



# Open Source components for Service-Oriented Mapping applications

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15 July 2019, Tokyo, Japan



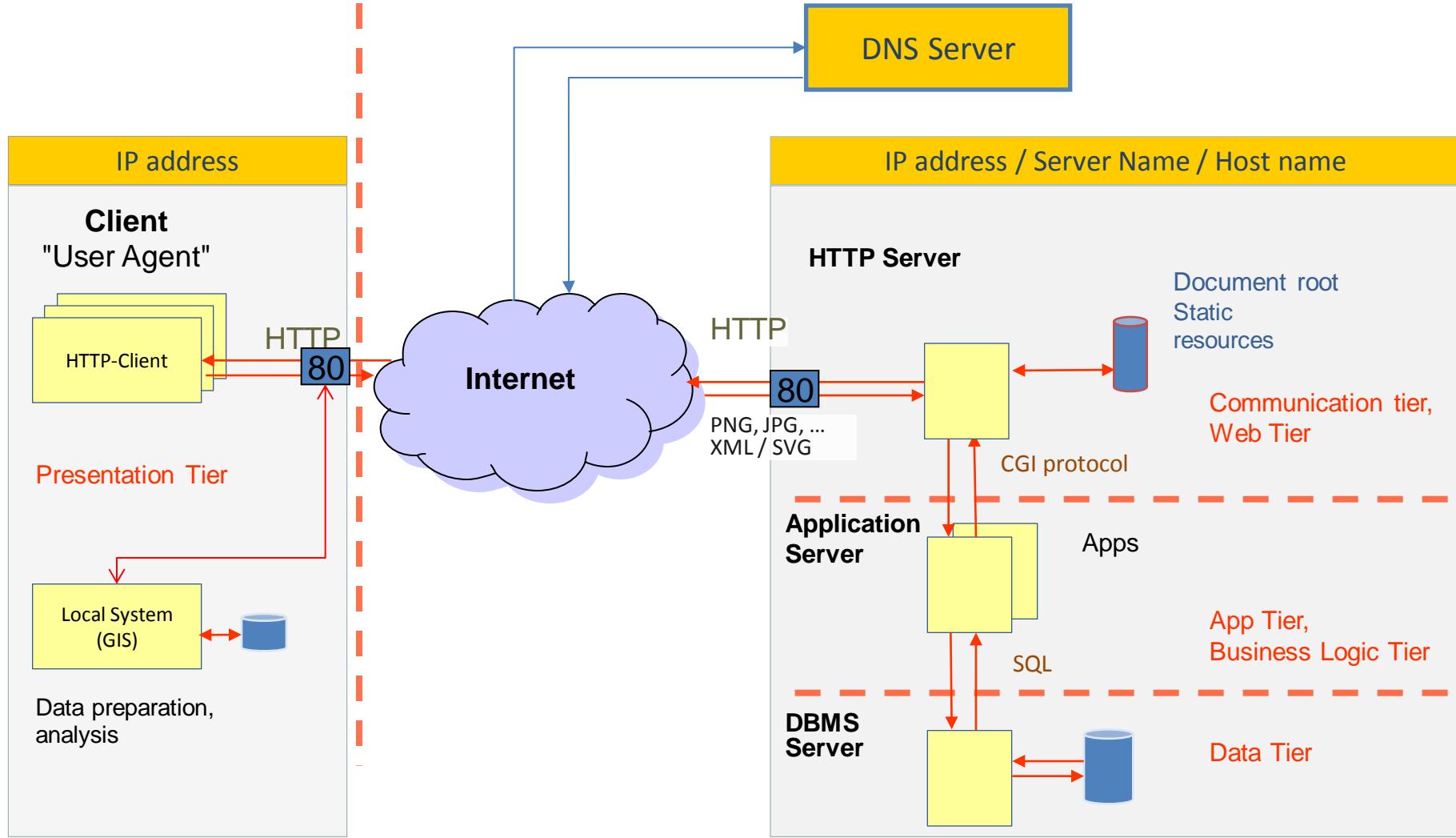
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# Outline

