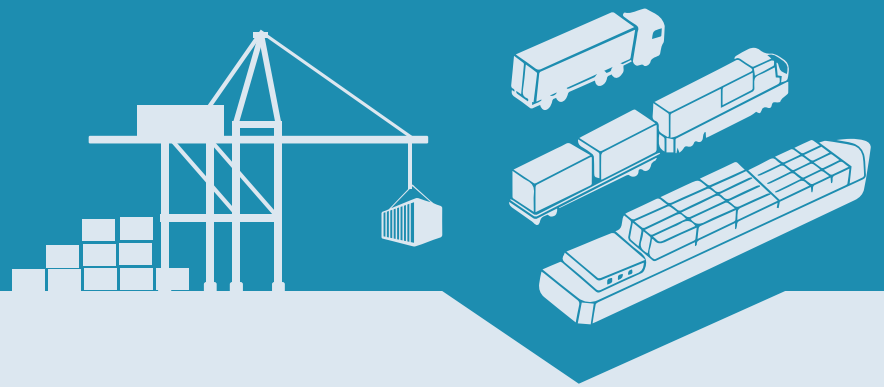
KU LEUVEN

Decision support for synchromodal transportation planning using real-time information



DISpATch

DISpATch consortium meeting

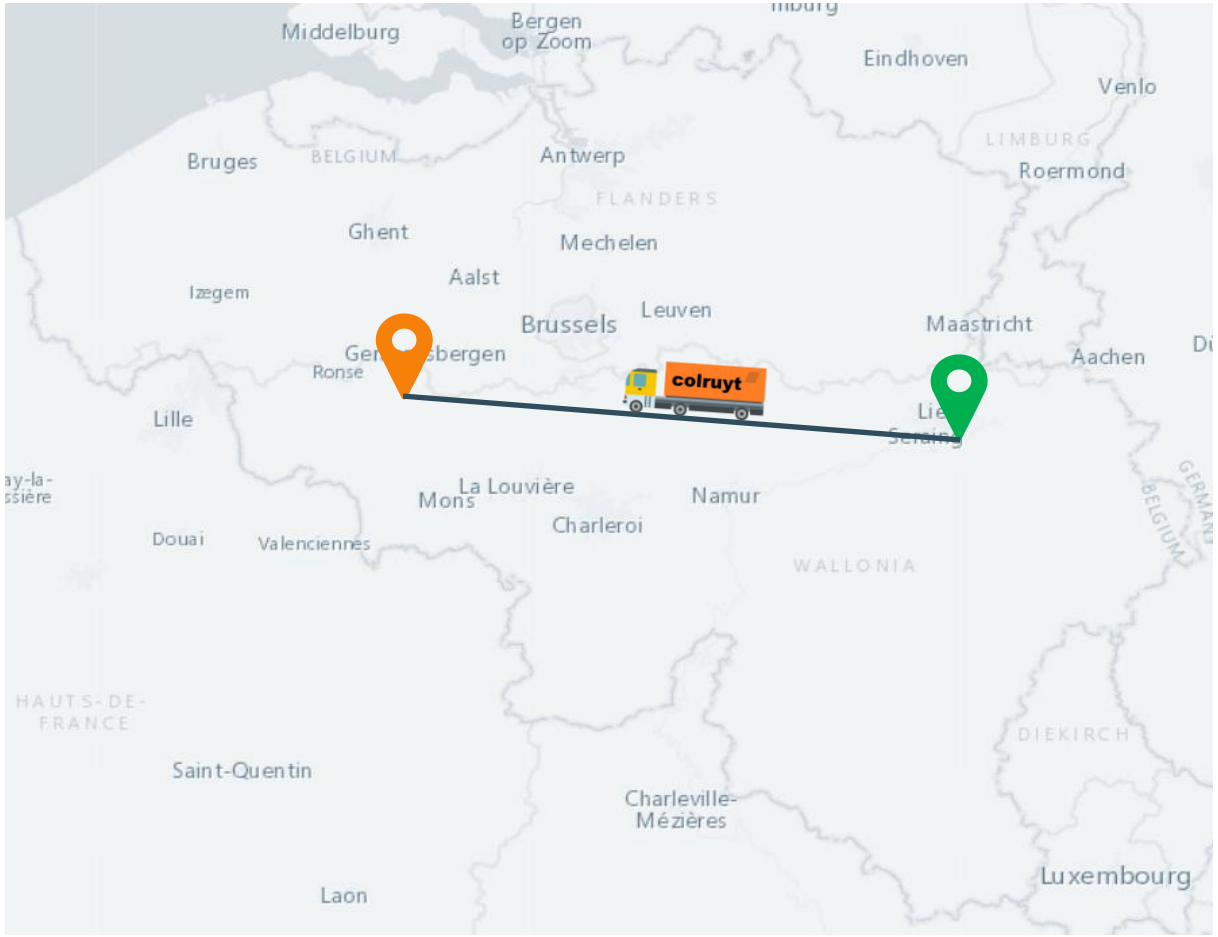
