Group 4

Collaborative Carrier Network

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Problem description

Background: Network of collaborating freight carrier companies

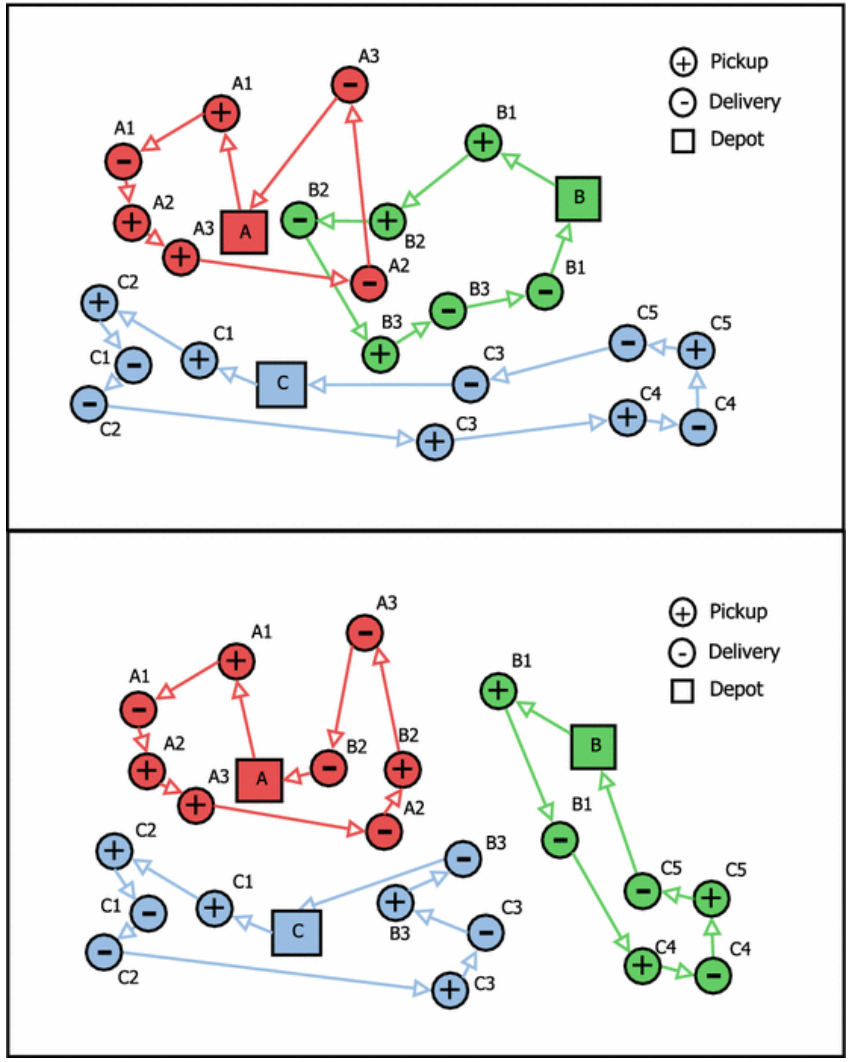
Problem: Some requests cannot be efficiently integrated into the route of a carrier

Approach: Optimization-based collaboration with auction-based exchange mechanisms

Goal:

- Maximize the overall profit of the network
- Few information transfer

Target users: Pickup and delivery service, e.g., courier services



Source:

- Klaus, P., 2003. Die "TOP 100" der Logistik: Berichtszeitraum 2001/2002.
- https://doi.org/10.1016/j.ejor.2017.10.023

