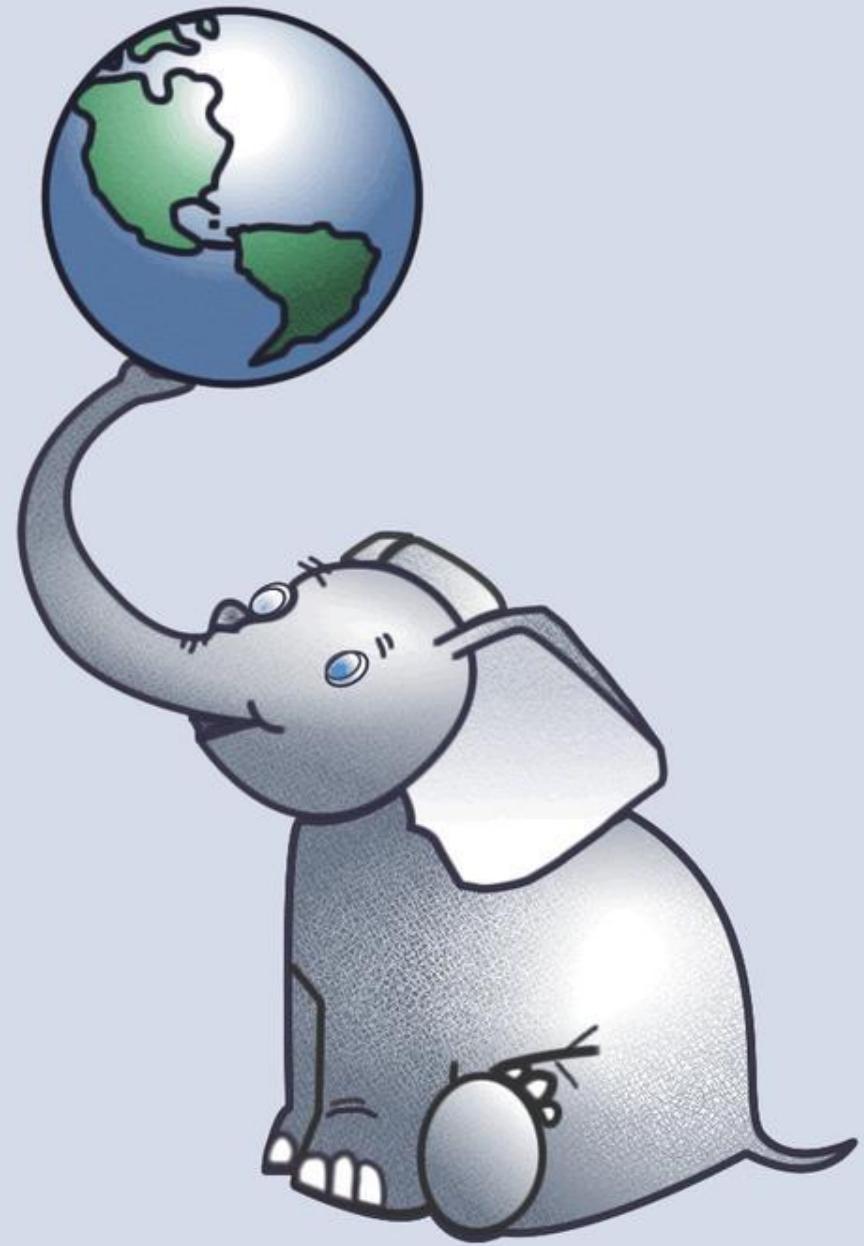
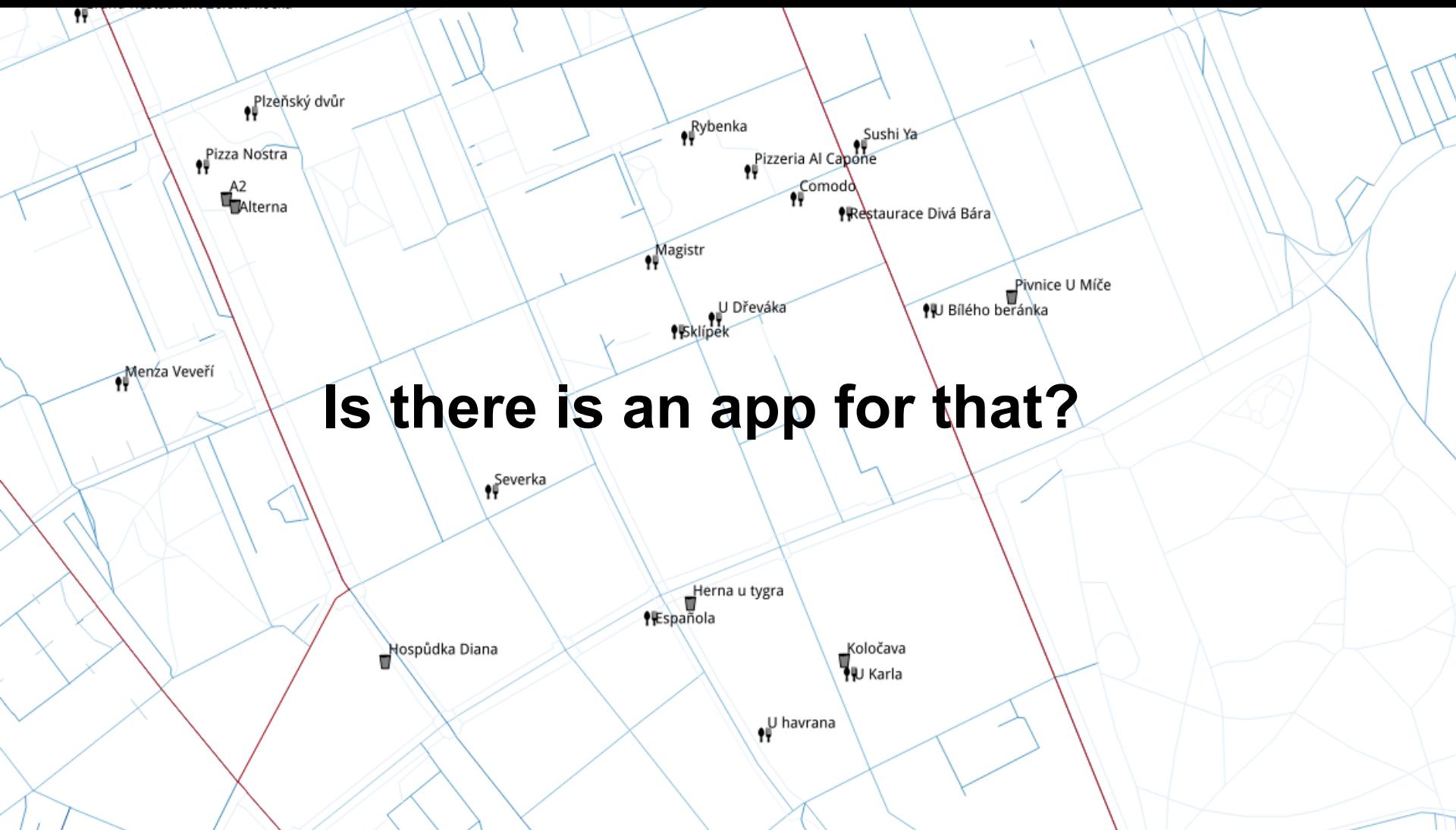