06/10/2020

Hannah Yee

Robert Boute

Colruyt case study

Investigate modal shift from road to intermodal rail

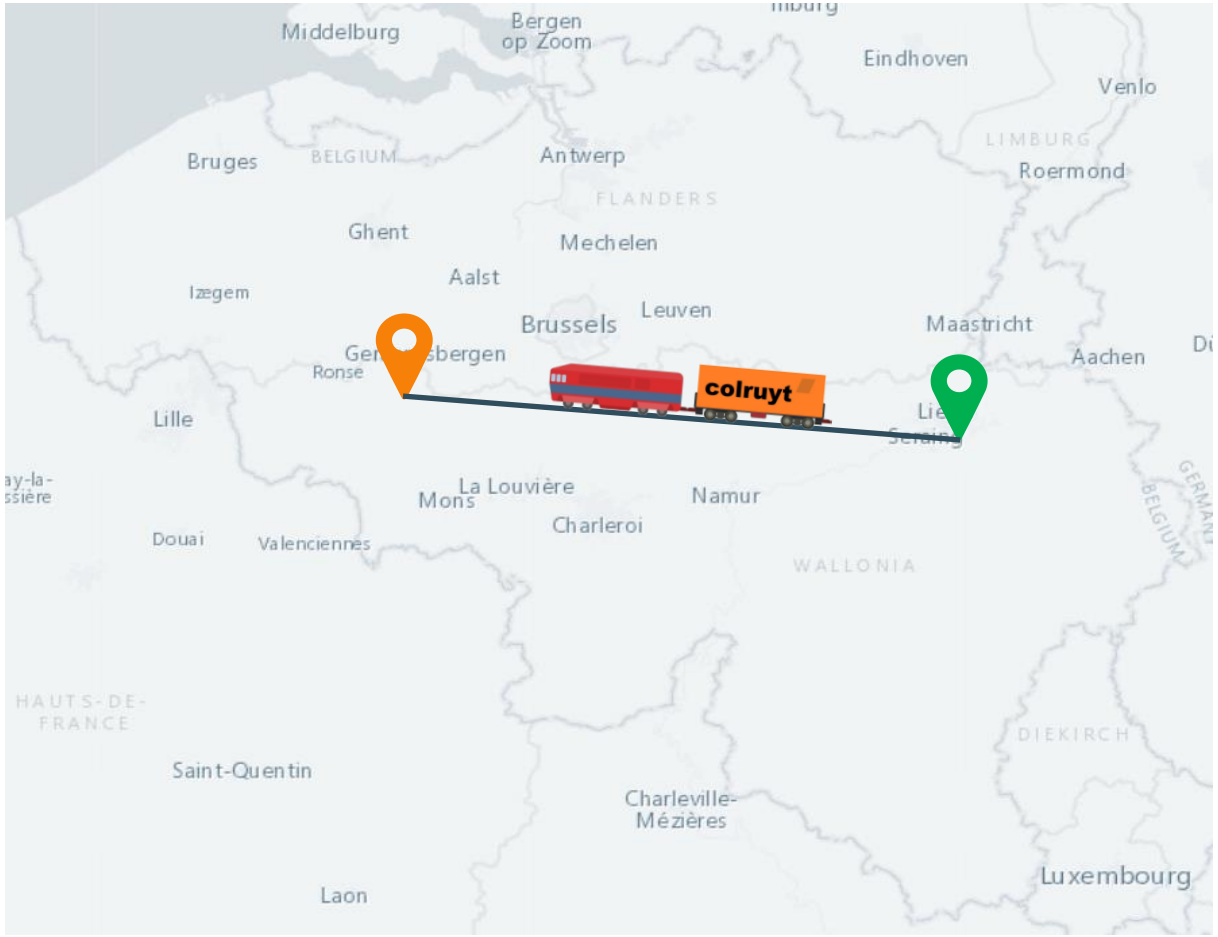


Shipments from supplier to distribution center

- Current situation: 

