Open Source Geospatial

The **One True Path** to Enlightenment

I had the opportunity to spend a few hours walking about Delft yesterday,
and I kept coming across the same phrase, over and over.

"hup holland hup"

And I have to tell you,
I'm really impressed that Holland already has a global warming plan!
Given the potential for sea level rise in the next 20 years,
I think going Hup! is an excellent plan for Holland.

If I've misinterpreted this, and it's possible I have,
please feel free to set me straight during the soccer game tonight.

The **One True Path** to Enlightenment

I would like to address both the practical,
and the spiritual aspects of
open source geospatial software today.

It is important to our immortal souls
that we make the right choices in life.
That we care for our fellow man.
and put the needs of other before ourselves.
That we are attentive to the voices of nature
and the spirits of the animals.
And that we choose the right software.

Care for Others

Honor Nature

So, in order to protect your immortal souls,
I'd like to take you on a tour
of the right software this morning.

Enlightenment

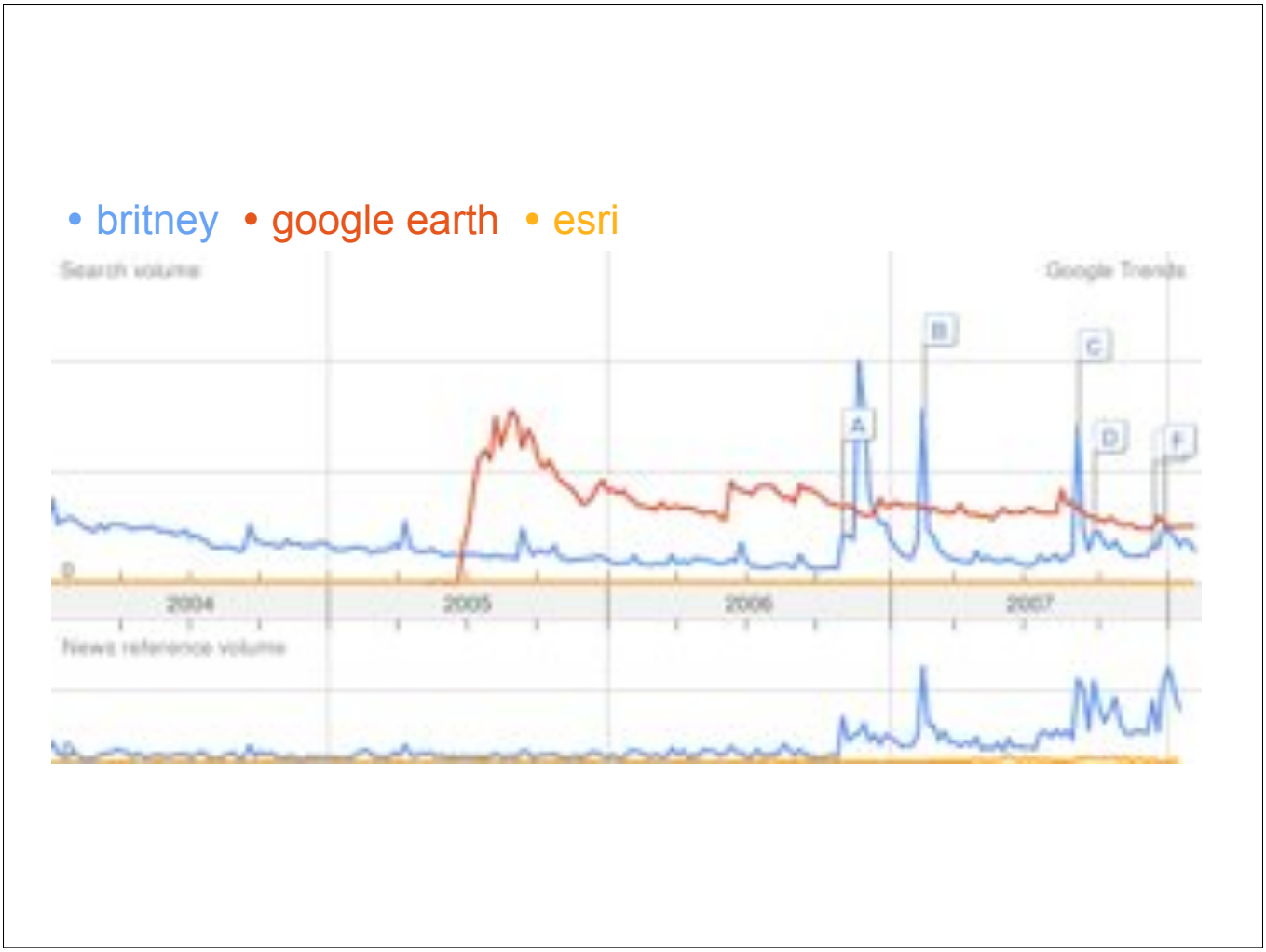
We want to use the right software,
to reach enlightenment.

But was does geospatial enlightenment look like?

I think we all know the answer...
it looks something like this.

Yes, I am being a bit sarcastic here,
but there can be no argument that the Google suite
has changed the way the world thinks about
electronic mapping.

Enlightened mapping is fast,
it is transparently easy to use,
and it looks really nice.



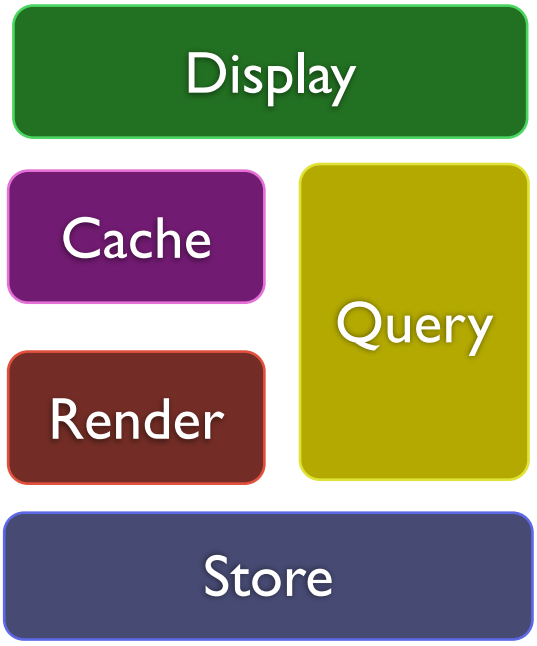
Just by way of illustrating how powerful
the impact of Google technology has been on general perceptions,
here's some searches in Google Trends.

Here's the rate of searching for the term "britney" from 2004 to the present.

In case you're interested,
"A" is filing for divorce,
"B" is entering rehab,
"C" is opening the MTV awards,
"D" is a rumor about a sex tape, and
"F" is leaving rehab.

So, a nice juicy, mass-market topic.

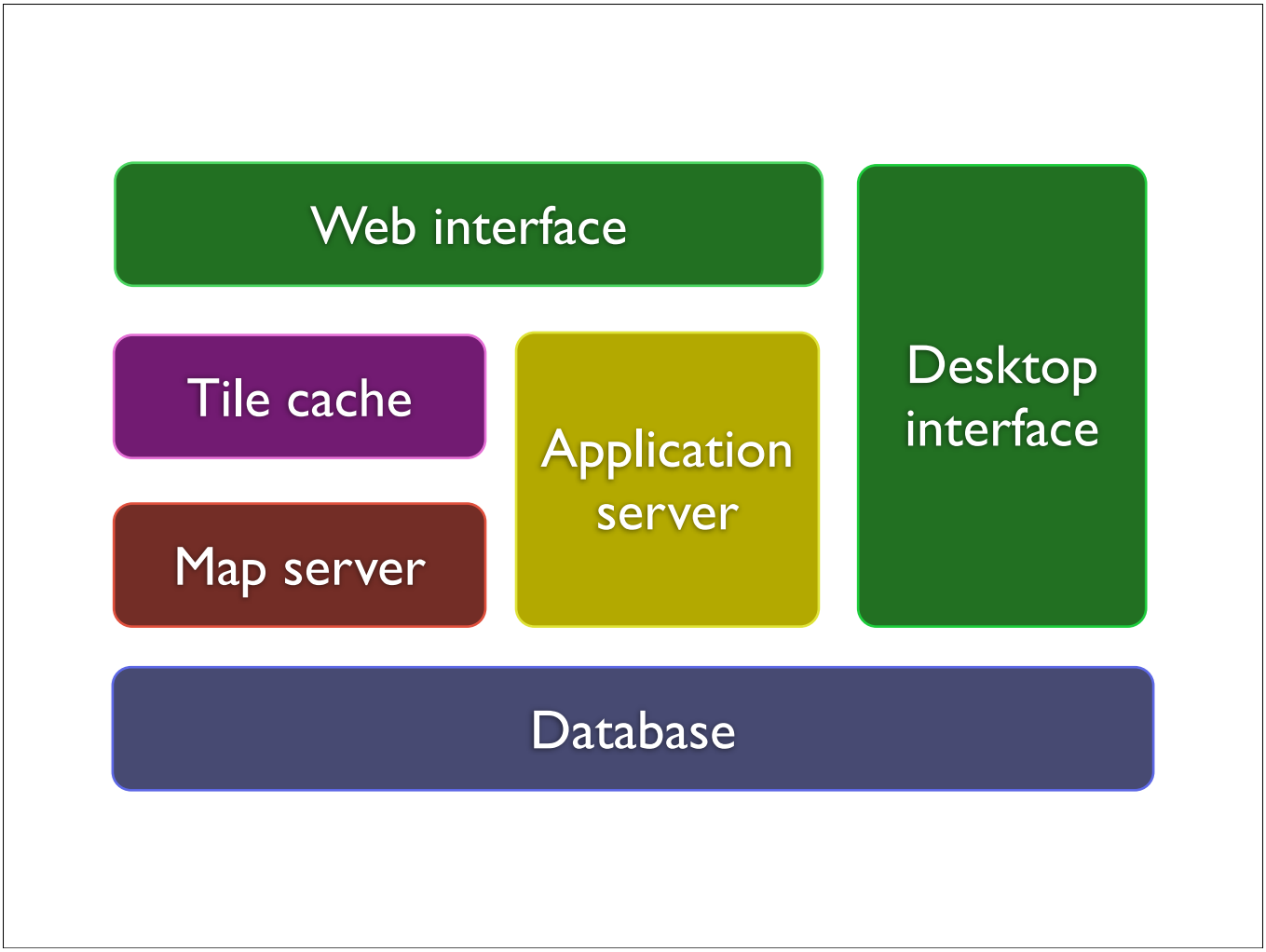
And here's the rate of searching for "google earth" superimposed on that.
And here's the rate of searching for "esri" superimposed on that.



How do they do it?
It is some kind of magic?
Voodoo, witchcraft?

No, it is the simple combination
of tools that allow them
to
Store
Render
Cache
Query and
Display
geospatial data.

That's a functional description of their architecture,
here's one using software component types.



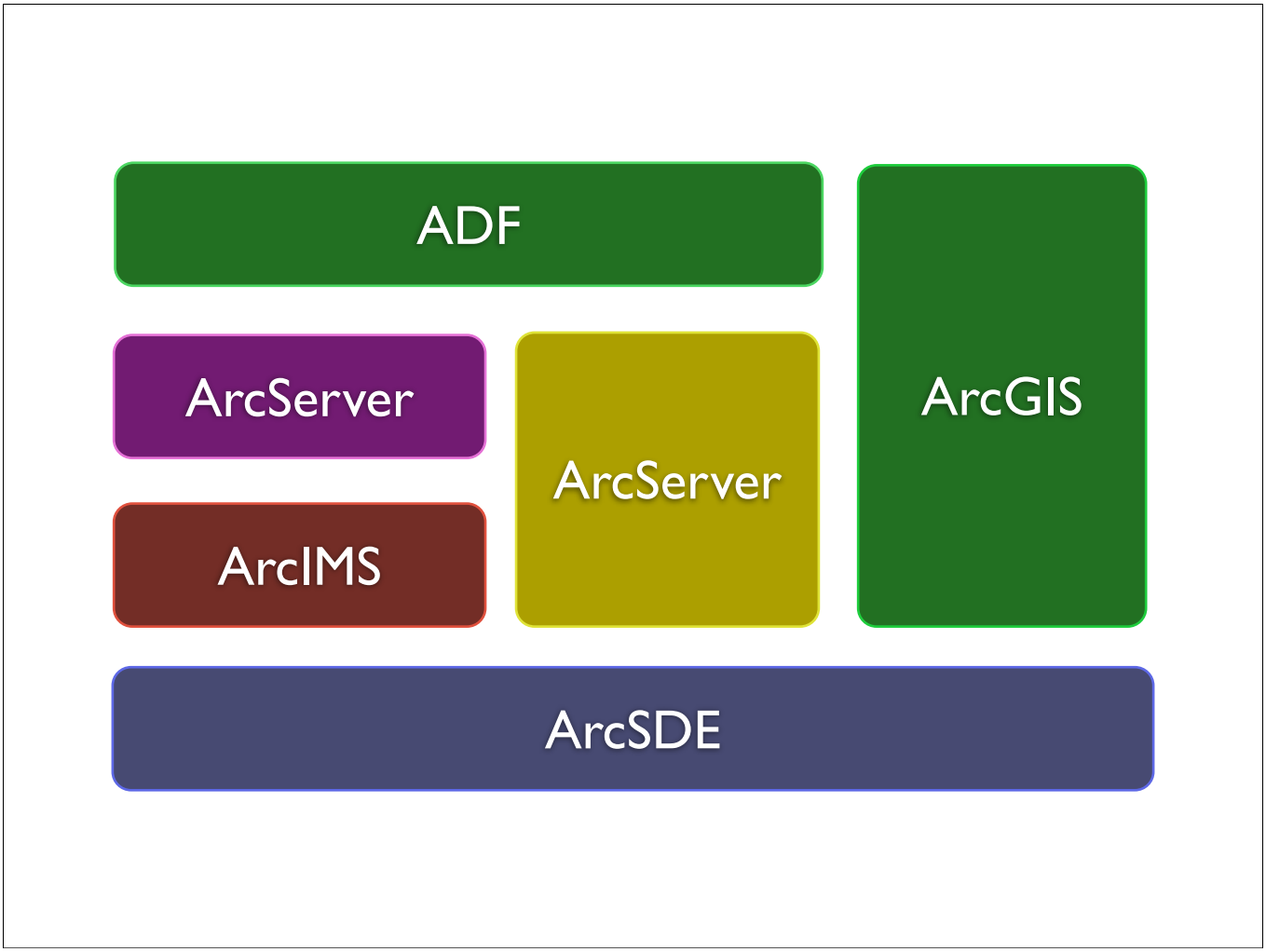
They store their data in a **database**.
It's a special database of their own design but still a database.

They combine their data with styling rules in a **map server** to build a map,
then they **cache** it as **tiles**.

They provide some routing and geocoding services,
using **application servers** for that special purpose.

They provide a **web interface**, in the clever
javascript Google Maps.

They even provide a **desktop application** that accesses
the rest of their stack, in Google Earth.



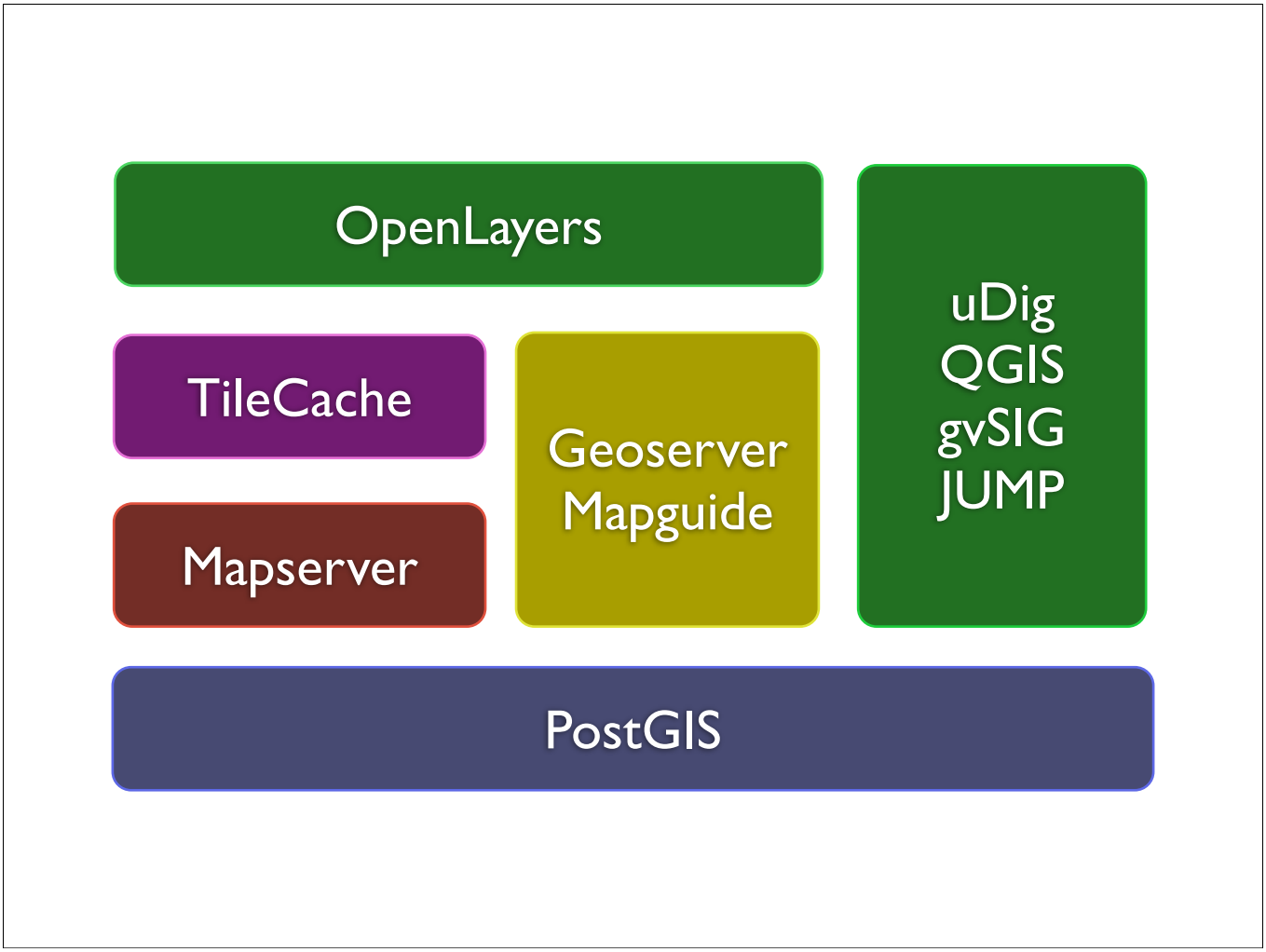
This is geospatial architecture 101.

The magic of Google is that they built an architecture
that can handle millions of simultaneous users.

You can buy the same functional architecture from ESRI,
it won't serve millions of users,
but it will have the same boxes,

The labels all just happen to start with "Arc".

However, we're trying to find the path to **ENLIGHTENMENT** here...



So here's the same architecture with open source softare.

The difference with open source, is that the components don't all start with "Arc",
and you have a lot more alternatives.

Also because it is open source,
you can scale it up
much more economically
than you can scale proprietary systems.

"Enterprise"	1 Dual-Core	2 Quad-Core
Oracle	$40,000	$160,000
DB2	$36,400	$145,600
SQL Server	$25,000	$50,000
Informix	$50,000	$200,000
PostgreSQL	$0	$0
Hardware	**US$2,000**	**US$5,000**

For example, in the database world, kitting out a single dual core, or dual quad server, is a six-figure proposition.

I took these prices from Dell.
(1 x dual core, 2gb ram, 2tb disk = $2000)
(2 x quad core, 16gb ram, 2tb disk = $5000)

Vendors like to talk about "scalability"
as if customers have infinite money to address their problems.

As if the only factor in scalability is straight performance.

But with modern hardware, the main cost driver in
scaling up an installation is no longer hardware,
it's software.

(ASIDE: Processor-based licensing provides
a financial incentive for vendors to reduce (or ignore) performance,
particularly in monopoly situations or situations
where the client has high switching costs.)

Your software licensing for that server will be many times your hardware cost, and that is not a good scalability situation.

Oracle Enterprise Edition pricing 2007-07: $40K * NCORES * 0.5 (for Standard Edition, use $15K instead of $40K)
IBM (2007-07) uses "value unit" now, https://www-112.ibm.com/software/howtobuy/passportadvantage/valueunitcalculator/vucalc.wss

Stop me now.
People love their tools.
I love open source.
“To a man with a hammer, the whole world looks like a nail.”
And I love open source. But I try to be realistic about it.
There are plusses and minuses and every case has to be evaluated individually.

Community

So, I'm going to provide a quick tour now,
of some of the more popular and useful
open source geospatial tools.

Because my time is limited
it be a mile wide and an inch deep.

I'm going to be talking about software,
but within the context of community,
because open source software can **ONLY**
be understood through an examination
of the communities that build it and use is.

Discussions about open source
bog down all too frequently
in license arcana:

GPL or BSD or LGPL or Creative Commons,
blah blah blah blah blah.

This is all chatter,
and it misses the point about open source:
Licenses are a means
not an end.

And the end is a
functioning **community** of **collaborators.**

Open source software without
a community is nonfunctional.
It a beehive without bees.

Communities are funny things,
the don't grow just anywhere,
it is hard to grow a universal global community.

Ever heard of Orkut?

It is the most popular social networking site...
in Brazil.

So, if you don't speak portuguese.
It's hard to participate in the orkut community

Communities are very sensitive to language barriers.

- Open source is about community
- Communities share a language
- Open source communities share languages

Open source communities grow within the context of TWO different language barriers,

The first is the language of the community,
The working language of the human communities is almost exclusively English.
The exceptions are gvSIG (es) and TerraView (pt) and to some extent Deegree (de).

The second is the language of the software code,
the computer dialect the humans are working with.

Most computer programmers are multi-lingual,
but, like you, they have a “native language” they are most comfortable in, which determines what projects they are most likely to be active in.

I started studying this in 2004, when writing a survey of
all open source geospatial software.

When you look at who is active in given open source geospatial communities,
you see the same names popping up again and again on different mailing lists.

