PgRouting: Izračun območij dostopnosti

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Nekaj o meni:

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Območja dostopnosti:

- mrežne analize,
- izolinije (zanimajo nas linije, ki označujejo enako oddaljenost od točke izvora glede na razdaljo ali čas)

Naloga

Razdeli omrežje na pasove med izolinije, ki označujejo enako dostopna območja od točke izvora glede na čas.

- Podatki: OSM
- Baza: Postgresql (10.0)
- Postgis (2.4.0) - razširitev baze Postgresql za prostorske podatke
- PgRouting (2.5.0) - razširitev baze Postgresql za izračunavanje poti

Postopek izračuna

Okolje za izvajanje analiz je Ubuntu 16.04 LTS server.

1. Pridobitev podatkov o cestah
2. Uvoz podatkov
3. Izračun
4. Izris rezultatov

PostgreSQL

Pridobitev podatkov o cestah:

- BBOX="14.22,45.93,14.85,46.25" (območje Ljubljane)
- http://www.overpass-api.de (‘read- only’ API, ki vrne podatke za poljubno območje in vsebino OSM podatkov)

- wget --progress=dot:mega -O "roads.osm" "http://www.overpass-api.de/api/xapi?*[bbox=${BBOX}][@meta]"

Uvoz podatkov

- orodje osm2pgrouting (uvozi datoteko *.osm v postgresql bazo)
- https://github.com/pgRouting/osm2pgrouting
- težave z starejšimi verzijami osm2pgrouting pri uvozu podatkov
- lasten ‘build’ zadnje verzije osm2pgrouting v2.3.0
- osm2pgrouting --f ./roads.osm --conf ./car_config.xml --dbname routing --username postgres --password postgres --clean --host 127.0.0.1

Izračun

Osm2pgrouting nam uvozi podatke v tabelo oglišč in robov:

Hočemo izračunati strošek od izbranega oglišča do katerega koli drugega oglišča, kjer nam strošek predstavlja čas vožnje.

Za izračun stroška (časovnih razdalj) uporabimo pgRouting funkcijo pgr_drivingDistance.

pgr_drivingDistance

Name

`pgr_drivingDistance` - Returns the driving distance from a start node.

boost
C++ LIBRARIES

Boost Graph Inside

Synopsis

Using Dijkstra algorithm, extracts all the nodes that have costs less than or equal to the value `distance`. The edges extracted will conform the corresponding spanning tree.

Signature Summary

```
pgr_drivingDistance(edges_sql, start_vid, distance)
pgr_drivingDistance(edges_sql, start_vid, distance, directed)
pgr_drivingDistance(edges_sql, start_vids, distance, directed, equicost)

RETURNS SET OF (seq, [start_vid,] node, edge, cost, agg_cost)
```

```
DROP TABLE IF EXISTS distances;
```