Colruyt case study

Investigate modal shift from road to intermodal rail



Shipments from supplier to distribution center

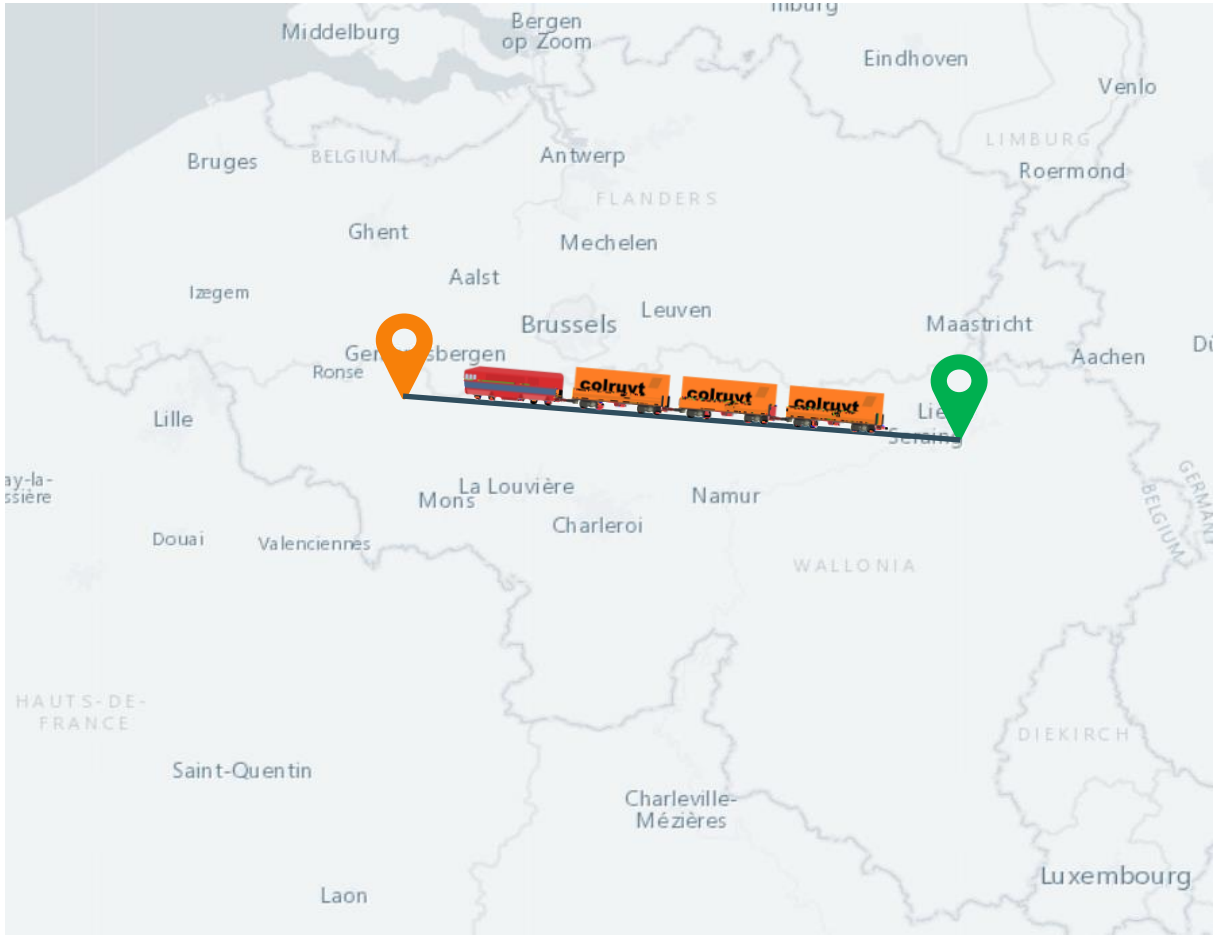
- Current situation: 

- Desired situation: 

How?

Colruyt case study

Investigate modal shift from road to intermodal rail



Shipments from supplier to distribution center

- Current situation: 

- Desired situation: 

How?

Setting up own rail service
100% intermodal replenishments

Colruyt case study

Investigate modal shift from road to intermodal rail

Shipments from supplier to distribution center

- Current situation: 

- Desired situation: 

How?

Use excess capacity on existing services
Dynamically replenish by road and rail

Using excess capacity on existing intermodal services.

- No need to set up own intermodal service
- Reduced cost of rail transport
- Smaller shipment sizes

Decision support for replenishment

- How to decide on modal choice?

Based on real-time information

- Available capacity on intermodal service
- Inventory level at distribution center

A decision support model for synchromodal transportation planning using travel time information.

- Adapt transport decisions to the real-time status of freight in transport

A decision support model for synchromodal transportation planning using travel time information.

- Adapt transport decisions to the real-time status of freight in transport

Our model considers stochastic elements of the transport system.

