# Vehicle Routing with OptaPlanner

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# Talk Overview

- Vehicle Routing Problem (VRP)
- Solving methods
- Geographical data and distance matrix
- Visualization
- OptaWeb Vehicle Routing Demo
- Summary

# Vehicle Routing Problem

Real world use cases

- food delivery
- package delivery
- personal transportation
- technician scheduling

# Vehicle Routing Problem

Flavors

- Capacitated VRP
- Multiple Depot VRP
- Split Delivery VRP
- VRP with Time Windows
- VRP with Pickup and Delivery, Backhauls, etc.

# Solution methods

Exact approach

- SLOW
- Example: Branch and bound algo.

Heuristic approach

- **fast** approximation

# Metaheuristics

- Advanced heuristic approach
- Not problem-specific
- Examples
  - Simulated Annealing
  - Tabu Search
  - Late Acceptance

# OptaPlanner

Implements several metaheuristics.

Developer tasks

- Learn.
- Model the domain in Java using OptaPlanner API.
- Write scoring function.

# VRP Scoring Function

- based on travel distance or time
- needs real-world data
- needs to be fast (no I/O)

# OpenStreetMap

- https://www.openstreetmap.org/
- Open data

# GraphHopper

- open source
- Java API
- travel time
- directions

# Leaflet map visualization

- JavaScript library

# Demo

# Summary

- VRP is difficult => metaheuristics
- OptaPlanner has metaheuristics and quick score calculation
  - Requirement: complete distance matrix in memory
- Geographical data tools
  - OpenStreetMap - map data
  - GraphHopper - route calculation
  - Leaflet - visualization on the web
- OptaWeb Vehicle Routing
  - OptaPlanner showcase for the VRP use case
  - Learn: https://www.optaplanner.org/learn/documentation.html
  - Try: https://github.com/kiegroup/optaweb-vehicle-routing
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# Q&A

Thank you!