PostGIS

Věroš Kaplan
<http://www.na-mytince.cz/>
@verosk



The nearest pub problem



Solution?

```
SELECT * FROM pubs  
ORDER BY  
    distance(position, me)  
DESC  
LIMIT 3;
```

PostgreSQL - geometric types

<http://www.postgresql.org/docs/9.3/static/datatype-geometric.html>

8.8. Geometric Types

Geometric data types represent two-dimensional spatial objects. [Table 8-20](#) shows the geometric types available in PostgreSQL.

Table 8-20. Geometric Types

| Name | Storage Size | Representation | Description |
|---------|--------------|---------------------------------------|-------------------------------------|
| point | 16 bytes | Point on a plane | (x,y) |
| line | 32 bytes | Infinite line (not fully implemented) | ((x1,y1),(x2,y2)) |
| lseg | 32 bytes | Finite line segment | ((x1,y1),(x2,y2)) |
| box | 32 bytes | Rectangular box | ((x1,y1),(x2,y2)) |
| path | 16+16n bytes | Closed path (similar to polygon) | ((x1,y1),...) |
| path | 16+16n bytes | Open path | [(x1,y1),...] |
| polygon | 40+16n bytes | Polygon (similar to closed path) | ((x1,y1),...) |
| circle | 24 bytes | Circle | <(x,y),r> (center point and radius) |

