

# GPS based Track and Trace for Transparent and Sustainable Global Supply Chains

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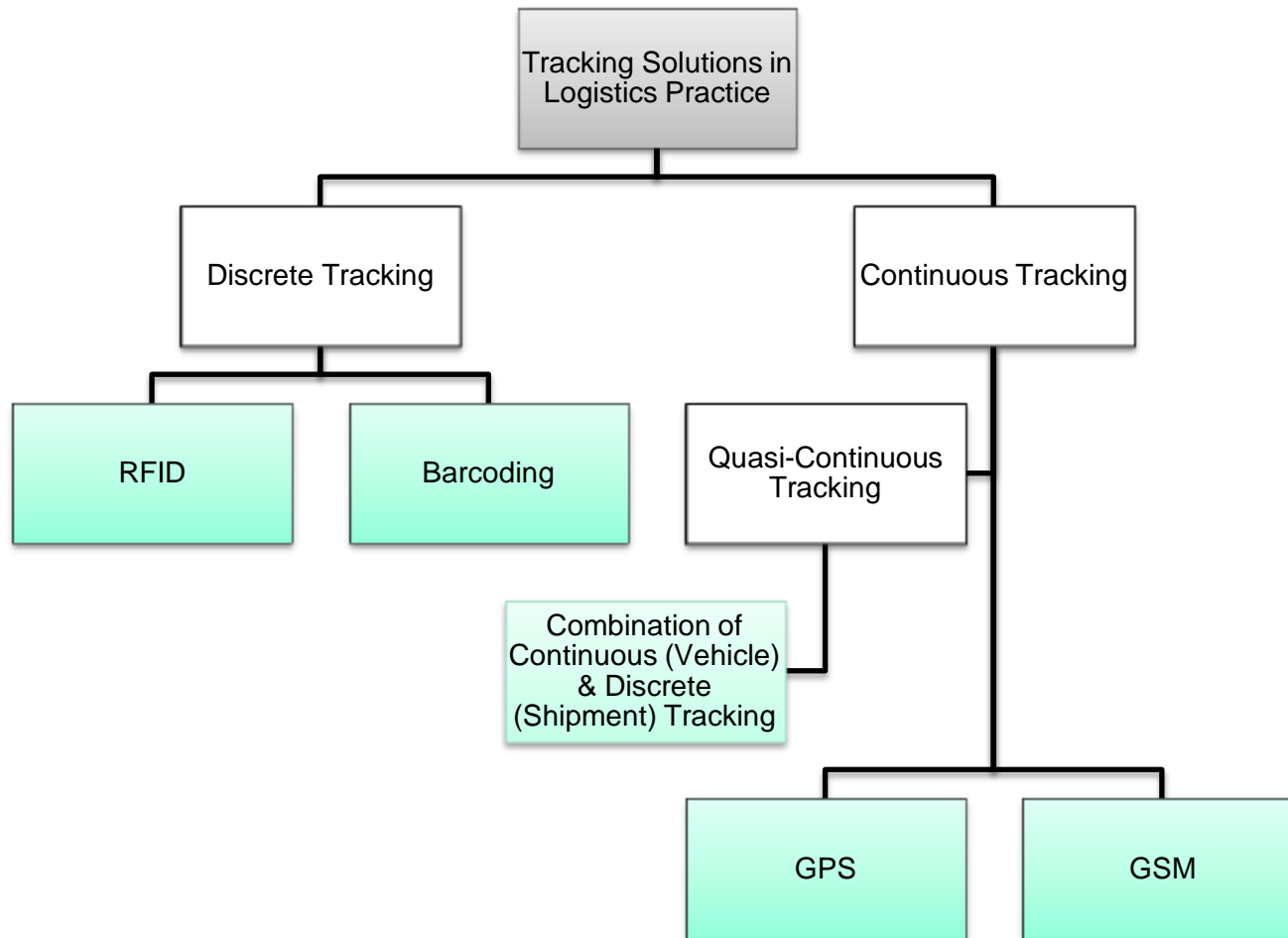
## Background Information

