Twin hub

Intermodal rail freight Twin hub Network North West Europe

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Twin hub network: an innovative concept to boost competitiveness of intermodal rail transport to the hinterland

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Research Institute OTB

Content of presentation

- General intermodal challenge
- The bundling challenge
- Twin hub concept
- Promising Twin hub networks
- Twin hub project
- The Rotterdam bundle challenge

Challenge (intermodal) transport

Intermodal rail transport is highly relevant

- High growth rates of freight transport (50% between 2000 and 2020)
- Impossible to accommodate growth mainly by truck transport
  (current share is about 75% in the EU)
- Rail transport is relatively? sustainable (e.g. climate, pollution, noise, accidents, infrastructure, space)
- Societal aims: increase share intermodal rail and barge transport
  In Rotterdam the aim is to increase rail share from 11% to 20% in 2033. In Antwerp to 15% in 2020.
- Commercial aims: Intermodal rail transport is a growth market for the railway sector

Intermodal rail transport is only modestly competitive

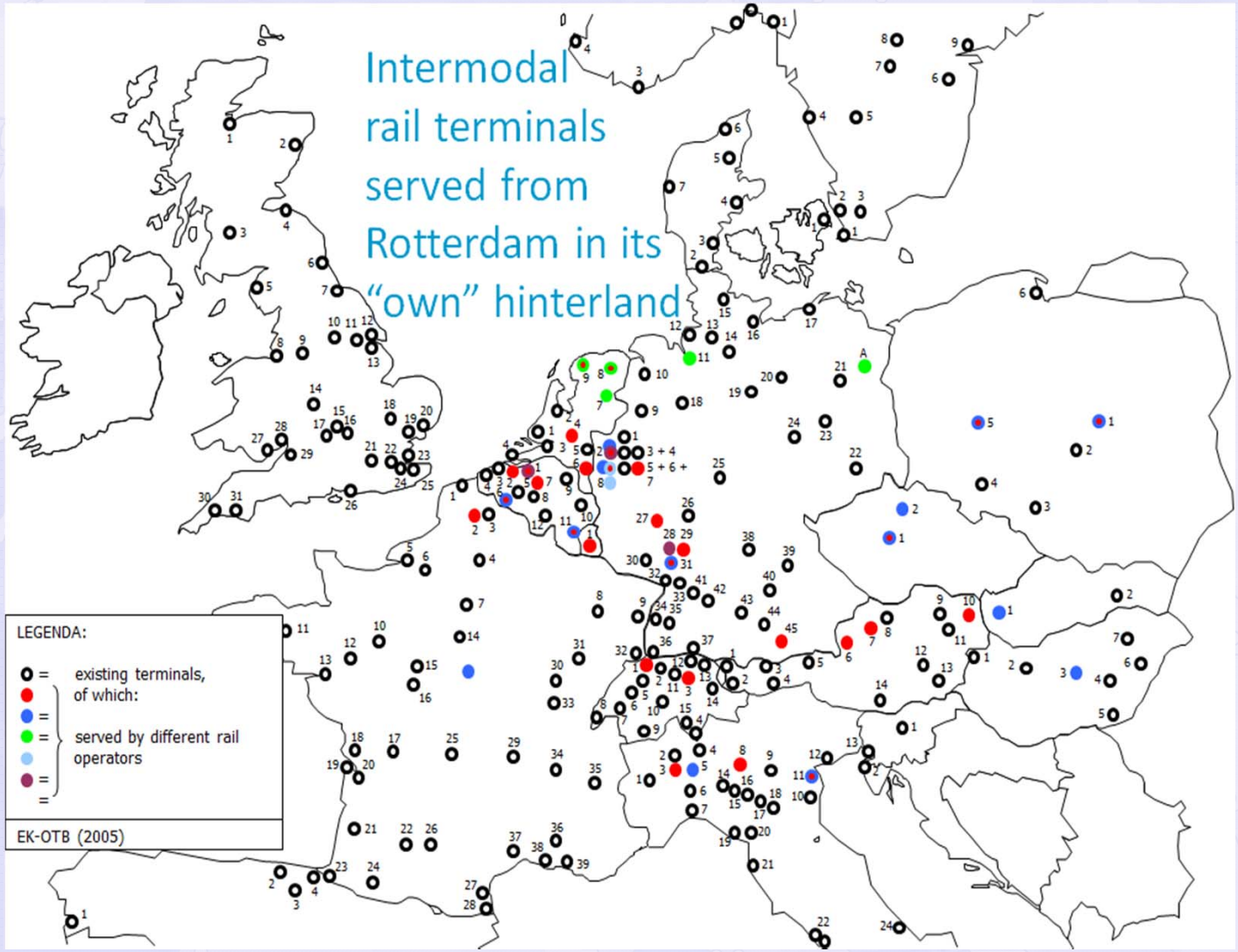
- Growth share intermodal rail transport is hampering

- Good quality only (according to the European project IQ):
  - In corridors with large flows
  - From and to large nodes
  - In some well organized regions

- Rail is typically chosen because of low costs, but numerous railway companies / intermodal rail operators cannot cover their costs

- Capacity restrictions in rail network at large nodes, in large seaports in particular