PostgreSQL - geometric types

This is Big fat red warning ™

Never ever use it!

```
distance = sqrt(  
    sqr (x1 - x2) + sqr (y2-y1)  
)
```

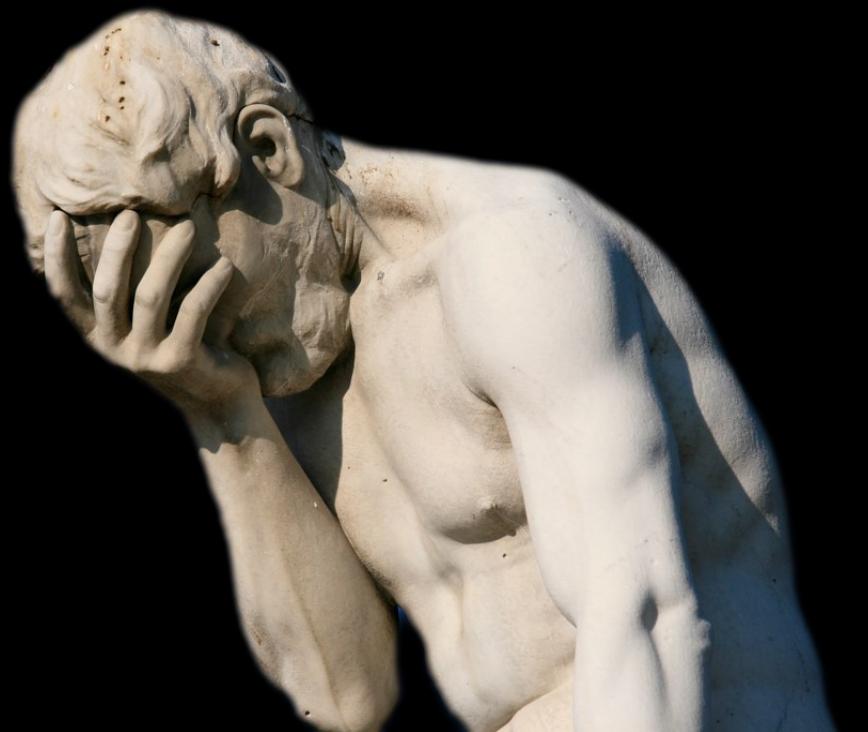
Exercise:

from fi.muni.cz to Koločava

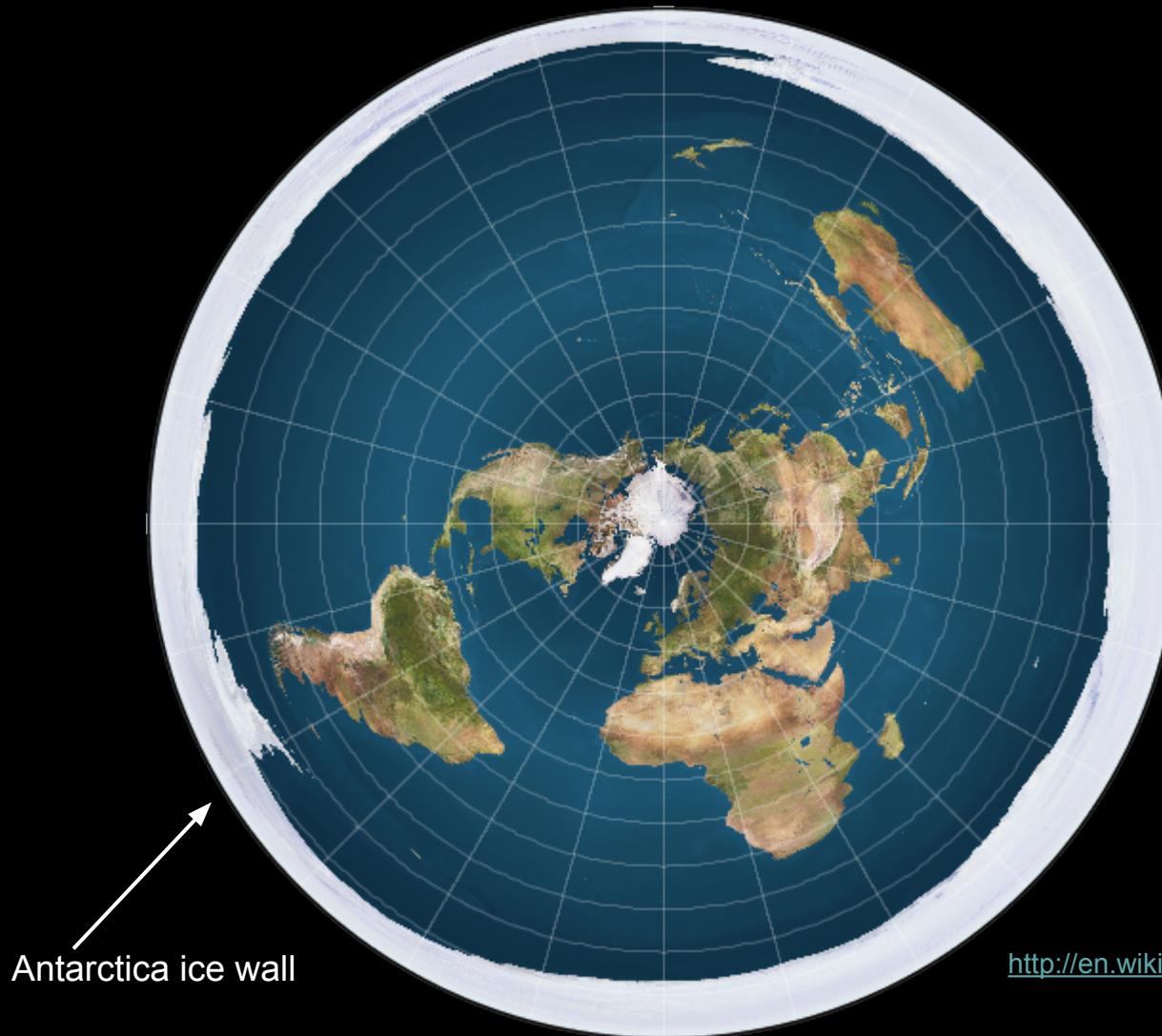
49.209983, 16.598916

49.206005, 16.602622

0.0054368 m



The Earth is not flat



http://en.wikipedia.org/wiki/Flat_Earth



Koločava

On GPSr: N49.206005, E16.602622

WGS 84: 49.206005, 16.602622

UTM 33N: 4342944. ..., 2194865. ...

S-JTSK (Křovák):

2881078. ..., -4546417. ...

