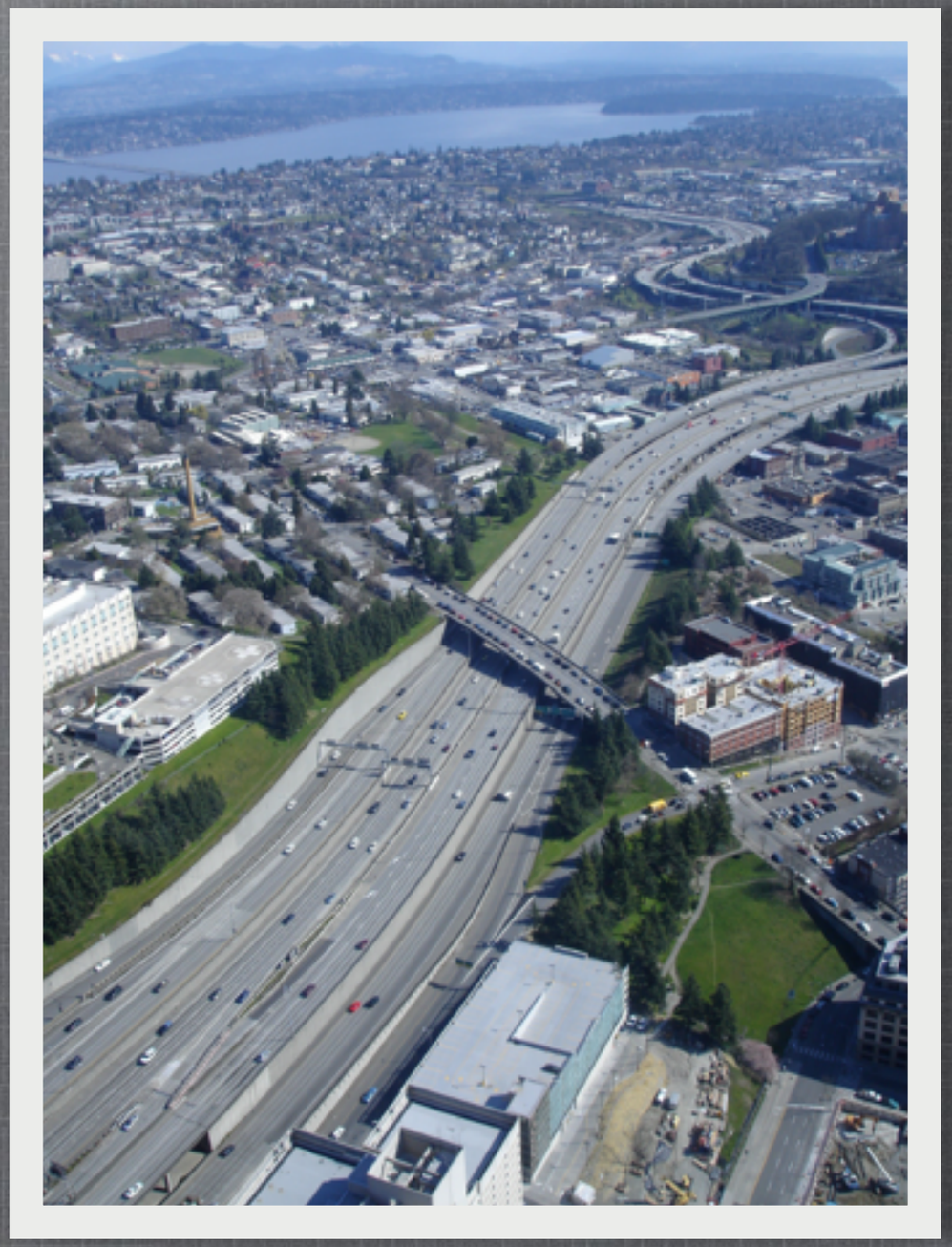
PGROUTING

Basée sur la présentation d'Anton Patrushev
http://heig.ch/74593 présentée à FOSS4G 2010 à Barcelone

C'EST QUOI UN RÉSEAU ROUTIER ?

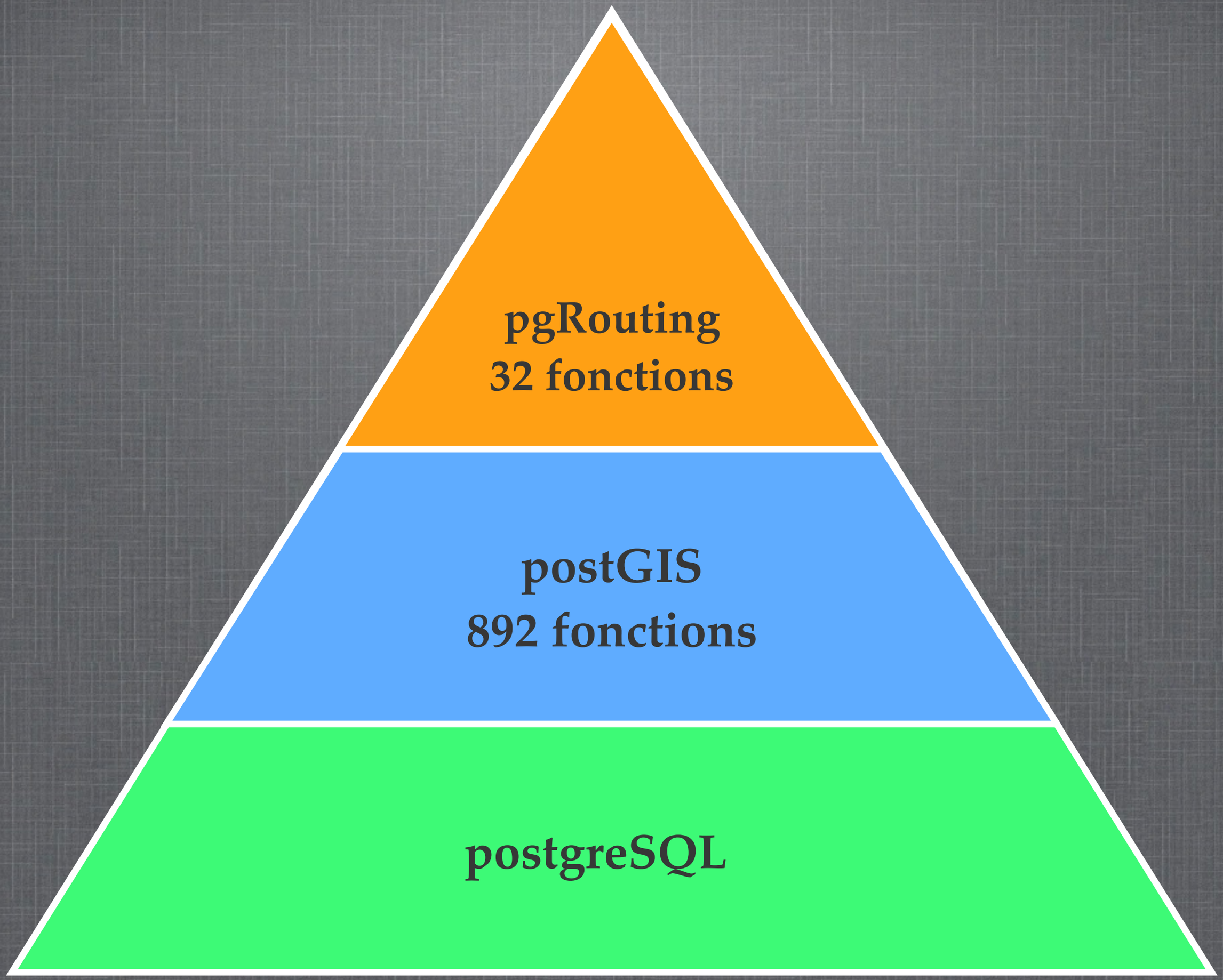



SIMPLE ?

COMPLIQUÉ?

DANGEREUX ?