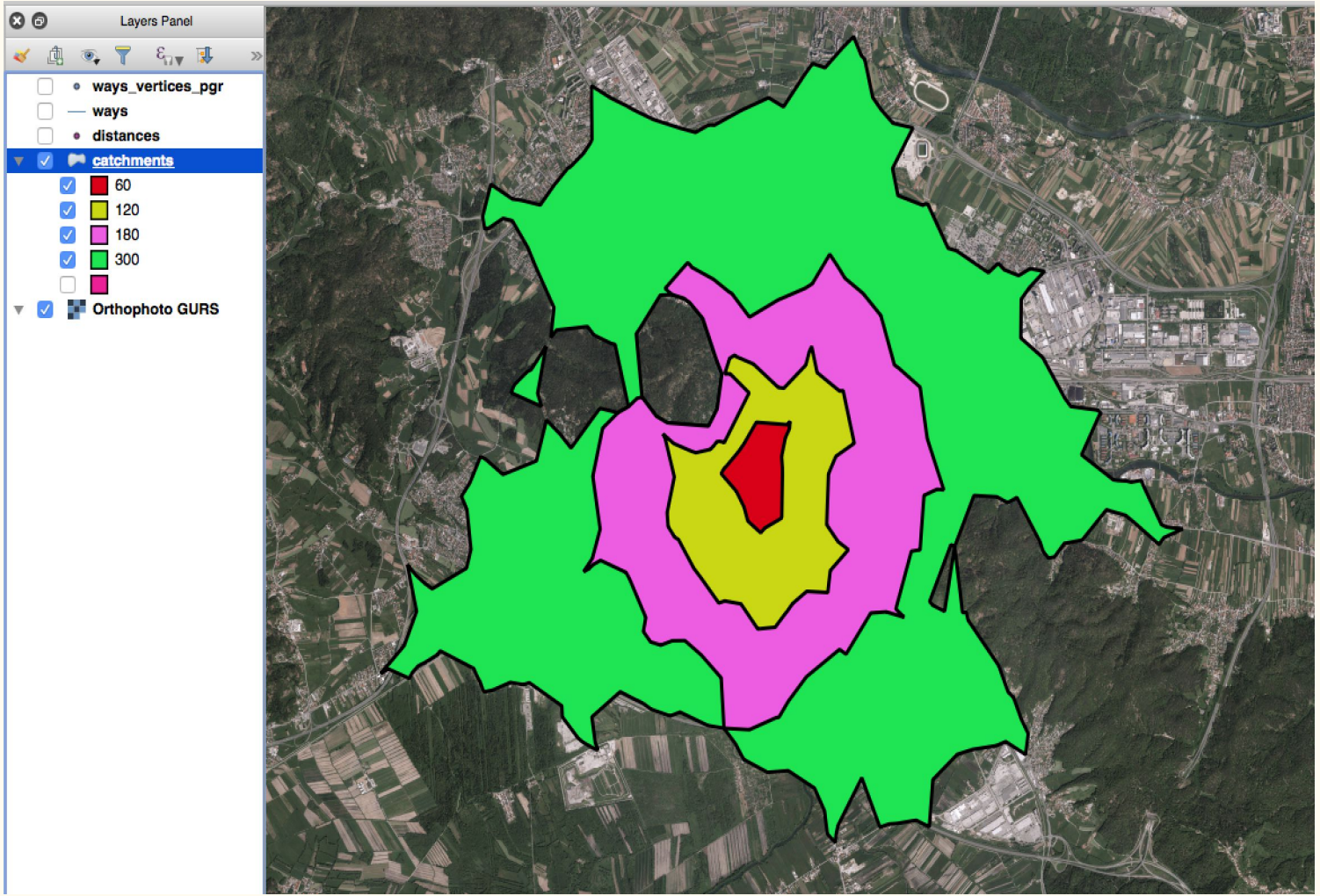
Ustvarimo tabelo razdalj ki vsebuje geometrije s podatkom o času, ki ga potrebujemo, da prevozimo to geometrijo/rob.

```
CREATE TABLE distances AS (SELECT a.node AS id, a.agg_cost AS distance,
b.the_geom
    FROM pgr_drivingDistance(
        'SELECT gid AS id, source, target, cost_s as cost, reverse_cost_s as
reverse_cost FROM
       public.ways', -- edges sql
             21819, -- start  node
             3600  -- distance value - 1 ura
           ) a, ways_vertices_pgr b WHERE a.node = b.id
);
```

Izračun poligonov (območij z enakim kriterijem dostopnosti):

```
DO $$
DECLARE
  dist int;
-- POLIGONE DOSTOPNOSTI DOLOČIMO S ČASI 5MIN, 3MIN, 2MIN, 1MIN
  arr int[] := ARRAY[300, 180, 120, 60];
BEGIN
  DROP TABLE IF EXISTS catchments;
  CREATE TABLE catchments(
    distance integer,
    the_geom geometry(multipolygon,4326)
  );
  FOREACH dist IN ARRAY arr
  LOOP
    RAISE INFO 'Distance is %', dist;
    WITH polygon AS (
      SELECT pgr_pointsAsPolygon(
        'SELECT id, ST_X(the_geom) AS x, ST_Y(the_geom) AS y
          FROM distances WHERE distance <= ' || dist || ';',
          0.00001
        ) AS geom
      )
      INSERT INTO catchments (distance,the_geom)
        SELECT dist, ST_SetSRID(st_multi(polygon.geom),4326) FROM polygon;
    END LOOP;
END$$;
```