Relevance of the performances



Conclusion for intermodal transport: Operational improvements

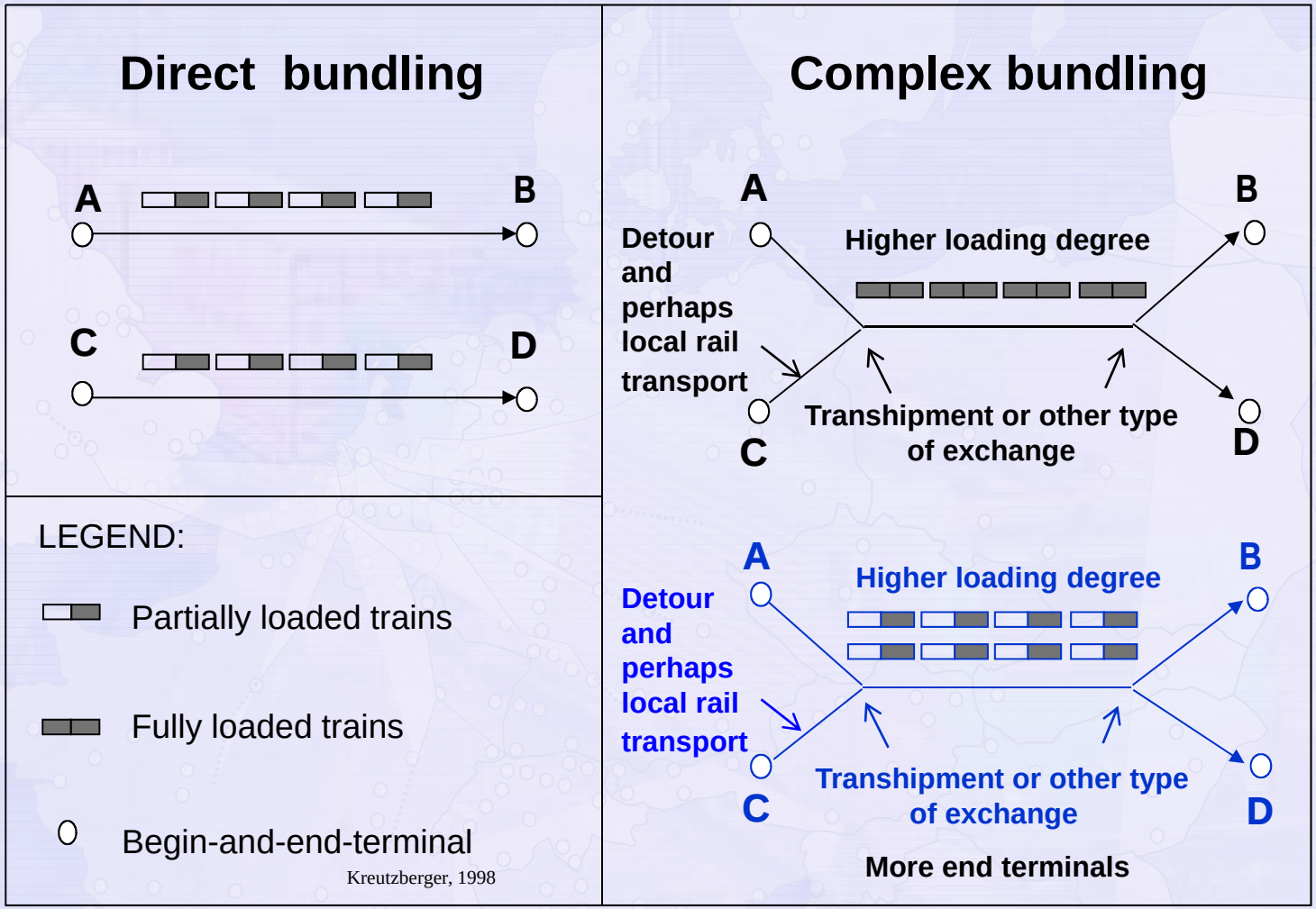
Continuously in search for appropriate innovations:

- Network design (mainly services):
  - Bundling of rail flows
  - Train roundtrips
  - Pre- and post-haulage
  - Spatial organization (locations of terminals and customers)
- Node design (services and infrastructure)
- Vehicle design
- Business and organisational design

The bundling challenge

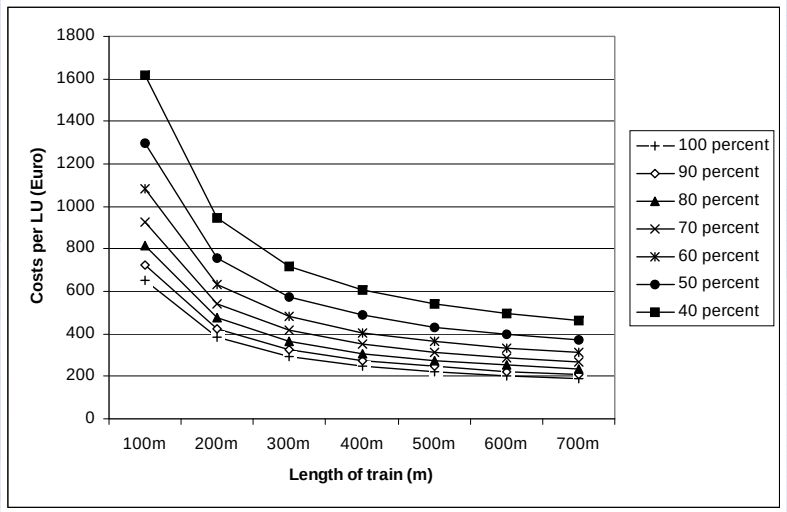
Basic bundling choices

- Many intermodal rail flows are too small for direct train services ...
- ... also from and to large nodes
- "Complex bundling" is required for many relations



Relevance of the performances

- Larger trainloads
  -> lower costs per load unit
  (most important for
  train costs)