But the names rarely traverse the language barriers.
An active Java developer rarely appears as an active C developer, and vice versa.

When I first talked about this, in 2004, there were only two active tribes,
but since then other distinct tribes have grown,
the .Net tribe,
and the “web” tribe with expertise in Javascript/DOM HTML and scripting languages.

I’m going to start with the oldest tribe, the “C tribe.

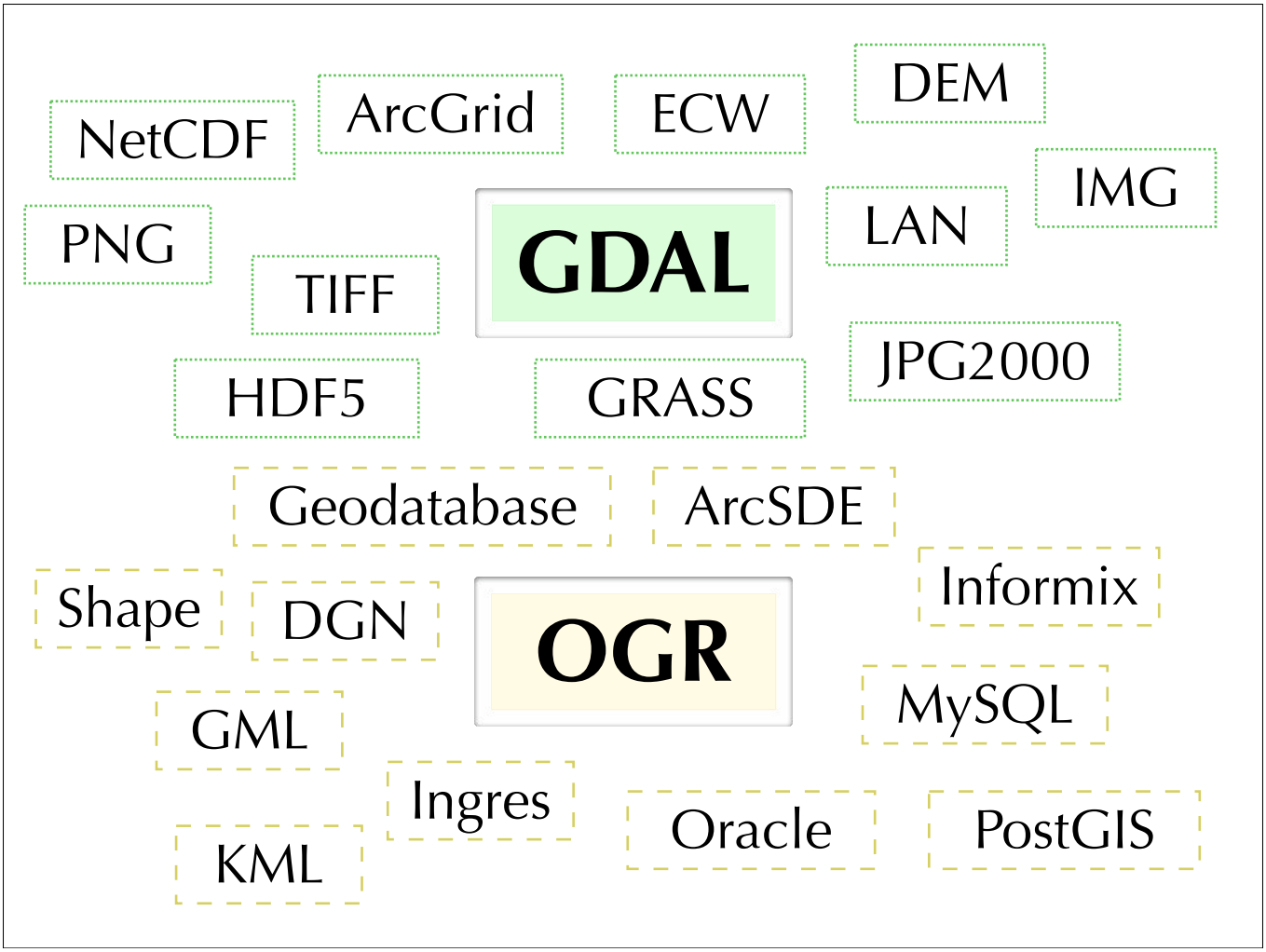
Much of the functionality shared by
the C family
is due to a powerful set of
shared libraries that
all the projects use.

.DLL .DYNLIB .SO

A code library is a piece of software that
provides generic functionality in a re-usable form.
Rather than re-write generic functionality over and over again,
programmers take the library and connect their program to it.

The .DLL files you see in Windows,
DLL stands for dynamic linking library,
the .dynlib files you see in OS/X,
the .so files you see in Linux.

These are all shared library files, that allow
multiple programs to take advantage of the same
infrastructural code.



The GDAL and OGR libraries provide support
for reading and writing multiple formats.
GDAL for raster imagery formats,
OGR for vector formats and databases.

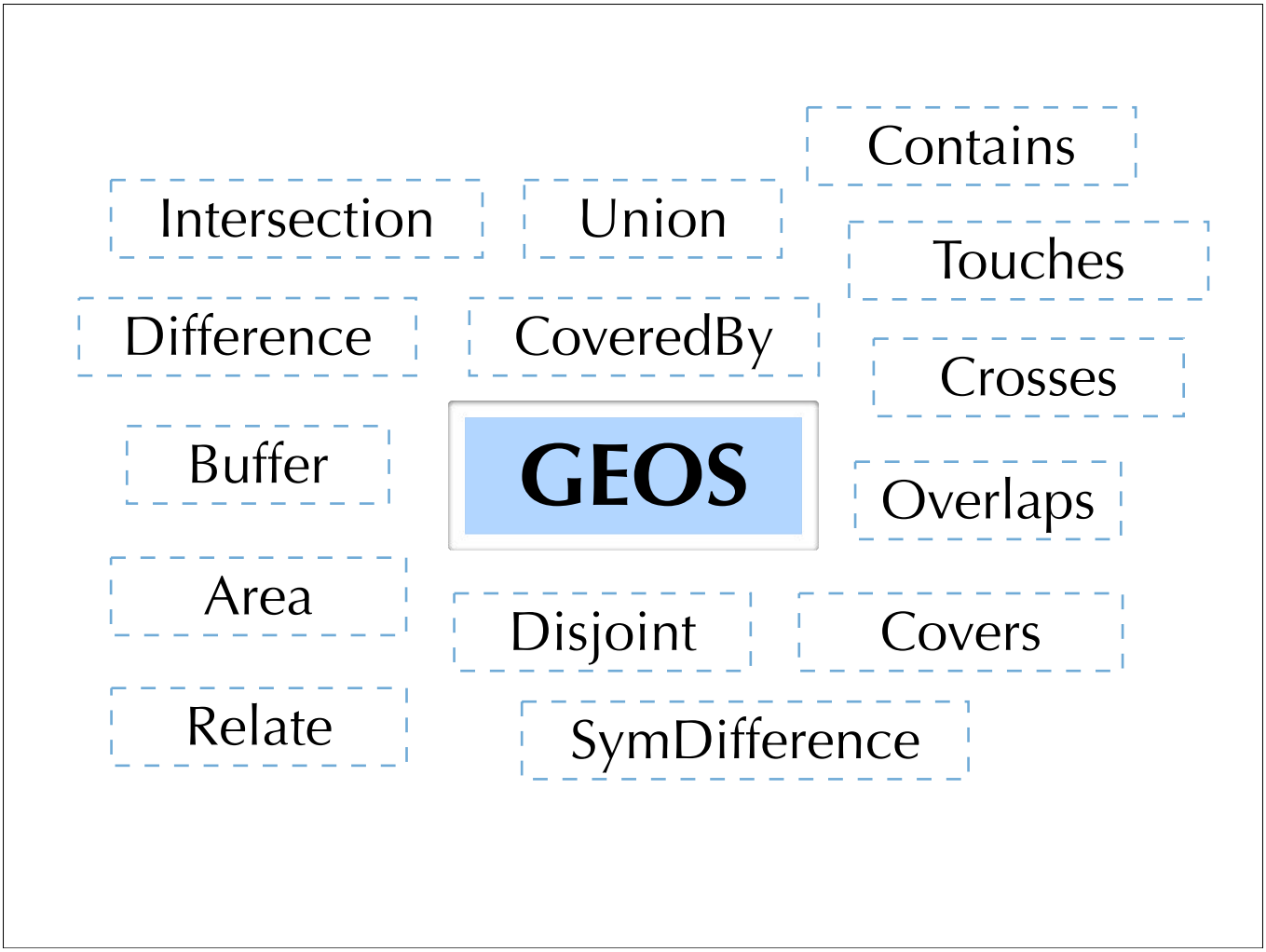
Because most of the C community programs
use GDAL/OGR for format support
they have the ability to use a
huge number of file types.

This is just a limited selection of the formats supported.

As GDAL/OGR is to formats, PROJ4 is to projections.

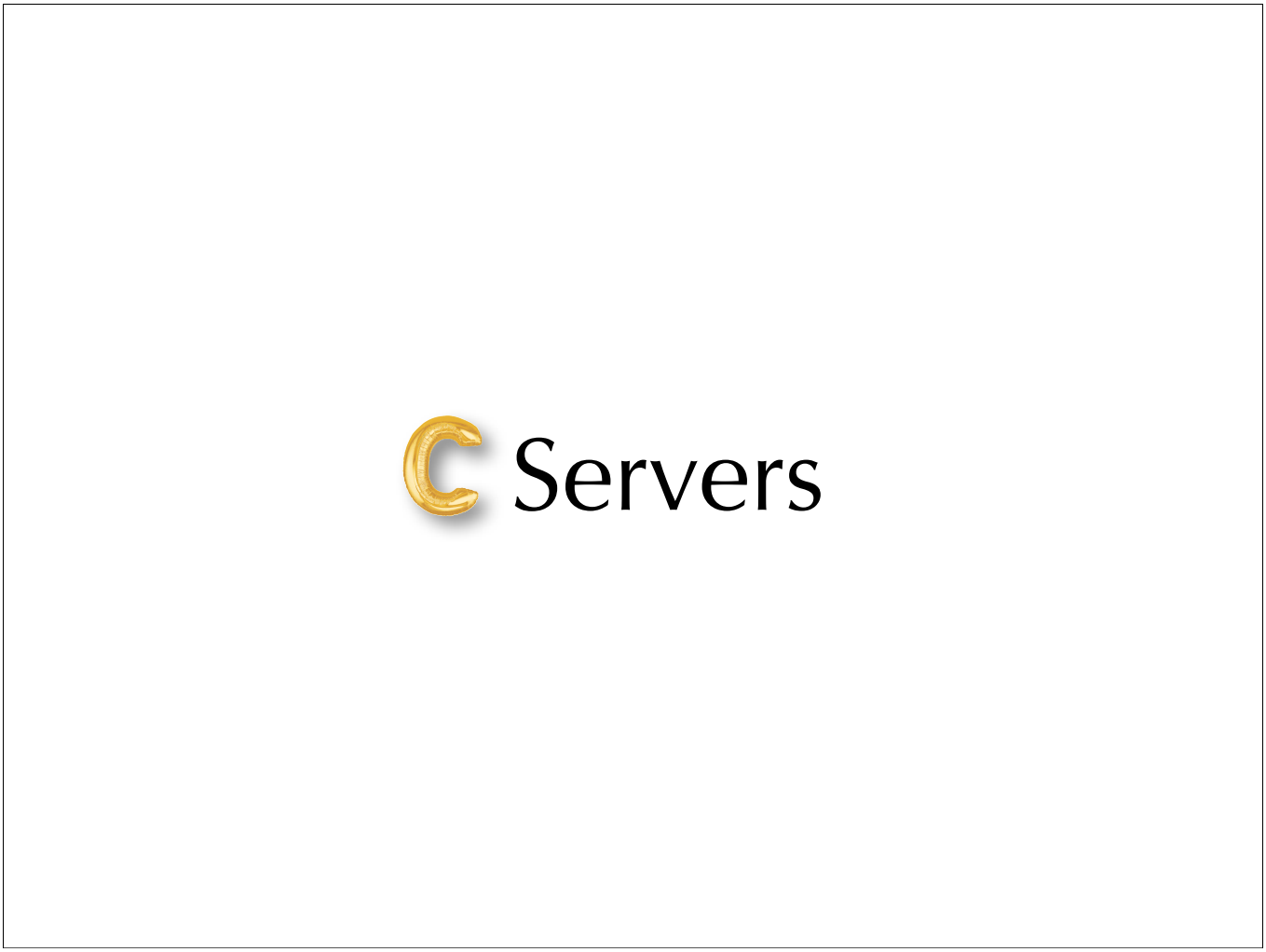
The coordinate reprojection support
in most open source geospatial software
in all languages
is derived from PROJ4,
either directly from using the library,
or through the translation of the algorithms
to a new language.

There are Java, .Net and Javascript versions of
the more common projection algorithms from Proj4 now.

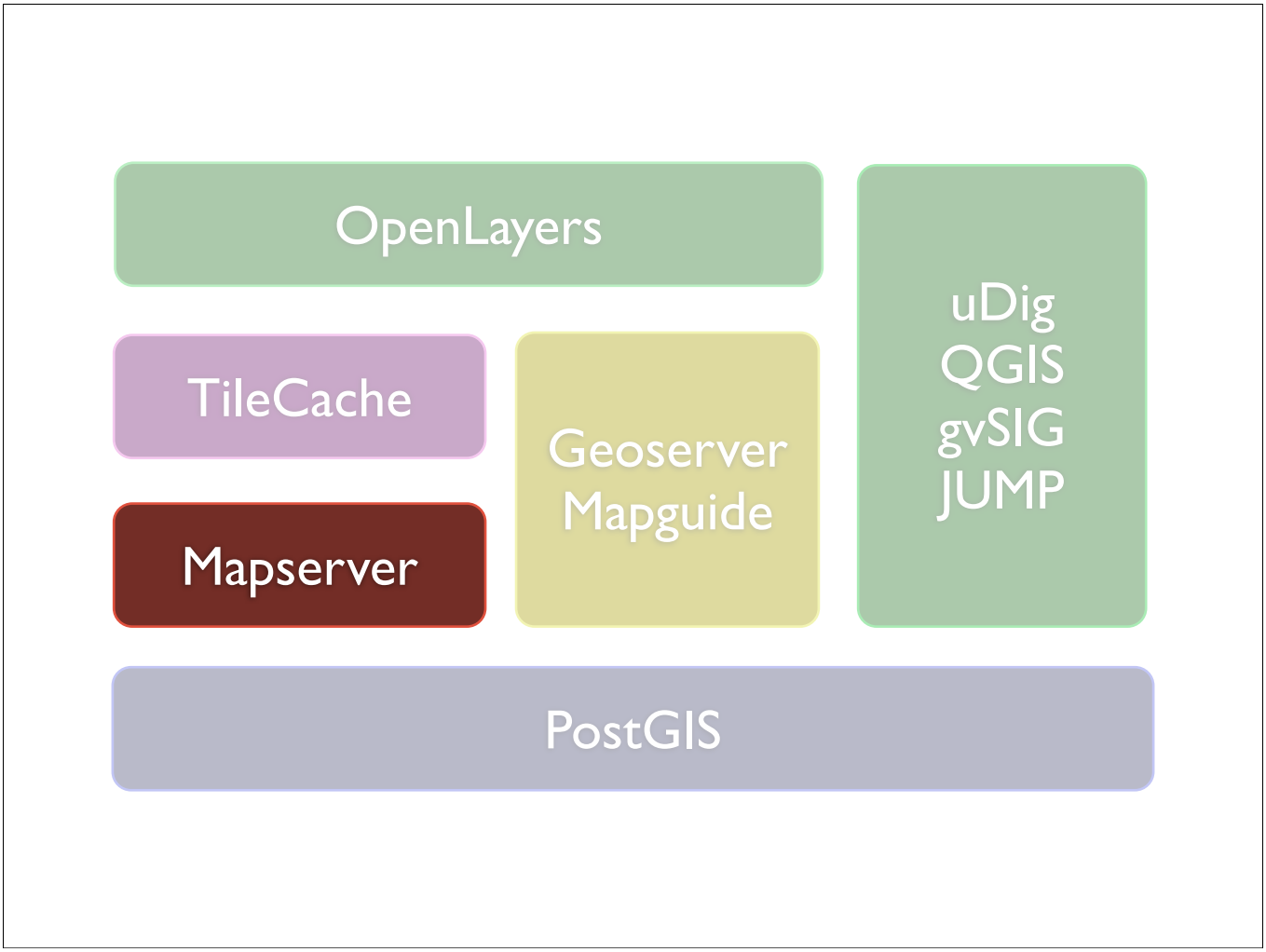


The GEOS library
provides standard geospatial functions
for testing relationships between shapes.

Like projections and formats,
geospatial predicates are hard to write correctly,
but used very frequently in software,
so GEOS is a very widely used library.