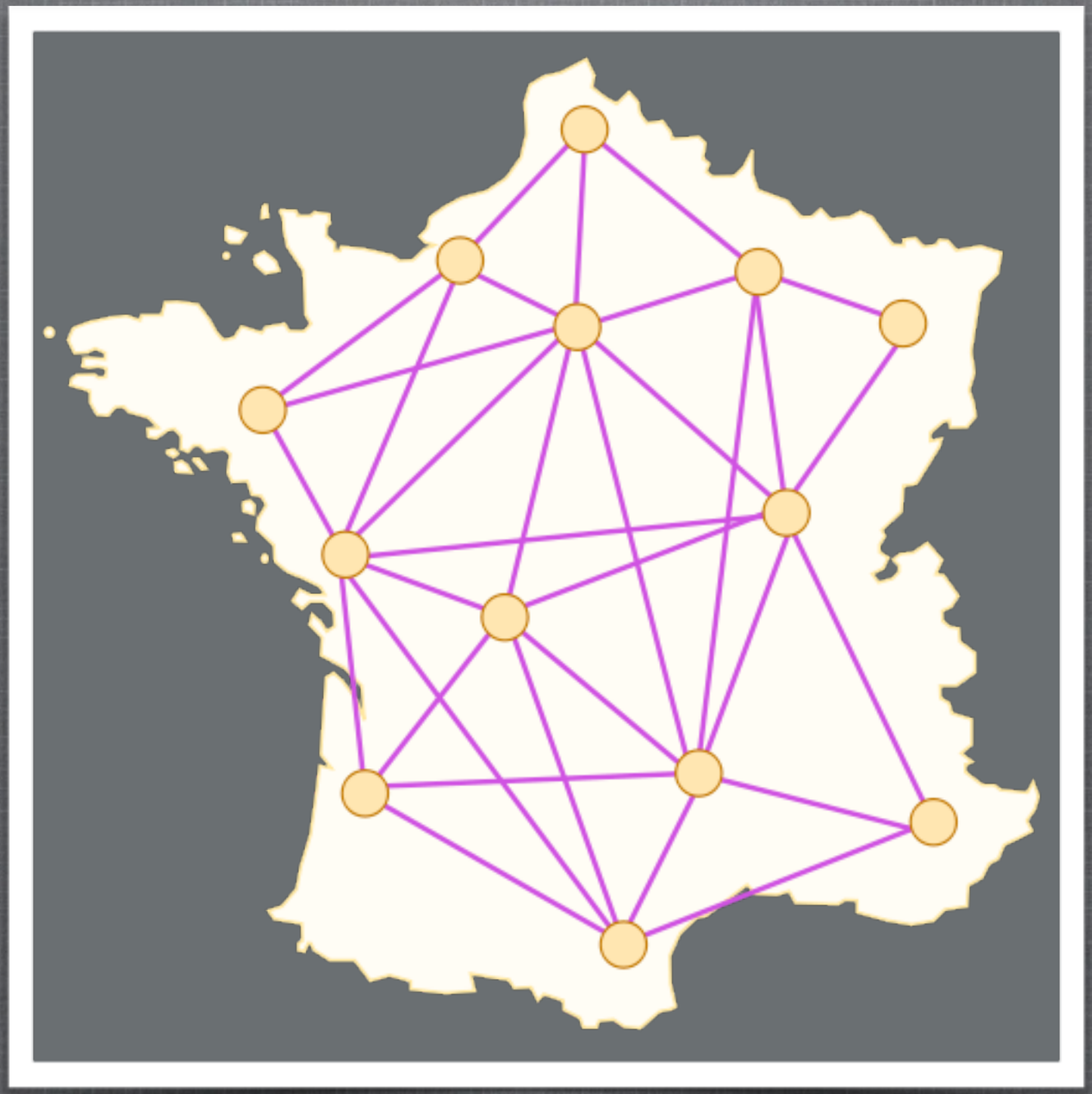
ET EN PLUS….

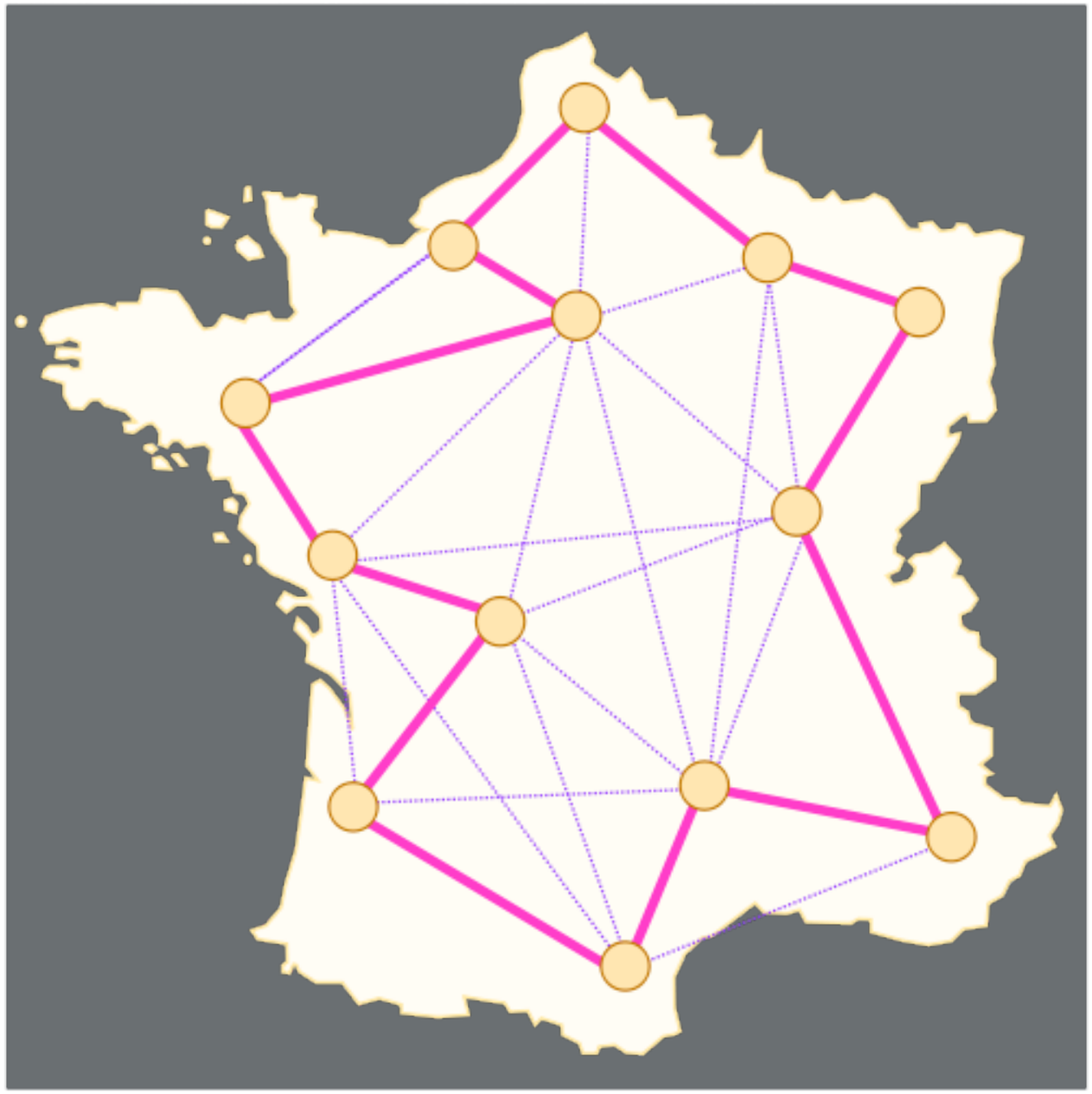

pgRouting
32 fonctions
postGIS
892 fonctions
postgreSQL

CALCUL DU PLUS COURT CHEMIN


Montalchez
Provence
Fresens
Mutrux
Vaumarcus
Romairon
Concise
Mauborget
Fontanezier
Villars-Burquin
Corcelles-près-Concise
Les Cluds
Vaugondry
Grandevent
Bonvillars
Onnens (VD)
Fontaines-sur-Grandson
Novalles
Bullet
Fiez
Champagne
Grandson
Vugelles-La Mothe
Giez
Orges
Grandson
Valeyres-sous-Montagny
Montagny-près-Yverdon
Champvent
Yverdon-les-Bains
Chambion
Cheseaux-Noréaz
Villars-Epeney
Yvonand
Rovray
Murist
Cheyres
Châbles
Châtillon (FR)
Font
Lully (FR
Bolion
Seiry
Les Monte
Nuvilly
Estavay
A1
A1

