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# Decentralized freight intelligence in the parcel delivery industry

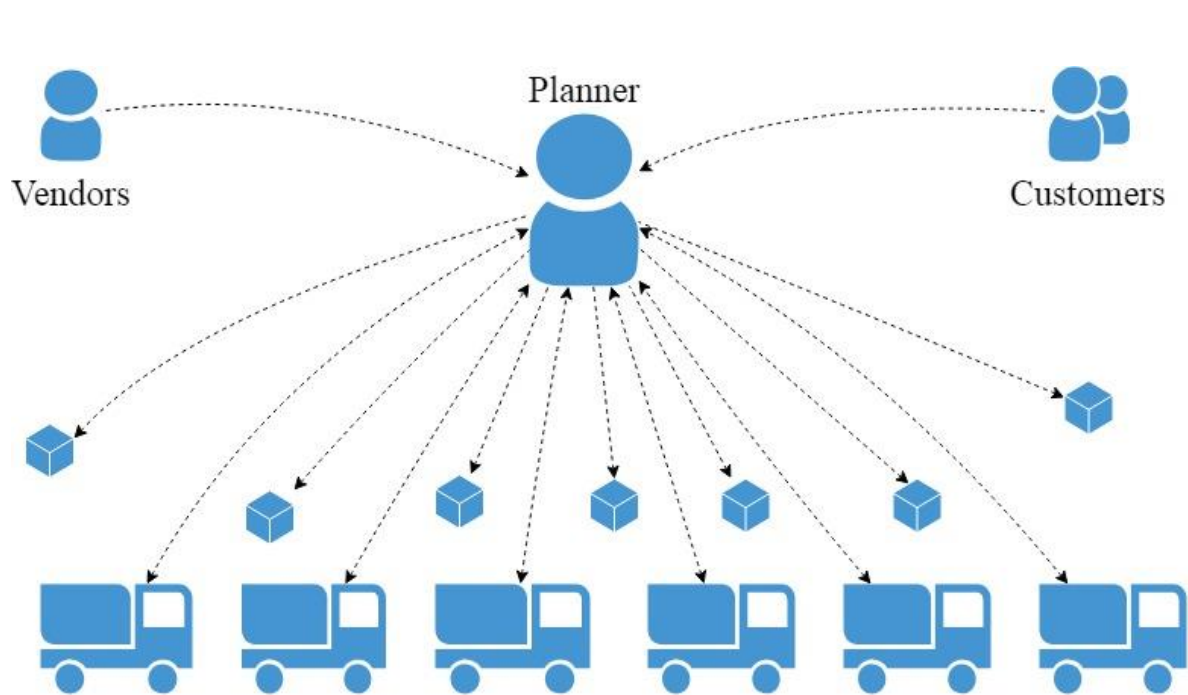
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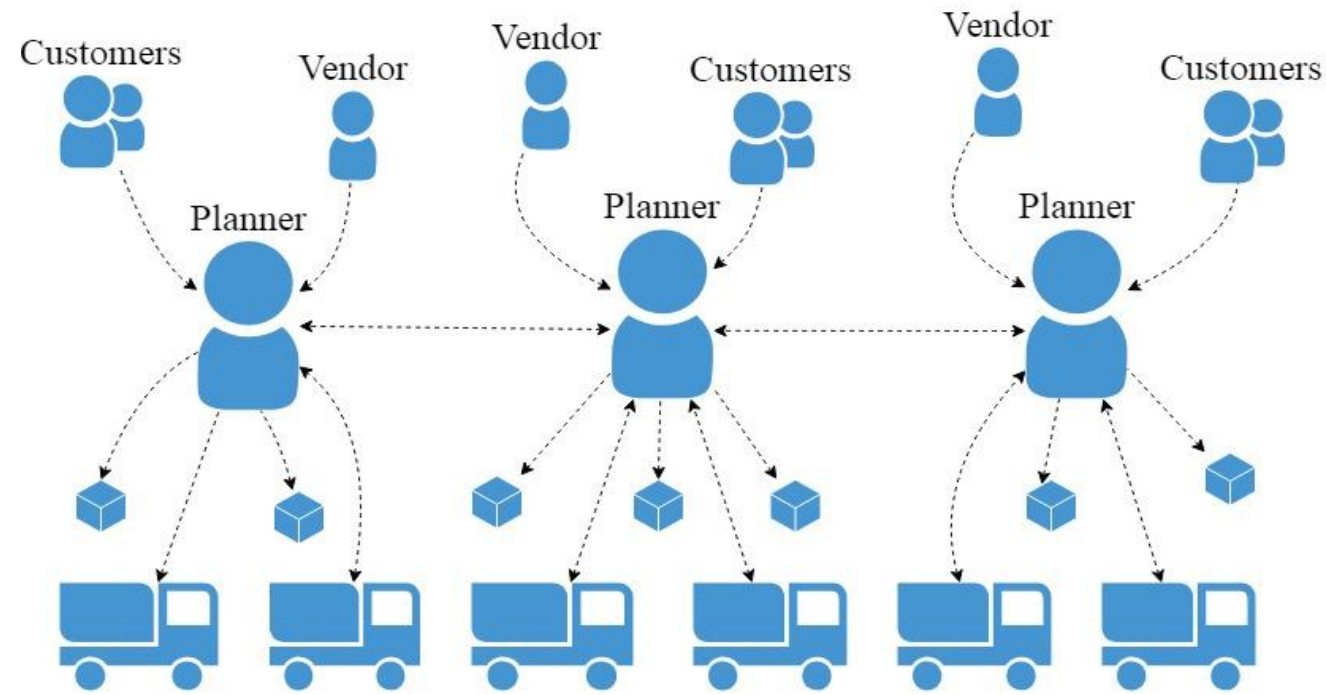
**IPIC 2019**



