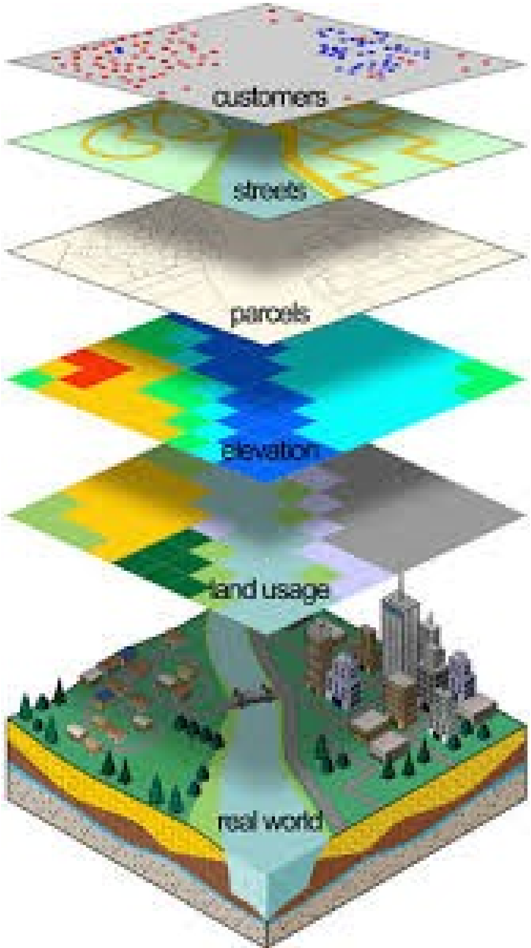
# PostGIS

# Post -
# G eographical
# I nformation
# S ystem

**Capture, create, store, analyze, share, visualize data related to space**

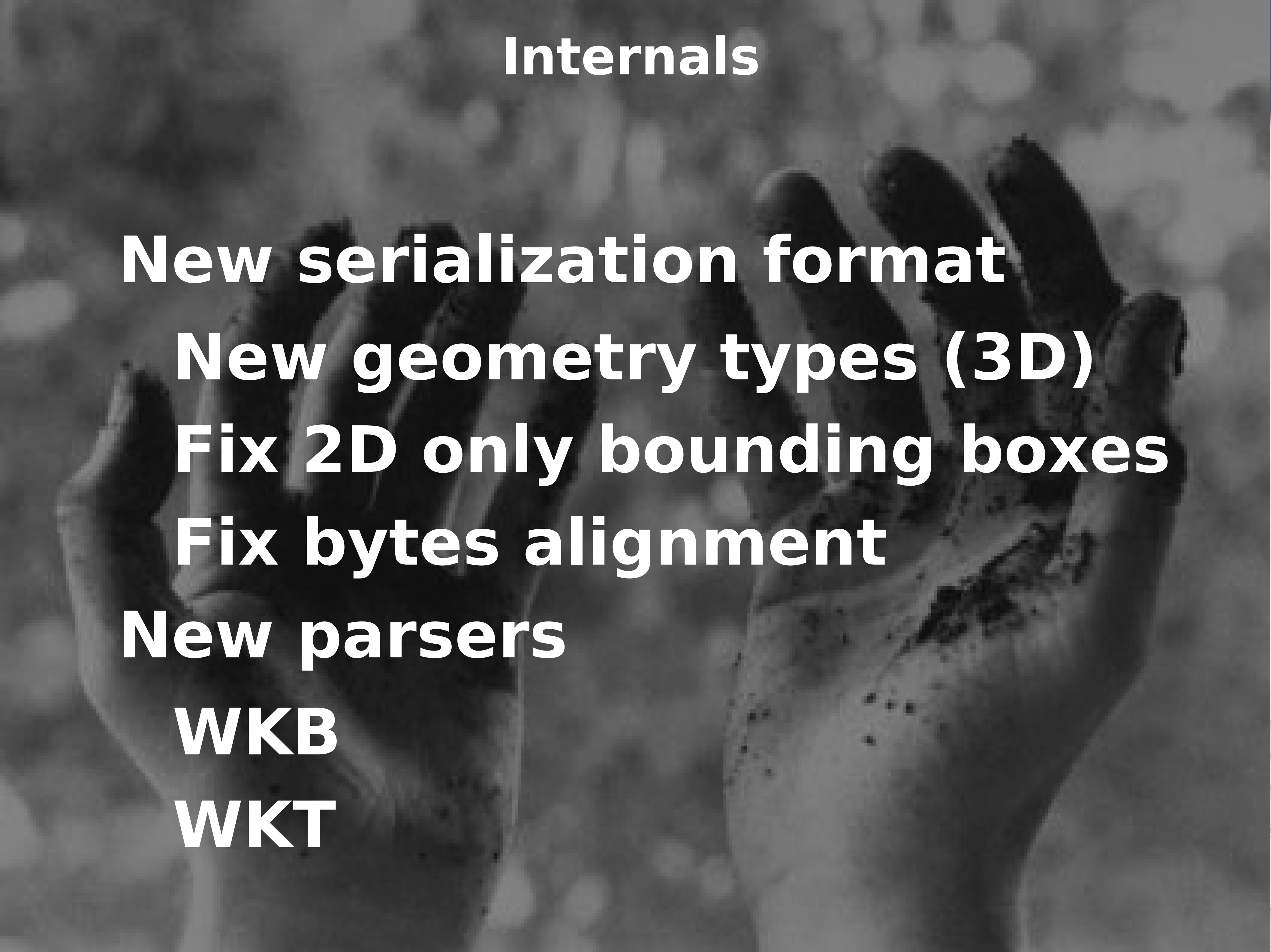


# PostGIS

# PostGIS 2.0 is out !

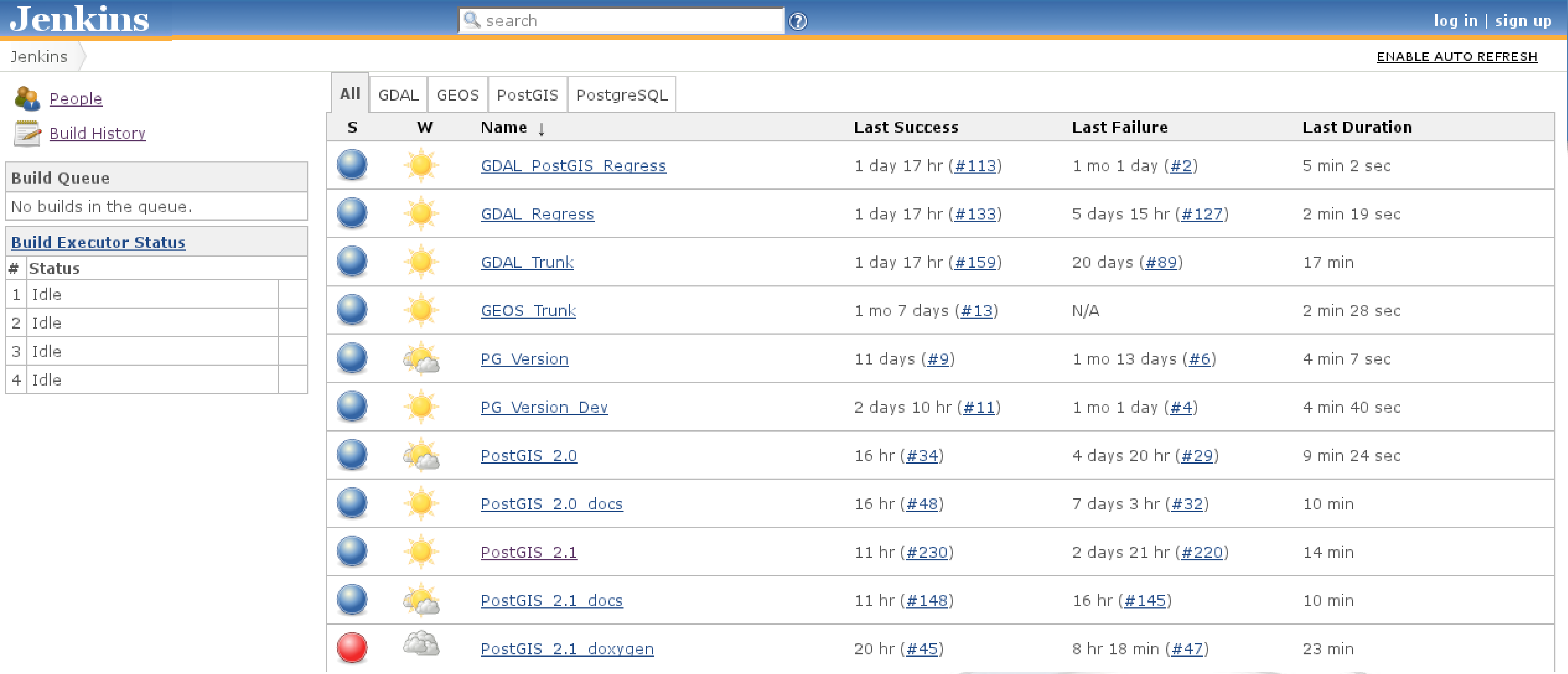
## (.. since 2012 ..)