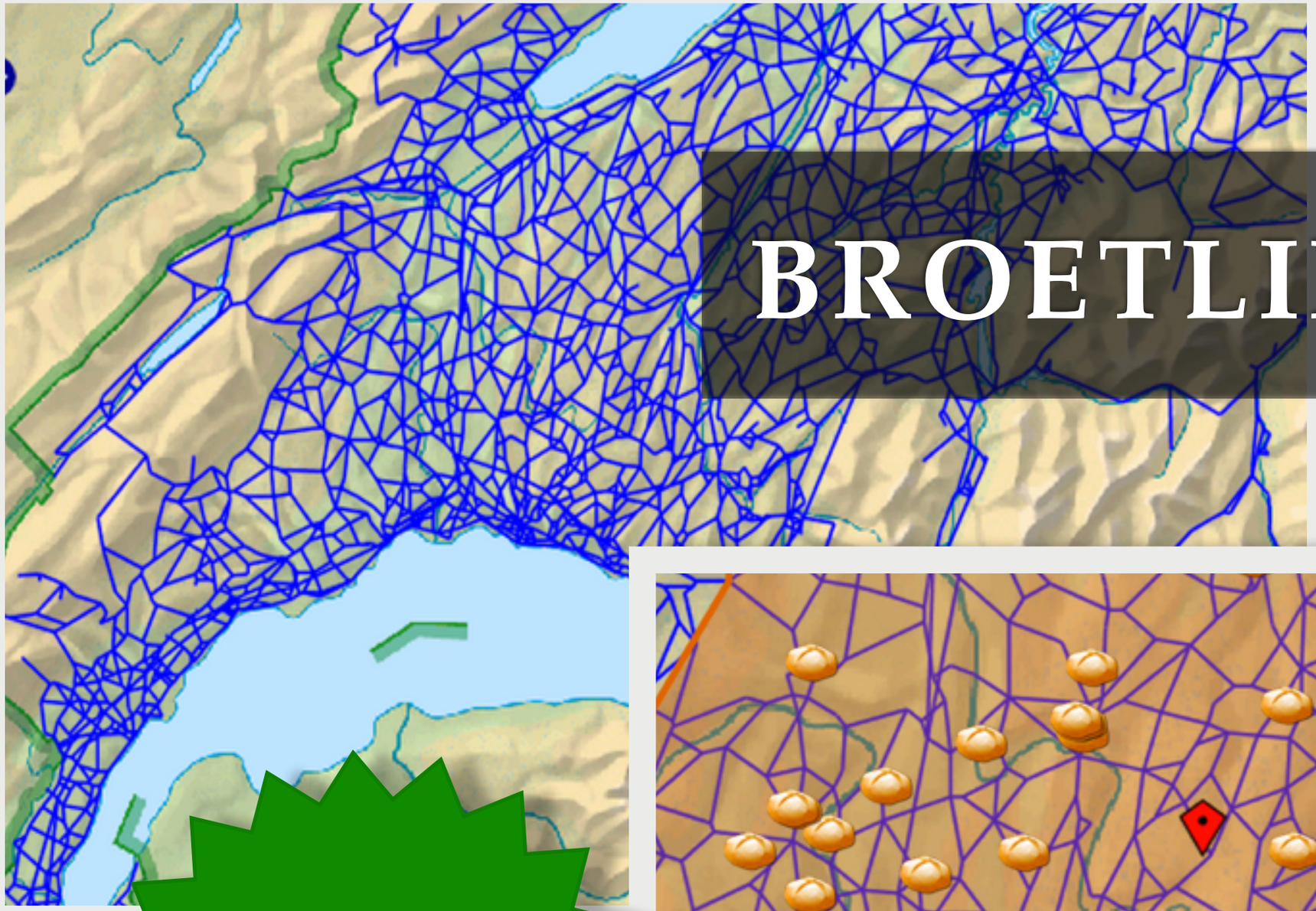
PROBLÈME DU VOYAGEUR DE COMMERCE (TSP)





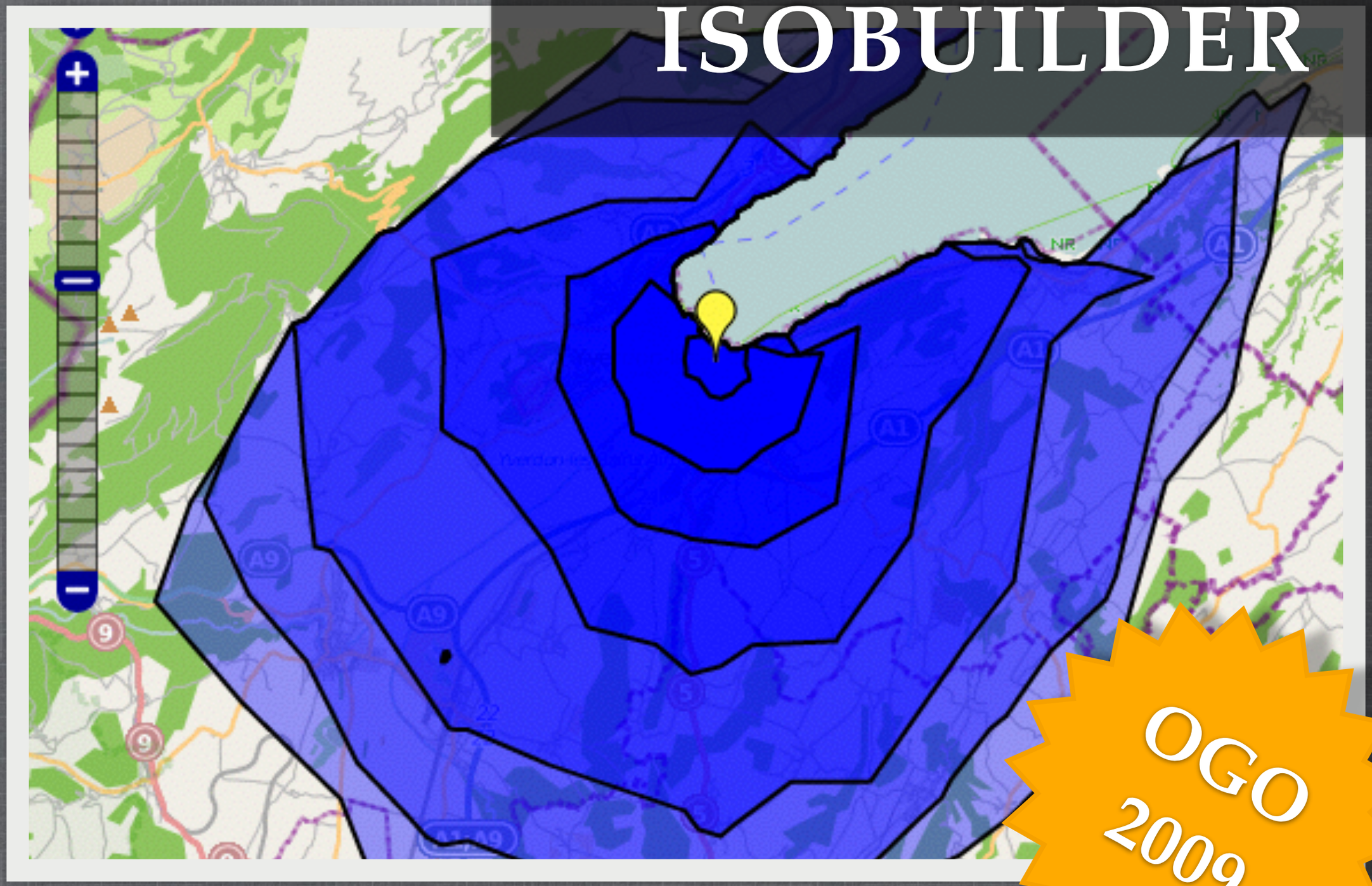
CRÉATION D'ISOCHRONES/ ISODISTANCE

BROETLIKRONES



OGO 2008

ISOBUILDER



OGO
2009

OGO
2014

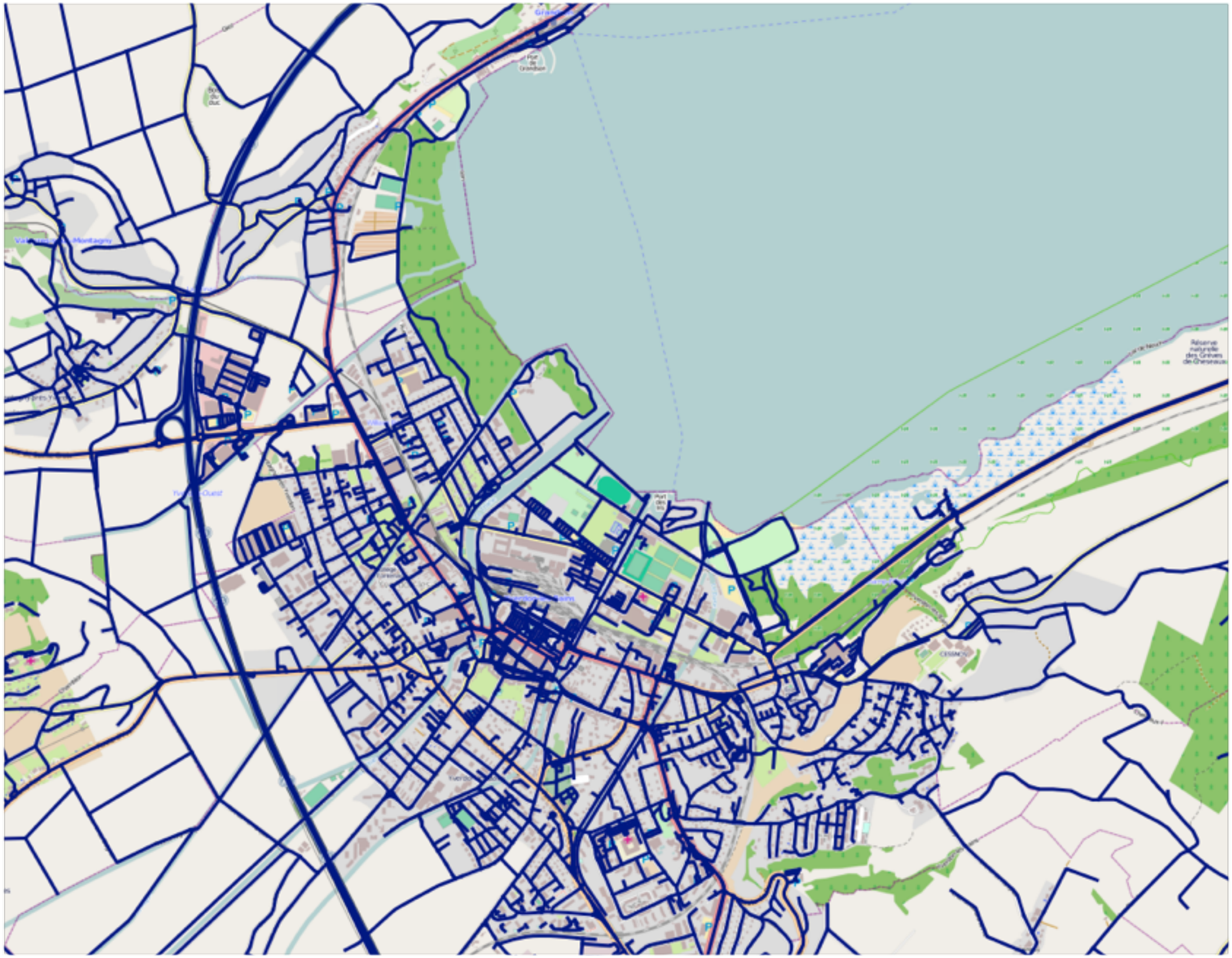
?

