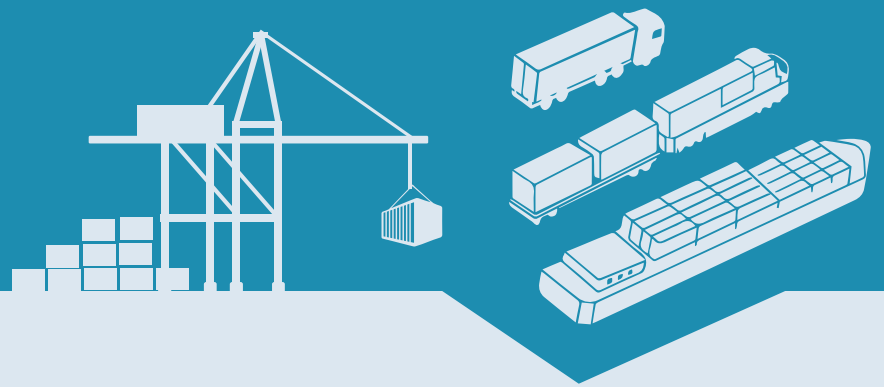
KU LEUVEN

Decision support for synchromodal transportation planning using real-time information



DISpATch

DISpATch consortium meeting

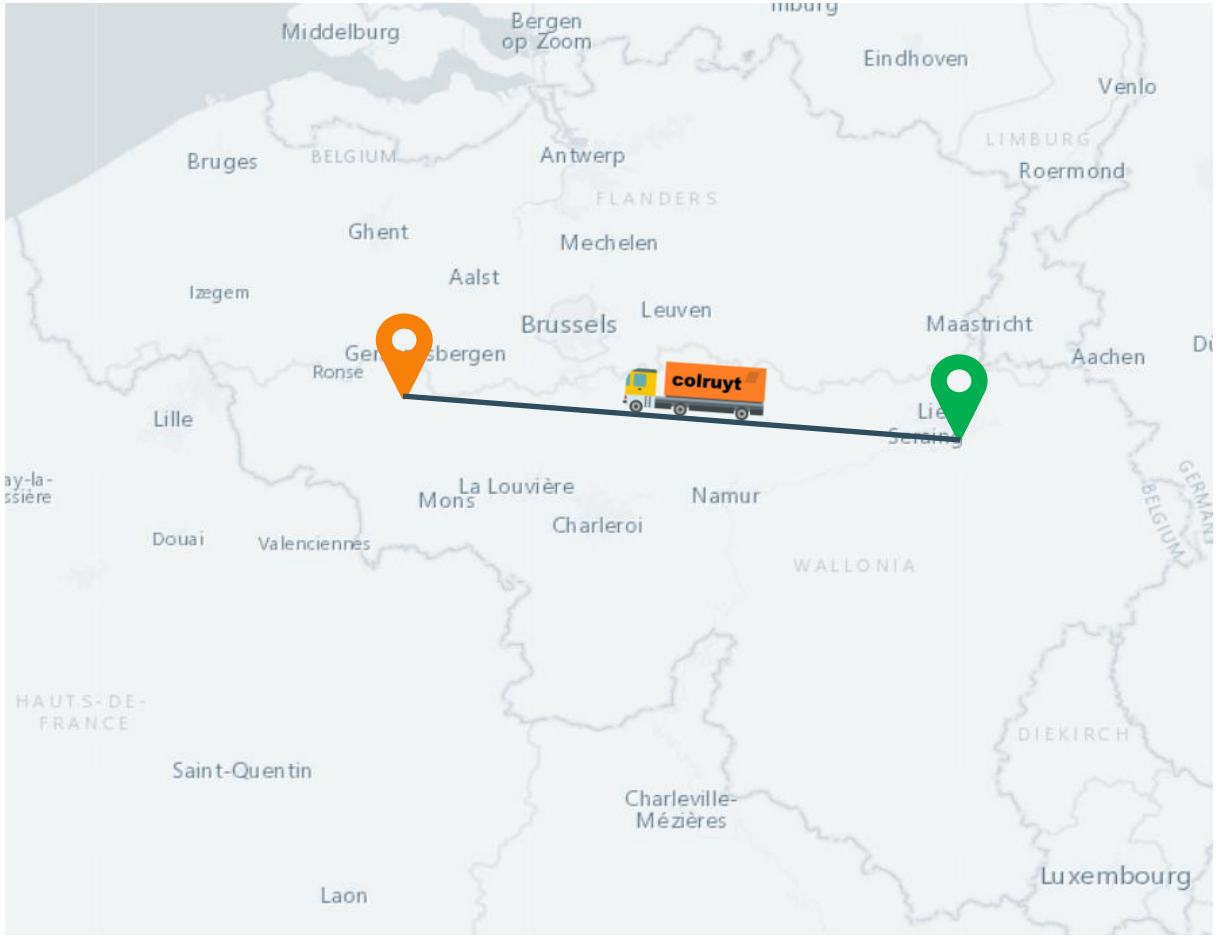