# 2012..



# Internals

- New serialization format
  - New geometry types (3D)
  - Fix 2D only bounding boxes
  - Fix bytes alignment
- New parsers
  - WKB
  - WKT



**Build Queue**

No builds in the queue.

**Build Executor Status**

| # | Status |
|---|---|
| 1 | Idle |
| 2 | Idle |
| 3 | Idle |
| 4 | Idle |

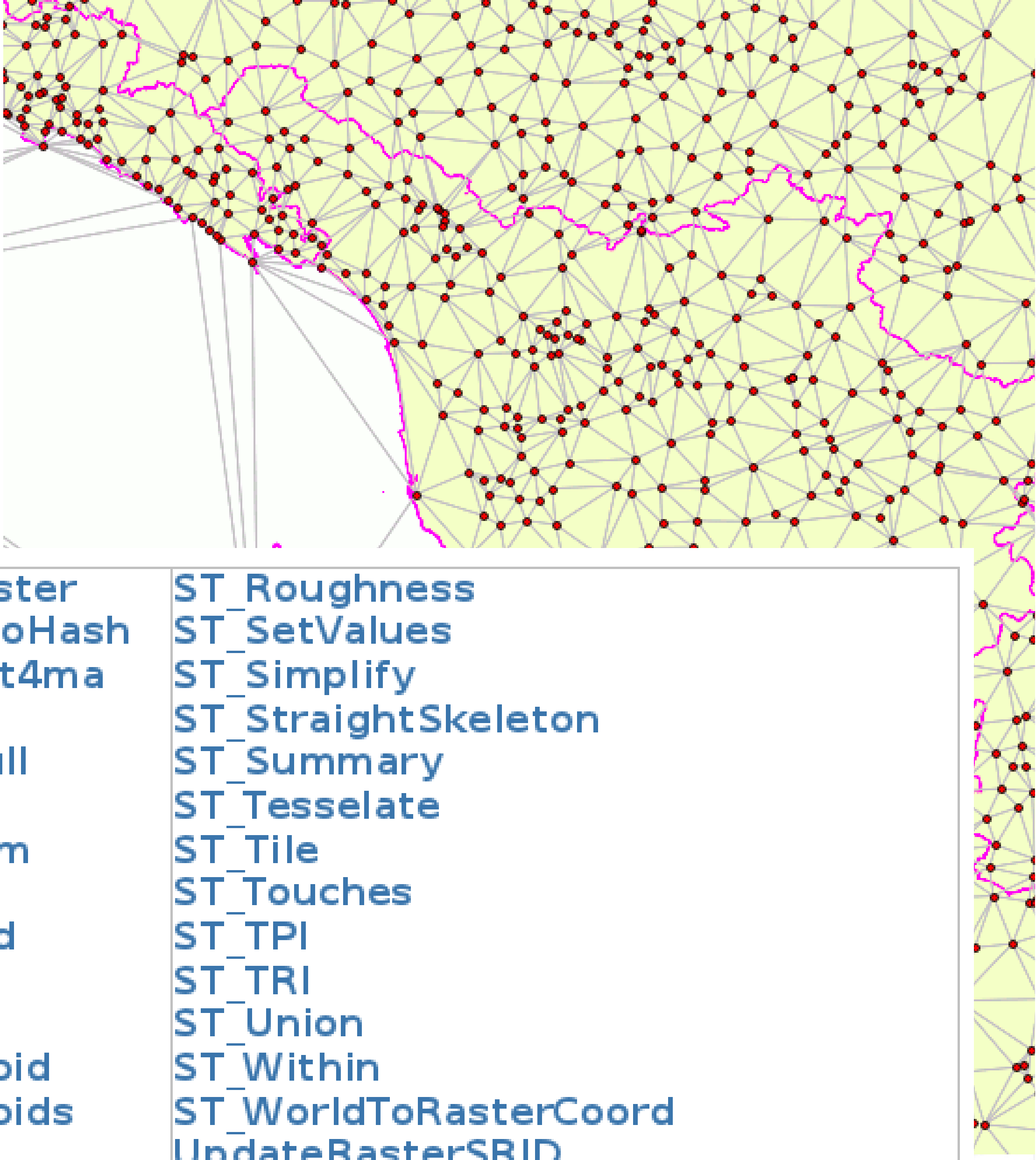
| S | W | Name ↓ | Last Success | Last Failure | Last Duration |
|---|---|---|---|---|---|
| 🔵 | ☀ | GDAL_PostGIS_Regress | 1 day 17 hr (#113) | 1 mo 1 day (#2) | 5 min 2 sec |
| 🔵 | ☀ | GDAL_Regress | 1 day 17 hr (#133) | 5 days 15 hr (#127) | 2 min 19 sec |
| 🔵 | ☀ | GDAL_Trunk | 1 day 17 hr (#159) | 20 days (#89) | 17 min |
| 🔵 | ☀ | GEOS_Trunk | 1 mo 7 days (#13) | N/A | 2 min 28 sec |
| 🔵 | ⛅ | PG_Version | 11 days (#9) | 1 mo 13 days (#6) | 4 min 7 sec |
| 🔵 | ☀ | PG_Version_Dev | 2 days 10 hr (#11) | 1 mo 1 day (#4) | 4 min 40 sec |
| 🔵 | ⛅ | PostGIS_2.0 | 16 hr (#34) | 4 days 20 hr (#29) | 9 min 24 sec |
| 🔵 | ☀ | PostGIS_2.0_docs | 16 hr (#48) | 7 days 3 hr (#32) | 10 min |
| 🔵 | ☀ | PostGIS_2.1 | 11 hr (#230) | 2 days 21 hr (#220) | 14 min |
| 🔵 | ⛅ | PostGIS_2.1_docs | 11 hr (#148) | 16 hr (#145) | 10 min |
| 🔴 | ☁ | PostGIS_2.1_doxygen | 20 hr (#45) | 8 hr 18 min (#47) | 23 min |