- Production alliances with several different players  
→ Common aim of added value
- Favorable production alliances  
→ Flexible and variable players  
→ A high level of communication
- Cooperation with innovative logistics service providers
- New solutions: technical, IT, etc.  
→ Secure delivery times and service levels
- Solution:  
Using the potentials of a GPS based track and trace system

## Benefits of Track and Trace in Logistics Practice

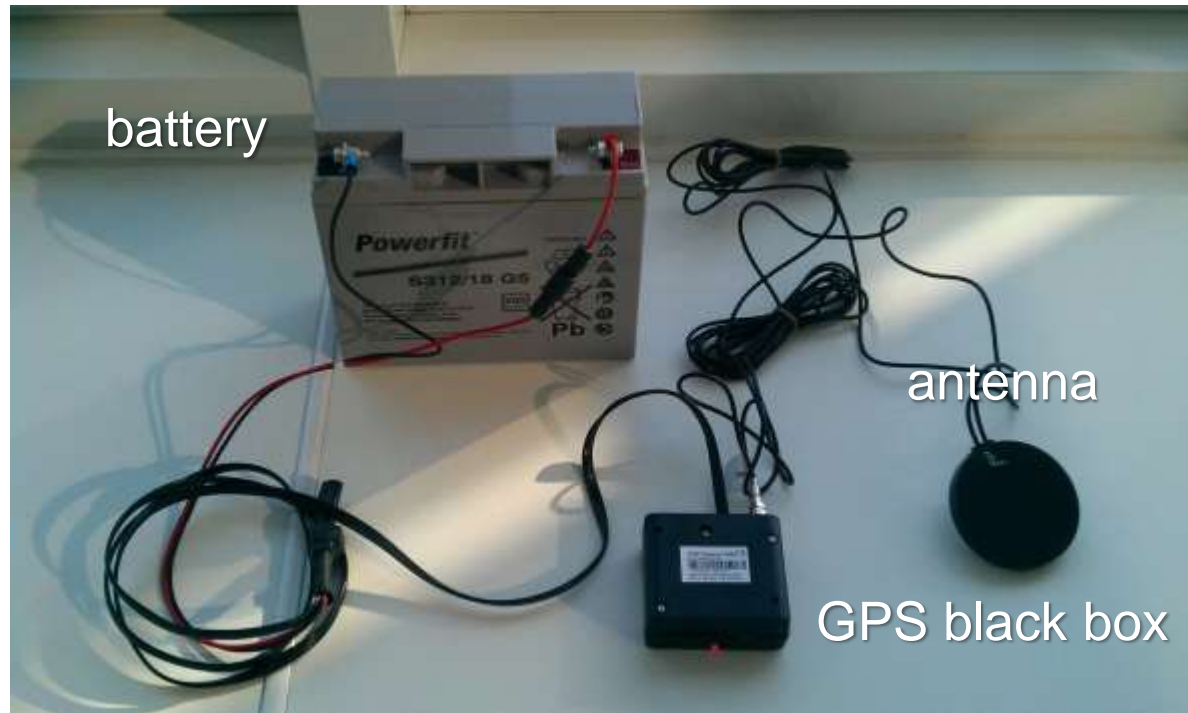
- Presentation of travelled routes (tracing)  
→ Analyzing complex transport chains (e.g. groupage network)
- Real-time tracking to estimate arrival times
- Well-founded data base for future production planning challenges
- Application in a *Supply Chain Event Management* environment

