Routing in der Datenbank

TOURENPLANUNG UND MEHR

Created by Daniel Kastl / @dkastl

PGROUTING PROJECT

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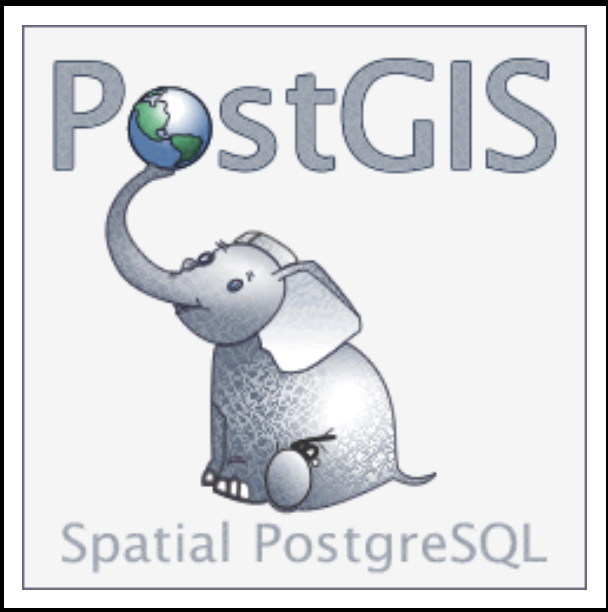
EINE ERWEITERUNG FÜR ...



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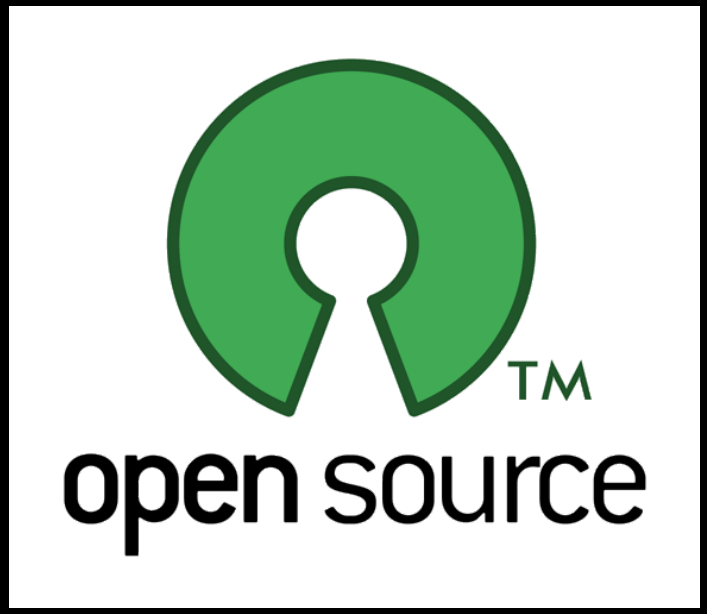
EIN OPEN SOURCE PROJEKT, ...



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EINE BIBLIOTHEK MIT ...

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EINE BIBLIOTHEK MIT ...

- Shortest Path Algorithmen
  - Dijkstra, A-Star, One-to-many, All-pair SP.
  - Alternative Routen & Abbiegebeziehungen
- Traveling Salesperson Algorithmus
- Ermittlung von Einzugsbereichen
- Vehicle Route Problem Solver

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ROUTING IN DER DATENBANK

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DATENBANK ERSTELLEN

pgRouting erweitert PostgreSQL/PostGIS

```
CREATE DATABASE routing;
\c routing
CREATE EXTENSION postgis;
CREATE EXTENSION pgrouting;
```

SQL ABFRAGE

```
SELECT * FROM pgr_dijkstra('
      SELECT gid as id,
             source::integer,
             target::integer,
             length::float8 as cost
        FROM ways',
    30, 60, false, false);
```