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

# **Four-Tier-Architecture**

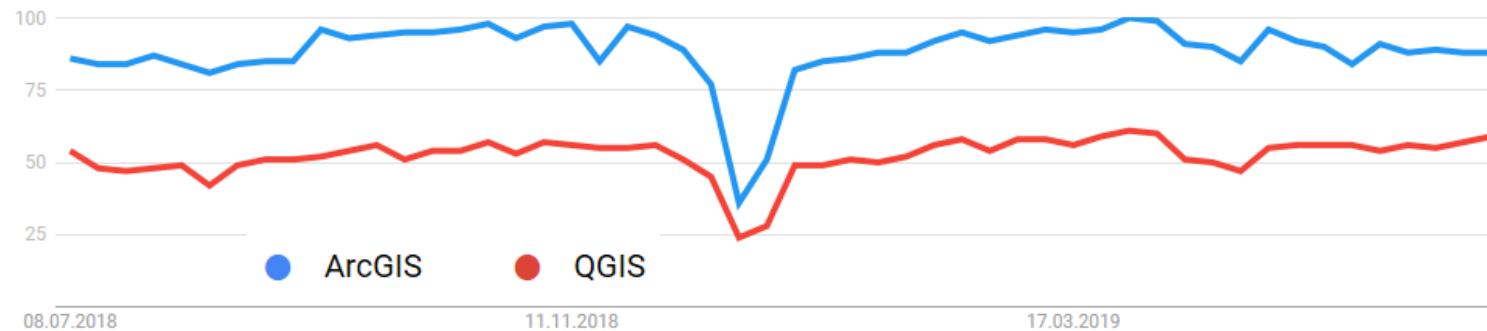
# Architecture



# **Presentation Tier**

# Presentation Tier: Desktop GIS

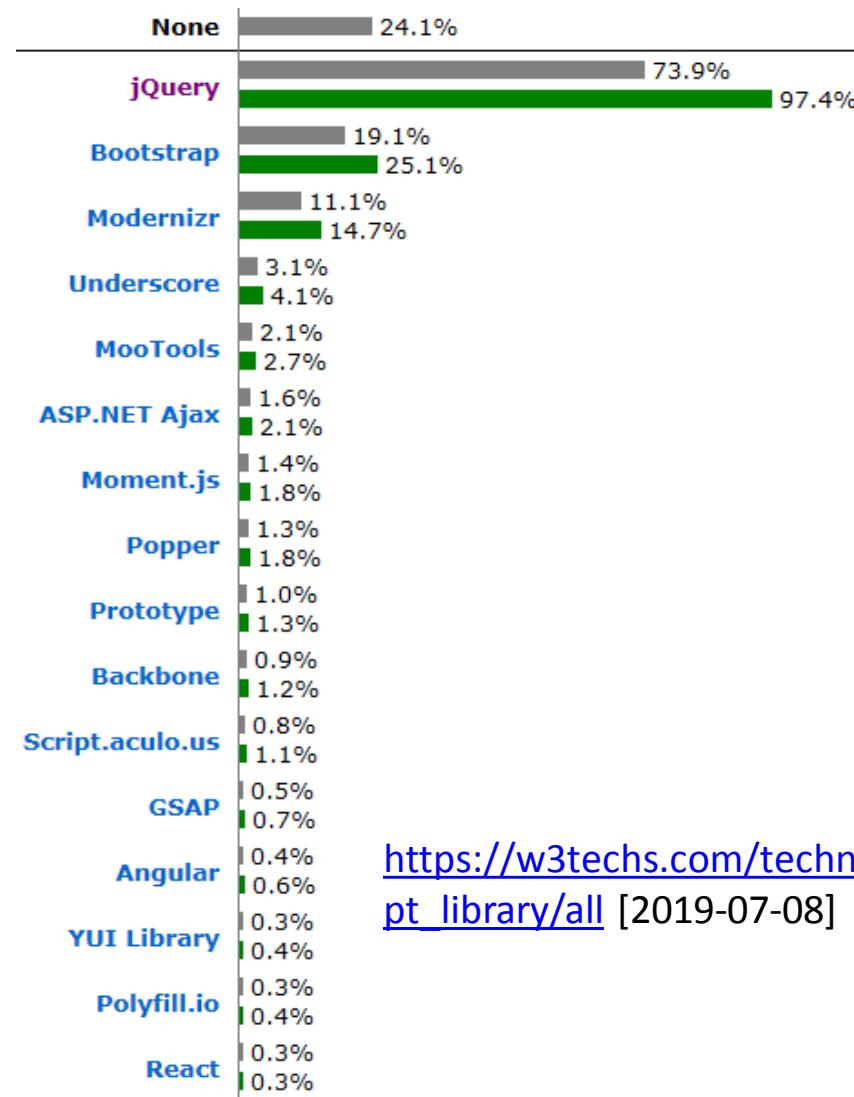
## The Most Epic GIS Software Battle in GIS History



<https://trends.google.com/trends/explore?q=ArcGIS,QGIS> [2019-07-08]

Source: 27 Differences Between ArcGIS and QGIS – The Most Epic GIS Software Battle in GIS History. <https://gisgeography.com/qgis-arcgis-differences/> [2019-07-15]

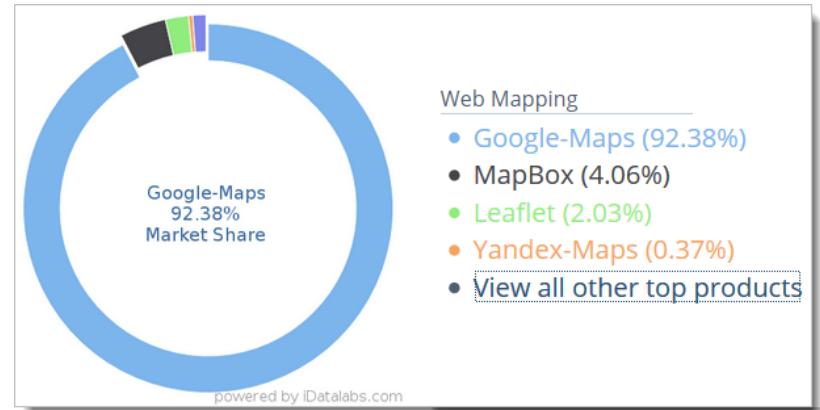
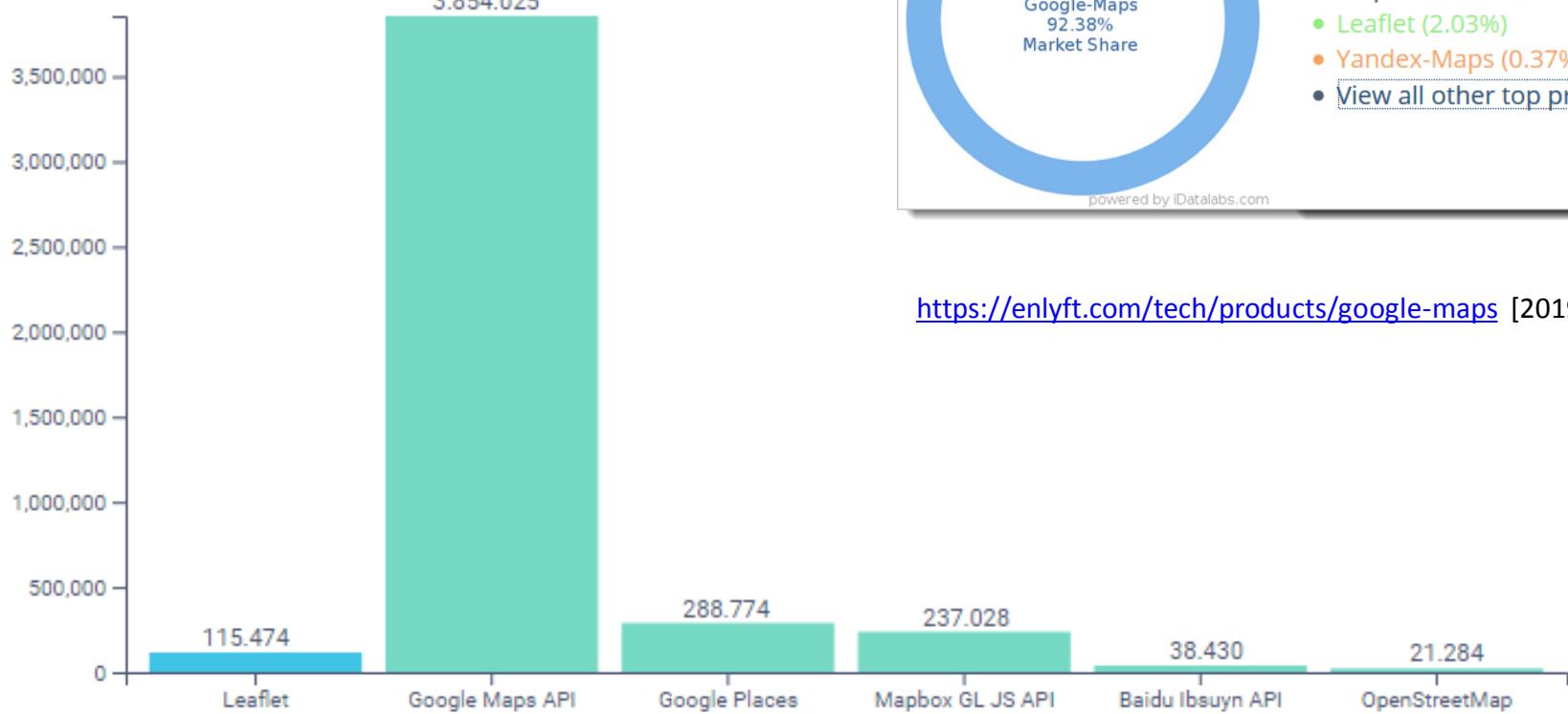
# Presentation Tier: JS General Purpose Libraries