# Traditional planning approaches



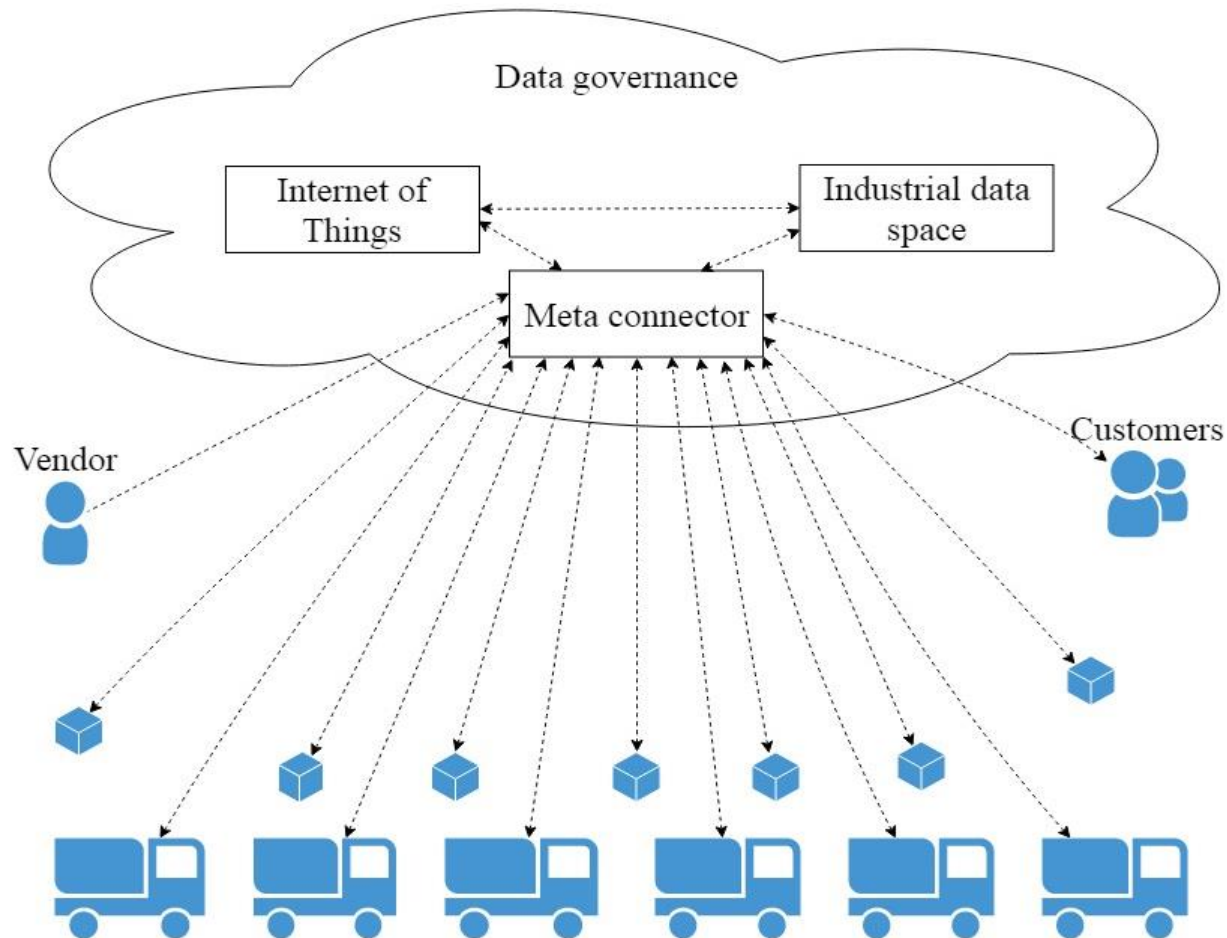
*Centralized planning approach*



*Decentralized planning approach*



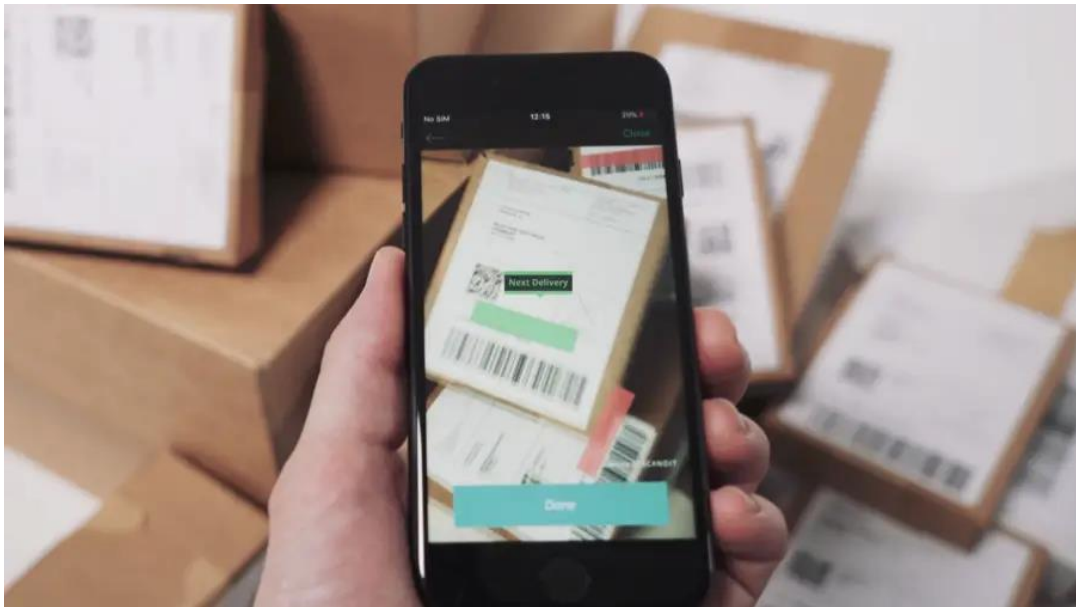
# Decentralized freight intelligence