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ABFRAGEERGEBNIS

```
 seq | node | edge |         cost
-----+------+------+----------------------
   0 |   30 |   53 |  0.0591267653820616
   1 |   44 |   52 |  0.0665408320949312
   2 |   14 |   15 |  0.0809556879332114
   3 |   13 |   14 |   0.072694271986776
   4 |   12 |   13 |   0.081239348480584
   5 |   11 |   12 | 0.00746935522787469
   6 |   10 | 6869 |  0.0164274192597773
   7 |   59 |   72 |  0.0109385169537801
   8 |   60 |   -1 |                    0
(9 rows)
```

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Variabilität vs. Geschwindigkeit

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VARIABLE KOSTEN

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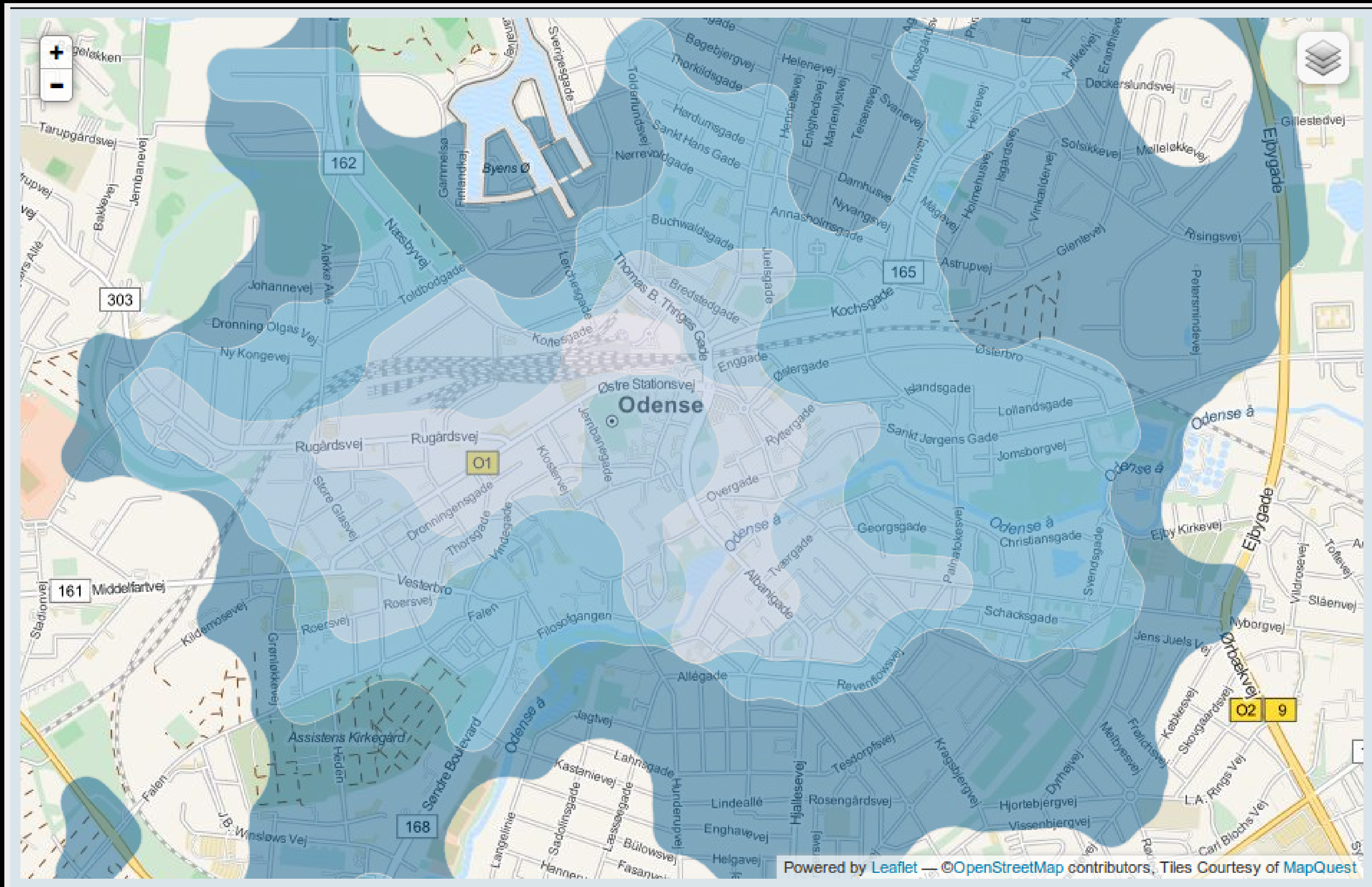
Quelle: http://imgs.xkcd.com/comics/goto.png