[https://w3techs.com/technologies/overview/javascript\\_library/all](https://w3techs.com/technologies/overview/javascript_library/all) [2019-07-08]

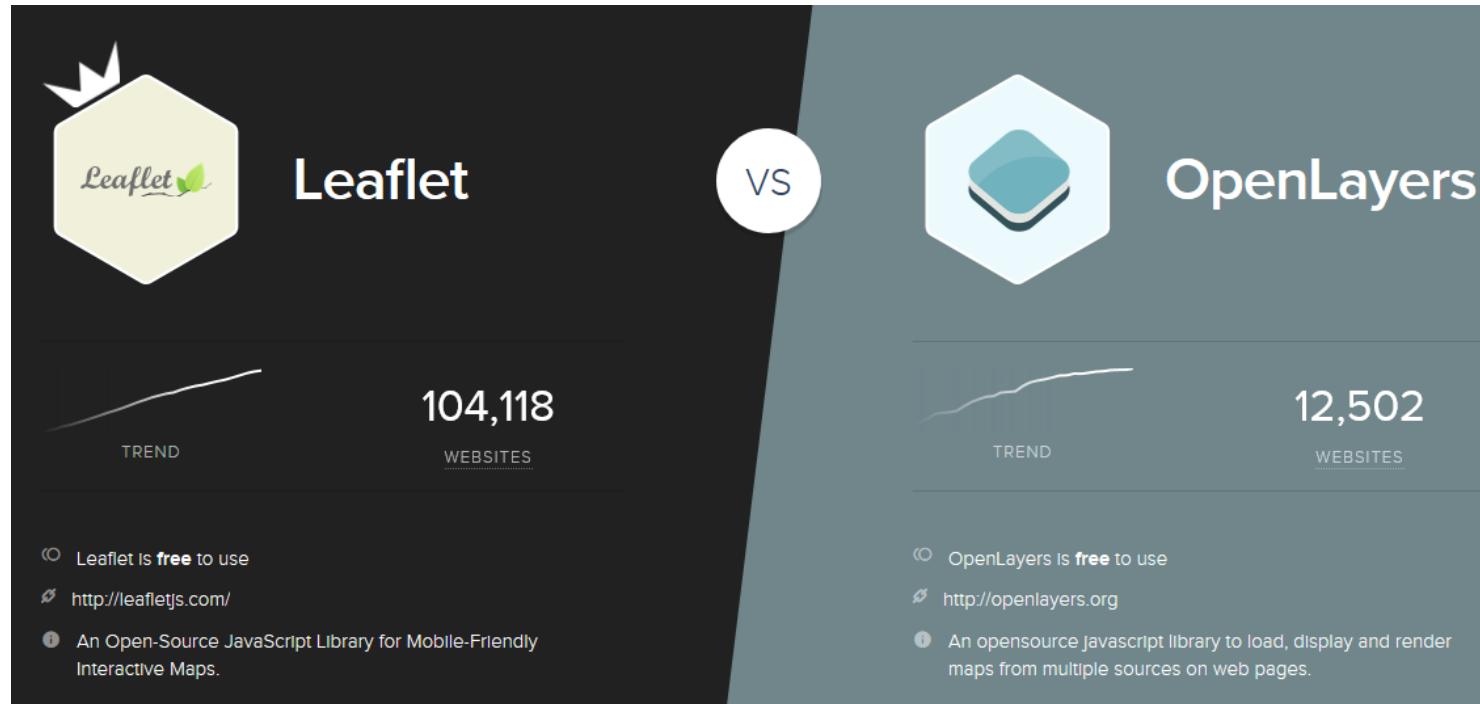
# Presentation Tier: Market Share

Open Source Software Components



<https://enlyft.com/tech/products/google-maps> [2019-07-15]

# Presentation Tier: OS Mapping-Libraries



<https://www.similartech.com/compare/leaflet-vs-openlayers> [2010-07-08]