### Current Methods and Solutions for Track and Trace



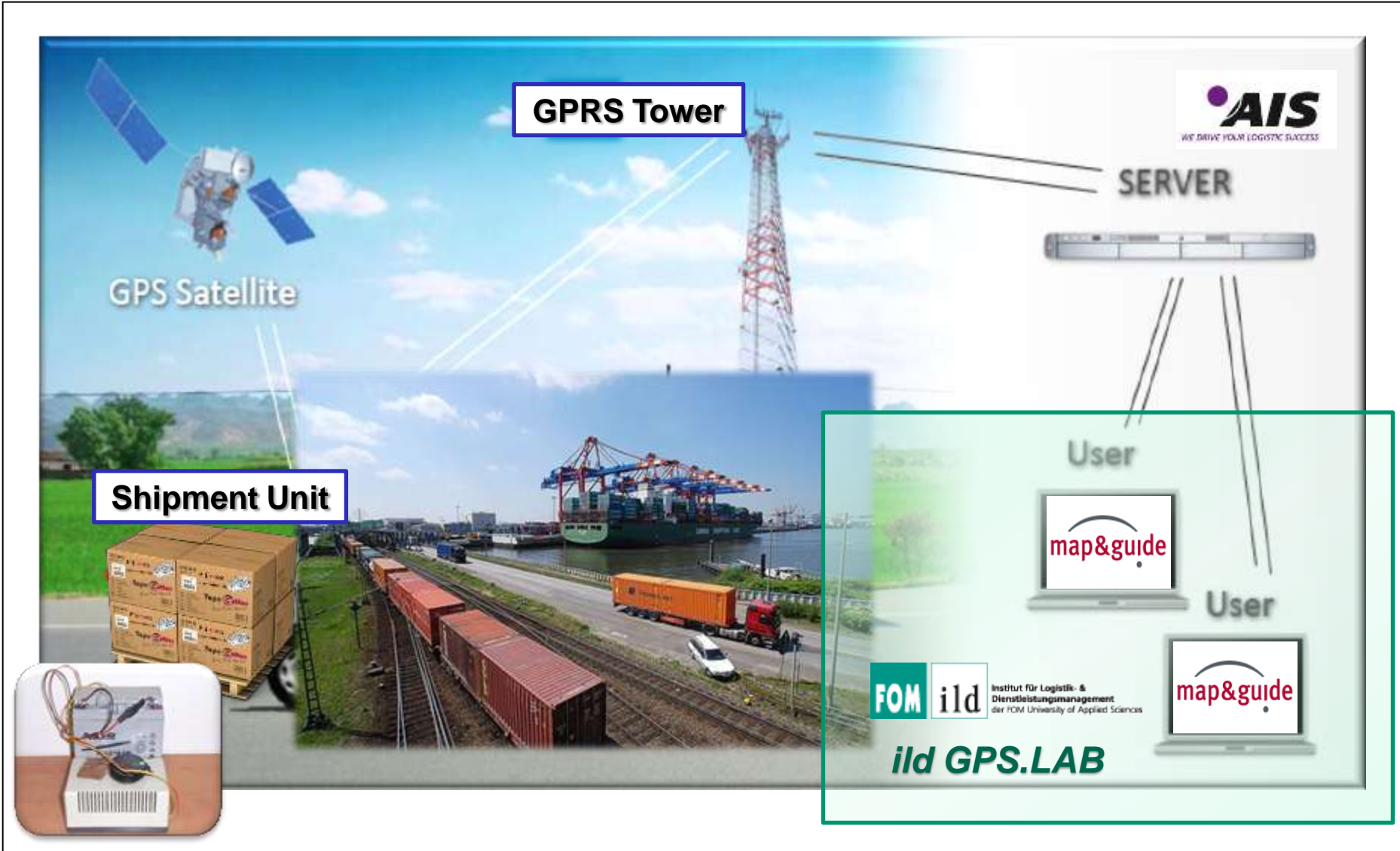
### Potentials of a Real-time GPS Based Track and Trace System

- Actual position in real-time upon request
- Battery powered GPS modules for carrier independent power supply
- Localization with the help of a web application (no special software has to be installed)
- Faster flow of information  
→ Longer reaction time after identifying a delay
- Today's applications:
  - railway waggons
  - oversea container tracking