OSLANDIA

# Functions

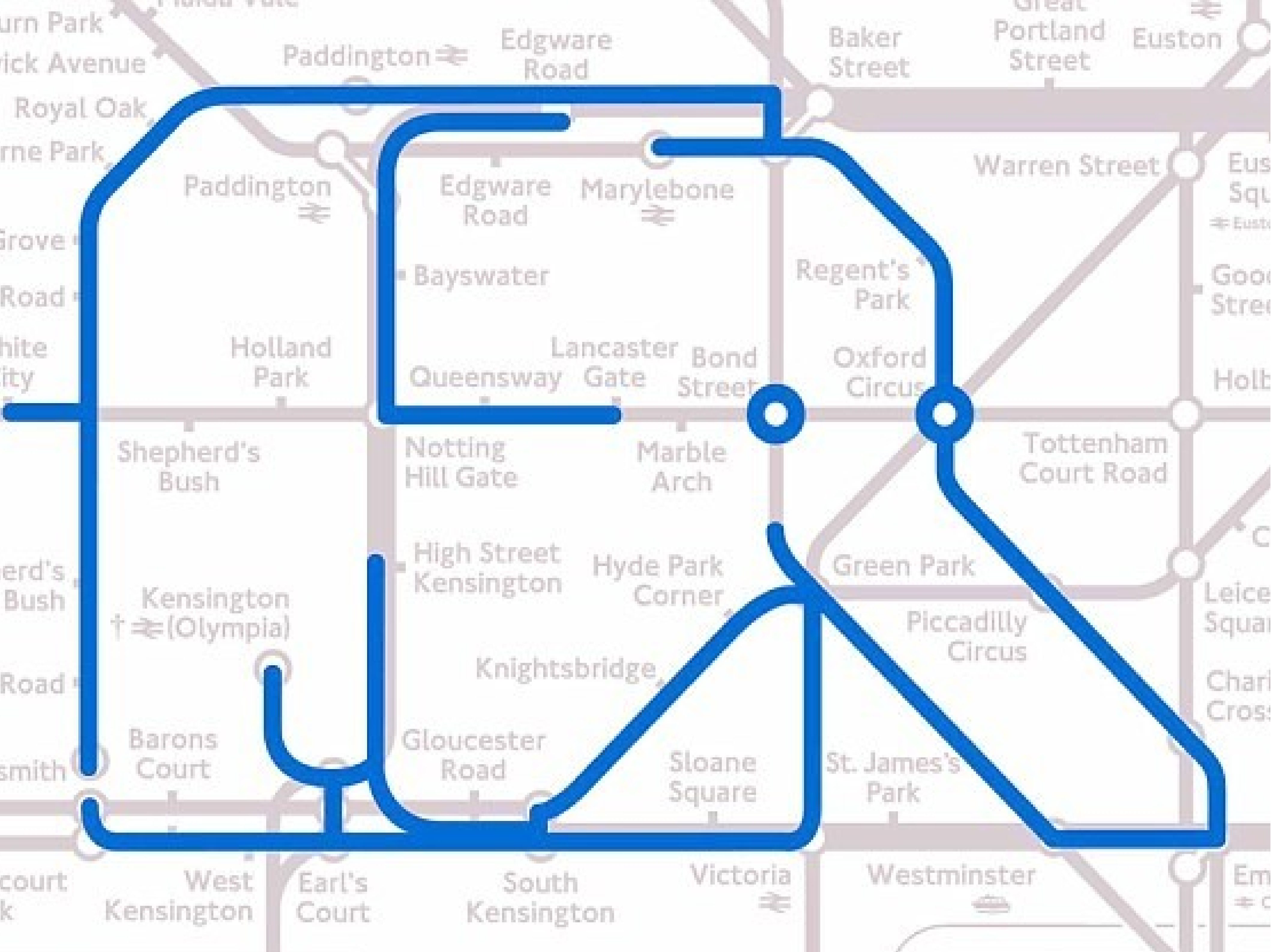
# PostGIS 2.1

Released



- AsTopoJSON
- clearTopoGeom
- Get_Geocode_Setting
- postgis_sfcgal_version
- Set_Geocode_Setting
- ST_3DArea
- ST_3DIntersection
- ST_ColorMap
- ST_Contains
- ST_ContainsProperly
- ST_CoveredBy
- ST_Covers
- ST_DelaunayTriangles
- ST_DFullyWithin
- ST_Disjoint
- ST_DumpValues
- ST_DWithin
- ST_Extrude
- ST_ForceLHR
- ST_FromGDALRaster
- ST_GeomFromGeoHash
- ST_InvDistWeight4ma
- ST_MapAlgebra
- ST_MinConvexHull
- ST_MinDist4ma
- ST_MinkowskiSum
- ST_NearestValue
- ST_Neighborhood
- ST_Orientation
- ST_Overlaps
- ST_PixelAsCentroid
- ST_PixelAsCentroids
- ST_PixelAsPoint
- ST_PixelAsPoints
- ST_PixelOfValue
- ST_PointFromGeoHash
- ST_RasterToWorldCoord
- ST_Resize
- ST_Roughness
- ST_SetValues
- ST_Simplify
- ST_StraightSkeleton
- ST_Summary
- ST_Tesselate
- ST_Tile
- ST_Touches
- ST_TPI
- ST_TRI
- ST_Union
- ST_Within
- ST_WorldToRasterCoord
- UpdateRasterSRID
- Drop_Nation_Tables_Generate_Script
- Loader_Generate_Nation_Script
- ST_NotSameAlignmentReason
- ST_Box2dFromGeoHash
- Pagc_Normalize_Address

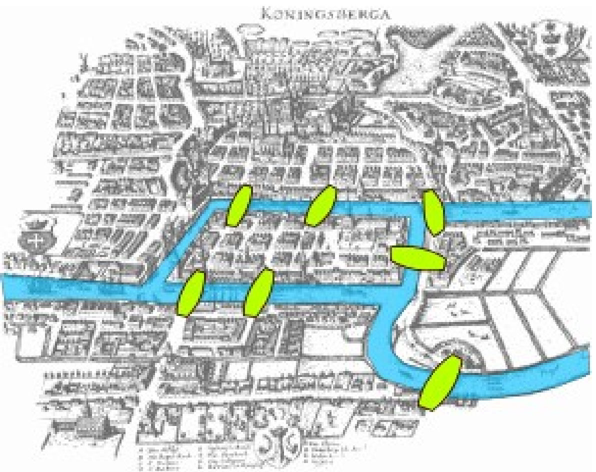
# Topology

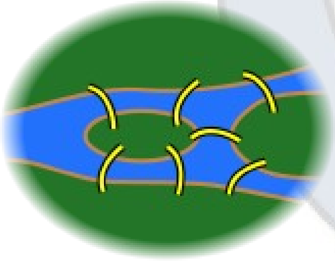

urn Park
Paddington
Edgware Road
Baker Street
Great Portland Street
Euston
ick Avenue
Royal Oak
rne Park
Paddington
Edgware Road
Marylebone
Warren Street
Eus Squ
Euston
Grove
Bayswater
Regent's Park
Road
Good Stre
hite ity
Holland Park
Lancaster Gate
Queensway
Bond Street
Oxford Circus
Holb
Shepherd's Bush
Notting Hill Gate
Marble Arch
Tottenham Court Road
erd's Bush
High Street Kensington
Hyde Park Corner
Green Park
Kensington (Olympia)
Leice Squa
Piccadilly Circus
Knightsbridge
Road
Chari Cross
Barons Court
Gloucester Road
Sloane Square
St. James's Park
smith
court k
West Kensington
Earl's Court
South Kensington
Victoria
Westminster
Em

