Open Source components for Service-Oriented Mapping applications

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Outline

- Four-Tier-Architecture of Client-Server-Applications
- Software solutions for each tier
- Tools and approaches to classify their market relevance
- Summary
Four-Tier-Architecture
Architecture

**IP address**

- **Client**
  - "User Agent" (HTTP-Client)
  - Presentation Tier
  - Local System (GIS)

- **Data preparation, analysis**

**Internet**

**IP address / Server Name / Host name**

- **DNS Server**
- **HTTP Server**
- **Application Server**
- **DBMS Server**

- **Communication tier, Web Tier**
- **App Tier, Business Logic Tier**
- **Data Tier**

- **Document root Static resources**
- **PNG, JPG, ... XML / SVG**
- **CGI protocol**
- **SQL**

**HTTP**

80

**HTTP-Client**

80
Presentation Tier
Presentation Tier: Desktop GIS

The Most Epic GIS Software Battle in GIS History


Presentation Tier: JS General Purpose Libraries

![Bar chart showing usage percentages of various JS libraries](attachment:chart.png)

- jQuery: 73.9% usage
- Bootstrap: 25.1% usage
- Modernizr: 11.1% usage
- Underscore: 4.1% usage
- MooTools: 2.1% usage
- ASP.NET Ajax: 2.1% usage
- Moment.js: 1.4% usage
- Popper: 1.3% usage
- Prototype: 1.3% usage
- Backbone: 1.2% usage
- Script.aculo.us: 0.8% usage
- GSAP: 0.5% usage
- Angular: 0.4% usage
- YUI Library: 0.3% usage
- Polyfill.io: 0.3% usage
- React: 0.3% usage

Percentages as of [2019-07-08].

[https://w3techs.com/technologies/overview/javascript_library/all](https://w3techs.com/technologies/overview/javascript_library/all)
Presentation Tier: Market Share


Presentation Tier: OS Mapping-Libraries

Presentation Tier: OS Mapping-Libraries – My impression

You can achieve a lot using Leaflet.

For sophisticated application use Openlayers
Presentation Tier: Operating System Market Share Worldwide

Communication Tier
Communication Tier: Products and Tools

- HTTP Servers
  - Apache HTTP Server (open source)
  - Nginx (open source)
  - Internet Information Server® (Microsoft)

http://news.netcraft.com/archives/category/web-server-survey/, based on > 1,333,421,275 sites
Communication Tier: FTP

• Tools for FTP based transfer
  – FileZilla (Client and Server, open source)
  – ...

Application Tier
Application Tier: Application Server

- In Geo-IT: Applikation servers implement services based on the recommendations of the Open Geospatial Consortium (OGC)
  - Web Map Service
  - Web Feature Service
  - Web Coverage Service
  - Catalogue Services

Geo-Applikationsserver

- Closed Source Solutions
- Open Source Solutions

https://trends.google.com/trends/explore?q=ArcGIS,GeoServer
Application Tier: Application Server: Open Source

• GeoServer
  – „an open source software server written in Java that allows users to share and edit geospatial data. Designed for interoperability, it publishes data from any major spatial data source using open standards.“ (http://geoserver.org/display/GEOSS/Welcome)

• MapServer (formerly called UMN MapServer, http://www.osgeo.org/mapserver)
  – Written in C, with PHP wrapper
  – WMS, WFS, Strong support of Shape files
  – Somehow old-fashioned, configuration by text file („map file“)

• Deegree Server
  – „deegree is a comprehensive geospatial software package with implementations of OGC Web Services like WMS and WFS, a geoportal, a desktop application, security mechanisms, and various tools for geospatial data processing and management. It is open source (LGPL), Java, standards-compliant (OGC, ISO) and an OSGeo project.“ (http://www.deegree.org/
  – Needs Java, and some time for configuration

• QGIS Server

• MapGuide Open Source
  – „enables users to develop and deploy web mapping applications and geospatial web services.“ (http://www.osgeo.org/mapguide)
Application Tier: Application Server: Closed Source

- ArcGIS Server® http://enterprise.arcgis.com/de/server/latest/get-started/windows/what-is-arcgis-for-server-.htm
- GeoMedia WebMap® https://www.hexagongeospatial.com/products/power-portfolio/geomedia-webmap
Application Tier: Application Server: Portal Server

