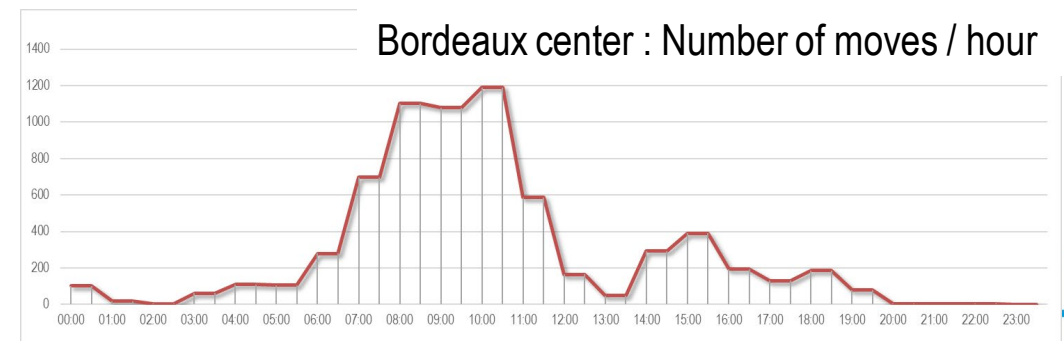
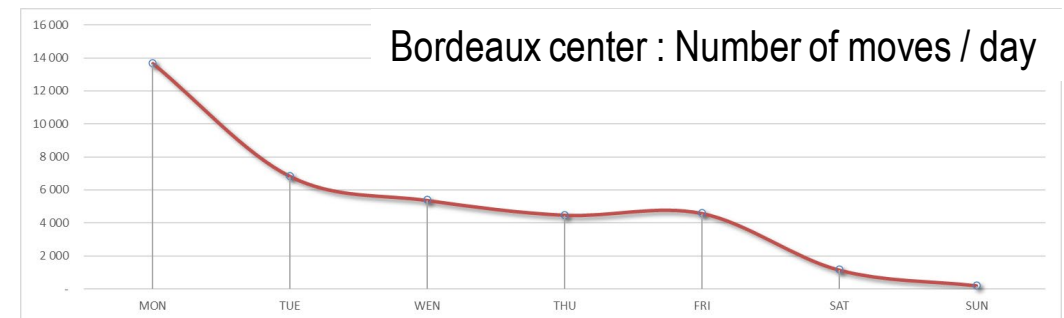
29%



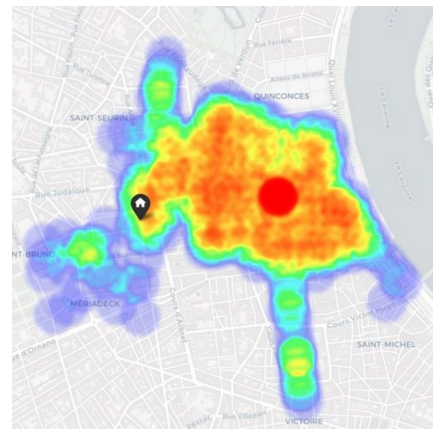
23%



9%



Complex zone (source : V. Salphati, 2023)



Parcel density (source : V. Salphati, 2023)

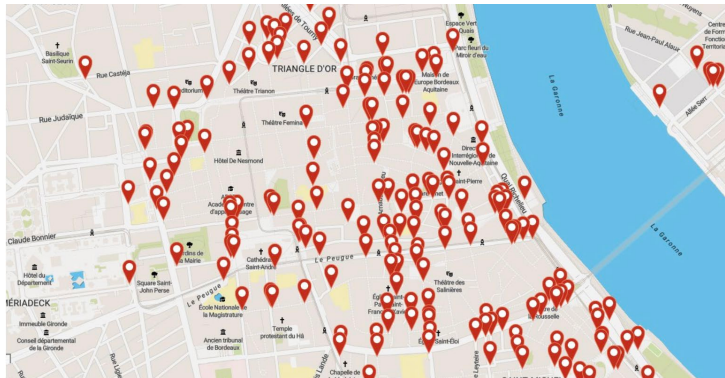
A LOW EMISSION TERRITORY



(Source : T. Baladon, 2023)

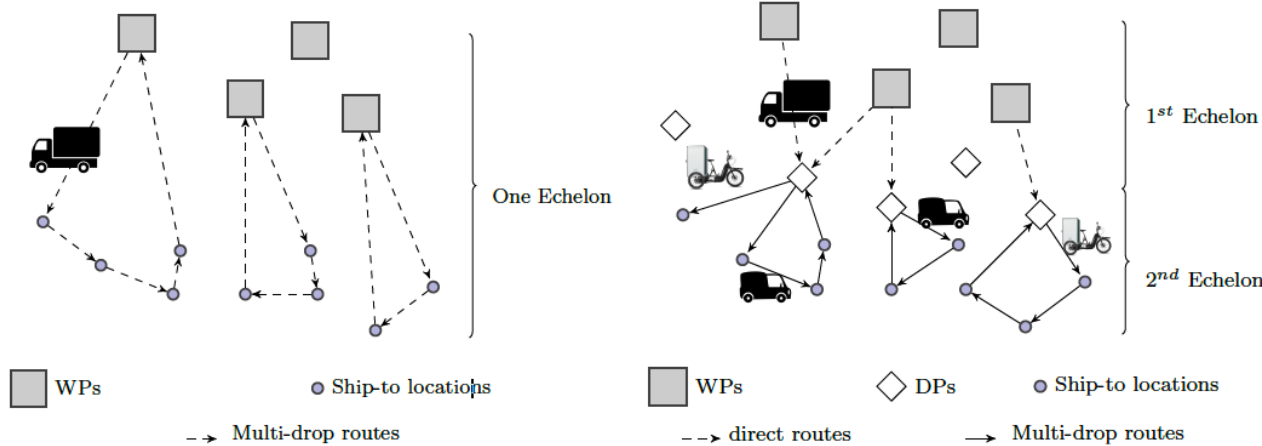
Access is prohibited with retractable bollards to ensure **pedestrian safety**

Deliveries are authorized between **7am and 11am**, and limited to vehicles under 7.5 tons



(Source : opendata.Bordeaux-metropole.fr "Borne d'accès")

Cargo-bikes : **24/7**



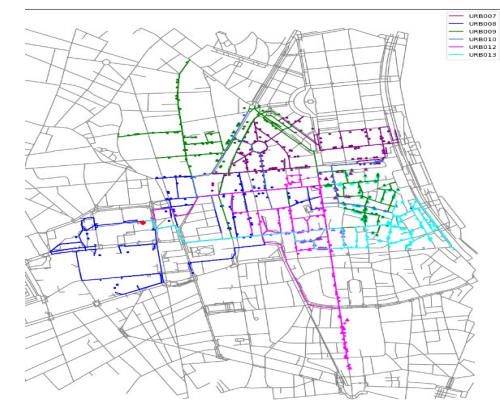
(a) One-echelon distribution network

(b) Two-echelon distribution network

(Source : I. Ben Mohamed et al., 2023)



