



# **PostGIS**

## **die PostgreSQL Erweiterung zur Geodatenhaltung**

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-  WhereGroup, Bonn
- Projektumsetzung im Bereich WebGIS
- Projekte mit PostgreSQL/PostGIS, MapServer, GeoServer, Quantum GIS
- Aktiv in **OSGeo** und **FOSSGIS e.V.**



# Was ist PostGIS?



# Was ist PostGIS ?

- PostGIS ist ein räumlicher Aufsatz zur Speicherung und Verwaltung von Geodaten in PostgreSQL
- konform mit der OGC Simple Feature Spezifikation für SQL (SFSQL)
- Orientierung an der ISO Spezifikation SQL/MM Teil 3



# Was ist PostGIS?

- Erweitert um PostGIS-eigene Funktionen
- Programmierung in C++, PL/pgSQL
- nutzt GEOS, Proj4, GDAL, LibXML2



# **Vorteile der Geodatenhaltung in der Datenbank**



# Vorteile

- Geometrie und Sachdaten können in einer Tabelle abgelegt werden
- Alles in einem System
- Berechnungen direkt in der Datenbank über PostGIS Funktionen - GIS wird nicht benötigt



# Die ersten Schritte



# Installation

- PostgreSQL, GEOS, PROJ4

```
tar xvzf postgis-1.5.3.tar.gz
```

```
cd postgis-1.5.3
```

```
./configure
```

```
make
```

```
make install
```



# Installation

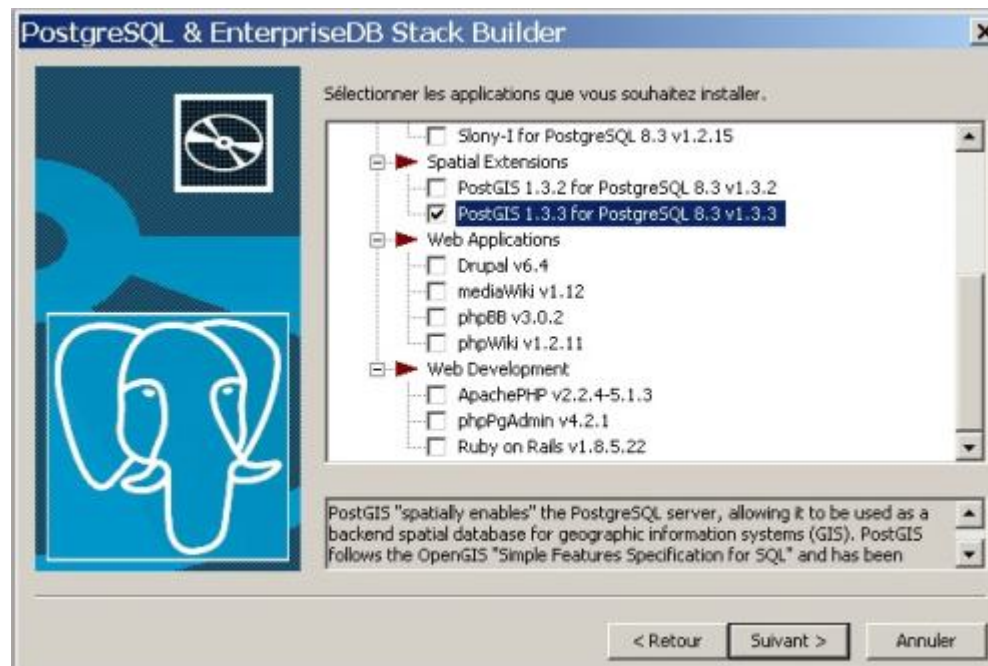
```
apt-get install postgresql  
postgresql-client postgresql-  
contrib pgadmin3
```

```
apt-get install postgresql-8.4-  
postgis
```



# Installation unter Windows

- PostgreSQL Stack-Builder





# PostGIS Datenbank

- prozedurale Sprache PL/pgSQL
- PostGIS Funktionen
- Metadatatabelle geometry\_columns
- Tabelle mit Projektionsangaben  
spatial\_ref\_sys



# PostGIS Datenbank anlegen

```
createdb -U postgres postgis_template
```

```
createlang -U postgres plpgsql postgis_template
```

```
psql -U postgres geodatabase -f  
/usr/share/postgresql/8.4/contrib/postgis-  
1.5/postgis.sql
```

```
psql -U postgres geodatabase -f  
/usr/share/postgresql/8.4/contrib/postgis-  
1.5/spatial_ref_sys.sql
```



# PostGIS Template verwenden

```
createdb -U postgres  
-T postgis_template  
geodatabase
```



# PostGIS Funktionen

- > 300 Funktionen
- C++ oder PL/pgSQL
- OGC Simple Feature for SQL Standard (SFSQL)
- SQL/MM Standard Teil 3
- PostGIS-eigene Funktionen



# Tabelle geometry\_columns

- Metadaten zu den Geometriespalten
  - Geometrietyp
  - Projektionssystem
  - Dimension

Ab 2.0 als View

|   | table_catalog | table_schema | table_name | geometry_column_name | coord_dimension | srid  | type       |
|---|---------------|--------------|------------|----------------------|-----------------|-------|------------|
| 1 |               | public       | poi        | the_geom             | 2               | 31467 | POINT      |
| 2 |               | public       | leitung    | the_geom             | 2               | 31466 | LINESTRING |



