

PostGIS



FELIX KUNDE

slides.com/fxku/postgis

ABOUT ME

Research Assistant @ Beuth University Berlin

Geoinformatics background

Guest lecturer on spatial databases

Core dev for [3DCityDB](#) and [pgMemento](#)

@FlxKu



WHAT IS POSTGIS?



- Extension to [PostgreSQL](#) database
- Comes with it's own datatypes for geodata
- Supports coordinate reference systems
- Spatial indexing for fast geo queries
- You can do all the operations known from a GIS
- Open Source under GPLv2
- More infos under <http://postgis.net/>

WHY IS IT GREAT?

- Faster and more robust than your GIS
- So much geo power with just some SQL
- Great acceptance in the spatial industry
- Follows international OGC/ISO standards
- Build on top of one of the best databases



NoSQL
Streaming SQL



Cloud



POSTGRESQL

FORKS & EXTENSIONS



Time Series
TIMESCALE

TERADATA



DW / MPP
/ Hadoop



Sharding



GPU
PG-STORM





@delawen on PostGIS day

HIDDEN HEROES

GEOS
PROJ

Geometry
Engine
Open
Source

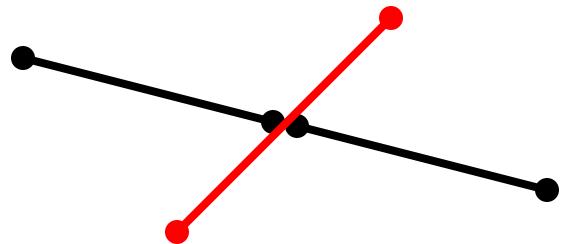


GDAL
GDAL - Geospatial Data
Abstraction Library

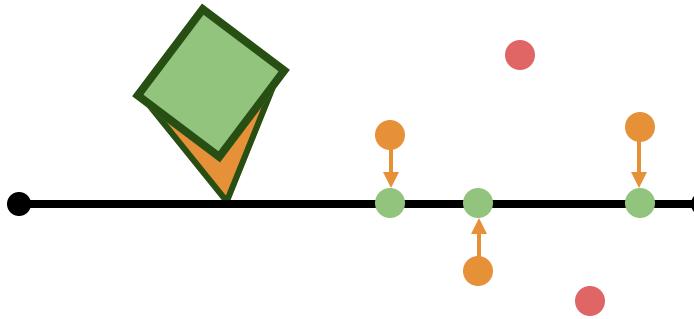
SF CGAL

VECTOR SUPPORT

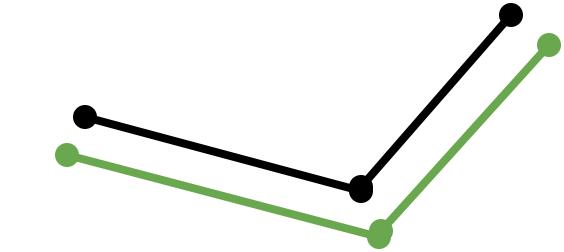
- Simple Features, Arcs
- Geometry vs. Geography
- Z- und M-Values
- Linear Referencing
- Topological Filter (Spatial Joins)
- K Nearest Neighbour searches
- Easy grouping and unnesting