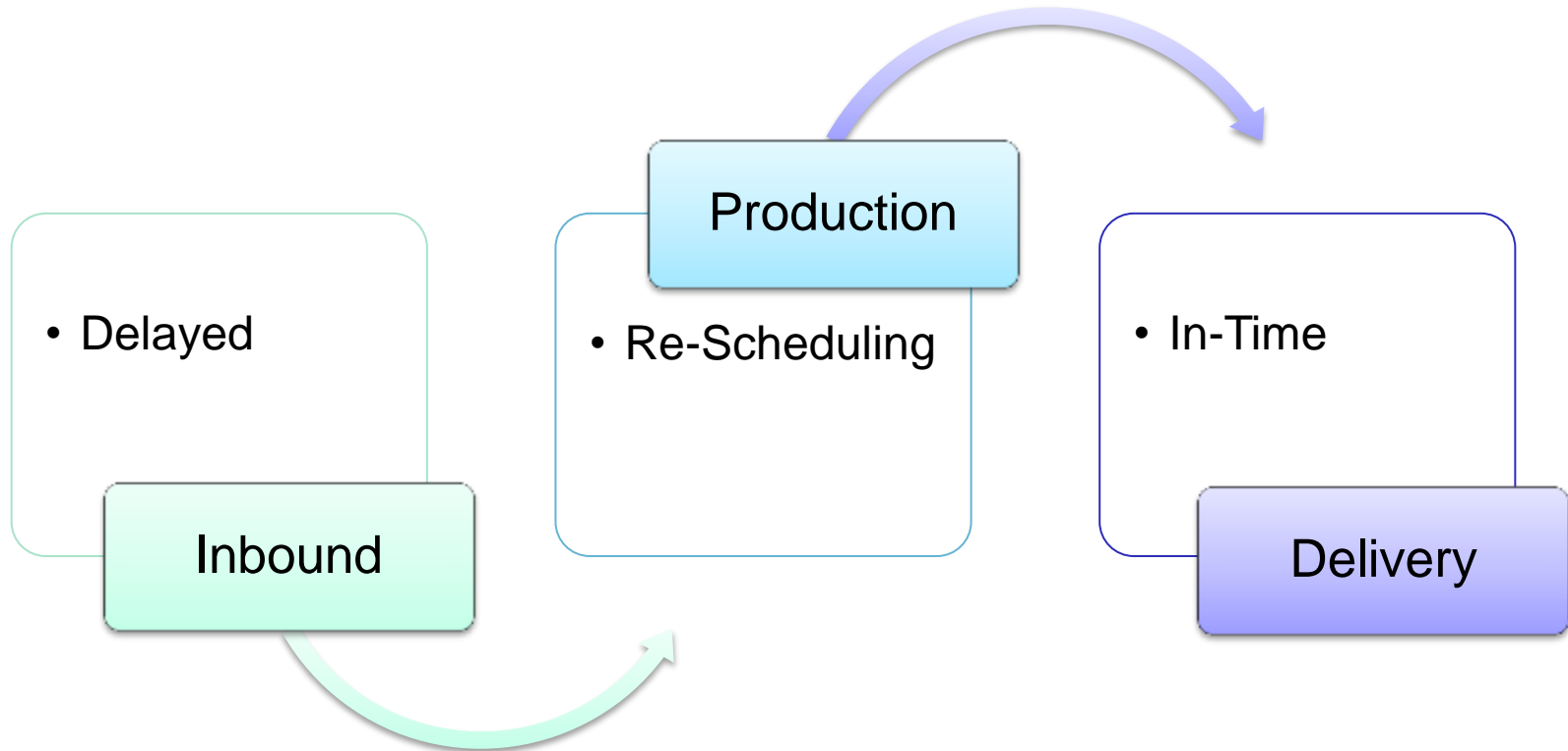
- 40 modules with GPRS device for parallel shipment tracking and real-time transmitting of position data
- High performance antenna for receiving position data even inside trailers or containers
- High powered rechargeable battery for operating time of at least 72 h