(Source : J. Leveque et al., 2023)



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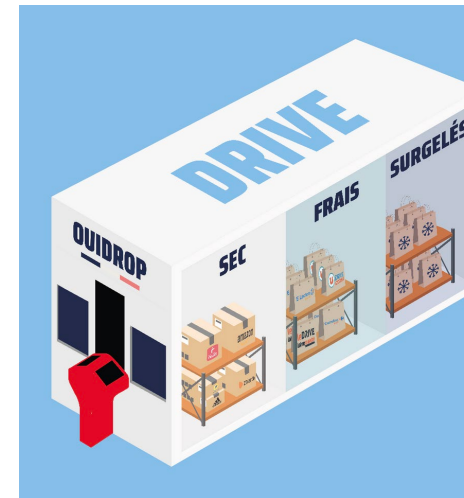
AN URBAN LOGISTICS TERRITORY

In May 2023, Bordeaux Métropole approved a **new roadmap** for the next 3 years.

Selected actions are grouped around the following areas:

- Integrating logistics **flows** in the city,
- Limiting **emissions** generated by logistics,
- Welcoming logistics **activities** in the city,
- Defining **governance** and spaces for exchange,
- Supporting **start-ups**.

OUIDROP : Designer of a **robotic click & collect** solution to provide a fully automated 3D storage space.



(Source : ouidrop.fr)

CONNECTING TRANSPORTATION SYSTEMS

Designing more efficient and **sustainable urban logistics**

Encapsulating goods in smart easy-to-handle and **modular PI-containers**

Enabling the emergence of **Urban Logistics Webs**



Van/trailer – Cubicycle
Source : DHL Group, 2016



Truck – Cargo Bike
City-Hub Rytle, 2018



Tramway - Cargo Bike
LastMileTram, 2019



Barge – Cargo Bike,
VNF, France, 2020



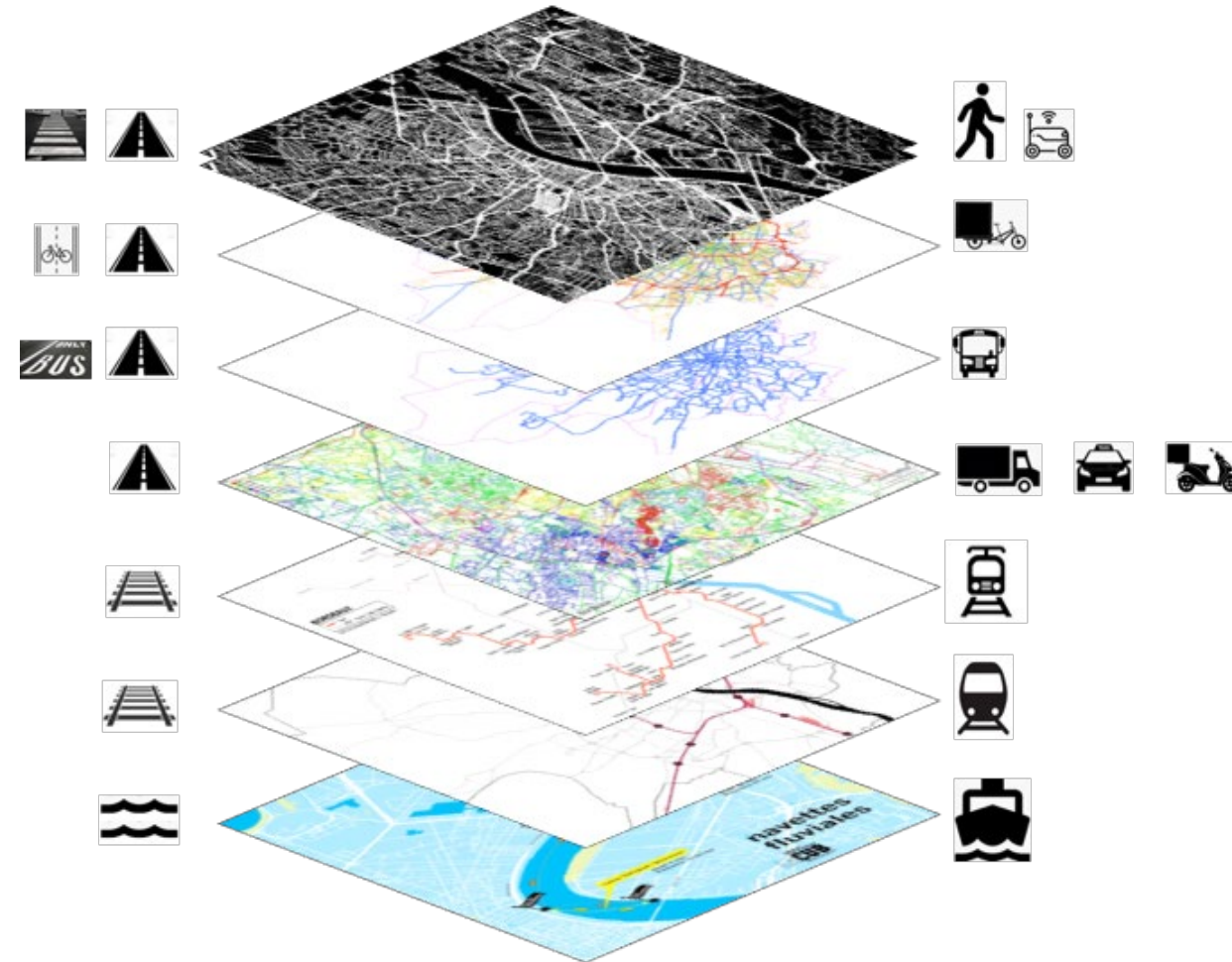
The Hub Company,
2022

MULTILAYER URBAN INFRASTRUCTURE

Hyperconnected City Logistics calls for
novel approaches

Planning and responding for **capacity**
and **resources** aligned with the
emerging urban needs and challenges

Relying on the potential of exploitation
of a **network of networks**



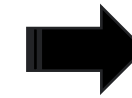
Source : O. Labarthe, G. Ahmadi, W. Klibi, J.-C. Deschamps, B. Montreuil, A sustainable on-demand urban delivery service enabled by synchromodality and synergy in passenger and freight mobility, *Transportation Research Part C: Emerging Technologies*, Vol. 161, 104544, 2024.