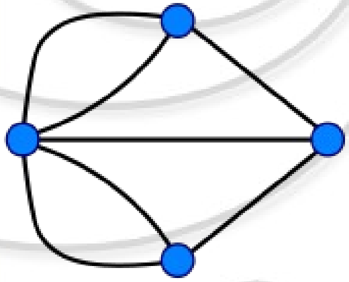
# Topology - Graphs

Released

- **Explicit relations between objects**
- **Graph representation**
- **OGC : Node / edge / face**
- **TopoGeometry datatype**
- **SQL/MM support**
- **Sandro Santilli – Toscane Region**







Recursive CTE

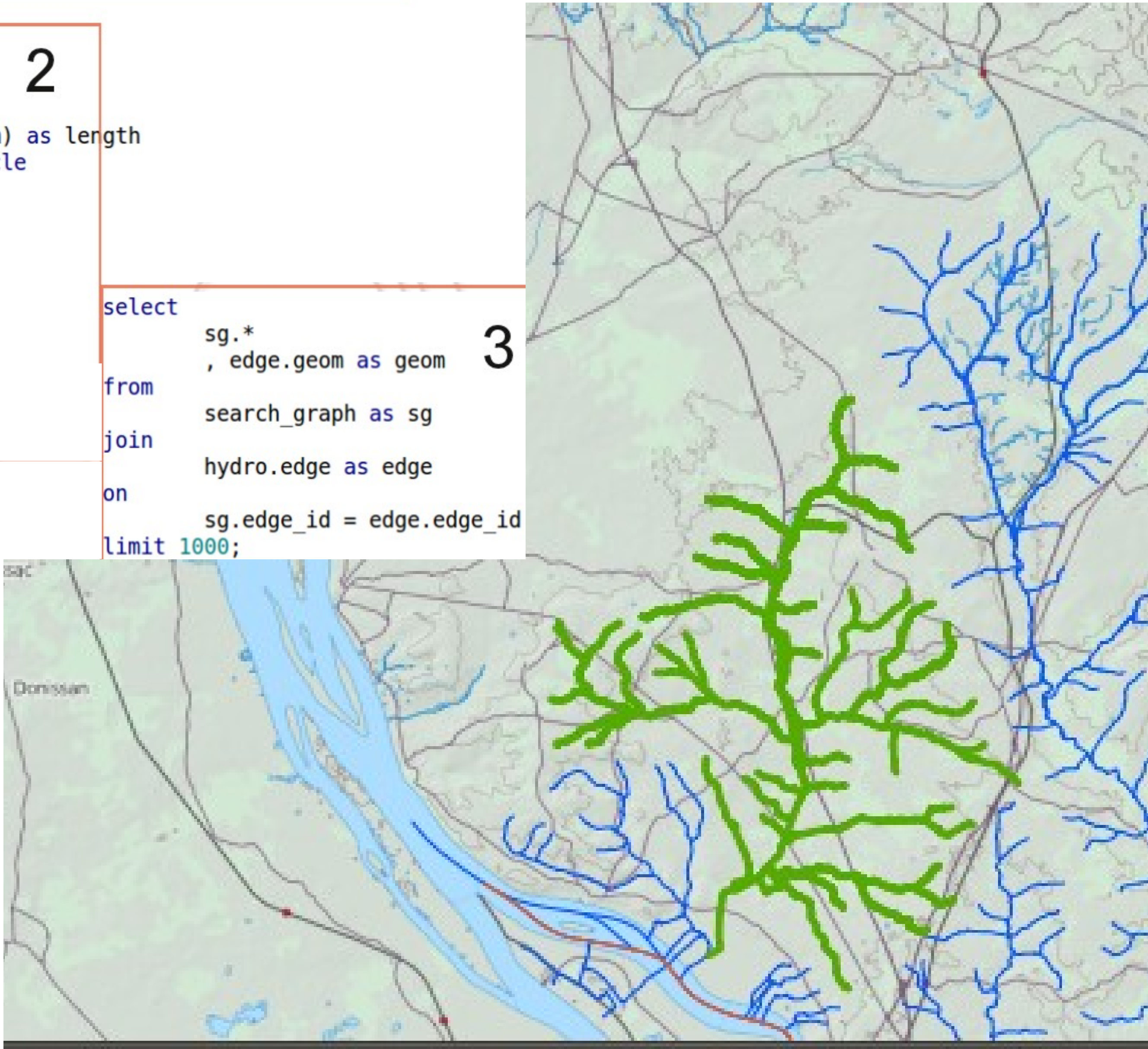
```
create table
        rec_res2 as
with recursive
        search_graph(edge_id, start_node, depth, path, length, cycle) as (
                select
                        g.edge_id, g.start_node, 1 as depth, ARRAY[g.edge_id] as path
                        , st_length(geom) as length, false as cycle
                from
                        hydro.edge as g
                where
                        edge_id = 173832
                union all
                select
                        g.edge_id
                        , g.start_node
                        , sg.depth + 1 as depth
                        , path || g.edge_id as path
                        , sg.length + st_length(g.geom) as length
                        , g.edge_id = ANY(path) as cycle
                from
                        hydro.edge as g
                join
                        search_graph as sg
                on
                        sg.start_node = g.end_node
                where
                        not cycle
                )
```

1

2

```
select
        sg.*
        , edge.geom as geom
from
        search_graph as sg
join
        hydro.edge as edge
on
        sg.edge_id = edge.edge_id
limit 1000;
```