# Tabelle spatial\_ref\_sys

- > 3000 EPSG Codes
- Umrechnungsparameter für Transformation

|   | srid | auth_name | auth_srid | srtext            | proj4text                      |
|---|------|-----------|-----------|-------------------|--------------------------------|
| 1 | 3819 | EPSG      | 3819      | GEOGCS["HD1909... | +proj=longlat +ellps=bessel... |
| 2 | 3821 | EPSG      | 3821      | GEOGCS["TWD67"... | +proj=longlat +ellps=aust_S... |

| srid  | auth_name | auth_srid | srtext        | proj4text                                                                                             |
|-------|-----------|-----------|---------------|-------------------------------------------------------------------------------------------------------|
| 25832 | EPSG      | 25832     | PROJCS["ET... | +proj=utm +zone=32 +ellps=GRS80 +units=m +no_defs                                                     |
| 31466 | EPSG      | 31466     | PROJCS["DH... | +proj=tmerc +lat_0=0 +lon_0=6 +k=1 +x_0=2500000 +y_0=0 +ellps=bessel +datum=potsdam +units=m +no_defs |

|   |      |      |      |                    |                                |
|---|------|------|------|--------------------|--------------------------------|
| 5 | 3906 | EPSG | 3906 | GEOGCS["MGI 190... | +proj=longlat +ellps=bessel... |
| 6 | 4001 | EPSG | 4001 | GEOGCS["Unknow...  | +proj=longlat +ellps=airy +... |
| 7 | 4002 | EPSG | 4002 | GEOGCS["Unknow...  | +proj=longlat +a=6377340....   |
| 8 | 4003 | EPSG | 4003 | GEOGCS["Unknow...  | +proj=longlat +ellps=aust_S... |



# Geometrietypen

- POINT, LINESTRING, POLYGON
- MULTIPOINT, MULTILINESTRING, MULTIPOLYGON
- GEOMETRYCOLLECTION
- CIRCULARSTRING, COMPOUNDCURVE, CURVEPOLYGON, MULTICURVE, MULTISURFACE
- GEOGRAPHY (ab 1.5)
- ab 2.0: TIN, POLYHEDRALSURFACE, TRIANGLE
- Ab 2.0: Raster
- Ab 2.0: TopoGeometry



# WKT Repräsentation

`POINT(0 0)`

`POINT(0 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 1,1 2),(2 3,3 2,5 4))`

`GEOMETRYCOLLECTION(POINT(2 3),LINESTRING(2 3,3 4))`



# Die erste Tabelle



# Tabelle mit Punktobjekten

```
CREATE TABLE poi (gid  
serial, name varchar);
```

```
SELECT AddGeometryColumn(  
'public' , 'poi' ,  
'the_geom' , 31466 ,  
'POINT' , 2  
);
```



# ST\_GeomFromText

```
INSERT INTO poi
  (name , the_geom)
VALUES (
  'Rathaus' ,
  ST_GeomFromText(
    'POINT(2568793 5631376)' ,
    31466
  )
);
```





# Name

ST\_GeomFromText — Return a specified ST\_Geometry value from Well-Known Text representation (WKT).

## Synopsis

geometry **ST\_GeomFromText**(text *WKT*);

geometry **ST\_GeomFromText**(text *WKT*, integer *srid*);

## Description

Constructs a PostGIS ST\_Geometry object from the OGC Well-Known text representation.



There are 2 variants of ST\_GeomFromText function, the first takes no SRID and returns a geometry with no defined spatial reference system. The second takes a spatial reference id as the second argument and returns an ST\_Geometry that includes this srid as part of its meta-data. The srid must be defined in the spatial\_ref\_sys table.

- ✓ This method implements the [OpenGIS Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2 - option SRID is from the conformance suite.
- ✓ This method implements the SQL/MM specification. SQL-MM 3: 5.1.40
- ✓ This method supports Circular Strings and Curves

## Examples

```
SELECT ST_GeomFromText('LINESTRING(-71.160281 42.258729,-71.160837 42.259113,-71.161144 42.25932)');
SELECT ST_GeomFromText('LINESTRING(-71.160281 42.258729,-71.160837 42.259113,-71.161144 42.25932)',4269);

SELECT ST_GeomFromText('CIRCULARSTRING(220268 150415,220227 150505,220227 150406)');
```

## See Also

[ST\\_GeomFromEWKT](#), [ST\\_GeomFromWKB](#), [ST\\_SRID](#)

[Prev](#)  
[ST\\_GMLToSQL](#)

[Up](#)  
[Home](#)

[Next](#)  
[ST\\_GeomFromWKB](#)



# ST\_MakePoint

```
INSERT INTO poi
  (name , the_geom)
VALUES (
  'Schule',
  ST_SetSRID(
    ST_MakePOINT(2568833.6,5631230.1),
    31466
  )
);
```



# ST\_POINT

```
INSERT INTO poi
  (name , the_geom)
VALUES (
  'Museum',
  ST_SetSRID(
    ST_POINT(2569104.4 , 5631326.4) ,
    31466
  )
);
```