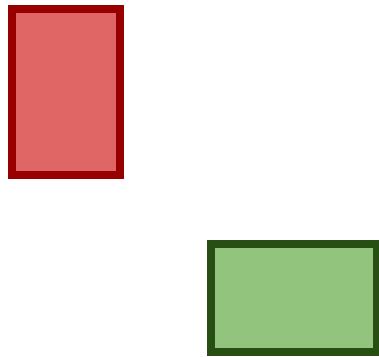
`ST_Split`



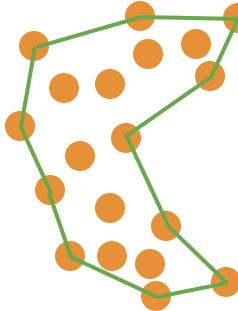
`ST_Snap`



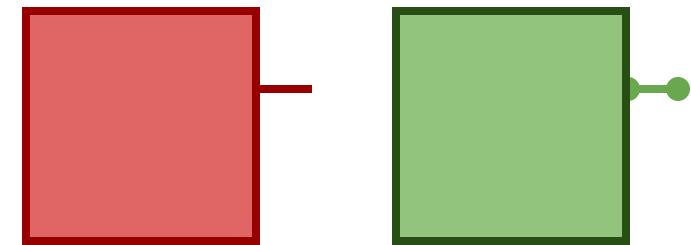
`ST_OffsetCurve`



`ST_FlipCoordinates`



`ST_ConcavHull`



`ST_MakeValid`



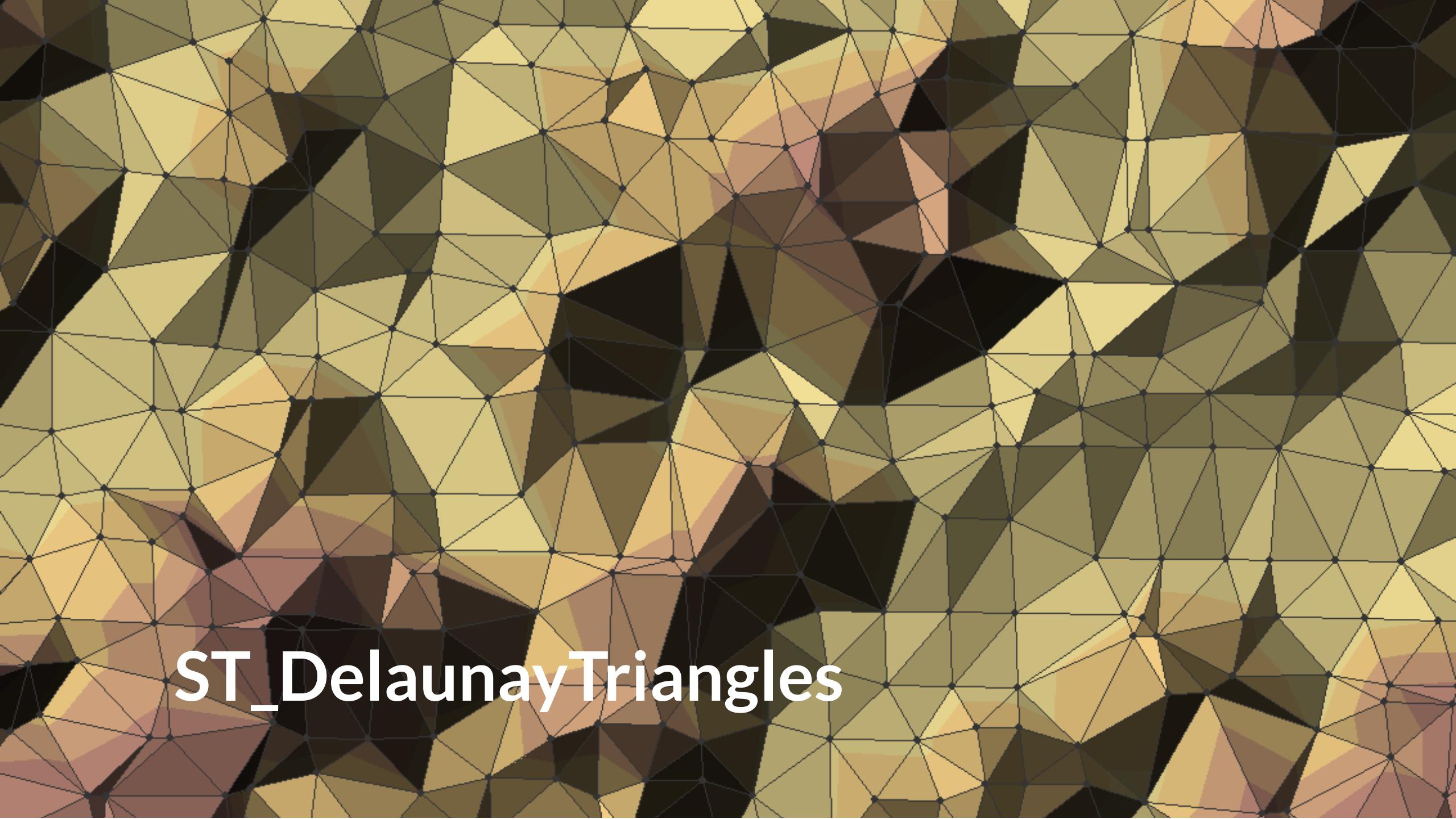
ST_Subdivide

(ST_Segmentize for lines)