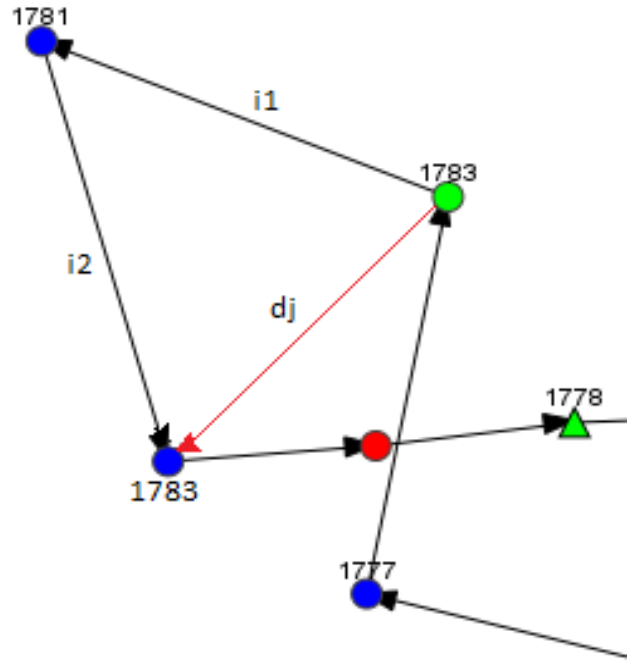
Outline

1. Solution
2. Quality of solution
3. Demo
4. Evaluation of SCRUM

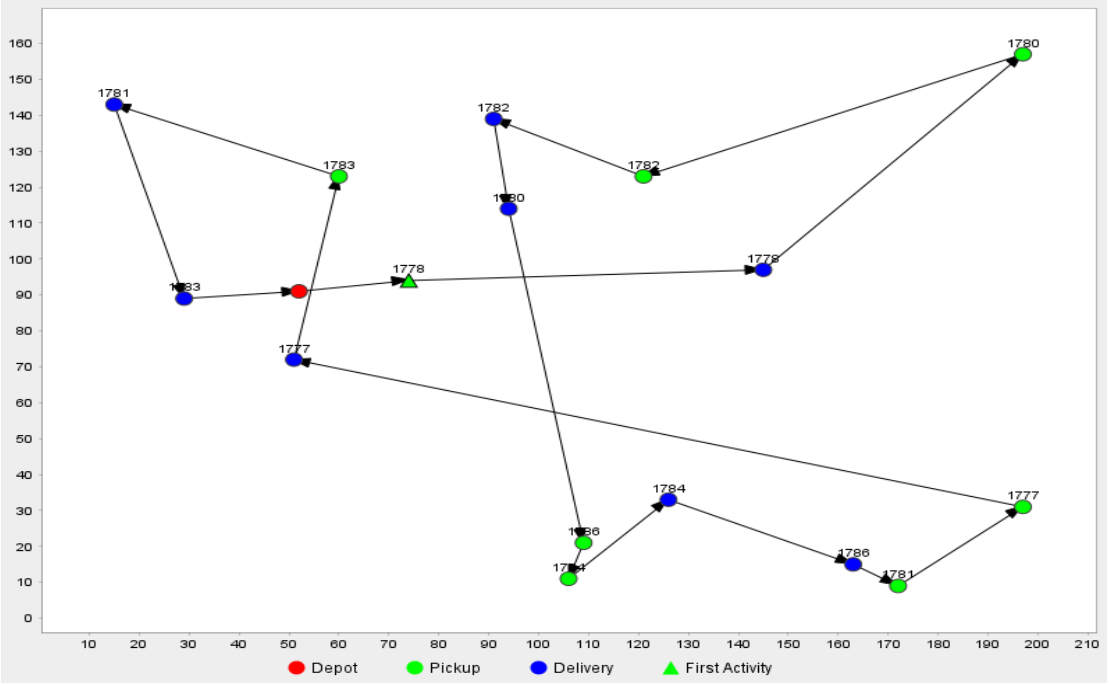