MULTIMODAL URBAN MOBILITY

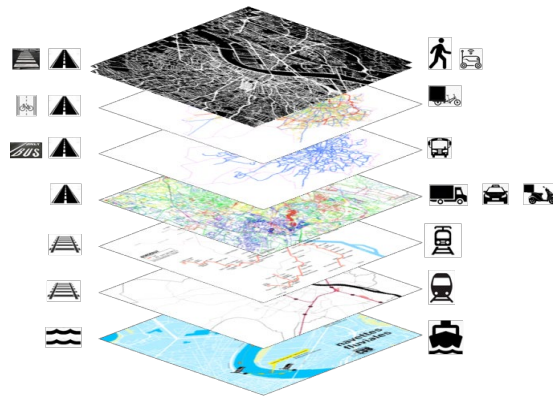


Underutilized spare capacity in
public transportation

Multitude of mobility options
in urban areas
+
Spare capacity in public
transportation



How to transship goods
based on the joint use of
public transport modes and
on-demand freight modes ?



Different transportation **modes**

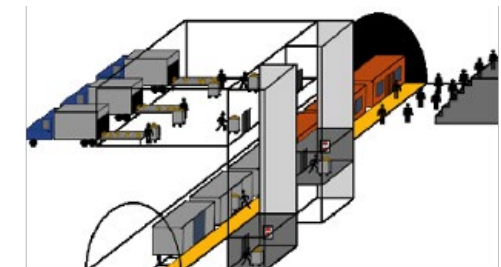
Synergies between Freight and People mobility



TRAM-FRET Pilot,
Bordeaux, France, 2015.

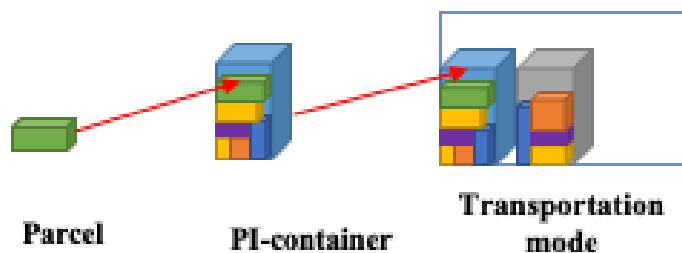


Combined Passenger-Cargo,
Miyazaki, Japan, since 2014.



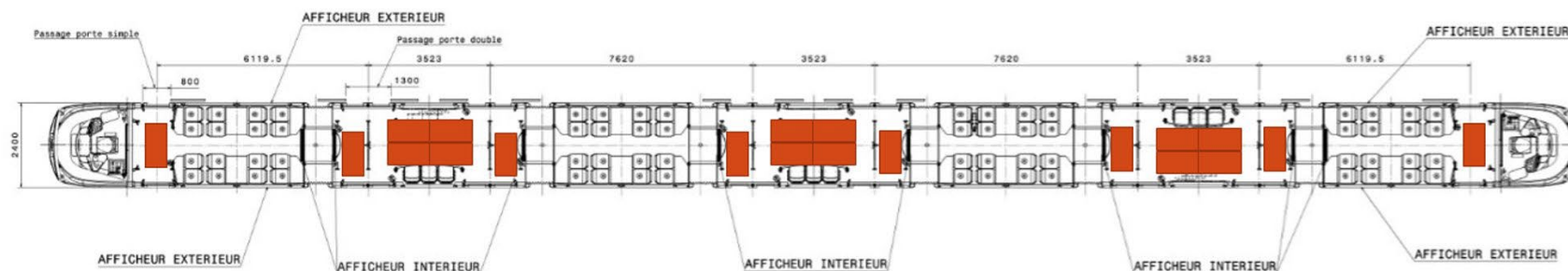
Subway Delivery
(Montreuil et al., 2018)

URBAN PARCEL DELIVERY CONSIDERING TRAMWAY

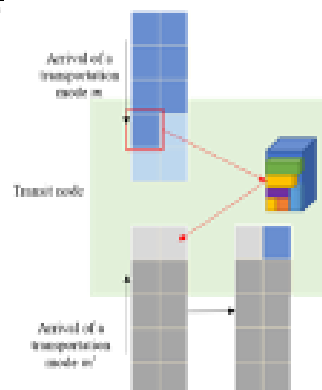


Parcel container,

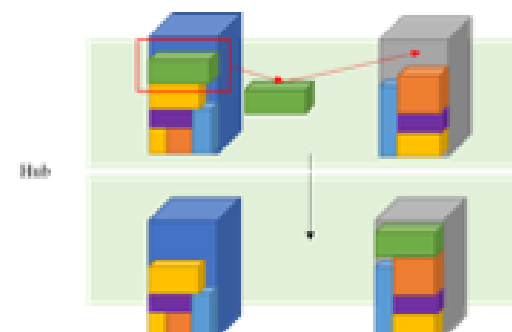
Source : project-mo.de, 2020.



- **Transshipment** : Moving a container from a mode m to a mode m'



- **Reload** : Moving a parcel from a container Q to another container Q'