# WKB und WKT

WKB – Well Known Binary

WKT – Well Known Text

```
SELECT the_geom, astext(the_geom) from poi limit 1;
```

the\_geom

-----

0101000020EA7A0000000000802C99434100000000647B5541

astext

-----

POINT(2568793 5631376)



# ST\_AsEWKT

```
SELECT ST_AsText(the_geom), ST_AsEWKT(the_geom)
FROM poi limit 1;
```

```
st_astext
```

```
-----
```

```
POINT(2568793 5631376)
```

```
st_asewkt
```

```
-----
```

```
SRID=31466;POINT(2568793 5631376)
```



# LINESTRING

```
CREATE TABLE leitung (gid serial, name varchar);
```

```
SELECT AddGeometryColumn( 'public' , 'leitung' ,  
'the_geom' , 31466 , 'LINESTRING' , 2);
```

```
INSERT INTO leitung (name , the_geom) VALUES  
( 'Wasserleitung',  
GeometryFromText( 'LINESTRING(2568996.2 5631464 ,  
2568849 5631296)', 31466));
```



# Länge ermitteln mit ST\_Length

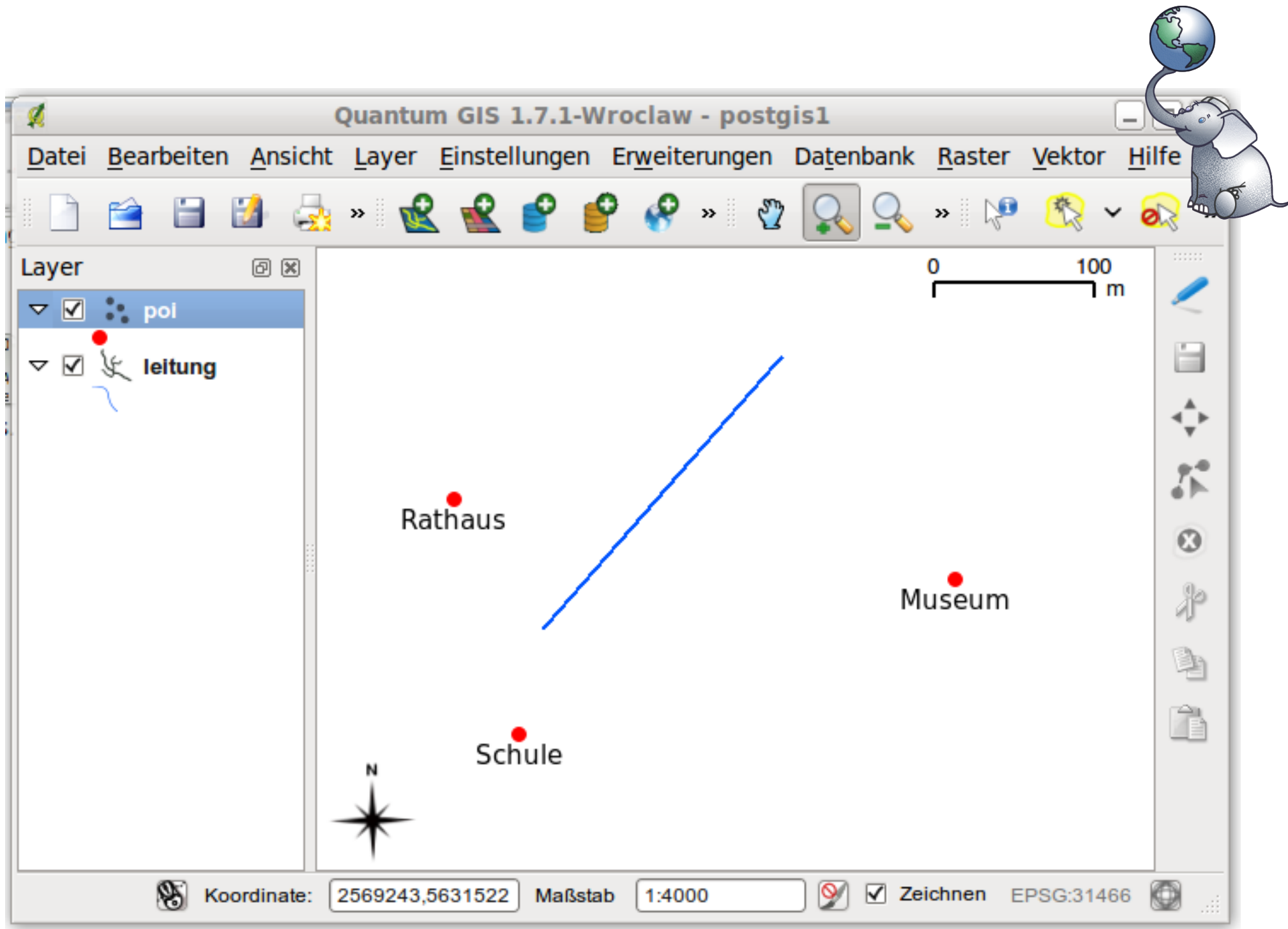
```
SELECT name ,  
       ST_Length(the_geom)  
FROM leitung;
```