EIGENE FUNKTIONEN

```
CREATE OR REPLACE FUNCTION pgr_fromAtoB(
    IN tbl varchar,
    IN x1 float, IN y1 float,
    IN x2 float, IN y2 float,
)
RETURNS SETOF record AS $$
BEGIN
    FOR rec IN EXECUTE sql LOOP
        RETURN NEXT;
    END LOOP;
END;
$$ LANGUAGE 'plpgsql' VOLATILE STRICT;
```



Odense
Østre Stationsvej
Rugårdsvej
Thomas B. Thriges Gade
Kochsgade
Østerbro
Enggade
Østergade
Sankt Jørgens Gade
Jomsborgvej
Lollandsgade
Overgade
Odense å
Vesterbro
Filosofgangen
Allégade
Albanigade
Tværgade
Schacksgade
Christiansgade
Georgsgade
Dronningensgade
Thorsgade
Vindegade
Kongensgade
Jernbanegade
Klosterbakken
Buchwaldsgade
Annasholmsgade
Nørrevoldgade
Sankt Hans Gade
Toldbodgade
Næsbyvej
Dronning Olgas Vej
Ny Kongevej
Johannevej
Byens Ø
Assistens Kirkegård
Søndre Boulevard
Middelfartvej
Ejbygade
Ørbækvej
Risingsvej
Astrupvej
Glentevej
Solsikkevej
Døckerslundsvej
Jagtvej
Lahnsgade
Hunderupvej
Lindeallé
Enghavevej
Rosengårdsvej
Hjallesevej
Hjortebjergvej
Vissenbjergvej
Reventlowsvej
Jens Juels Vej
Nyborgvej
Roersvej
Kildemosevej
Tarupgårdsvej
Jernbanevej
162
165
168
161
303
O1
O2
9
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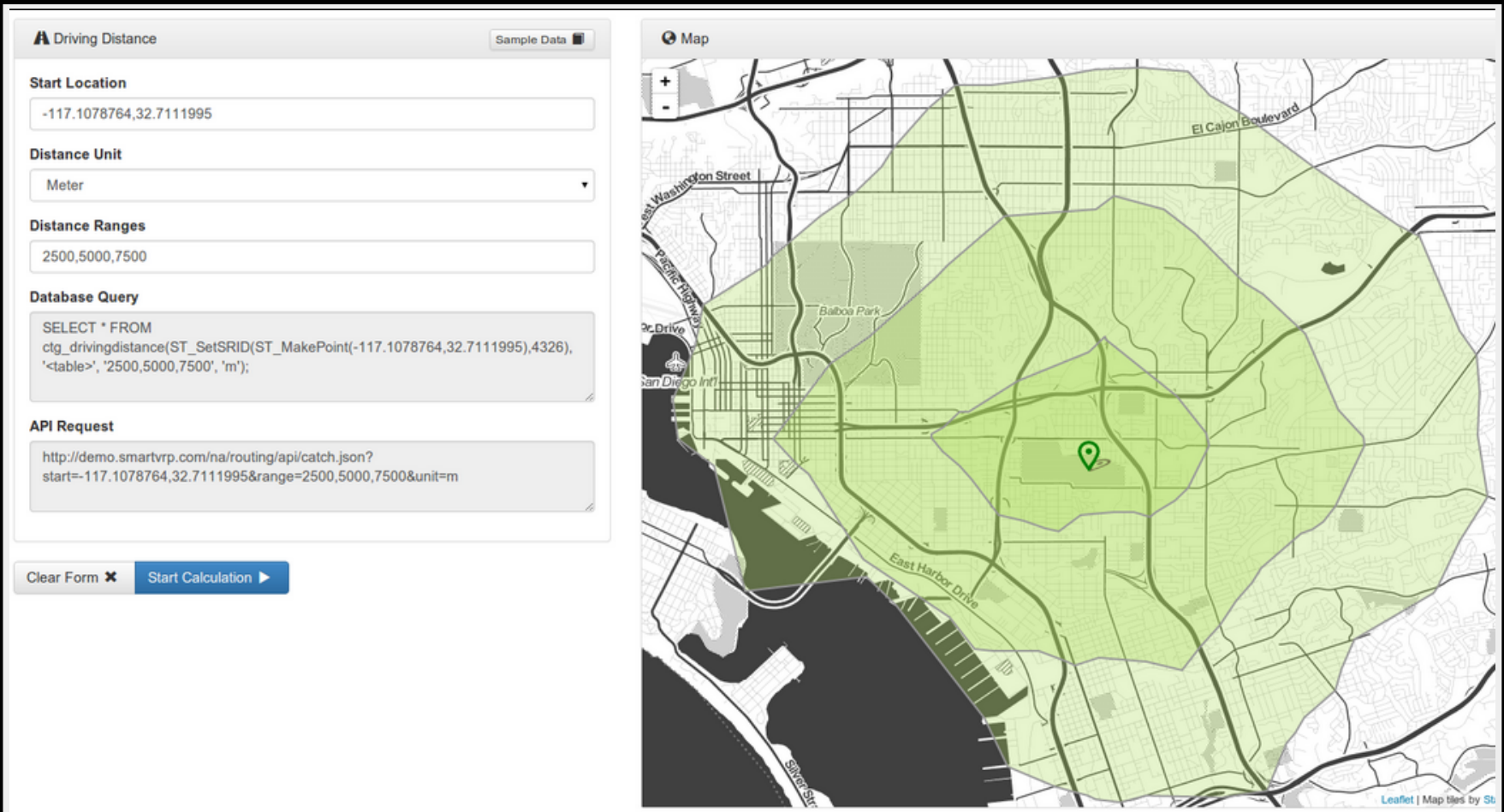


```
SELECT * FROM ctg_drivingdistance(
 ST_SetSRID(
 ST_MakePoint(-117.1078764,32.7111995),4326),
 'ways', '2500,5000,7500', 'm');
```