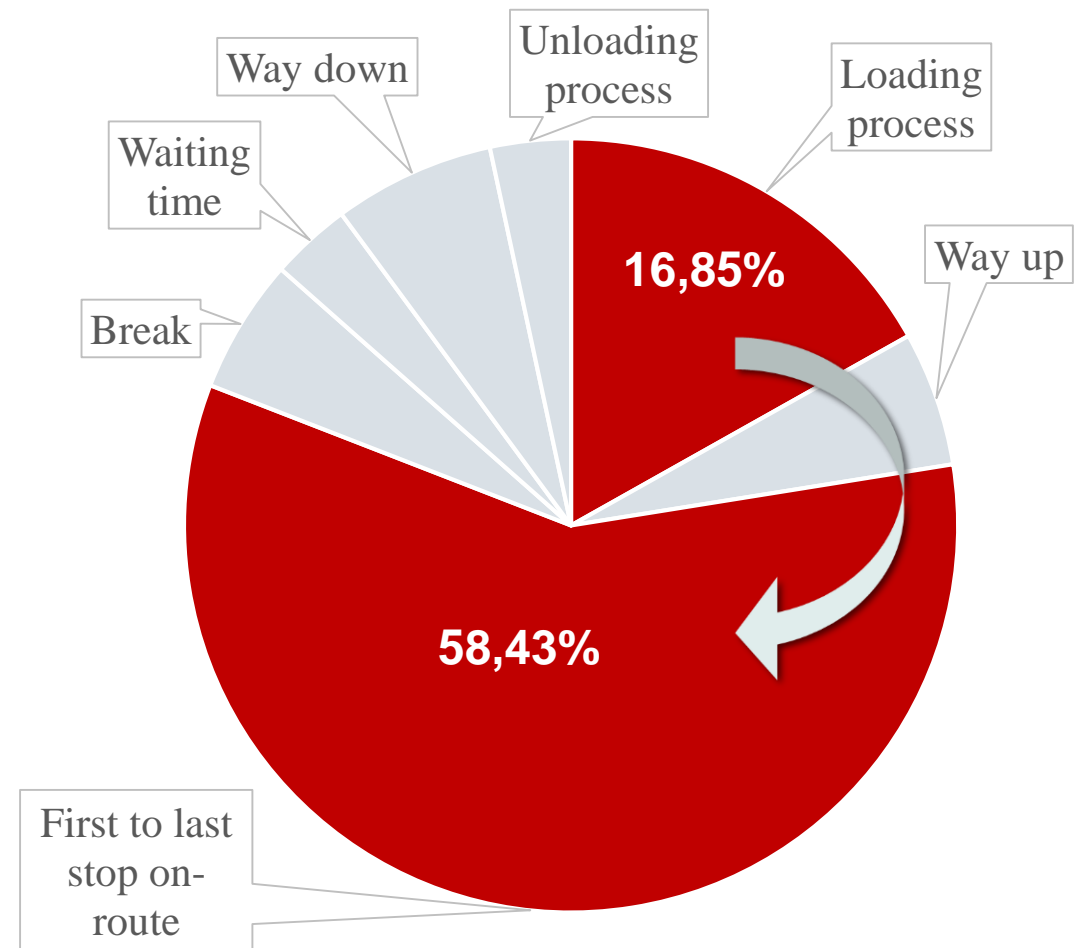
# Decentralized freight intelligence





# Route efficiency vs situational awareness

- > Goal: more efficient operations for more driving time
- > Challenge: Drivers lose some situational awareness