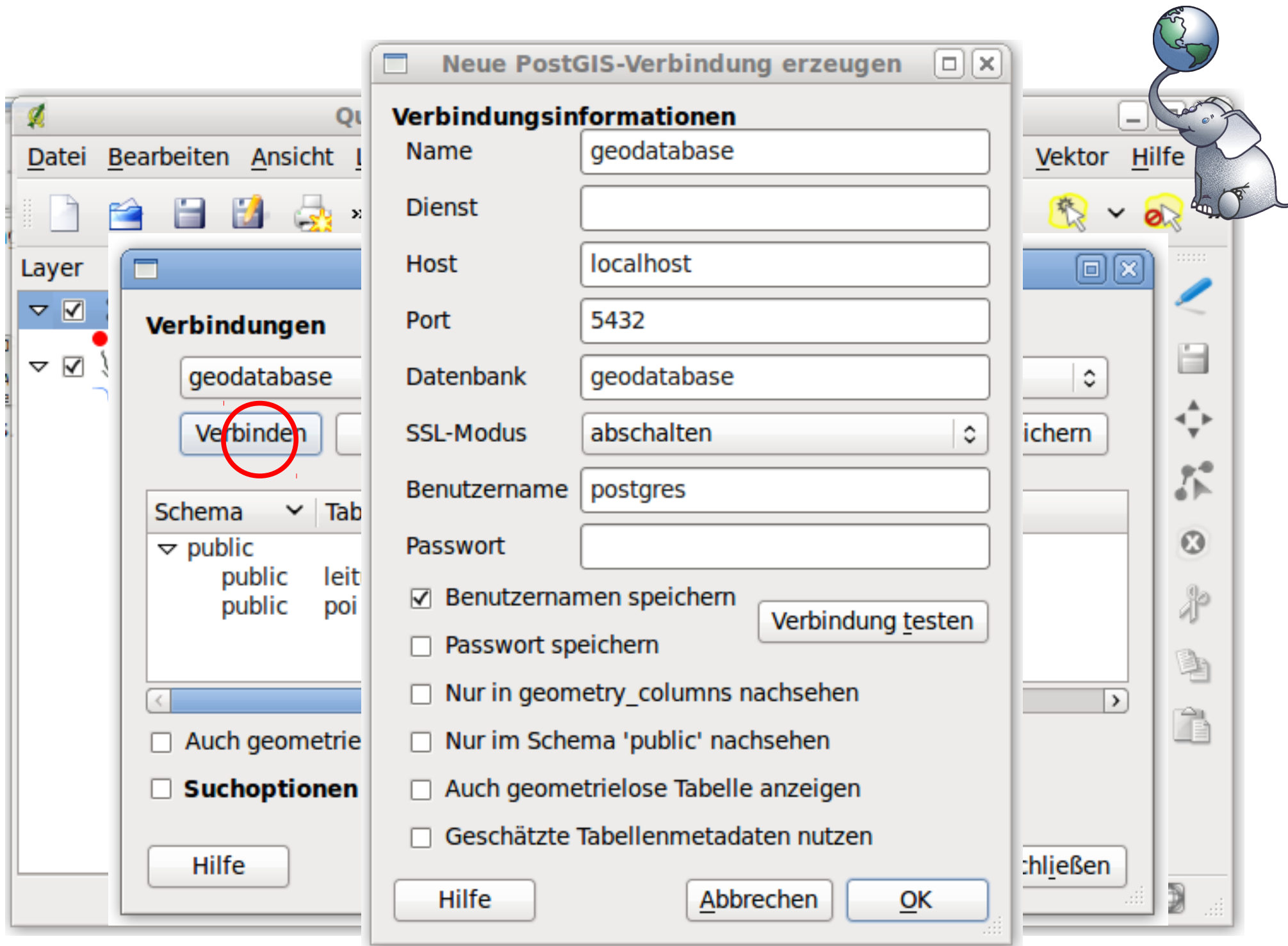
| name          | st_length        |
|---------------|------------------|
| -----+-----   |                  |
| Wasserleitung | 223.364813701834 |



# Datenvisualisierung

- Quantum GIS
- GvSIG
- uDig
- Jump
- SAGA
- Spatial Commander
- UMN MapServer
- GeoServer
- Deegree
- MapInfo 10+
- AutoCAD
- ArcGIS über SDE
- ...







# QGIS PostGIS Feature

- Visualisierung
- Abfragen über den Abfragemanager
- Import von Shape nach PostgreSQL über Plugin Spit oder PostGIS Manager
- Digitalisierung
- Offline Digitalisierung
- 3D Visualisierung über Plugin
- PostGIS Raster Plugin



# Datenimport

- shp2pgsql
- shp2pgsql-gui
- ogr2ogr (GDAL)
- Quantum GIS Spit Plugin
- osm2pgsql, osmosis, Imposm
- FME



# shp2pgsql

```
shp2pgsql -I -s 4326 -W LATIN1  
countries.shp laender > laender.sql
```

-I     Erstellt einen Geometrie-Index  
-s     <epsgcode> SRID wird gesetzt  
-W     <encoding>   Encoding



# shp2pgsql-gui

Shape File to PostGIS Importer

PostGIS Connection

Username: postgres

Password: .....

Server Host: localhost 5441

Database: postgis20\_sampler

Test Connection... Connection succeeded.