3



# Raster

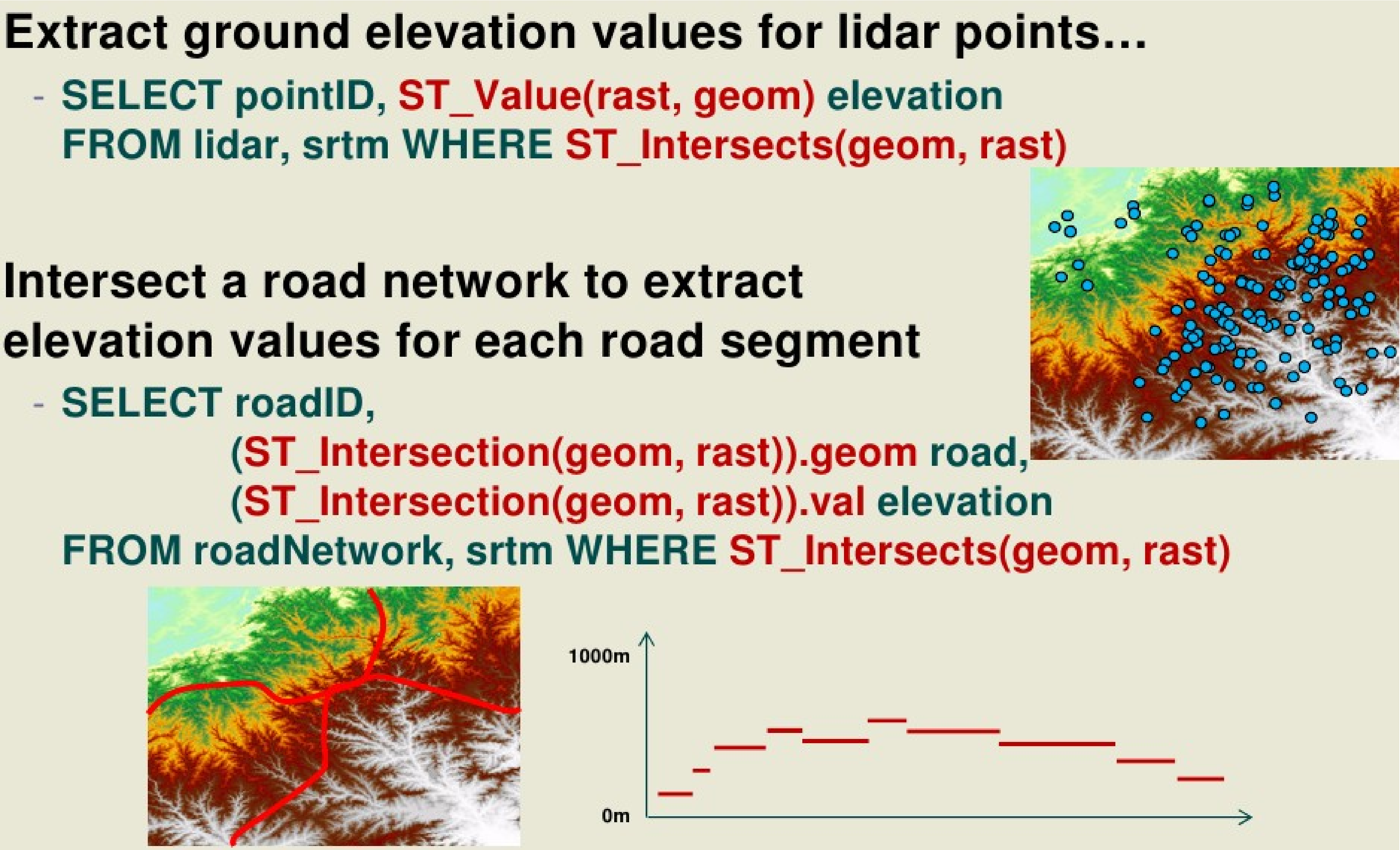
# Rasters

Released

- Raster / vector analysis
- New datatype
  - Looks like geometry
  - But for rasters
- Multiresolution, multiband, tile coverage
- Import/export (GDAL)
- Functions
  - Statistics, reprojection, edit, compute
  - Vector/raster functions
  - More & more functions & faster

WIP

# Rasters



**Extract ground elevation values for lidar points…**

```
- SELECT pointID, ST_Value(rast, geom) elevation
  FROM lidar, srtm WHERE ST_Intersects(geom, rast)
```

**Intersect a road network to extract elevation values for each road segment**

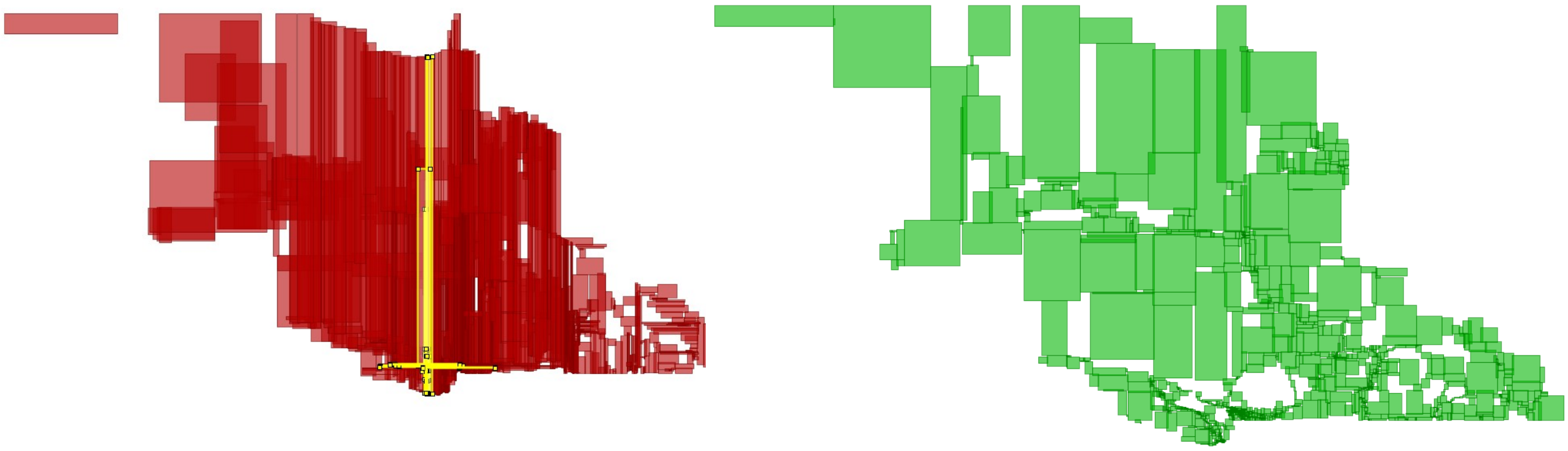
```
- SELECT roadID,
              (ST_Intersection(geom, rast)).geom road,
              (ST_Intersection(geom, rast)).val elevation
  FROM roadNetwork, srtm WHERE ST_Intersects(geom, rast)
```

# Indexing

# Indexing - pick-split

Released

- #define KOROTKOV_SPLIT 1
- « Double sorting-based node splitting algorithm for R-tree »
- Huh ?
- → Better bbox organization in indexes



(Suggestion of presentation)

# KNN-Search

Released

- KNN-GIST search in PostgreSQL 9.1+
- Use indexes !
- Spatial nearest neighbors

```
SELECT name, gid FROM geonames
ORDER BY
   geom <-> st_setsrid(st_makepoint(-90,40),4326)
LIMIT 10;
```

- Distance operator
  - <-> or <#> : center or bbox
  - Need to refine for non-point geometries

# SP-Gist

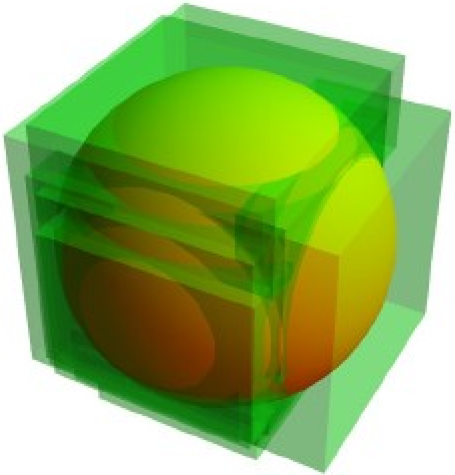
- « SP » = SPatial
- New PG index type
- Faster to read
- 3x faster to build
- Good fit for spatial data
- GSoC 2014
- OK for points, not for other geometries

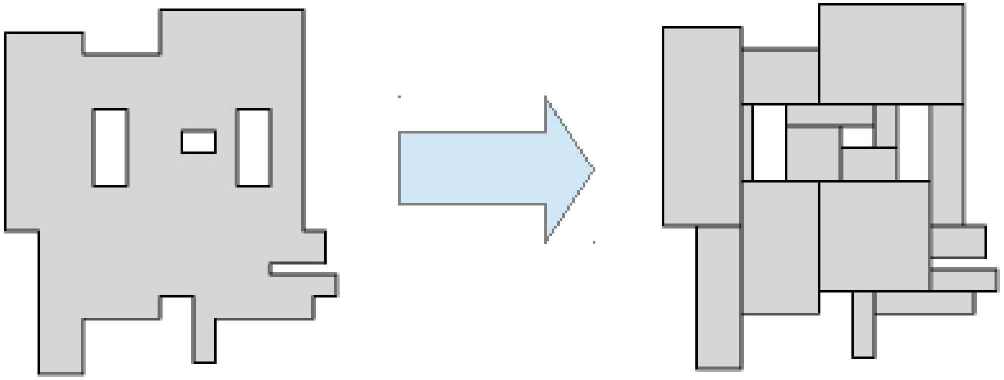
WIP

# VODKA

- Korotkov, Bartunov, Sigaev
- create index .. using vodka
- Derivation of JSONB indexing
- R-Tree based on GiST as entry tree
- Use multiple boxes per polygons