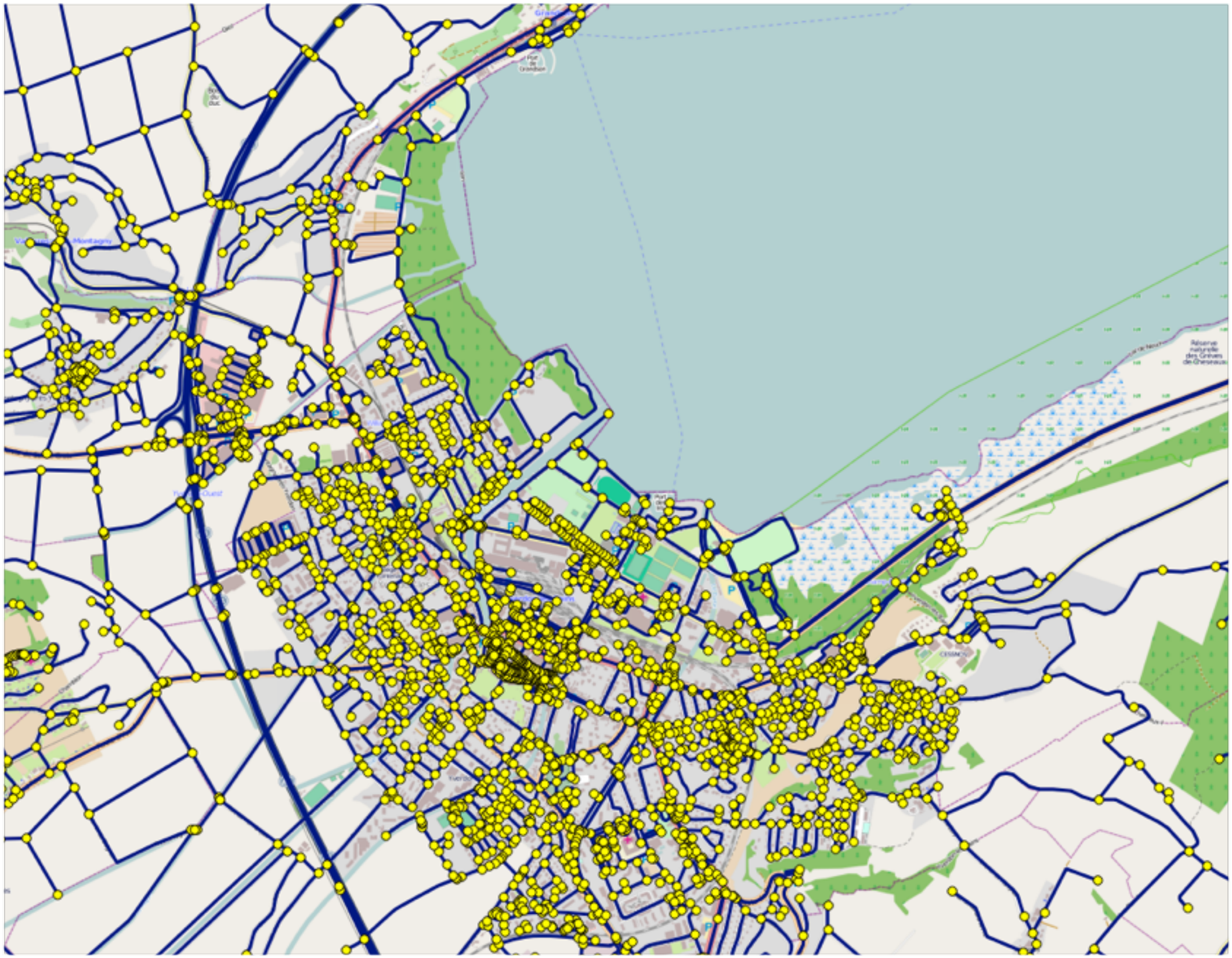
COMMENT FAIRE RENTRER UN RÉSEAU ROUTIER DANS UNE BASE DE DONNÉES ?


Grandson
Avenue de la Gare
Valeyres-sous-Montagny
Montagny-près-Yverdon
Route de Sainte-Croix
Route de Lausanne
Avenue de Grandson
Yverdon-les-Bains
Rue d'Orbe
Rue Cordey
Rue du Midi
Rue des Philosophes
Route d'Yverdon
Grand-Rue
Route de Cheseaux
Réserve naturelle des Grèves de Cheseaux
A5