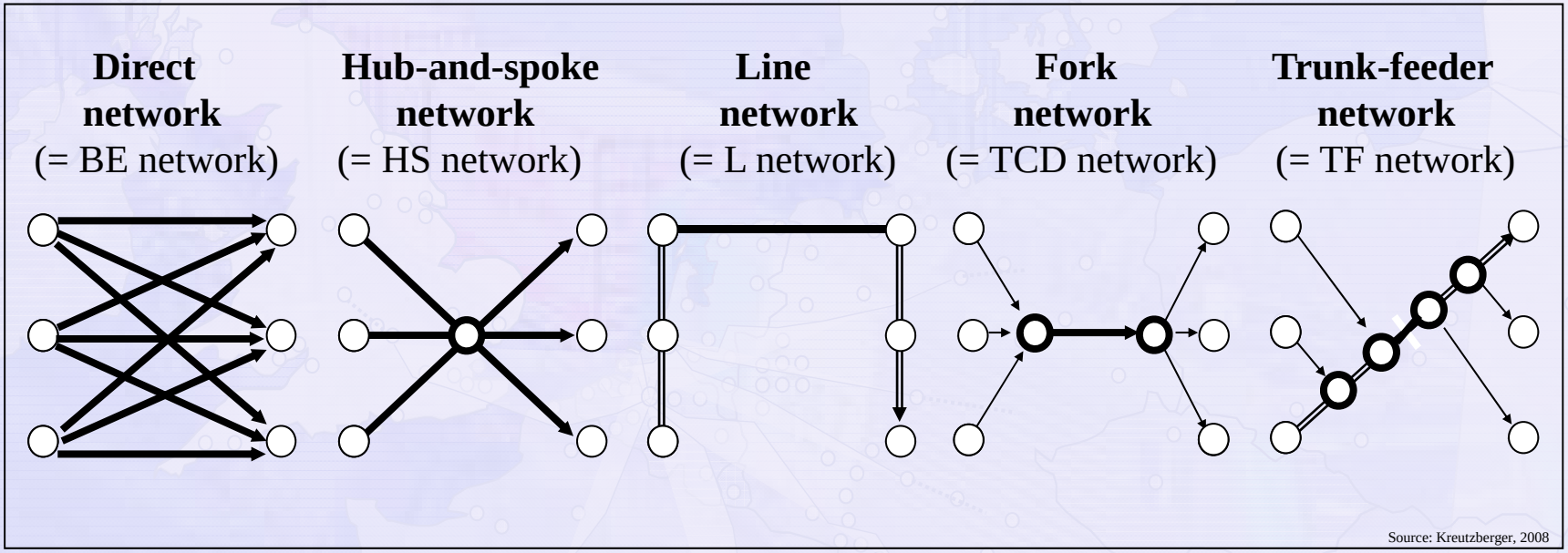


- Higher frequencies -> lower costs of shipper:
  - E.g. interest costs for goods in circulation
  - Storage costs at the shippers' locations

- Higher network connectivity -> shorter distances pre- and post-haulage -> lower door-to-door costs

- More efficient use of infrastructure -> less land use and lower infrastructure and hence transport costs per load unit

Basic bundling choices

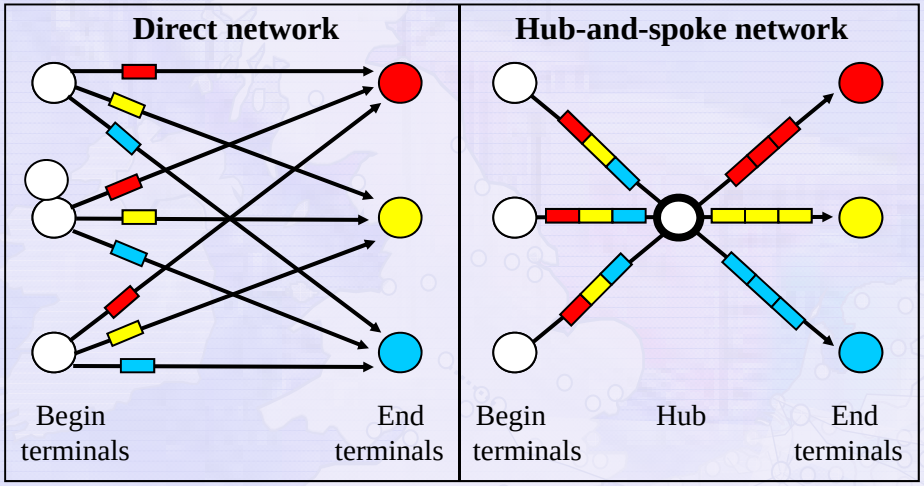


Only trunk rail network
(with full trainloads)

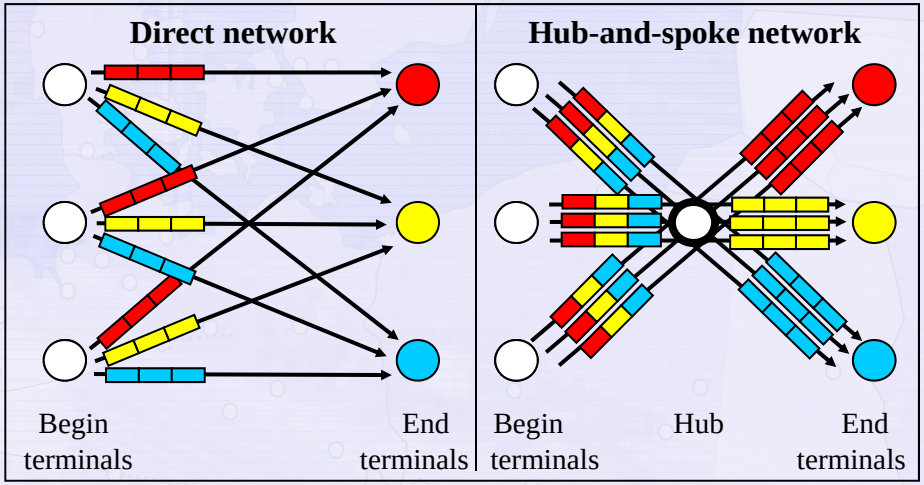
Trunk rail and local rail network
(with full and small trainloads)