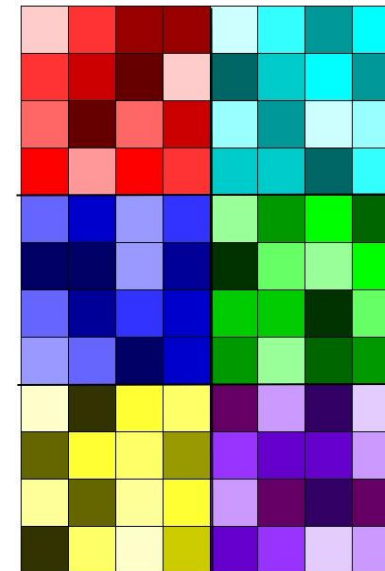




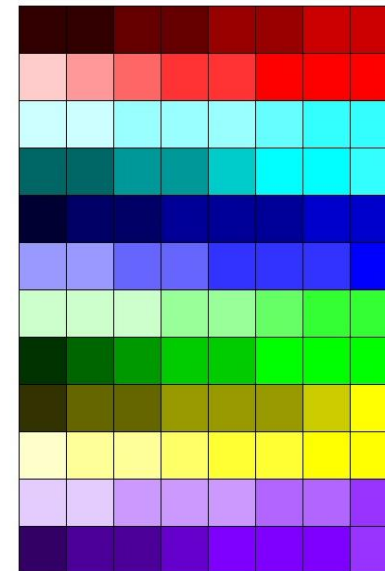
# Experiment

- > Field experiment in real-life operations  
an international parcel delivery  
company
  - 2 drivers – each six days in total
    - 1 time benchmark
    - 2 times some information
    - 2 times more information
- > Measure: search time