WIP





*Beware of the spaghetti monster killing your R-Trees !*

# Geocoding

# PAGC in PostGIS

Done

- Address standardizer as PG extension

WIP

- standardizer → PostGIS project
- Soon replace TIGER parts
- Later work on Next gen. Geocoder
  - European addressing
  - ...
  - Collaboration with PAGC team
- Stephen Woodbridge & Regina Obe

# 3D

# PostGIS 3D / SFCGAL

**SFCGAL**

**=**

CGAL

**+**

CERTIFIED
OGC®
COMPLIANT

ISO 19107:2013

ISO 19125:2013

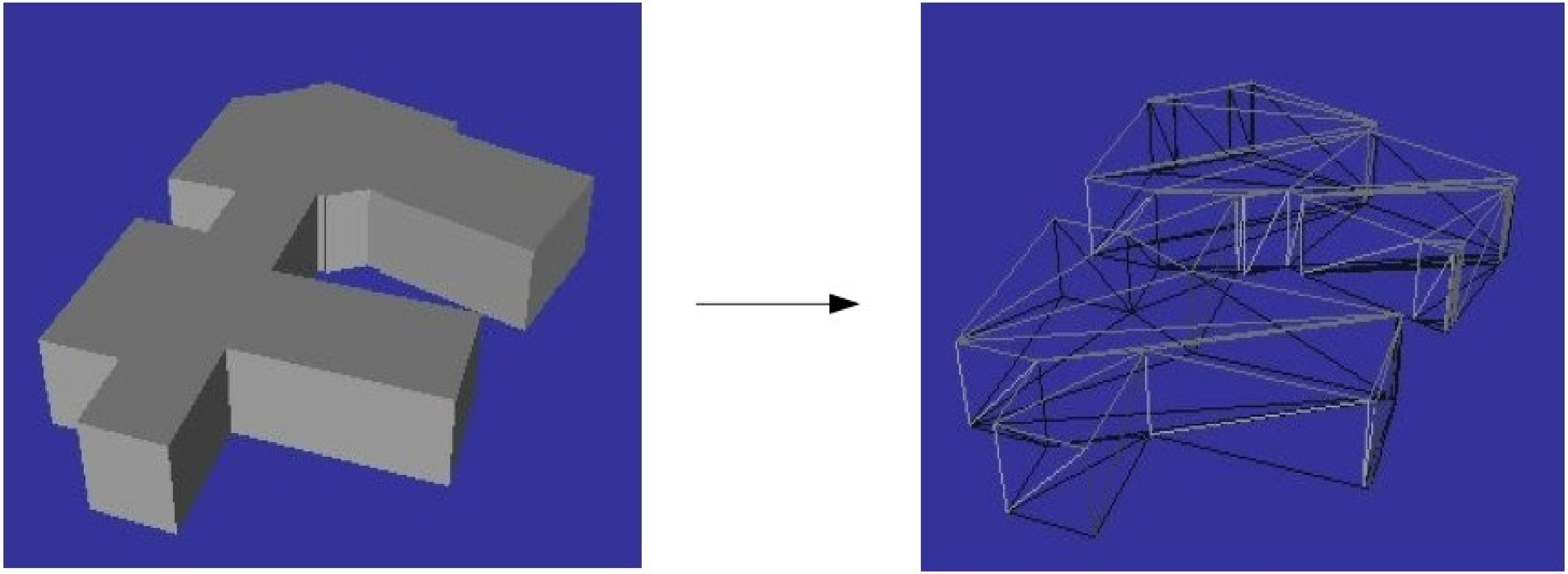
CGAL

# SFCGAL functions

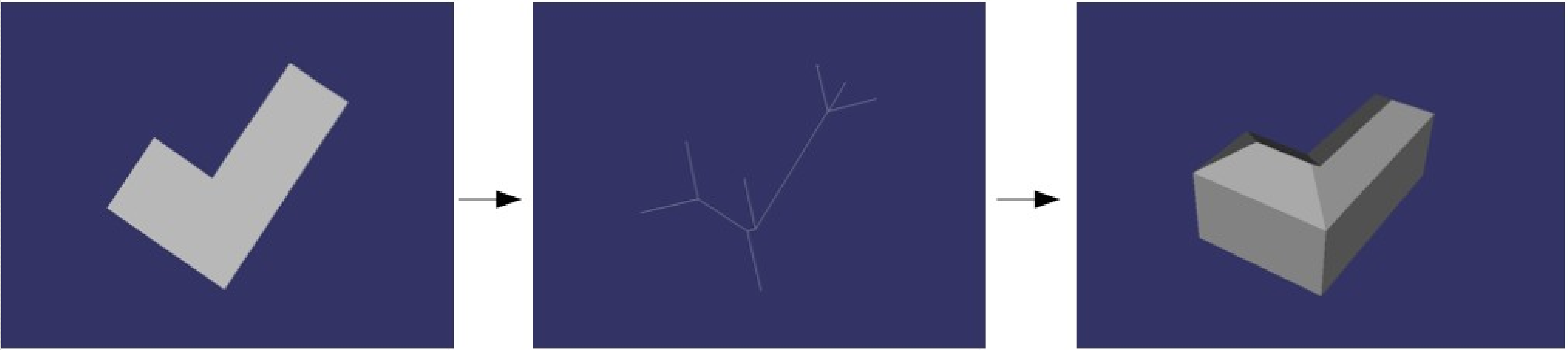
Released

- ST_3DIntersection
- ST_Tesselate
- ST_3DArea
- ST_Extrude
- ST_ForceLHR
- ST_Orientation
- ST_MinkowskiSum
- ST_StraightSkeleton

# ST_Tesselate



# ST_StraightSkeleton



2D Building
Footprint

Straight Skeleton

Extrusion
& roof computation

# SFCGAL news

- create extension sfcgal ;
- Windows binaries
- Some more functions

Done

- CI integration (regress, unit)
- Texture support
- More import/export, « GeoJSON 3D », CityGML

