

# GPS-Based Real-time Transport Control for Production Network Scheduling Simulation

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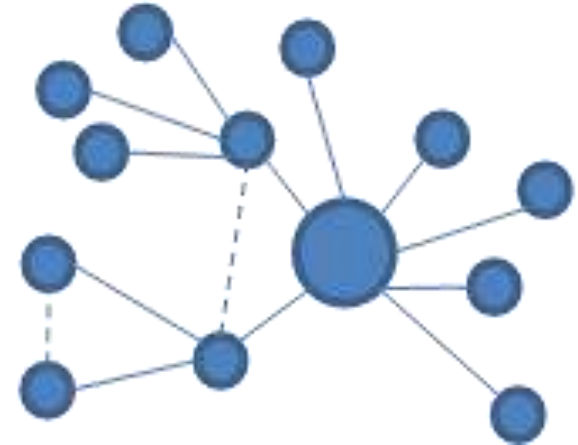
ESM 2011 at University of Minho



1. Problem Description
2. Cargo Tracking in Production Networks
3. Real-Time Transport Control
4. Integration of Transport Control in Production Planning
5. Testing Example
6. Conclusion and Outlook

## Nowadays production networks

- Players and connections
- Connections as logistic processes often bottlenecks with many interruptions
- Flow of materials not continuously visible
- Production control individually organized
- Much coordination effort



- **Technical solutions necessary for controlling flow of materials in real-time and using tracking data for production scheduling**
- **Battery powered GPS-based track and trace system**

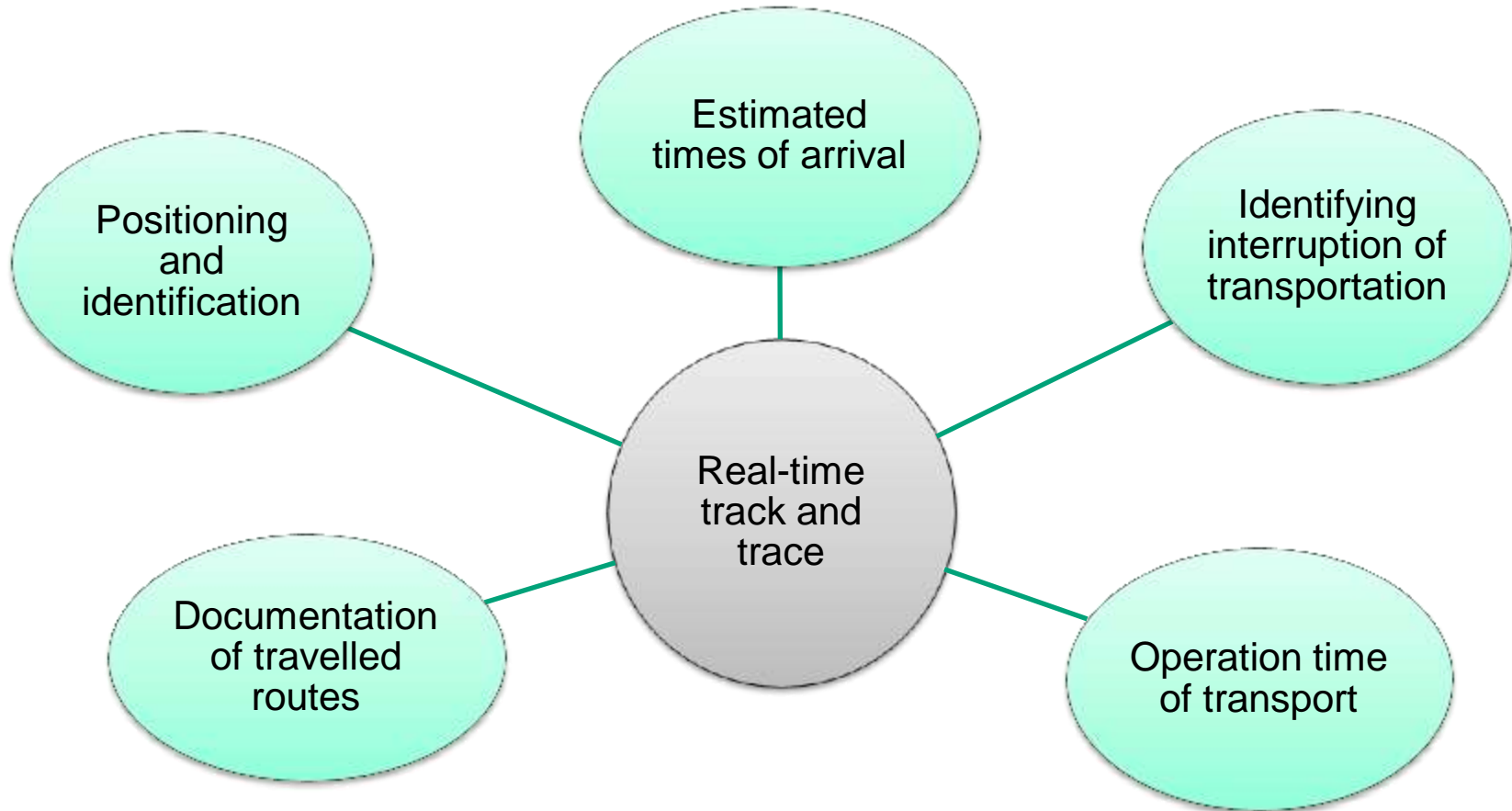
## Basic conditions of production networks

