IMPLEMENTING WEB GIS SOLUTIONS

USING OPEN SOURCE SOFTWARE

Karsten Vennemann

TERRA GIS
TERRESTRIAL ENVIRONMENT REGIONAL ANALYSIS
Seattle

Talk Overview

Why and What		*What is Open Source (GIS)?* *Why use it ?*
Application Components	**Overview of Web GIS**	*Components of a Web GIS* *What is out there ?*
	Some Foundations	*OGR, GDAL, PROJ4, GeoTools*
	Web GIS Engines	*Mapserver* *Geoserver*
	Frameworks	*Mapbender, MapFish, Cartoweb* *Open Layers, Ka-Map*
	Extending GIS Capabilities	*Spatial Data Storage Solutions* *Additional Tools*
Resources		*How can you build your own ?* *...5 simple steps*

What is Open Source (GIS)?

Open source means that the source code is available to the general public for use, distribution, and modification from its original design free of charge (among a long list of other requirements)

Open Source ≠ Open Standards

While most open source geospatial software is built on the standards of the Open Geospatial Consortium (OGC) the term "Open Source" it is not synonymous with Open Standards because both proprietary and open source software can be compliant with the OGC Open Standards. http://www.opengeospatial.org

OSGeo is the organization that supports the development of the highest quality open source geospatial software. http://www.osgeo.org

Why use it ? General and incomplete listing

- User is in control
  - Pick you favorite operating system: supports many operating systems: Windows-Linux-Solaris-…
  - No licensing issues (did we install one to many PCs with software XY?)
  - Vendor independency
  - Access to source code: don't like something, need changes to the core system, need extensions – hire somebody to change it right now
- High performance, high quality, high interoperability
  - distributed programming effort, highly modular…
  - System heterogenity - less prone to hacker attacks and viruses
  - Interoperable – very advanced support of OGC open standards
- Exceptional Support - Commercial and non commercial
  - Mailing lists, user groups, Conferences, IRC channels
  - Fast response times for bug fixes
    typically tracked on the web accessible and open to everybody to report or fix a bug
- It is free

- What is out there ?

A whole lot !
A jungle !
Difficulties finding XY…

More than 250 project entries on
http://opensourcegis.org/

Selection of some of the
most advanced and
popular WEB OS GIS components

"Something for everybody, some are special have need features"