WIP

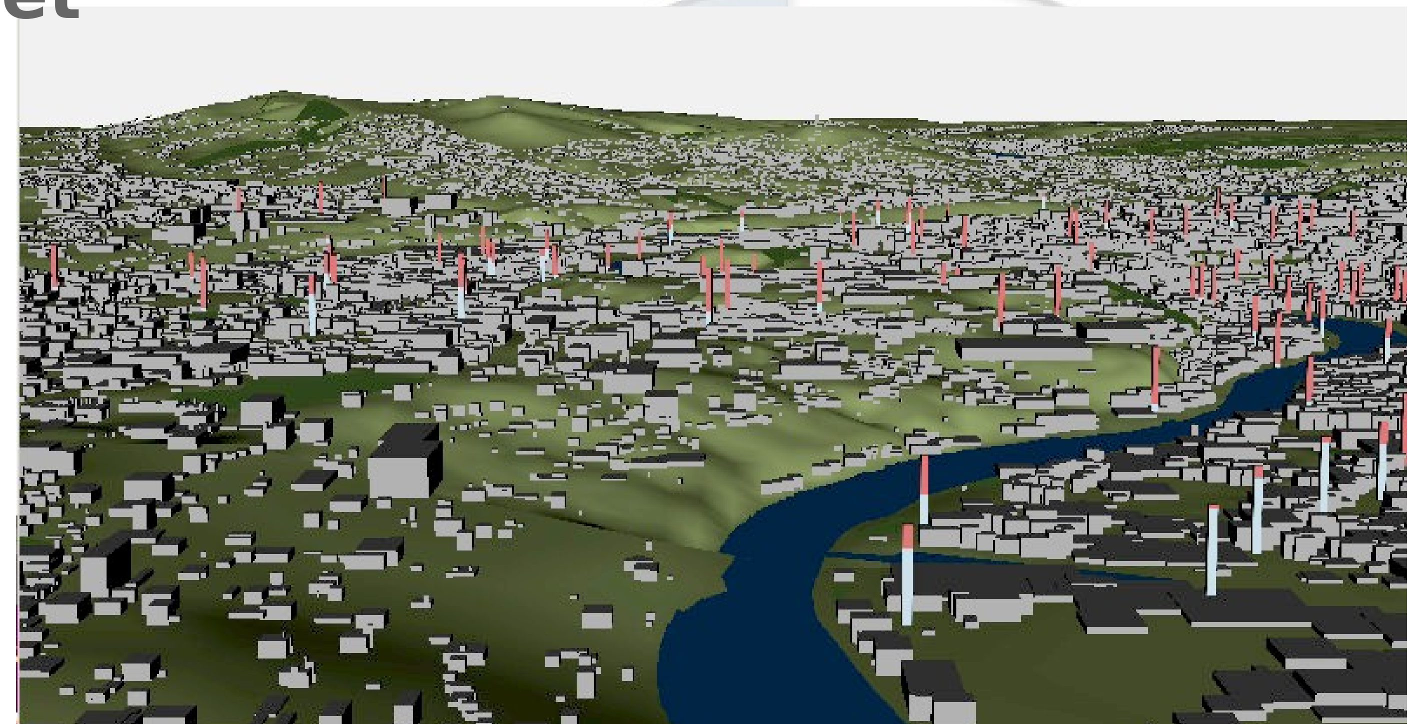
```
SET postgis.backend = 'geos' ;
```

```
SET postgis.backend = 'sfcgal' ;
```

# Viewer : Horao

Released

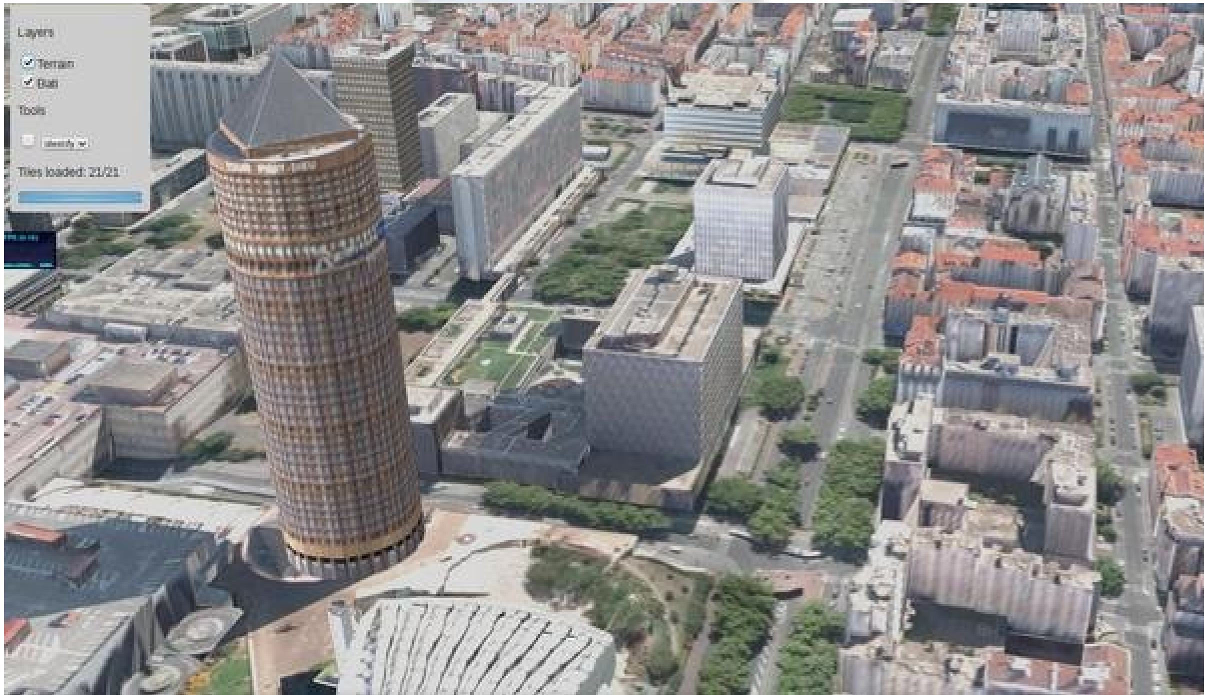
- OpenSceneGraph-based
- Independant + QGIS plugin
- Synchronization with QGIS
- MNT, 3D, custom queries
- www.horao.net



# Viewer : Cuardo

Released

- Full WebGL viewer
- Mixed 2D/3D viewer/generator
- Using Three.js power
- GIS server with 3D webservices
- PostGIS companion
- 3D GIS Stack