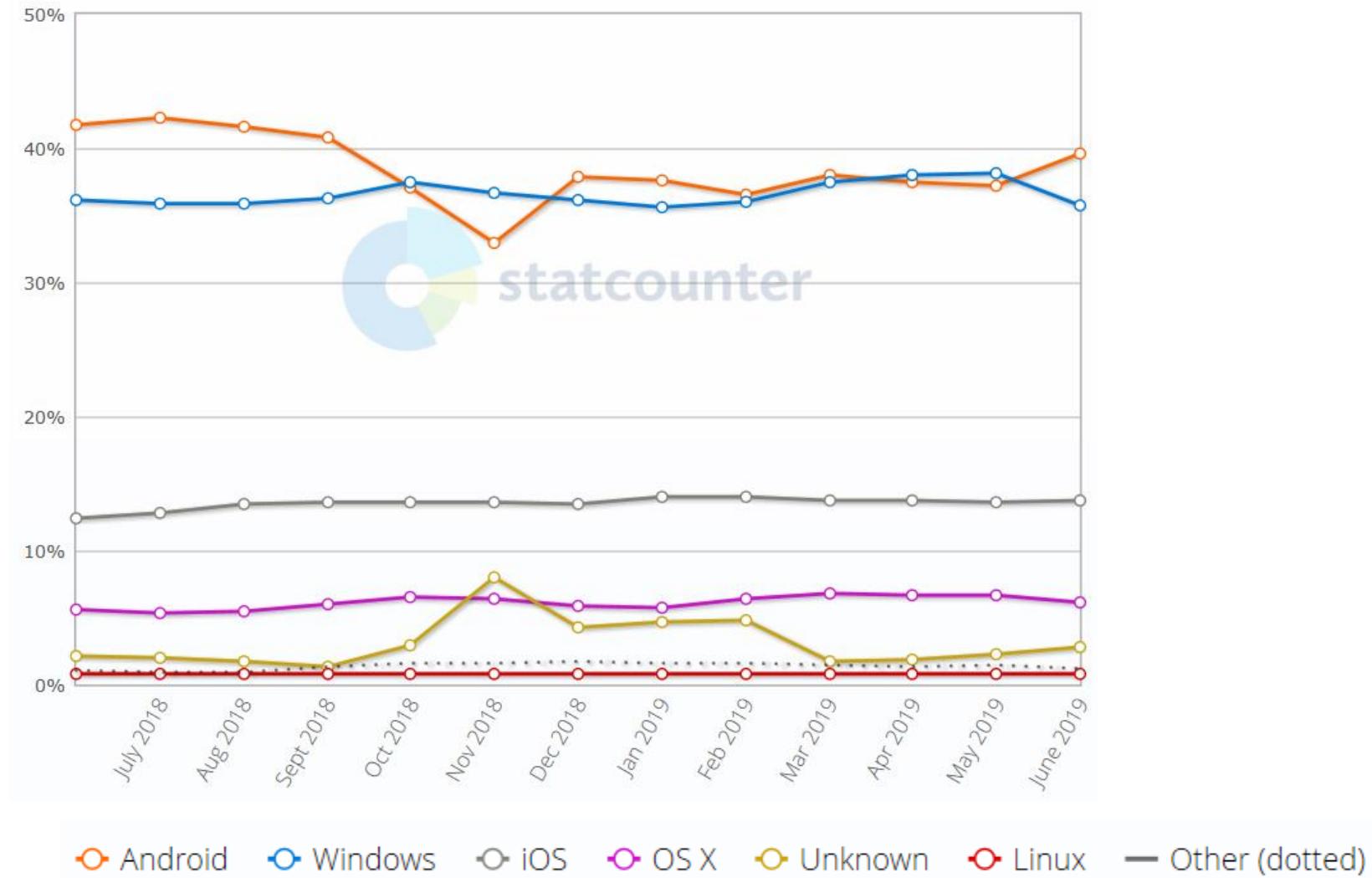
# Presentation Tier: OS Mapping-Libraries – My impression

You can achieve a lot using Leaflet.

For sophisticated application use Openlayers

# Presentation Tier: Operating System Market Share Worldwide

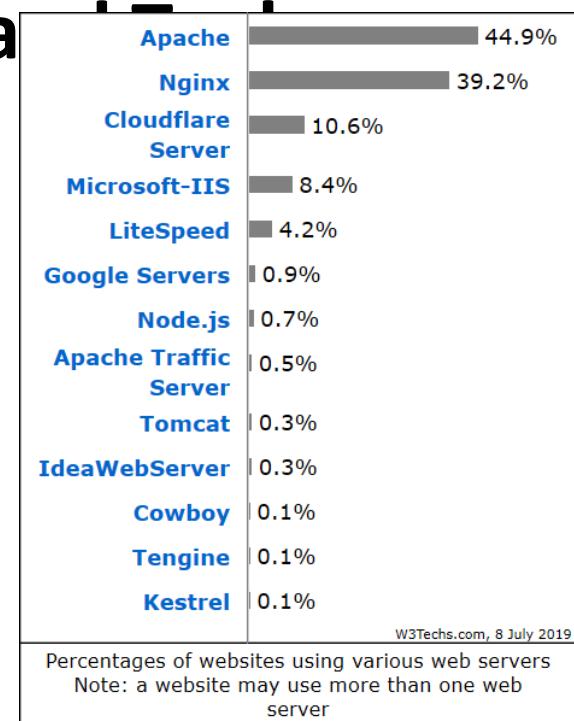
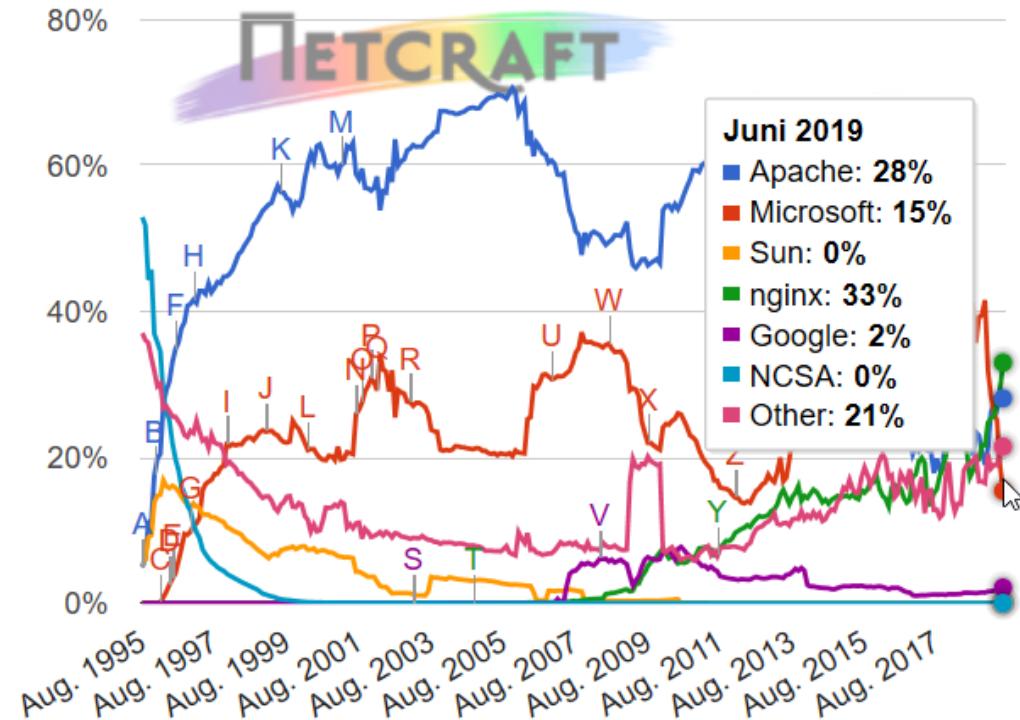
Open Source Software Components