PostGIS

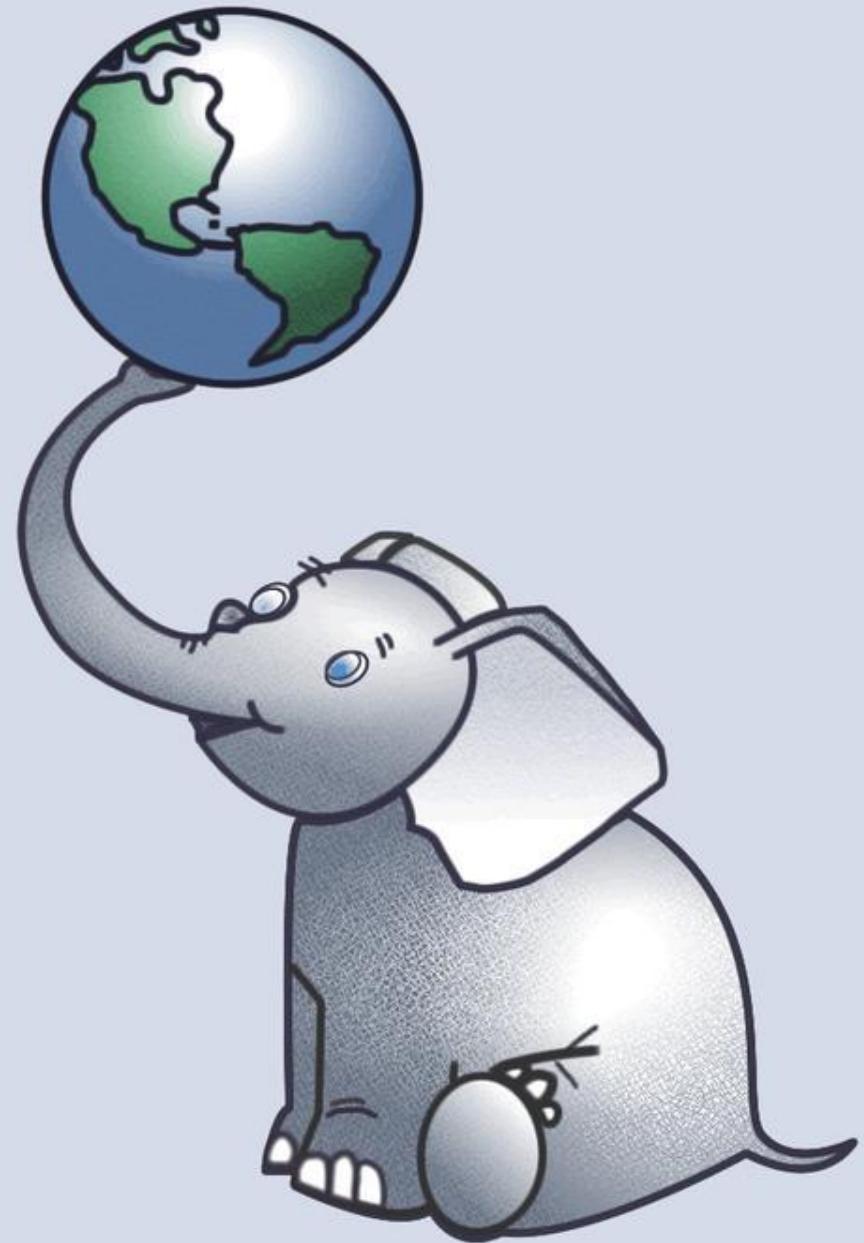
<http://www.postgis.net/>

Refractions Research

<http://postgis.refractions.net/>

OS Geo

<http://www.osgeo.org/>



Install PostGIS

- from (source || package)
 - build binary extension
 - need PROJ, GEOS
- \$... make & magic ...

Enable PostGIS on database

- add geometry functions to database

```
$ psql -f .../postgis.sql
```

- load spatial reference systems list

```
$ psql -f .../spatial_ref_sys.sql
```

Check PostGIS version

```
veros=# SELECT postgis_full_version();
```

```
postgis_full_version
```

```
-----
```

```
POSTGIS="1.5.3" GEOS="3.2.2-CAPI-1.6.2" PROJ="Rel. 4.7.1, 23 September 2009" LIBXML="2.7.8"  
USE_STATS
```

Enable Postgis on database

```
veros=# \dt
              List of relations
 Schema |      Name      | Type | Owner
-----+-----+-----+-----
public | geometry_columns | table | veros
public | spatial_ref_sys | table | veros
```

Enable Postgis on database

```
veros=# \dT
          List of data types
 Schema |      Name       | Description
-----+-----+-----
public | box2d        |
public | box3d        |
public | box3d_extent |
public | chip         |
public | geography    |
public | geometry     |
public | geometry_dump|
public | gidx         |
public | pgis_abs     |
public | spheroid     |
(10 rows)
```

```
CREATE TABLE pubs(  
    id INTEGER PRIMARY KEY,  
    name VARCHAR NOT NULL);  
  
-- add geometry column  
SELECT AddGeometryColumn  
    ('pubs','location',4326,'POINT',2);
```

```
veros=# \d pubs;
```

Table "public.pubs"

| Column | Type | Modifiers |
|----------|-------------------|-----------|
| id | integer | not null |
| name | character varying | not null |
| location | geometry | |

Indexes:

```
"pubs_pkey" PRIMARY KEY, btree (id)
```

Check constraints:

```
"enforce_dims_location" CHECK (st_ndims(location) = 2)
"enforce_geotype_location" CHECK (geometrytype(location) = 'POINT'::text OR
location IS NULL)
"enforce_srid_location" CHECK (st_srid(location) = 4326)
```

```
INSERT INTO pubs (id, location, name)
VALUES (1,
st_GeomFromText(
'POINT(49.206005 16.602622)', 4326),
'Koločava');
```

```
INSERT INTO pubs (id, location, name)
VALUES (1,
st_GeomFromText(
'POINT(49.206005 16.602622)', 4326),
'Koločava');
```

Well Known Text

```
INSERT INTO pubs (id, location, name)
VALUES (1,
st_GeomFromText(
'POINT(49.206005 16.602622)', 4326),
'Koločava');
```

4.1.1. OpenGIS WKB and WKT

The OpenGIS specification defines two standard ways of expressing spatial objects: the Well-Known Text (WKT) and the coordinates which form the object.