06/10/2020

Hannah Yee

Robert Boute

Colruyt case study

Investigate modal shift from road to intermodal rail

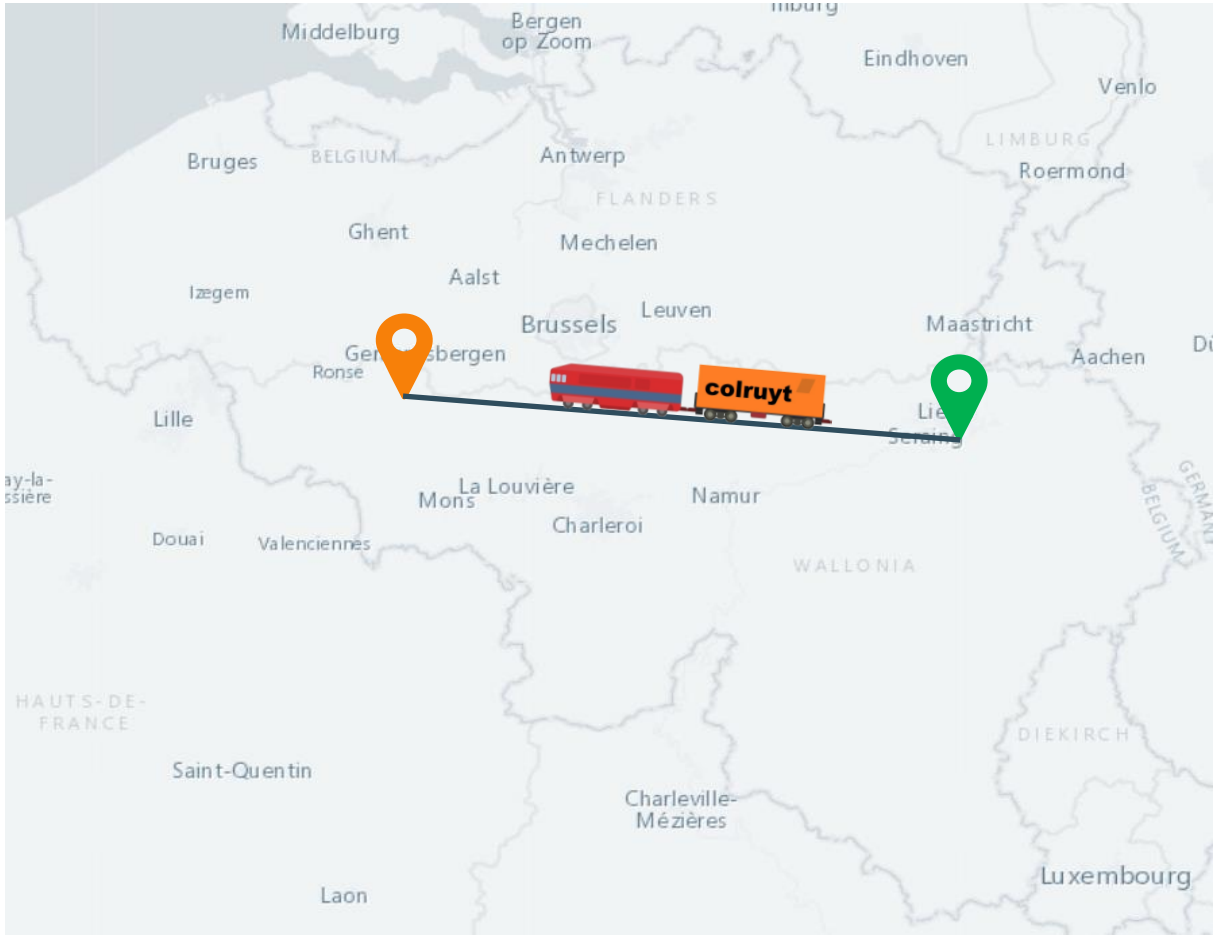


Shipments from supplier to distribution center

- Current situation: 