Shape File

Add File

| Shapefile                                  | Schema | Table         | Geometry Column | SRID | Mode   | Rm                       |
|--------------------------------------------|--------|---------------|-----------------|------|--------|--------------------------|
| C:\projects\postgis\data\world_borders.shp | public | world_borders | geom            | 4326 | Create | <input type="checkbox"/> |
| C:\projects\postgis\data\place.shp         | public | place         | geom            | 4326 | Create | <input type="checkbox"/> |

Options... Import About Cancel

Import Log

connecting to postgis20\_sampler  
Connection succeeded.  
pgui\_action\_open\_file\_dialog called.  
pgui\_action\_open\_file\_dialog called.



# ogr2ogr

```
ogr2ogr -f PostgreSQL PG:"host=localhost  
dbname=geodatabase user=postres password=xxx"  
poi.shp -nln poi -a_srs EPSG:31466
```

```
ogr2ogr --formats
```

```
-f   Ausgabeformat
```

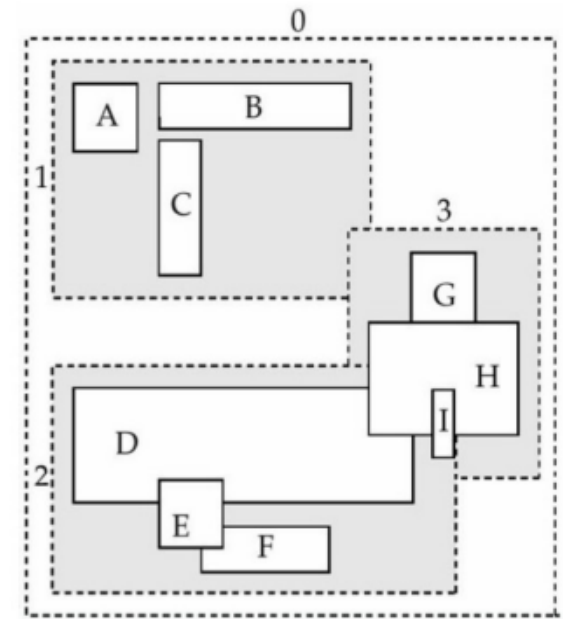
```
-nln <tabellenname> gewünschter Tabellenname
```

```
-a_srs EPSG:4326 Angabe des Referenzsystems
```



# GIST Index

- Generalized Search Tree
- Schnellere räumliche Abfragen
- Nutzt BBOX



```
CREATE INDEX gix_poi
ON poi
USING GIST ( the_geom
GIST_GEOMETRY_OPS );
```

# Räumliche Funktionen in PostGIS



- Generierung, Analyse, Manipulation via SQL
- Mehr als 300 räumliche Funktionen
- Operatoren (z.B. &&)
- OGC SFSQL (konform ab Version 0.9, 2005)
- ISO Spezifikation SQL/MM Teil 3
- Eigene PostGIS Funktionen



# Eine Auswahl

- ST\_EXTENT(geometry)
- ST\_Touches(geometry,geometry)
- ST\_Intersects(geometry,geometry)
- ST\_Overlaps(geometry,geometry)
- ST\_Union(geometry,geometry)
- ST\_ExteriorRing(polygon)
- ST\_Centroid(geometry)
- ST\_IsValid(geometry)

<http://postgis.org/documentation/>



# **Leitungsverlegung benötigt eine 20 m breite Baustelle**



# Puffern mit ST\_Buffer

```
Create View st_buffer_10 AS  
SELECT oid, gid,  
       ST_Buffer(the_geom, 10)  
       AS the_geom  
FROM leitung;
```