- Geonetwork OpenSource: a widely used catalog application to manage spatially referenced resources
  
  https://geonetwork-opensource.org/

- Geonode: for developing geospatial information systems (GIS) and for deploying spatial data infrastructures (SDI).
  
  https://geonode.org/

- pycsw
Libraries: Software using GDAL

- **3D DEM Viewer** from MS MacroSystem
- **Bluemapia**: Multi-Map (Google, Microsoft, Open Street Map, NOAA/BSB Charts, self-calibrated raster) location-based GPS app for Windows
- **Cadcorp SIS**: A Windows GIS with a GDAL and OGR plugins.
- **Cartographica**: Macintosh GIS package
- **CatchmentSIM**: A Windows terrain analysis model for hydrologic applications
- **Daylon Leveller**: A terrain/heightfield/bumpmap module
- **Demeter**: Another OpenGL based terrain engine somewhat similar to VTP.
- **Depiction**: Mapping, simulation and collaboration software.
- **Enfusion**: Analysis and visualization of time-varying spatial datasets integrated via true data fusion.
- **EOxServer**: OGC compliant server for Earth Observation (EO) data supporting WMS and WCS with EO application profiles.
- **ERDAS ER Viewer**: Image viewer for very large JPEG 2000 and ECW files. Can also read most other common file types
- **ESRI ArcGIS 9.2+**: A popular GIS platform.
- **Eternix Blaze**: Advanced geo-spatial visualization application and SDK
- **FalconView**: Windows based GIS platform with roots in military mission planning, now available as a free GIS visualization and analysis platform.
- **Feature Data Objects (FDO)**: Open source spatial data access libraries.
- **Fiona**: Fiona is OGR's neater API – sleek and elegant on the outside, indomitable power on the inside
- **flighttrack**: GPS track viewing and downloading software for Mac.
- **FME**: A GIS translator package includes a GDAL plugin.
- **Fortified GIS VantagePoint(TM)**: GIS desktop viewer and analysis tool
- **GdalToTiles**: C# Program (open source) for make image tiles for Google Earth with KML Superoverlay.
- **GenGIS**: Software for geospatial analysis of genetic data.
- **Geographic Imager**: DEM / aerial / satellite image processing GIS plug-in for Adobe Photoshop, by Avenza Systems
- **GeoView Pro**: IOS mobile mapping application
- **GeoDjango**: A framework for building geographic web applications.
- **GeoKettle**: An open source spatial ETL (Extract, Transform and Load) tool.
- **GeoMatrix Toolkit**, and **GeoPlayerPro** from GeoFusion: 3D visualization.
- **GeoServer**: An open source software server written in Java that allows users to share and edit geospatial data
- **Geoweb3d**: A 3D virtual globe that provides on-the-fly, game-quality visualization of GIS data.
- **GMT (Generic Mapping Tools)**: an open source collection of tools for processing and displaying xy and xyz datasets
- **Google Earth**: A 3D world viewer.
- **GPSeismic**: A suite of applications for seismic survey.
- **GRASS GIS**: A raster/vector open source GIS uses GDAL for raster/vector import and export (via r.in.gdal/r.out.gdal and v.in.ogr/v.out.ogr).
- **gstat**: a geostatistical modelling package.
- **gvSIG**: Desktop GIS Client.
- **HydroDaVE Explorer**: A web-enabled client that provides users an easy to use, secure, and reliable data management platform to efficiently
- **IDRISI**: A GIS and Image Processing Windows Desktop application. Uses GDAL for import/export/warp raster data.
- **ILWIS**: Remote Sensing and GIS Desktop Package.
- **Image I/O-Ext**: includes gdalframework, a framework leveraging on GDAL via SWIG's generated JAVA bindings to provide support for a range
- **IONIC Red Spider**: an OGC Web Services platform includes a GDAL plugin.
- **iShare**: Web data integration and publishing platform by Astun Technology.
Data Tier
Related Products and Tools: (O)RDBMS

- (O)(R)DBMS: (Object) (Relational) Database Management System
  - commercial products
    - Oracle,
    - SQLServer (Microsoft),
    - Informix, DB2 (IBM),
    - ...