TOURENPLANUNG

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PGR_VRPONEDEPOT

Vehicle Routing Problem Solver

```
SELECT * FROM pgr_vrpOneDepot(
        'SELECT * FROM vorders'::text,
        'SELECT * FROM vvehicles'::text,
        'SELECT * FROM vdistance'::text,
    1 );
```

(Die Funktion befindet sich momentan in einer pgRouting Branch.)

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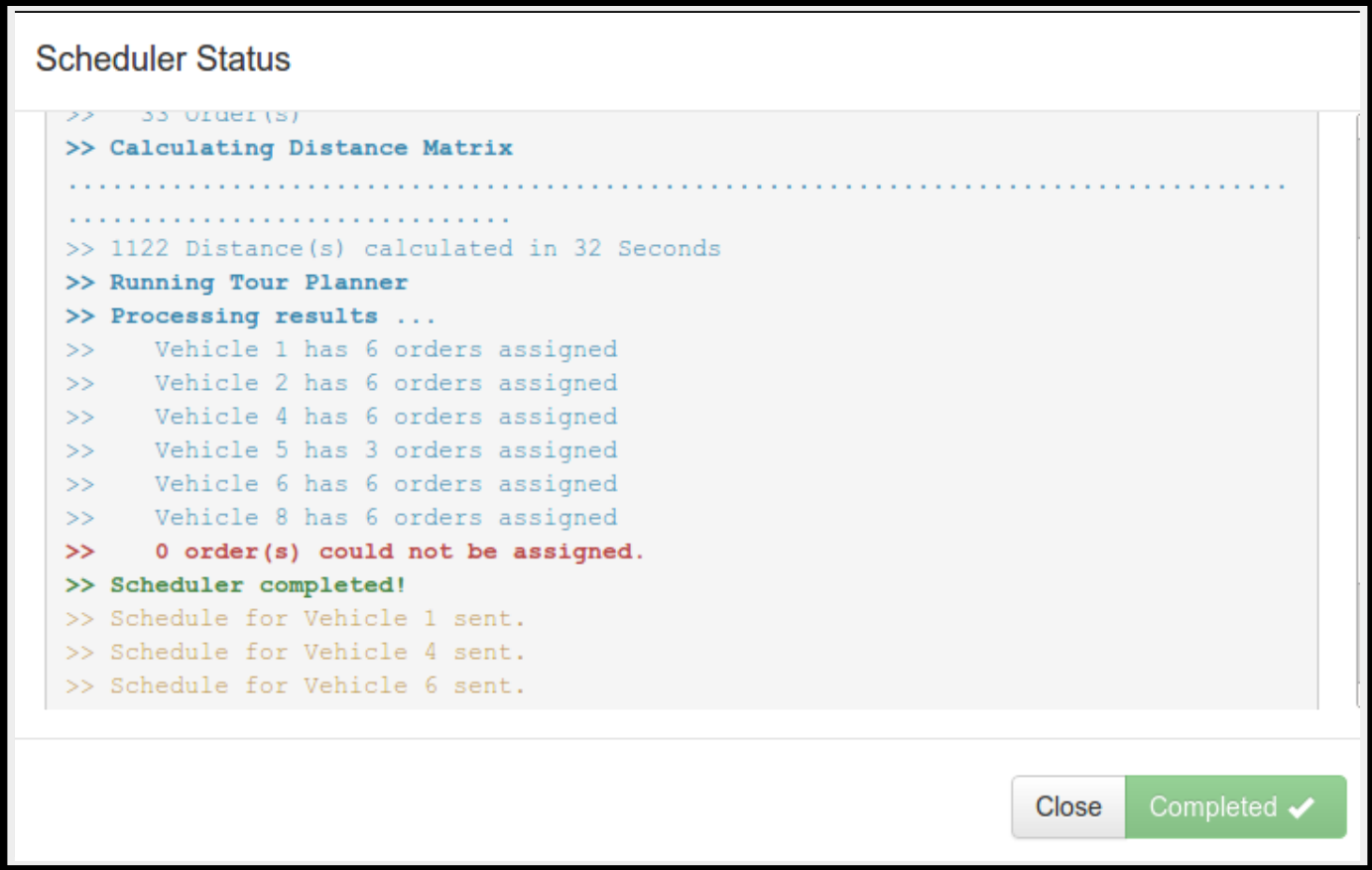
BEISPIELANWENDUNG



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Vehicles

Add Vehicle | Sample Data

```
1, 200, 5
2, 200, 5
3, 200, 5
4, 200, 5
5, 200, 5
```