Segments

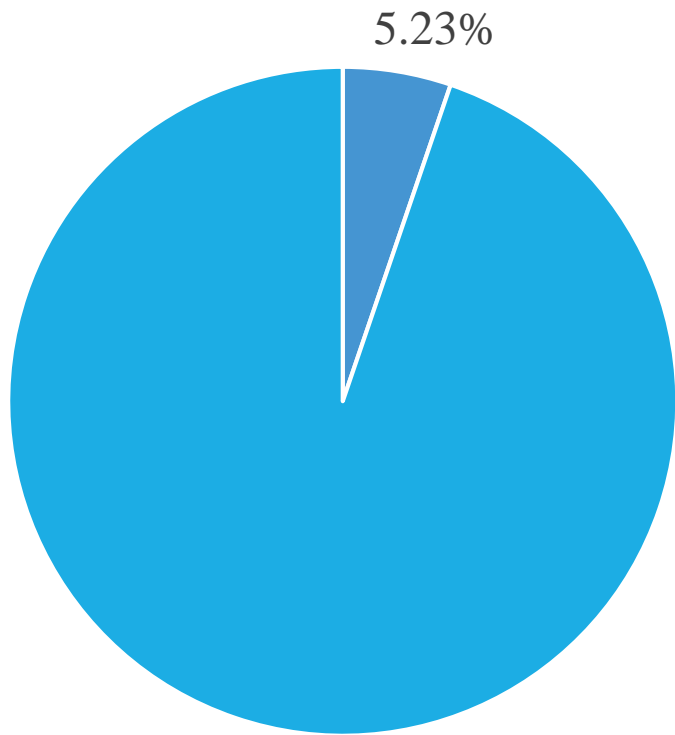


LIFO

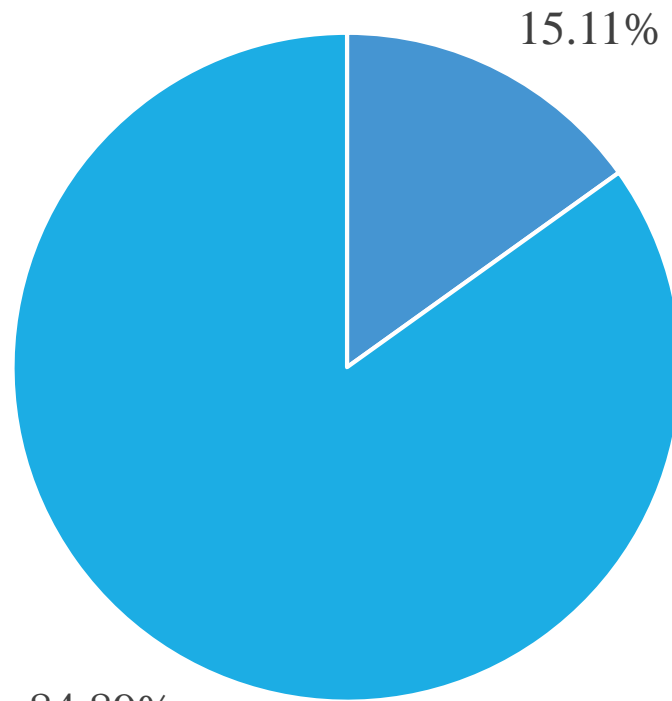




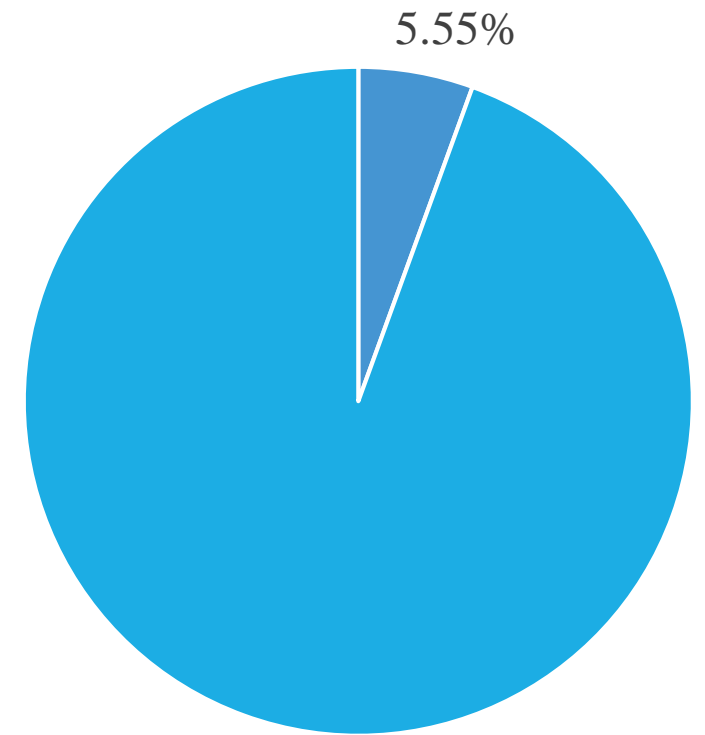
# Search times as % of stop time



*(i) benchmark*