Source: https://fedudesign.vn

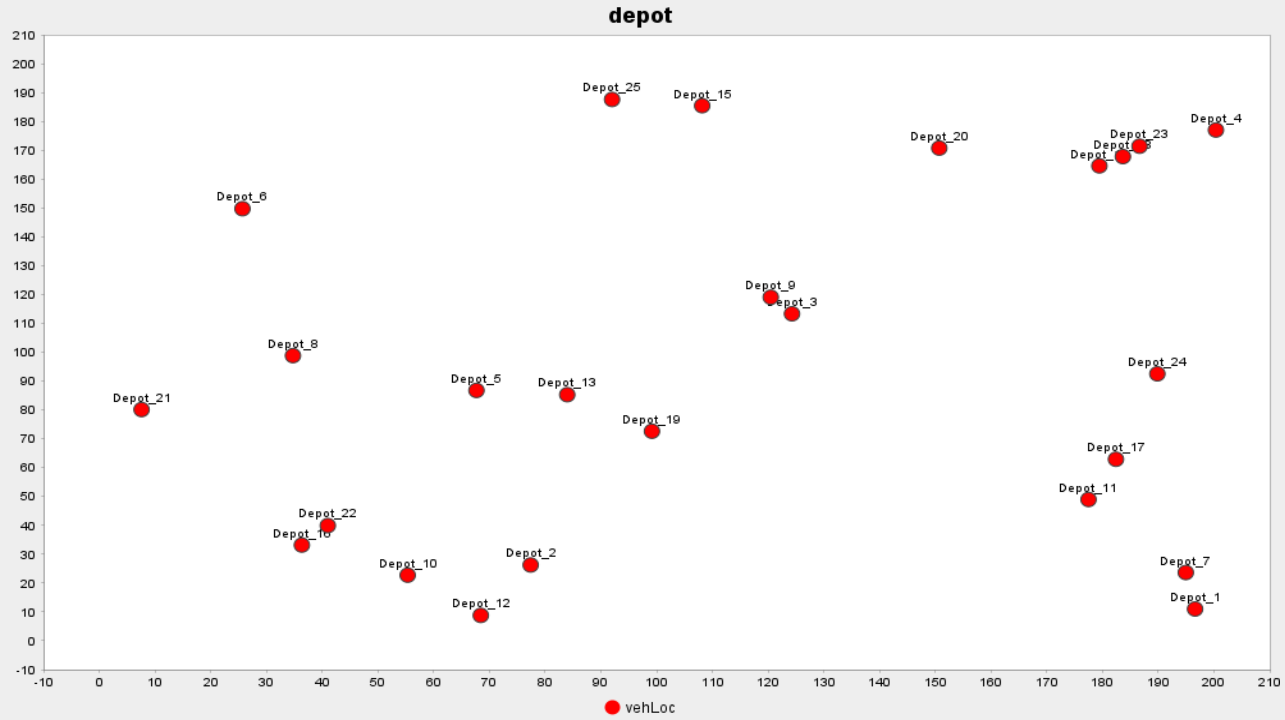
Cost calculation - Tour optimization and visualization