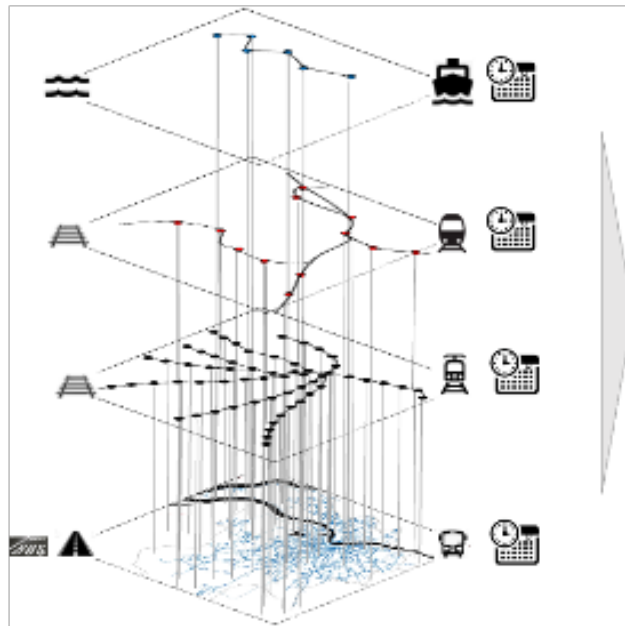


HCL INTEGRATING PEOPLE MOBILITY NETWORKS

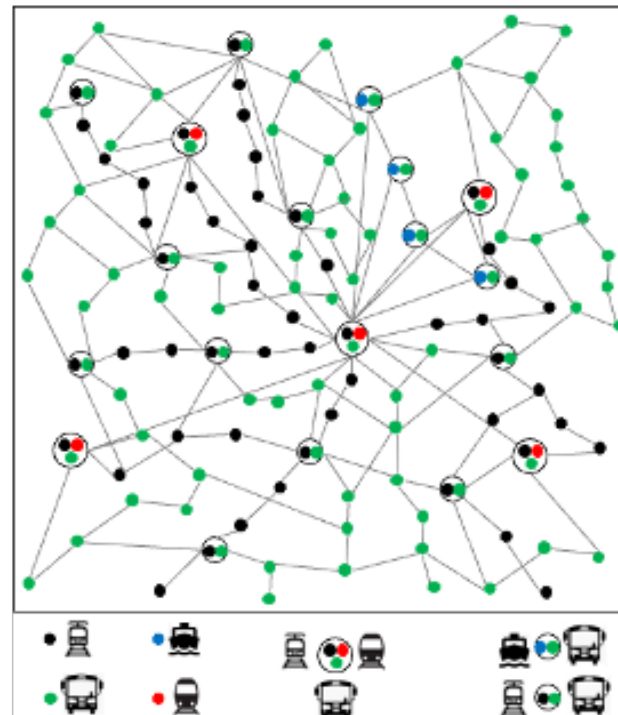
Investigates the feasibility of **goods transshipment** with a joint usage of **public mobility** and **freight urban vehicles**

Assess the **potential benefit** of a **joint mobility system** for goods delivery in urban areas

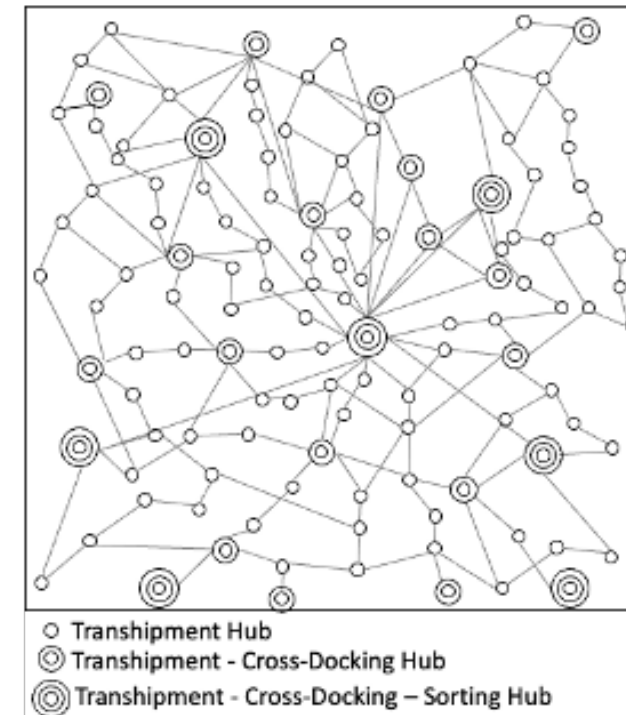
Multi-layer representation of the scheduled public transportation network



Urban area interaction network for passengers



Hyperconnected transshipment based on people mobility networks

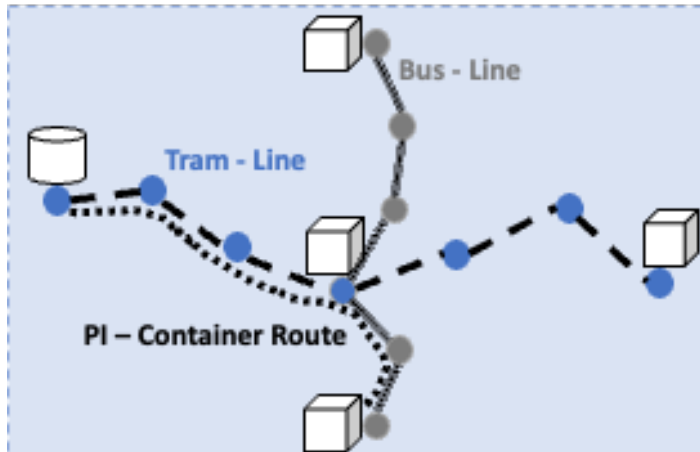


HYPERCONNECTED URBAN SYNCHROMODALITY

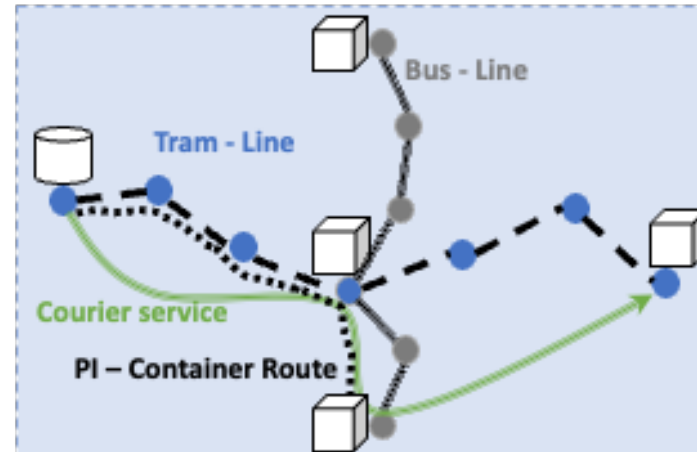
		Freight Mobility (excluding Air)		
		Multimodality (Traffic-centered)	Intermodality (Loading units-centered)	Urban Sychromodality (Time-centered)
Network-based Hyperconnectivity	Low	# of planned freight modes = 2 Waterway-Rail OR Waterway-Road OR Rail-Road	# of planned freight modes = 2 Combined Transport <i>Road usage as short as possible</i> (Waterway-Road) OR (Rail-Road) Co-modality <i>Optimal & sustainable utilisation of resources</i> (Waterway-Rail) OR (Waterway-Road) OR (Rail-Road)	# of transportation modes =2 Planned dedicated freight mode (Waterway or Rail or Road) On-demand freight mode (Waterway or Rail or Road) Scheduled Public transport mode (Waterway or Rail or Road)
	High	# of planned freight modes > 2 Waterway & Rail & Road	# of planned freight modes > 2 Combined Transport <i>Road usage as short as possible</i> Waterway & Rail & Road Co-modality <i>Optimal & sustainable utilisation of resources</i> Waterway & Rail & Road	# of transportation modes > 2 Planned dedicated freight mode (Waterway or Rail or Road) On-demand freight mode (Waterway or Rail or Road) Scheduled Public transport mode (Waterway or Rail or Road)