Servers are where open source geospatial shines,
and the C servers have the longest history.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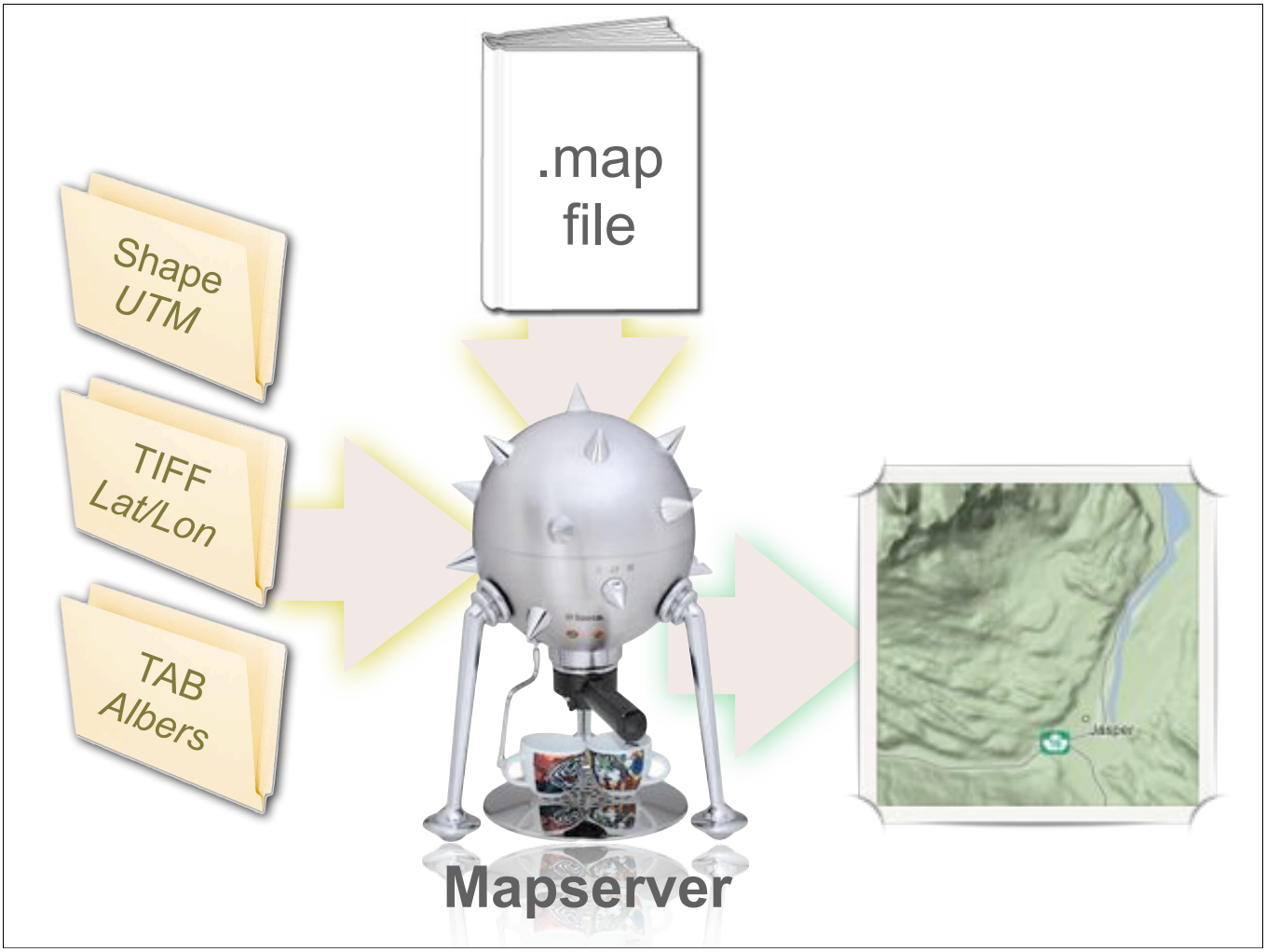
Mapserver
Geoserver
Mapguide
uDig
QGIS
gvSIG
JUMP
PostGIS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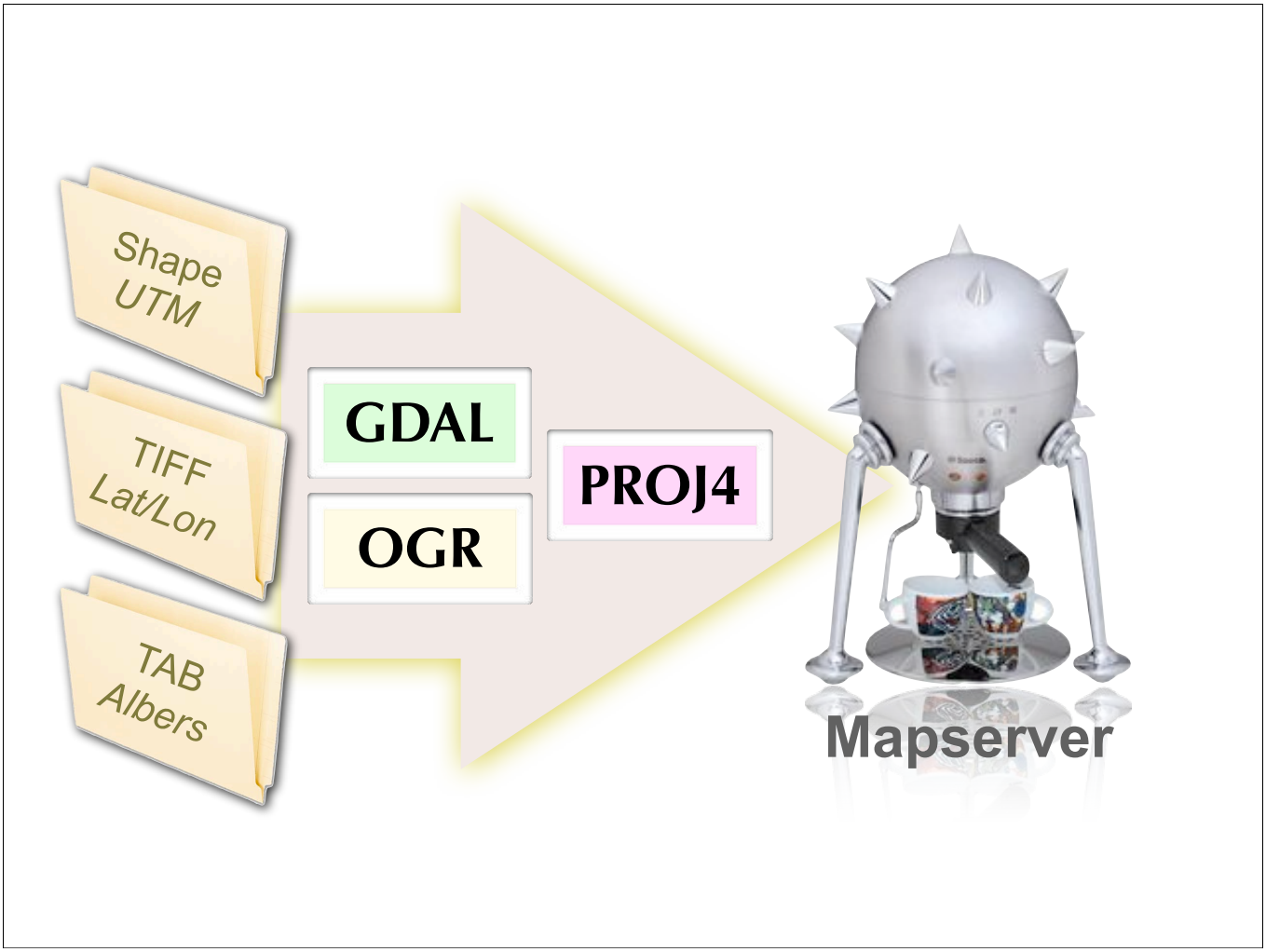
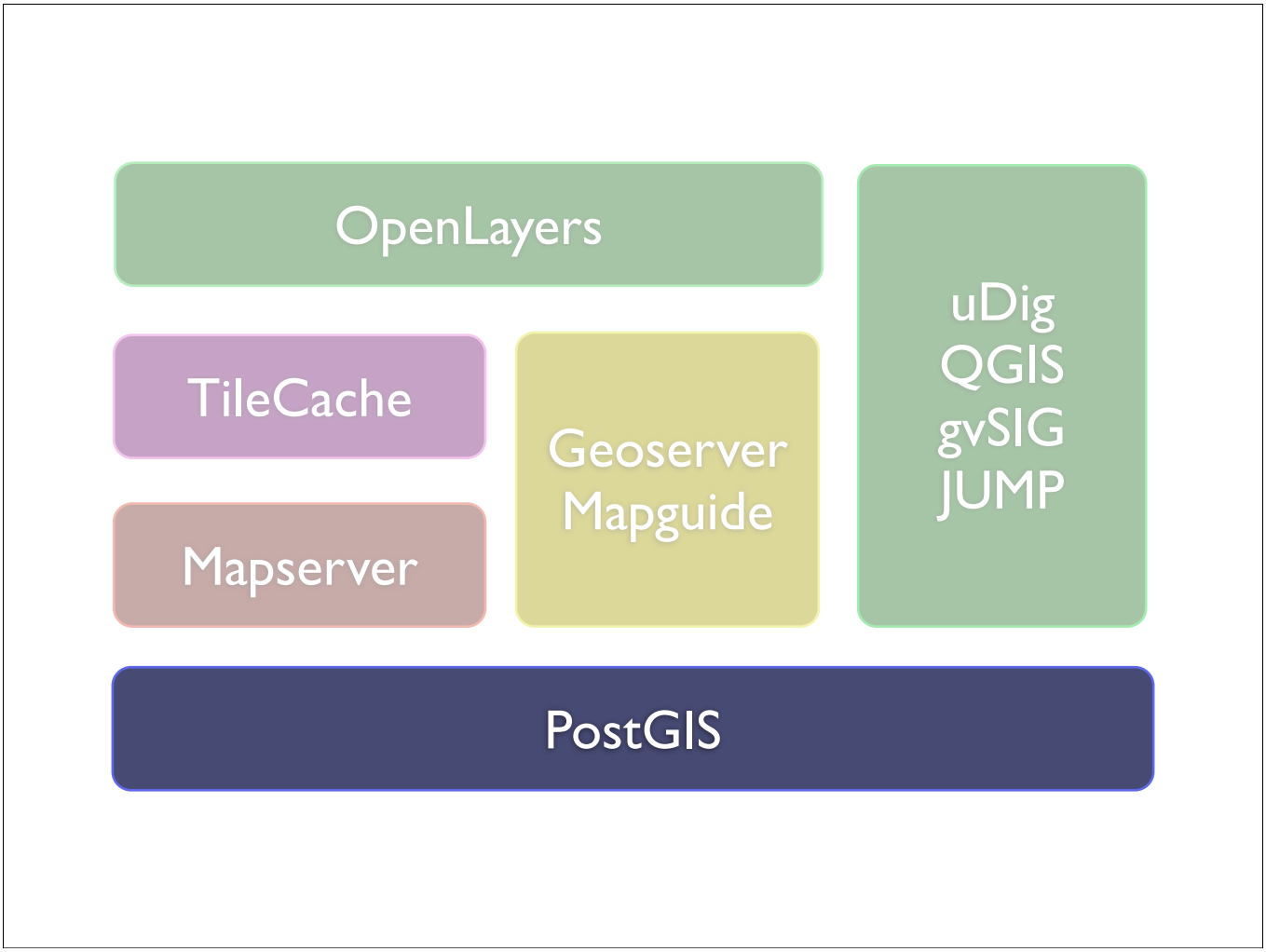
Albers
Jasper
Mapserver


Shape
UTM
TIFF
Lat/Lon
TAB
Albers
GDAL
OGR
PROJ4
Mapserver

Mapserver

- Multi-format (GDAL/OGR/PROJ)
- Multi-protocol (WMS/WFS/CGI)
- Fast render
- Simple service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JUMP
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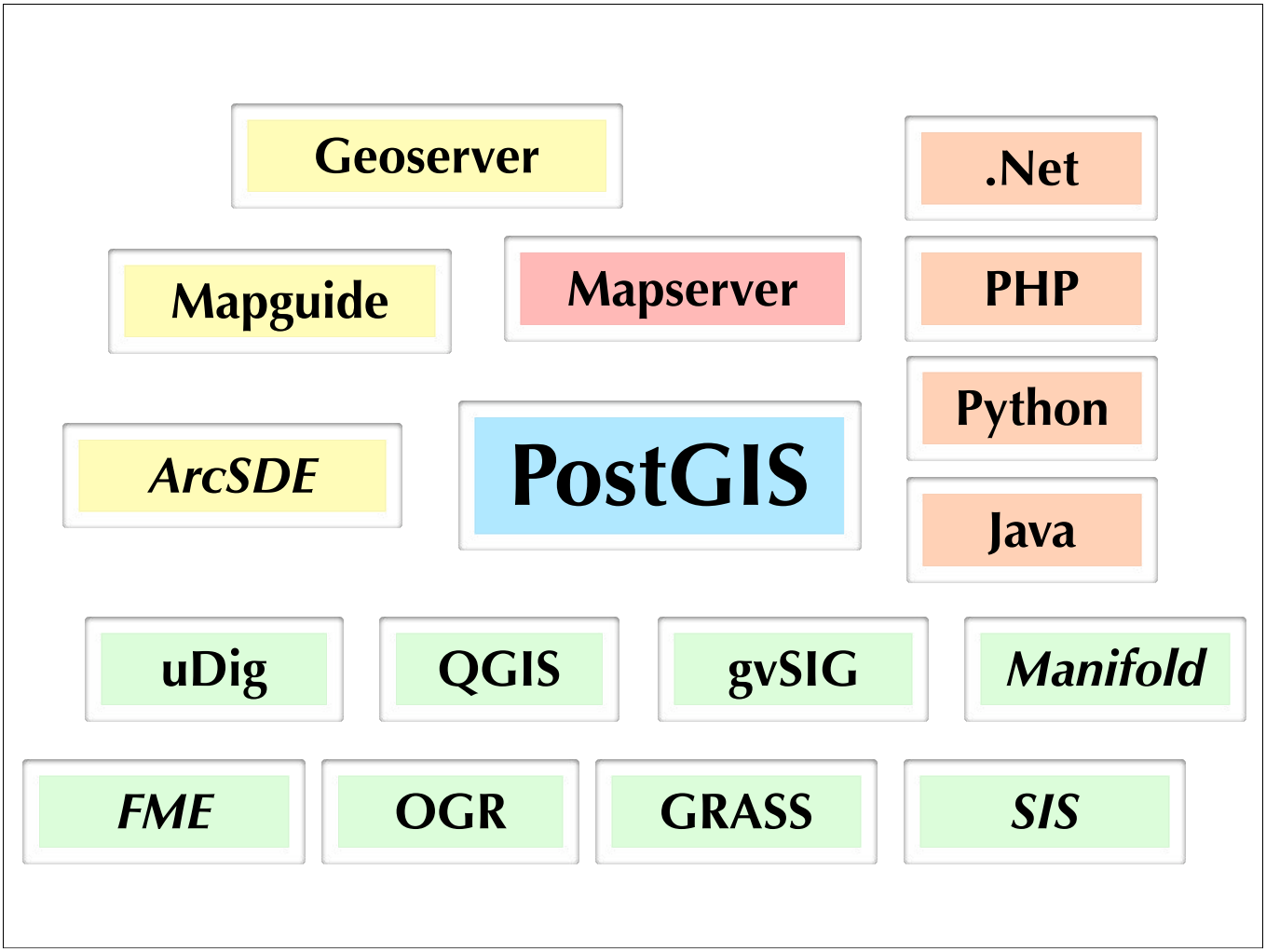
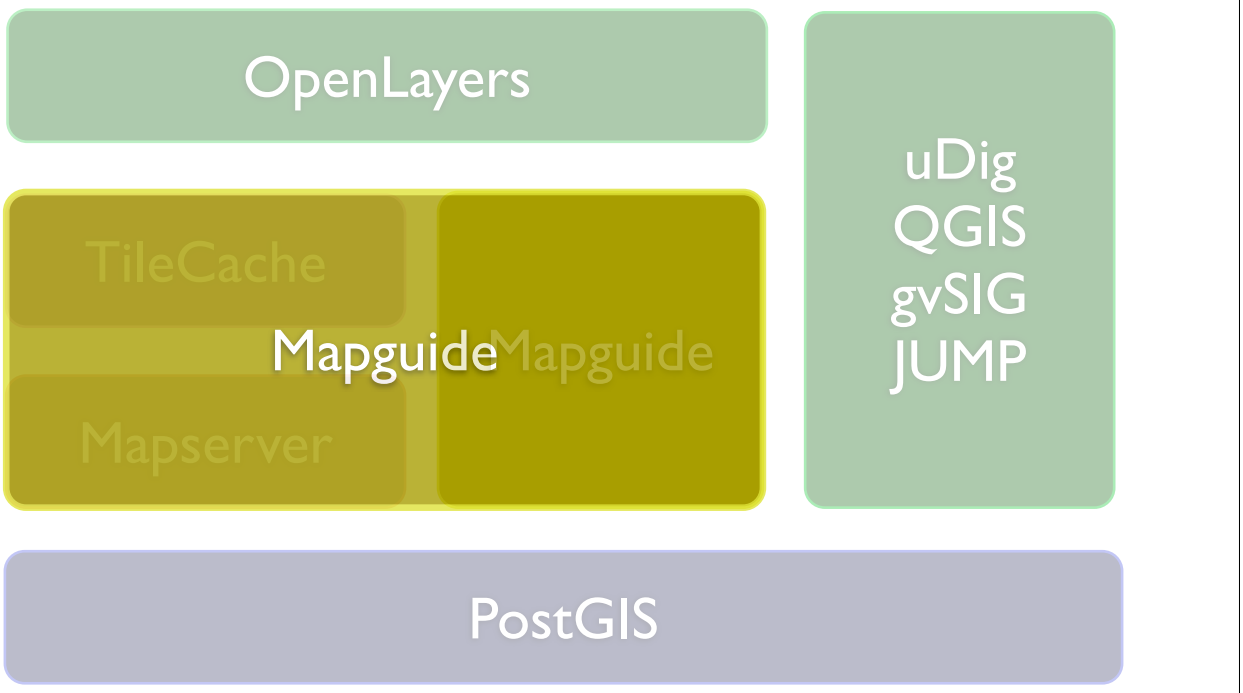

Geoserver
.Net
Mapguide
Mapserver
PHP
Python
ArcSDE
PostGIS
Java
uDig
QGIS
gvSIG
Manifold
FME
OGR
GRASS
SIS

PostGIS

- Fast
- Cheap
- Supported
- Complete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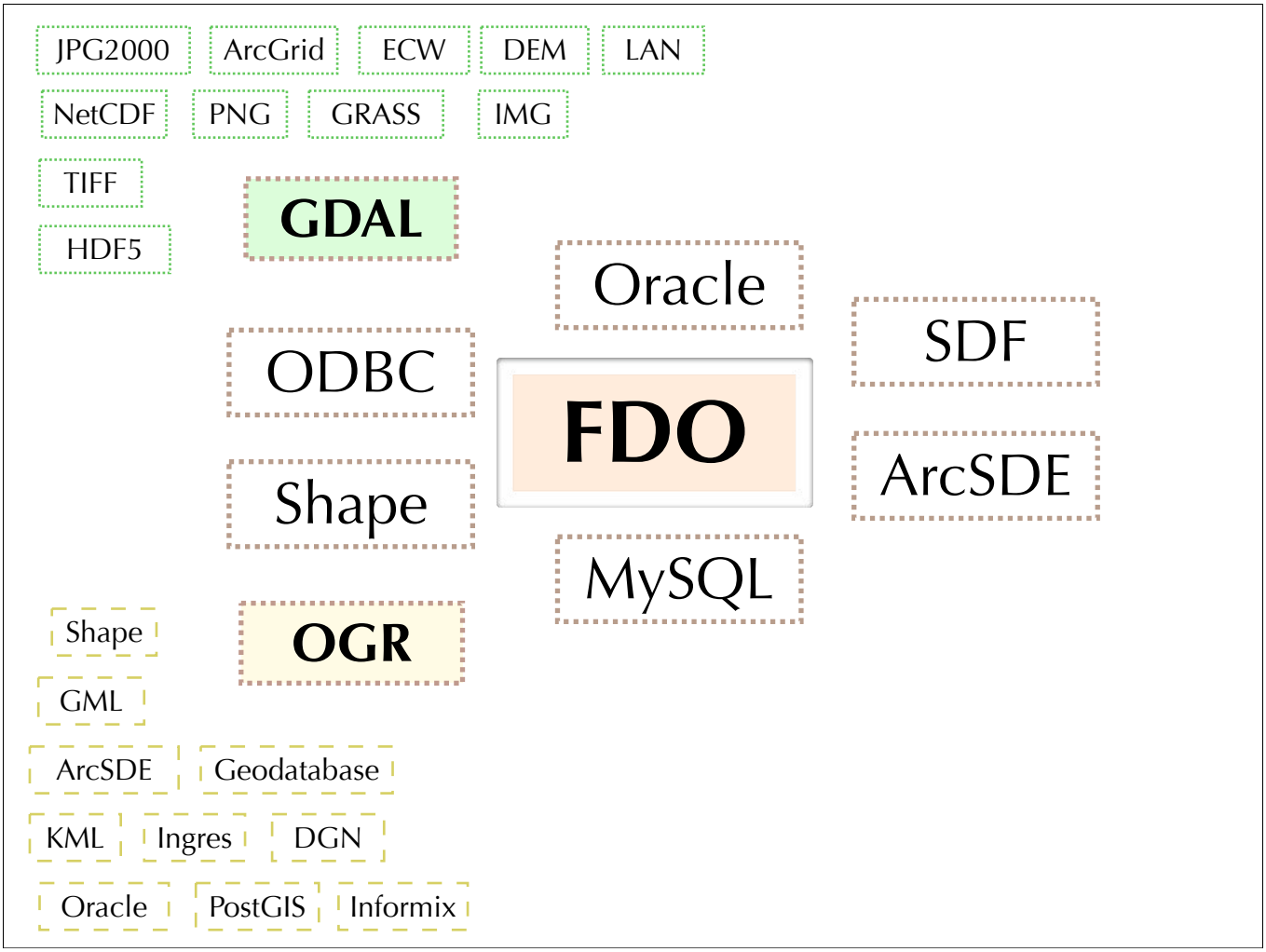
QGIS
gvSIG
JUMP
PostGIS

MapGuide

2000

2006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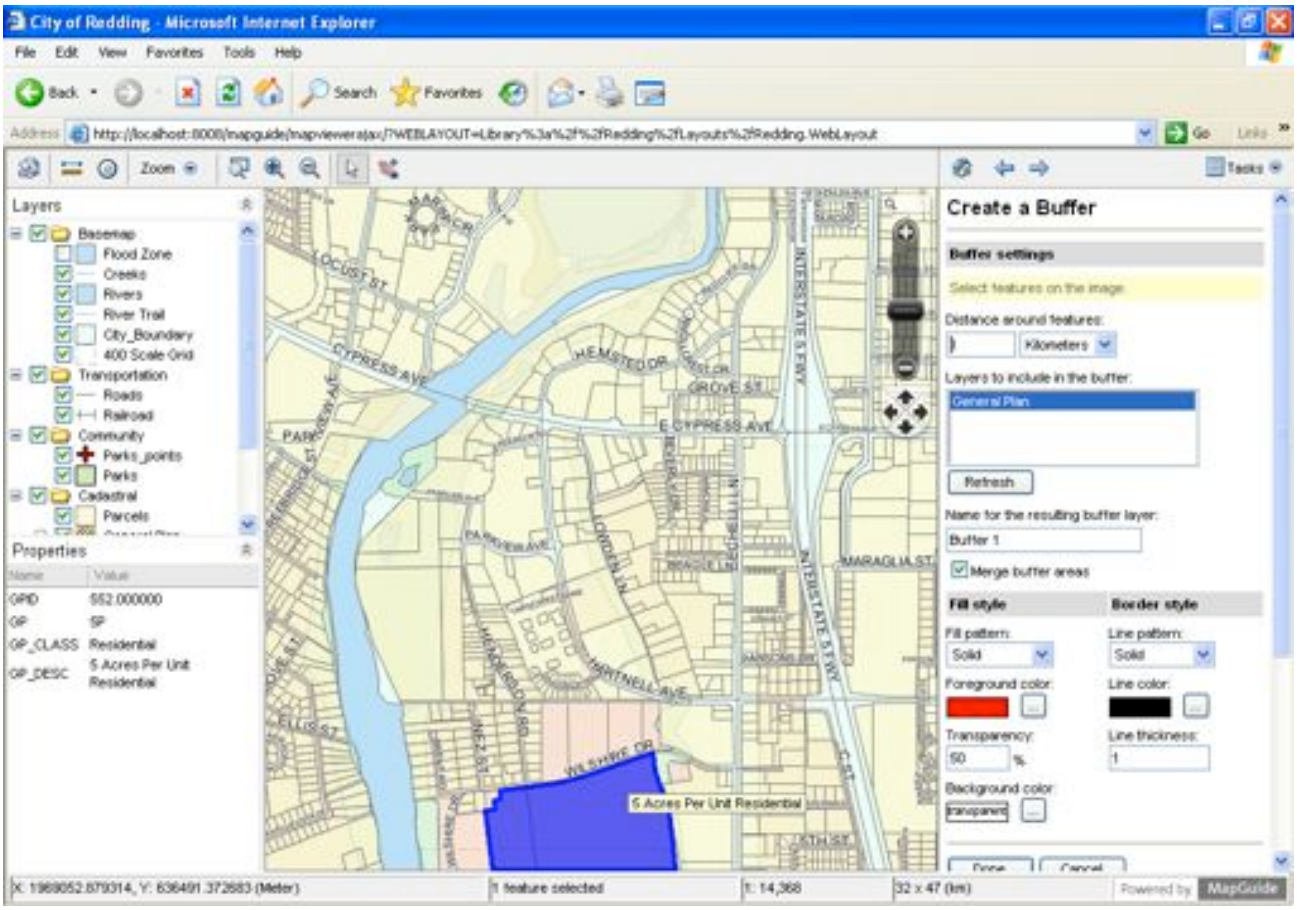
ECW
DEM
LAN
NetCDF
PNG
GRASS
IMG
TIFF
HDF5
GDAL
Oracle
SDF
ODBC
FDO
ArcSDE
Shape
MySQL
Shape
OGR
GML
ArcSDE
Geodatabase
KML
Ingres
DGN
Oracle
PostGIS
Informix

Mapguide

- Multi-format (FDO/GDAL/OGR)
- Multi-protocol (WMS/WFS/CGI)
- Scriptable (PHP/Java/.Net)
- Read / write (FDO)
- Easy deploy (GUI/Fusion)