Colruyt case study

Investigate modal shift from road to intermodal rail



Shipments from supplier to distribution center

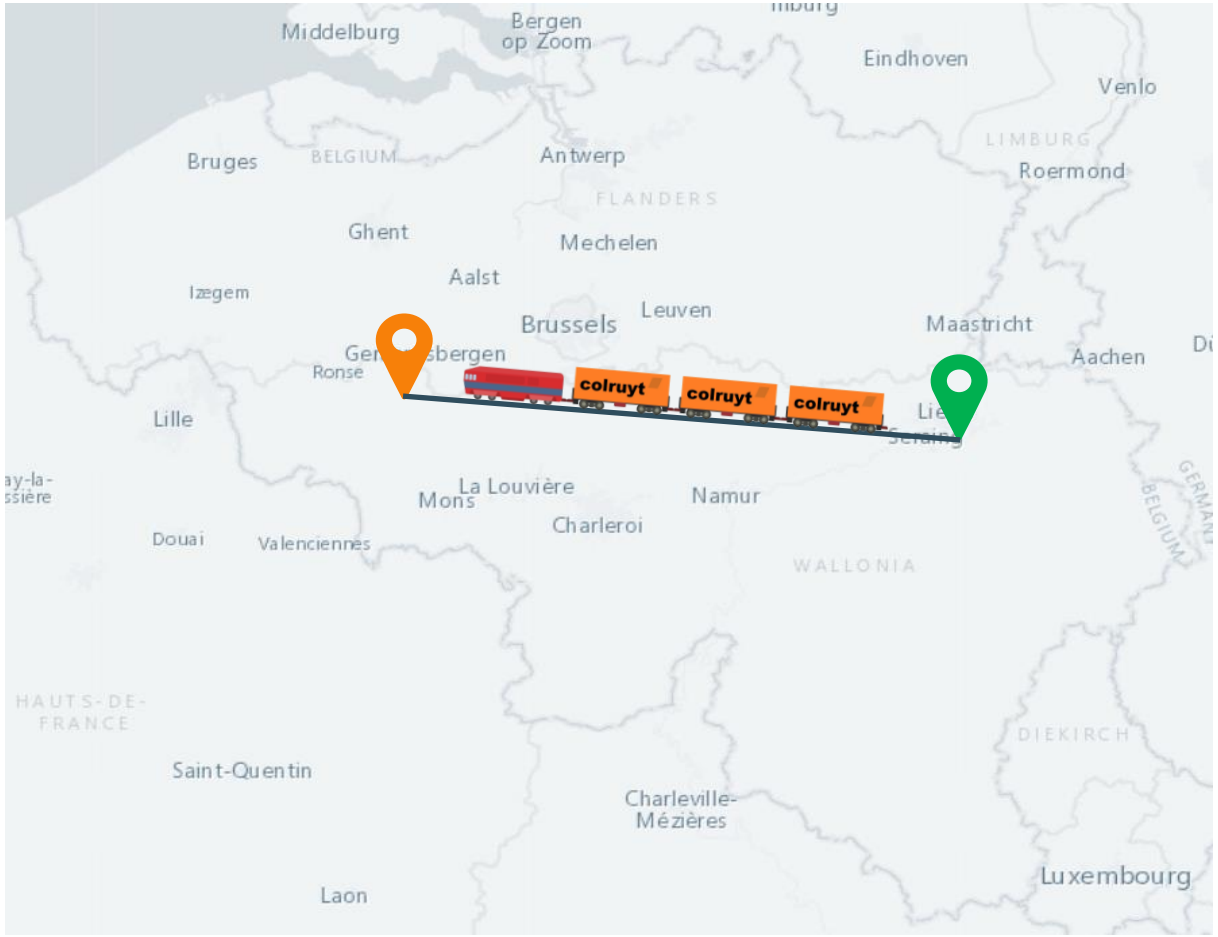
- Current situation: 

- 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

→ not cost effective 

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

→ to be researched!

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

→ Optimal mode choice based on the travel time information

Transit delays at the Panama Canal due to water measures

Michele Labrut | Mar 02, 2020

→ Deal with unreliability in transport system: delays, disturbances, …

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

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Transit delays at the Panama Canal due to water measures

Michele Labrut | Mar 02, 2020

→ Deal with unreliability in transport system: delays, disturbances, …

Our model considers stochastic elements of the transport system.