MULTIMODAL ON-DEMAND TRANSSHIPMENT

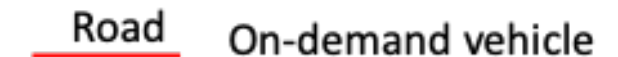
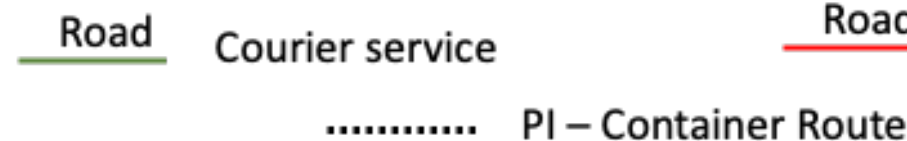
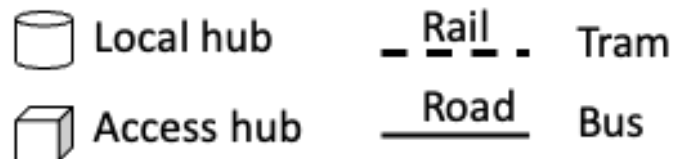
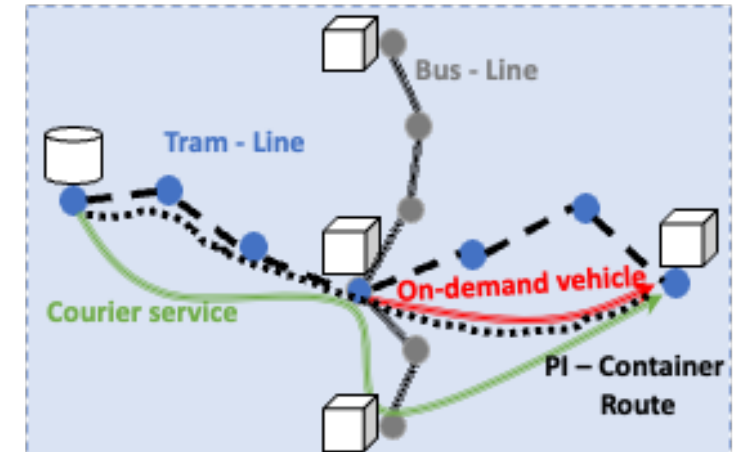
Public scheduled transport



Multimodal scheduled delivery



Multimodal & on-demand delivery

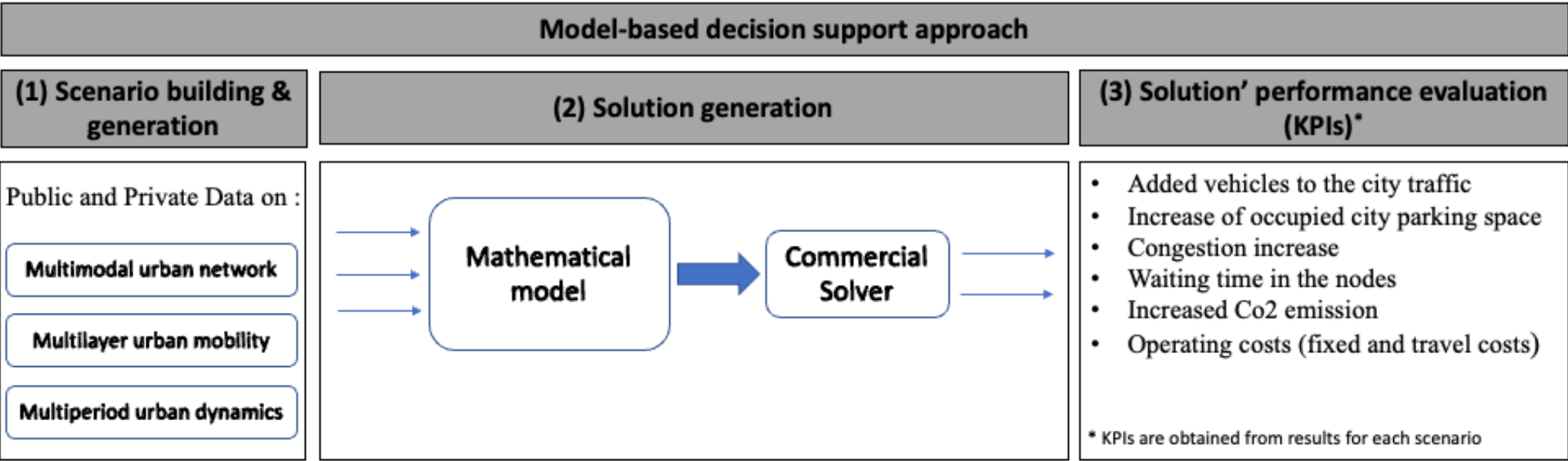


Multiple **transportation options** for each PI-Container.

More possibilities to satisfy **due dates**.