# **Communication Tier**

# Communication Tier: Products and Services

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



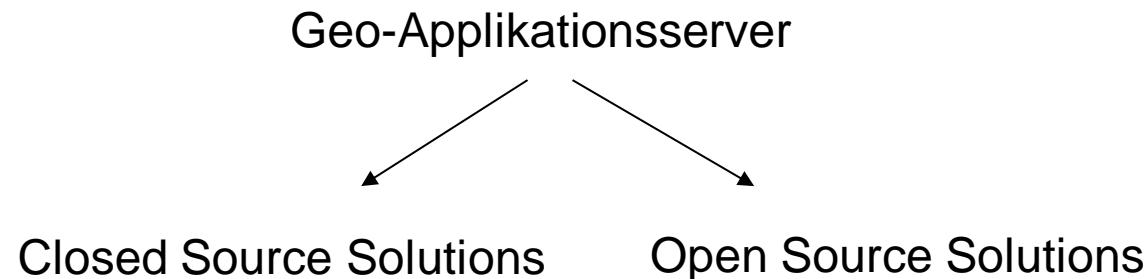
# Communication Tier: FTP

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

# **Application Tier**

# Application Tier: Application Server

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



# 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://www.osgeo.org/mapserver](http://geoserver.org/display/GEOS>Welcome</a>)</li></ul></li><li>• MapServer (formerly called UMN MapServer, <a href=))
    - 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>
- MapInfo MapXtreme® <https://www.pitneybowes.com/us/location-intelligence/geographic-information-systems/mapxtreme.html>

# Application Tier: Application Server: Portal Server

- Geonetwork OpenSource: a widely used catalog application to manage spatially referenced resources

<https://geonetwork-opensource.org/>

The screenshot shows the GeoNetwork OpenSource application. At the top, there is a navigation bar with links for News, Documentation, Download, Community, Gallery, and Search. The main content area has a header "GeoNetwork" with the OSGeo logo. Below this, a section titled "Find & get information" displays a search interface with a dropdown menu showing categories like "water", "water\_government", etc. To the right of the search bar is a map viewer interface with a legend and a map of a coastal area. A descriptive text block explains that GeoNetwork is a catalog application for managing spatially referenced resources, providing powerful metadata editing and search functions, and an interactive web map viewer.

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

<https://geonode.org/>

The screenshot shows the Geonode application interface. At the top, there is a navigation bar with links for Gallery, Quick Start, Try the Demo, and View. The main content area has a header "GeoNode" with the OSGeo logo. Below this, a section titled "Open Source Geospatial Content Management System" provides an overview of Geonode's purpose and features. It includes download links for "GeoNode 2.6.0 (tar)" and "GeoNode 2.6.0 Windows 32bit EXE". To the right is a large image of a laptop displaying a map of Ethiopia. Below the main heading are three sections: "For Users", "For Developers", and "For Admins", each with a brief description and a "Take the Tour" button.

- pycsw

- [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 modeler
- [Demeter](#): Another OpenGL based terrain engine somewhat similar to VTP.
- [Depiction](#) Mapping, simulation and collaboration software.
- [Eonfusion](#): 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 pa
- [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](#): a 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.o
- [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 efficien
- [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 re
- [IONIC Red Spider](#): an OGC Web Services platform includes a GDAL plugin.
- [iShare](#): Web data integration and publishing platform by Astun Technology.
- [TerraMap](#): A GIS spatial data display, management, spatiotemporal analysis, and many other various analyses