City of Redding - Microsoft Internet Explorer
File Edit View Favorites Tools Help
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Go
Zoom
Tasks
Layers
Basemap
Flood Zone
Creeks
Rivers
River Trail
City_Boundary
400 Scale Grid
Transportation
Roads
Railroad
Community
Parks_points
Parks
Cadastral
Parcels
Properties
Name Value
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GP SP
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GP_DESC 5 Acres Per Unit Residential
Create a Buffer
Buffer settings
Select features on the image
Distance around features:
Kilometers
Layers to include in the buffer:
General Plan
Refresh
Name for the resulting buffer layer:
Buffer 1
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Solid
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LOCUST ST
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E CYPRESS AVE
HEMSTED DR
GROVE ST
INTERSTATE 5 FWY
PARKVIEW AVE
LONDEN LN
HARTNELL AVE
MARAGLIA ST
WILSHIRE DR
HENDERSON RD
ELLIS ST
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1 feature selected
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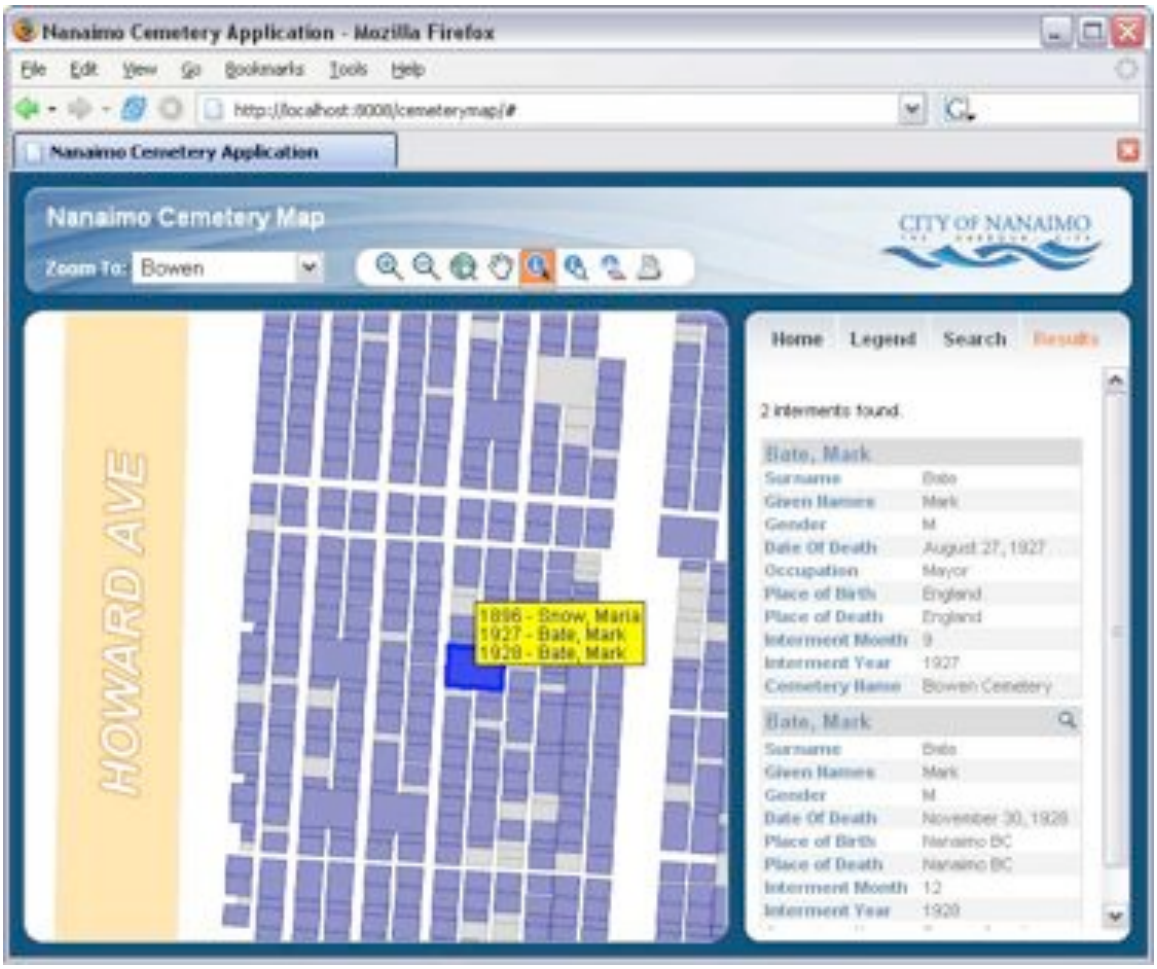
32 x 47 (km)
Powered by MapGuide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File Edit View Go Bookmarks Tools Help
http://localhost:8000/cemeterymap/#
Nanaimo Cemetery Application
Nanaimo Cemetery Map
Zoom To: Bowen
CITY OF NANAIMO
HOWARD AVE
1896 - Snow, Maria
1927 - Bate, Mark
1928 - Bate, Mark
Home Legend Search Results
2 interments found.
Bate, Mark
Surname Bate
Given Names Mark
Gender M
Date Of Death August 27, 1927
Occupation Mayor
Place of Birth England
Place of Death England
Interment Month 9
Interment Year 1927
Cemetery Name Bowen Cemetery
Bate, Mark
Surname Bate
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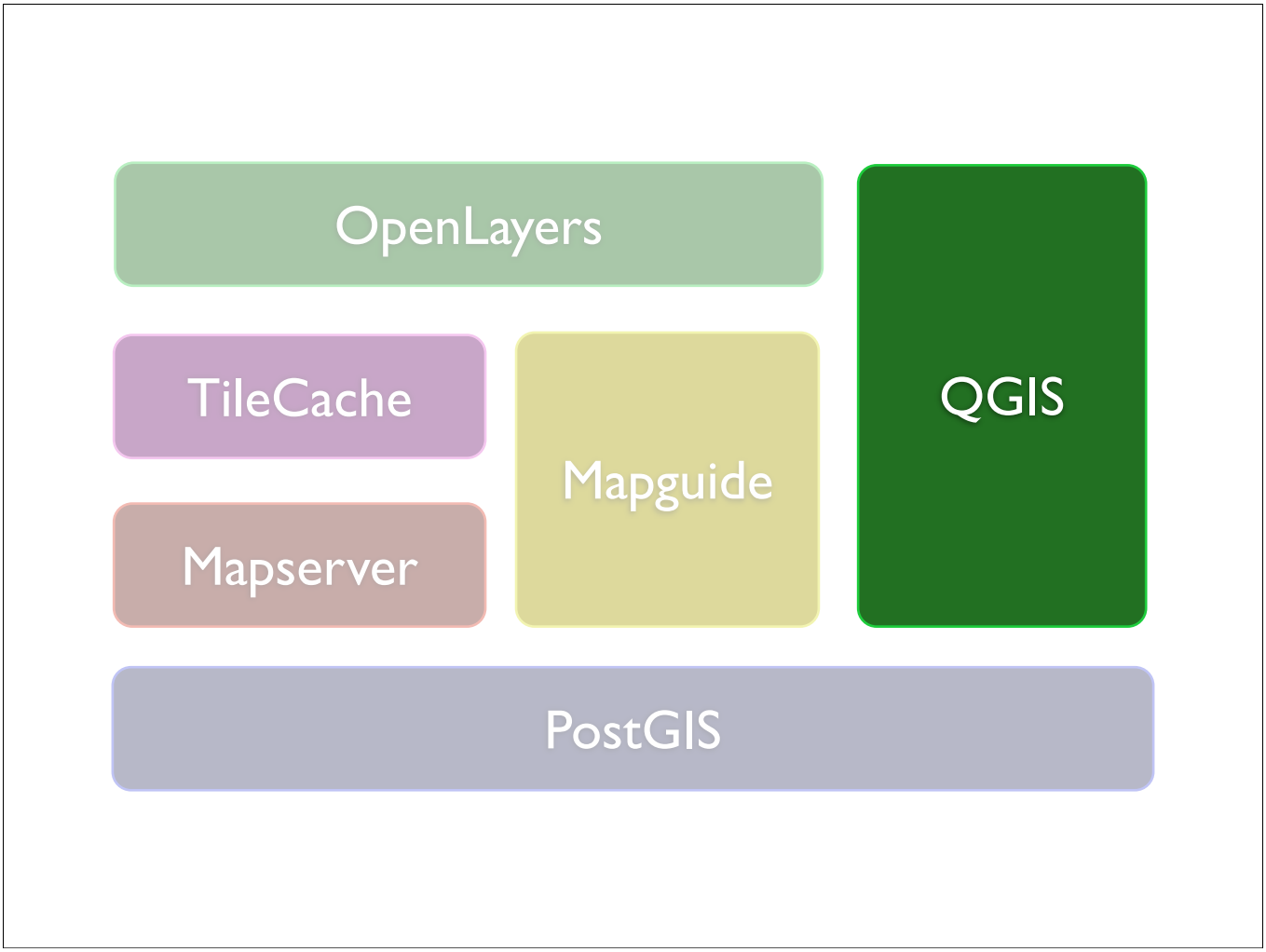
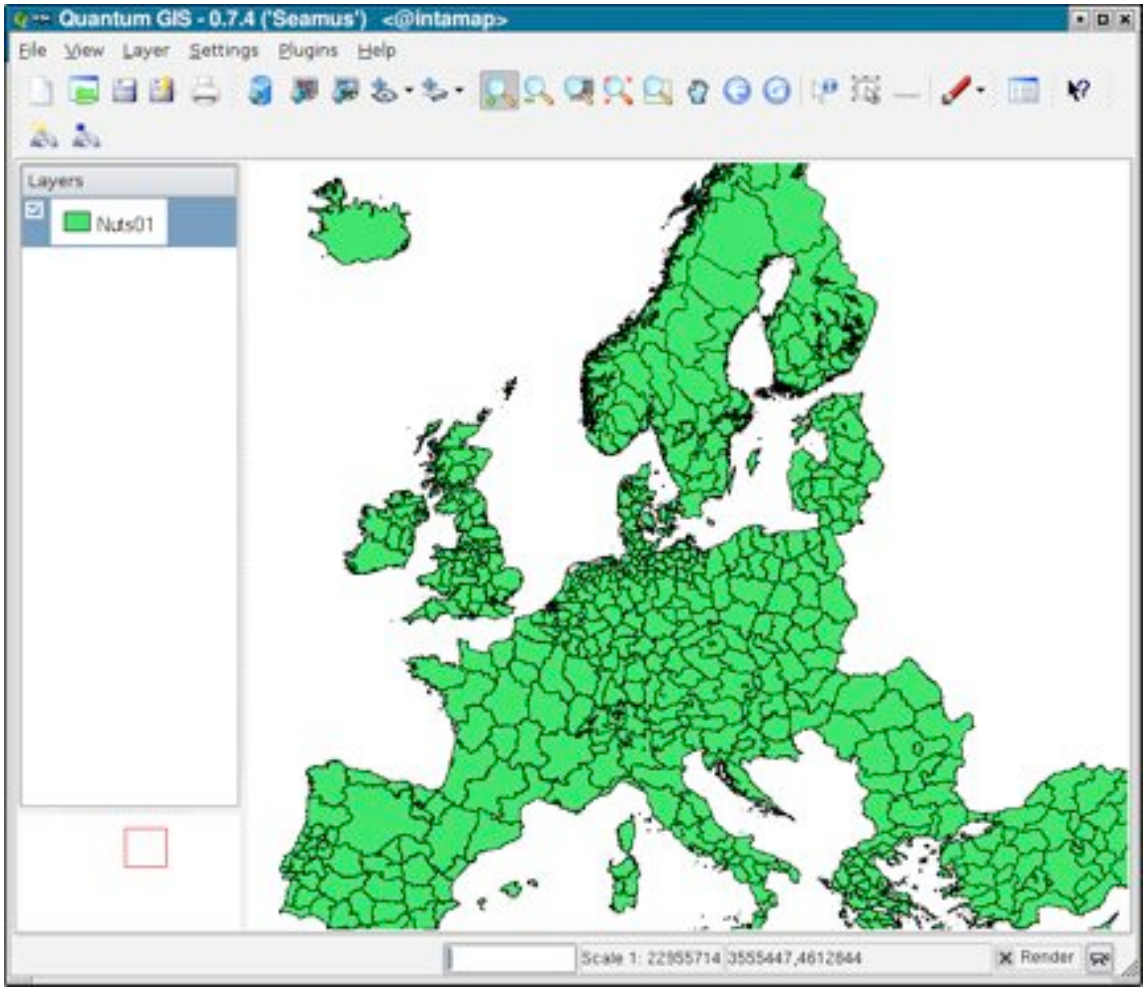
Gender M
Date Of Death November 30, 1928
Place of Birth Nanaimo BC
Place of Death Nanaimo BC
Interment Month 12
Interment Year 1928

Applications


OpenLayers
TileCache
Mapserver
Mapguide
QGIS
PostGIS


GEOS
GDAL
PROJ4
OGR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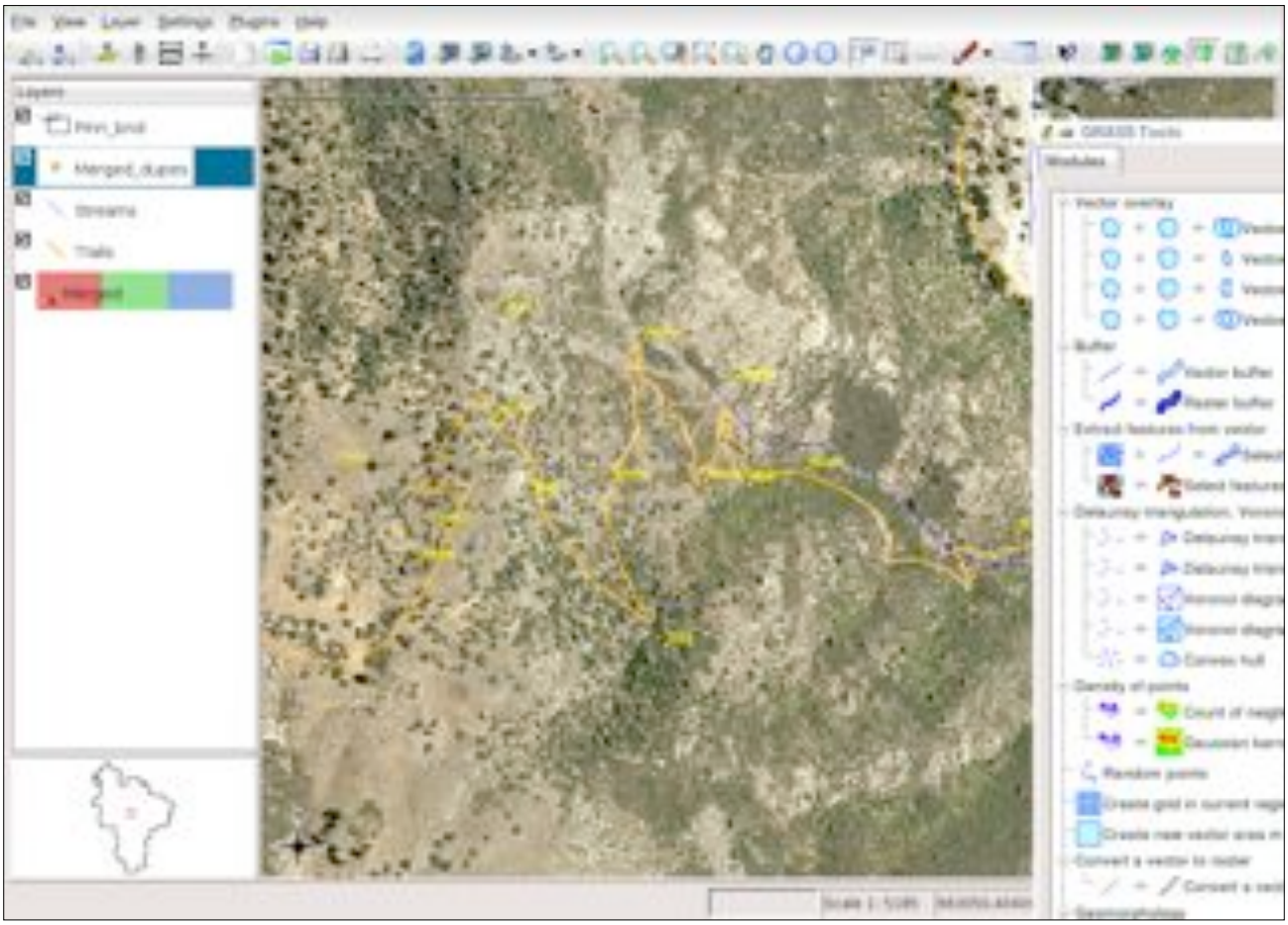

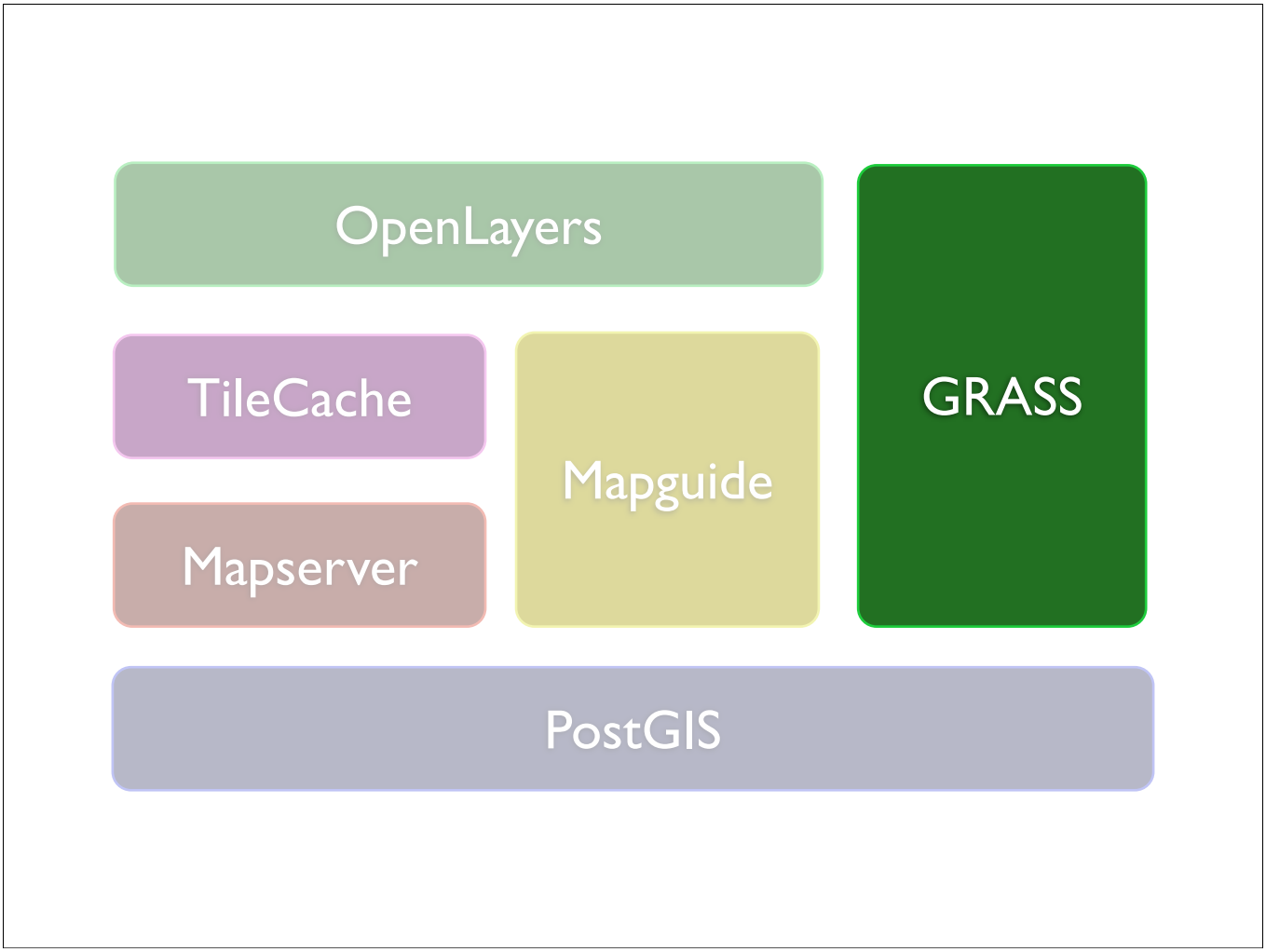
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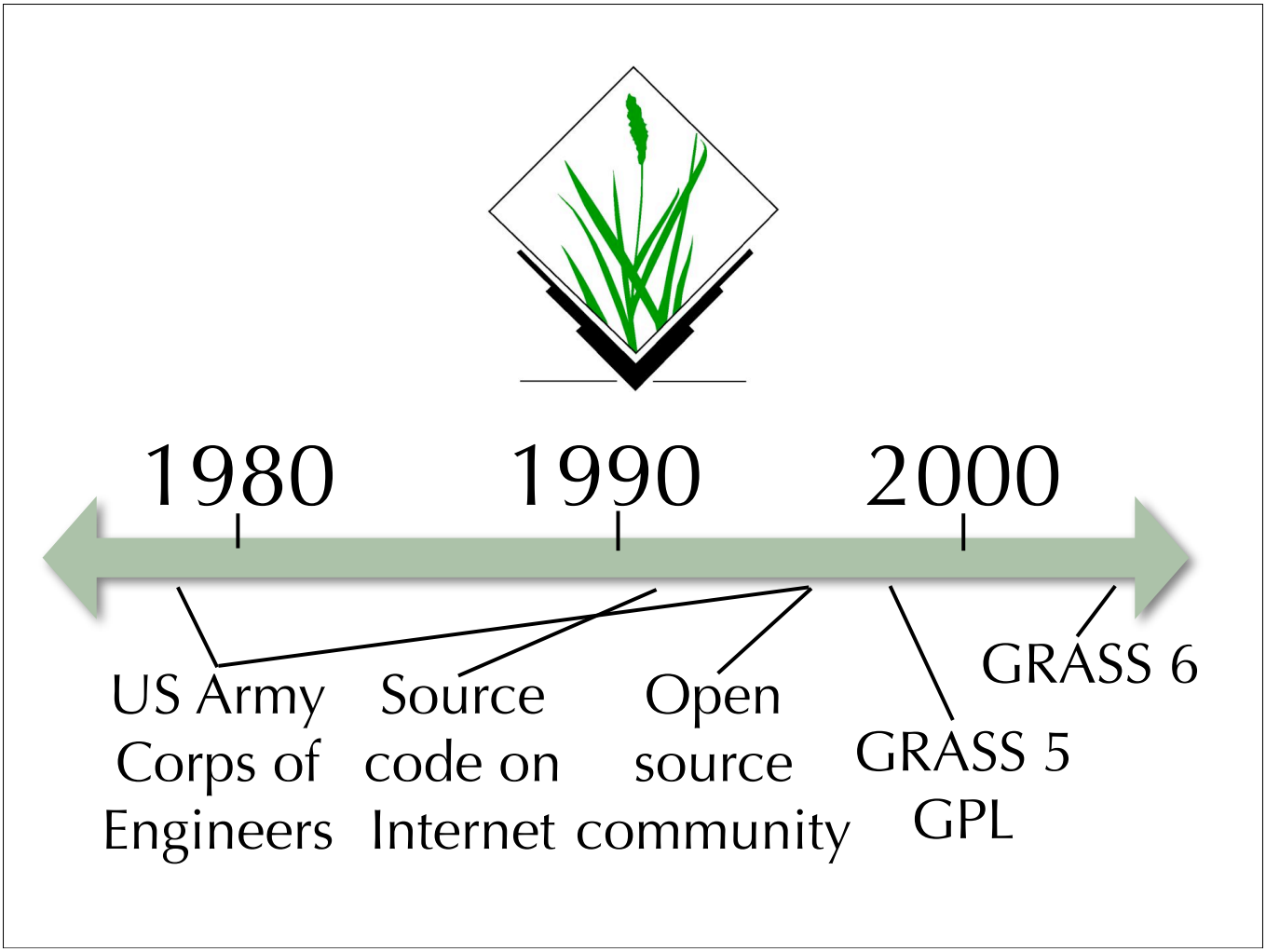
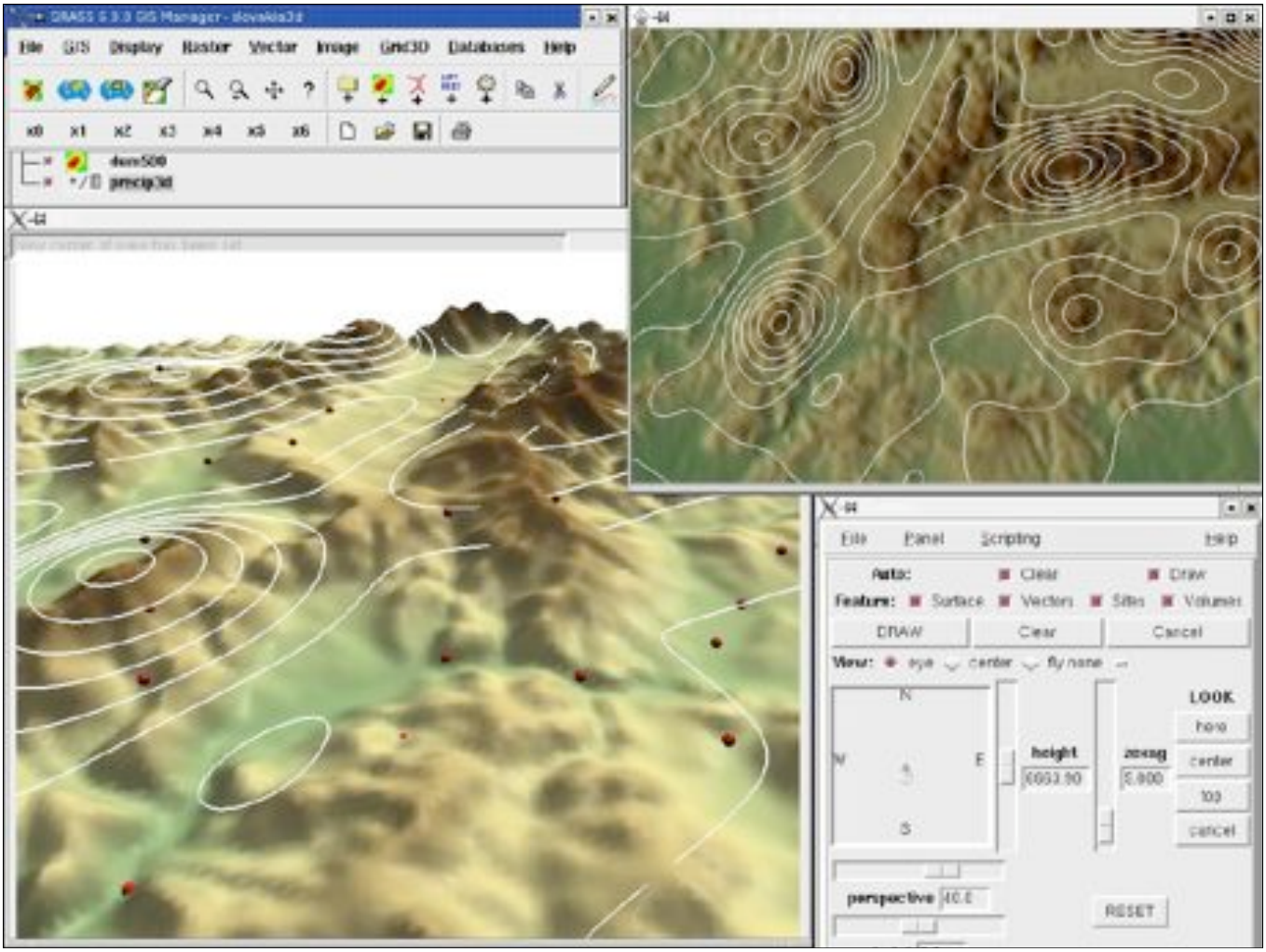