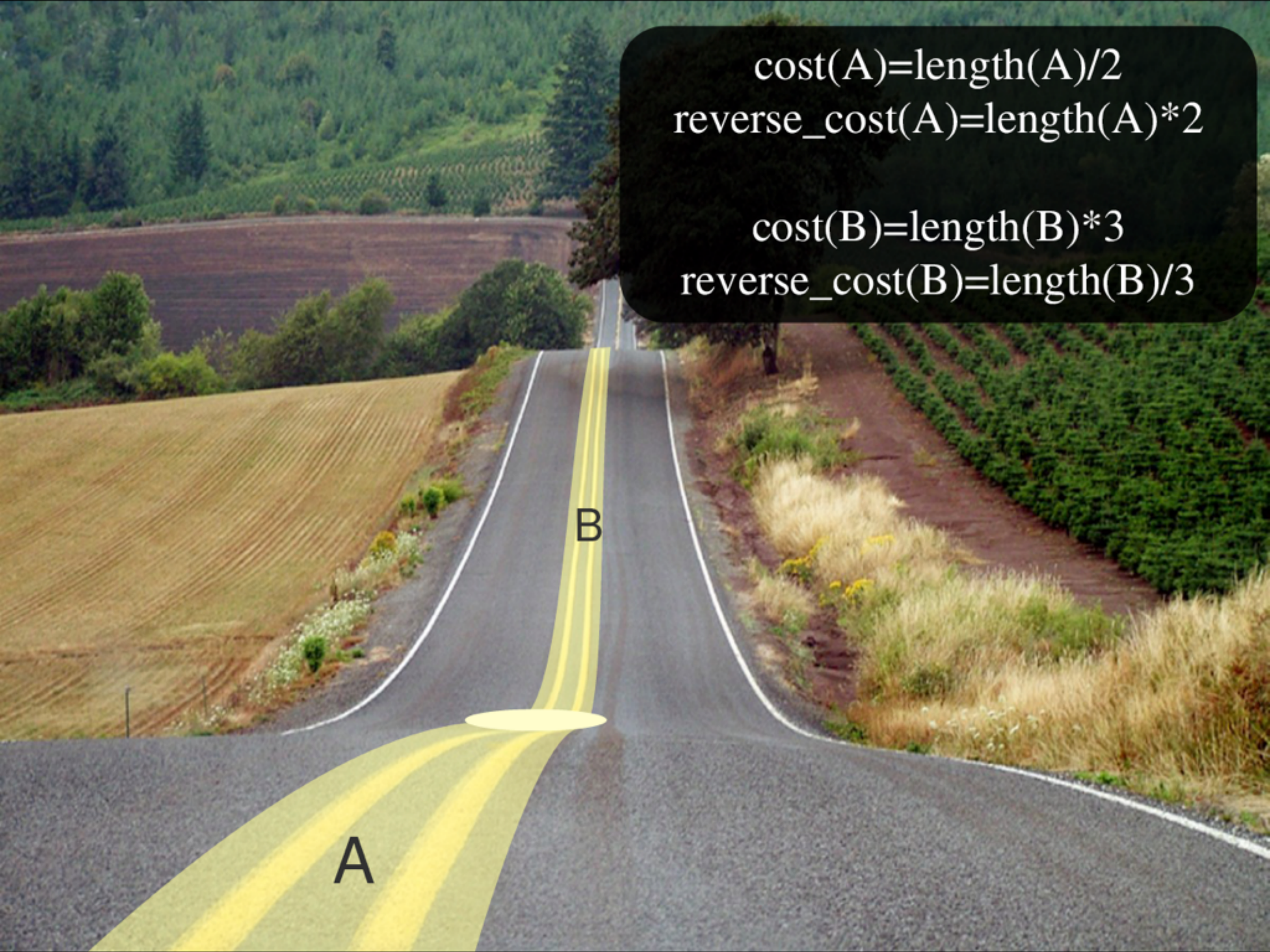
```
<way id="4085144" version="29" timestamp="2010-03-02T14:12:18Z" uid="125339" user="efred" changeset="4017157">
    <nd ref="2811930"/>
    <nd ref="411907710"/>
    <nd ref="505201"/>
    <nd ref="505203"/>
    <nd ref="335592416"/>
    <nd ref="505208"/>
    <tag k="ref" v="A1"/>
    <tag k="highway" v="motorway"/>
    <tag k="layer" v="1"/>
    <tag k="oneway" v="yes"/>
    <tag k="bridge" v="yes"/>
    <tag k="maxspeed" v="100"/>
    <tag k="int_ref" v="E 23;E 25;E 62"/>
    <tag k="lanes" v="3"/>
    <tag k="toll" v="yes"/>
  </way>
  <way id="4085145" version="26" timestamp="2011-01-30T07:56:00Z" uid="103273" user="HB9DTX"
changeset="7130771">
    <nd ref="21692864"/>
    <nd ref="21692865"/>
    <nd ref="21692866"/>
    <tag k="lit" v="no"/>
    <tag k="ref" v="A1;A9"/>
    <tag k="highway" v="motorway"/>
    <tag k="oneway" v="yes"/>
    <tag k="maxspeed" v="120"/>
    <tag k="int_ref" v="E 23;E 25"/>
    <tag k="toll" v="yes"/>
  </way>
  <way id="4085148" version="36" timestamp="2010-03-02T14:12:09Z" uid="125339" user="efred" changeset="4017157">
    <nd ref="20934866"/>
    <nd ref="314989998"/>
    <nd ref="313288230"/>
    <nd ref="2661185"/>
```

```
$ osm2pgrouting -file ./file.osm
-conf ./mapconfig.xml
-dbname ma_base
-user user
-passwd user
-clean
```