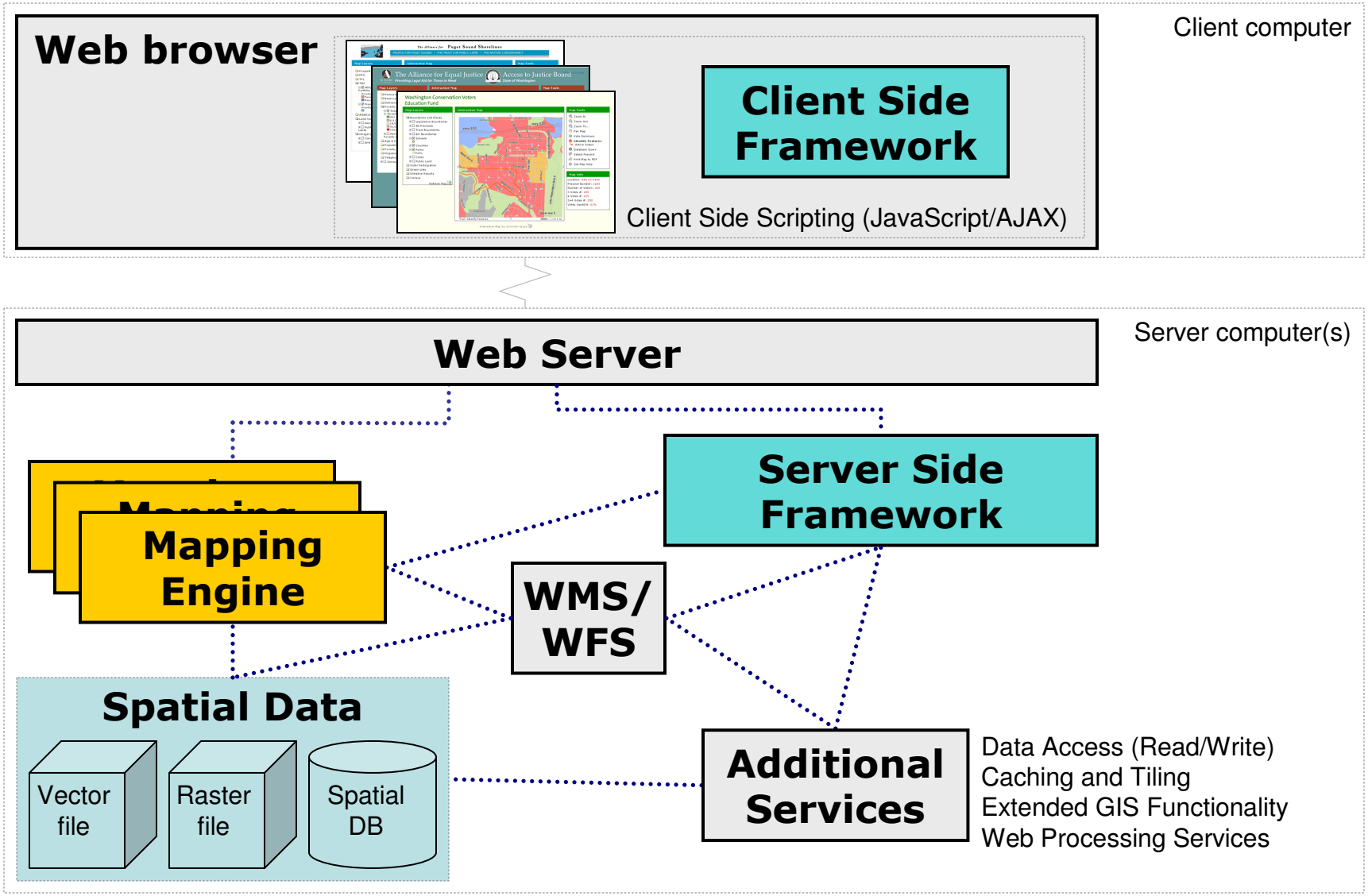
Overview

- OS Software uses synergies: sharing of libraries
  ►not too much duplication of effort

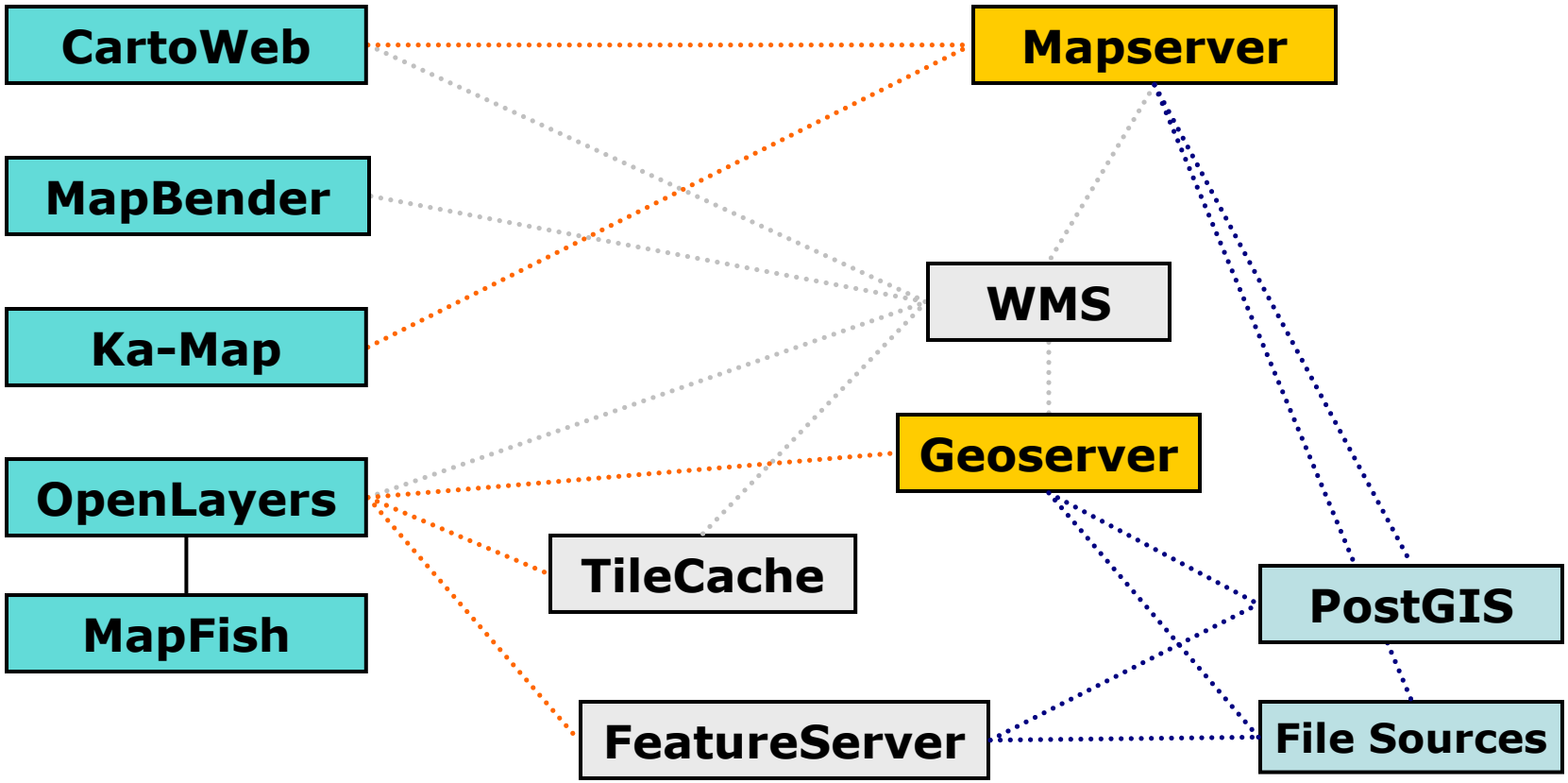
- Different tribes use different tools:

"Tribe"	Examples
• C/C++ Tribe	Mapserver, GRASS, Mapguide, QGIS PostGIS, OGR/GDAL, PROJ4, GEOS, FDO
• Java Tribe	GeoTools, GeoServer, uDig, DeeGree JUMP, gvSIG
• Web tribe	MapBender, OpenLayers, Ka-map
• .Net Tribe	SharpMap, WorldWind, MapWindow

Schematic View Interoperable Web GIS



Relations of Web GIS Components



Modified from "The State of Open Source GIS", Paul Ramsey, Sep. 2007, formerly Refractions Research, Victoria, BC, Canada

Some Foundations (Tools)

A few libraries that are the foundation of many
Open Source and commercial Geospatial Software Packages

- GDAL (Raster) and OGR (Vector)
  Geospatial Data Abstraction Library / OpenGIS Simple Features Reference Implementation
  - Tools for reading, writing and processing of raster and vector data sets -> formats
  - Important base for many Desktop GIS systems e.g. ArcGIS
  - OGR extends Mapserver formats
    Oracle Spatial, ESRI Geodatabase (MDB), TIGER, MapInfo…
- PROJ4 is a library for cartographic projection routines
  - stand alone projection utility "proj"
  - libraries for more than 2500 projections (e.g. EPSG list)
- GeoTools is an open source Java GIS toolkit is a library for cartographic projection routines
  - Similar usage as OGR and GDAL for Java based projects
  - Udig and Geoserver are based on GeoTools

Web GIS Engines

- Mapserver (C)

  MAPSERVER

- Geoserver (Java)

- Mapnik (C++)

  mapnik

- Map Guide Open Source (C++)

  + “Fusion” by DM Solutions

Map Server MAPSERVER

Originally developed at the University of Minnesota (UMN), short "MapServer"

- one of the most mature open source projects
- written in C

Main Focus

- rendering spatial data
- development environment for spatially-enabled internet applications

Map output

- CGI mapserv (Linux) and mapserv.exe (windows)
- MapScript API available for Python, PHP, Perl, and Java
- Map/Layer configuration text file .map

Formats

- In: PostGIS, Oracle Spatial ArcSDE, WMS, GDAL and OGR formats
- Out: GIF, JPG, PNG, all GDAL formats, WFS and WMS

GeoServer 

Main supporter The Open Planning Project (TOPP)

- newer development than Mapserver)
- written in Java, built on top of Geotools (like Udig)