*(ii) segments*

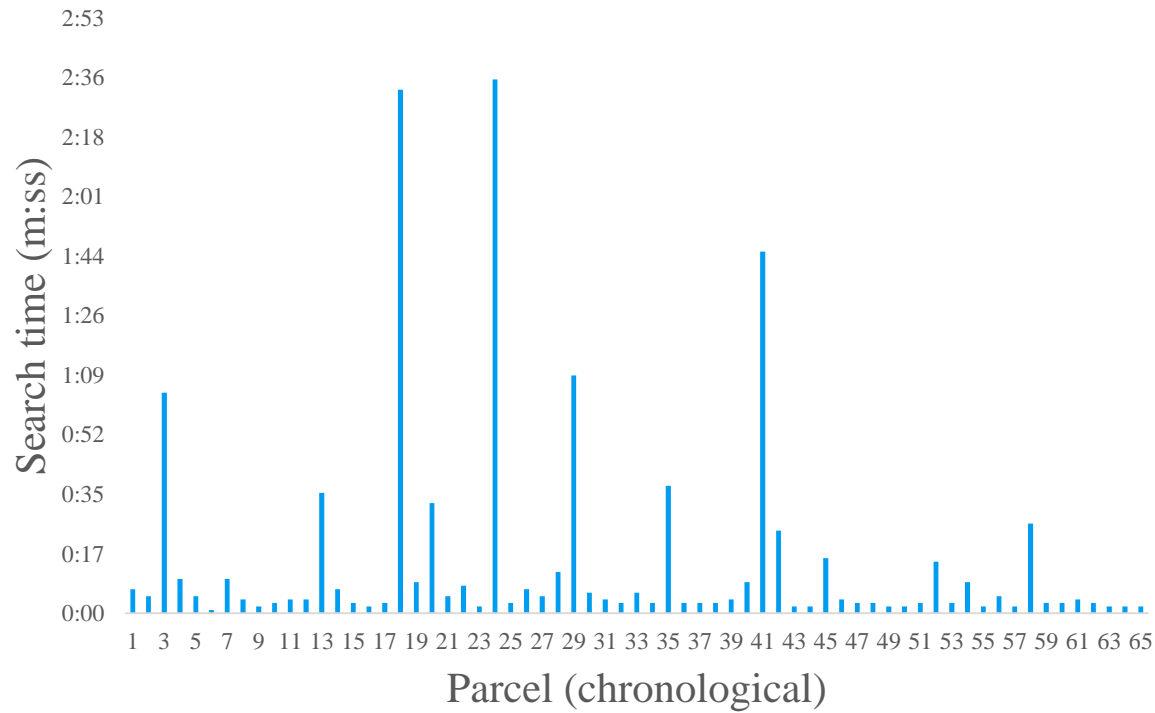


*(iii) LIFO*

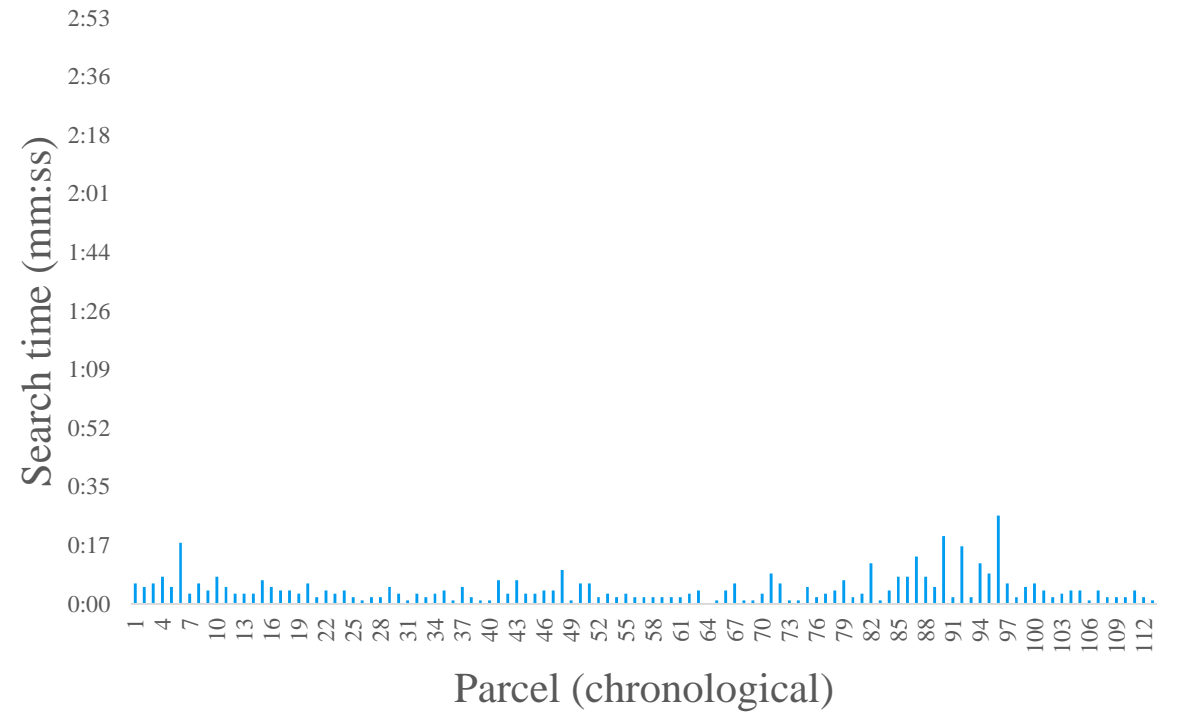




# Search time distribution over the trips



*(ii) segments*



*(iii) LIFO*





# Decentralized intelligence

## > Trade-off

- Efficiency gain by utilizing loading time for driving
- Efficiency drop by loss of situational awareness