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

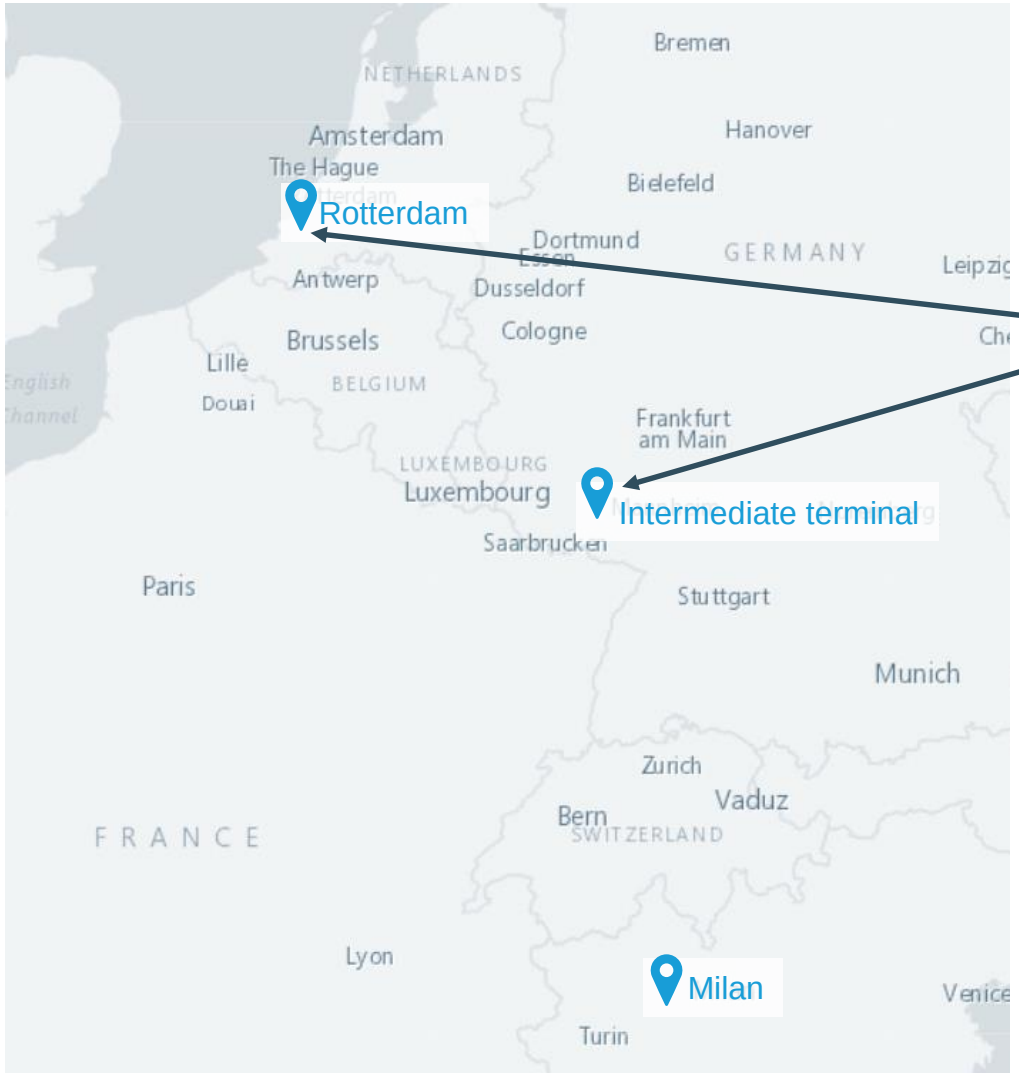
Travel time duration of transport services (long-haul transport)

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.



A shipment from Rotterdam to Milan…

Our model supports the transport mode decision.

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

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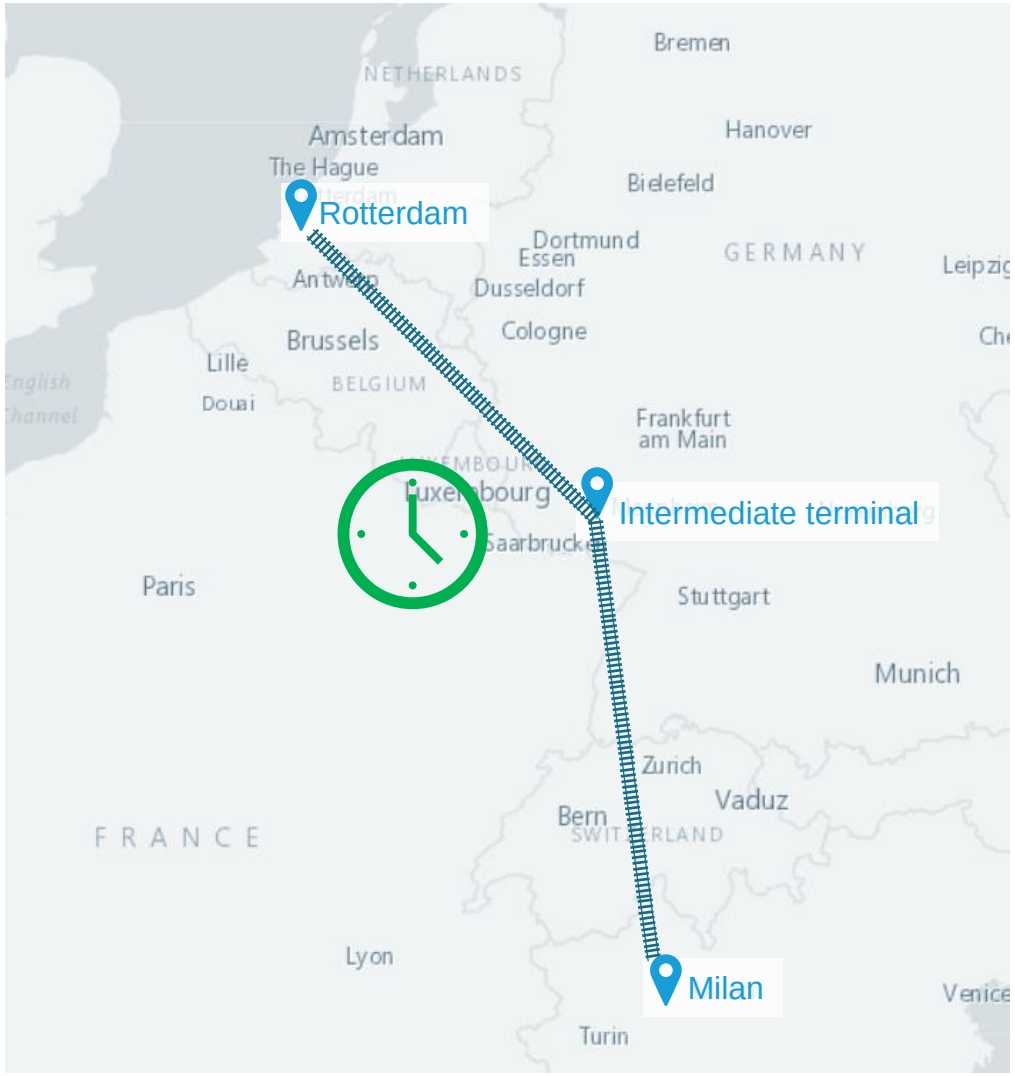