- Synchromodal decision-making based on **real-time information**

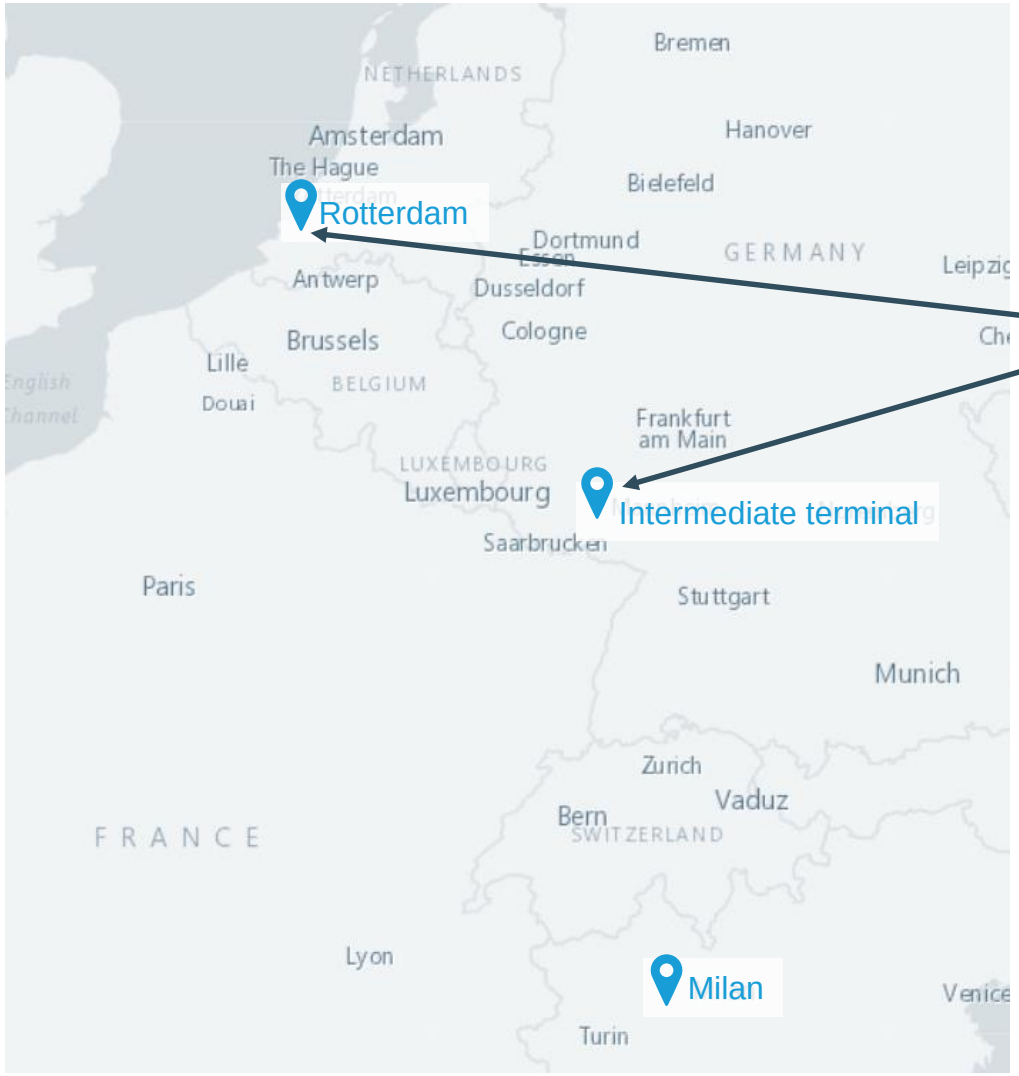
Travel time duration of transport services (long-haul transport)

Schedules of intermodal services

Capacity availability on the services

- Perspective of an individual shipper plugged into a data platform

The optimal mode choice is based on the travel time information.



Our model supports the transport mode decision.

The optimal mode choice is based on the travel time information.

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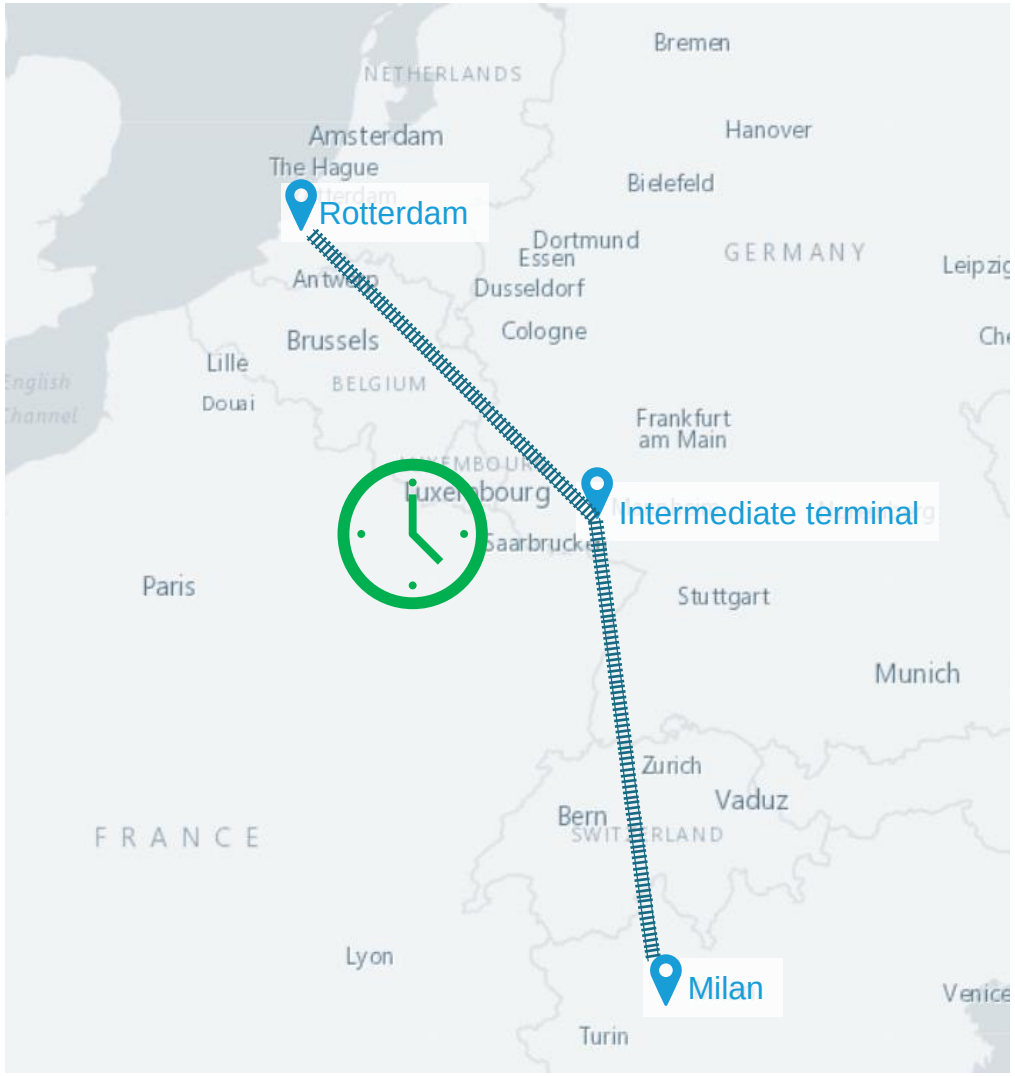