The advantages of HS bundling

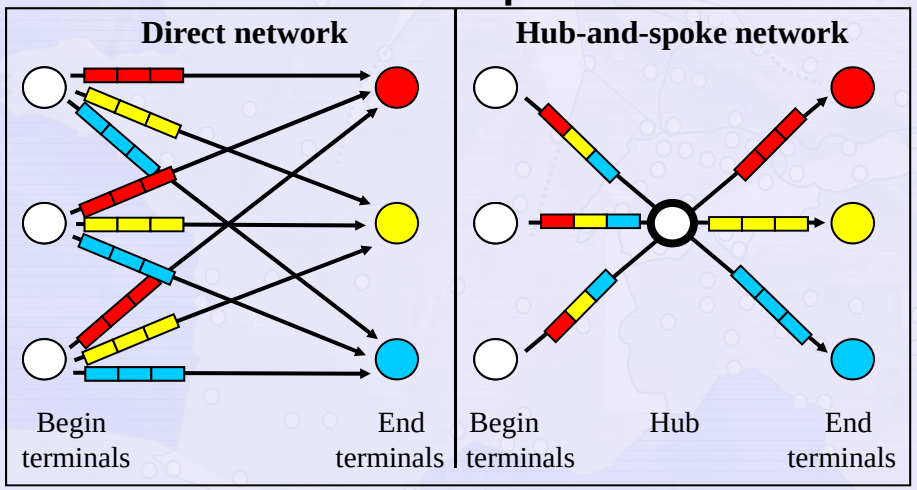
HS network: larger trainloads *



HS network: higher transport frequencies *



HS network: smaller transport network volumes required *



*** Than in direct network**

Source: Kreutzberger, 2011

Physical choices within HS networks

Shunting of wagons (formerly including containers)

Crane transhipment of containers at a terminal

Physical choices for HS bundling

- Exchanging single wagons on gravity shunting yard
  is relative expensive and time consuming

- Exchanging wagon groups on flat (or gravity) shunting yard
  is acceptable for costs and time, but only suitable for flows which are large enough to fill a wagon group

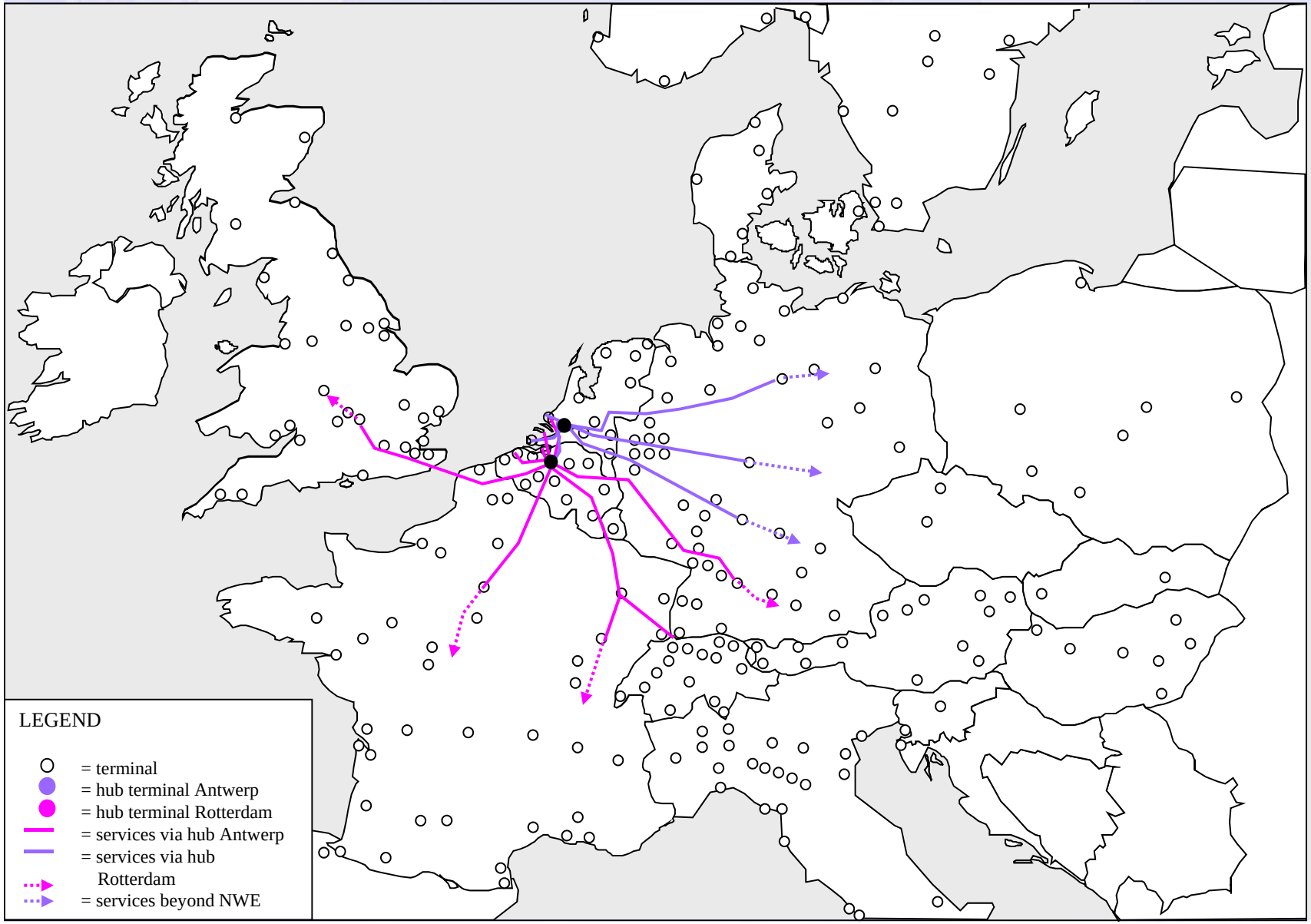
- Transhipping load units at true hub terminal
  is acceptable for costs and time and also suitable for smaller flow sizes than required in wagon group trains