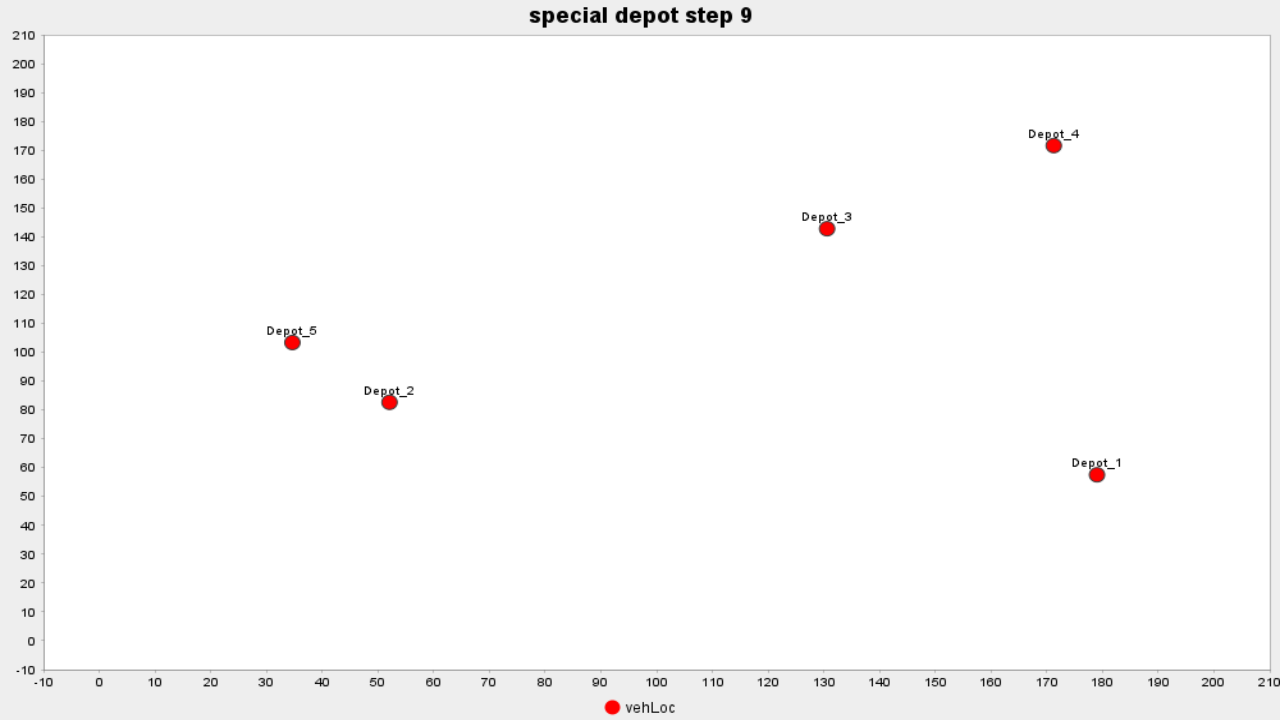
- Price of request/order j: $\mathbf{r_j = a_1 + a_2 * d_j}$
- Real cost: $\mathbf{c_j = b_1 + b_2 * l_j}$
  - $\mathbf{l_j = L(N) – L(N\backslash\{j\})}$
- Profit by doing request j: $\mathbf{p_j = r_j - c_j}$