  - free
    - PostGreSQL (PostGIS), fully conformant to OGC’s Simple Feature Specification – highly recommended
    - MySQL
    - SpatialLite
### Market share

#### 2008 (Closed Source)

<table>
<thead>
<tr>
<th>Database</th>
<th>Currently Deployed</th>
<th>Plan to Deploy Next Year</th>
<th>Plan to Deploy but Not in the Next Year</th>
<th>No Plans to Deploy</th>
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<tr>
<td>Oracle</td>
<td>70%</td>
<td>8%</td>
<td>9%</td>
<td>14%</td>
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<tr>
<td>SQL Server</td>
<td>68%</td>
<td>11%</td>
<td>6%</td>
<td>15%</td>
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<td>10%</td>
<td>28%</td>
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<tr>
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<td>39%</td>
<td>12%</td>
<td>11%</td>
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<tr>
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<td>18%</td>
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<td>14%</td>
<td>55%</td>
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<tr>
<td>Sybase ASE</td>
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<td>14%</td>
<td>14%</td>
<td>57%</td>
</tr>
<tr>
<td>Sybase IQ</td>
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<td>14%</td>
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<td>59%</td>
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<tr>
<td>Teradata</td>
<td>11%</td>
<td>15%</td>
<td>13%</td>
<td>61%</td>
</tr>
</tbody>
</table>

#### 2012 (FOSS)

- PostgreSQL 14%
- MariaDB 17%
- CouchDB 5%
- MongoDB 21%
- MySQL 43%


Trend of Relational DBMS Popularity

How Postgres and Open Source Are Disrupting The Market for Database Management Systems


<table>
<thead>
<tr>
<th>Rank</th>
<th>February 2018</th>
<th>January 2018</th>
<th>February 2017</th>
<th>DBMS</th>
<th>Datenbankmodell</th>
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<td>1.</td>
<td>1.</td>
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<td>Relational DBMS</td>
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<td>Relational DBMS</td>
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<td>11.</td>
<td>11.</td>
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<td>Suchmaschine</td>
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<td>7.</td>
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<td>Wide Column Store</td>
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<tr>
<td>18.</td>
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<tr>
<td>22.</td>
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<td>23.</td>
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<td>23.</td>
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<td>24.</td>
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<td>25.</td>
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<td>26.</td>
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<td>Microsoft Azure SQL Database</td>
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</tr>
</tbody>
</table>

The top 5 commercial systems, November 2017

<table>
<thead>
<tr>
<th>Rank</th>
<th>System</th>
<th>Score</th>
<th>Overall Rank</th>
</tr>
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<td>Oracle</td>
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<td>12.</td>
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The top 5 open source systems, November 2017

<table>
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</tr>
<tr>
<td>5.</td>
<td>Redis</td>
<td>121</td>
<td>9.</td>
</tr>
</tbody>
</table>
Popularity

Number of systems, July 2019

Popularity scores, July 2019

Die Daten liegen im ESRI-Shape-Format vor, eine freie GIS-Software zur Bearbeitung des Daten finden sie unter QuantumGIS (QGIS). Neben den Daten können sie in QGIS auch unsere WMS-Dienste einbinden.

Boundless announced its partnership with the United Nations (UN) to support its UN Open GIS Initiative, which aids UN operations around the world through open source geospatial software and services.

Geoportal des Bundes gewinnt Open Source Award

geo.admin.ch, das Geoportal des Bundes erhält eine Auszeichnung für den Einsatz von Open Source Software

Summary
• (Geospatial) Client Server Solutions consist of four tiers

• To fulfil your needs: Open Source resources are available for each tier.

• Communication Tier: high share of general purpose Open Source-Solutions

• Alternative solutions exist and need to be assessed
  – according your requirements
  – According to the support of open, acknowledged standards

• Tendency towards OS solutions, especially for public agencies

• Needed: Software + Services + Data
Literatur

• The Top 19 GIS Software. https://www.g2crowd.com/categories/gis#highest_rated [2018-11-22]
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Stuttgart University of Applied Sciences
franz-josef.behr@hft-stuttgart.de

http://georeferenced.files.wordpress.com/2014/03/openclo
se_flickr_leo_reynolds_cc.jpg