Twin hub concept

Twin hub concept

- Bundle rail flows of Rotterdam and Antwerp and of smaller seaports
  - Transport Dutch load units in Antwerp trains wherever they have or could have a strong market position
  - Transport Belgian load units in Rotterdam trains wherever they have or could have a strong market position
  - Complementary corridors in acknowledgement of seaport competition
  - Move load units between inland terminals and different ("west") seaports in the same train
- Organize such bundling by means of hub-and-spoke- (= HS-) networks
- Two hubs, in regions Antwerp and Rotterdam (= gravity points of flows)
- The Twin hub concept enlarges the service area of each hub increasing the advantages of HS bundling

Twin hub concept

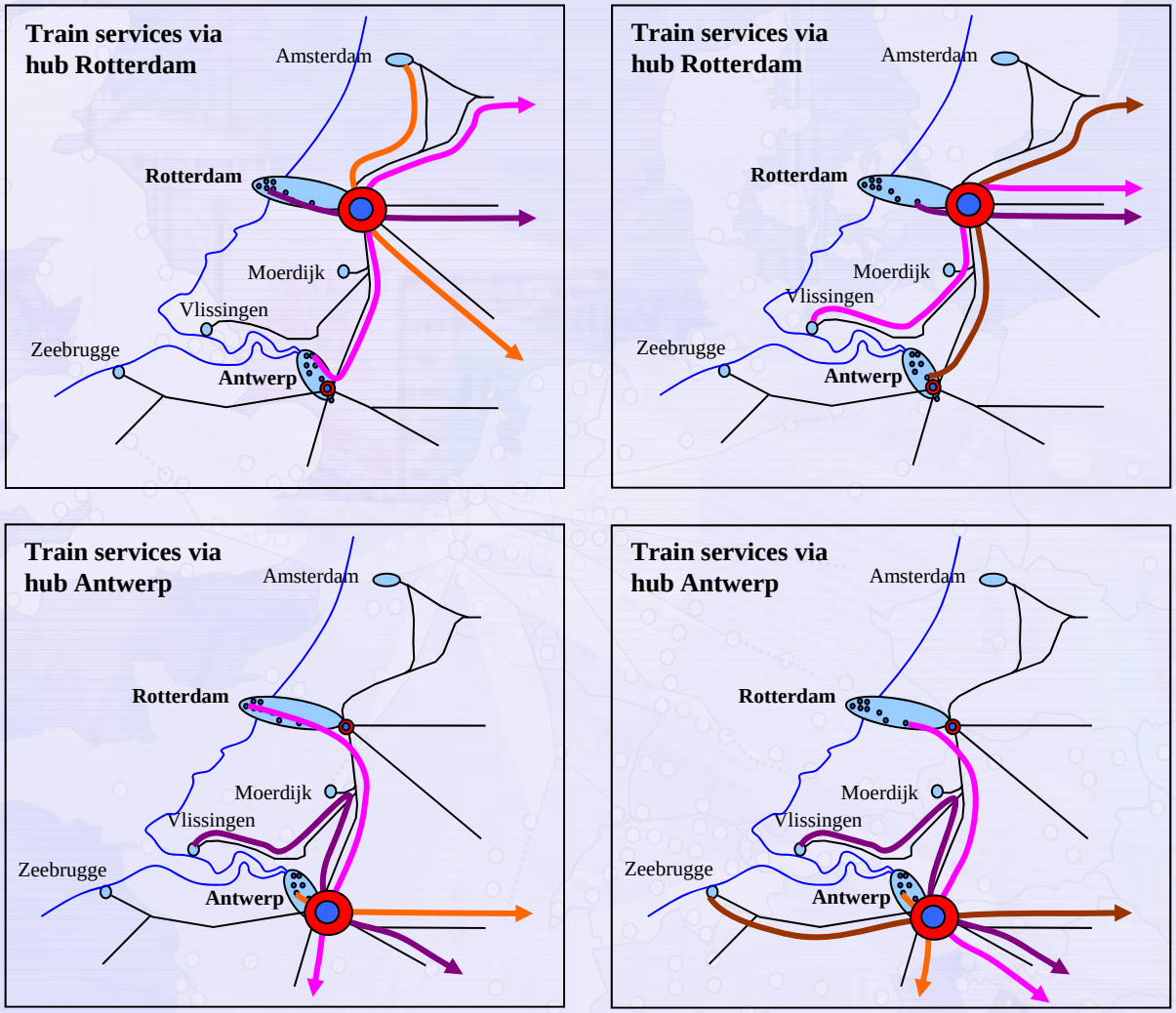


TU Delft

nwe

INTERREG IVB

Twin hub concept



LEGEND= train services to/from European inland terminals

Twin hub concept

Avoid inefficient types of operations. Therefore:

- Each train and load unit only visits 1 hub
- No exchange of single wagons. Instead:
  - Rail-rail transshipment of load units between trains
  - Exchange of wagon groups between trains
- No local trains with relative small trainloads