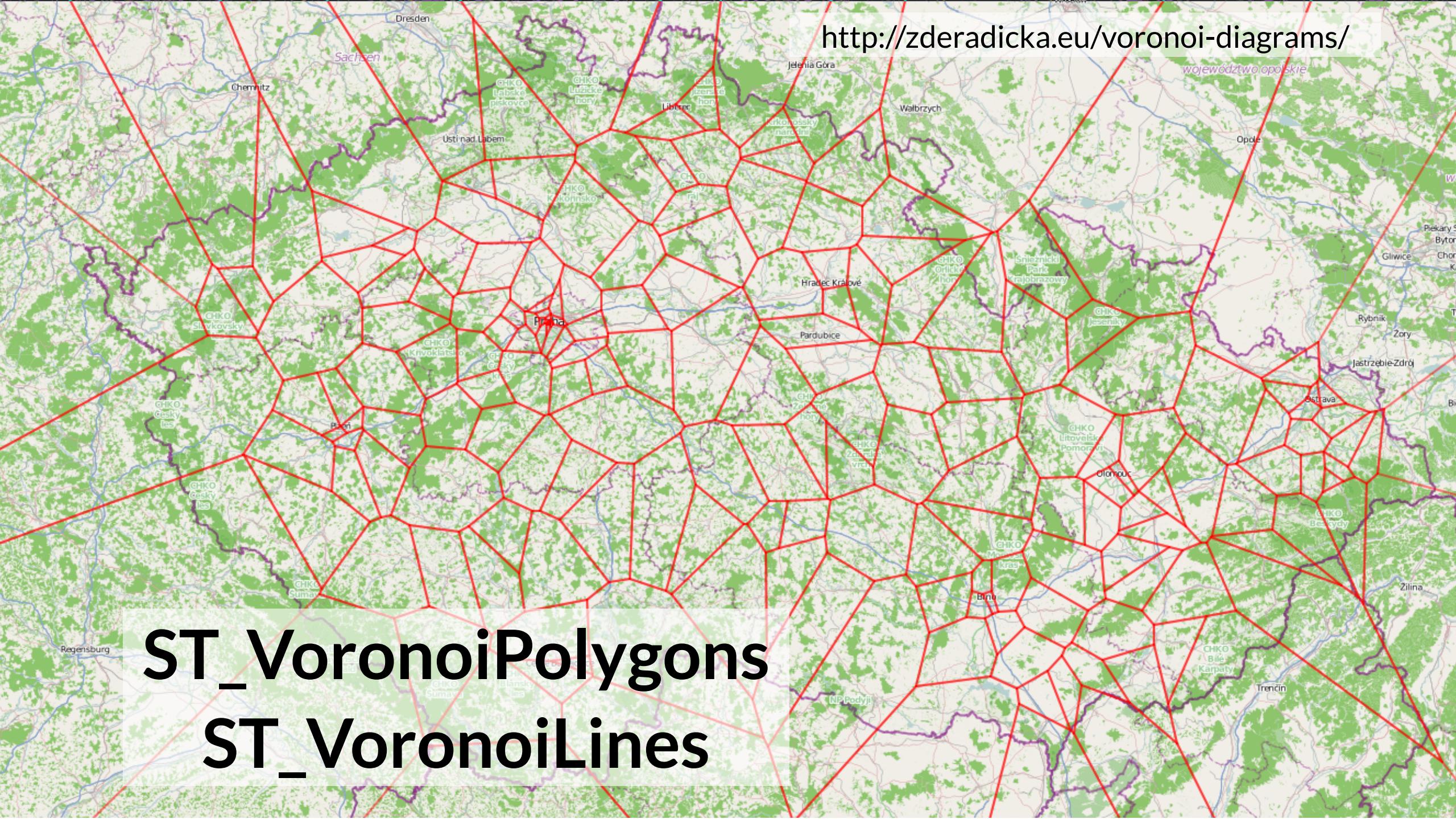
ST_Subdivide

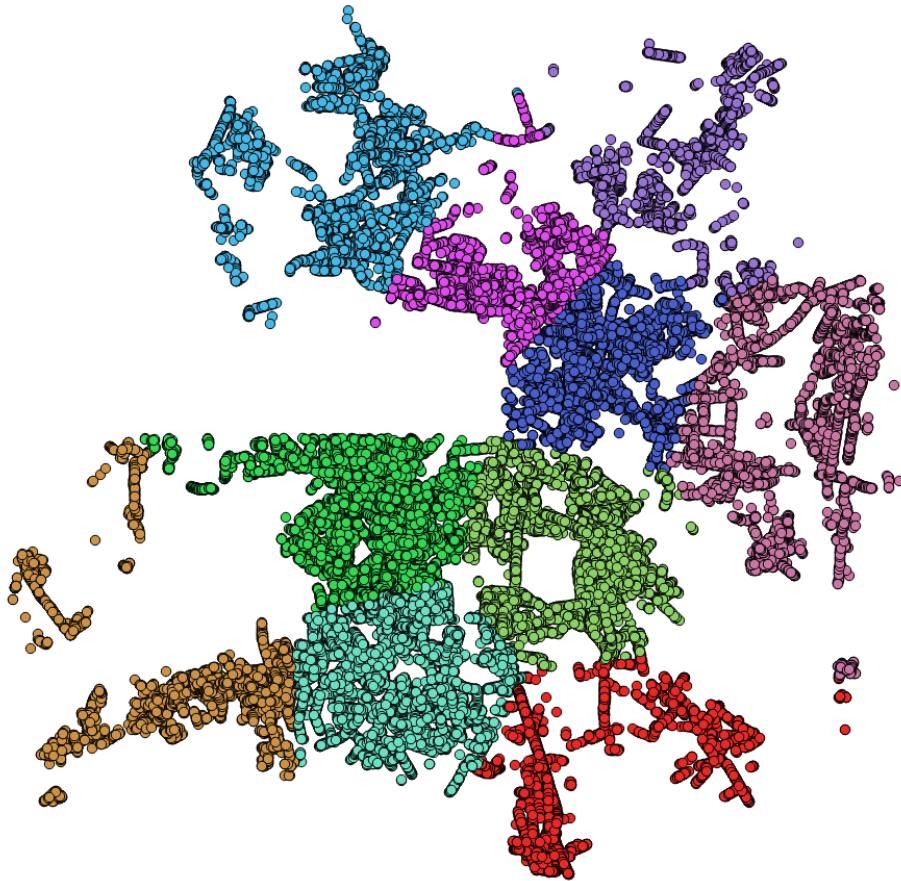
(ST_Segmentize for lines)

The background of the image features a complex Delaunay triangulation pattern. The triangles are filled with various shades of brown, tan, and beige, creating a textured, organic appearance. The pattern is composed of numerous small triangles, some of which are shaded darker than others, giving them a three-dimensional effect. The overall composition is a dense, repeating geometric texture.