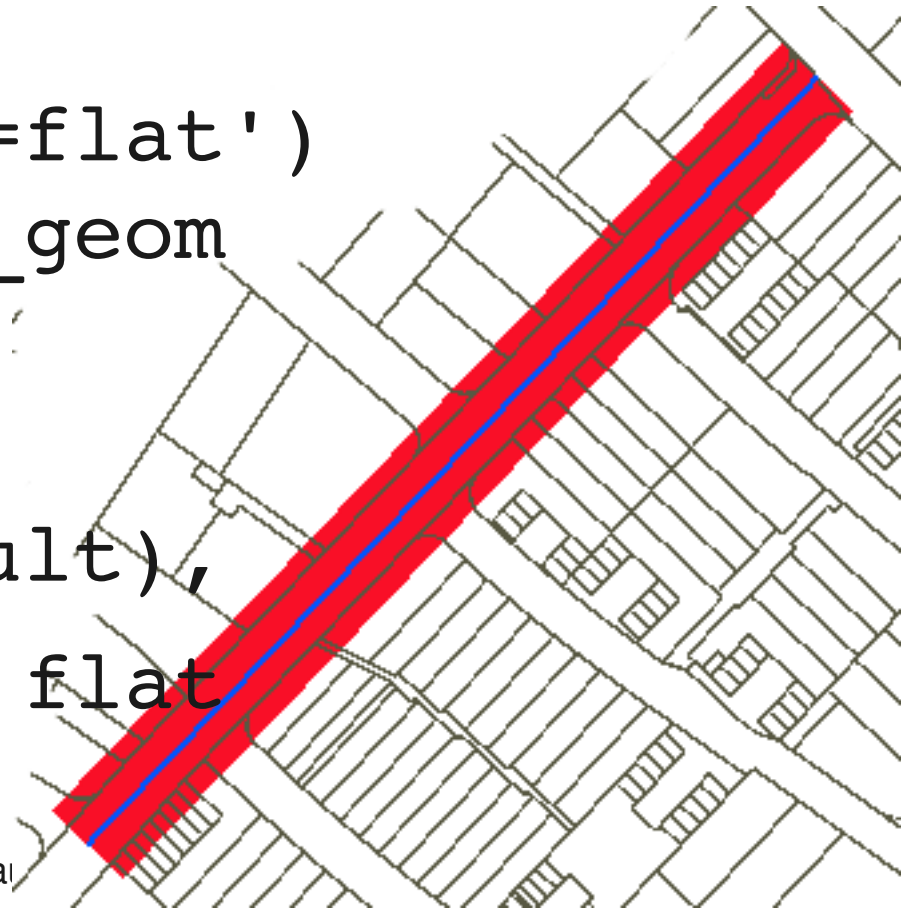




# ST\_Buffer mit endcap=flat

```
Create View st_buffer_10 AS
SELECT oid, gid,
       ST_Buffer(the_geom,
                 10 ,
                 'endcap=flat')
       AS the_geom
FROM leitung;
```

endcap – round (default),  
square oder flat





# Wie groß ist die Fläche?



# Fläche berechnen mit ST\_Area

```
SELECT ST_Area(  
    ST_Buffer(the_geom,  
              10 ,  
              'endcap=flat')  
    ) AS flaeche  
FROM leitung;
```

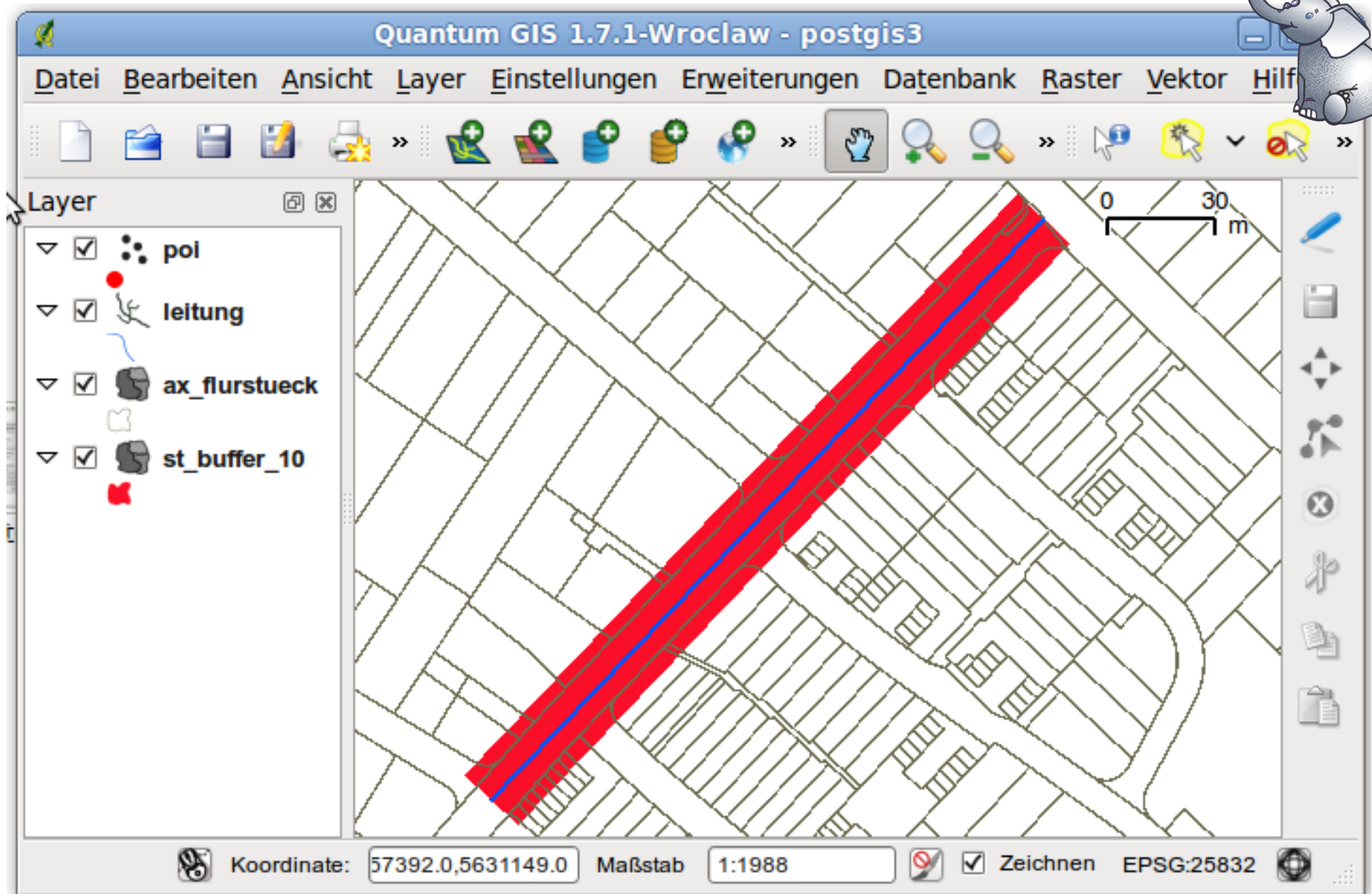
flaeche

-----

4467.29627418518



# Welche Flurstücke sind betroffen?





# ST\_Intersect

```
SELECT
```

```
flur
```

```
FROM
```

```
WHER
```

```
ST_I
```

**FEHLER**

ung

```
    ST_Buffer(the_geom,10 , 'en  
dcap=flat' ),  
    wkb_geometry);
```