Main Focus

- rendering images, serving and editing spatial data

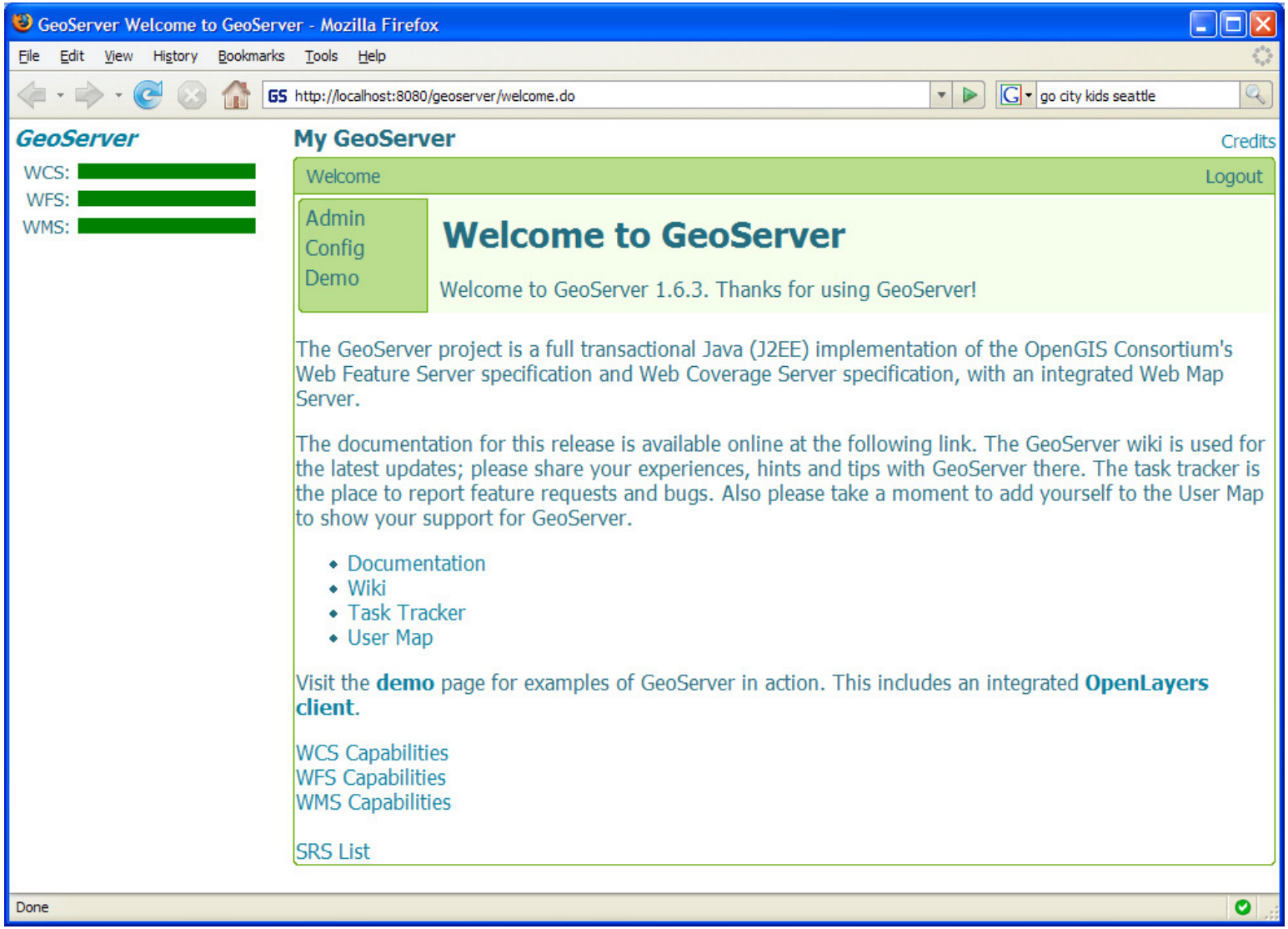
More differences to Mapserver

- configuration web-based Graphical user interface (stored as xml)
- transactional capabilities, support for shared editing

Formats

- PostGIS, Shapefile, ArcSDE, DB2, Oracle
  (soon VPF, MySQL, MapInfo, WFS)
- JPG, GIF, PNG, SVG, KML/KMZ, GML, Shapefile, GeoJSON, GeoRSS
- WFS and WMS output

GeoServer


GeoServer Welcome to GeoServer - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost:8080/geoserver/welcome.do
go city kids seattle
GeoServer
WCS:
WFS:
WMS:
My GeoServer
Credits
Welcome
Logout
Admin
Config
Demo
Welcome to GeoServer
Welcome to GeoServer 1.6.3. Thanks for using GeoServer!
The GeoServer project is a full transactional Java (J2EE) implementation of the OpenGIS Consortium's Web Feature Server specification and Web Coverage Server specification, with an integrated Web Map Server.
The documentation for this release is available online at the following link. The GeoServer wiki is used for the latest updates; please share your experiences, hints and tips with GeoServer there. The task tracker is the place to report feature requests and bugs. Also please take a moment to add yourself to the User Map to show your support for GeoServer.
Documentation
Wiki
Task Tracker
User Map
Visit the demo page for examples of GeoServer in action. This includes an integrated OpenLayers client.
WCS Capabilities
WFS Capabilities
WMS Capabilities
SRS List
Done