Depot

Sample Data

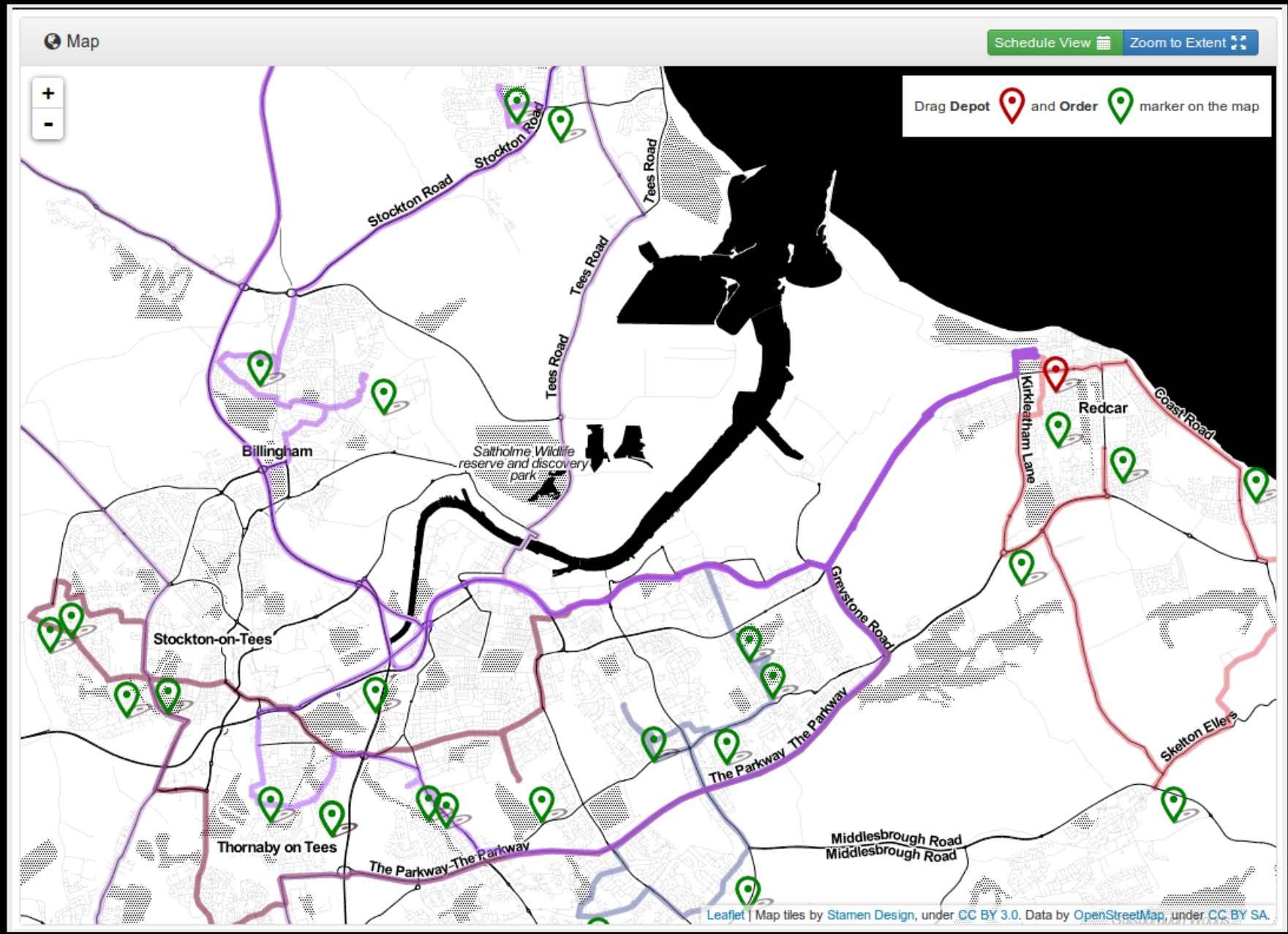
```
0, 0, 0, 465, 0, -1.078825, 54.616138
```

Orders

Sample Data

```
1, 10, 0, 465, 60, -1.22289659907124, 54.6582746443252
2, 10, 0, 465, 60, -1.23562348265080, 54.6614882483297
3, 10, 0, 465, 60, -1.21743127379647, 54.6936140430909
4, 10, 0, 465, 60, -1.24643812670616, 54.6888636465231
5, 10, 0, 465, 60, -1.22850727930929, 54.7091629687364
6, 10, 0, 465, 60, -1.26140648627224, 54.5438245794979
7, 10, 0, 465, 60, -1.27687718490744, 54.5620577694872
8, 10, 0, 465, 60, -1.25625460264735, 54.5426361265823
```

Clear Form ✖ | Start Scheduler ▶


Map
Schedule View
Zoom to Extent
+
-
Drag Depot and Order marker on the map
Stockton Road
Stockton Road
Tees Road
Tees Road
Tees Road
Billingham
Saltholme Wildlife reserve and discovery park
Kirkleatham Lane
Redcar
Coast Road
Grevstone Road
Stockton-on-Tees
The Parkway
The Parkway
Skelton Eller
Thornaby on Tees
The Parkway
The Parkway
Middlesbrough Road
Middlesbrough Road
Leaflet | Map tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under CC BY SA.