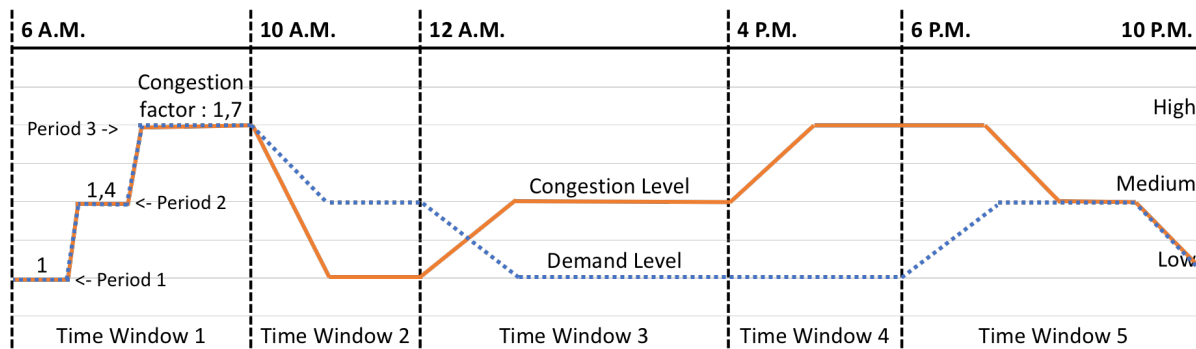
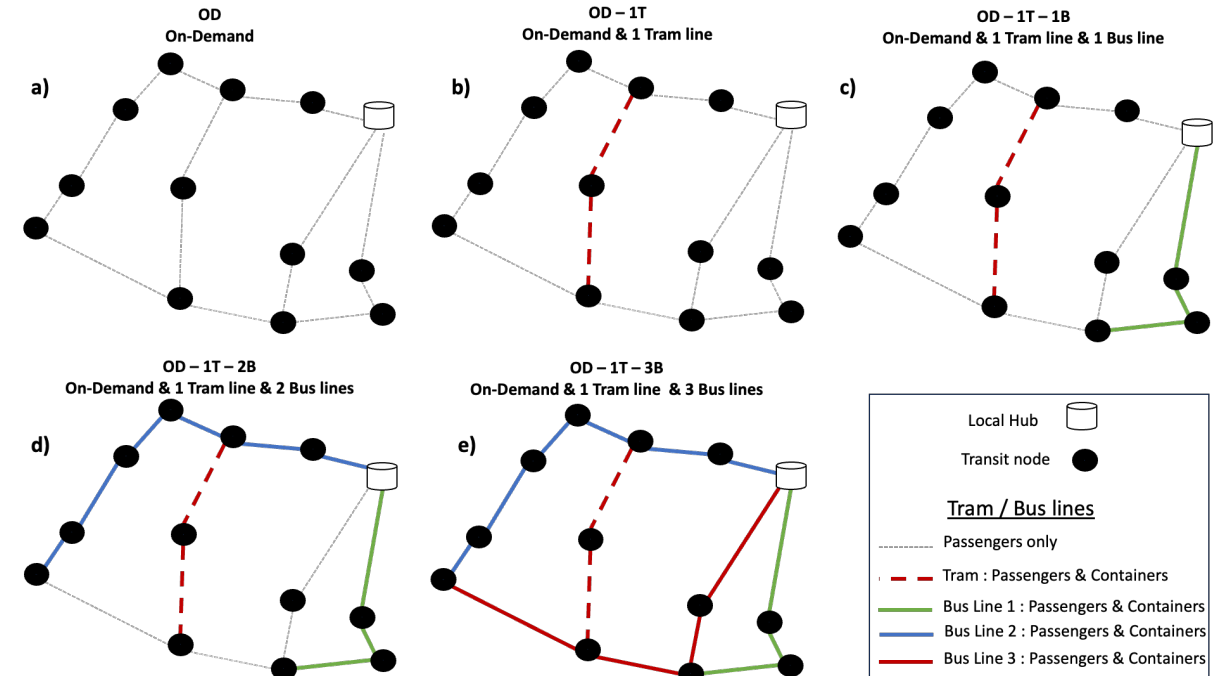
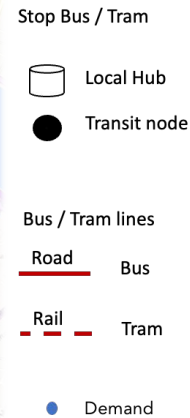
THREE-PHASE DECISION SUPPORT APPROACH

Minimize the impact of **containers' journey** in the **time** and **space** of urban transport network.



The objective considered in this **planning problem** is to commit to a **high service level** (all requests delivered before the due date) with the **minimum urban footprint**.

CASE STUDY OF THE CITY OF BORDEAUX



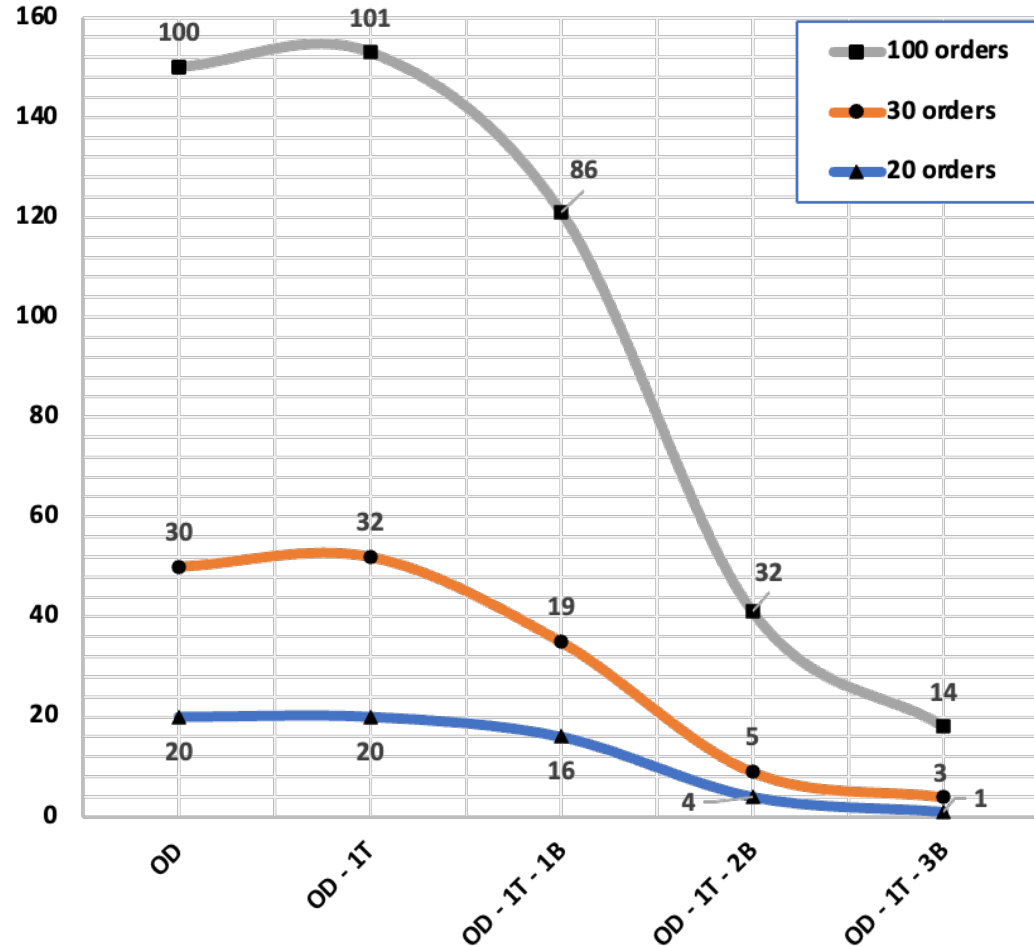
Travel-time based on **transport mode** and **congestion factor**.

Capacity of each transportation mode **vary during the day**.