ST_DelaunayTriangles

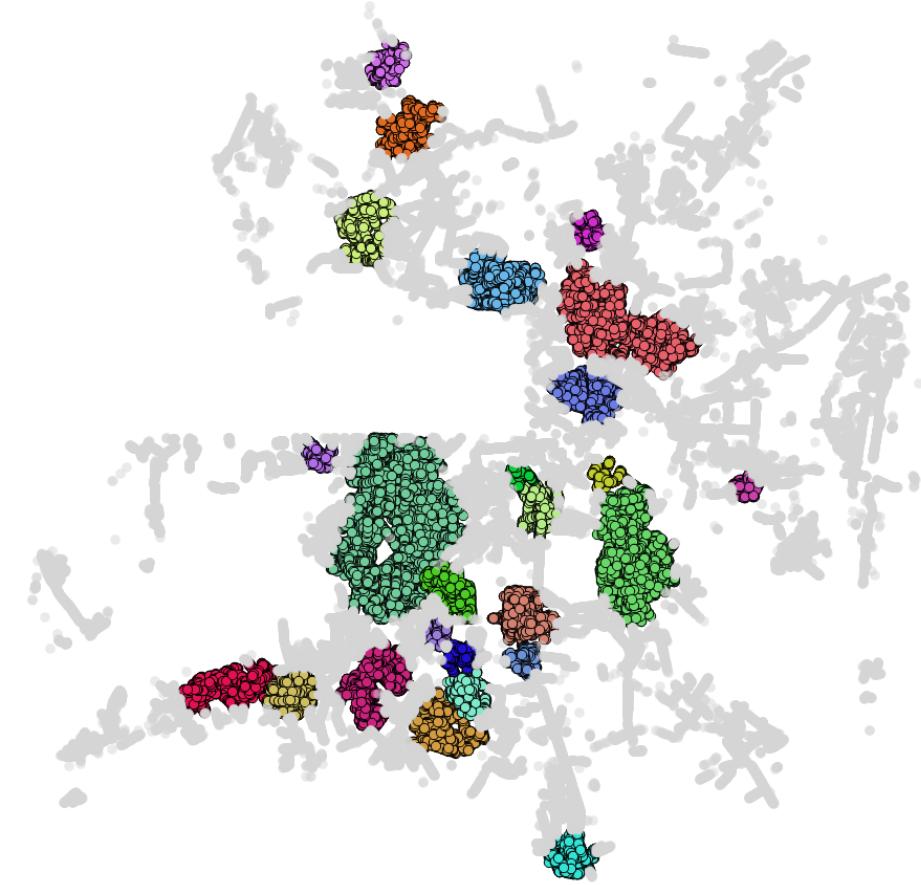
ST_VoronoiPolygons ST_VoronoiLines





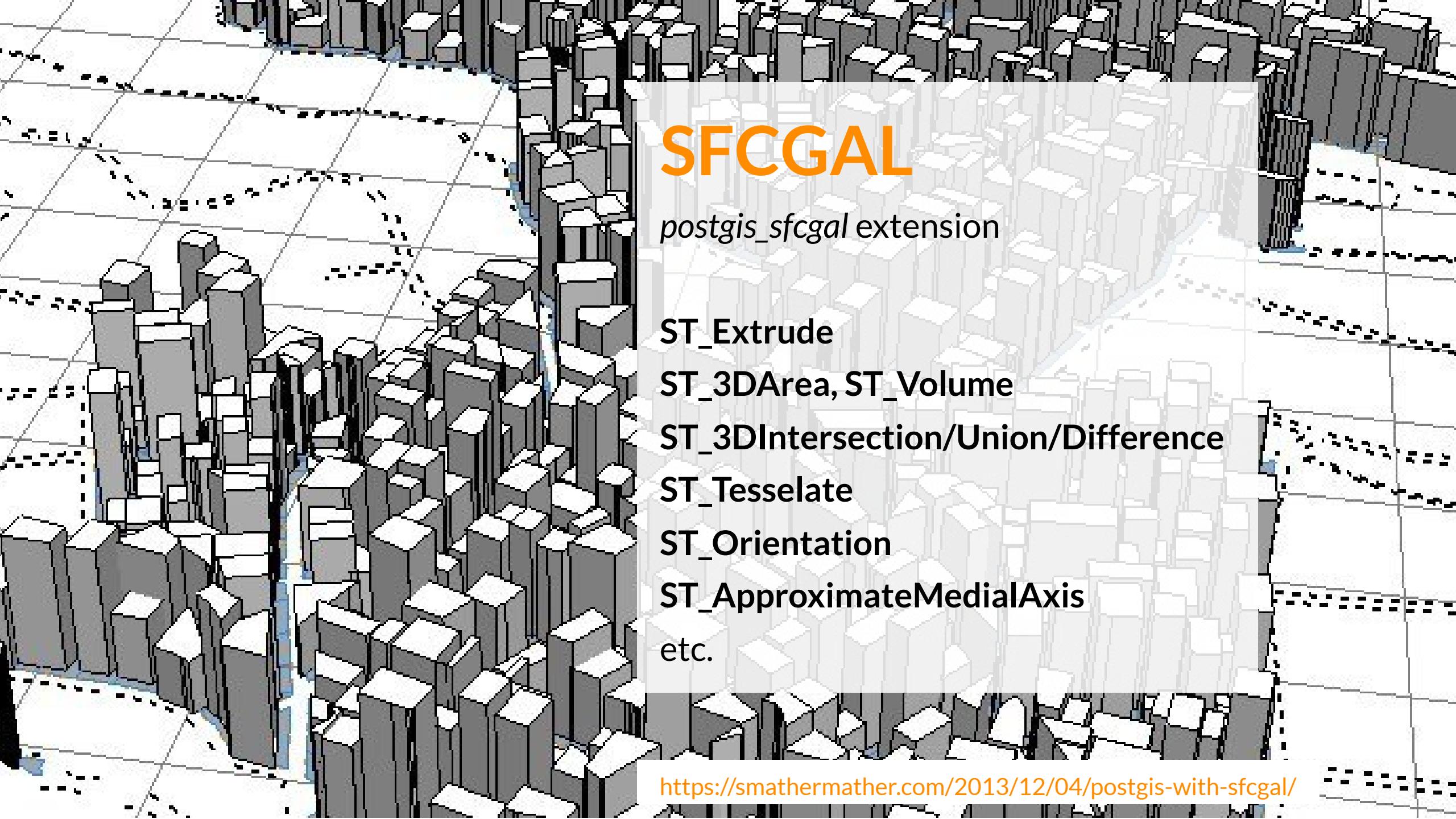
ST_ClusterKMeans

(simple, fast)



ST_ClusterDBSCAN

(more realistic, but harder)