OPTIMIERTER FAHRPLAN

Vehicle ID: 1

#	Order ID	Arrival	Departure	Service Time
0	0	-1	0	0
1	14	7	67	60
2	13	73	133	60
3	12	142	202	60
4	15	210	270	60
5	16	274	334	60
6	19	339	399	60
7	0	402	-1	0

Total Drivetime: 41 min | **Total Distance:** 32 km

demo.smartvrp.com

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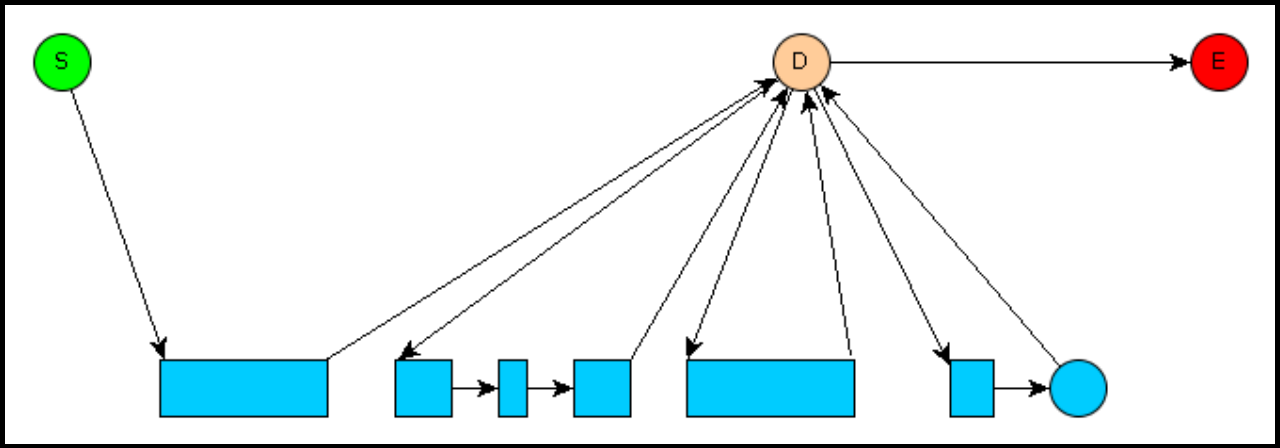