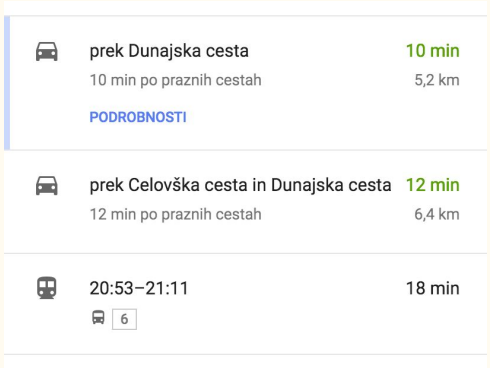
Izgled poligonov:



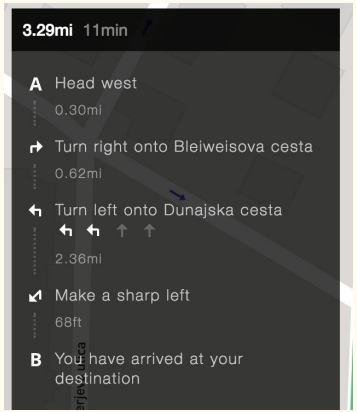
Vrednotenje rezultatov

Start node 21819 leži poleg Kongresnega trga. Ali se lahko v 5 minutah pripeljemo od Kongresnega trga do gostine Ruski car?

Google maps:



OSRM:



Konfiguracija osm2pgrouting:

GNU nano 2.5.3 File: car_config.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<configuration>
  <tag_name name="highway" id="1">
    <tag_value name="motorway"          id="101" priority="1.0" maxspeed="130" />
    <tag_value name="motorway_link"     id="102" priority="1.0" maxspeed="130" />
    <tag_value name="motorway_junction" id="103" priority="1.0" maxspeed="130" />
    <tag_value name="trunk"             id="104" priority="1.05" maxspeed="110" />
    <tag_value name="trunk_link"        id="105" priority="1.05" maxspeed="110" />
    <tag_value name="primary"           id="106" priority="1.15" maxspeed="90" />
    <tag_value name="primary_link"      id="107" priority="1.15" maxspeed="90" />
    <tag_value name="secondary"         id="108" priority="1.5" maxspeed="90" />
    <tag_value name="secondary_link"    id="109" priority="1.5" maxspeed="90"/>
    <tag_value name="tertiary"          id="110" priority="1.75" maxspeed="90" />
    <tag_value name="tertiary_link"     id="111" priority="1.75" maxspeed="90" />
    <tag_value name="residential"       id="112" priority="2.5" maxspeed="50" />
    <tag_value name="living_street"     id="113" priority="3" maxspeed="20" />
    <tag_value name="service"           id="114" priority="2.5" maxspeed="50" />

    <tag_value name="unclassified"      id="117" priority="3" maxspeed="90"/>
    <tag_value name="road"              id="100" priority="5" maxspeed="50" />
  </tag_name>
</configuration>
```

Npr.: omejitev na Dunajski cest 60 km/h in ne 90 km/h

Popravljena konfiguracija osm2pgrouting:

```
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<configuration>
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    <tag_value name="trunk_link"        id="105" priority="1.05" maxspeed="110" />
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    <tag_value name="primary_link"      id="107" priority="1.15" maxspeed="60" />
    <tag_value name="secondary"         id="108" priority="1.5" maxspeed="90" />
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    <tag_value name="road"              id="100" priority="5" maxspeed="50" />
  </tag_name>
</configuration>
```


Saveljska cesta
Sava
H3
H3
Slovenčeva ulica
Dunajska cesta
Topniška ulica
Vilharjeva cesta
Ljubljana
20 min
vsake 40 minute
Zmajski most
Kongresni trg 1