# Libraries: Software using GDAL

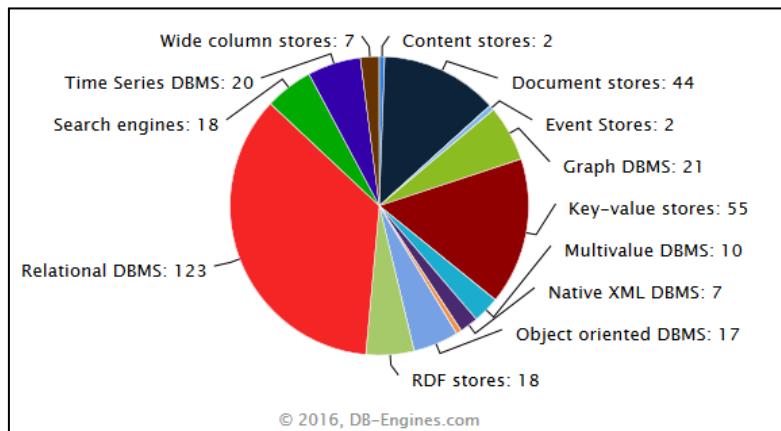
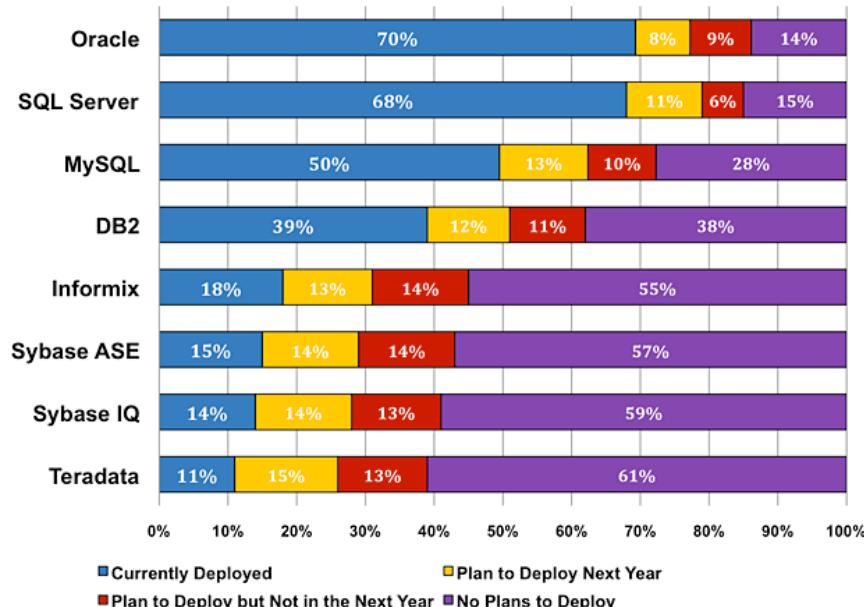
# **Data Tier**

# Related Products and Tools: (O)RDBMS

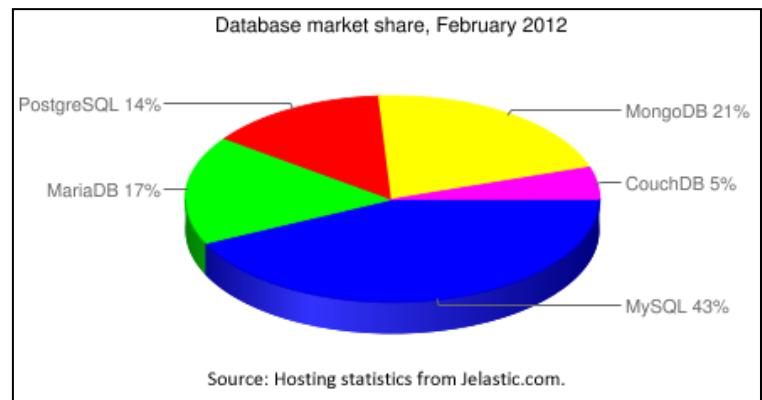
- (O)(R)DBMS: (Object) (Relational) Database Management System
  - commercial products
    - Oracle,
    - SQLServer (Microsoft),
    - Informix, DB2 (IBM),
    - ...
  - free
    - PostGreSQL (PostGIS), fully conformant to OGC's Simple Feature Specification – highly recommended
    - MySQL
    - SpatialLite

# Market share

2008 (Closed Source)



2012 (FOSS)



<http://blog.jelastic.com/2012/02/23/open-source-database-market-share-within-jelastic-february-2012/>