GARBAGE COLLECTION

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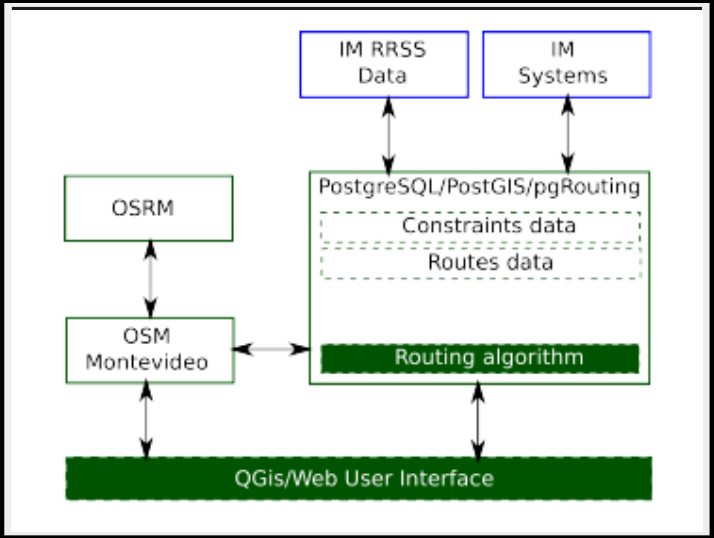
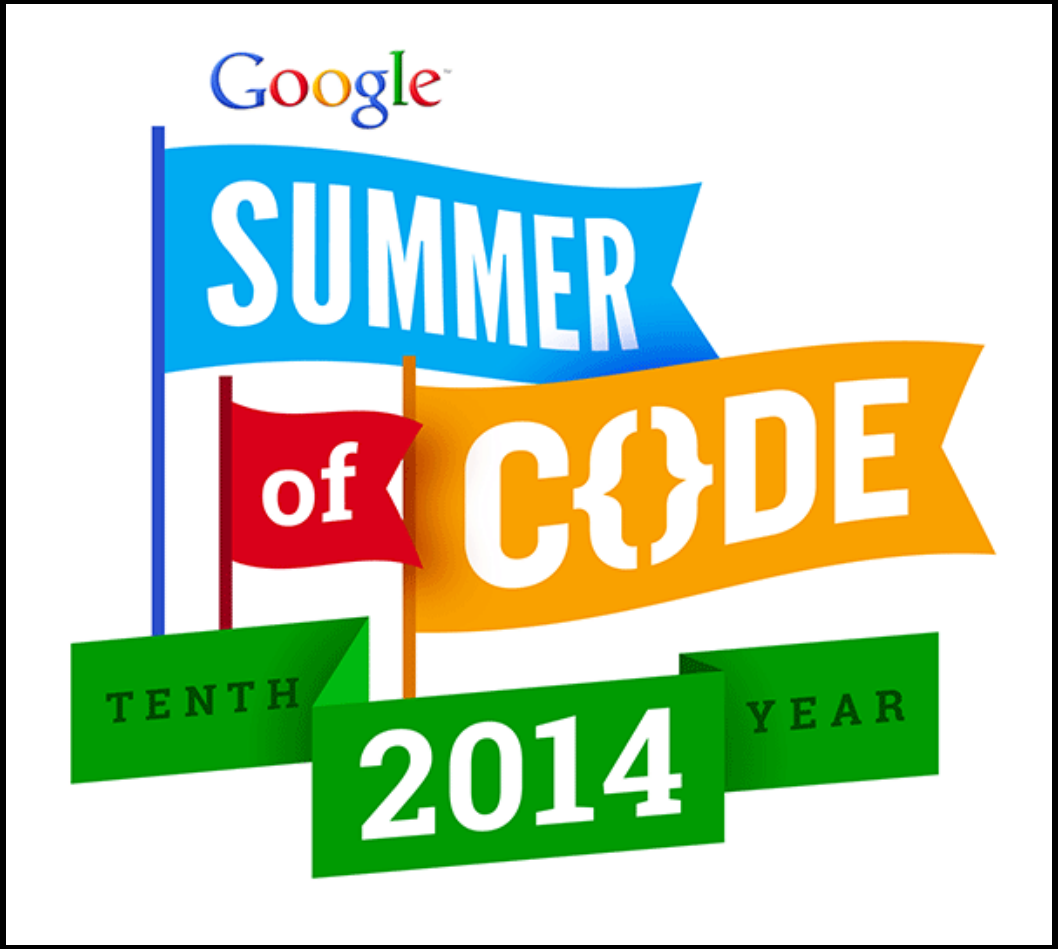
KOMPLEXES OPTIMIERUNGSPROBLEM

- Deponien zum Entleeren der Fahrzeuge
- Verschiedene Fahrzeugtypen
- Unterschiedliche Arten von Abfall
- Keine U-Turns erlaubt
- Anfahrt auf der richtigen Strassenseite
- Spezielle Anforderungen





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GSOC PROJEKTE SEIT 2010

- Multimodal Routing
- Time-Dependent Shortest Path
- Graphenpartitionierung
- VRP mit Time Windows

pgRouting sucht Sponsoren!

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ROUTING IN DER DATENBANK

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