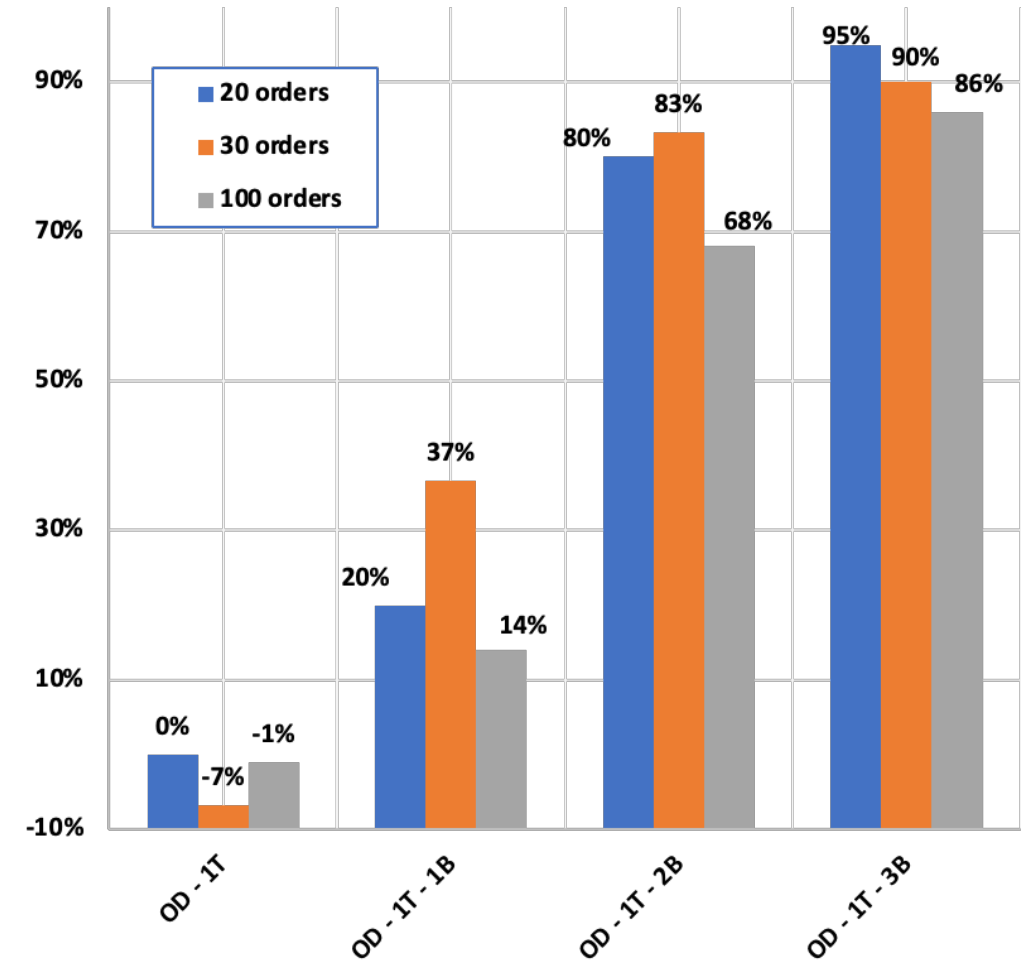
Capacity decrease with the increase of **congestion level**.

IMPACTS OF NETWORK CONNECTIVITY

Number of moves with On-Demand (Heuristic)



On-Demand moves reduction (Heuristic)