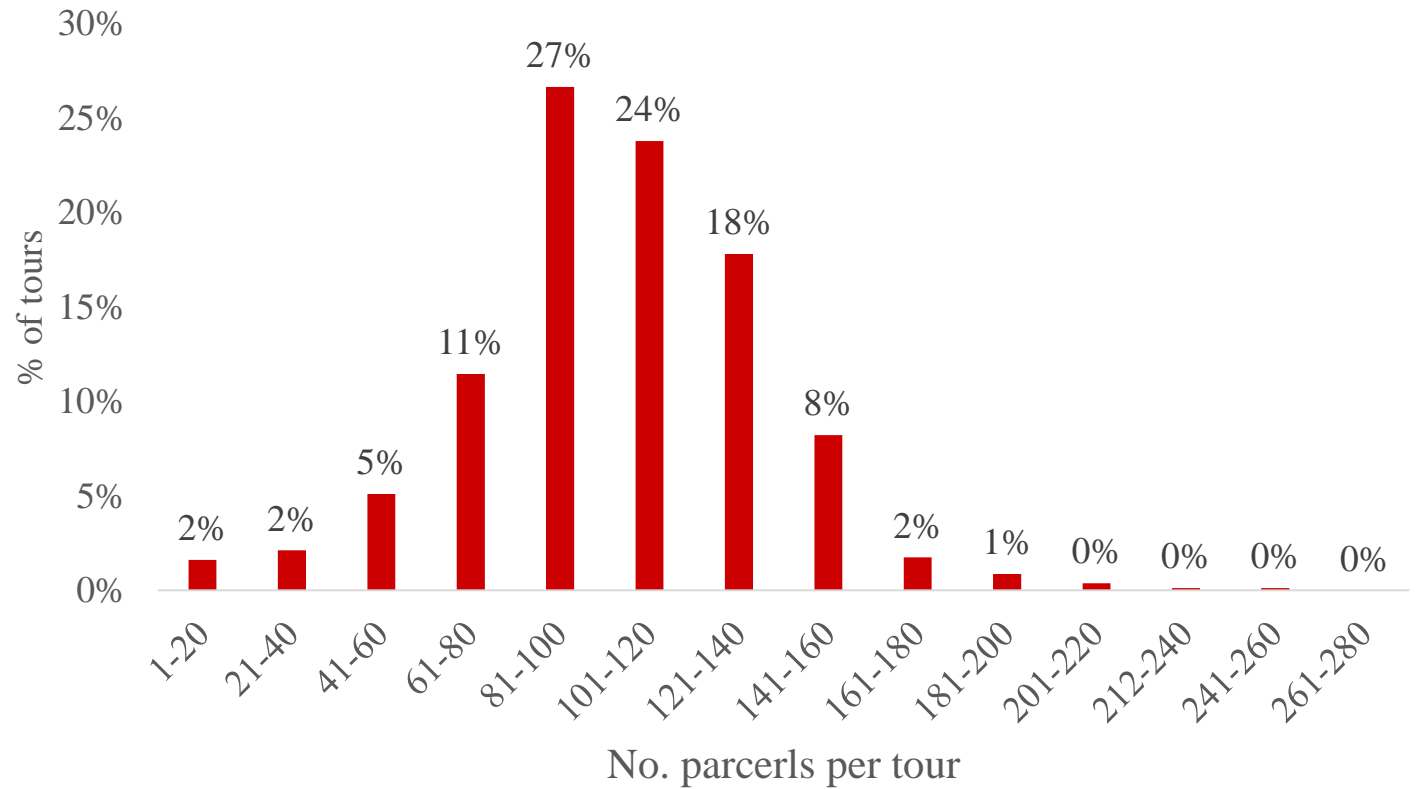
## > Use of decentralized information

- Efficiency drop can be mitigated already with very little information





# Volume capacity





# Efficiency gains

- > Goal: More efficient operations -> more parcels per vehicle -> less vehicles on the road
- > Means: use loading time for driving, provide drivers with information
- > Routing constraints
  - Total driving time constraints
  - Volume constraints (no. of parcels per vehicle)

No. of parcels per vehicle	Some information (segments)	More information (LIFO)
160	86.8%	77.2%
155	88.7%	78.9%
150	90.4%	80.4%
145	92.9%	82.6%
140	97.1%	86.4%
135	104.6%	93.0%
130	110.1%	98.4%



## Key take-aways

- › Decentralized freight intelligence may result in loss of situational awareness, but this can be mitigated already with very little information
- › Reduction of 20% in the number of vehicles is feasible