# Trend of Relational DBMS Popularity

Forbes / Tech / #BigBusiness

MAR 8, 2016 @ 10:25 AM 9,749

2 Free Issues of Forbes

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

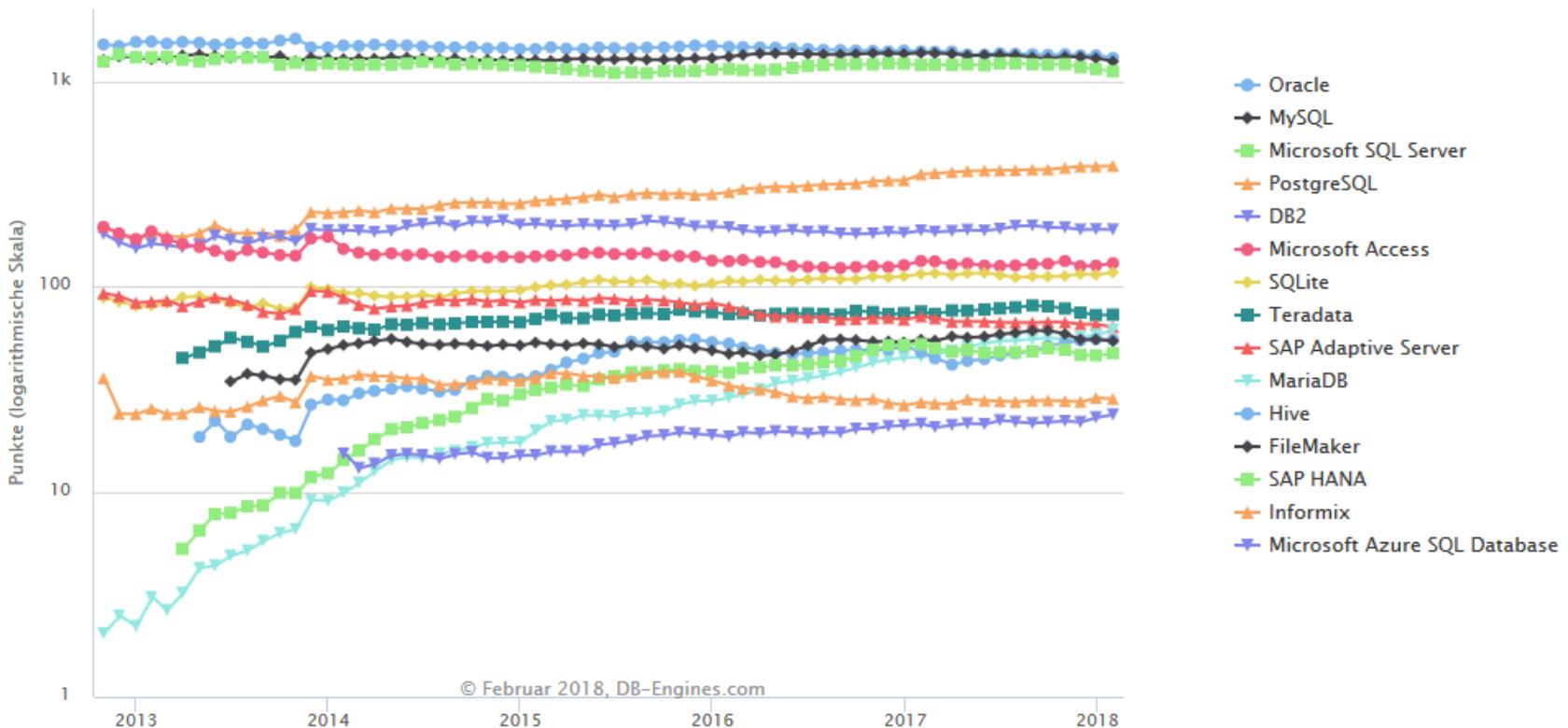


**Ben Kerschberg, CONTRIBUTOR**  
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<https://www.forbes.com/sites/benkerschberg/2016/03/08/how-postgres-and-open-source-are-disrupting-the-market-for-database-management-systems/#141b42e820a3>

Open Source Software Components



Rang	Feb 2018	Jan 2018	Feb 2017	DBMS	Datenbankmodell	Punkte		
						Feb 2018	Jan 2018	Feb 2017
1.	1.	1.	1.	Oracle +	Relational DBMS	1303,28	-38,66	-100,55
2.	2.	2.	2.	MySQL +	Relational DBMS	1252,47	-47,24	-127,83
3.	3.	3.	3.	Microsoft SQL Server +	Relational DBMS	1122,04	-26,03	-81,42
4.	4.	4.	4.	PostgreSQL +	Relational DBMS	388,38	+2,19	+34,70
5.	5.	5.	5.	MongoDB +	Document Store	336,42	+5,47	+0,92
6.	6.	6.	6.	DB2 +	Relational DBMS	189,97	-0,30	+2,07
7.	7.	↑ 8.	8.	Microsoft Access	Relational DBMS	130,07	+3,37	-3,32
8.	↑ 9.	↑ 10.	10.	Redis +	Key-Value Store	127,02	+3,88	+12,98
9.	↑ 10.	↑ 11.	11.	Elasticsearch +	Suchmaschine	125,32	+2,76	+17,01
10.	↓ 8.	↓ 7.	7.	Cassandra +	Wide Column Store	122,78	-1,10	-11,60
11.	11.	↓ 9.	9.	SQLite +	Relational DBMS	117,27	+3,02	+1,96
12.	12.	12.	Teradata		Relational DBMS	72,99	+0,36	-2,60
13.	↑ 15.	↑ 16.	Splunk		Suchmaschine	67,27	+3,27	+11,24
14.	14.	14.	Solr		Suchmaschine	63,87	-0,50	-3,81
15.	↓ 13.	↓ 13.	SAP Adaptive Server +		Relational DBMS	63,49	-1,98	-8,25
16.	16.	↓ 15.	HBase		Wide Column Store	61,70	+0,07	+2,46
17.	17.	↑ 20.	MariaDB +		Relational DBMS	61,65	+3,35	+16,30
18.	18.	↑ 19.	Hive +		Relational DBMS	55,06	-0,43	+7,11
19.	19.	↓ 17.	FileMaker		Relational DBMS	54,36	-0,85	-0,84
20.	20.	↓ 18.	SAP HANA +		Relational DBMS	47,36	+1,20	-5,09
21.	↑ 22.	↑ 22.	Amazon DynamoDB +		Multi-Model ↗	39,88	+1,95	+7,69
22.	↓ 21.	↓ 21.	Neo4j +		Graph DBMS	39,82	-0,14	+3,56
23.	23.	23.	Couchbase +		Document Store	31,75	+0,32	+0,57
24.	↑ 25.	24.	Memcached		Key-Value Store	28,93	+0,78	-1,60
25.	↓ 24.	25.	Informix		Relational DBMS	28,38	-0,30	+1,13
26.	26.	↑ 27.	Microsoft Azure SQL Database +		Relational DBMS	23,78	+0,76	+2,36
27.	27.	↓ 26.	CouchDB		Document Store	20,29	-0,37	-3,13

<https://db-engines.com/de/ranking> [2018-01-26]