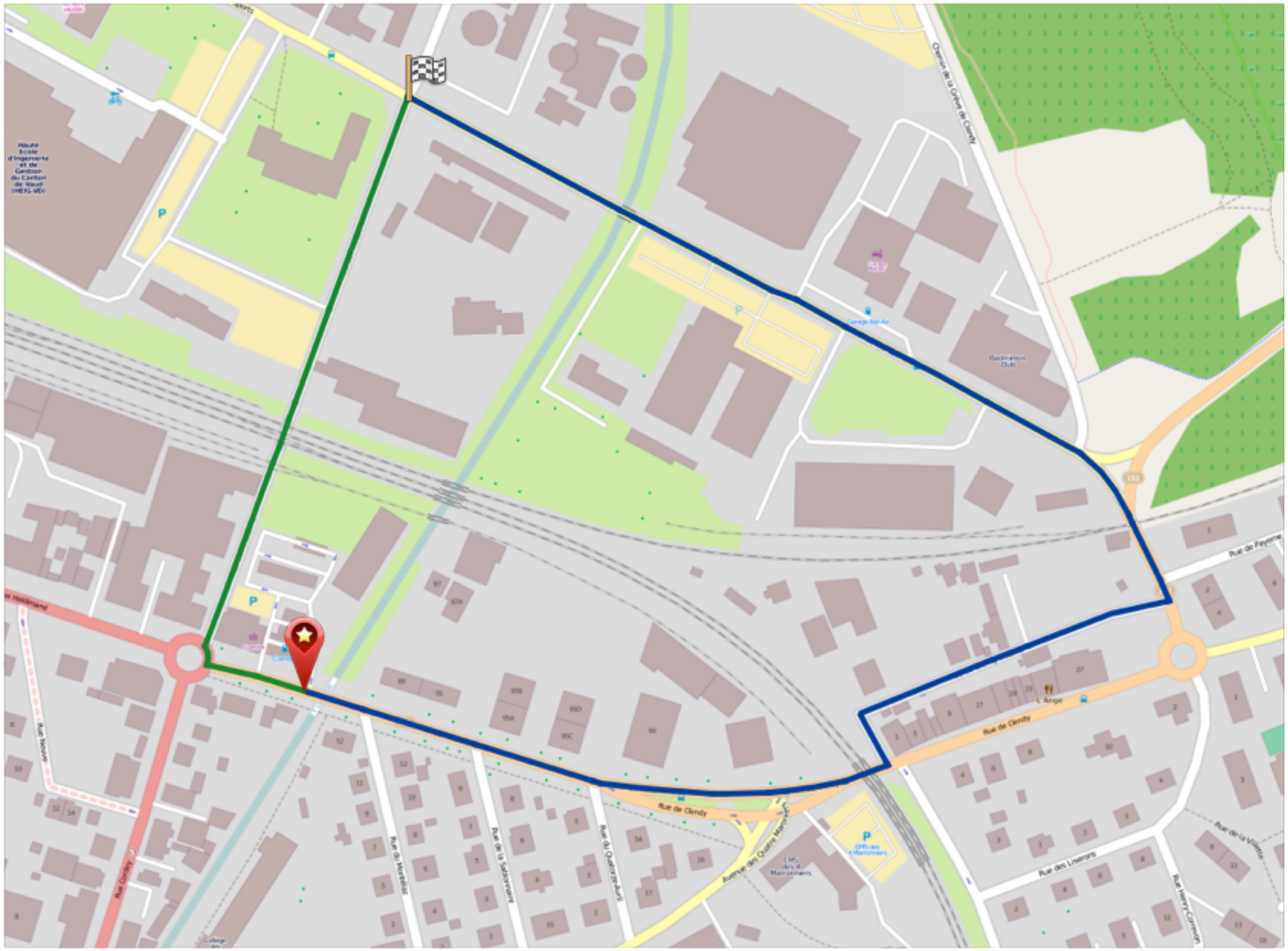


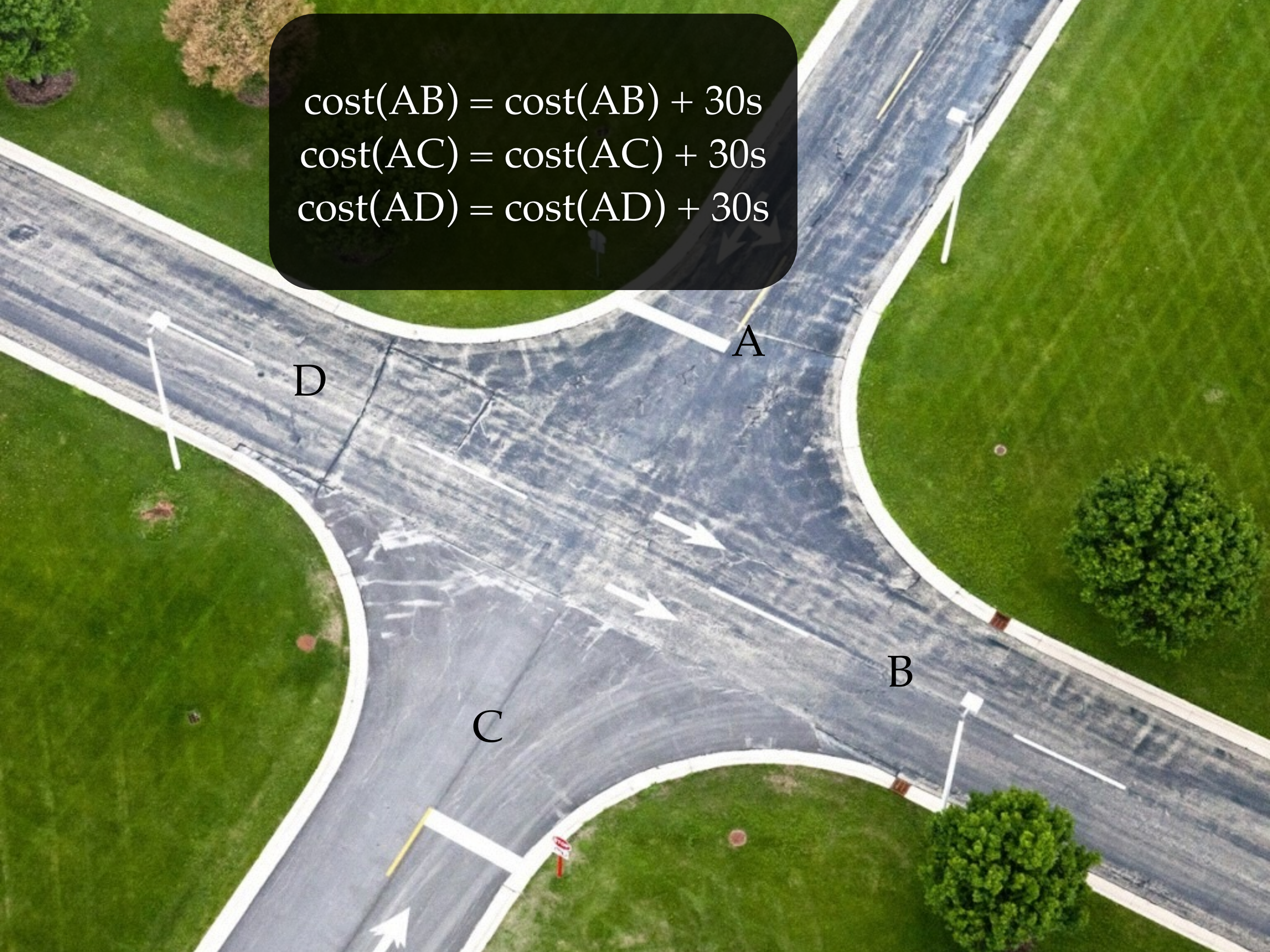

source
target
target
gid,
source,
target,
the_geom
x1,y1,
x2,y2,
to_cost, reverse_cost,
maxspeed_forward,
maxspeed_backward,
length,
etc…
Rue du Vallon
Place du Nord
La Bossette
Rue de l'Industrie
Harper's Pub
Hôtel de police
Café des Amis
Château Saint-Maire
Le Château


cost(A)=length(A)/2
reverse_cost(A)=length(A)*2
cost(B)=length(B)*3
reverse_cost(B)=length(B)/3
B
A