1980s US Army Corps of Engineers
Construction Engineering Research Lab (CERL)
1991 First internet release
1997 Open source development
(CERL no longer leading)
1999 GRASS 5.0, GPL license
2007 GRASS 6.2.2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File Panel Scripting Help
Auto: Clear Draw
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perspective
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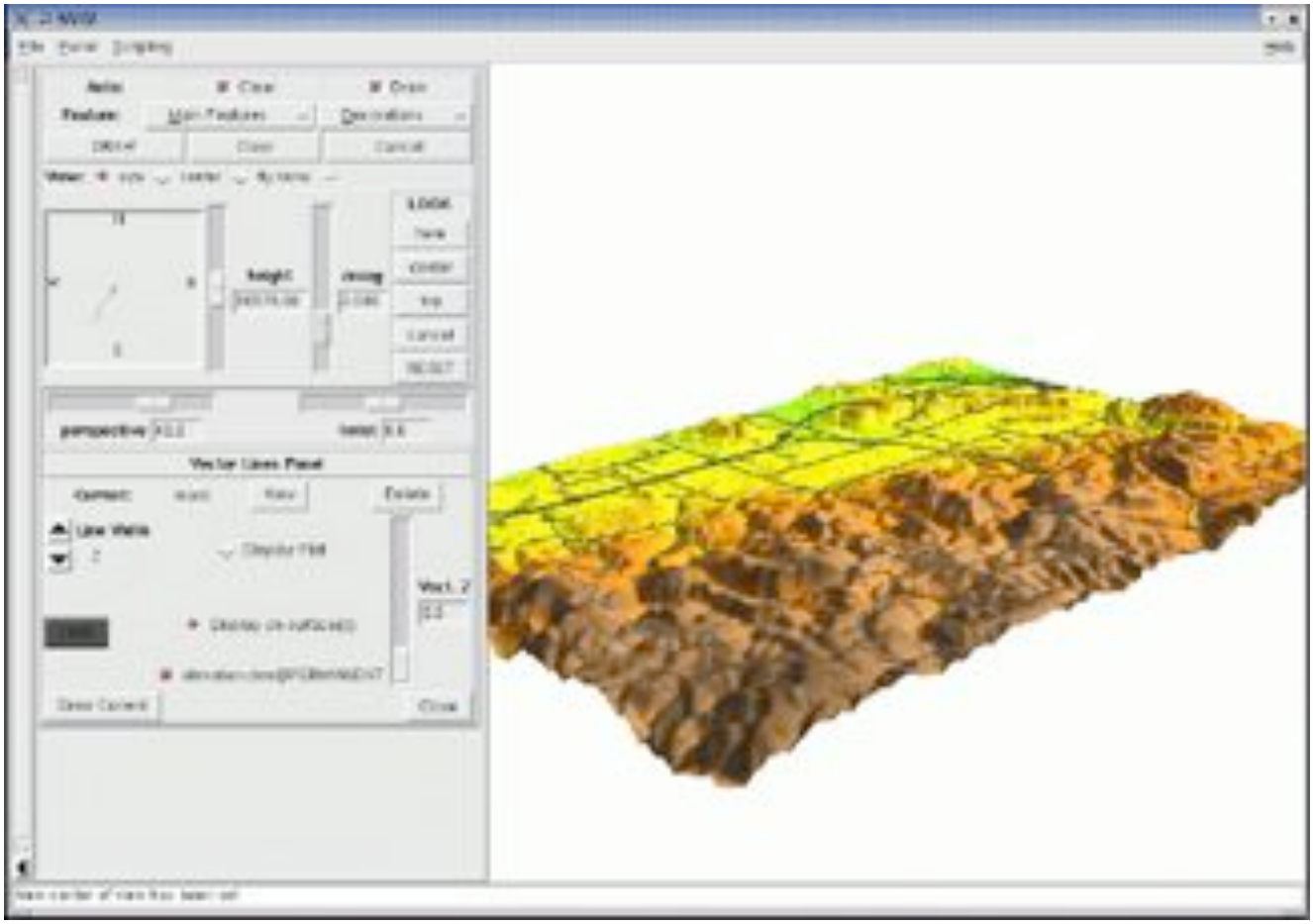
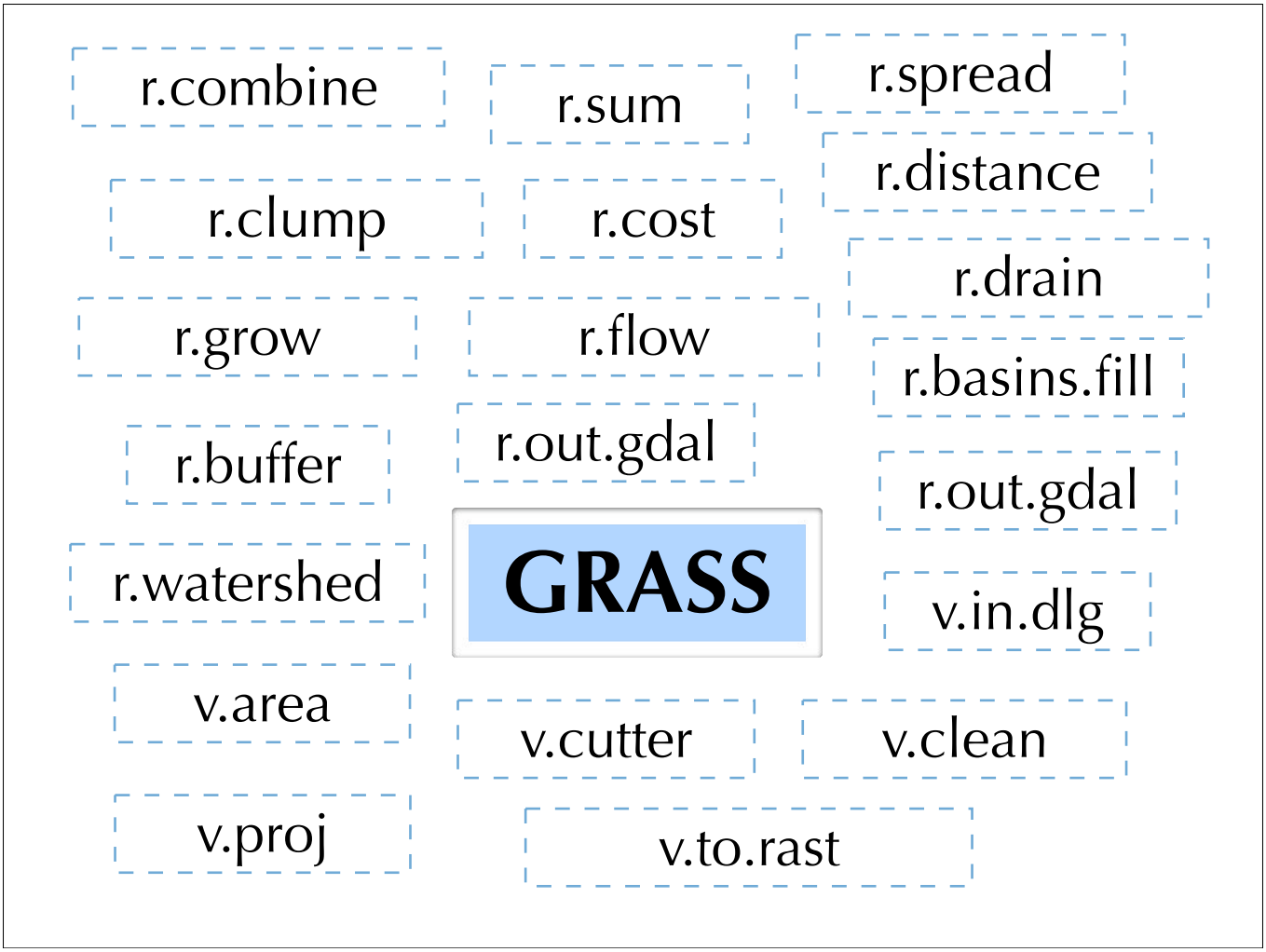

Vector Lines Panel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r.spread
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r.clump
r.cost
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r.flow
r.basins.fill
r.buffer
r.out.gdal
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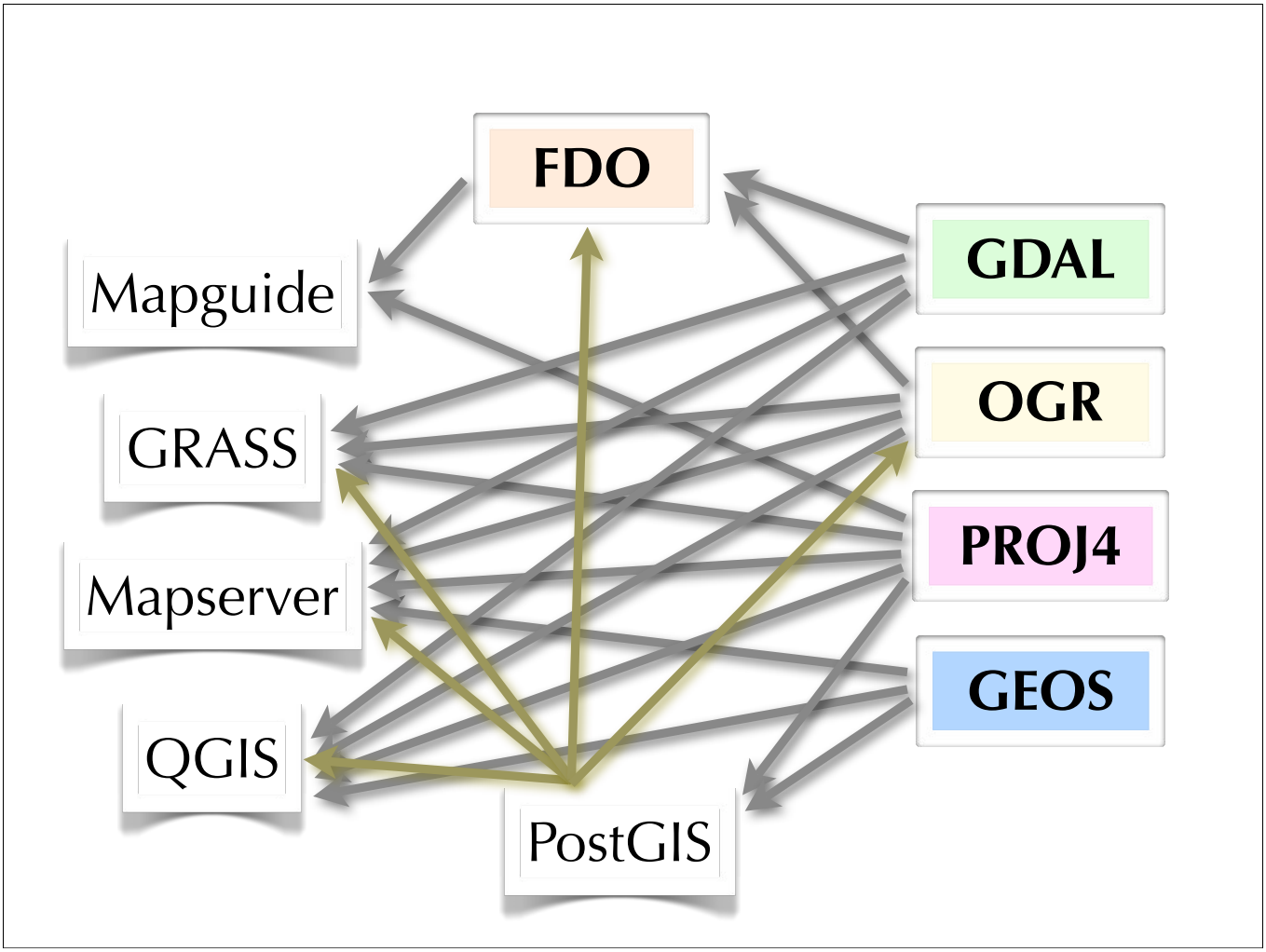
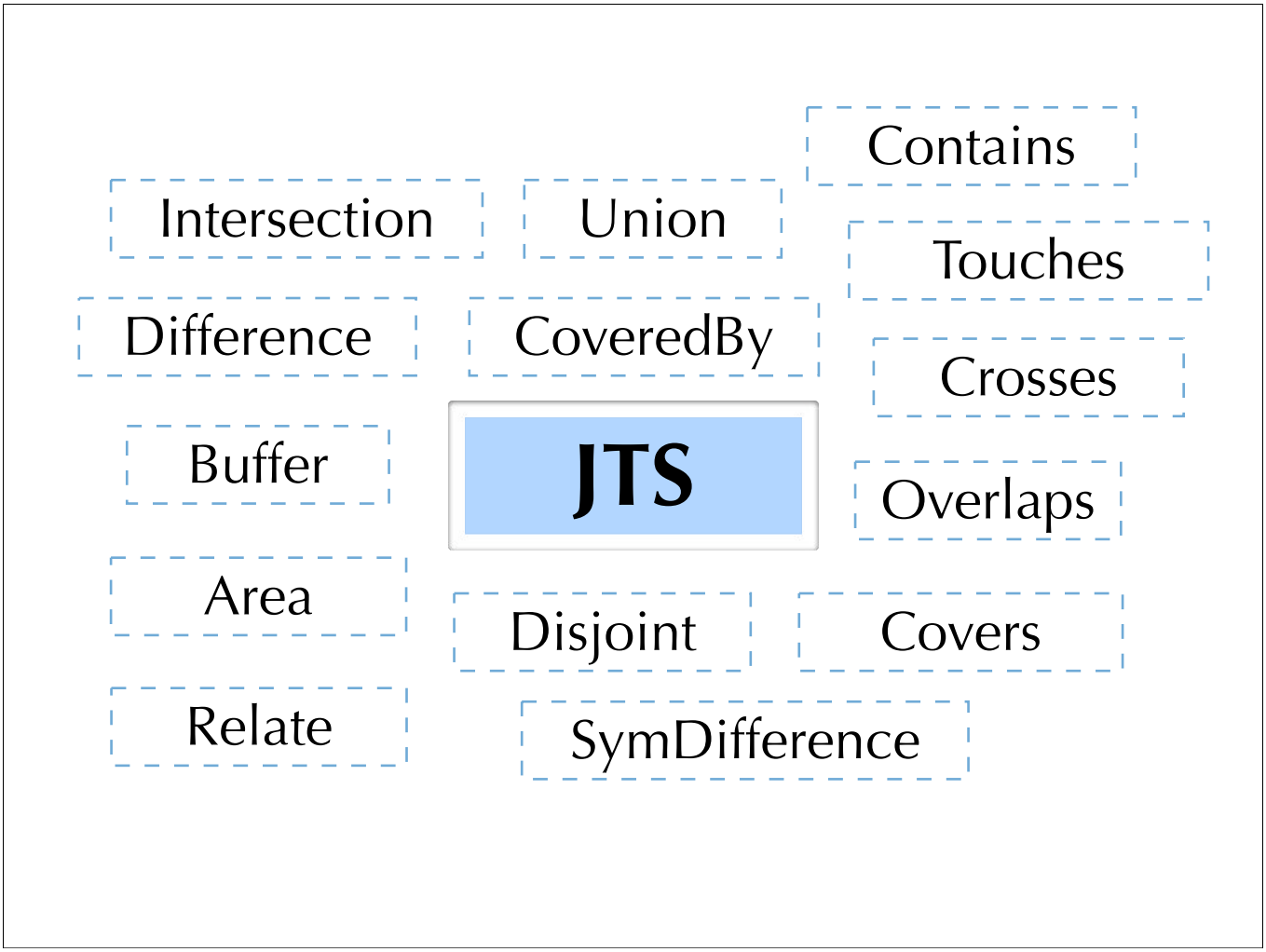
v.cutter
v.clean
v.proj
v.to.rast