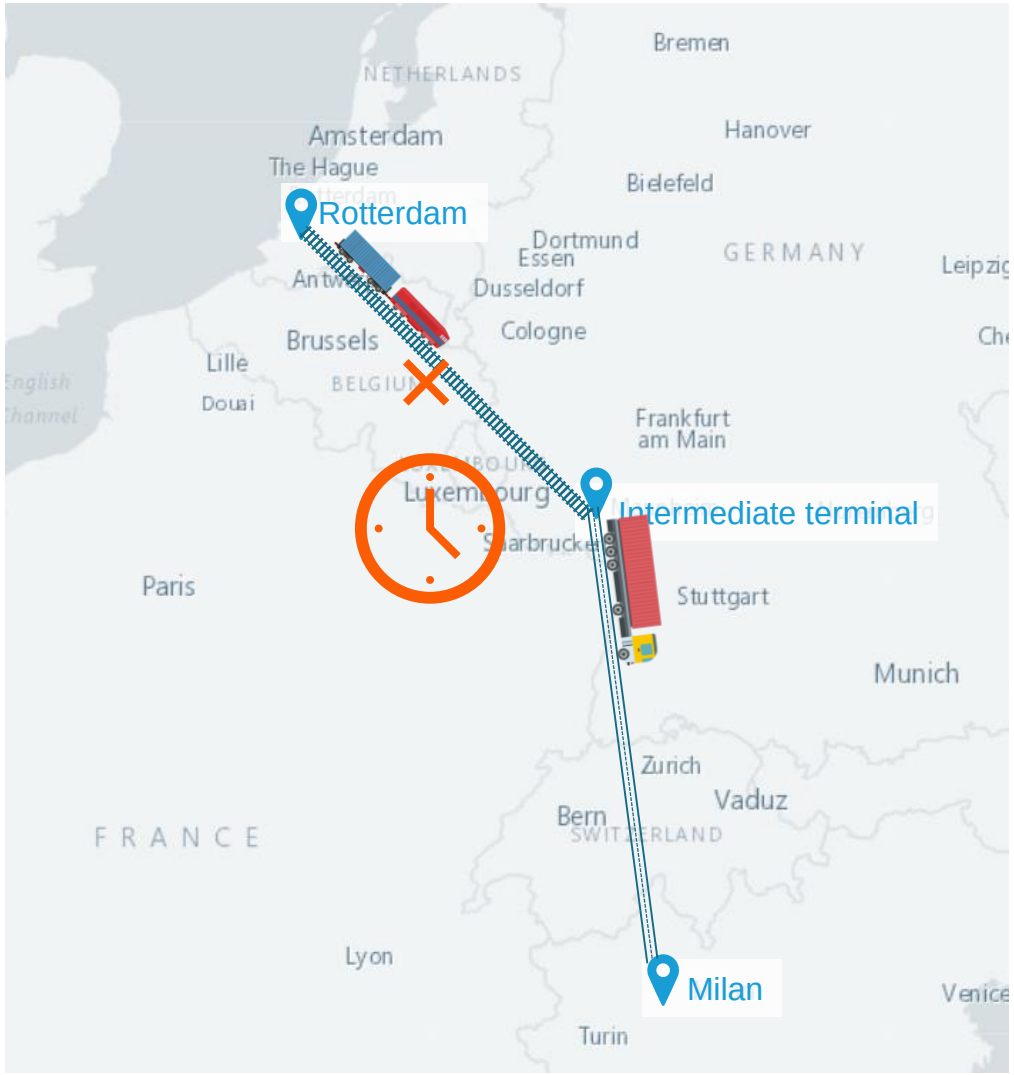

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