The Pickup and Delivery Problem with Scheduled Lines
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Agenda

• Introduction
• Problem definition
• Solution methodologies
• Conclusions
Pickup and delivery problem

PDP with Scheduled lines

Legend
- Pick-up parcel
- Drop-off parcel
Motivation

- Amount of air pollution and CO$_2$e emissions
- Economically unreasonable deliveries in low density areas

Integrated networks will potentially lead to:
- Less traveling time of PD vehicles
- Fewer CO$_2$e emissions
- Less cost solutions

Problem definition

An extension of the multi-depot PDP-TW, where:
- Transfers to scheduled lines are allowed at predefined locations (train/bus stations, etc.)
- Packages can share the ride, on both modes
- Capacity constraints
- Each transfer point is a consolidation point for parcels
- Time windows for all requests
- Demand, travel and service times are deterministic
- *Pickup and Delivery Problem with Scheduled Lines (PDP-SL)*
- Minimize operating costs: routing and SL costs (per shipped unit of request)
Solution methodologies

- Model the problem as a mixed-integer linear program – formalize the problem, able to optimally solve small instances (up to 12 requests)
- ALNS – heuristic. Trade optimality and accuracy in favor of solution speed (larger instances – e.g. 100 requests)
- Exact decomposition algorithm – based on Column generation

Conclusions

- Integrated system leads to significant savings in terms of total travel time and CO2e emissions (operational costs) – up to 20%
- Focus is on operational aspects of the problem
- However, the savings may be inconsequential due to relative positioning of the SLs and requests
- Tactical decisions need to be investigated:
  - Configuration and frequency of the SLs, capacity, storage areas at the transfer nodes
QUESTIONS ANSWERS

Thank You!!

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