Examples of the text representations (WKT) of the spatial objects of the features are as follows:

- POINT(0 0)
- LINESTRING(0 0,1 1,1 2)
- POLYGON((0 0,4 0,4 4,0 4,0 0),(1 1,2 1,2 2,1 2,1 1))
- MULTIPOINT(0 0,1 2)
- MULTILINESTRING((0 0,1 1,2),(2 3,3 2,5 4))
- MULTIPOLYGON(((0 0,4 0,4 4,0 4,0 0),(1 1,2 1,2 2,1 2,1 1)), ((-1 -1,-1 -2,-2 -2,-2 -1,-1 -1)))

```
INSERT INTO pubs (id,location,name)
VALUES (9,
st_SetSRID(
    st_MakePoint(49.209983,16.598916),
    4326),
'FI MUNI');
```

~~WTF~~

WKB

```
veros=# select * from pubs;
```

| id | name | location |
|----|--------------|--|
| 1 | Koločava | 0101000020E6100000FFE7305F5E9A4840A1D9756F459A3040 |
| 2 | Jiná hospoda | 0101000020E6100000FFE7305F5E9A4840A1D9756F459A3140 |

```
veros=# select id,name, ST_AsText(location) from pubs;
```

| id | name | st_astext |
|----|--------------|----------------------------|
| 1 | Koločava | POINT(49.206005 16.602622) |
| 2 | Jiná hospoda | POINT(49.206005 17.602622) |

WKB - accessors

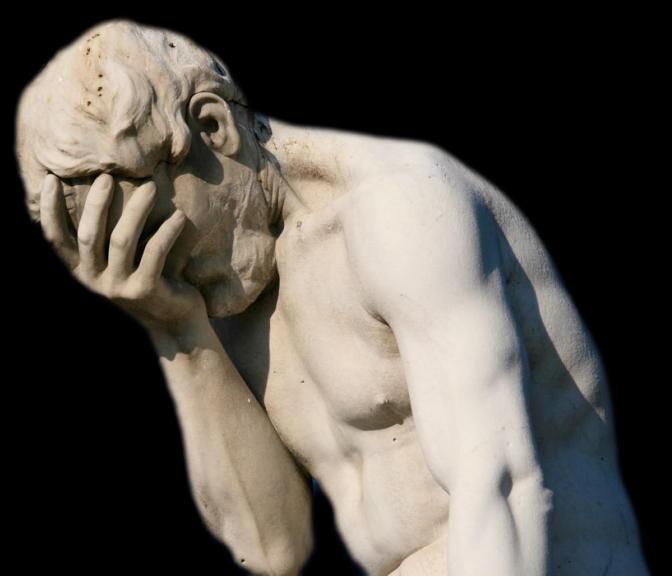
```
veros=# select id,name, ST_X(location),ST_Y(location) from pubs;  
id | name | st_x | st_y  
---+-----+-----+-----  
1 | Koločava | 49.206005 | 16.602622  
5 | Jiná hospoda | 49.206005 | 17.602622
```

Select by distance

```
veros=# select name,  
          st_distance(st_setsrid(st_makepoint(49.209983,16.598916), 4326), location)  
FROM pubs;
```

| id | name | location | st_distance |
|----|----------|---------------------|---------------------|
| 1 | Koločava | 01010000...459A3040 | 0.00543681156561791 |
| 9 | FI MUNI | 01010000...52993040 | 0 |

Starting with version 1.5, PostGIS provides this functionality through the **geography** type.



Select geography by distance

```
veros=# select id, name, geography,  
    st_distance(geography(st_setsrid(st_makepoint(49.209983,16.598916), 4326)),  
    geography(location))  
FROM pubs;
```

| id | name | st_distance |
|----|----------|------------------|
| 1 | Koločava | 590.246928778734 |
| 9 | FI MUNI | 0 |

Geography - the better way

```
CREATE TABLE better_pubs(  
    id serial,  
    name varchar,  
    locations geography  
);
```

...

PostGIS functions

- constructors (Point, MakeEnvelope ...)
- relationship (ClosestPoint, Within, CoveredBy ...)
- accessors (NumRings, GeometryType, ...)
- editors (Make2D, ...)
- processor (Union, Intersect, Buffer, ConvexHull, ...)
- Operators (&&, @ ...)

Visualization

QGIS



QGIS 2.0.1-Dufour – postgis talk

Project Edit View Layer Settings Plugins Vector Raster Database Processing Help

Layers

- railways
 - rail
 - tram
- Pubs
 - pub
 - restaurant
- Schools
 - school
 - university
- roads-brno
- brno-buffer

Coordinate: 616637,5451457 Scale 1:9387 Render EPSG:32633

SpatiaLite

OGC compatible SQLite