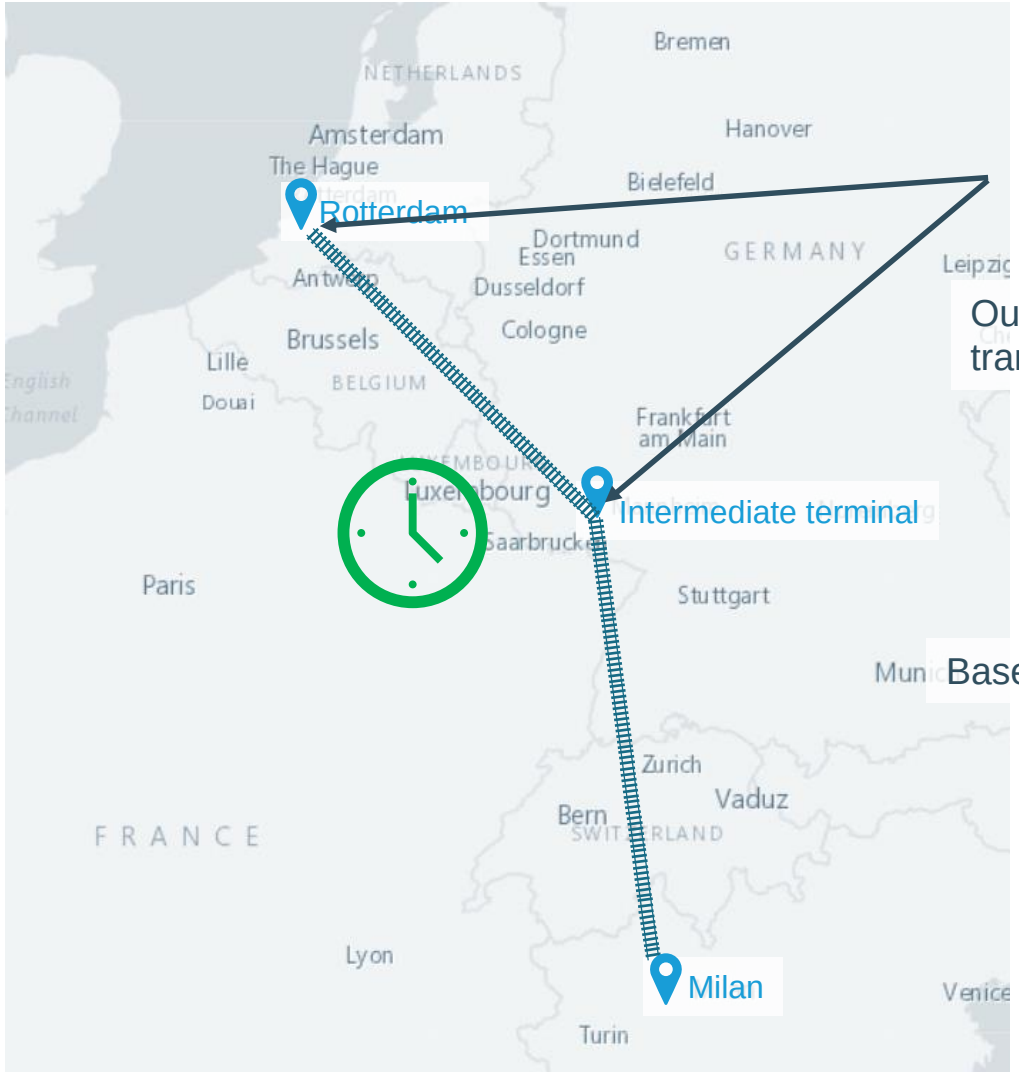
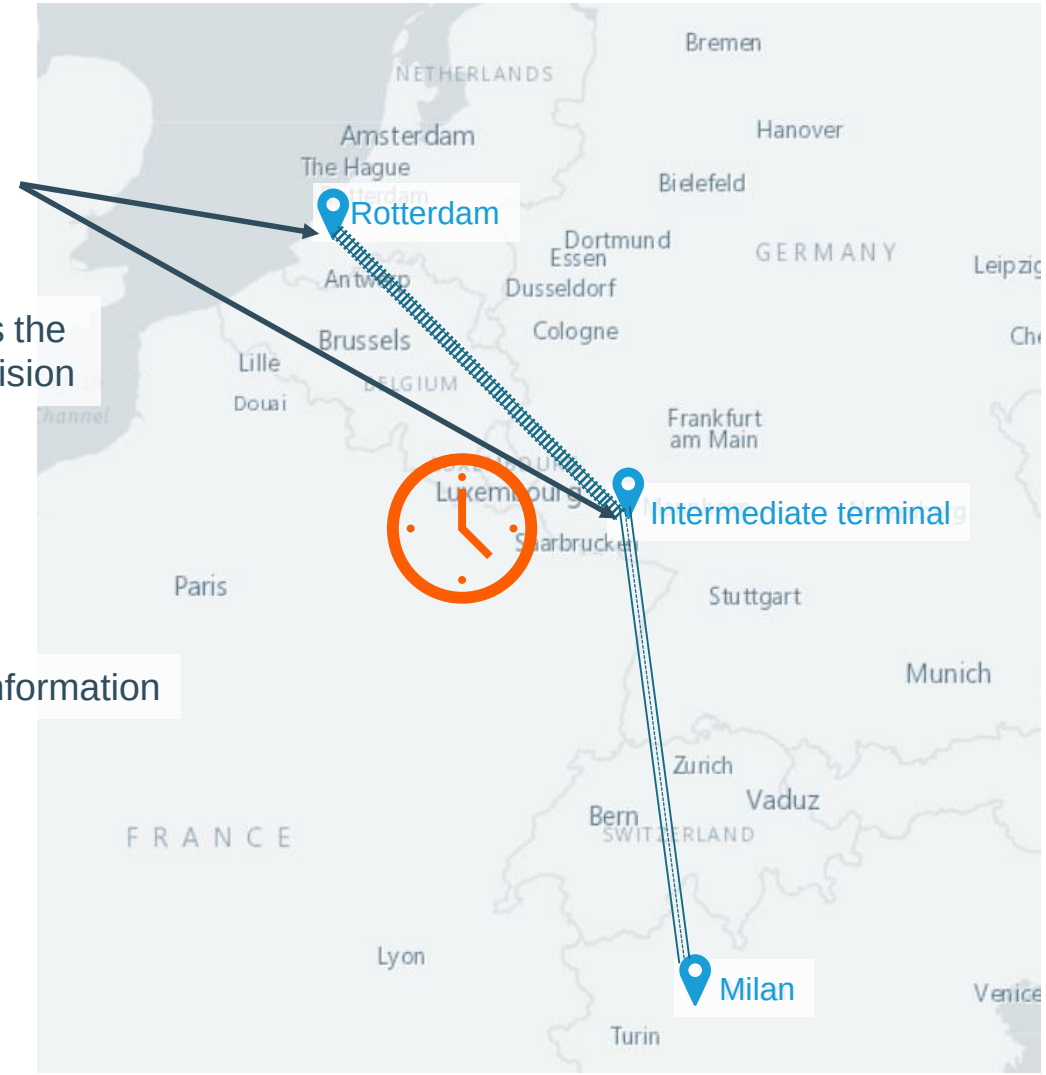