Twin hub concept

Twin hub:

- Cooperation between competitors
  - seaports
  - countries
  - rail operators

Currently: Intermodal hub-and-spoke bundling by train is typically restricted to:

- seaports within 1 country
- 1 rail firm or ”family” of rail firms

Twin hub: open to new actors to participate

Twin hub project

Twin hub project

Lasts almost 4 years

Budget more than 5,5 million Euros

Partners:

- 4 universities
- 4 rail operators
- 2 seaports
- 3 consultants

Advisory group

Four work packages:

1) Identification of promising Twin hub networks
2) Business plan pilot, pilot, monitoring pilot, innovative booking system
3) Twin hub infrastructure on the long term
4) Societal benefits

Identification of Twin hub networks

Approaches to identify promising Twin hub networks

1. On the basis of flows (combination of flows) (TU Delft)
2. On the basis of a new bundling tool (cost minimization) (TU Delft)
3. On the basis of the Euro Terminal model (VUB, Brussels)
4. Modal shift analysis for (1) and (2)

Approach 1 is the subject of further presentation

Bundling of flows in the terminal-terminal matrix

			Day A / B relations					
		End ->	Terminal E1	Terminal E2	Terminal E3	Terminal E4	Terminal E21	Terminal E22
	Begin ↓							
Seaport Rotterdam	Terminal	B1	0.1	0.4	0.5	0.4	0.8	0.8
	Terminal	B2	0.0	0.0	0.2	0.0	0.0	0.0
	Terminal	B3	0.7	0.2	0.1	0.2	0.2	0.0
	Terminal	B4	0.0	0.0	0.0	0.0	0.0	0.0
	Terminal	B5	0.1	0.0	0.1	0.0	0.0	0.0
Seaport Antwerp	Terminal/Cay	B6	0.0	0.5	0.4	0.5	0.8	0.9
	Terminal/Cay	B7	0.5	0.1	0.0	0.4	0.1	0.2
	Terminal/Cay	B8	0.3	0.1	0.1	0.1	0.0	0.1
	Terminal/Cay	B9	0.0	0.0	0.0	0.0	0.0	0.0
	Terminal/Cay	B10	0.2	0.0	0.1	0.0	0.0	0.0
Other seaports	Amsterdam	B11	0.0	0.1	0.0	0.0	0.0	0.1
	Moerdijk	B12	0.1	0.0	0.1	0.0	0.1	0.0
	Vlissingen	B13	0.1	0.0	0.0	0.1	0.1	0.1
	Gent	B14	0.0	0.0	0.0	0.0	0.0	0.0
	Zeebrugge	B15	0.1	0.0	0.1	0.0	0.0	0.0
	TOTAL		2.2	1.4	1.7	1.7	1.3	2.2

Bundling in the hinterland

(e.g. L bundling)

* The flows in this table are fictive ones. Pink cell = reference flow.
"Day A/B" is to say that the train arrives at the end terminal on the day after departure.

Bundling of flows in the terminal-terminal matrix

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Bundling in 1 seaport

(e.g. HS bundling)

(in case of only 2 rail also L bundling is possible, as in current operations)

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Bundling of flows in the terminal-terminal matrix

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Twin hub bundling:

Of flows of several seaports

plus UK (not shown here)

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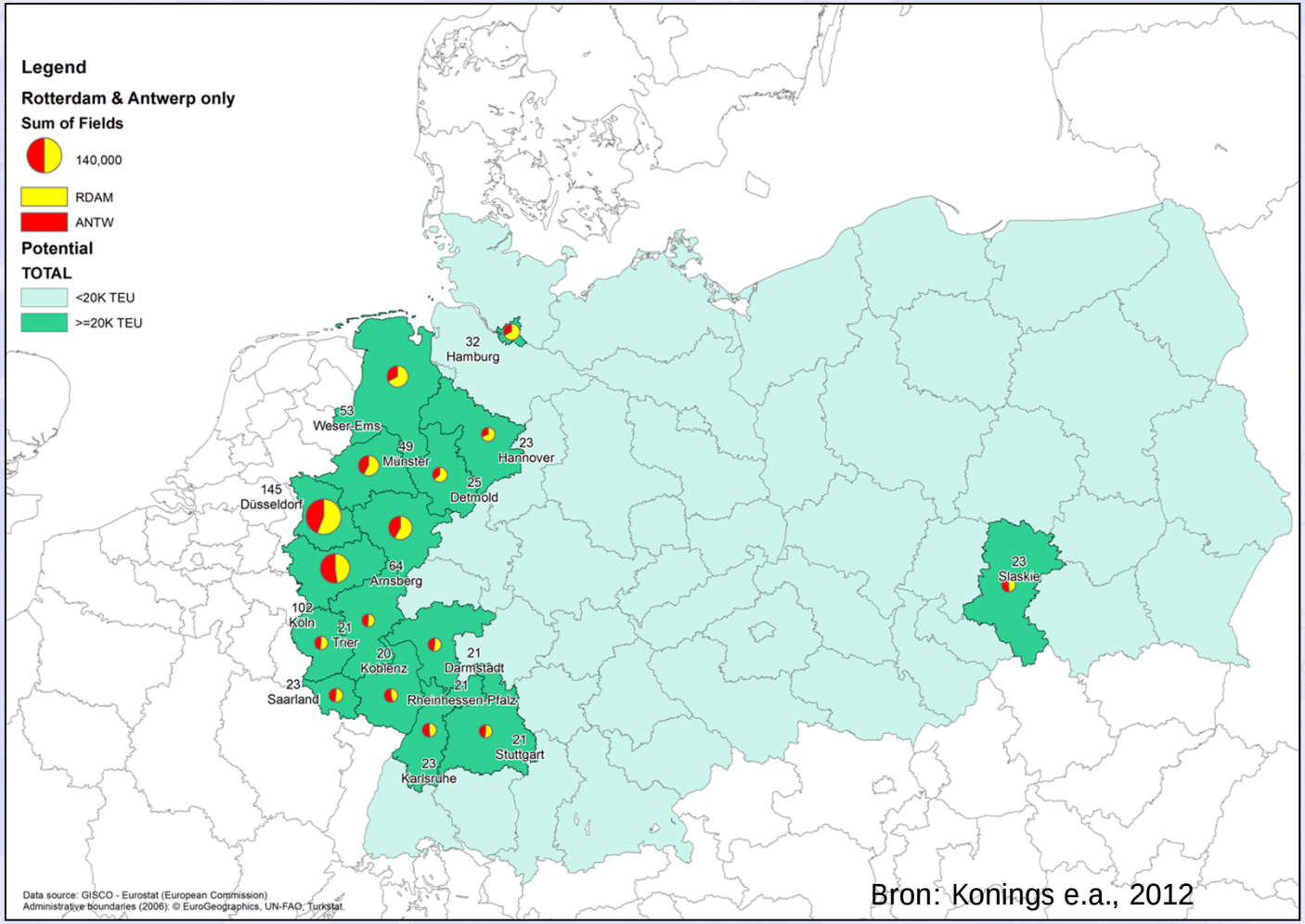
Concrete identification of promising Twin hub networks