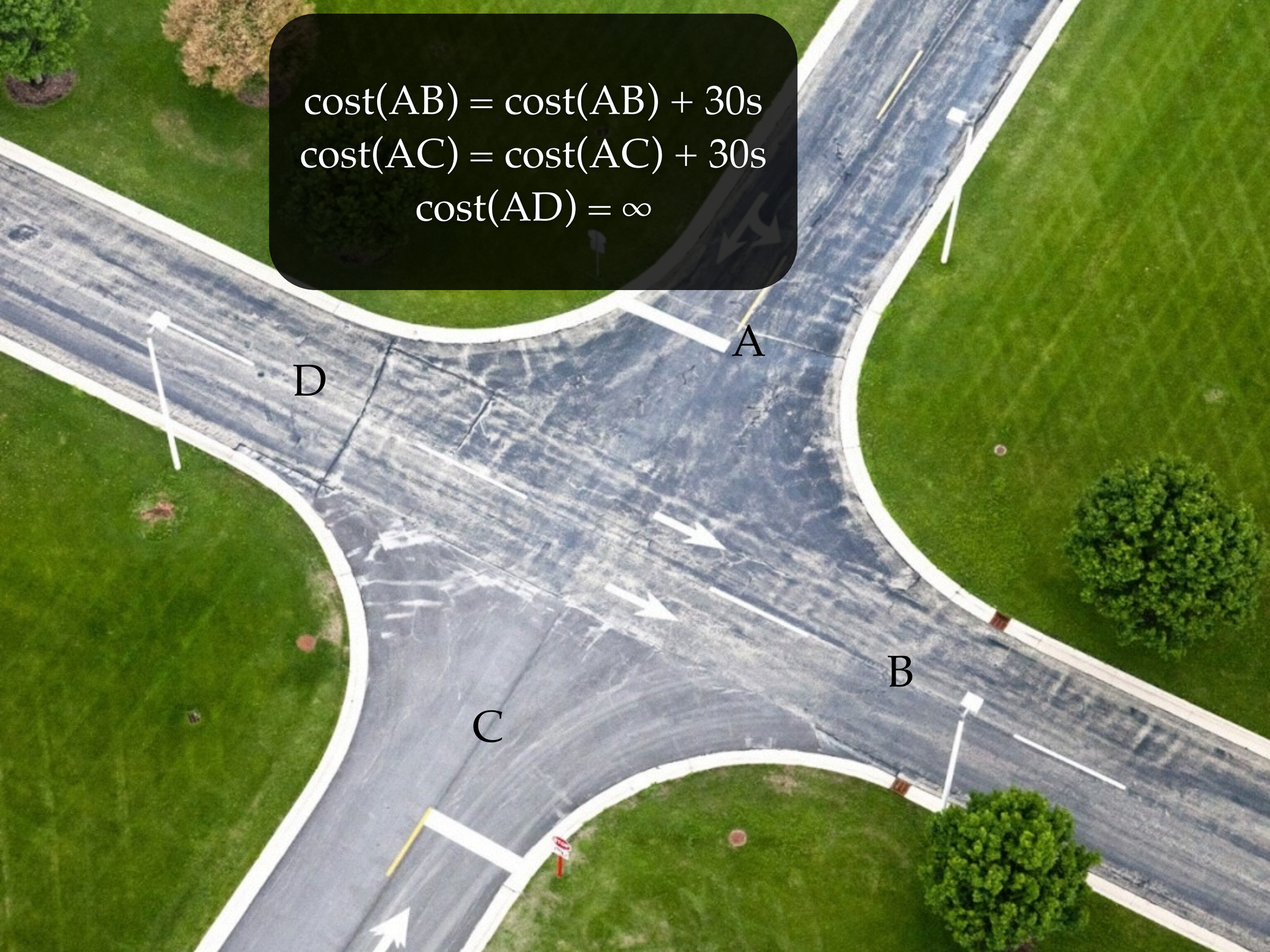

ONE WAY


cost(A)=length(A)
reverse_cost(A)=∞
A

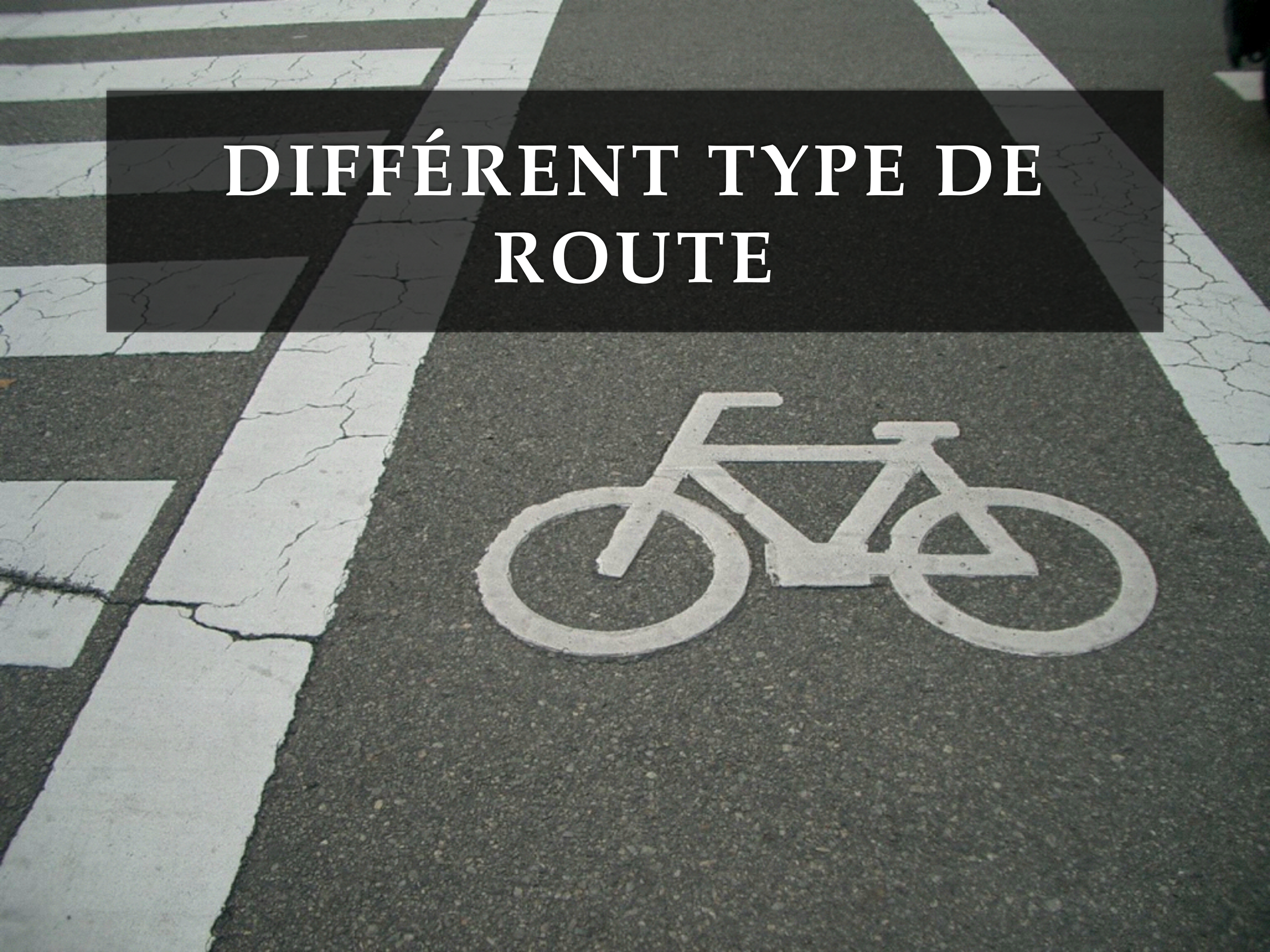

Rue de Clendy
Rue de Payerne
Rue des Liserons
Rue Henry Cornaz
Rue de la Villette
Rue de la Sablonnaire
Rue du Quatre-Août
Avenue des Quatre Marronniers
Rue Moyne
Rue de Montolieu
L'Ange


cost(AB) = cost(AB) + 30s
cost(AC) = cost(AC) + 30s
cost(AD) = cost(AD) + 30s
A
B
C
D


NO LEFT
TURN



$$\text{cost}(AB) = \text{cost}(AB) + 30s$$
$$\text{cost}(AC) = \text{cost}(AC) + 30s$$
$$\text{cost}(AD) = \infty$$



DIFFÉRENT TYPE DE ROUTE

LES COÛTS SONT DYNAMIQUES!

UN CHANGEMENT SUR LE RÉSEAU?


```
UPDATE WAYS
SET
COST = 999999,
REVERSE_COST = 999999
WHERE ID=1
```

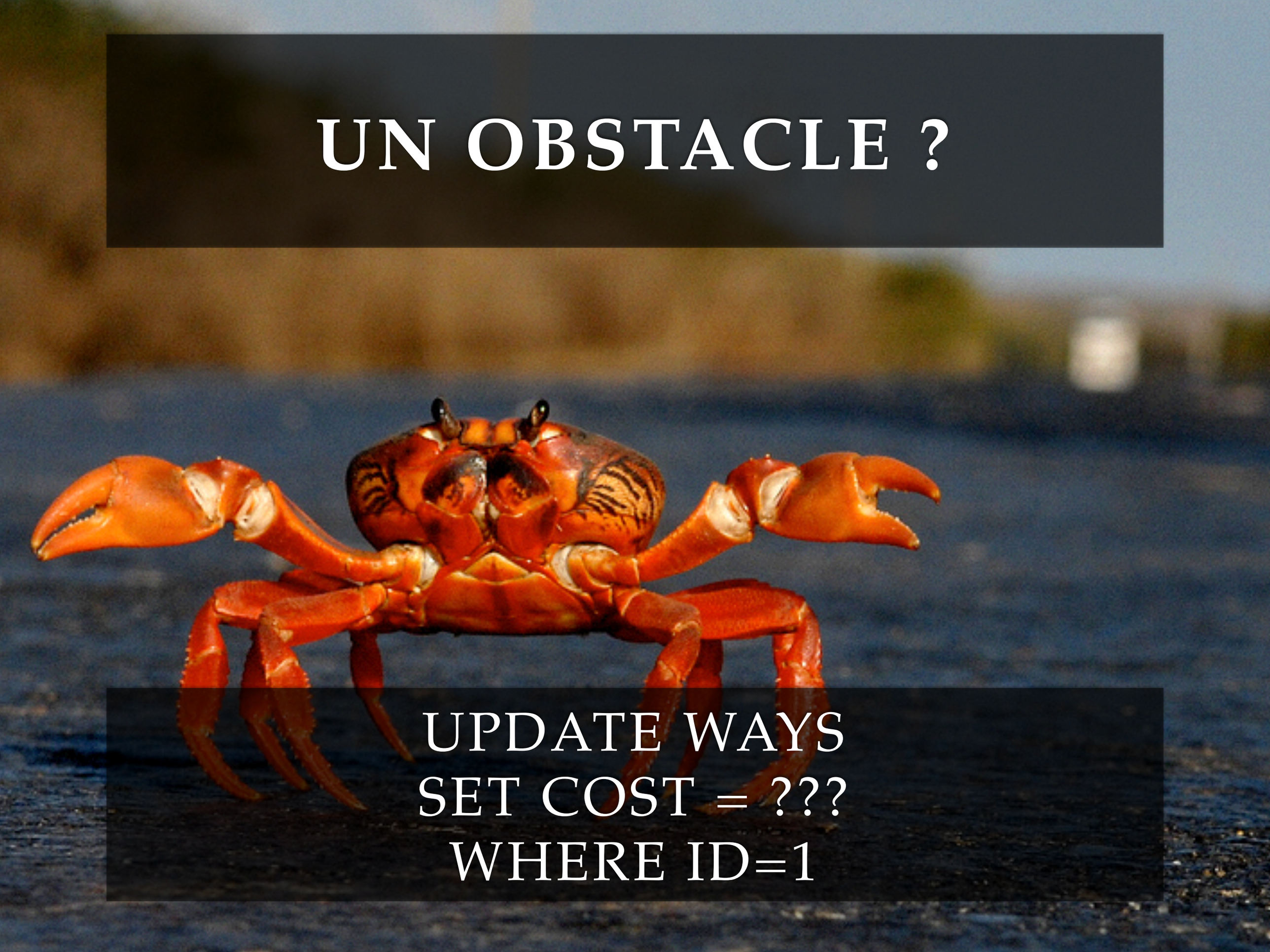
UN CHANGEMENT SUR LE RÉSEAU?

UPDATE WAYS
SET REVERSE_COST = 999999
WHERE ID=1

MAUVAISES CONDITIONS?

```
UPDATE WAYS
SET
COST = 3*COST,
REVERSE_COST = 6*REVERSE_COST
WHERE ID=1
```

UN OBSTACLE ?



UPDATE WAYS
SET COST = ???
WHERE ID=1

LE COÛT SERA PRIS EN COMPTE LORS DU PROCHAIN CALCUL

LE COÛT N'A PAS D'UNITÉ

UPDATE WAYS
SET
to_cost = length,
reverse_cost = length

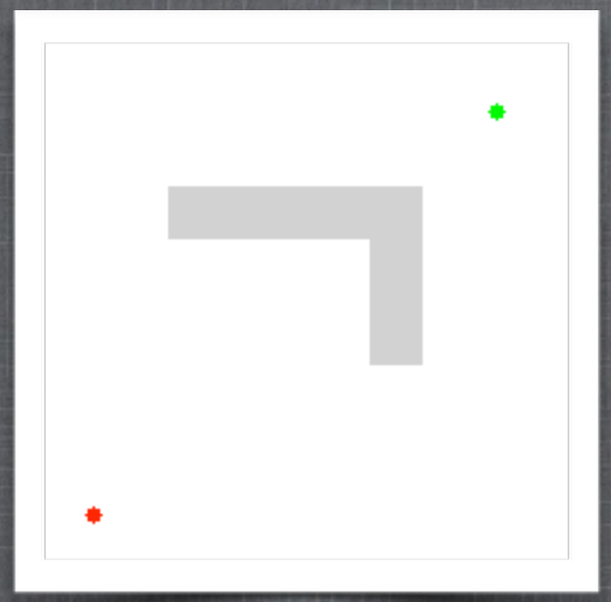
UPDATE WAYS
SET
to_cost = length / maxspeed_forward,
reverse_cost = length / maxspeed_backward

IL EST DONC POSSIBLE DE

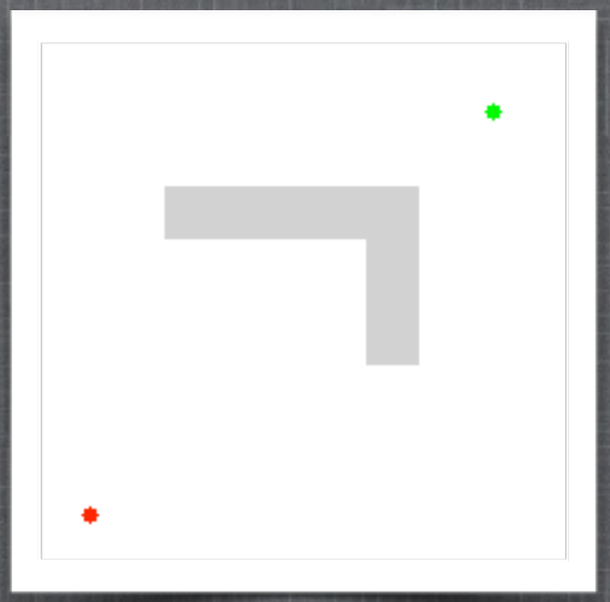
CRÉER DES RÉSEAUX POUR N'IMPORTE QUEL BESOIN

DEUX ALGORITHMES DIFFÉRENTS

Dijkstra



A*



DES QUESTIONS ?