Our model supports the transport mode decision

Based on real-time information



The model is formulated as a Markov decision process.

Decision-support model

- Markov decision process

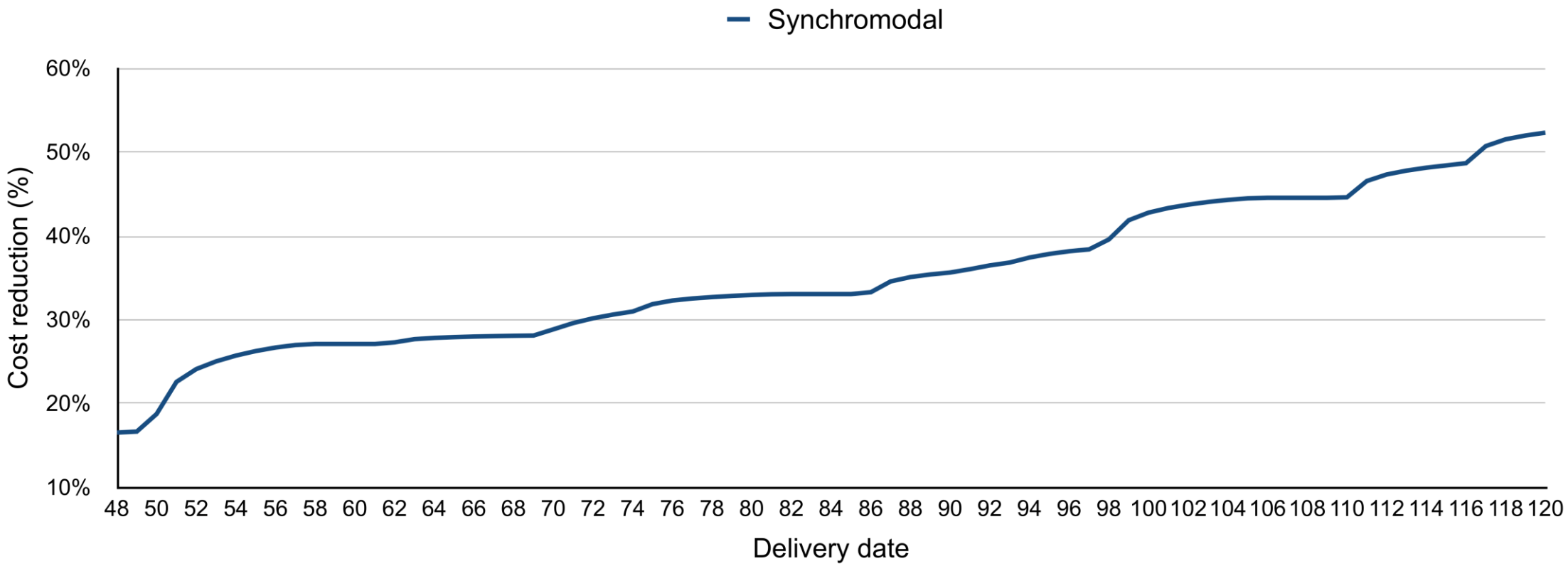
- Anticipates stochasticity in the system when making decisions

- Action: transport mode decision at intermodal terminal
- State:
  - Availability of services given service schedule
  - Capacity availability on the transport services
  - Realized travel time duration of previous services (determines arrival time at intermediate terminal)