Criterion:

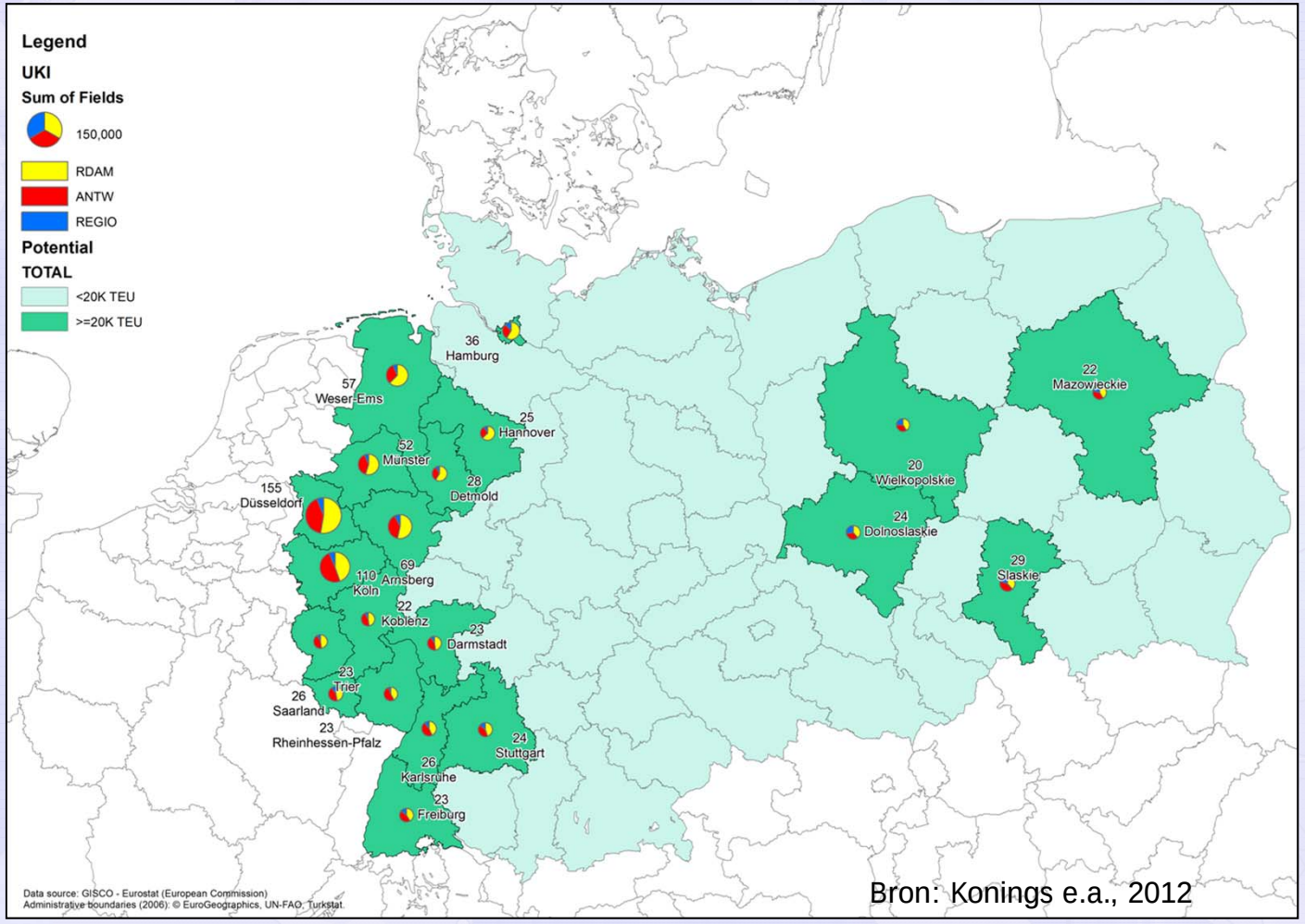
- 3 departures per week and direction
- 600m train length
- 20,000 TEU or more per year in two directions, of which at least 6,500 TEU in the minor direction
- To be achieved by e.g. loading degrees of 90% in one and 60% in the other direction

Regions that can be served by Twin hub services (in 1.000 TEU) between seaports Rotterdam / Antwerp and Germany / Czech republic / Poland, 2010