Web GIS Frameworks

Client Side

JavaScript/Ajax Libraries

Open Layers
JavaScript API

Ka-Map
JavaScript API

Client-Server Side

JavaScript/Ajax Libraries
Server Side Scripts, Database

Mapbender
PHP, JavaScript, PostGIS

MapFish
Python (Pylons), Java Script (ExtJs) and Open Layers

Cartoweb
PHP, JavaScript

Open Layers

OpenLayers

Main supporter "MetaCarta"

- object-oriented JavaScript library (using Prototype.js and Rico library)

Lets you add maps to any web page by embedding OpenLayer.js

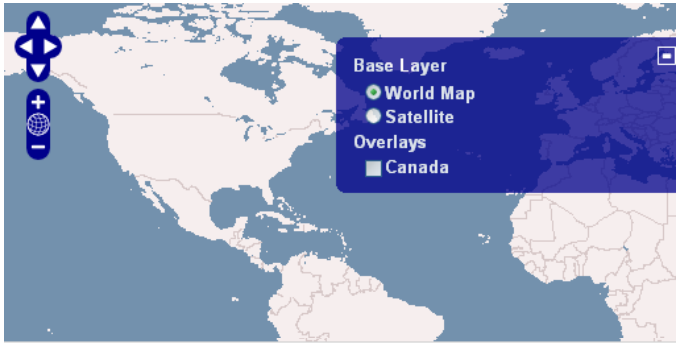
- no server-side dependencies
- Easily reusable component
  …similar to Google Maps and MSN Virtual Earth Web Mapping APIs
- "Slippy map style"

Input Formats

- Tile sources: Virtual Earth, Worldwind, Yahoo & Google Maps, WMS
- Vector layer input: KaMap, MapServer, GeoRSS, WFS, [KML]

Standard Tools

- Google Like zoom bar,
  standard functions
  like zoom in/out pan



MapFish

Main supporter "Camptocamp"