**FEHLER: Operation on two geometries with different SRIDs**

**KONTEXT: SQL-Funktion  
»st\_intersects« Anweisung 1**



# ST\_SRID

```
SELECT ST_SRID(wkb_geometry)
from ax_flurstueck limit 1;
```

st\_srid

-----

25832



# ST\_Transform

```
SELECT flurstueckskennzeichen
FROM ax_flurstueck, leitung
WHERE
  ST_Intersects(
    ST_Buffer(
      ST_Transform(the_geom, 25832)
      , 10 , 'endcap=flat' ),
    wkb_geometry
  ) ;
```



Quantum GIS 1.7.1-Wroclaw - postgis

Datei Bearbeiten Ansicht Layer Einstellungen Erweiterungen Datenbank Raster Vektor Hilfe

Layer

| srid  | auth_name | auth_srid | srttext        | proj4text                                                                                                                                         |
|-------|-----------|-----------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 25832 | EPSG      | 25832     | PROJCS["ET...] | +proj=utm +zone=32 +ellps=GRS80 +units=m +no_defs                                                                                                 |
| 31466 | EPSG      | 31466     | PROJCS["DH...] | +proj=tmerc +lat_0=0 +lon_0=6 +k=1 +x_0=2500000 +v_0=0 +ellps=bessel +datum=notsdam +units=m +no_defs<br>+towgs84=582,105,414,1.04,0.35,-3.08,8.3 |

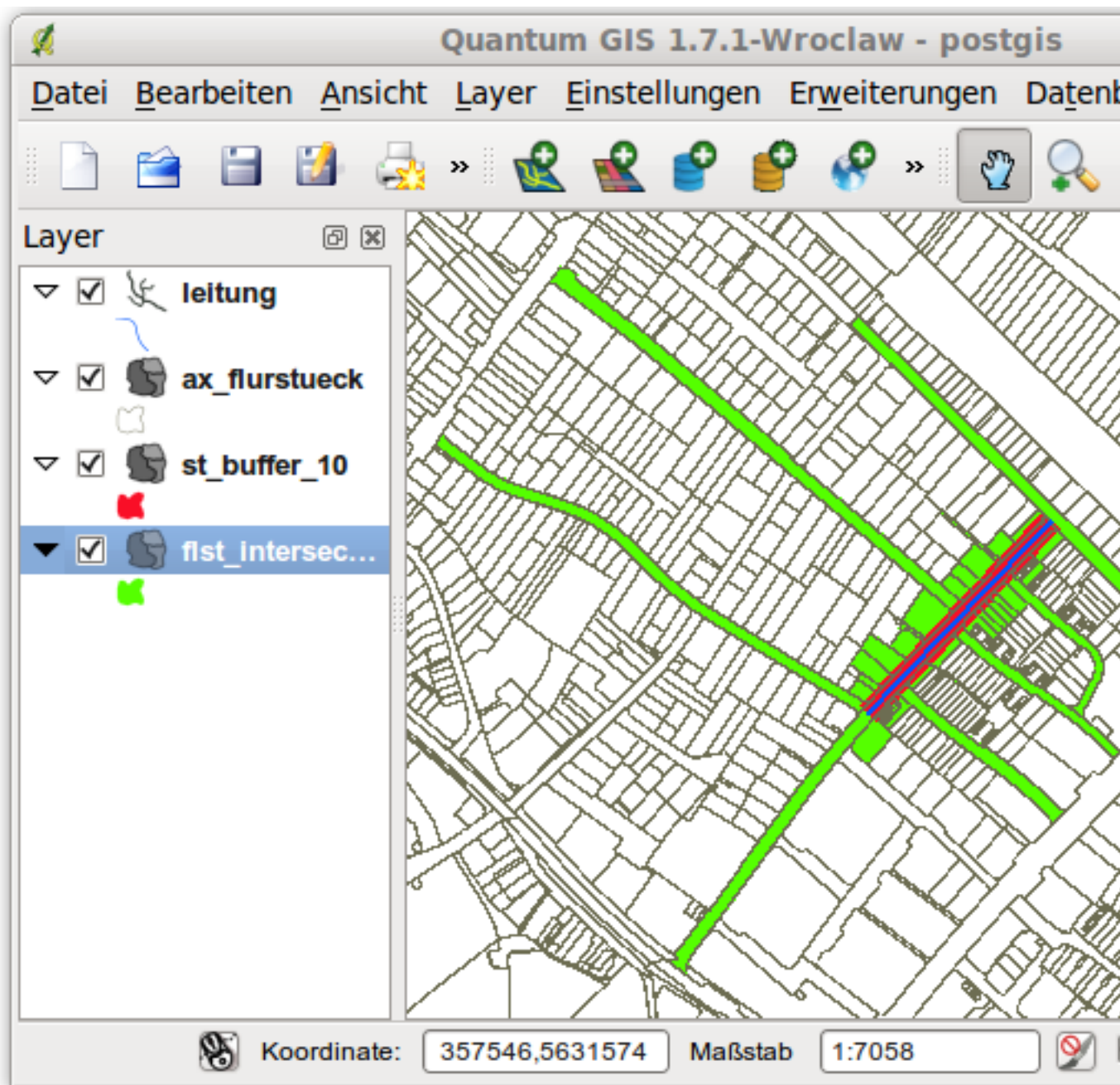
st\_buffer\_10

flst\_intersec...