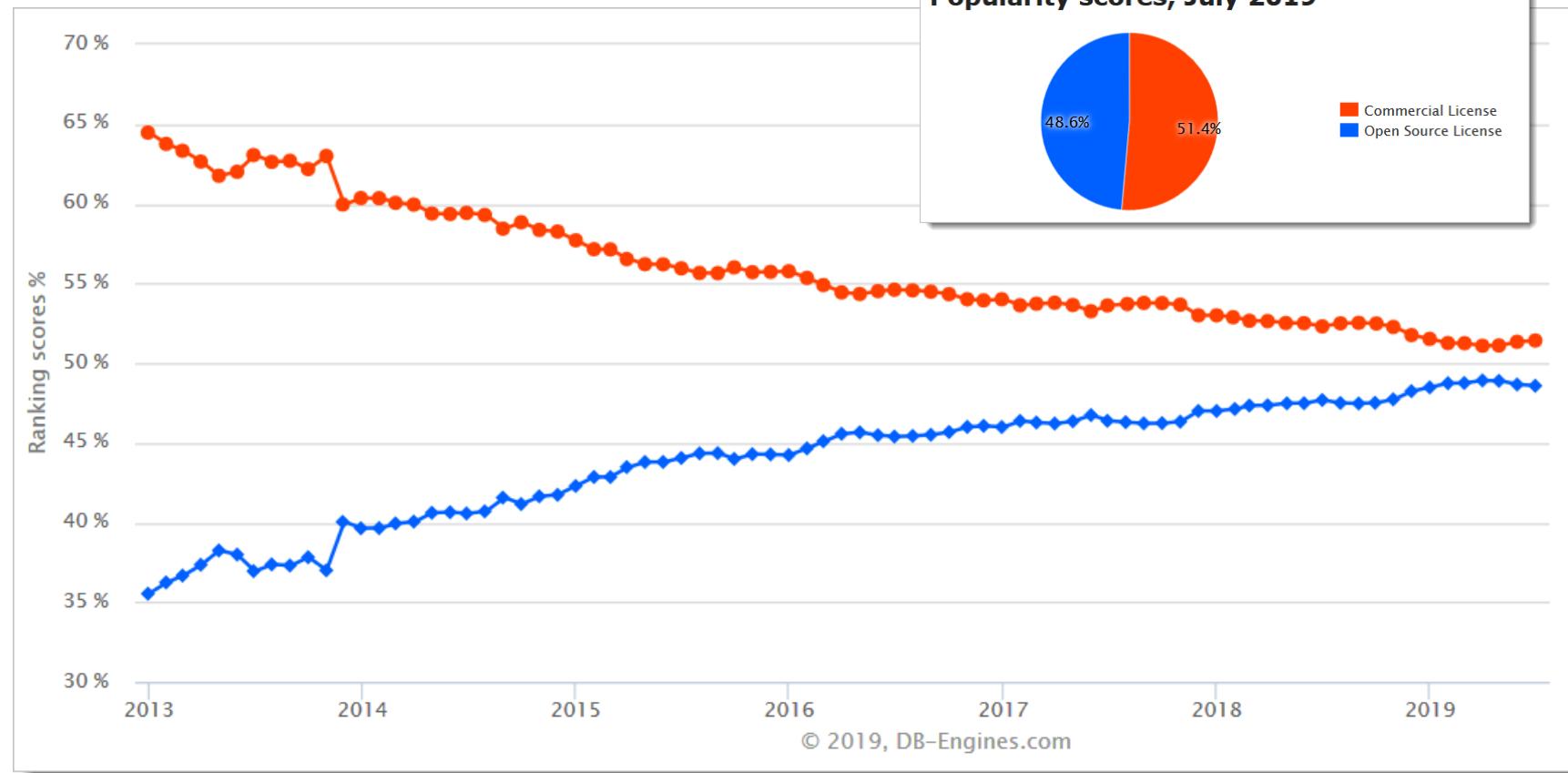
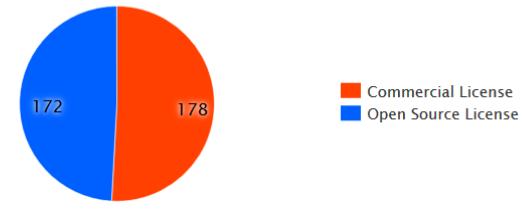
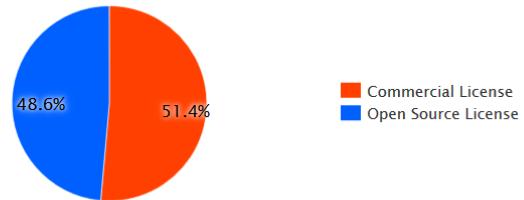
### The top 5 commercial systems, November 2017

Rank	System	Score	Overall Rank
1.	Oracle	1360	1.
2.	Microsoft SQL Server	1215	3.
3.	DB2	194	6.
4.	Microsoft Access	133	7.
5.	Teradata	78	12.

### The top 5 open source systems, November 2017

Rank	System	Score	Overall Rank
1.	MySQL	1322	2.
2.	PostgreSQL	380	4.
3.	MongoDB	330	5.
4.	Cassandra	124	8.
5.	Redis	121	9.

# 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 aides UN operations around the world through open source geospatial software and services.



The screenshot shows the homepage of the Geoportal des Bundes. At the top, there's a navigation bar with links like 'istbesucht', 'Tools', 'Conferences', 'To read', 'International', 'Wordpress', 'Lectures', and 'Technikgesch'. Below the navigation is a yellow banner with a red signature and the date 'Mittwoch, 08.10.2014'. The main title 'Geoportal Würtemberg' is displayed prominently. To the right, there's a large image of a highway overpass with a UN logo overlay. A sidebar on the left contains news items, one of which is about winning an Open Source Award. The footer features a link to 'Open-Source GeoPortal.rlp'.



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

Aus 23 Eingaben um das Rennen des Open Source Software Award 2014 wurde das Geoportal des Bundes ausgezeichnet. Der Preis wurde durch die Swiss Open Systems User Group /ch/open am 8. Oktober 2014 vergeben.

09.10.2014 | swisstopo DKW

Das GeoPortal Saarland wurde aus dem GeoPortal.rlp entwickelt. Alle relevanten Bestandteile basieren auf Open-Source-Software (OSS).

# 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

- S. Steiniger and A.J.S. Hunter (2012): The 2012 Free and Open Source GIS Software Map – A Guide to facilitate Research, Development and Adoption.  
[http://www.geo.uzh.ch/~sstein/manuscripts/fosgismap\\_sstein\\_v9\\_web.pdf](http://www.geo.uzh.ch/~sstein/manuscripts/fosgismap_sstein_v9_web.pdf)
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- Comparison of geographic information systems software.  
[https://en.wikipedia.org/wiki/Comparison\\_of\\_geographic\\_information\\_systems\\_software](https://en.wikipedia.org/wiki/Comparison_of_geographic_information_systems_software) [2018-11-22]

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