Widgets and plugins oriented architecture

MapFish Client - JavaScript framework – two parts

- mapping part OpenLayers
- user interface (GUI widgets) ExtJs library

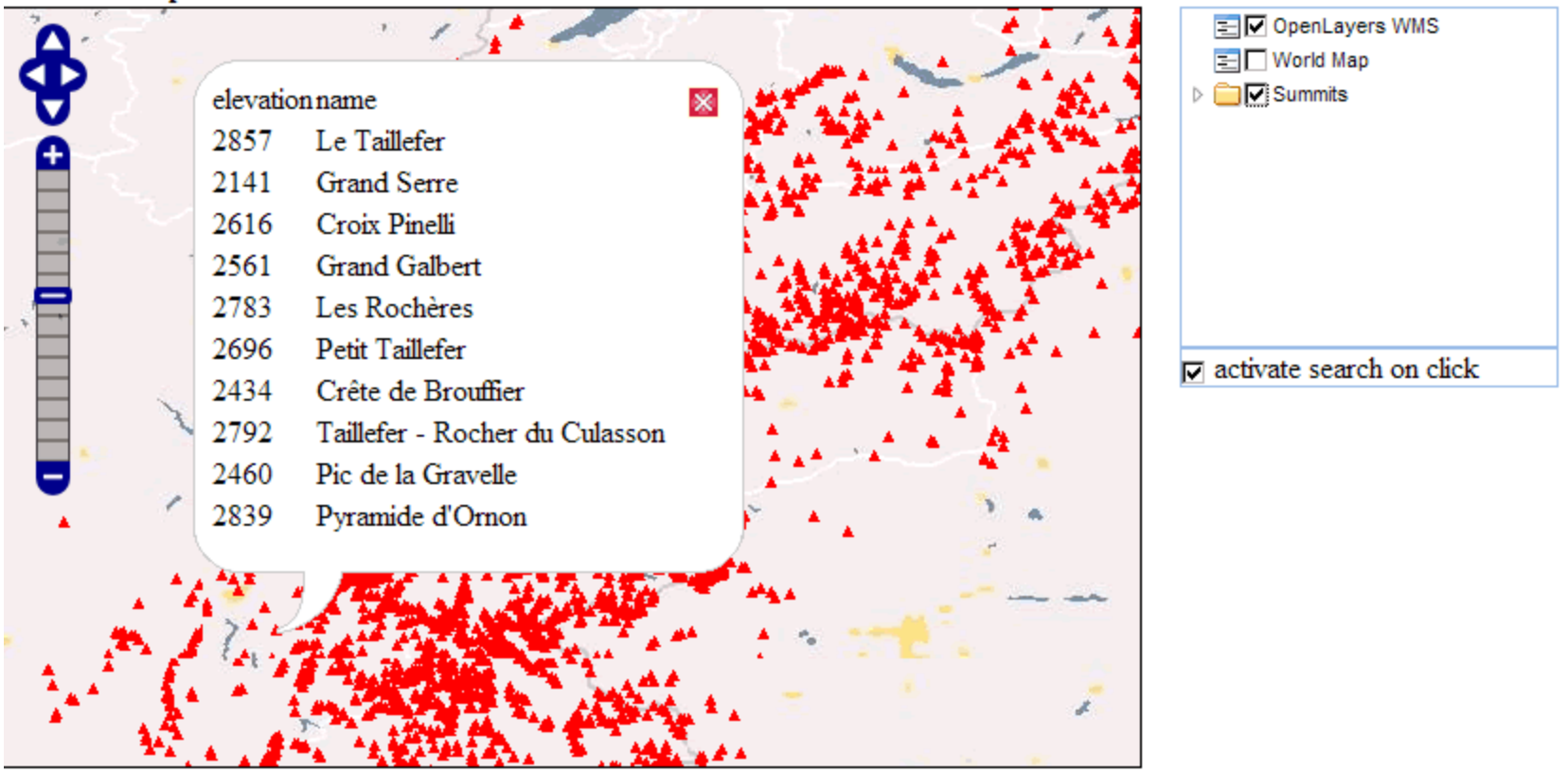
MapFish Server

- MapFish Server is a Python framework (based on Pylons)

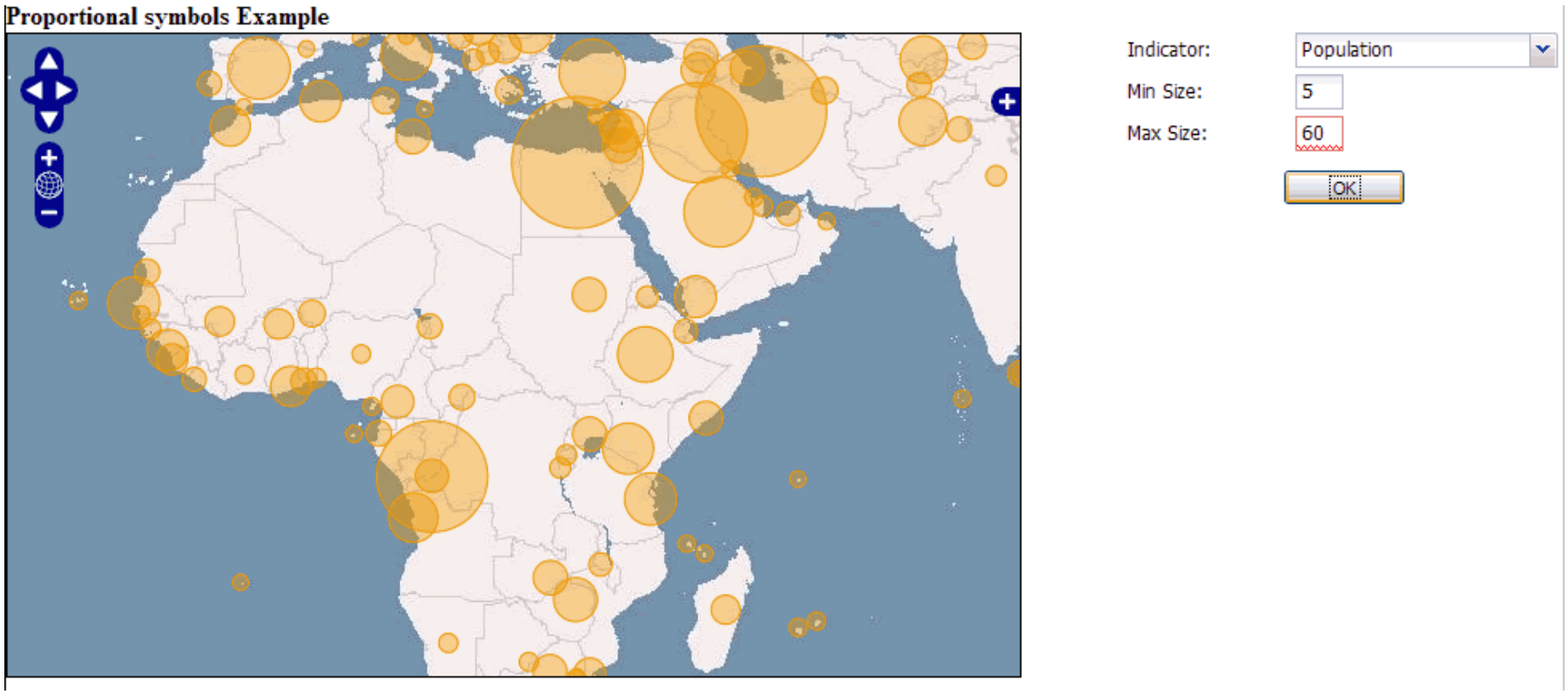
Main Focus - Adding server side framework to OpenLayers