- Minimized stock
- Reduction of cycle-time
- Just-in-time supply

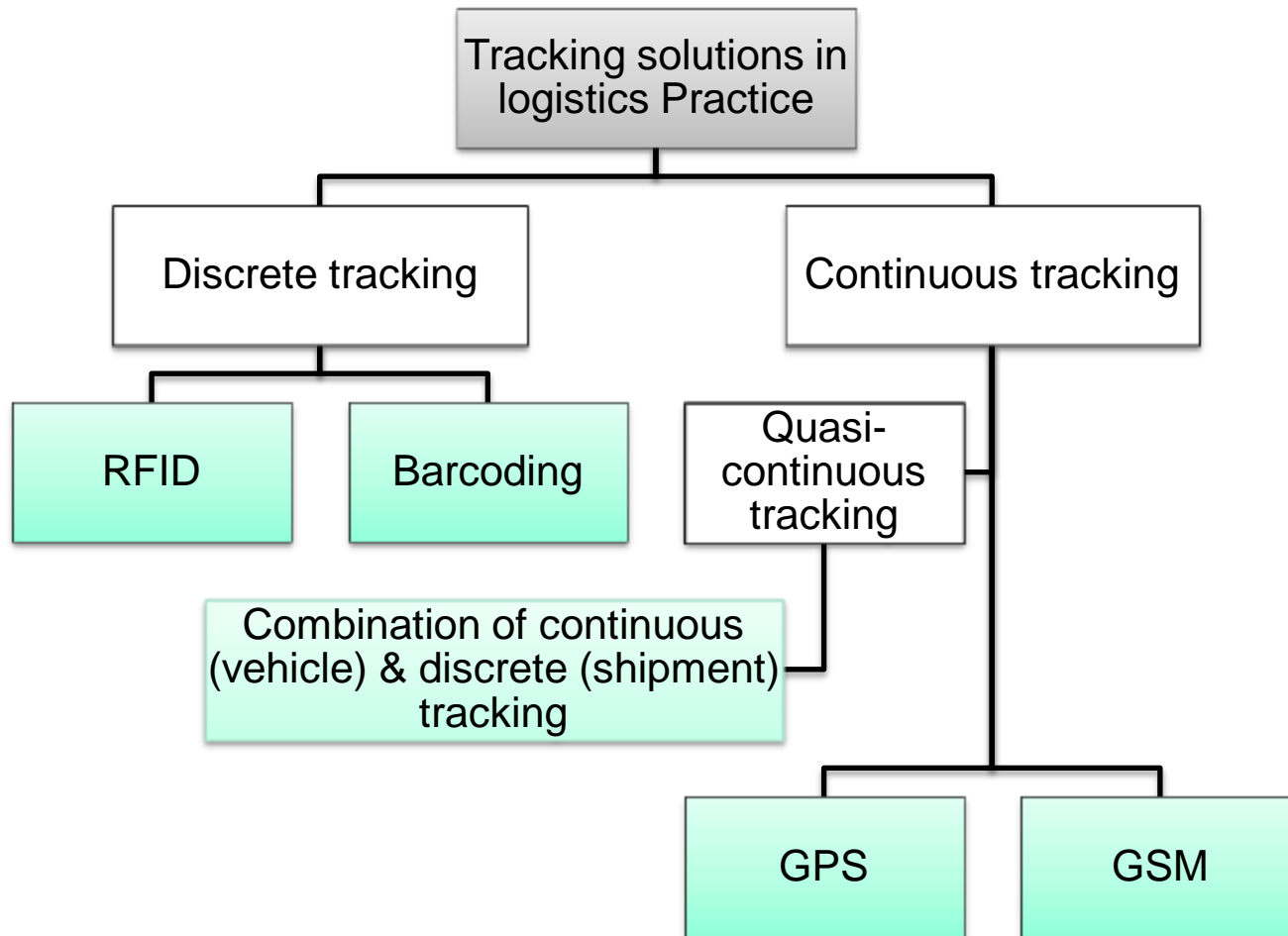
## Networks **demand for**

- Reliable flow of information
- Safeguarding deliveries
- Tracking in real-time to estimate arrival times
- LSP independent tracking solution