SFCGAL

postgis_sfcgal extension

ST_Extrude

ST_3DArea, ST_Volume

ST_3DIntersection/Union/Difference

ST_Tesselate

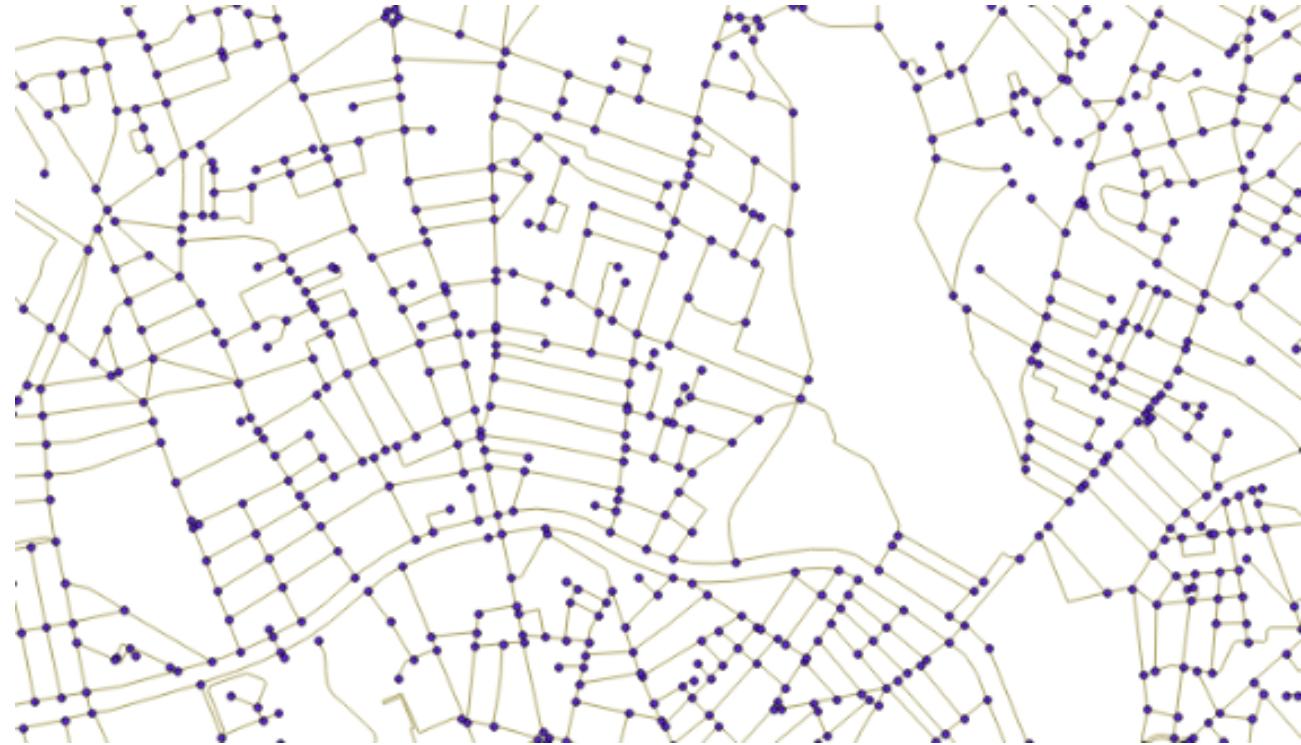
ST_Orientation

ST_ApproximateMedialAxis

etc.

TOPOLOGY & ROUTING

- Model of nodes, edges and faces
- Support editing, simplification etc.
- Output to GML and TopoJSON
- *postgis_topology* extension
- pgRouting project
 - Dijkstra, A*, Shooting Star
 - Driving Distance, TSP

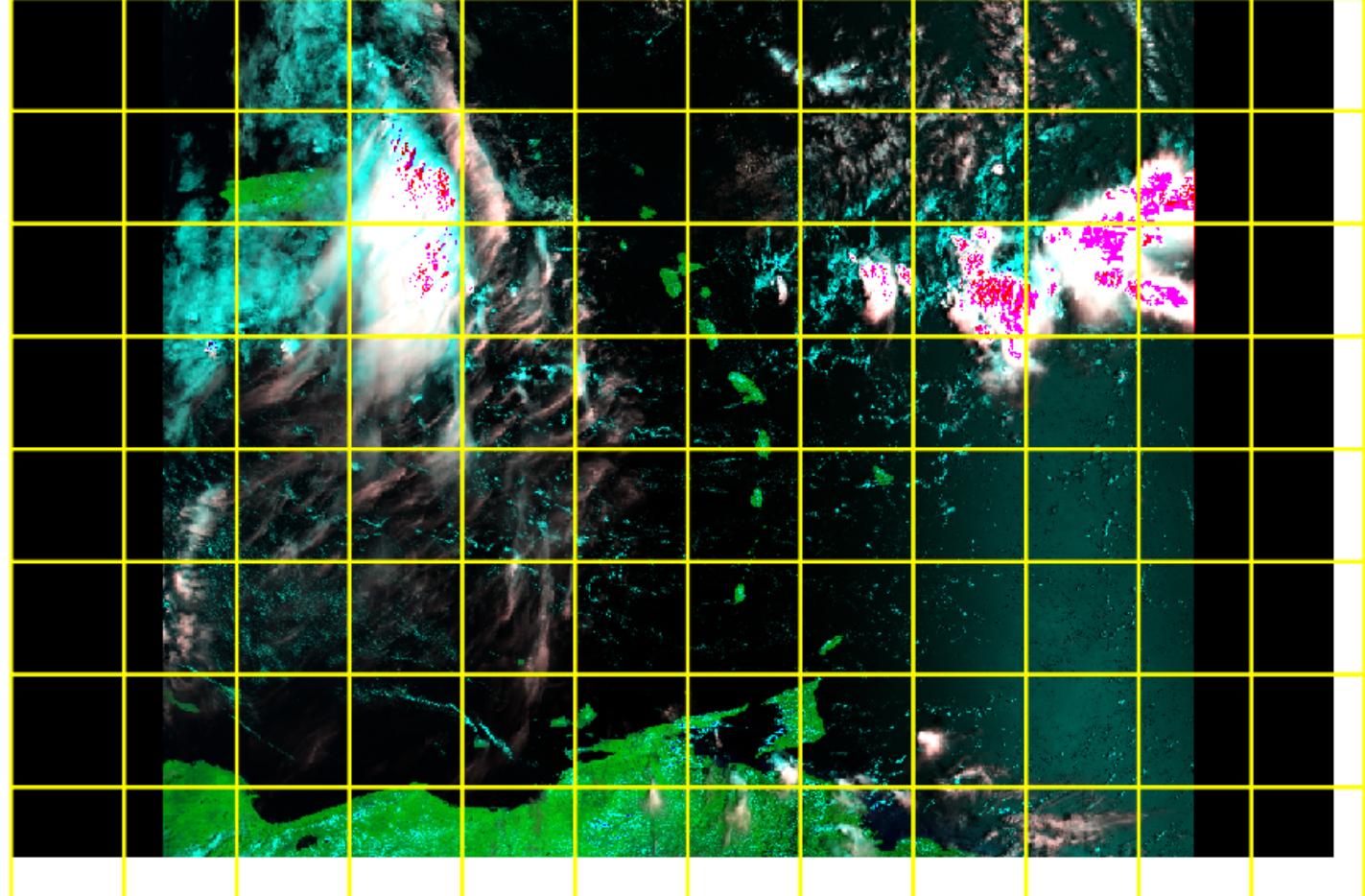


<http://blog.mathieu-leplatre.info/use-postgis-topologies-to-clean-up-road-networks.html>



RASTER SUPPORT

- Im- and export via GDAL
- *in-db* vs. *out-db* storage
- Tiling, Union, Rescaling etc.
- Terrain analysis functions
- Joins between rasters and vector geometry
- Convert to vector



WEB MAPPING

ST_AsMVTGeom (for geometry)

ST_AsMVT (MVTGeom + attributes)

ST_AsGeoBuff (lossless, meant for exchange)