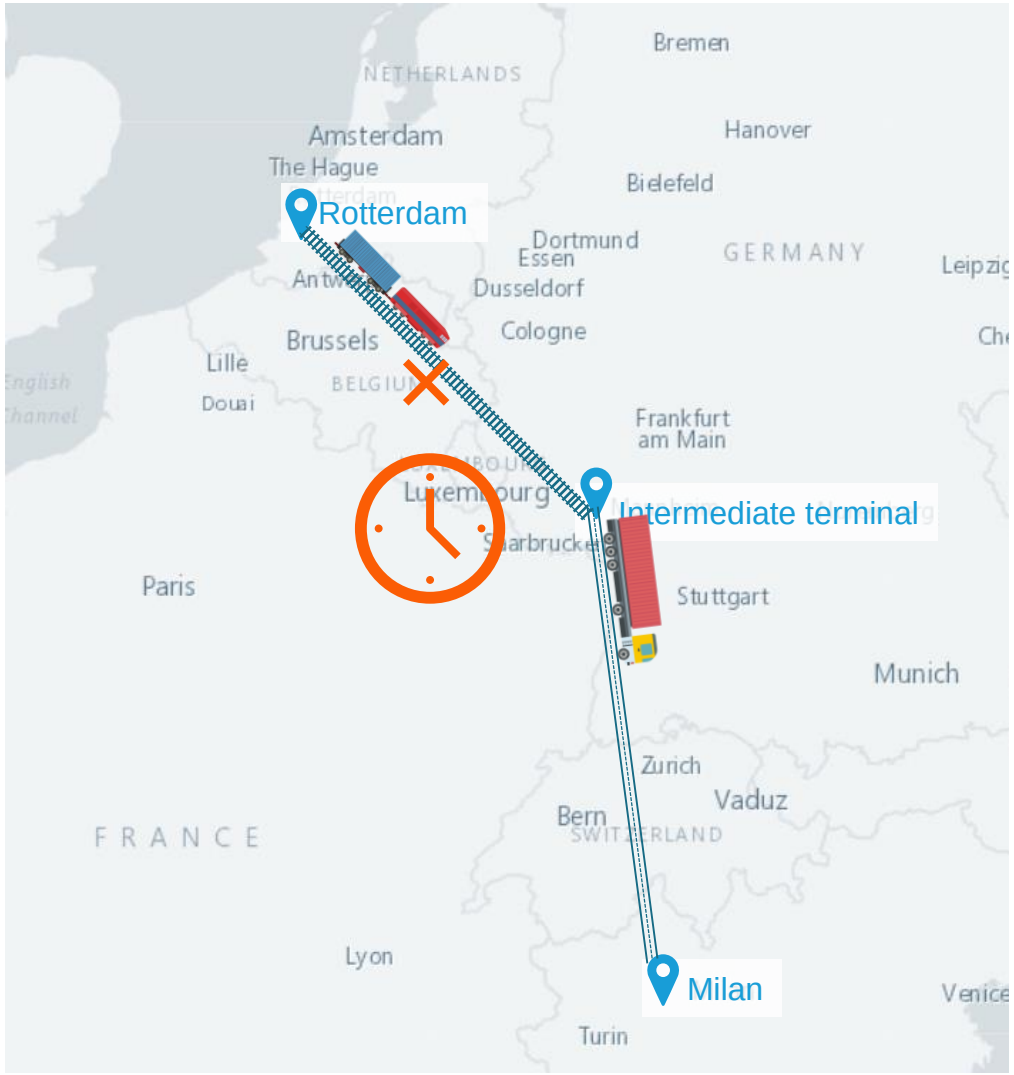

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