### Potentials of a real-time GPS-based track and trace

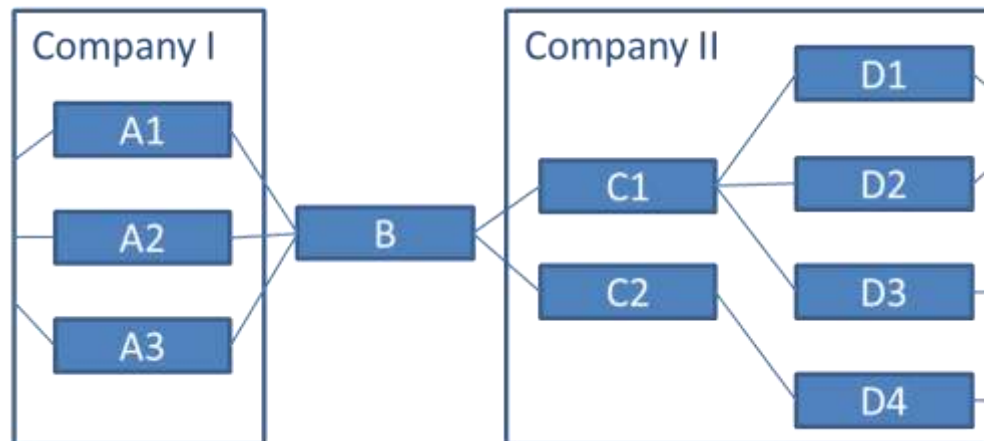


## Current methods and solutions for track and trace



## Basic conditions

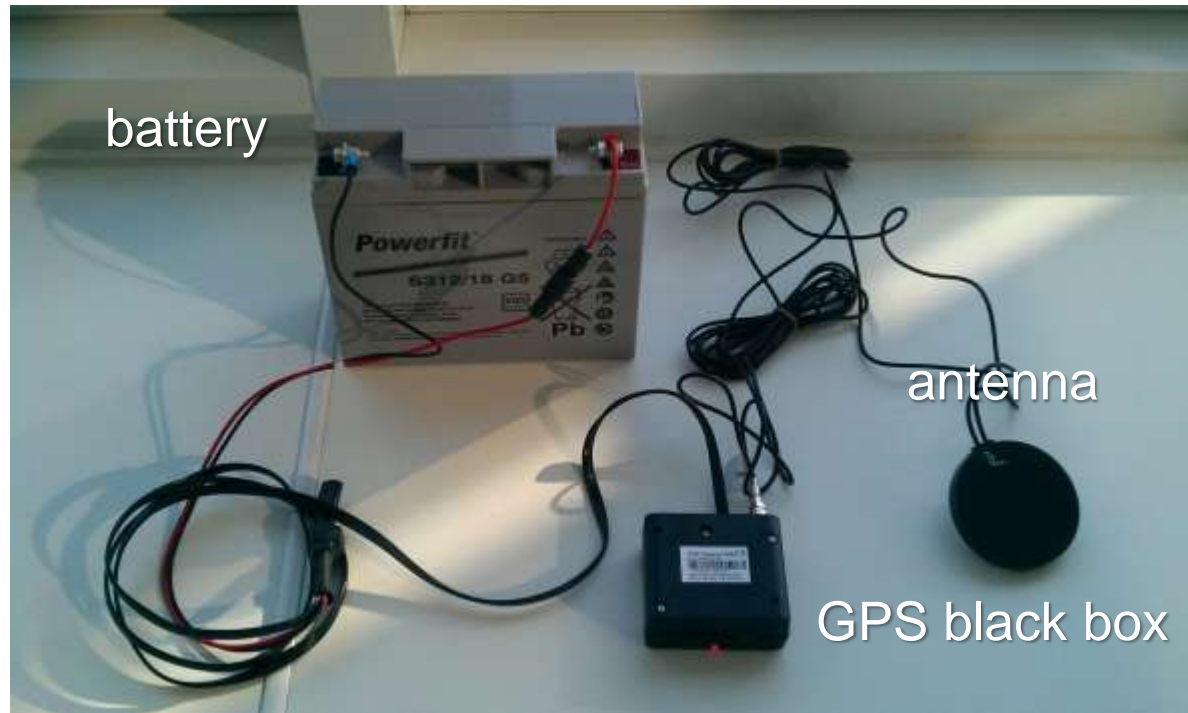
- Defined tasks and flow of material through production network
- Pre-defined starting and operating times
  - Comparism of original and actual schedule
- Challenge:
  - Identifying of discrepancies from original schedule
  - Extend reaction time to avoid production interruptions