### 3. GPS.LAB at FOM ild



# 4. Cargo Tracking in Production

Reduction of production cycle-time  
because of automatic calculation of ETA

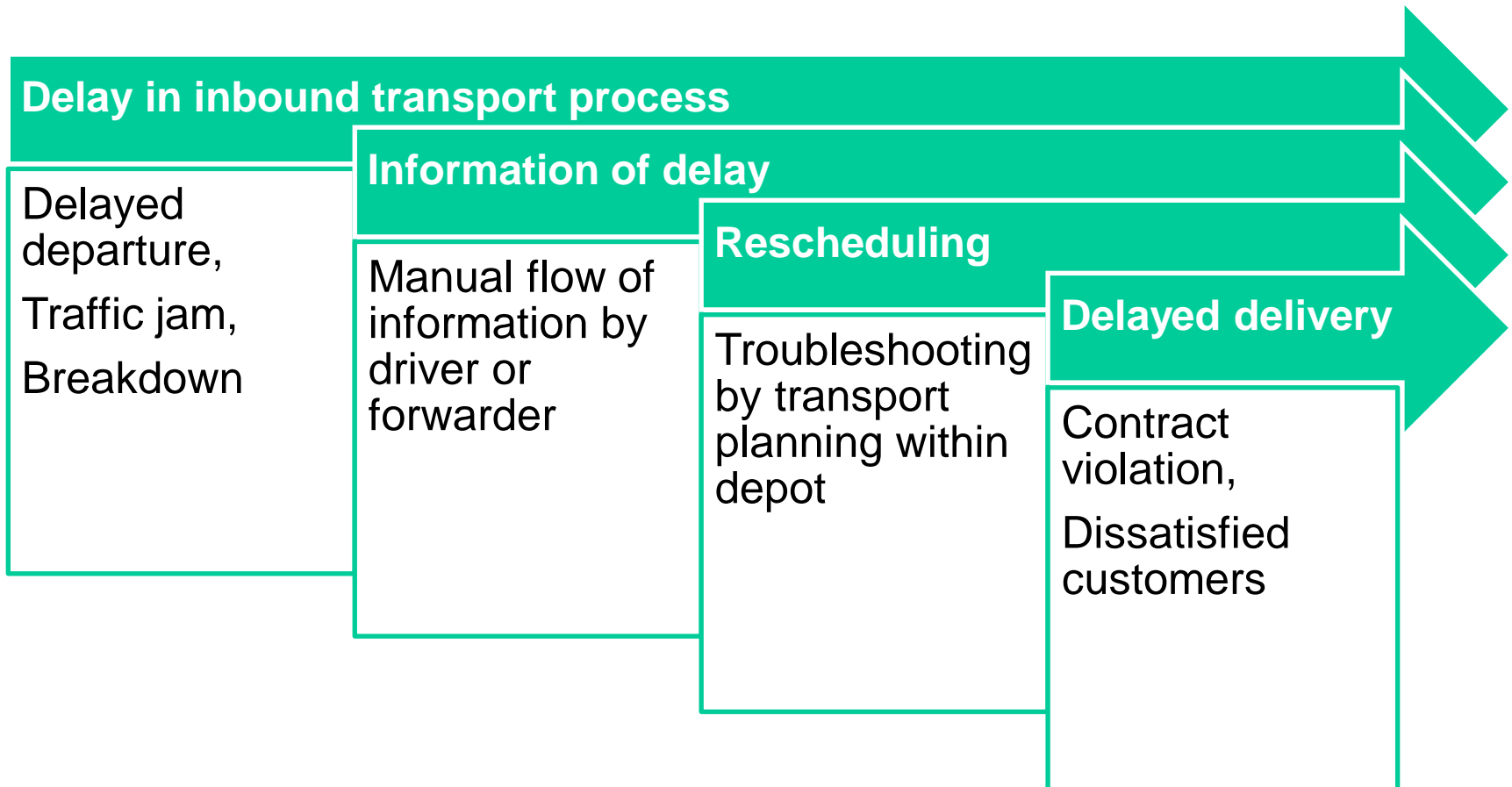


Real-time tracking supports  
the flow of information

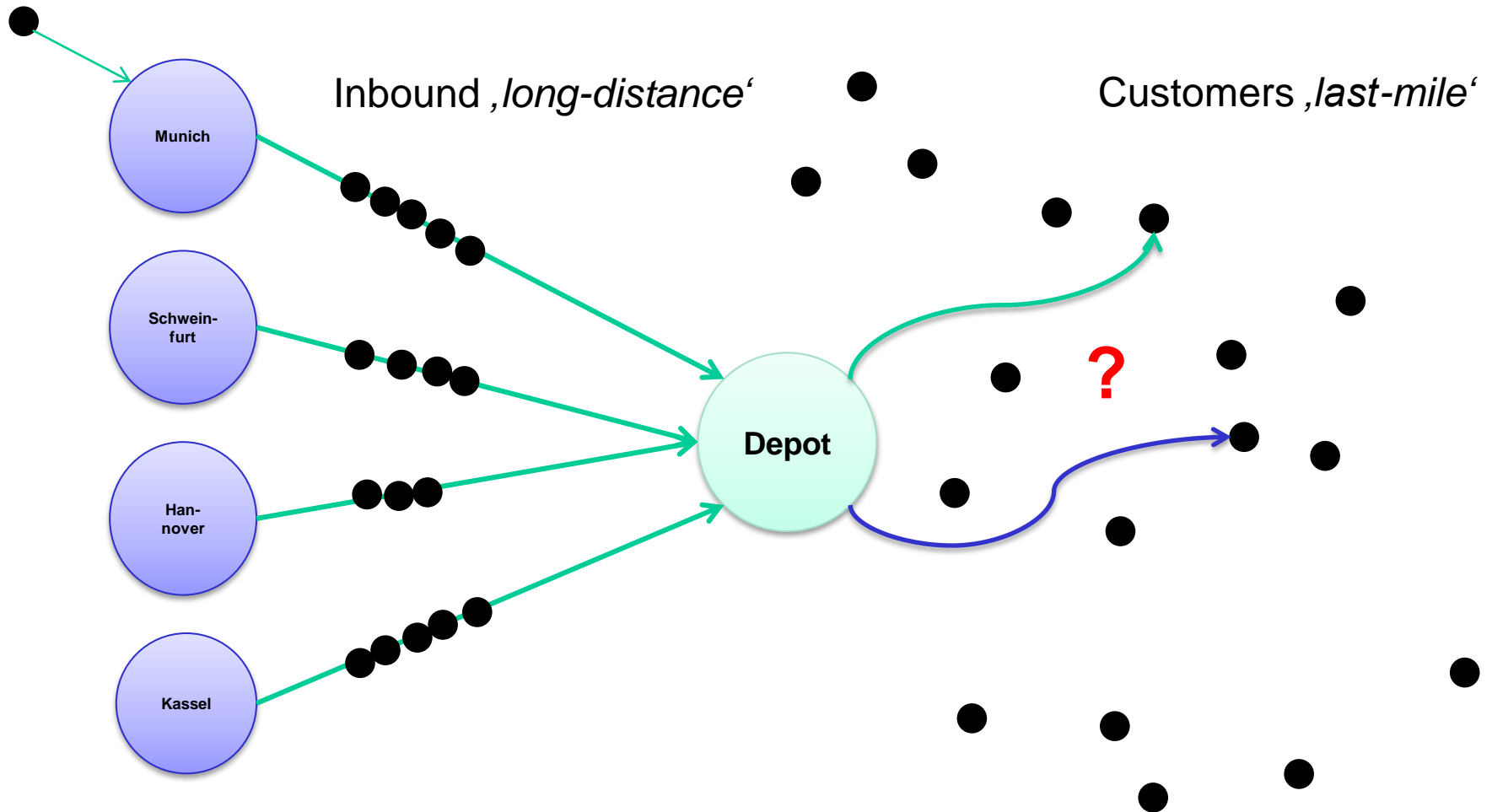
## 5. Last Mile Event Routing in Logistics

- 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

## Process Timeline in a Groupage Freight Depot without Cargo Tracking in Case of a Delay



# Tourplanning Process at a Groupage Freight Depot



## Influence of Delay on Tour Planning

Depot	Departure DU			Arrival DU		
	Plan	Actual	Delay	Plan	Actual	Delay
<b>Munich</b>	20:00	19:39	-----	05:00	04:57	-----
<b>Schweinfurt</b>	20:00	20:00	-----	04:00	04:02	-----
<b>Hannover</b>	17:30	18:25	00:55	05:00	03:12	-----
<b>Kassel</b>	18:00	18:05	00:05	04:30	05:25	<b>00:55</b>