Tribe


FDO
Mapguide
GRASS
Mapserver
QGIS
PostGIS
GDAL
OGR
PROJ4
GEOS

JAVA™ Libraries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Intersection
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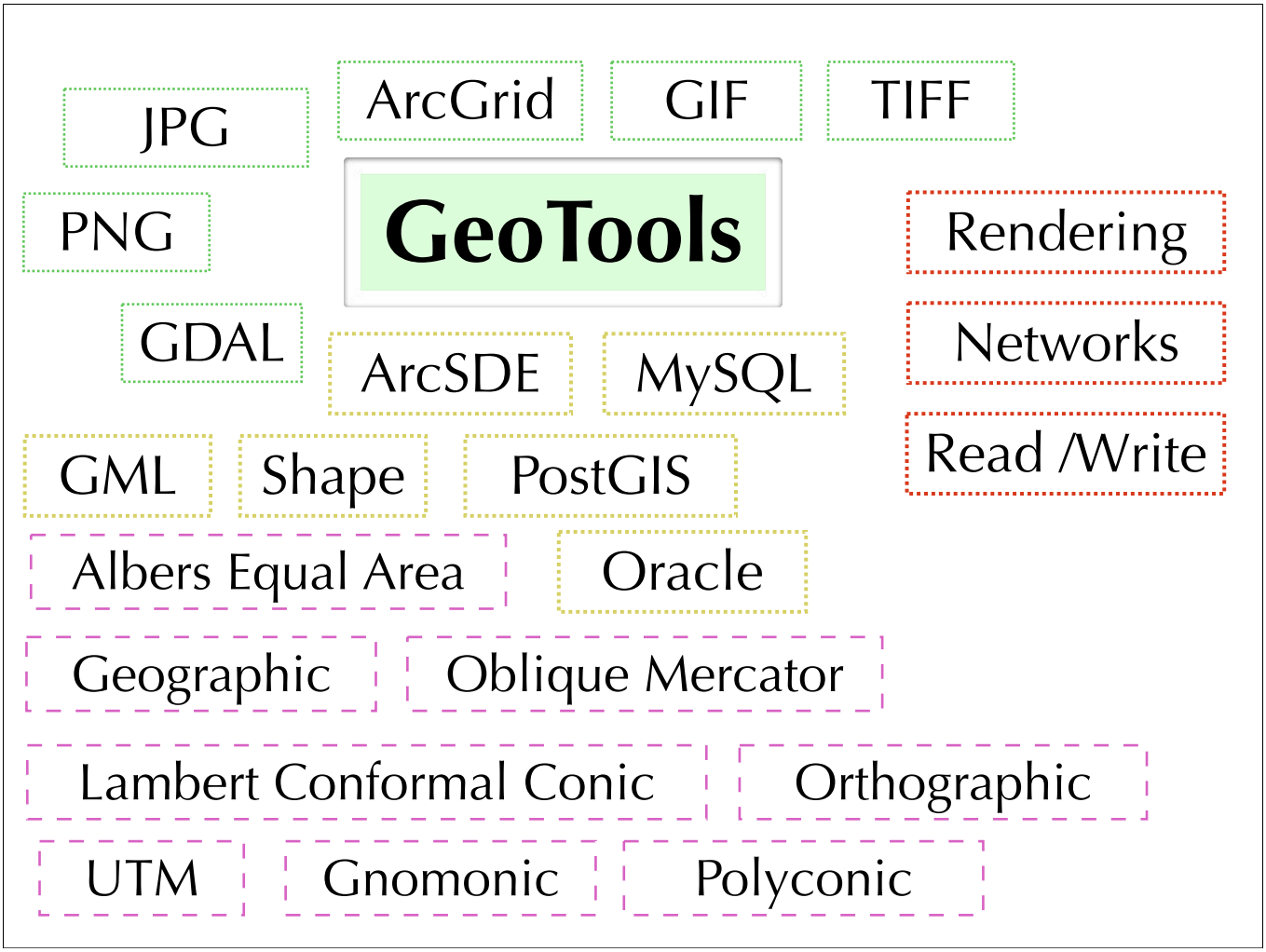
SymDifference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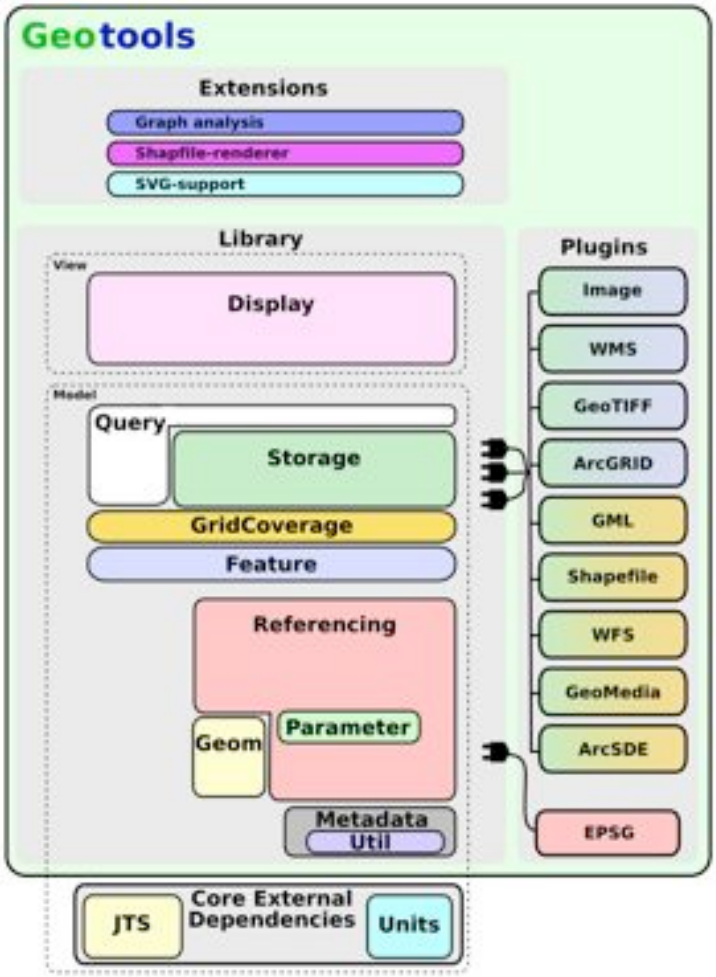
Albers Equal Area
Oracle
Geographic
Oblique Mercator
Lambert Conformal Conic
Orthographic
UTM
Gnomonic
Polyconic


Geotools
Extensions
Graph analysis
Shapfile-renderer
SVG-support
Library
View
Display
Model
Query
Storage
GridCoverage
Feature
Referencing
Geom
Parameter
Metadata
Util
Plugins
Image
WMS
GeoTIFF
ArcGRID
GML
Shapefile
WFS
GeoMedia
ArcSDE
EPSG
JTS
Core External Dependencies
Units

JAVA™ Applications

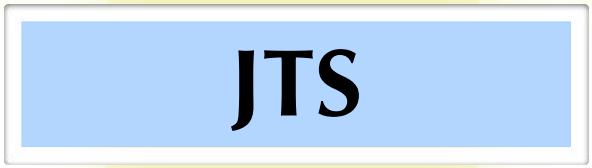
deegree

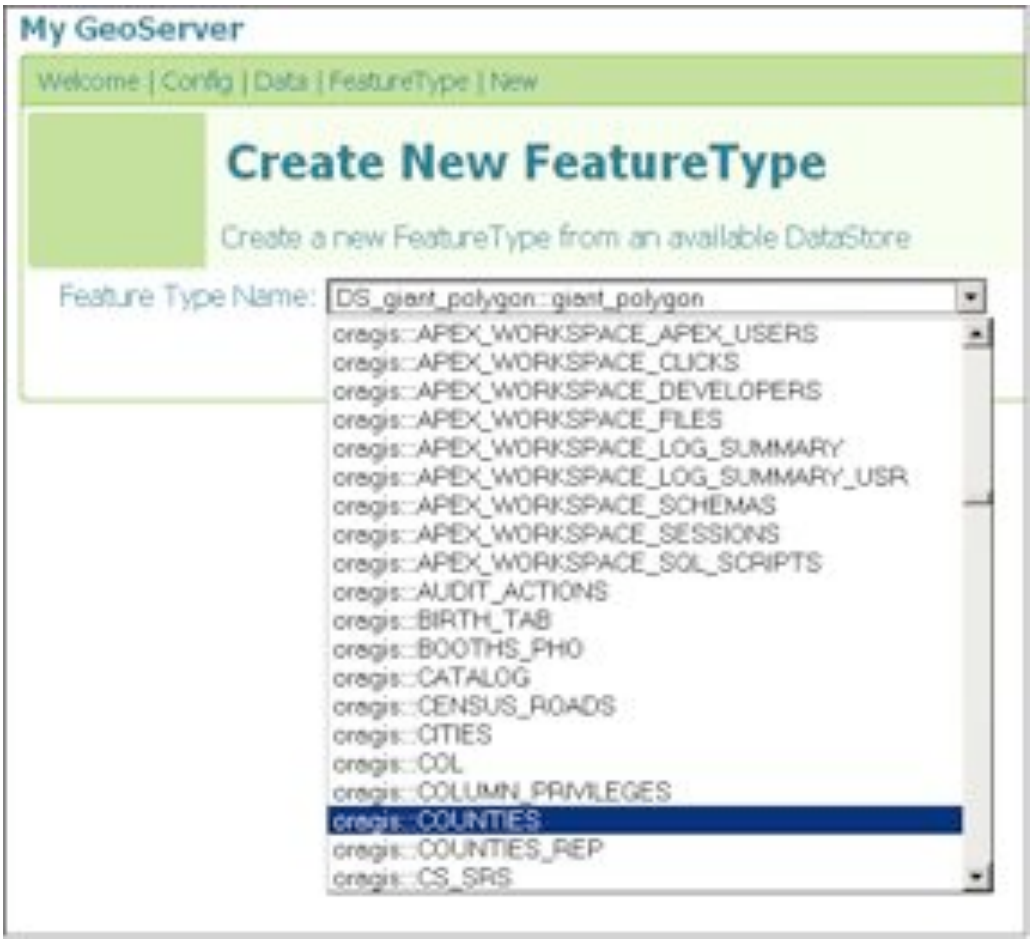
OpenMap™
Open Systems Mapping Technology


uDig
User-friendly Desktop Internet GIS


GeoServer
Open Gateway for Geospatial Data


GeoTools
The open source Java GIS toolkit


JTS


My GeoServer
Welcome | Config | Data | FeatureType | New
Create New FeatureType
Create a new FeatureType from an available DataStore
Feature Type Name:
DS_giant_polygon:giant_polygon
oregis::APEX_WORKSPACE_APEX_USERS
oregis::APEX_WORKSPACE_CLICKS
oregis::APEX_WORKSPACE_DEVELOPERS
oregis::APEX_WORKSPACE_FILES
oregis::APEX_WORKSPACE_LOG_SUMMARY
oregis::APEX_WORKSPACE_LOG_SUMMARY_USR
oregis::APEX_WORKSPACE_SCHEMAS
oregis::APEX_WORKSPACE_SESSIONS
oregis::APEX_WORKSPACE_SQL_SCRIPTS
oregis::AUDIT_ACTIONS
oregis::BIRTH_TAB
oregis::BOOTHS_PHO
oregis::CATALOG
oregis::CENSUS_ROADS
oregis::CITIES
oregis::COL
oregis::COLUMN_PRIVILEGES
oregis::COUNTIES
oregis::COUNTIES_REP
oregis::CS_SRS

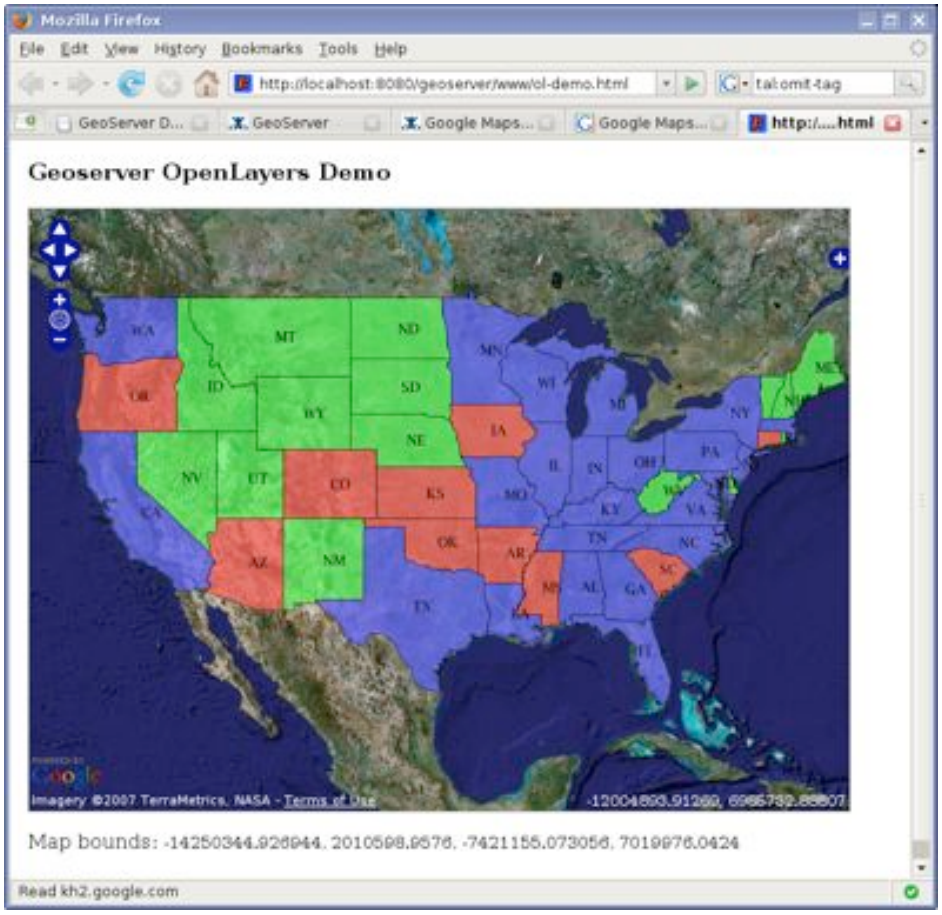
Inputs

- TIFF
- Shape
- PostGIS
- Oracle
- ArcSDE

Geoserver

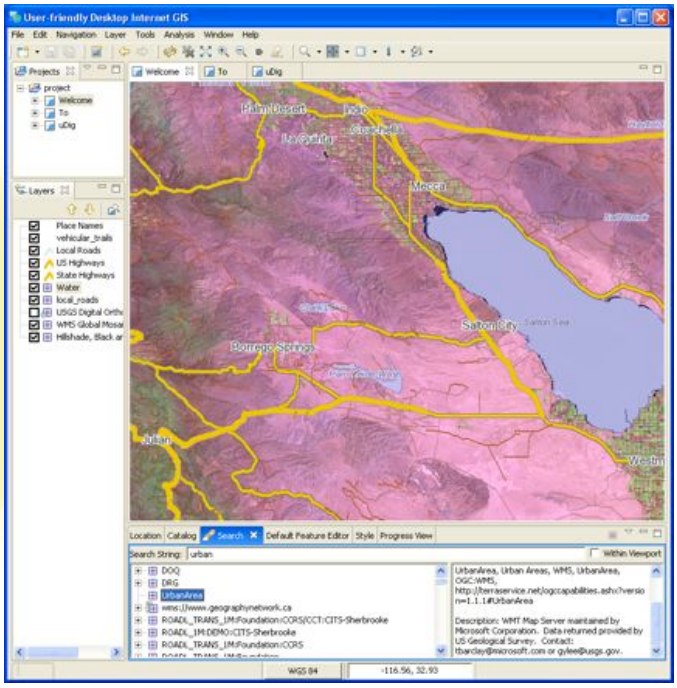
Outputs

- WMS
- WFS
- KML
- GeoJSON
- GeoRSS

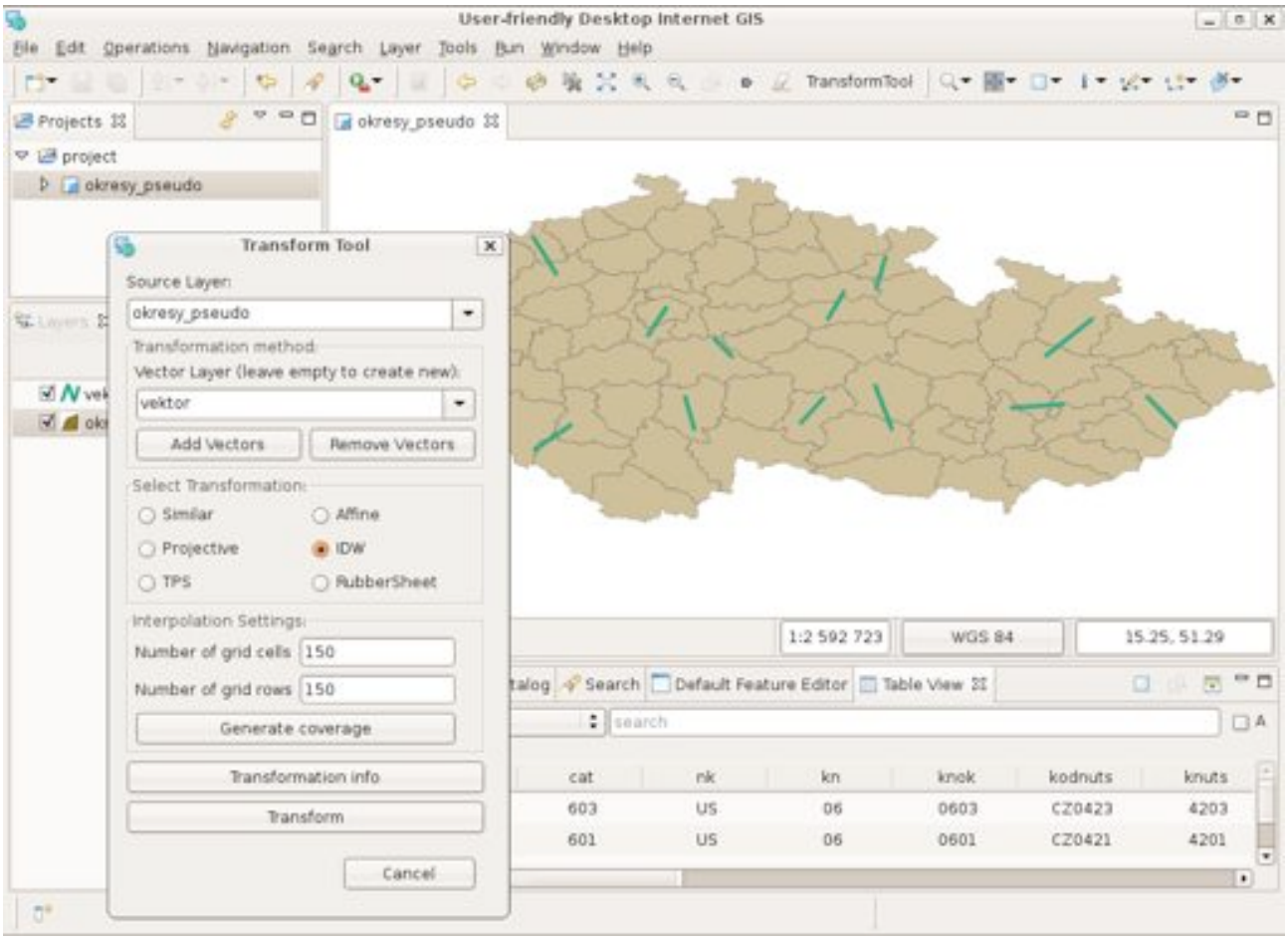

Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost:8080/geoserver/www/ol-demo.html
GeoServer D...
GeoServer
Google Maps...
Google Maps...
http://....html
Geoserver OpenLayers Demo
WA
MT
ND
MN
OR
ID
SD
WI
MI
NY
WY
NE
IA
NV
UT
CO
KS
IL
IN
OH
PA
MO
KY
WV
VA
CA
AZ
NM
OK
AR
TN
NC
MS
AL
GA
SC
TX
FL
Imagery ©2007 TerraMetrics, NASA - Terms of Use
-12004893.91299, 6986732.88807
Map bounds: -14250344.926944, 2010598.9576, -7421155.073056, 7019976.0424
Read kh2.google.com

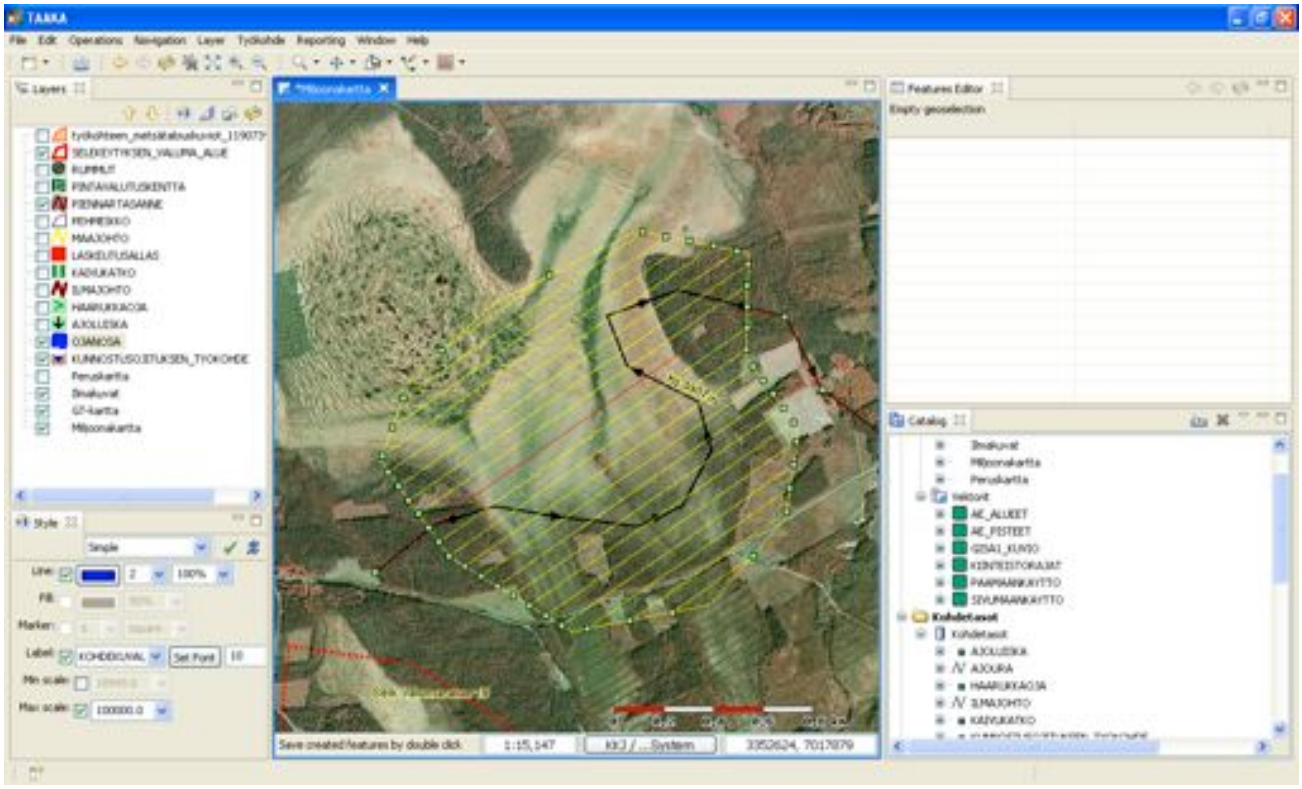
- WMS
- WFS
- KML
- TIFF
- Shape
- PostGIS
- Oracle
- ArcSDE