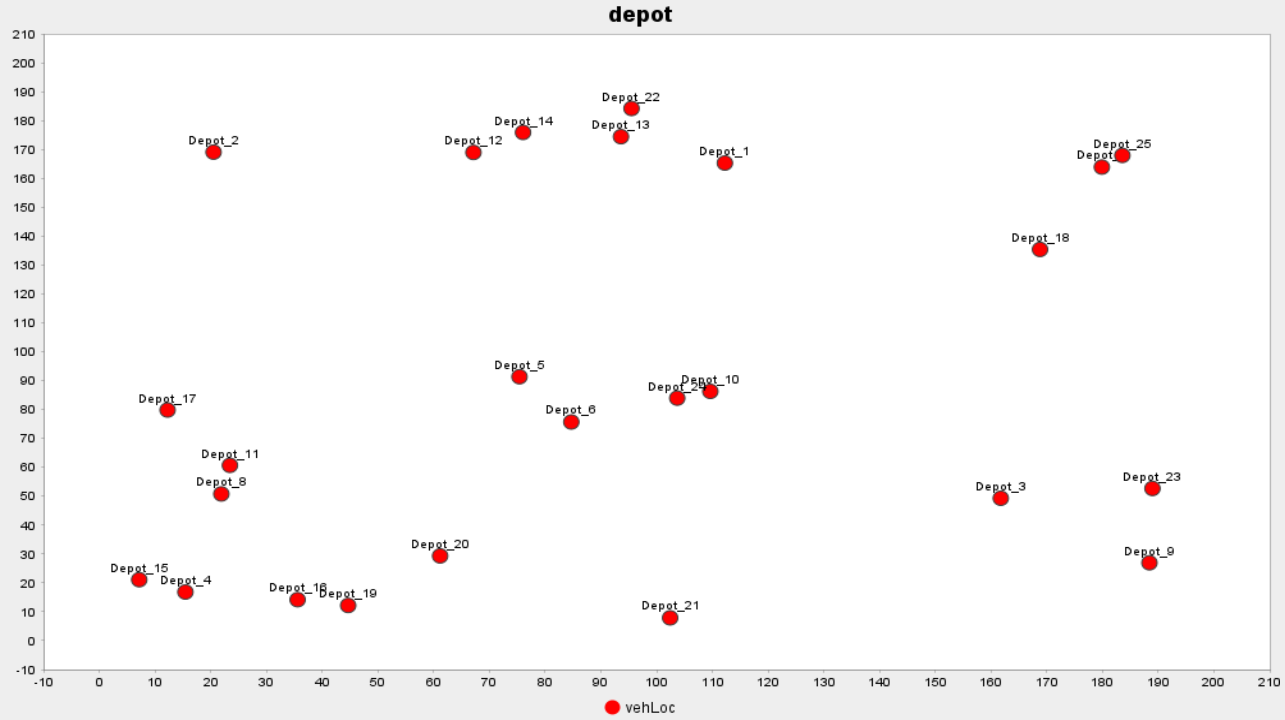


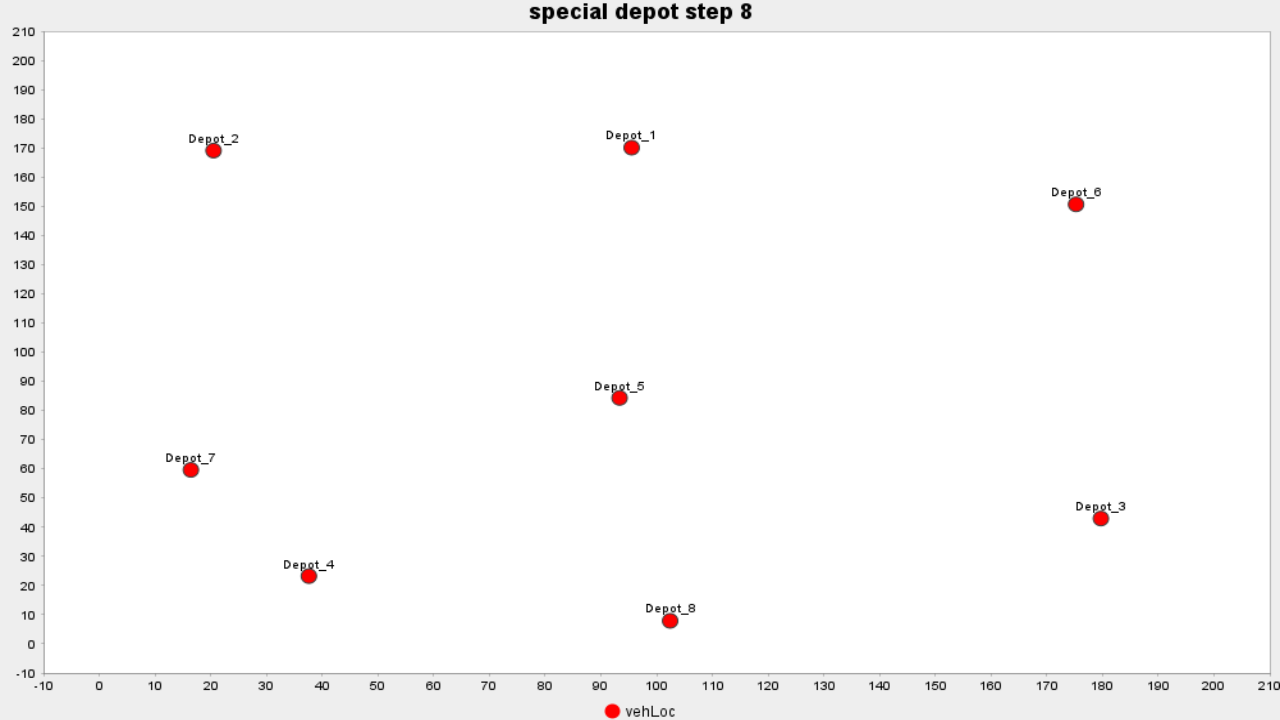
- Open source **Jsprit** for solving VRP
- Basic setting:
  - Capacity dimension of vehicle is 2
  - Transport request is considered as 1