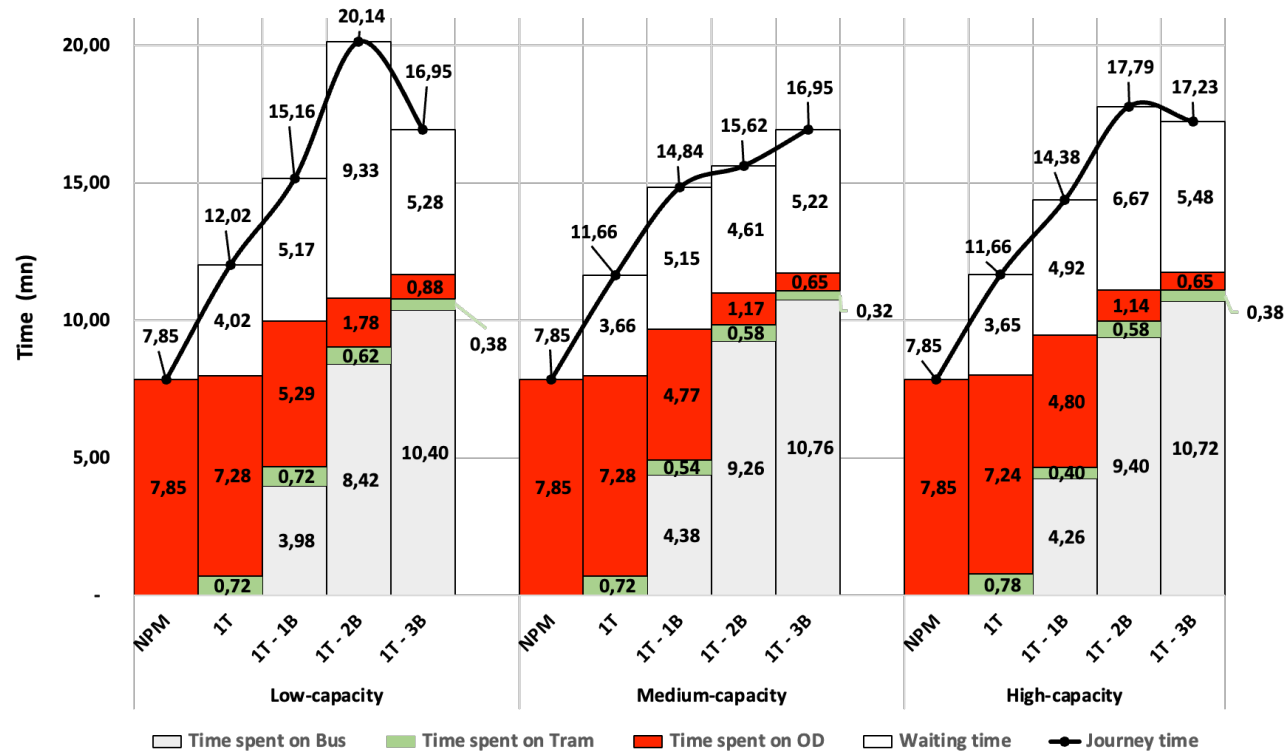


IMPACT OF TRANSPORT CAPACITY

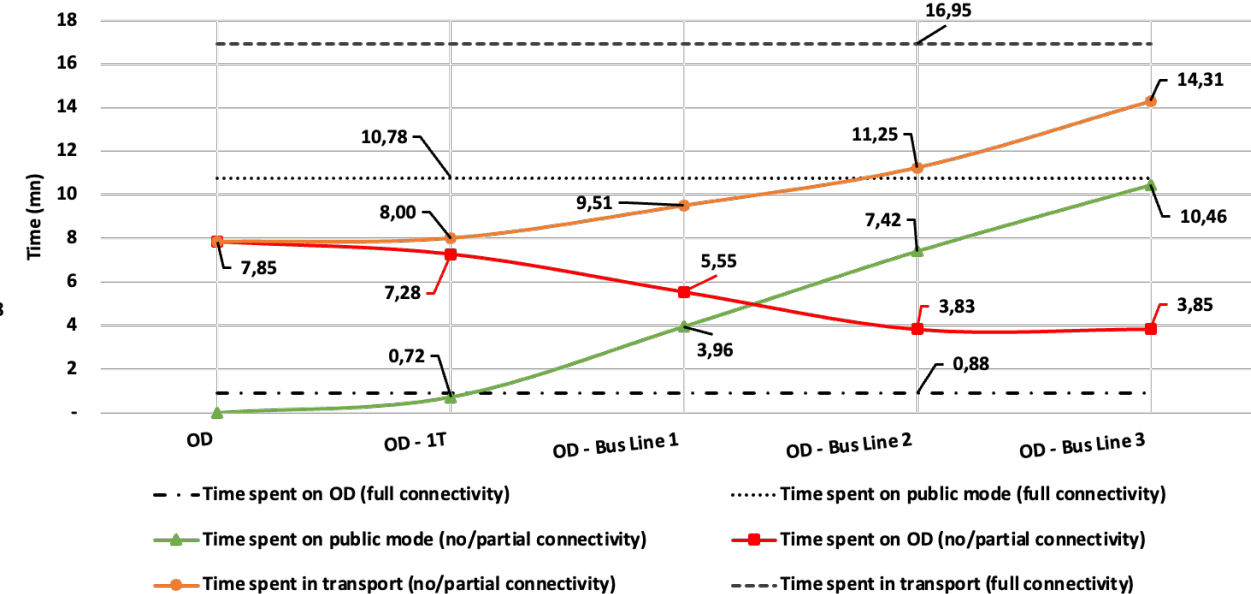
Transportation mode capacity (Container)

Public transportation mode	Low-capacity level	Medium-capacity level	High-capacity level
Tram	8	20	25
Bus	8	15	25
On-demand vehicles			
Cargo bike	1	1	1
Van	1	1	1

Mean time / container



Impact on time spend in transport mode



CONCLUSIONS AND PERSPECTIVES

New approach for urban freight **transshipment** based on joint use of **on-demand mode** and **public transport**

The role of synchromodality **reducing parcels footprint** and congestion levels

Extending the model to consider several local hubs, **more vehicle types/services** in an on-demand mode

MOBILE



Micro-depots UPS,
Hamburg, Germany,
2012.



Mobile depot TNT
Express, Brussels,
Belgium, 2013.



CubiVan, City-Hub,
Source : DHL Group,
Germany, 2017.



City-Hub Rytle,
Source : Krone Group,
Germany, 2018.



EZ-PRO Renault
& DPDgroup
scenarios, 2018.

STATIONARY



Micro-platform
project,
Bordeaux,
France, 2003.



Micro-platform
project, Barcelona,
Spain, 2014.



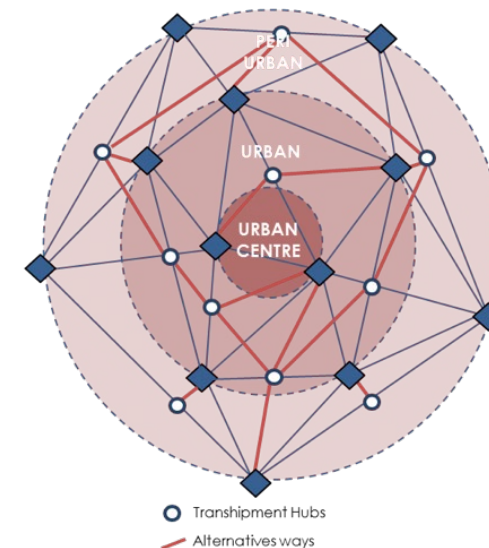
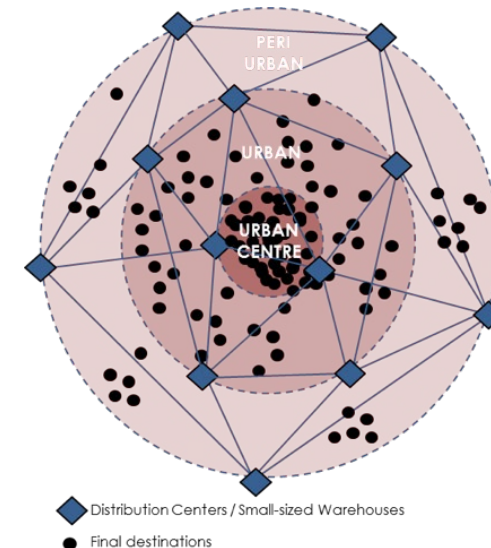
KoMoDo project,
open micro hub,
Berlin, Germany,
2018.



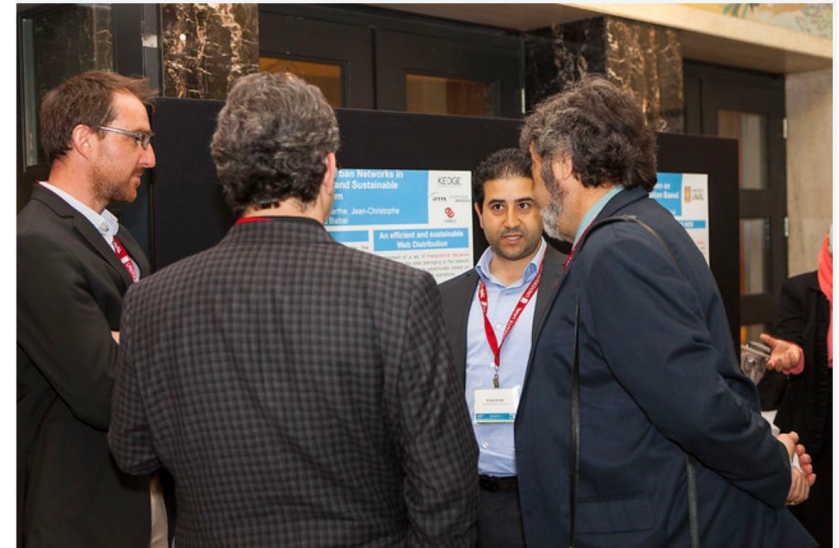
Micro depot in public
spaces, source : DPD,
Germany, 2019.



Micro-hub,
Paketin GmbH
2020.



Towards a hyperconnected city Logistics : already addressed ten years ago



Thank you for your attention

IPIC 2024