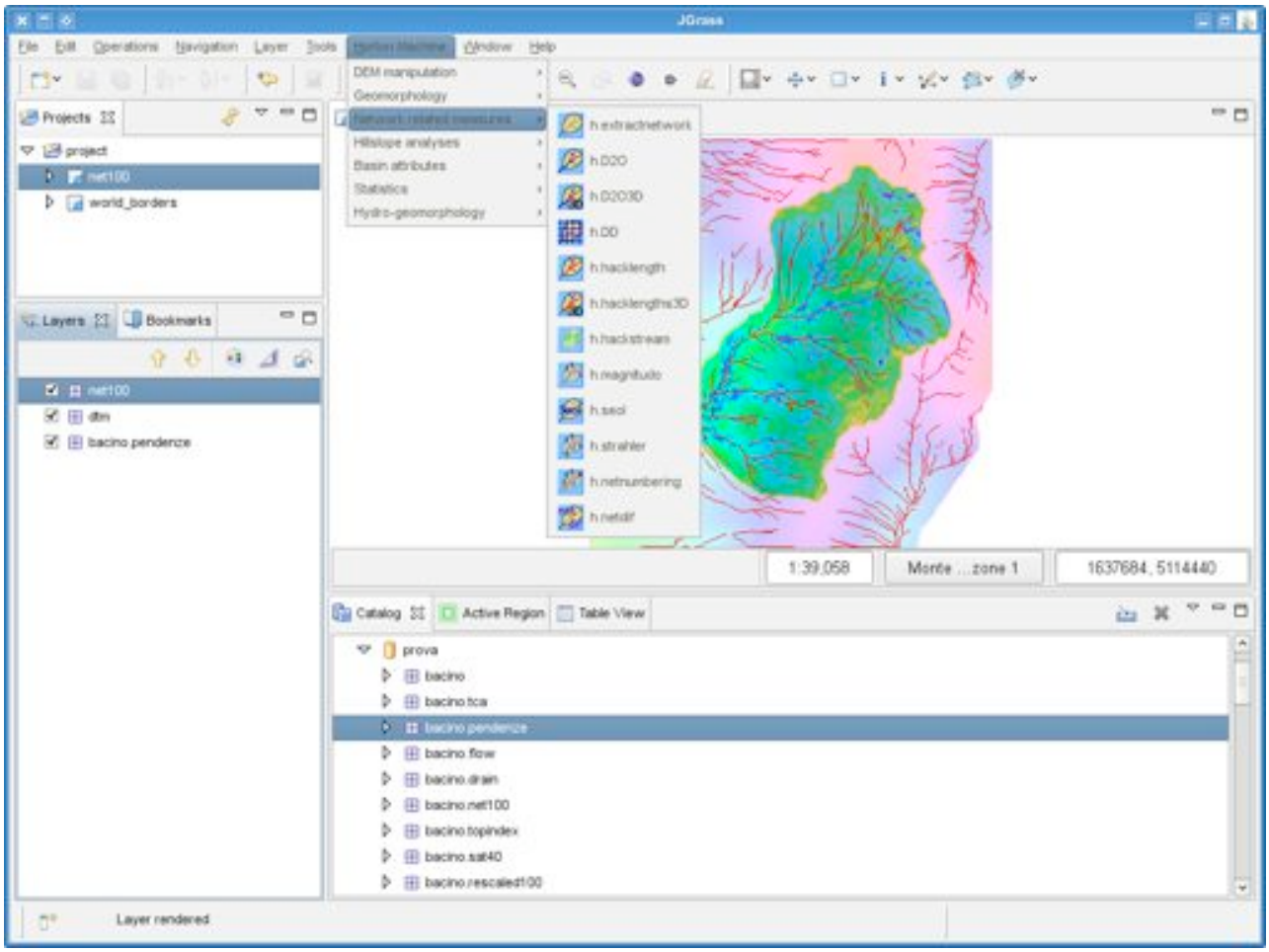
uDig
User-friendly Desktop Internet GIS

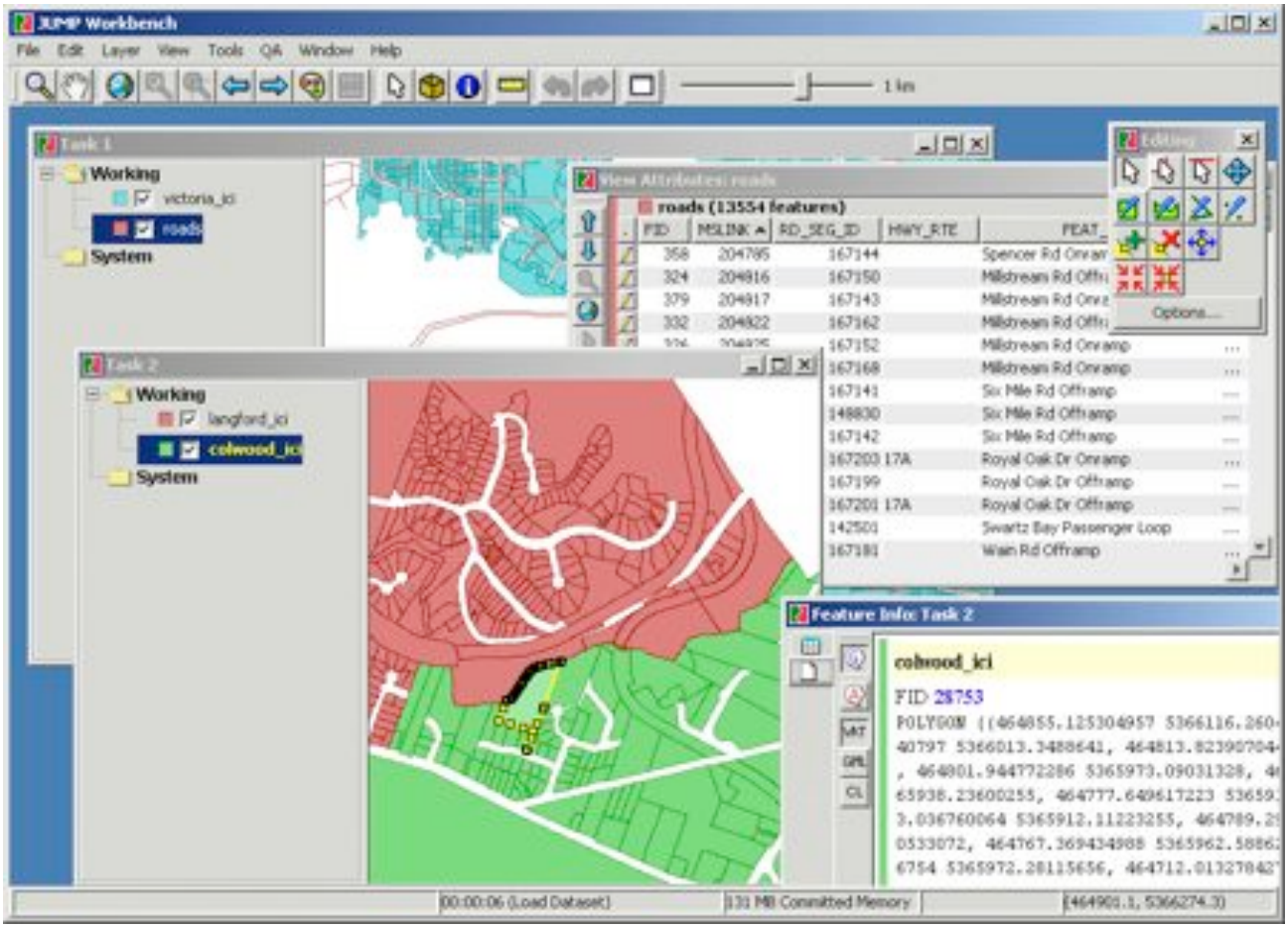



eclipse
Rich
Client
Platform

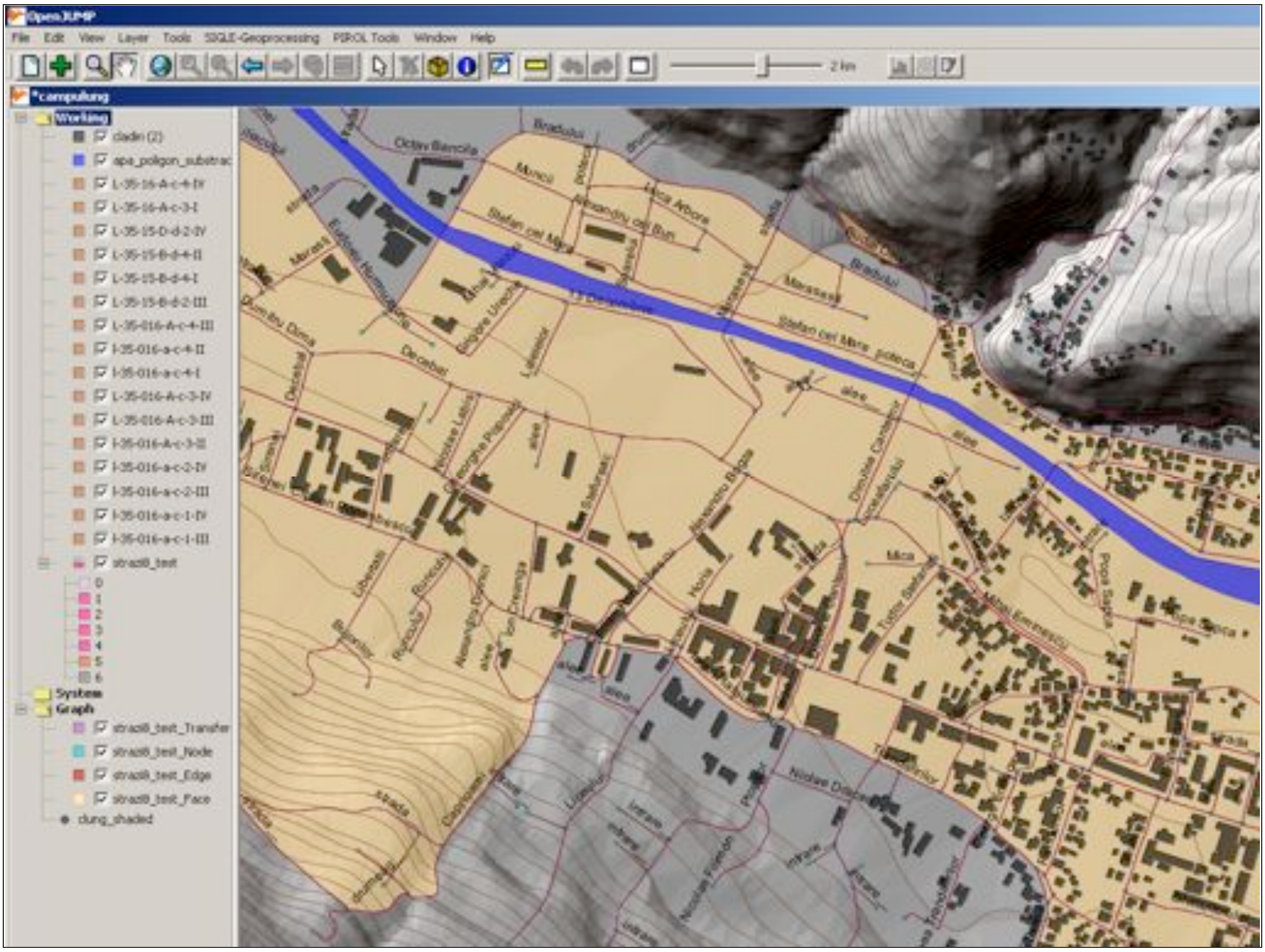

User-friendly Desktop Internet GIS
File Edit Operations Navigation Search Layer Tools Run Window Help
TransformTool
Projects
project
okresy_pseudo
okresy_pseudo
Transform Tool
Source Layer:
okresy_pseudo
Transformation method:
Vector Layer (leave empty to create new):
vektor
Add Vectors
Remove Vectors
Select Transformation:
Similar
Affine
Projective
IDW
TPS
RubberSheet
Interpolation Settings:
Number of grid cells 150
Number of grid rows 150
Generate coverage
Transformation info
Transform
Cancel
1:2 592 723
WGS 84
15.25, 51.29
Search
Default Feature Editor
Table View
search
cat nk kn knok kodnuts knuts
603 US 06 0603 CZ0423 4203
601 US 06 0601 CZ0421 4201


TAKKA
File Edit Operations Navigation Layer Työkohde Reporting Window Help
Layers
Style
Features Editor
Empty geoselection
Catalog
Save created features by double click
1:15,147
3352624, 7017879


JGrass
File Edit Operations Navigation Layer Tools Window Help
DEM manipulation
Geomorphology
Hillslope analyses
Basin attributes
Statistics
Hydro-geomorphology
h.extractnetwork
h.D2O
h.D2O3D
h.DD
h.hacklength
h.hacklengths3D
h.hackstream
h.magnitudo
h.sasi
h.strahler
h.netnumbering
h.netdif
Projects
project
net100
world_borders
Layers
Bookmarks
net100
dtm
bacino pendenze
1:39,058
Monte ...zone 1
1637684, 5114440
Catalog
Active Region
Table View
prova
bacino
bacino.tca
bacino.pendenze
bacino.flow
bacino.drain
bacino.net100
bacino.topindex
bacino.sat40
bacino.rescaled100
Layer rendered

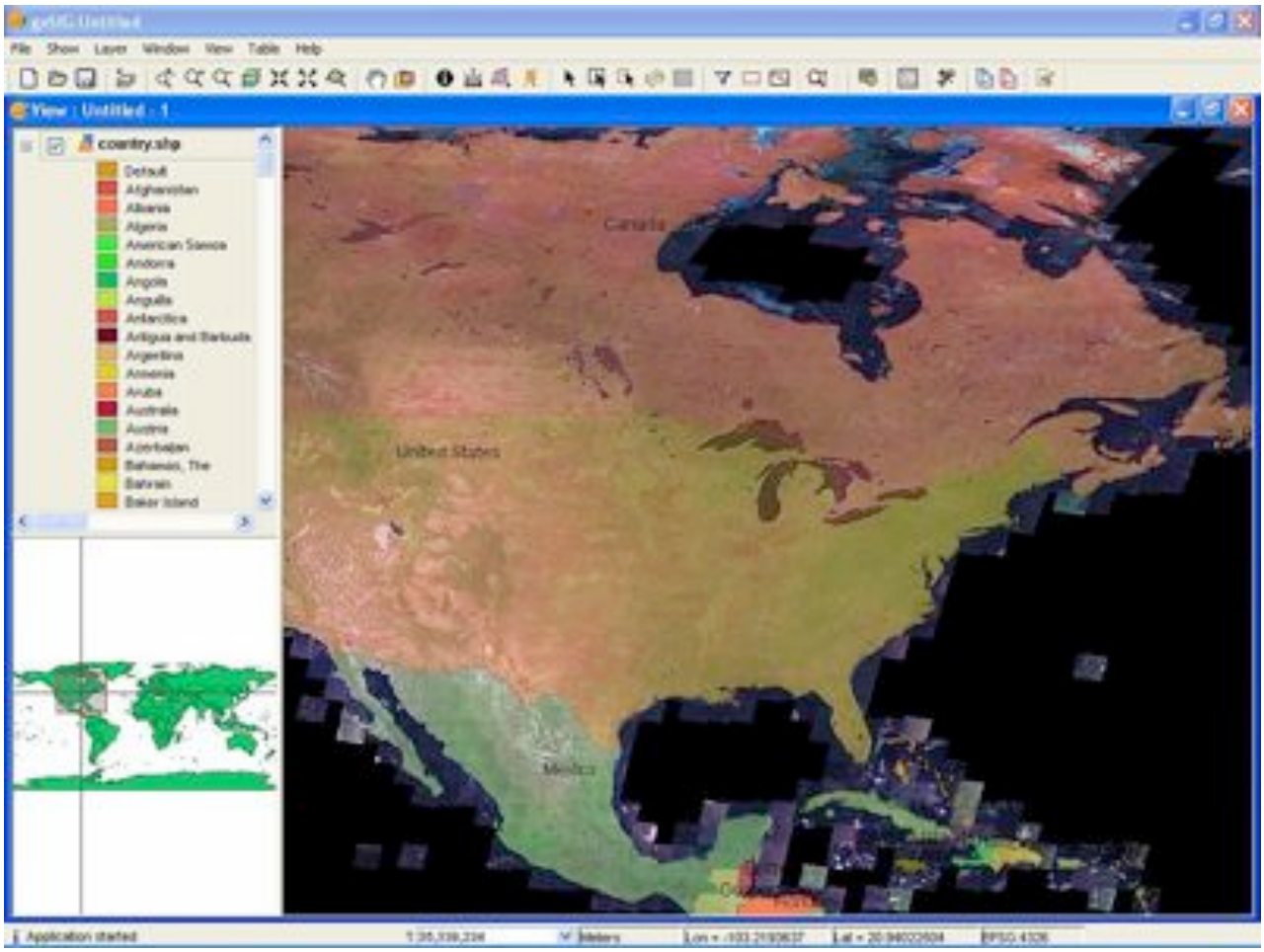

JUMP Workbench
File Edit Layer View Tools QA Window Help
Task 1
Working
victoria_ici
roads
System
roads (13554 features)
FID MSLINK RD_SEG_ID HWY_RTE FEAT_
Task 2
Working
langford_ici
colwood_ici
System
Feature Info: Task 2
colwood_ici
FID 28753
POLYGON ((464855.125304957 5366116.260
40797 5366013.3488641, 464813.82390704
, 464801.944772286 5365973.09031328, 4
65938.23600255, 464777.640617223 53659
3.036760064 5365912.11223255, 464789.2
0533072, 464767.369434988 5365962.5886
6754 5365972.28115656, 464712.01327842
00:00:06 (Load Dataset)
131 MB Committed Memory
(464901.1, 5366274.3)

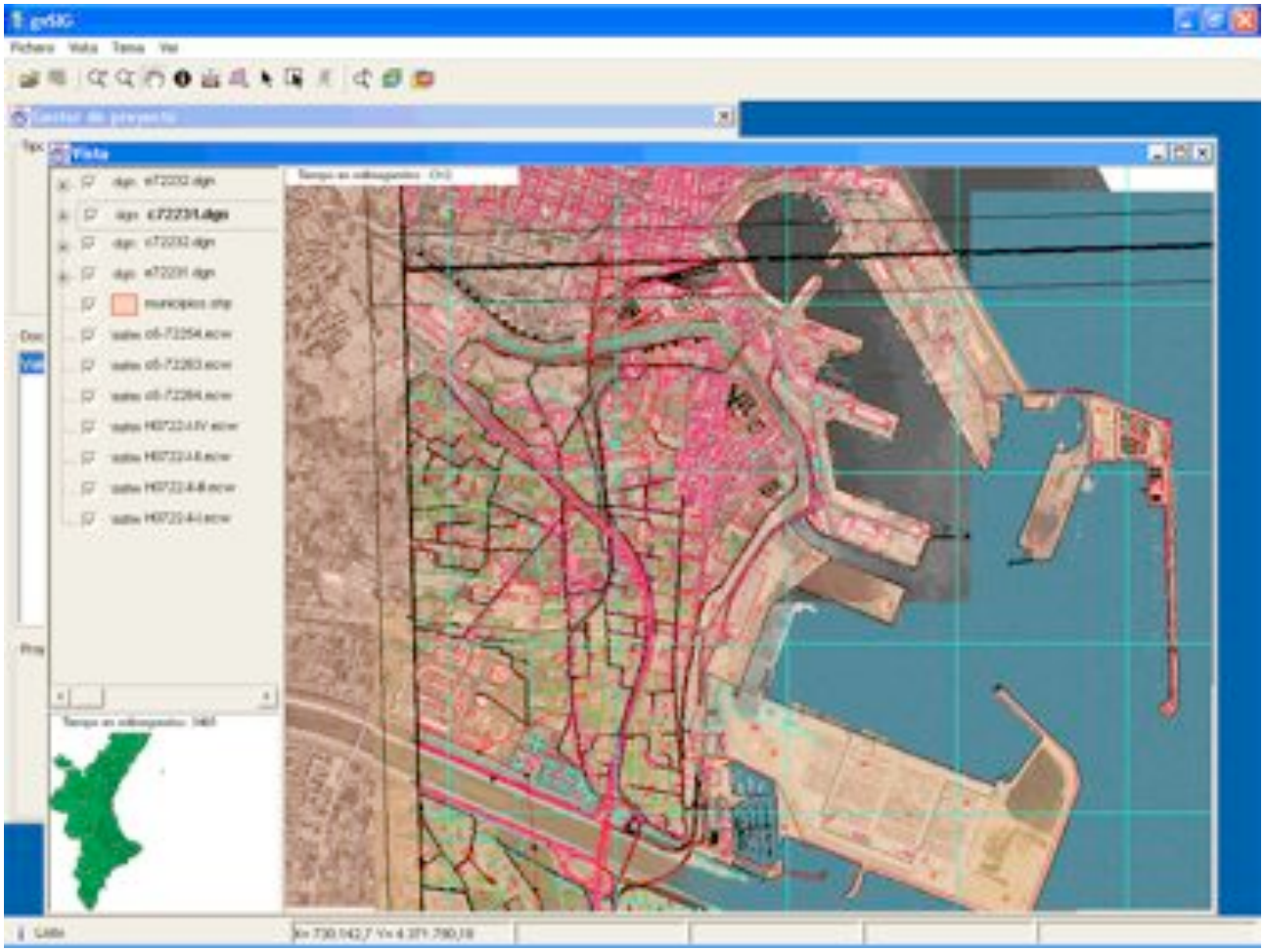

JUMP
OpenJUMP
Kosmo
SkyJUMP
PirolJUMP


OpenJUMP
File Edit View Layer Tools SIGLE-Geoprocessing PIROL Tools Window Help
2 km
*campulung
Working
cladiri (2)
apa_poligon_substrac
System
Graph
strazi8_test_Transfer
strazi8_test_Node
strazi8_test_Edge
strazi8_test_Face
clung_shaded
Octav Bancila
Decebal
Horia
Mica