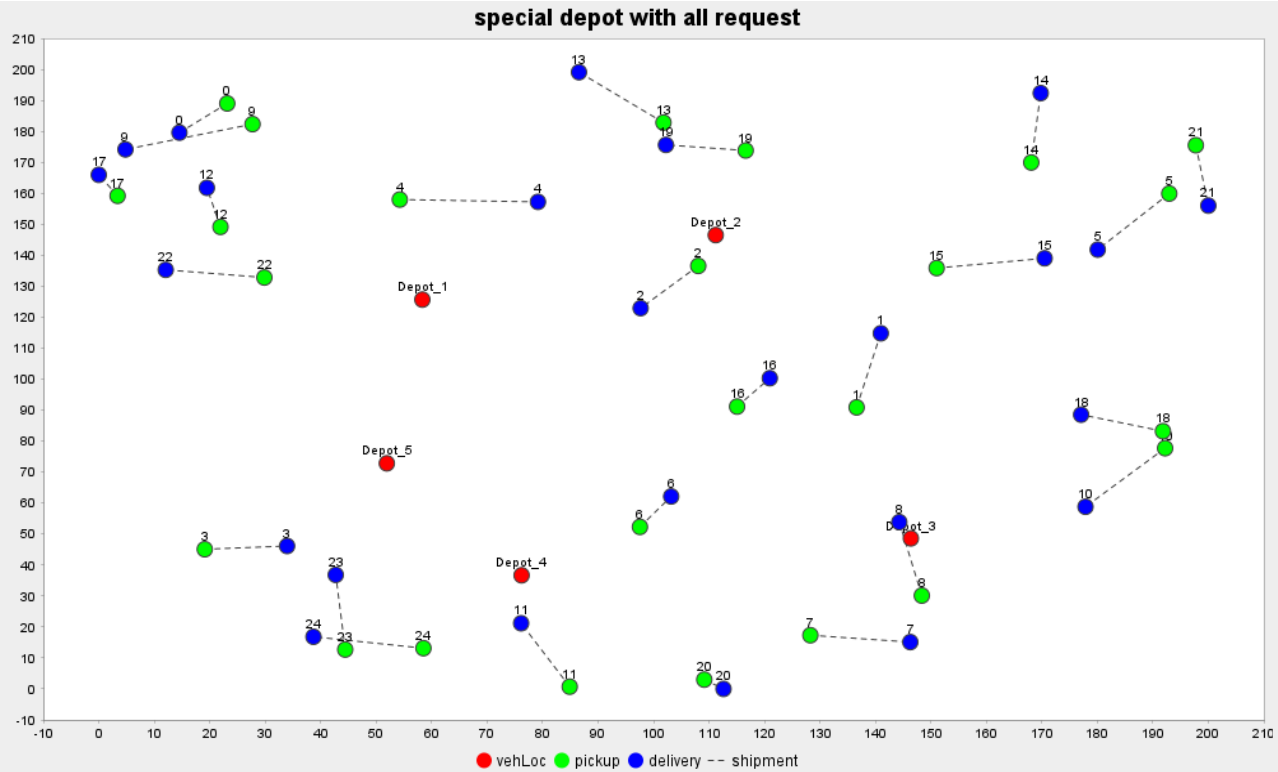


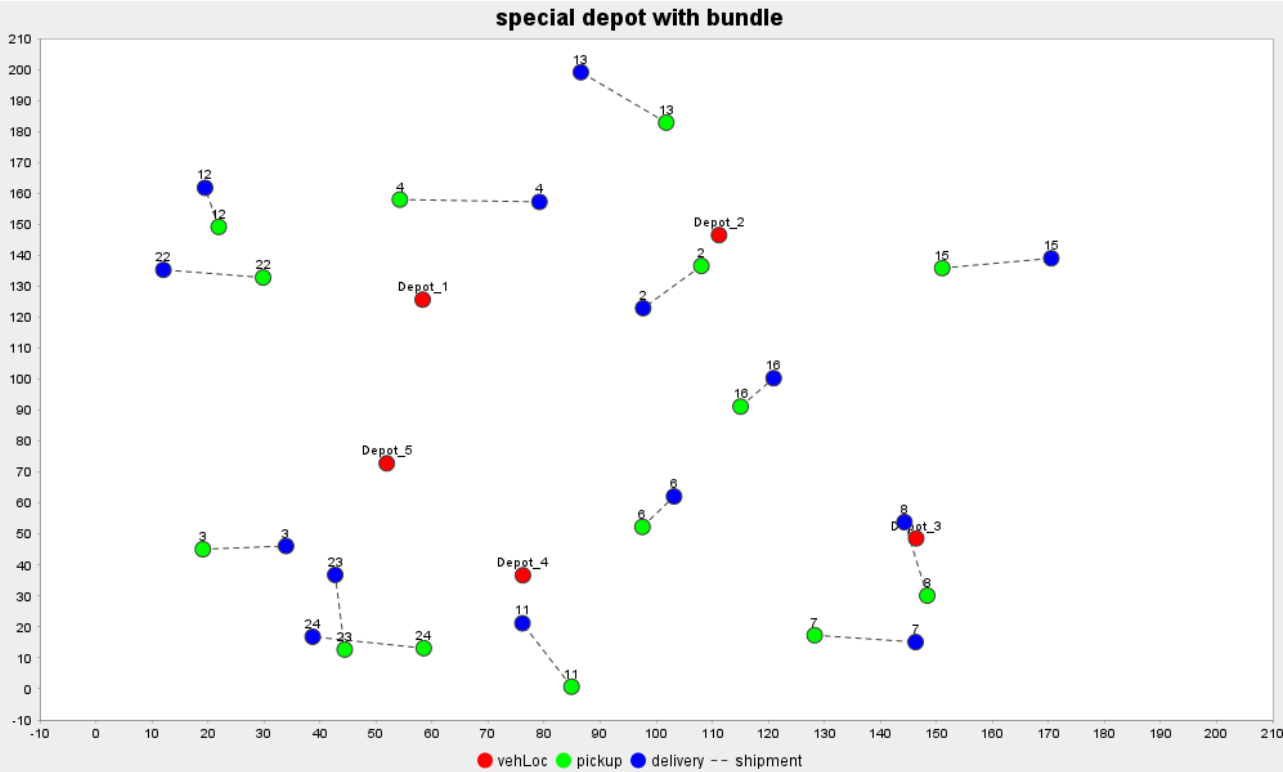

depot
Depot_25
Depot_15
Depot_4
Depot_20
Depot_23
Depot_6
Depot_9
Depot_3
Depot_8
Depot_24
Depot_5
Depot_13
Depot_21
Depot_19
Depot_17
Depot_11
Depot_22
Depot_16
Depot_2
Depot_10
Depot_7
Depot_12
Depot_1
vehLoc


special depot step 9
Depot_4
Depot_3
Depot_5
Depot_2
Depot_1
vehLoc


depot
Depot_22
Depot_14
Depot_2
Depot_12
Depot_13
Depot_1
Depot_25
Depot_18
Depot_5
Depot_10
Depot_17
Depot_6
Depot_11
Depot_8
Depot_3
Depot_23
Depot_20
Depot_9
Depot_15
Depot_4
Depot_16
Depot_19
Depot_21
vehLoc


special depot step 8
Depot_2
Depot_1
Depot_6
Depot_5
Depot_7
Depot_3
Depot_4
Depot_8
vehLoc


special depot with all request
Depot_1
Depot_2
Depot_3
Depot_4
Depot_5
vehLoc pickup delivery -- shipment


special depot with bundle
Depot_1
Depot_2
Depot_3
Depot_4
Depot_5
vehLoc pickup delivery -- shipment

