GeoPackage, das Shapefile der Zukunft

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About Sourcepole

- **QGIS**
  - 4 C++ core devs
  - Project Steering Commitee
  - QGIS Server, Printing, Plugins, …
  - QGIS Enterprise
  - QGISCloud

- **OGR / GDAL**
  - Interlis drivers
  - Schema support for PostGIS driver

- **Web-GIS and more**
  - Contributions to PostGIS, MapServer, Openlayers, Mapfish…

GeoPackage

- **OGC Standard published 2014**

- **"An open standard non-proprietary platform-independent GeoPackage container for distribution and direct use of all kinds of geospatial data"**

- **Vector and Raster data stored in SQLite file DB**

SQLite

- **Self-contained, single-file, cross-platform, serverless, transactional, open source RDBMS container**

- **Well-proven and widely used**
  - Version 1.0: 17.8.2000
  - Android, Mozilla, Apple, Adobe, Skype, …

- **Embedded database**
  - File based, no server process
  - C programming language
  - Access via library (<275KiB)
  - SQL API
  - Dynamic type system

SQLite

- **Good SQL-92 compatibilty**
  - Joins, views, triggers
  - Transactions

- **Locking:**
  - Write ahead logging (WAL) introduced in 3.7
  - Before that write access locked database also for reading

- **GeoPackage based on SQLite 3**

- **Maximum size of a GeoPackage file ~140TB**

GeoPackage introduction

- **Spatial extension to SQLite embedded database**
    - Like PostGIS extends PostgreSQL

- **Spatial data types & functions**

- **Raster and tile pyramid data sets**

GeoPackage data

- **OGC Simple Feature types (WKT, WKB)**
  - Point, MultiPoint
  - LineString, MultiLineString
  - Polygon, MultiPolygon
  - XY, XYZ, XYM, XYZM

- **WKB based BLOB**

- **One geometry column per table**

- **R*Tree index tables**

- **Raster tile sets (PNG, JPEG)**

GeoPackage functions

> **Minimal available functions**
>> ST_SRID, ST_GeometryType, GPKG_IsAssignable, ST_Is3D, ST_IsMeasured,
>> ST_MinX, ST_MaX, ... ST_MaxZ, ST_MaxM

> **Geometry access**
>> ST_GeomFromText, ...
>> ST_AsText, ST_AsBinary, ST_AsGML

> **Queries and operations**
>> ST_Intersects, ST_Contains, ST_Touches, ...
>> ST_Buffer, ST_Intersection, ST_Union, ...
>> ST_LocateAlong, ST_LocateBetween
>> ...

```
SELECT t2.Name, t2.Peoples,
   ST_Distance(t1.geom, t2.geom) AS Distance
   FROM Towns AS t1, Towns AS t2
   WHERE t1.Name = 'Firenze' AND
   ST_Distance(t1.geom, t2.geom) < 10000;
```

Sidenote: Additional SpatiaLite features

- **CLI and GUI-Tools**

- **Import and export**
  - Shapefiles
  - DXF

- **Use of external files as virtual tables**
  - Shapefiles (+DBF)
  - CSV/TxtTab
  - XLS
  - OGR datasources

- **Library for networks and routing**

- **Raster data library, WFS Client, ...**

Raster

> **Multiple tile set tables**

> **Extension of MBTiles specification**
> > Widely used for OSM tiles download & offline storage

```
sqlite> SELECT * FROM tiles;

zoom_level | tile_column | tile_row | tile_data

5          | 13          | 23       | [PNG data]

5          | 13          | 24       | [PNG data]

5          | 14          | 23       | [PNG data]

5          | 14          | 24       | [PNG data]

5          | 15          | 25       | [PNG data]
```

Metadata

- **gpkg_contents**: list of geospatial contents

- **gpkg_data_columns**: descriptive information about columns in user vector feature and tile matrix data tables

- **gpkg_geometry_columns**: vector data

- **gpkg_tile_matrix_metadata**: raster data

- **gpkg_spatial_ref_sys**: coordinate reference system definitions

- **gpkg_metadata**: XML metadata

- **gpkg_metadata_reference**: row level metadata

Metadata (Extensions)

- **gpkg_extension**: supported functionality

- **gpkg_rtree_index**: available index tables

- **gpkg_geometry_type_trigger**: type checks

- More formats: WEBP, TIFF, NITF

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Useful Geopackage extensions

- **Non-Linear Geometry Types**

- **Aspatial data - Tables/views without a geometry column**

- **Point cloud data**

QGIS „all-in-one" extension

> Store QGIS projects in GPKG-File

> Includes graphics for styling (e.g. SVG markers) and print layouts (e.g. JPEG logos)

> Implemented as QGIS plugin

> Exchange data including map views!

GeoPackage Advantages

> **Data exchange *and* direct use**

> **Single file**

> **Vector *and* raster**

> **From mobile to server**

> **Custom extensions mechanism**

> **Promote GeoPackage**
>> Provide GeoPackage
>> Ask for GeoPackage

> **Open Data!**

Links

- **GeoPackage:**
  - http://www.geopackage.org/

- **SQLite:**
  - http://www.sqlite.org/

- **Extensions:**
  - http://www.geopackage.org/spec/*extension_geometry_types
  - http://www.gdal.org/geopackage_aspatial.html
  - http://www.slideshare.net/mpgx/geo-package-pointclouds

Danke!

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