*Arrival time inbound  
+ operating time (1h)*

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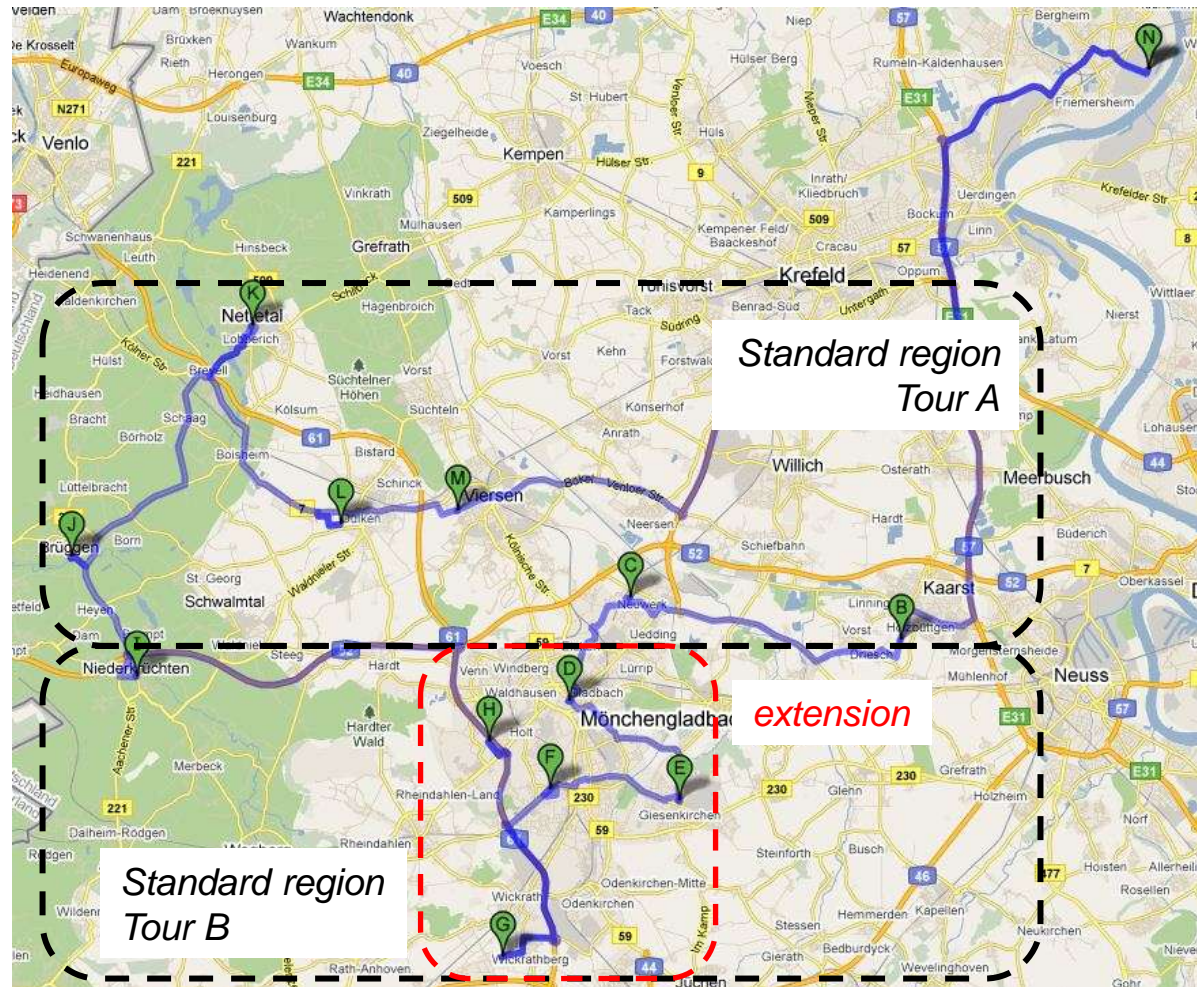
*earliest departure last-mile delivery tour*