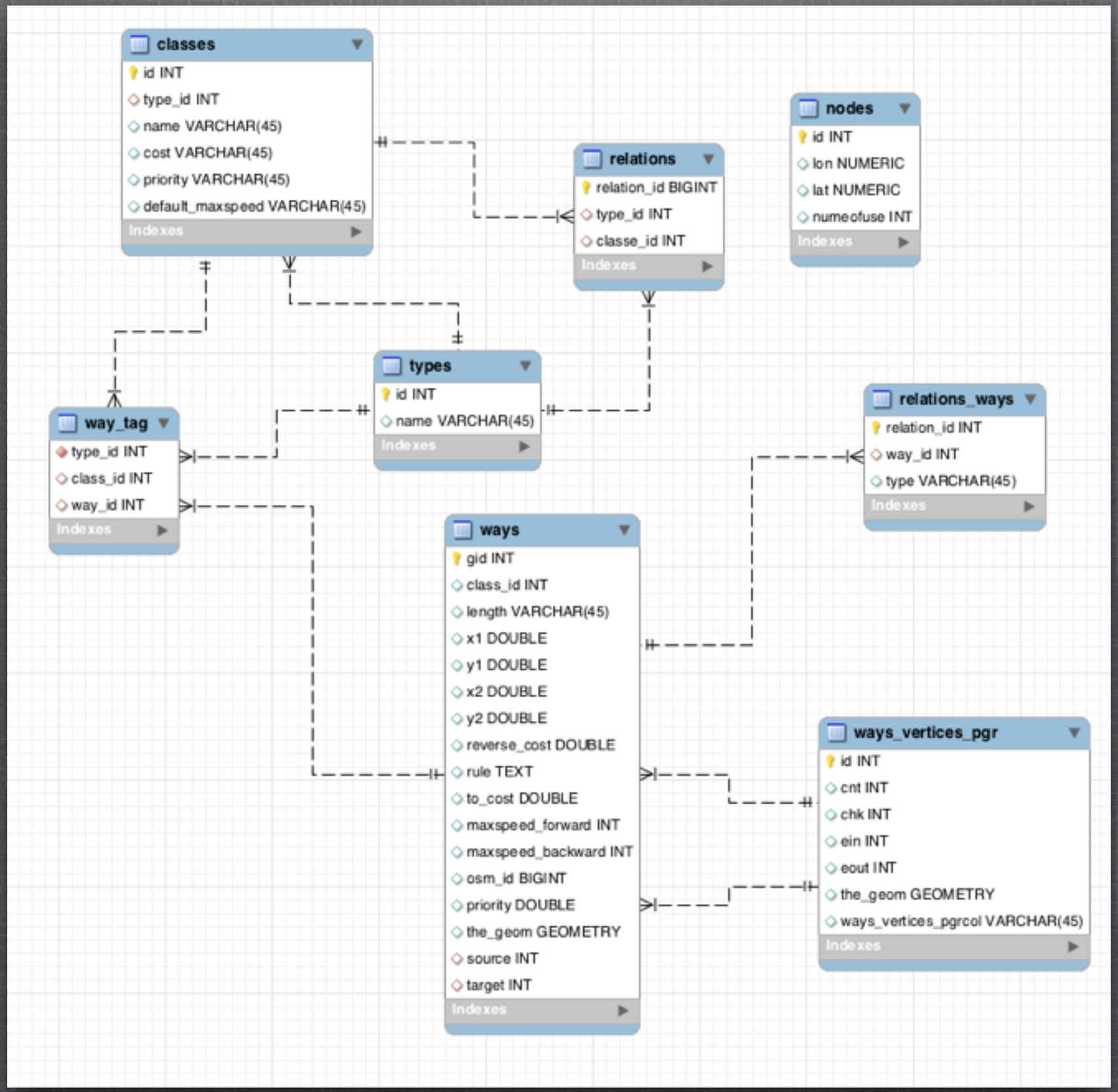
ET EN PRATIQUE ?

UN RÉSEAU ?

- http://wiki.openstreetmap.org/wiki/Planet.osm propose plusieurs sources
- wget -O lausanne.osm http://overpass.osm.rambler.ru/cgi/xapi_meta?*[bbox=6.6072,46.5041,6.6593,46.5466] pour les petites zones

IMPORT

- Créer une base de données héritant de pgrouting
- Depuis le terminal
- osm2pgrouting -file ./fichier.osm
  -conf ./mapconfig.xml
  -dbname ma_base
  -user user
  -passwd user
  -clean


classes
id INT
type_id INT
name VARCHAR(45)
cost VARCHAR(45)
priority VARCHAR(45)
default_maxspeed VARCHAR(45)
Indexes
relations
relation_id BIGINT
type_id INT
classe_id INT
Indexes
nodes
id INT
lon NUMERIC
lat NUMERIC
numeofuse INT
Indexes
types
id INT
name VARCHAR(45)
Indexes
way_tag
type_id INT
class_id INT
way_id INT
Indexes
relations_ways
relation_id INT
way_id INT
type VARCHAR(45)
Indexes
ways
gid INT
class_id INT
length VARCHAR(45)
x1 DOUBLE
y1 DOUBLE
x2 DOUBLE
y2 DOUBLE
reverse_cost DOUBLE
rule TEXT
to_cost DOUBLE
maxspeed_forward INT
maxspeed_backward INT
osm_id BIGINT
priority DOUBLE
the_geom GEOMETRY
source INT
target INT
Indexes
ways_vertices_pgr
id INT
cnt INT
chk INT
ein INT
eout INT
the_geom GEOMETRY
ways_vertices_pgrcol VARCHAR(45)
Indexes

TROUVER LES NOEUDS DE DÉPART/ DESTINATION

AVANT

```
SELECT gid, source, target, the_geom,
  distance(
    the_geom,
    GeometryFromText('POINT(6.4894234
46.7348077)', 4326)) AS dist
FROM vertices_tmp
WHERE the_geom &&
   setsrid('BOX3D(7.8 46.0, 7.9 46.1)'::box3d,
4326)
ORDER BY dist
LIMIT 1
```

MAINTENANT

```
SELECT id
FROM ways_vertices_pgr
ORDER BY the_geom <-> ST_GeometryFromText('POINT(6.617
46.52)',4326)
LIMIT 1;
```

CHEMIN LE PLUS COURT

- **Création d'un wrapper**
- **http://heig.ch/biritsu**

```
SELECT * FROM pgr_dijkstra('ways',
START_NODE,END_NODE);

SELECT st_astext(ST_MakeLine(route.geom)) FROM (
  SELECT * FROM pgr_dijkstra('ways', START_NODE,
END_NODE)
) as route;
```

COMMERÇANT ITINÉRANT

```sql
SELECT *
FROM pgr_tsp(
  'SELECT id::integer, st_x(the_geom) as x,st_x(the_geom) as y
  FROM ways_vertices_pgr
  WHERE id IN (2941, 145, 7595, 77, 420, 2341, 96, 1095)
  ',
  1095, -- Noeud de départ
  7595 -- Noeud d'arrivée
);
```

ISODISTANCE ?

```
SELECT ST_ConcaveHull(st_union(the_geom), 0.95)
FROM (
  SELECT ways_vertices_pgr.the_geom
    FROM pgr_drivingDistance(
      'SELECT gid as id, source, target, st_astext(the_geom), ST_Length(the_geom::geography)
as cost FROM ways',
      START_NODE,
      COST,
      false,
      false)
    INNER JOIN ways on (ways.gid = id2)
    INNER JOIN ways_vertices_pgr on (ways_vertices_pgr.id = ways.source)
) as t
```

ISOCHRONE ?

```
SELECT ST_ConcaveHull(st_union(the_geom), 0.95)
FROM (
  SELECT ways_vertices_pgr.the_geom
    FROM pgr_drivingDistance(
      'SELECT gid as id, source, target, st_astext(the_geom), ST_Length(the_geom::geography)
/ maxspeed_forward as cost FROM ways',
      START_NODE,
      COST,
      false,
      false)
    INNER JOIN ways on (ways.gid = id2)
    INNER JOIN ways_vertices_pgr on (ways_vertices_pgr.id = ways.source)
) as t
```