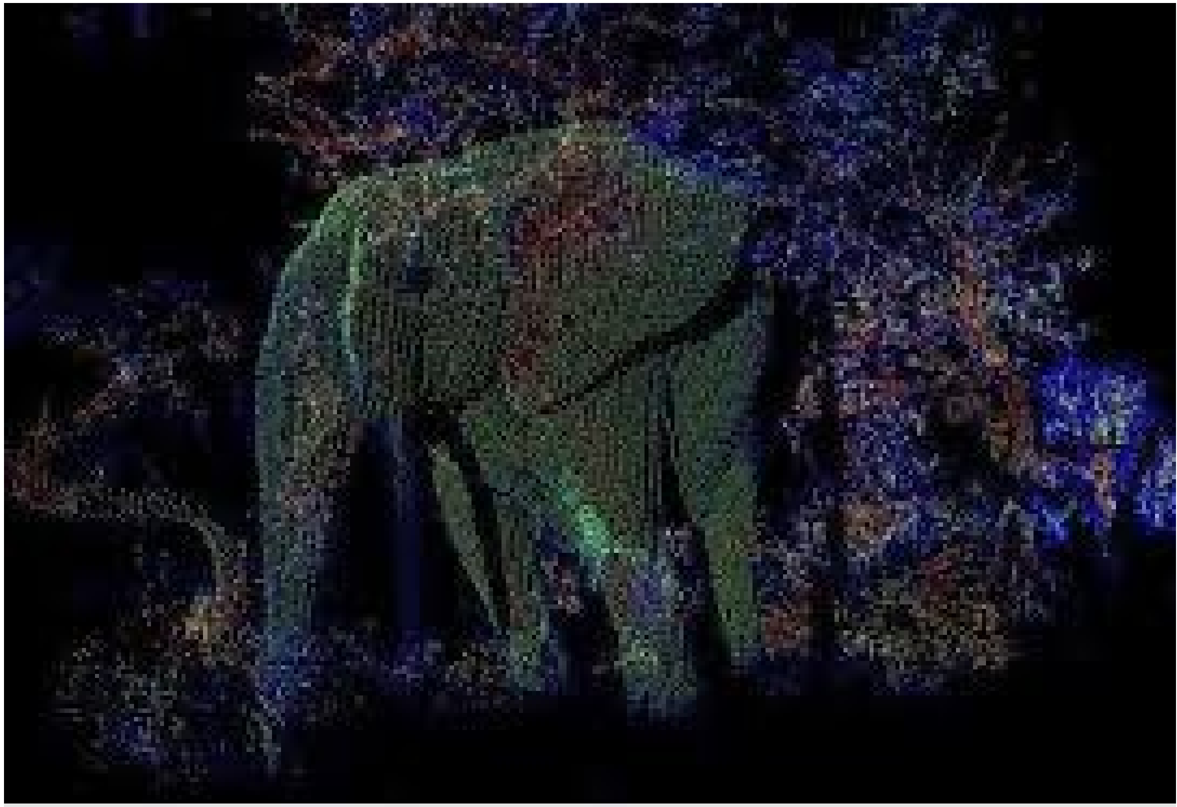
# PointCloud

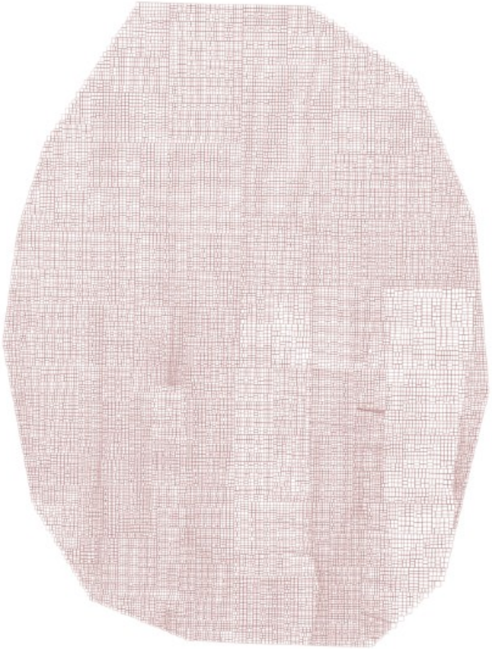
# PointCloud

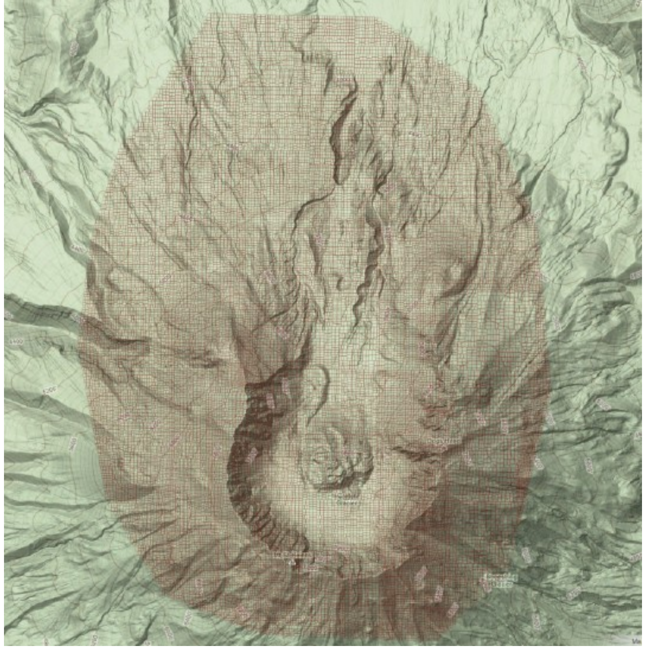
Released

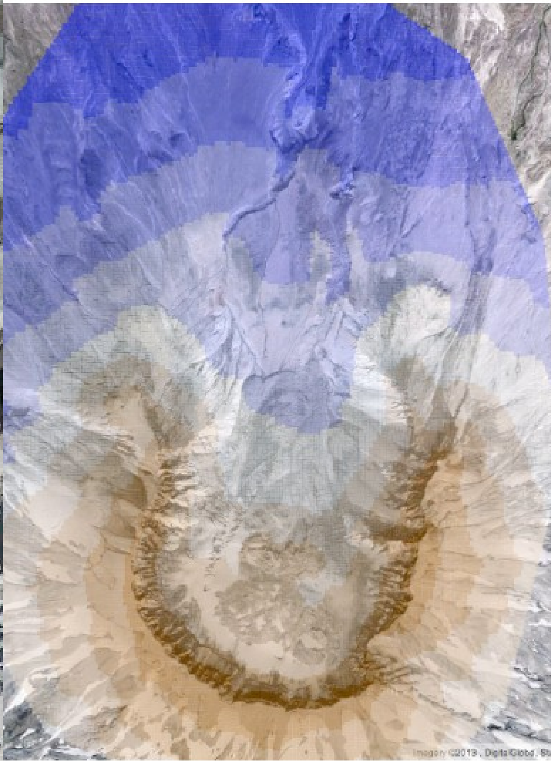
- PostgreSQL extension + PostGIS
- Paul Ramsey – Natural resources Canada
- LIDAR - Huge point datasets
- N-Dimensional
- PDAL I/O

- Point patches
- Indexes
- Functions








Imagery ©2013 , DigitalGlobe, St

# Try it out

# docker-pggis

- Docker container for latest database GIS stuff
- Latest versions
  - PG 9.4b
  - PostGIS 2.1.4 + SFCGAL
  - PointCloud master
  - PDAL
- Run everything in two lines
- Based on phusion baseimage
- Not for production !

Done

https://github.com/vpicavet/docker-pggis

docker

```
docker build -t oslandia/pggis .
docker run --rm -P --name pggis_test oslandia/pggis
```

# Oracle FDW

# oracle_fdw

- FDW for Oracle database (Laurenz Albe)
- NEW : Oracle Spatial support (Vincent Mora)
- Native, R+W, Fast !
- Points, lines & polygons
- Combine with Materialized V.

Done

- Heterogeneous systems
- Migration

- ora2pg support

WIP

# PG 9.x

# PG → PostGIS

- PG improvements → PostGIS benefits :-)
- Some parts :
  - JSONB & GeoJSON
  - Multimaster logical replication
  - Postgres-XL ( parallel PG )

WIP

# What more ?

# Other PostGIS stuff...

- Raster features
- Function interruptions in GEOS
- More formats
  - Vector tiles
  - ...
- 3D
  - More functions
  - Server-side services
- More functions

WIP

# That's (almost) all

# Thank them

Mark Cave-Ayland
Regina Obe
Bborie Park
Paul Ramsey
Sandro Santilli
Jorge Arévalo
Nicklas Avén
Olivier Courtin
Pierre Racine
David Zwarg
Chris Hodgson
Kevin Neufeld
Dave Blasby
Mateusz Loskot
Jeff Lounsbury
Mark Leslie
Stephen Woodbridge
Alex Bodnaru
Alex Mayrhofer
Andrea Peri
Andreas Forø Tollefsen
Andreas Neumann
Anne Ghisla
Barbara Phillipot
Ben Jubb
Bernhard Reiter

Brian Hamlin
Bruce Rindahl
Bruno Wolff III
Bryce L. Nordgren
Carl Anderson
Charlie Savage
Dane Springmeyer
David Skea
David Techer
Eduin Carrillo
Even Rouault
Frank Warmerdam
George Silva
Gerald Fenoy
Gino Lucrezi
Guillaume Lelarge
Hugo Mercier
IIDA Tetsushi
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Llari
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Maxime van Noppen
Michael Fuhr
Nathan Wagner
Nathaniel Clay
Nikita Shulga
Norman Vine
Rafal Magda
Ralph Mason
Richard Greenwood
Silvio Grosso
Steffen Macke
Stephen Frost
Tom van Tilburg
Vincent Mora
Vincent Picavet
All PostgreSQL developers
All sponsors
People I forgot (sorry)

# Thank you

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