ST_AsGeoJSON, ST_AsKML, ST_AsX3D

ST_Simplify, ST_RemoveRepeatedPoints

@__phiphou__ (https://twitter.com/_phiphou_/status/878599027473952769)

<https://carto.com/blog/inside/MVT-mapnik-vs-postgis/>

Compress Geometry with **ST_AsTWKB**

```
SELECT
    pg_size.pretty(sum(ST_MemSize(geom))) AS original,
    pg_size.pretty(sum(length(ST_AsTWKB(geom)))) AS twkb
FROM
    vorarlberg.wald;

original | twkb
-----
17 MB   | 2333 kB
```

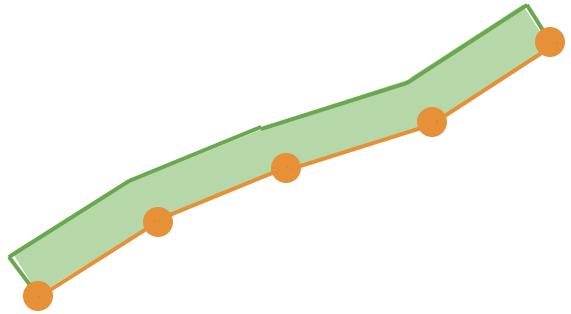
More: <https://carto.com/blog/smaller-faster/>

POSTGIS 2.5

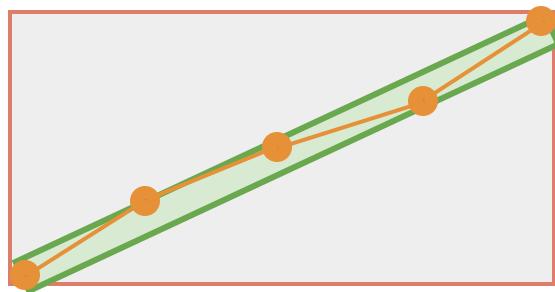
2018/09/23

SP-GIST Index for geometry

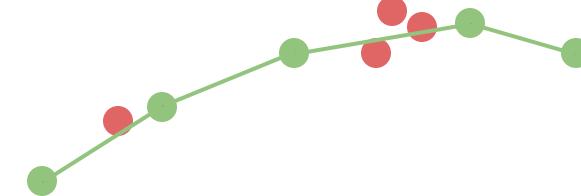
- Space-partitioned trees like kd tree, quadtree etc.
- Indexing points and bounding boxes
- Faster search on "spaghetti" data (with many overlaps)
- 2D and 3D opclass
- Yet no KNN support
- Only works with PostgreSQL v11 (compress option)



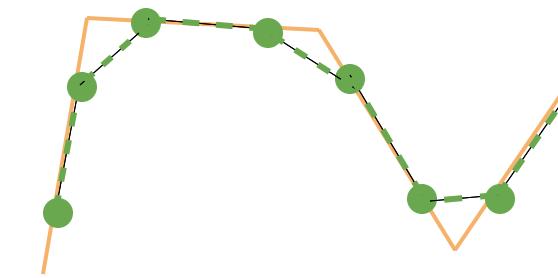
ST_Buffer with 'side={left | both | right}'



ST_OrientedEnvelope
(**ST_MinimumRectangle**)



ST_FilterByM



ST_ChaikinSmoothing
(Iterate to create Bezier curves)

THERE'S MORE

- Better parallel query support ([#3561](#) [#3751](#) [#3927](#))
- **ST_AsText(geom, maxdecimaldigits)**
- **ST_GeomFromGeoJSON** can consume JSON/B
- **ST_LineInterpolatePoints** with repeat function
- **ST_Angle** between 3 pts or 2 vectors
- **ST_Greyscale** for raster
- Extended out-db band settings
- **ST_QuantizeCoordinates** to reduce precision
- Geometry is hashed in CTEs
- etc. etc.



9.4+

POSTGIS 3.0

2019/20

- Make **upgrades** less painful! Change lib name.
- New **disk format**? External storage type?
- Function **COSTs** depending on geometry size
- **Raster** in or out of Core?
- **Tolerance & Precision (#1629)**?
- 3D-aware geography?
- **Index-only scans** with geometry?
- **nD-Geometry**, e.g. for trajectories?
- Cast to JSON / JSONB ([#3687](#))?
- osm2topology converter?
- Apply some "modern" C?
- <https://trac.osgeo.org/postgis/wiki/PostGIS3>

Google Summer of Code 2018

pgAdmin4 plugin for viewing data

Mentors: [Victoria Rautenbach](#) and [Frikan Erwee](#)

→ pgAdmin graphical user interface (GUI) administration tool for → PostgreSQL that allows you to execute spatial queries using → PostGIS on geospatial data. Currently, there is no integrated geospatial data viewer in pgAdmin and external applications, such as → QGIS, are required. For this project, you will develop a GUI that allows users to view the tables in a spatial database and the results of queries executed as geometries. Also, refer to → [this page](#) for more detail on the project.

Languages and APIs: Python, [JavaScript?](#) and [JavaScript?](#) APIs such as, require.js, bootstrap and OL3.

Test for potential students:

Task 1: Write a Python program to construct an array by repeating the values within the original array three times.

Expected Output:

Original array [1, 2, 3, 4]

Repeating 2 times [1 2 3 4 1 2 3 4]

Repeating 3 times [1 2 3 4 1 2 3 4 1 2 3 4]

Task 2: Create a basic web map using [OpenLayers?](#) displaying JSON layer, also ensure that you bootstrap the page. You can use any open data JSON layer, for example, datasets from the World Bank Open Data Portal.