### Algorithm draft

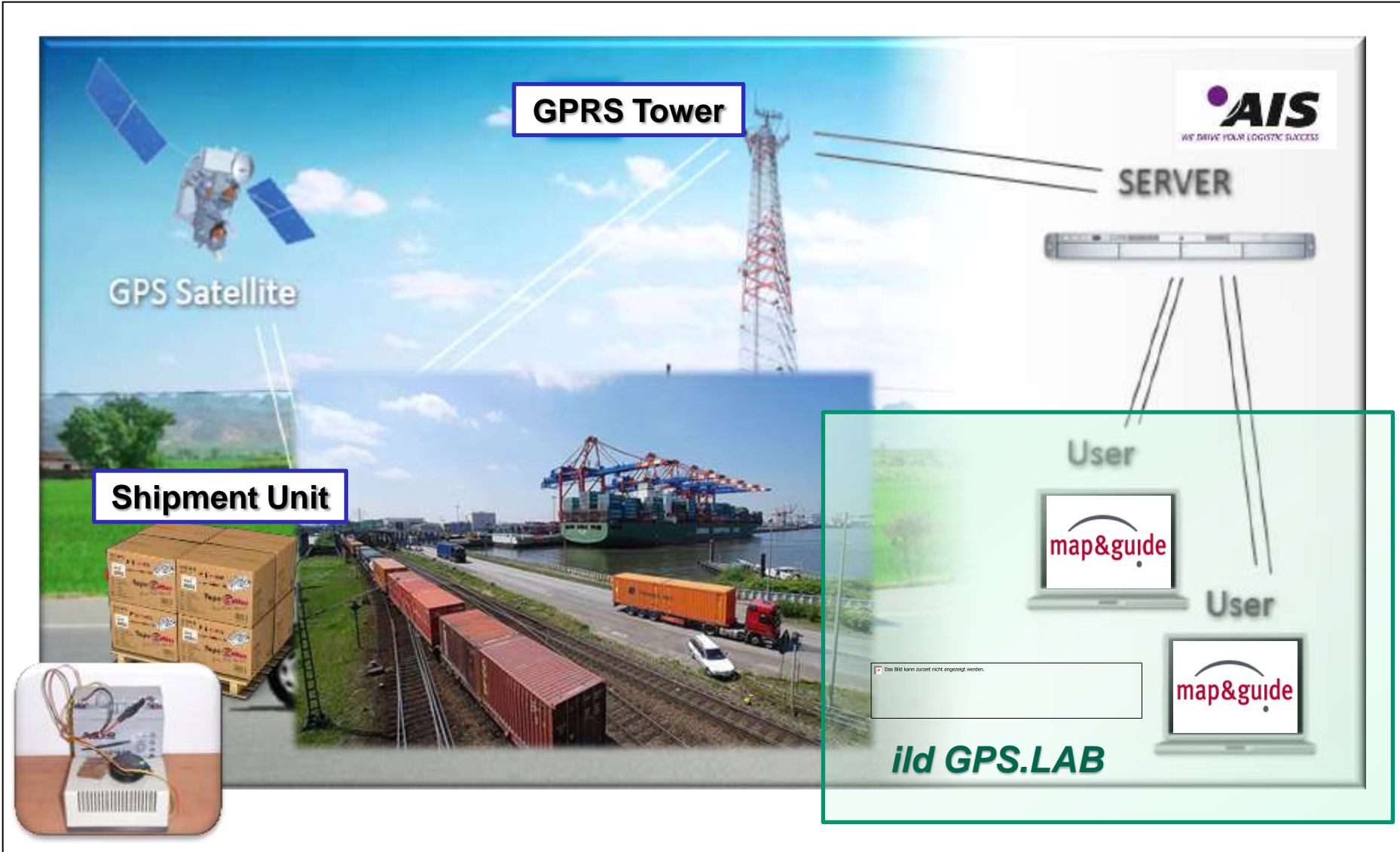
- 1 **For** every transport process **do**
- 2     Request of actual position of shipment/vehicle
- 3     Route planning from actual position to destination
- 4     Comparism of planned arrival time (starting time downstream process) and estimated time of arrival (result route planning step 2)
- 5     **If** estimated arrival time is equal or less than planned arrival time **then**
- 6         Next request
- 7     **Else**
- 8         Production Re-Scheduling
- 9     **End If**
- 10 **End For**

## 4. Integration of Transport Control in Production Planning



- 40 GPS modules with GPRS device for parallel shipment tracking and real-time transmitting of position data
- High performance antenna for receiving position data even inside trailers or containers
- High powered rechargeable battery for operating time of at least 72 h