GPL

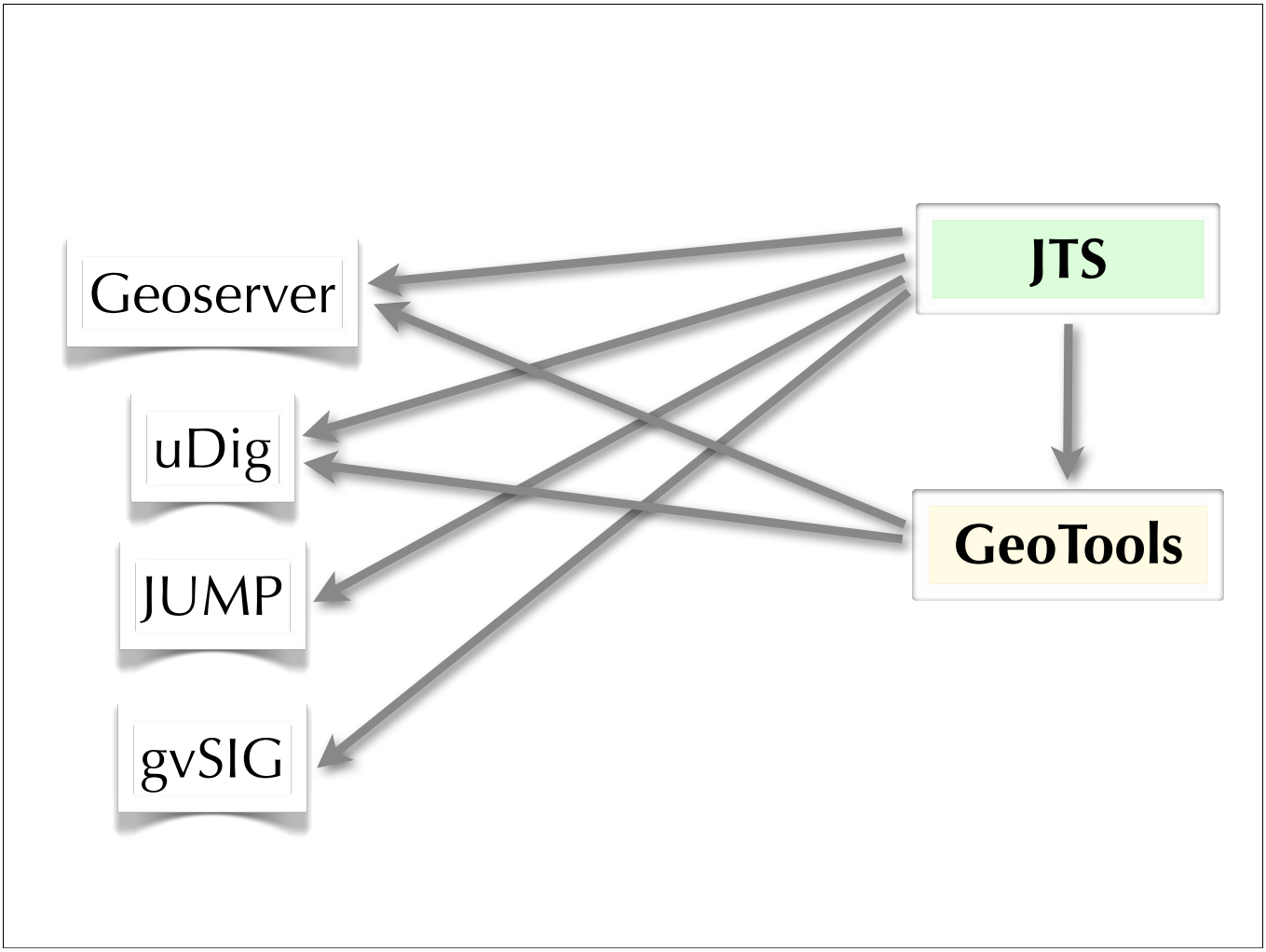
€2.000.000


File Show Layer Window View Table Help
View : Untitled - 1
country.shp
Default
Afghanistan
Albania
Algeria
American Samoa
Andorra
Angola
Anguilla
Antarctica
Antigua and Barbuda
Argentina
Armenia
Aruba
Australia
Austria
Azerbaijan
Bahamas, The
Bahrain
Baker Island
Canada
United States
Mexico
Application started


gvSIG
Fichero Vista Tema Ver
Vista
municipios.shp

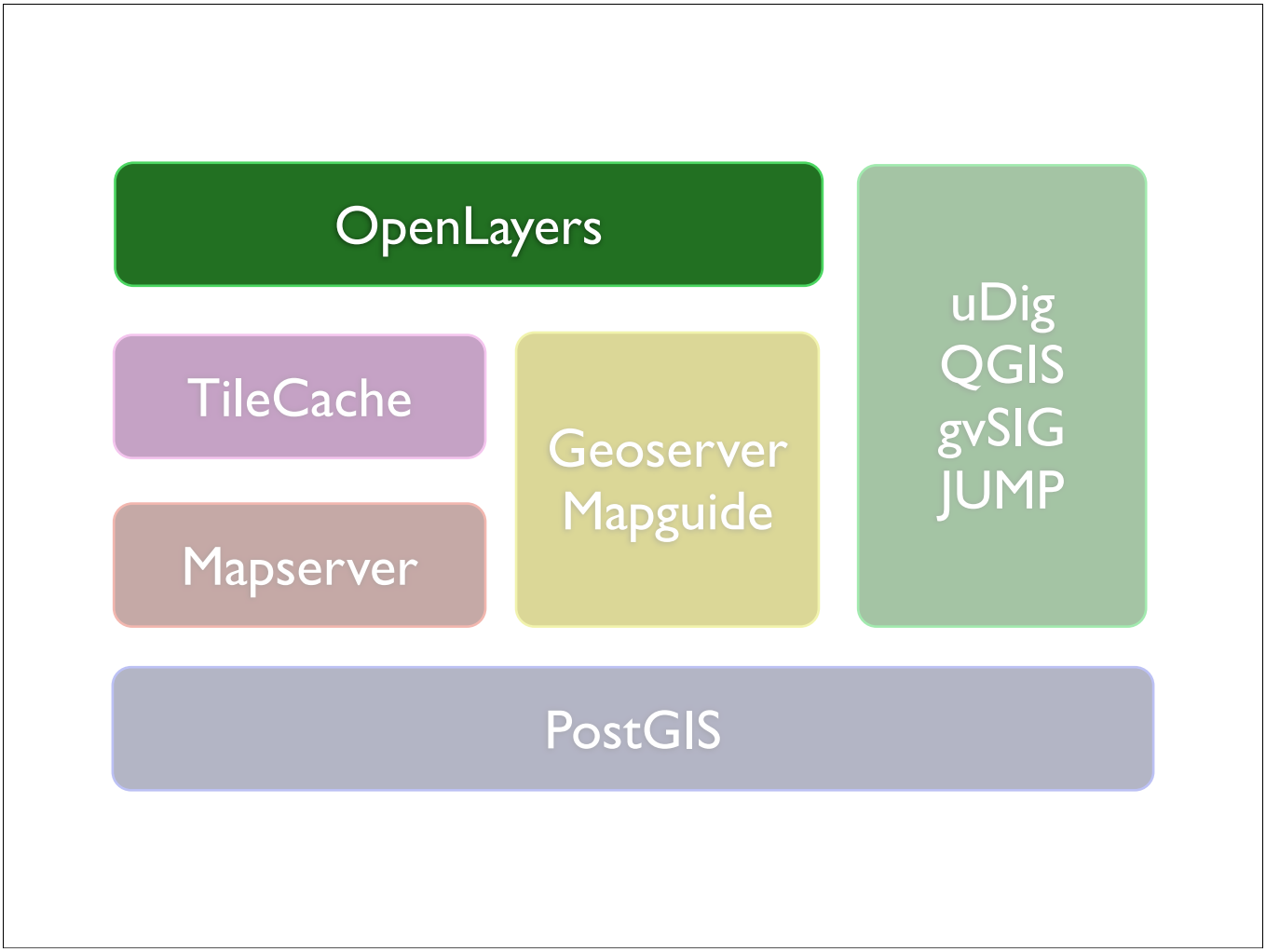

uDig
User-friendly Desktop Internet GIS
Galacia
Rioja
Castilla y Leon
Cataluña
Costa Brava
Aragon
Costa Dorado
Madrid
Mayorca
Majorca
gv SIG
Extremadura
Castilla La Mancha
Ibiza
Costa Blanca
Murcia
Kosmo
Costa Calida
Lanzarote
Tenerife
Fuerteventura
Costa Almeria
Sol

JAVA™ Tribe

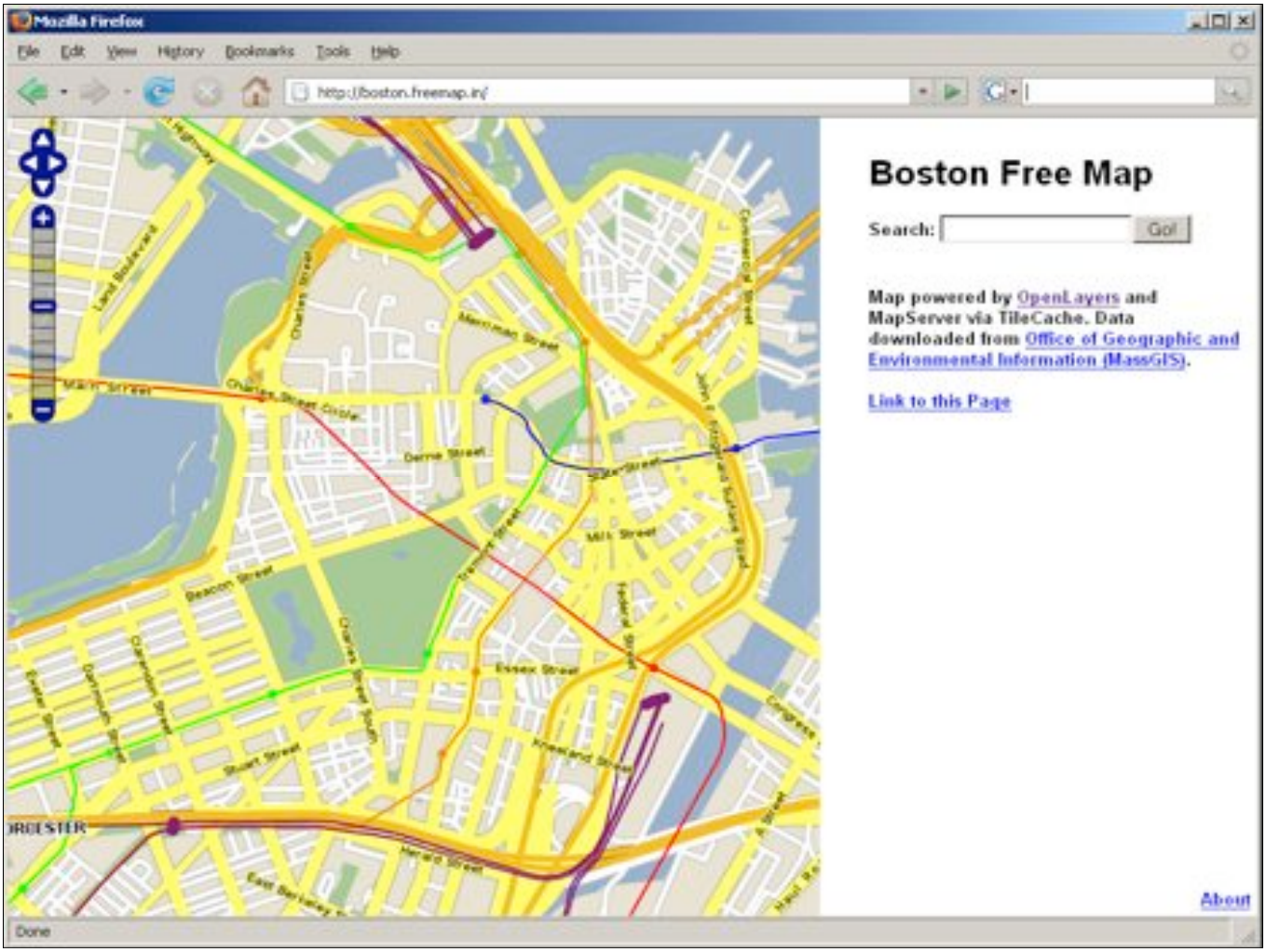

JTS
Geoserver
uDig
JUMP
gvSIG
GeoTools

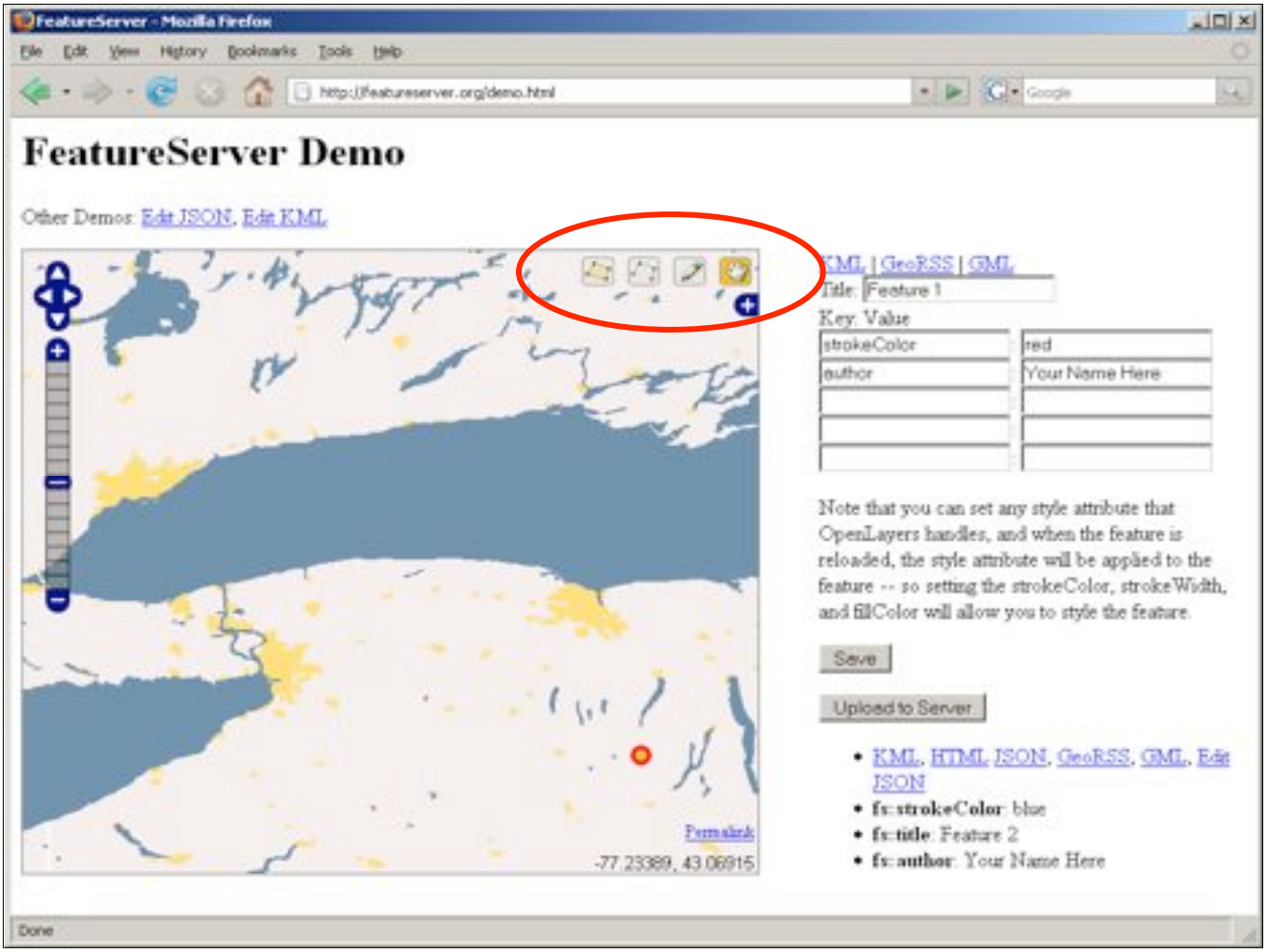
Tribe

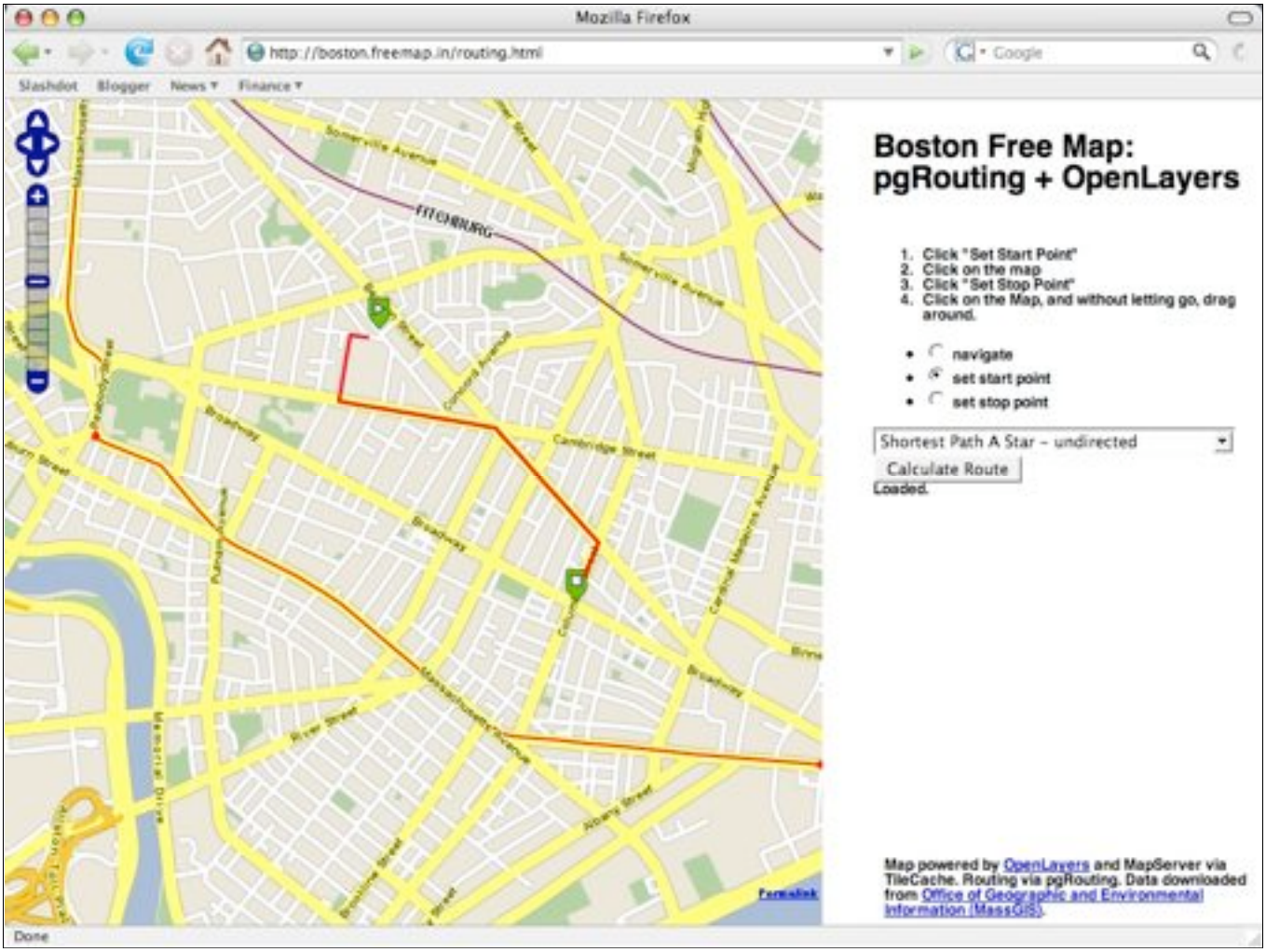

HTML
php
Javascript
AJAX
Tribe


OpenLayers
TileCache
Mapserver
Geoserver
Mapguide
uDig
QGIS
gvSIG
JUMP
PostGIS

- Tile based, continuous pan, discrete zoom levels (ala Google Maps)
- Pure Javascript, no server-side
- Component, very re-usable
  - Fusion for Mapguide
  - CartoWeb
- Multiple tile sources
  - MS Virtual Earth
  - Worldwind
  - Yahoo Maps
  - Google Maps
  - WMS
  - TMS


Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://boston.freemap.in/
Boston Free Map
Search:
Go!
Map powered by OpenLayers and MapServer via TileCache. Data downloaded from Office of Geographic and Environmental Information (MassGIS).
Link to this Page
About
Done


FeatureServer - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://featureserver.org/demo.html
FeatureServer Demo
Other Demos: Edit JSON, Edit KML
KML | GeoRSS | GML
Title: Feature 1
Key: Value
strokeColor red
author Your Name Here
Note that you can set any style attribute that OpenLayers handles, and when the feature is reloaded, the style attribute will be applied to the feature -- so setting the strokeColor, strokeWidth, and fillColor will allow you to style the feature.
Save
Upload to Server
KML, HTML, JSON, GeoRSS, GML, Edit JSON
fs:strokeColor: blue
fs:title: Feature 2
fs:author: Your Name Here
Permalink
-77.23389, 43.06915
Done


Mozilla Firefox
http://boston.freemap.in/routing.html
Slashdot
Blogger
News
Finance
Somerville Avenue
FITCHBURG
Broadway
Cambridge Street
River Street
Albany Street
Permalink
Boston Free Map:
pgRouting + OpenLayers
1. Click "Set Start Point"
2. Click on the map
3. Click "Set Stop Point"
4. Click on the Map, and without letting go, drag around.
navigate
set start point
set stop point
Shortest Path A Star - undirected
Calculate Route
Loaded.
Map powered by OpenLayers and MapServer via TileCache. Routing via pgRouting. Data downloaded from Office of Geographic and Environmental Information (MassGIS).
Done

fin