Improvement ideas

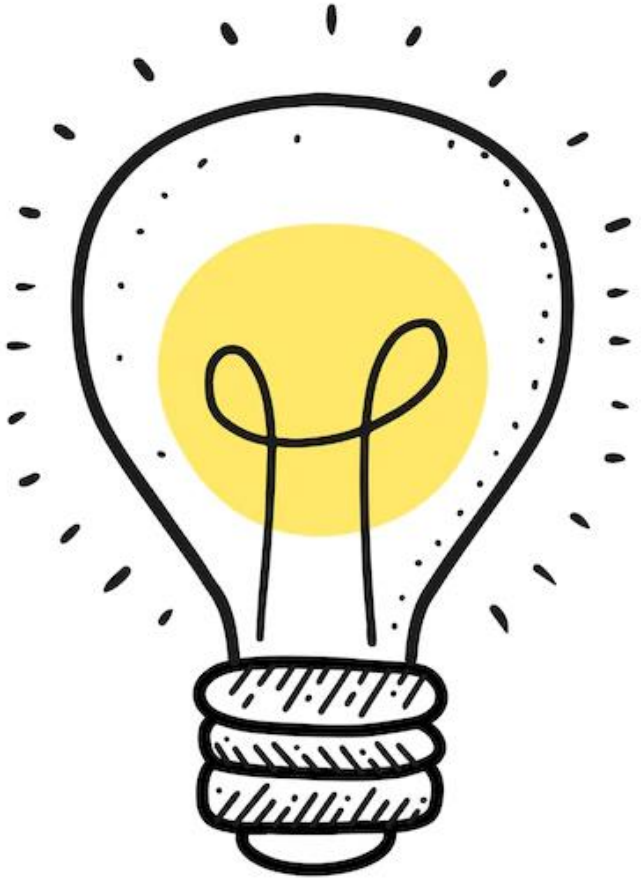
- Option to add new transport requests

- Auctioneer can control number of bidders

  OR

- Carriers can decide whether to join auction process

- Decentralized system
  - Option to set up new database
  - Automatic assignment of carriers in database
  - Multiple auctioneers



Source: https://img.freepik.com

Quality of solution
Auction process

- Max profit of transport requests to be sold ≥ 0
  - *Guaranteed:* **Only** unprofitable requests are auctioned off
- Min profit of transport requests to be bought ≥ 0
  - *Guaranteed:* **Only** profitable requests are bid on
- *Goal:* Individual profit of the carriers can **only** be increased

Source: https://thumbs.dreamstime.com

Quality of solution
Bundle strategy

- Bundles contain only profitable transport requests to a special depot location
  - *Goal:* Maximize number of cost-effective bundles to carriers

- *Scenario:* Carriers won same transport requests in different bundles:
  - Bundles are sold to carriers with higher total payment
  - Unsold transport requests are auctioned again
  - *Goal:* Maximize earning of sellers

Source: https://media.istockphoto.com

Evaluation of SCRUM

SCRUM feature	How useful?
Product backlog with user stories	 Useful to define key focus for each sprint
2-week sprint	 Bugs can be discovered in early stages.
Sprint planning + sprint backlog	 • Convert user stories in implementable tasks • Give orientation to focus on
Sprint review	 Mostly useful for product owner
Weekly meeting	 • Useful if takes place more frequently • Good for effective communication

Source: https://wdrfree.com

Additional notes

Sources:

- Product backlog
- Lecture slides

Download instructions:

- *README.md* in GitLab repository

Source: https://us.123rf.com