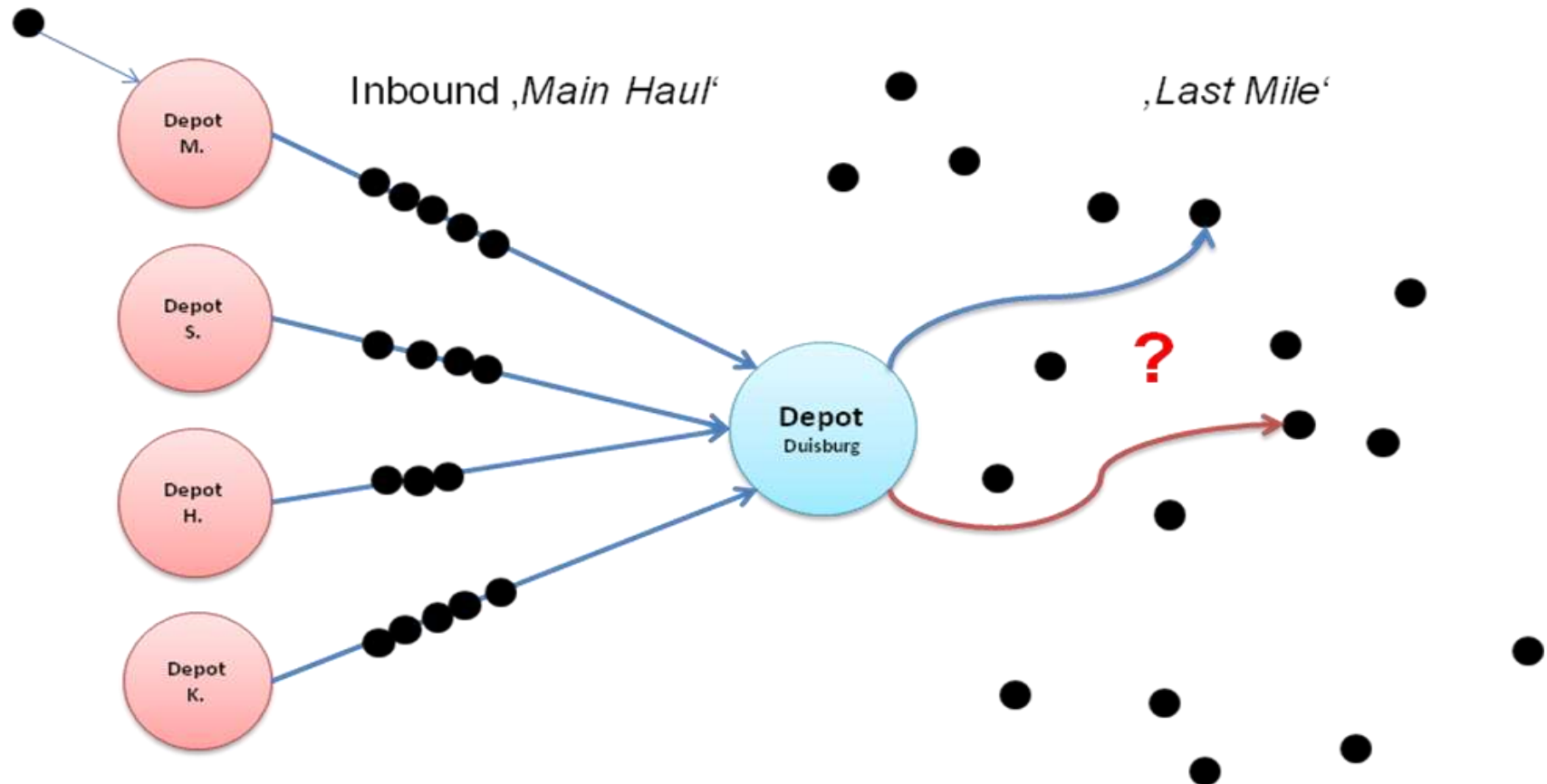
# 4. Integration of Transport Control in Production Planning