Bron: Konings e.a., 2012

Regions that can be served by Twin hub services (in 1.000 TEU) between seaports Rotterdam / Antwerp / Greater London and Germany / Czech republic / Poland, 2010



Bron: Konings e.a., 2012

Conclusions
Twin hub network:

- First steps to identify promising Twin hub networks seem to confirm:
  - Twin hub networks allows to access more inland-terminals by bundling Rotterdam en Antwerp flows, which otherwise will go by road (increase of network connectivity)
  - Twin hub network increases size of trainloads
  - Twin hub network increases service frequency
- All to be confirmed by cost optimization models and to be proven in the project pilot

The Rotterdam bundle challenge

Bundling challenge in seaports

Rotterdam

- Increasing number of rail terminals (within and outside of MV 2)
- L bundling not sufficient to integrate flows to trainloads
- Solutions: barge, feeder train, hub-and-spoke bundling (= HS)
- HS is very promising, especially based on hub terminal
- But Rotterdam has no hub terminal

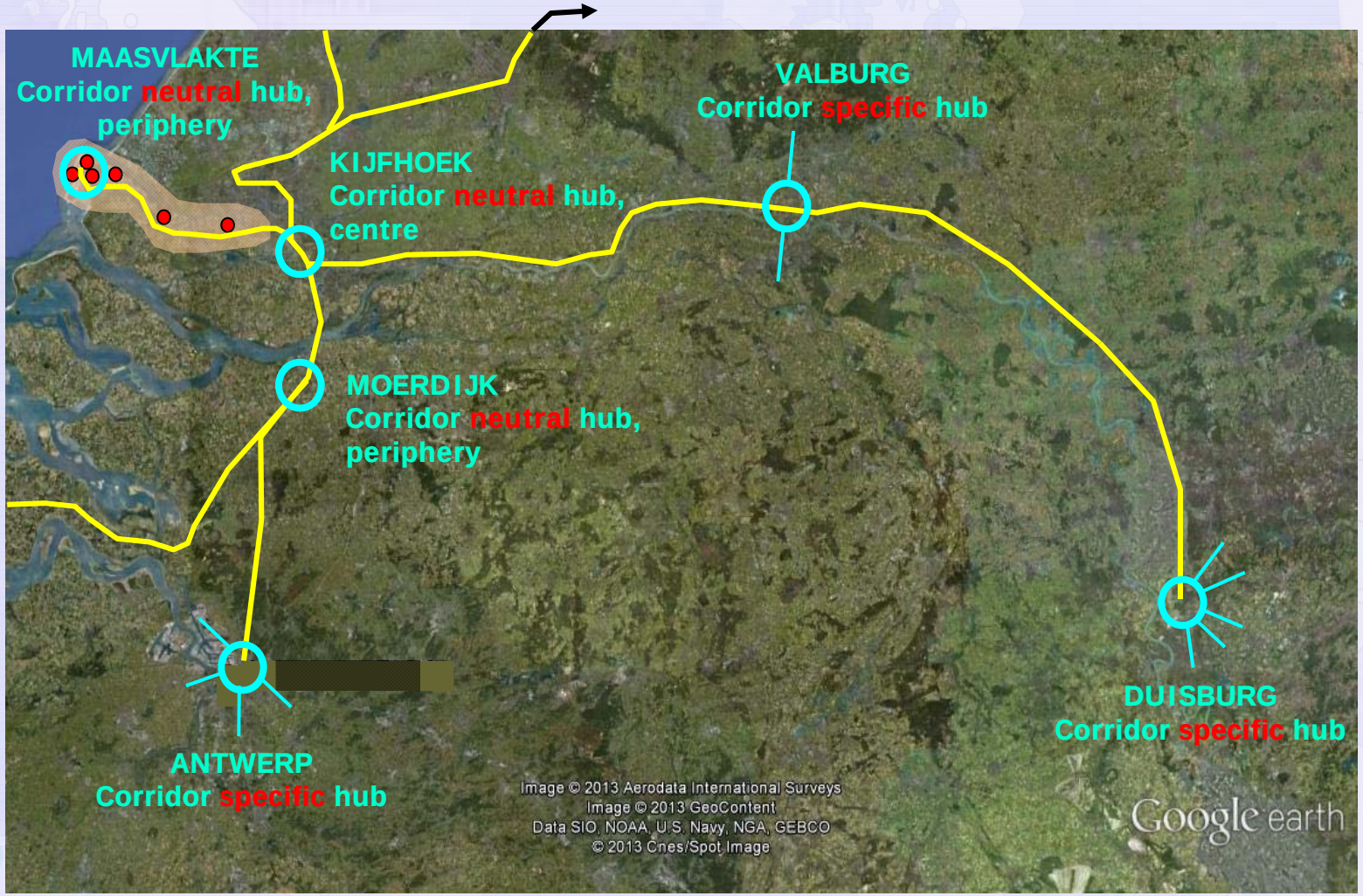
Antwerp

- Missing rail links to reach the seaport

Smaller seaports

- Get attached tot the train services of the large seaports
- By barge and by rail (multi-destination trains to the hub terminals of the large seaports)

Potential locations hub terminal for Rotterdam flows



Criteria to analyse potential hub locations

- Corridor neutral:
  -> bundling easier than corridor specific
  -> outplacement of port functions easier than corridor specific
  -> useful for other seaports, contrary to corridor specific

- Periphery (e.g. Moerdijk)
  -> less optimal than centre

- Periphery (Mvt): -> only suitable for bundling of Mvt flows
  (= future maybe 80% of all Rotterdam flows),
  contrary to centre

Questions ?