## Rescheduled Shipments in Detail

Shipment number	Depot	PLZ	Ort	Planned Arrival DU	Actual Arrival DU	delay	PLZ last-mile	Earliest Departure Last-Mile	Pre-defined Tour	Planned departure	LMER	Check	Action	Actual departure
9110820	Kassel	40210	DUESSELDORF	04:30	05:25	yes	402	05:30	1	06:00	06:25	EVENT	1 >>> 3	08:00
9110820	Kassel	40221	DUESSELDORF	04:30	05:25	yes	402	05:30	1	06:00	06:25	EVENT	1 >>> 3	08:00
9110820	Kassel	40221	DUESSELDORF	04:30	05:25	yes	402	05:30	1	06:00	06:25	EVENT	1 >>> 3	08:00
9110820	Kassel	40221	DUESSELDORF	04:30	05:25	yes	402	05:30	1	06:00	06:25	EVENT	1 >>> 3	08:00
9110817	Kassel	40221	DUESSELDORF	04:30	05:25	yes	402	05:30	1	06:00	06:25	EVENT	1 >>> 3	08:00
9110817	Kassel	40223	DUESSELDORF	04:30	05:25	yes	402	05:30	1	06:00	06:25	EVENT	1 >>> 3	08:00
9110820	Kassel	40233	DUESSELDORF	04:30	05:25	yes	402	05:30	1	06:00	06:25	EVENT	1 >>> 3	08:00
9110817	Kassel	40233	DUESSELDORF	04:30	05:25	yes	402	05:30	1	06:00	06:25	EVENT	1 >>> 3	08:00
9110820	Kassel	40235	DUESSELDORF	04:30	05:25	yes	402	05:30	1	06:00	06:25	EVENT	1 >>> 3	08:00
9110820	Kassel	41061	MOENCHENGLADBACH	04:30	05:25	yes	410	05:30	4	06:15	06:25	EVENT	4 >>> 5	08:15
9110820	Kassel	41066	MOENCHENGLADBACH	04:30	05:25	yes	410	05:30	4	06:15	06:25	EVENT	4 >>> 5	08:15
9110820	Kassel	41069	MOENCHENGLADBACH	04:30	05:25	yes	410	05:30	4	06:15	06:25	EVENT	4 >>> 5	08:15
9110817	Kassel	41189	MOENCHENGLADBACH	04:30	05:25	yes	411	05:30	4	06:15	06:25	EVENT	4 >>> 5	08:15
9110817	Kassel	41189	MOENCHENGLADBACH	04:30	05:25	yes	411	05:30	4	06:15	06:25	EVENT	4 >>> 5	08:15
9110820	Kassel	41238	MOENCHENGLADBACH	04:30	05:25	yes	412	05:30	4	06:15	06:25	EVENT	4 >>> 5	08:15
9110820	Kassel	41238	MOENCHENGLADBACH	04:30	05:25	yes	412	05:30	4	06:15	06:25	EVENT	4 >>> 5	08:15
9110820	Kassel	41239	MOENCHENGLADBACH	04:30	05:25	yes	412	05:30	4	06:15	06:25	EVENT	4 >>> 5	08:15

The **delay of 55 minutes** of the inbound transport from Kassel implicates that these 17 shipments did not reach their pre-defined last-mile tour

# Influence on Geographical Areas of Last-mile Routes



## Process Timeline in a Groupage Freight Depot with Real-Time Tracking of Inbound Transports in Case of a Delay

**Delay in inbound transport process**

**Information of the delay**

**Re-Scheduling**

Delayed departure, traffic jam, breakdown

Automatic and forwarder independent information about the delay integrated in tour planning software

Enough reaction time so that the last-mile planning can be executed with the information about a delay

**Delay of the shipment delivery can be avoided**

- Integration of GPS data into route planning software
  - Estimating the expected time of arrival in real-time automatically
  - Troubleshooting activities could be reduced
  - Delivery times could be guaranteed because delays can be cleared still during the transport process
- Applying of the results on material supply and production scheduling in a modified way
- Future research challenge
  - Identifying potentials of a continuous tracking system in real production environments
  - Developing of a structural model for Last Mile Event Routing

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**Thank you for your attention!**



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