Adapt transport mode decisions to real-time circumstances

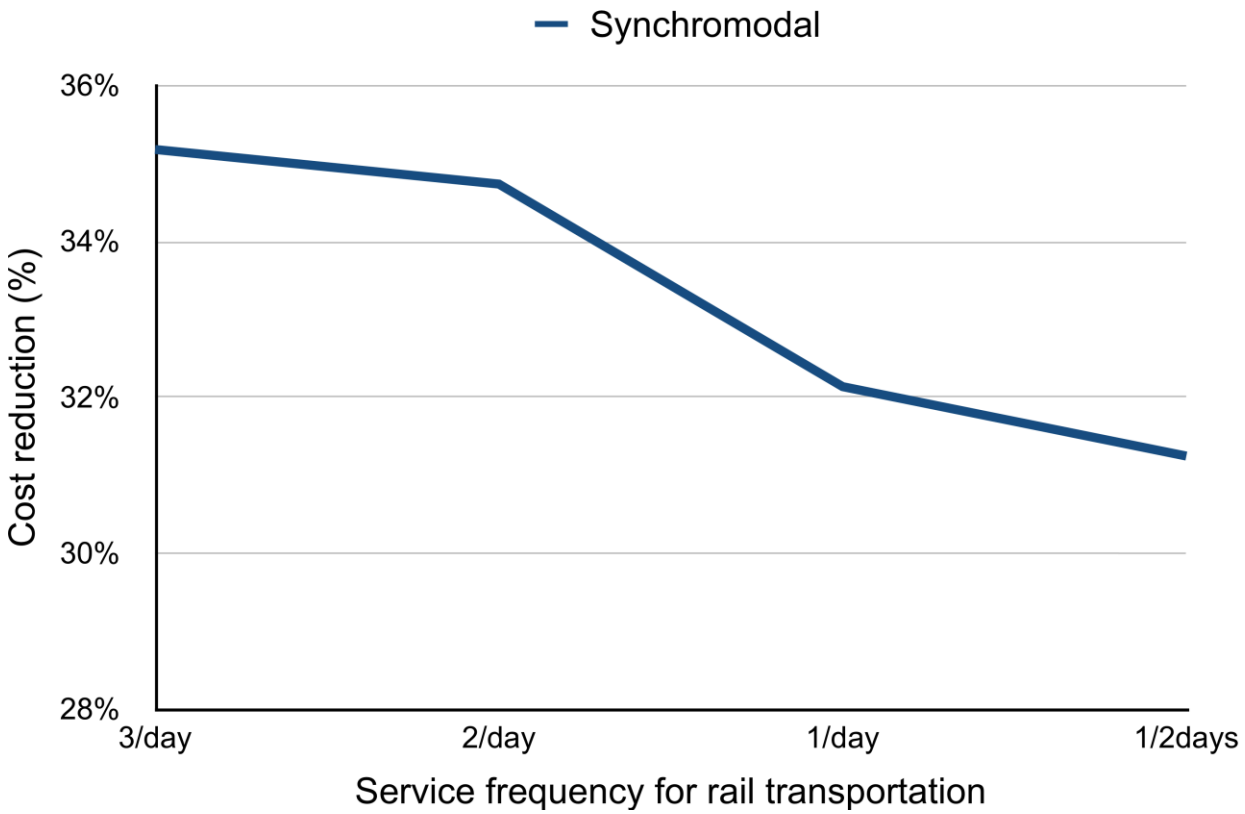
Result: the value of synchromodal decision-making increases when the delivery is less urgent.

- Measure: % cost-reduction against unimodal road transport



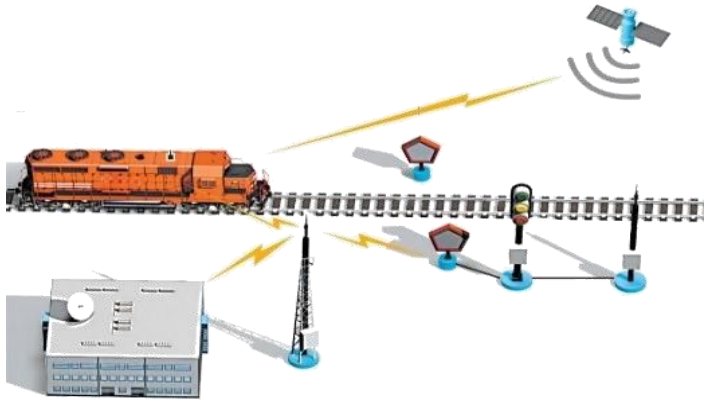
Result: the value of synchromodal decision-making increases when available intermodal services are more frequent.

- Measure: % cost-reduction against unimodal road transport



Several prerequisites for implementation in practice.

- Input on travel time uncertainty
- Input on service schedules and capacity availability
- Technologies that can track trucks and trains in transit



- Synchromodal platforms that combine real-time information with decision-support models

Next steps for the case study.

- A smart replenishment model deciding how much to ship via which transport mode, based on real-time information about the system

Schedules of intermodal services

Capacity availability on the services

Inventory level at the distribution center