?

# Transformationsparameter prüfen!

Koordinate: 357720,5631386 Maßstab 1:7058 Zeichnen EPSG:25832



flurstueckskennzeichen

-----  
05469701600171  
05469701600186  
05469901701661  
05469901703924  
05469901701658  
05469901704653  
05469901701660  
05469901701659  
05469901701663  
05469901701662  
05469701600199  
05469701600189  
05469700700359  
05469701600241  
05469701600242  
05469901701664  
05469901701666

...  
(42 Zeilen)



# ST\_Distance

```
SELECT p.name,  
ST_Distance(p.the_geom, ST_Buffer(l.the_geom,  
10,'endcap=flat')) AS entfernung  
FROM poi p, leitung l;
```

| name        | entfernung       |
|-------------|------------------|
| -----+----- |                  |
| Rathaus     | 84.8403629422498 |
| Schule      | 63.5849795875077 |
| Museum      | 162.06076177808  |



# Auf geht's!

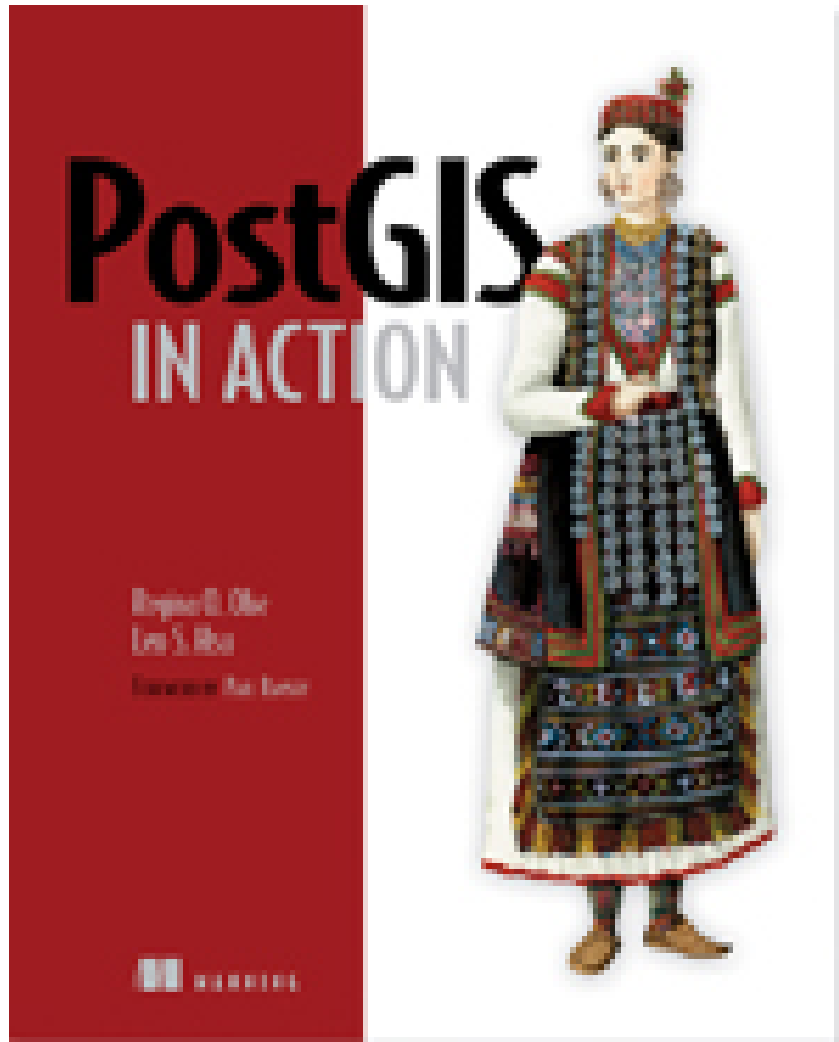


# PostGIS Dokumentation

- sehr gute und ausführliche Dokumentation mit SQL-Beispielen und Grafiken
- HTML oder PDF-Version
- <http://postgis.org/documentation/>
- **PostGIS Wiki** (Tutorials, Präsentationen, Videos)



# PostGIS in Action



<http://www.manning.com/obe/>

Regina O. Obe und Leo S. Hsu

Vorwort Paul Ramsey

April 2011, 520 Seiten

ISBN 9781935182269

# PostGIS auf



- <http://live.osgeo.org>
- GIS Software Kollektion
- > 40 GeoSpatial Open Source Anwendungen
- Beispieldaten
- Dokumentationen
- basiert auf Xubuntu
- bootfähige DVD, USB-Stick oder virtuelle Maschine
- iso zum Download unter <http://live.osgeo.org/de/download.html>



# Vielen Dank !

Fragen?

**Feedback**

<https://www.postgresql.eu/events/feedback/pgconfde2011/>

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