pgAdmin 4

File ▾ Object ▾ Tools ▾ Help ▾

Browser

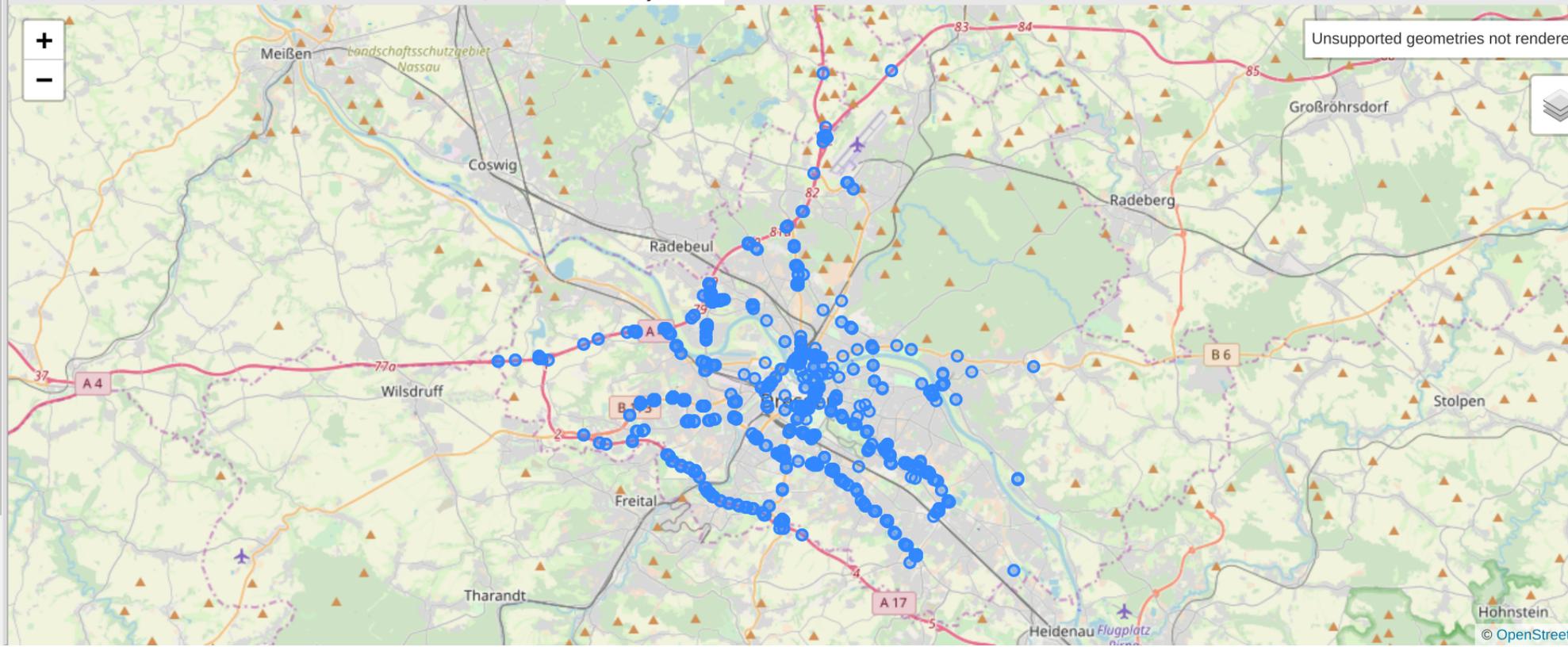
- public
 - Collations
 - Domains
 - FTS Configurations
 - FTS Dictionaries
 - FTS Parsers
 - FTS Templates
 - Foreign Tables
 - Functions
 - Materialized Views
 - Sequences
- Tables (17)
 - fahrten
 - fcd_matched
 - floating_car_data
 - matched_tracks
 - matched_tracks_occupied
 - matched_tracks_segments
 - matched_tracks_unoccupied
 - road_ang_speed_angle
 - road_avg_speed
 - road_avg_speed_dist
 - roads_osm
 - sensor_direction
 - sensor_graph
 - sensors
 - spatial_ref_sys
 - stadtteile_dd
 - track2connect
- Trigger Functions
- Types
- Views

Dashboard Properties SQL Statistics Dependencies Dependents Query - excell on flydix@pg10_local *