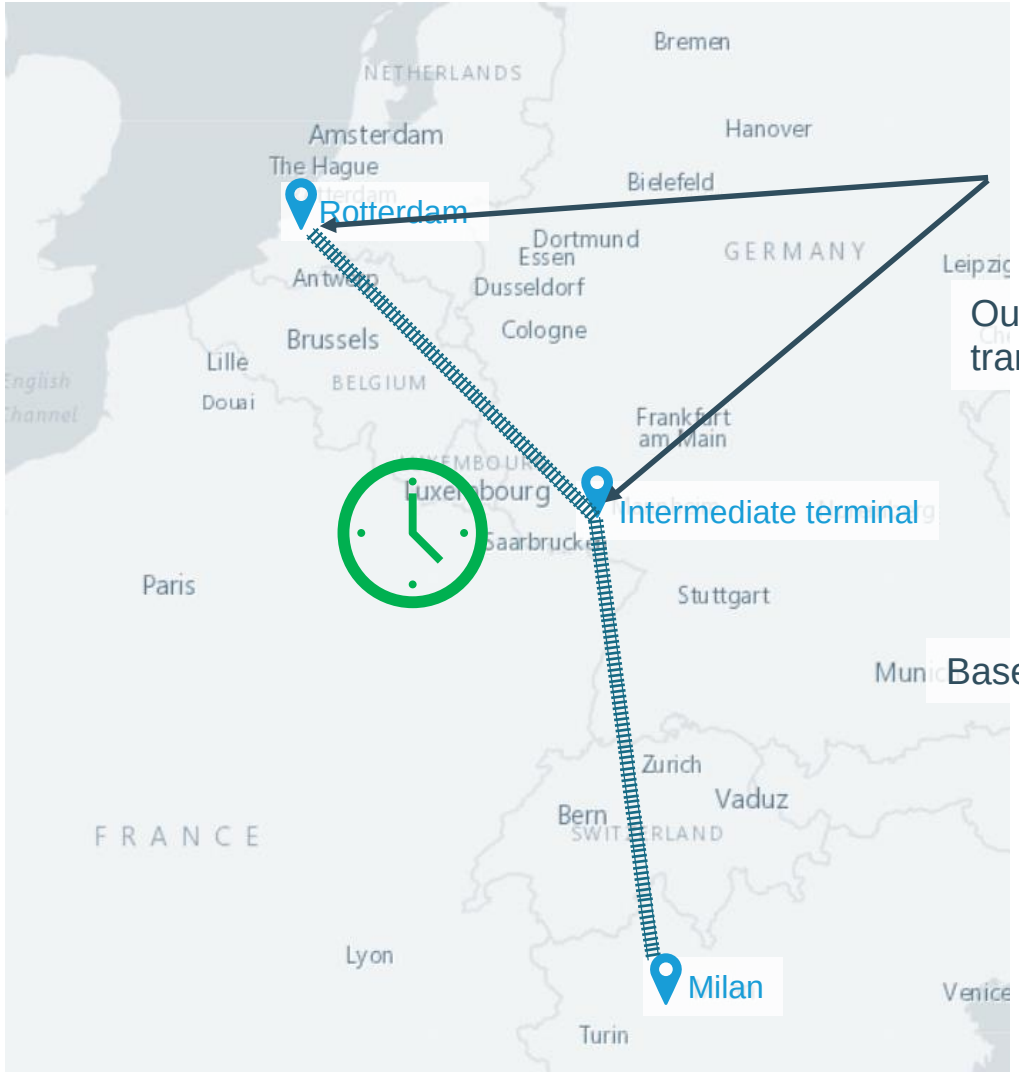
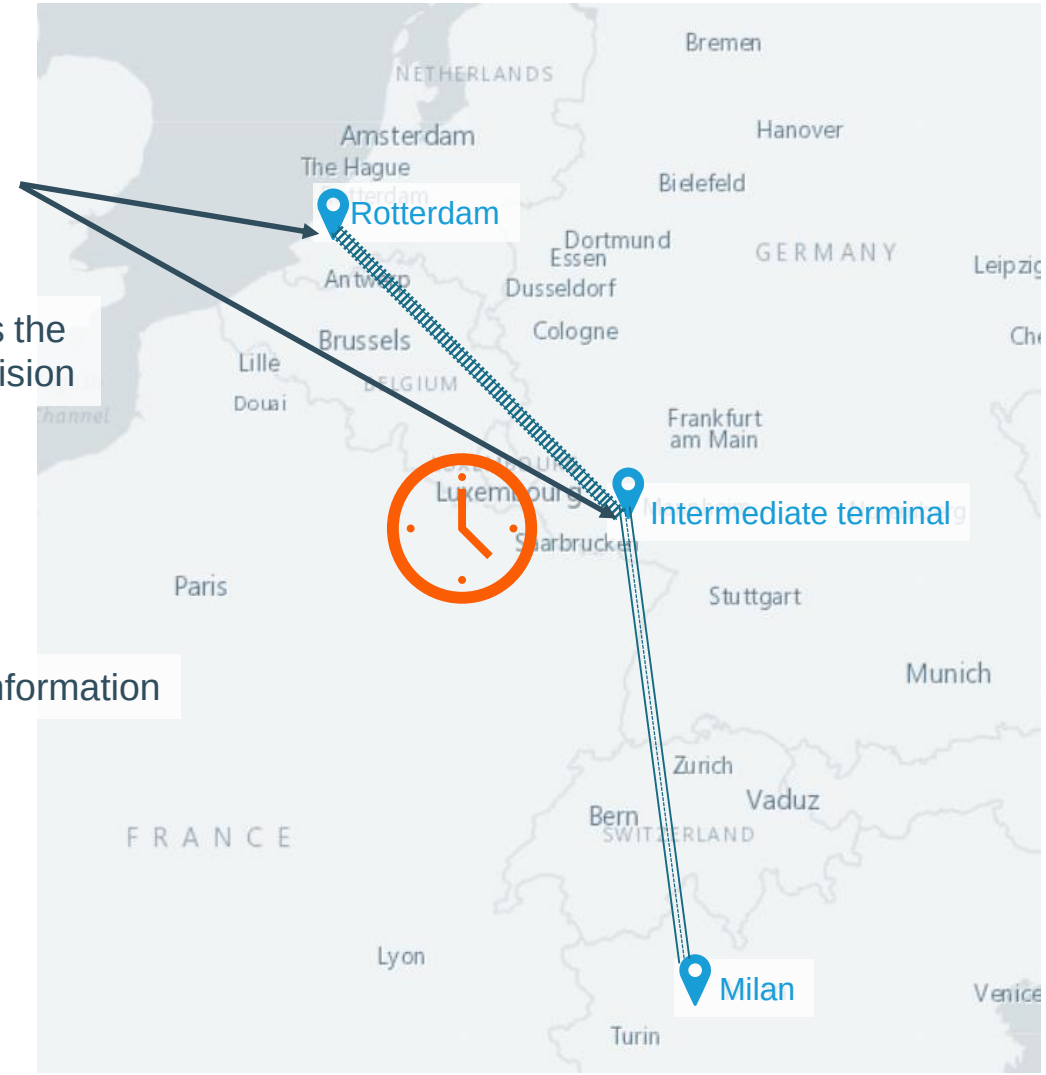