- Advanced UI components: layer tree…
- Server-side services: authentication, query…
- Server-side processing: routing, editing…

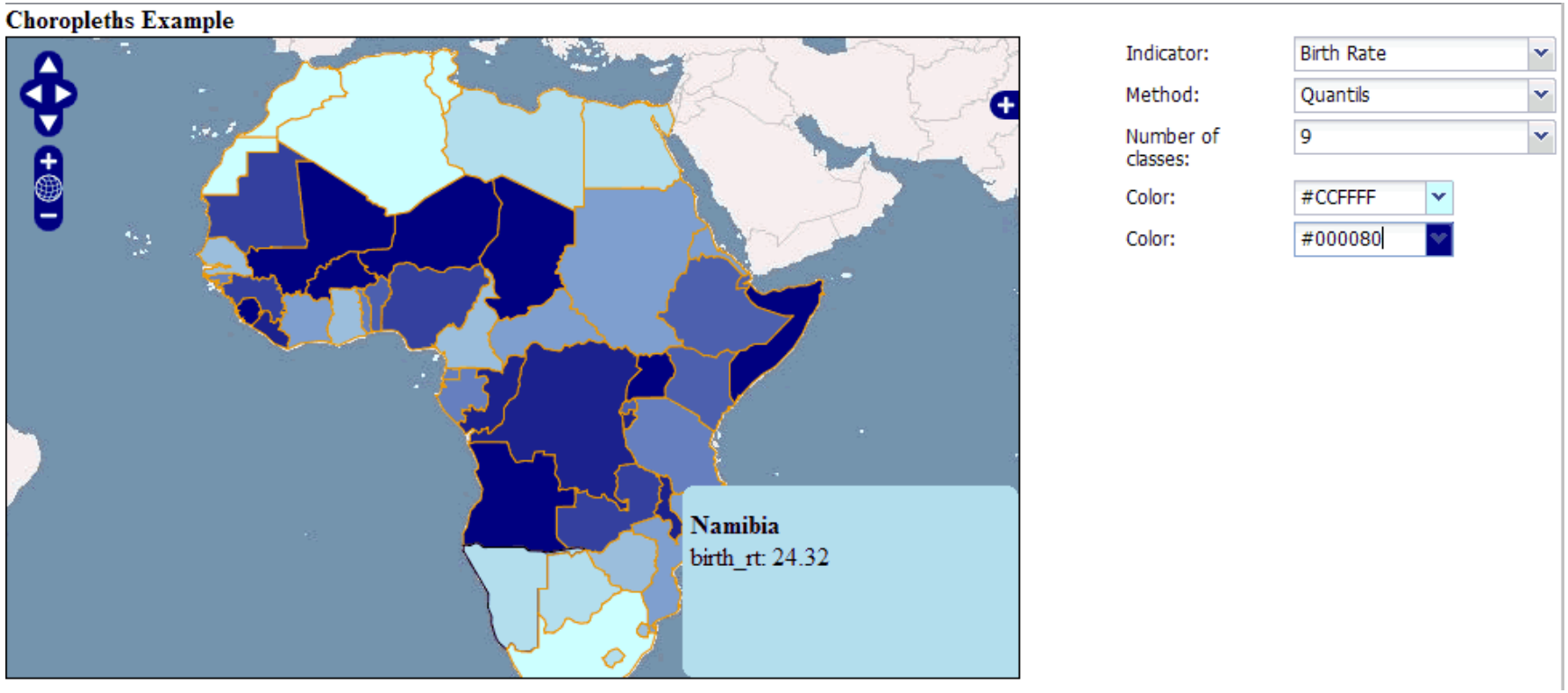
MapFish


Search Example
elevation name
2857 Le Taillefer
2141 Grand Serre
2616 Croix Pinelli
2561 Grand Galbert
2783 Les Rochères
2696 Petit Taillefer
2434 Crête de Brouffier
2792 Taillefer - Rocher du Culasson
2460 Pic de la Gravelle
2839 Pyramide d'Ornon
OpenLayers WMS
World Map
Summits
activate search on click