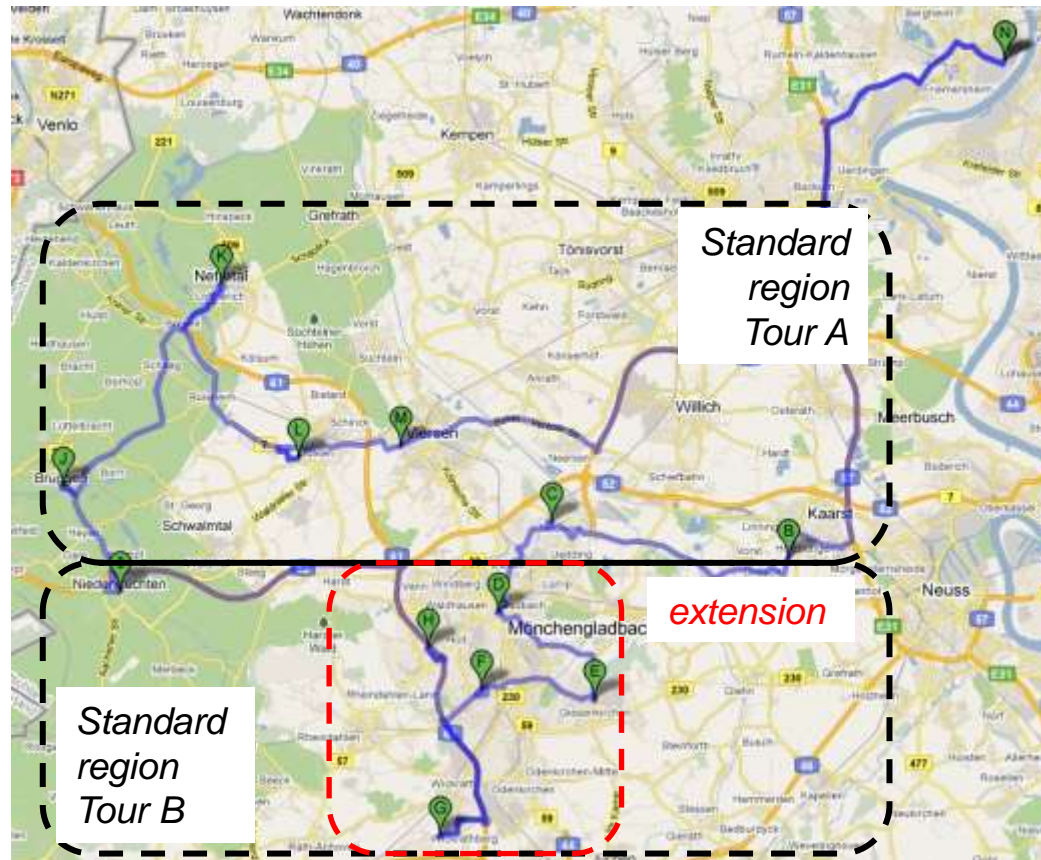
### Characteristics of groupage freight production

- **Standard** conditions for routing process in a groupage freight depot
- **Discrepancies** of standard conditions (e.g. a delay in delivery)  
→ Special actions of scheduling department
- Problem: **Identification** of any discrepancy
- The earlier a delay can be identified the longer is the reaction time
- Consequence: **Re-scheduling** of last-mile route planning (shipment takes another tour/ vehicle leaves the depot delayed)
- A cargo tracking could safeguard the identification of a delay
- Possible: Integration of information in the production planning algorithm

Last mile tour planning problem as path-dependent problem from main haul in logistics practice



New dynamic situation based on real-time transport control information



## Conclusion

Process timeline with real-time transport control and application of dynamic production scheduling

### Transportation Process

Delay in transportation process

Information of the delay

Re-Scheduling

Delayed departure, traffic jam, breakdown

Automatic and forwarder independent information about the delay integrated in production scheduling software

Enough reaction time so that a re-scheduling can be executed based on information

**Production down-time can be avoided**

### Outlook

- Increasing cooperation within production networks
- Tracking data access as input for manufacturing execution systems
- Development of a **structural model** for dynamic production scheduling based on GPS real-time information
- Integrating production control on supply chain level
- **Further applications** of GPS tracking systems with benefits for production networks
  - Mystery Shipping (audit approach)
  - Security of dangerous goods (safety approach)
  - Well-founded data base for future planning challenges (sustainable approach)

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Thank you for your kind attention!

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