Our model supports the transport mode decision

Based on real-time information



The model is formulated as a Markov decision process.

Decision-support model

- Markov decision process

MDP: prescribes optimal action given the system's state

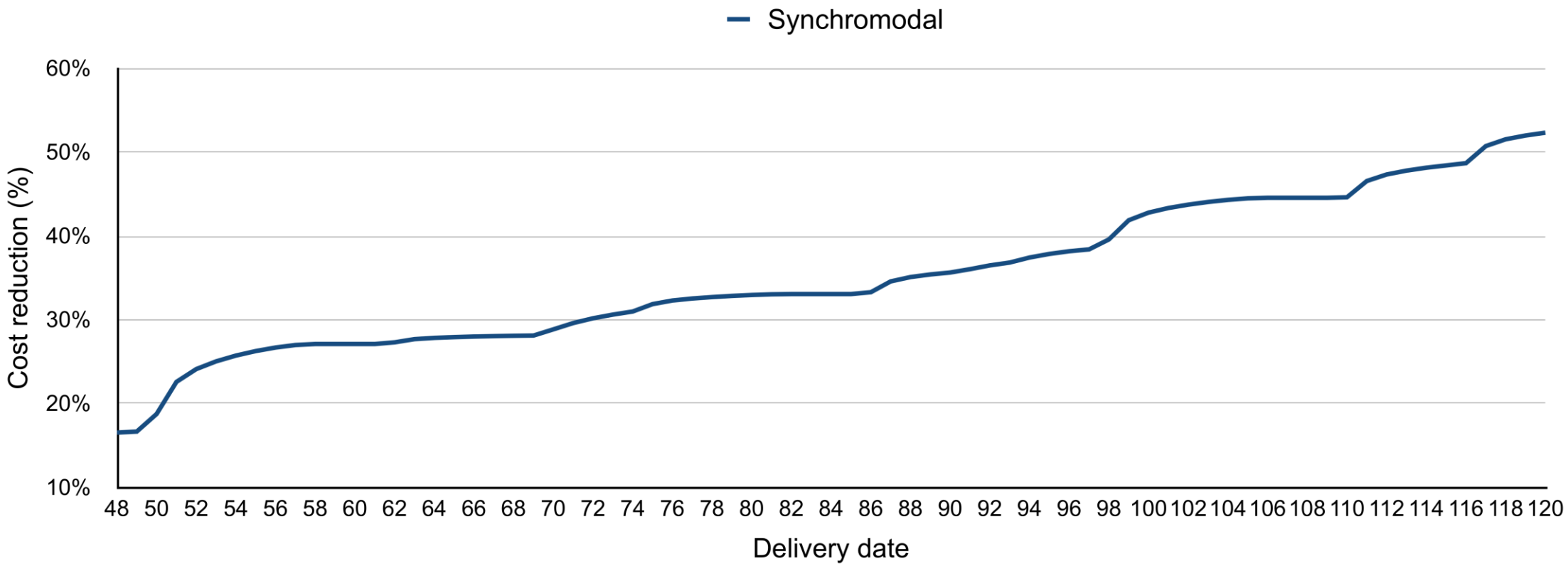
- Anticipates stochasticity in the system when making decisions