MapFish


Proportional symbols Example
Indicator:
Population
Min Size:
5
Max Size:
60
OK

MapFish


Choropleths Example
Namibia
birth_rt: 24.32
Indicator:
Birth Rate
Method:
Quantils
Number of classes:
9
Color:
#CCFFFF
Color:
#000080

Mapbender Mapbender

Main supporter "WhereGroup"

Comprehensive Client - Server framework

- implemented in PHP, JavaScript and XML
- Management Database MySQL or PostgreSql

Functionality

- displaying, navigating, editing and querying spatial data and maps
- map services authorization services (OWS proxy functionality)
- management interfaces for user, group and service administration
- Management of WMS and WFS
- User interface configuration and tool stored in data base

Input

- WMS and WFS

Extending GIS Capabilities

Spatial Data Storage solutions - PostGIS

Main supporter "Refractions"

- PostGIS is an extension for PostgreSQL
- adds support for geographic objects to PostgreSQL
- enables PostgreSQL server to be used as a backend spatial database for GIS
- Spatial operations and analysis simply mean running a (spatial) SQL query in the database
- Similar functions as SDE and much more ….

Extending GIS Capabilities - Additional tools

FeatureServer

middleware for publishing and modifying geospatial data in lots of different formats to the web (RESTful Geographic Feature Service)

- *dynamic capabilities to read geographic features (or collections) with standard HTTP methods from distributed sources (aggregation)*
- *translate geographic features between formats*
  e.g. input shape file and open in Google Earth

TileCache

server software solution with caching and rendering capabilities

- *create your own local disk-based cache of any WMS server*
- *use the resulting map tiles in supporting clients*
  e.g. OpenLayers, Google maps, Virtual Earth, Worldkit
- *create a fast performing slippy style map a la Google Maps*

Articles

The State of Open Source GIS,
Version September 2007. By Paul Ramsey, formerly Refractions Research, Victoria. 49pages.
http://www.foss4g2007.org/presentations/viewattachment.php?attachment_id=8

Comparison Of Geographic Information System Software (Arcgis 9.0 And Grass 6.0): Implementation And Case Study
MS Thesis by Todd R. Buchanan, Fort Hays State University. 89pages
http://covenant-tech.com/thesis.pdf

Geospatial Interoperability Return on Investment Study,
National Aeronautics and Space Administration, Geospatial Interoperability Office, April 2005. 80pages
http://www.egy.org/files/ROI_Study.pdf

Web Sites

Free GIS Project http://www.freegis.org/
Open source GIS list http://opensourcegis.org/
Map Tools http://maptools.org/
OSGeo http://www.osgeo.org/

Open source utilities and websites

Simple Feature Library (OGR)	www.gdal.org/ogr
Geospatial Data Abstraction Library (GDAL)	www.gdal.org
GeoTools	http://sourceforge.net/projects/geotools
PROJ4	http://www.remotesensing.org/proj
Mapserver	http://ms.gis.umn.edu
Geoserver	http://geoserver.org
Open Layers	www.openlayers.org
Ka-Map	http://ka-map.maptools.org
Cartoweb	http://www.cartoweb.org
Mapbender	www.mapbender.org
MapFish	http://trac.mapfish.org/trac/mapfish
PostgreSQL	www.postgresql.org
PostGIS	http://postgis.refractions.net
Featureserver	http://featureserver.org
TileCache	www.tilecache.org

Free and Open Source Software for Geospatial 2008

Cape Town International Convention Centre
September 29, 2008 – October 3, 2008
www.foss4g2008.org/

Local GIS user group:

"Cascadia Users of Geospatial Open Source"

http://groups.google.com/group/cugos

Monthly meeting every 3rd Wednesday, 5:30 pm
In the LizardTech offices, located near Pioneer Square:

The National Building
Suite 200
1008 Western Avenue
Seattle, WA 98104

CONTACT ME WITH QUESTIONS

Karsten Vennemann

www.terragis.net
Seattle, WA, USA
karsten@terragis.net
206 905 1711

TERRA GIS
TERRESTRIAL ENVIRONMENT REGIONAL ANALYSIS

TERRA GIS LTD OFFERS GIS CONSULTING AND TRAINING