excell on flydix@pg10_local

```
1 SELECT geom FROM sensors;
```

Data Output Explain Messages Notifications Query History Geometry Viewer

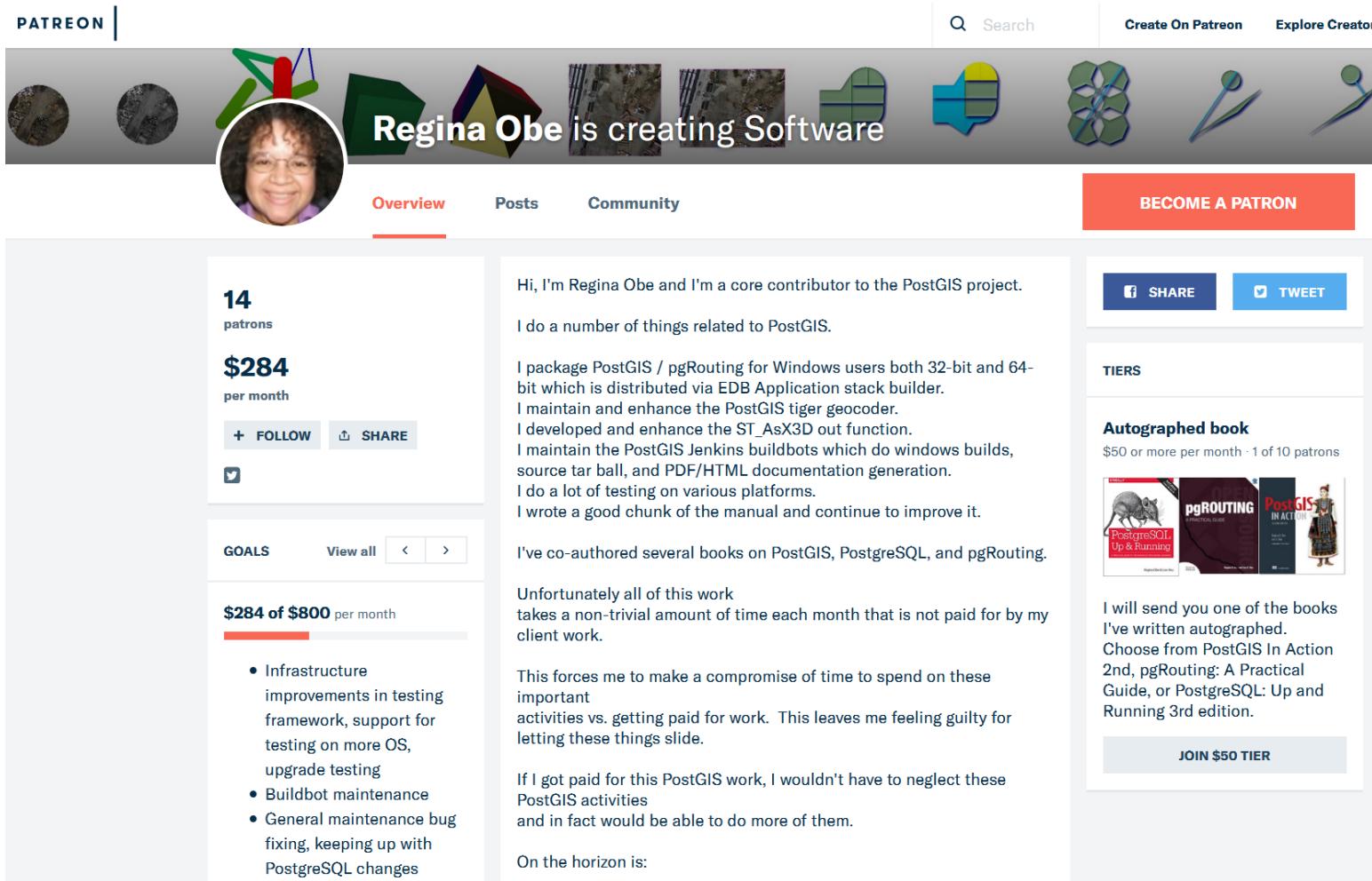


POSTGIS FUND ME

- Spatial partitioning via PG 10+ (~ [#181](#))
- Fixed precision for overlays ([#4001](#))
- Geoprocessing with GEOGRAPHY ([#3973](#))
- ST Blur & ST Sharpen for raster ([#2598](#), [#2599](#))
- Raster KDE ([#2894](#))
- Improvements for postgis_topology
- <https://trac.osgeo.org/postgis/milestone/PostGIS%20Fund%20Me>

ONE WAY TO FUND

PATREON |



Regina Obe is creating Software

Overview Posts Community BECOME A PATRON

14 patrons

\$284 per month

+ FOLLOW SHARE

GOALS View all < >

\$284 of \$800 per month

- Infrastructure improvements in testing framework, support for testing on more OS, upgrade testing
- Buildbot maintenance
- General maintenance bug fixing, keeping up with PostgreSQL changes

Hi, I'm Regina Obe and I'm a core contributor to the PostGIS project. I do a number of things related to PostGIS. I package PostGIS / pgRouting for Windows users both 32-bit and 64-bit which is distributed via EDB Application stack builder. I maintain and enhance the PostGIS tiger geocoder. I developed and enhance the ST_AsX3D out function. I maintain the PostGIS Jenkins buildbots which do windows builds, source tar ball, and PDF/HTML documentation generation. I do a lot of testing on various platforms. I wrote a good chunk of the manual and continue to improve it.

I've co-authored several books on PostGIS, PostgreSQL, and pgRouting. Unfortunately all of this work takes a non-trivial amount of time each month that is not paid for by my client work.

This forces me to make a compromise of time to spend on these important activities vs. getting paid for work. This leaves me feeling guilty for letting these things slide.

If I got paid for this PostGIS work, I wouldn't have to neglect these PostGIS activities and in fact would be able to do more of them.

On the horizon is:

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TIERS

Autographed book
\$50 or more per month · 1 of 10 patrons



I will send you one of the books I've written autographed. Choose from PostGIS In Action 2nd, pgRouting: A Practical Guide, or PostgreSQL: Up and Running 3rd edition.

JOIN \$50 TIER



Darafei Praliaskouski

Jul 23 at 2:22am

A day of fixing raster

Today user vinnix came to PostGIS IRC channel and told that he follows some PostGIS exercises he found on the web. In tutorial the queries were succeeding, and on his run they were giving a TopologyException.

[Continue reading](#)

postgis

1 Like



[Log in](#) to comment ...



Darafei Praliaskouski

Jul 21 at 11:53pm

Baking PostGIS 2.5beta2

Today I spent a day fixing stuff for Moday's PostGIS release.

First thing I decided to fix was 32bit FreeBSD build. Recently PGDG Apt repo maintainer Christoph Berg shared a link to logs from Debian buildfarm, and I found that 32bit Ubuntu crashes at the same spot.

[Continue reading](#)

postgis

1 Like



EXTERNAL PROJECTS YOU SHOULD KNOW

- Query on files (and more) with [ogr_fdw](#)
- OSM ETL: [osm2pgsql](#), [imposm](#)
- Storing pointclouds with [pgpointcloud](#)
- Vector Tiles: [Tegola](#), [t-rex](#), [tilesplash](#)
- [3D City Database](#) with export to Cesium
- <enter_your_domain_here>

THANKS

to

Regina, Paul, Sandro, Mark, Bborie,

Jorge, Nicklas, Dan, Olivier, Björn, Mateusz, Pierre, Darafei

Chris, Kevin, Dave, Jeff, Mark, David

Alex, Alex, Andrea, Andreas, Andreas, Anne, Arthur, Barbara, Ben, Bernhard, Brian, Bruce, Bruno, Bryce, Carl, Charlie, Dane, David, David, Eduin, Even,

Esteban, Frank, George, Gerald, Gino, Guillaume, Iida, Ingvild, Jason, Jeff, Jose Carlos, Julien, Kashif, Klaus, Kris, Leo, Loic, Luca, Maria, Mark, Markus,

Maxime, Maxime, Michael, Mike, Nathan, Nathaniel, Nikita, Norman, Rafal, Ralph, Rémi, Richard, Silvio, Steffen, Stephen, Tom, Vincent, Vincent

Teams behind GEOS, GDAL and Proj!

The whole PostgreSQL community!

The funding companies, organisations and individuals!