- 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

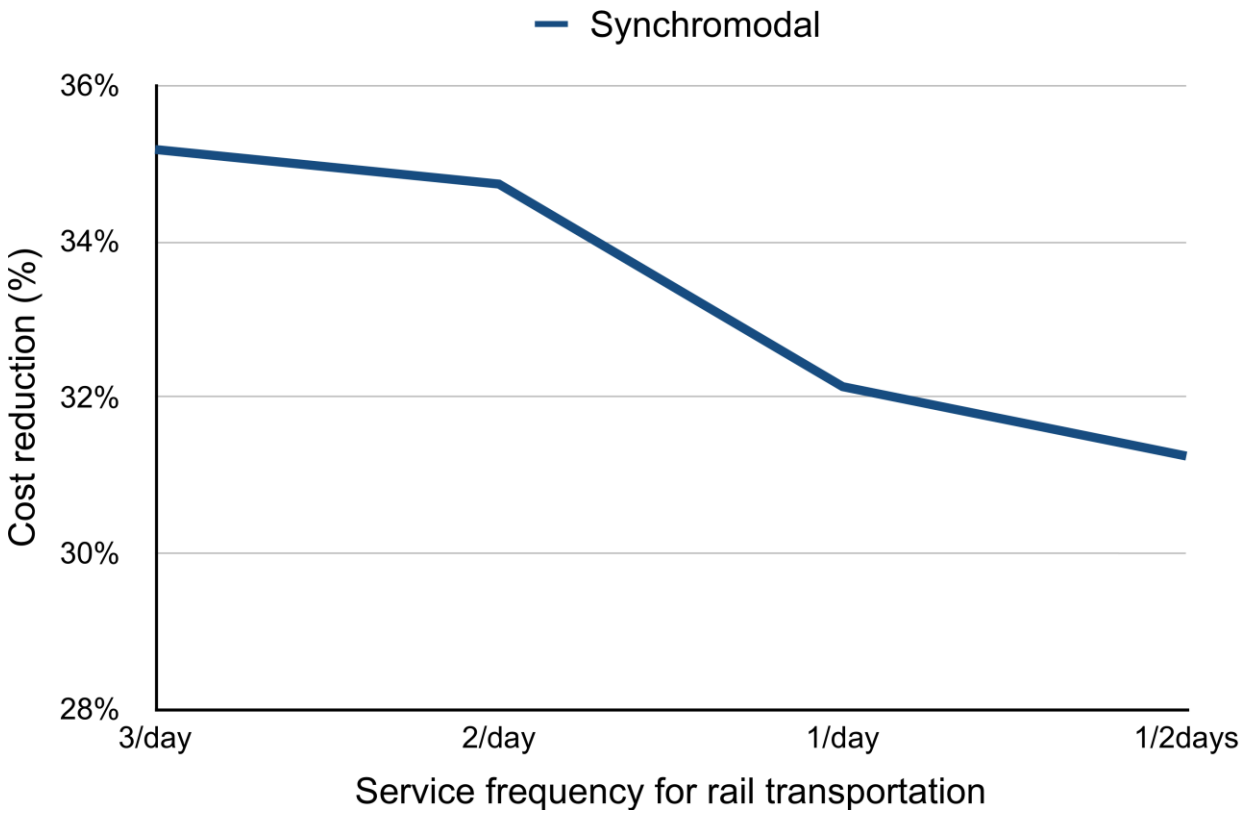
Result: the value of synchromodal decision-making increases when the delivery is less urgent.

- Measure: % cost-reduction against unimodal road transport



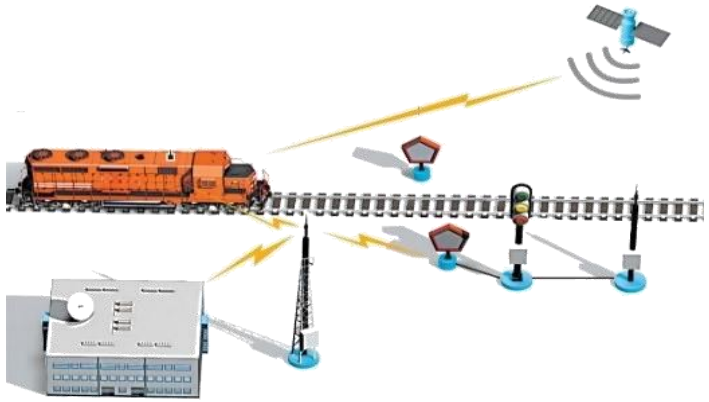
Result: the value of synchromodal decision-making increases when available intermodal services are more frequent.

- 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