



Analytical and Computer Cartography Winter 2017

Lecture 10: Open Source Computer Cartography

Open Source Computer Cartography

- Why bother?
- OSF vs. FSF
- The Cathedral and the Bazaar
- Open Source GIS
- Some examples
- What the bazaar offers
- The future

Software vs. data

The screenshot displays the OpenStreetMap website interface. At the top, the browser window shows the title 'OpenStreetMap' and the address 'www.openstreetmap.org'. The page includes a search bar with the text 'Search' and a magnifying glass icon. Below the search bar, there are examples of search terms: 'Alkmaar', 'Regent Street, Cambridge', 'CB2 5AQ', and 'post offices near Lünen'. The main content area is a map of North America, showing state and country boundaries. The map is titled 'OpenStreetMap The Free Wiki World Map'. On the left side, there is a navigation panel with a search bar and a list of links: 'Help Centre', 'Documentation', 'Copyright & License', 'Community Blogs', 'Foundation', 'User Diaries', 'GPS Traces', and 'Map Key'. The Windows taskbar at the bottom shows the time as 9:34 AM on 2/14/2013.

Mother of All Freeware

The image is a screenshot of a Firefox browser window displaying Google Maps. The browser's address bar shows the URL `https://maps.google.com/maps?hl=en&tab=wl`. The page features a search bar with the Google logo, navigation links like "Get directions" and "My places", and a map of Goleta, CA. The map shows major roads like Highway 101 and 217, and landmarks such as Santa Barbara Airport and UCSB. The Windows taskbar at the bottom shows the system clock as 9:35 AM on 2/14/2013.

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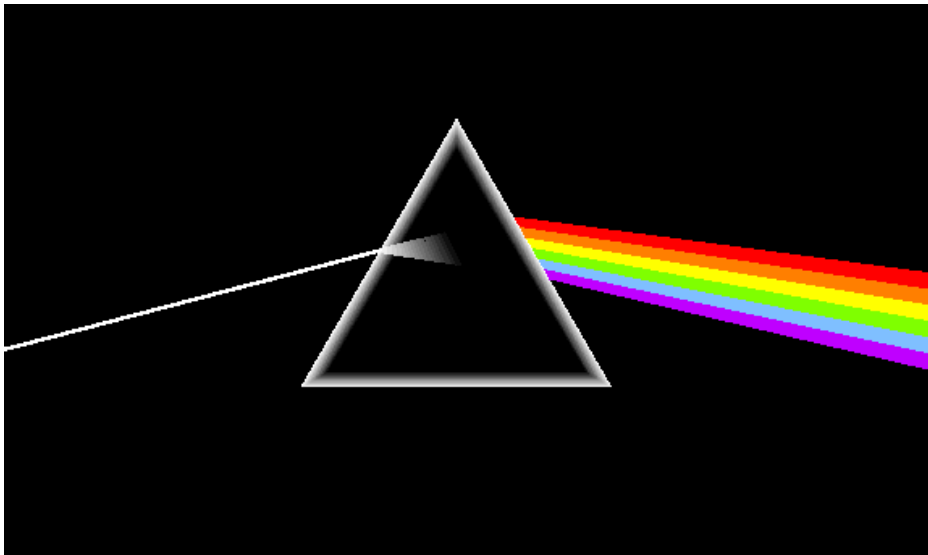
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- (h) restrict or inhibit any other user from using and enjoying the Products or Google services;
- (i) interfere with or disrupt Google services or servers or networks connected to Google services, or disobey any requirements, procedures, policies or regulations of networks connected to Google services;
- (j) use any robot, spider, site search/retrieval application, or other device to retrieve or index any portion of the Google services or Content, or collect information about users for any unauthorized purpose;
- (k) submit content that falsely expresses or implies that such content is sponsored or endorsed by Google;
- (l) create user accounts by automated means or under false or fraudulent pretenses;

Software as a spectrum



Proprietary

Freeware

Open source

What is Open Source?

Open Source Initiative

1. Free Redistribution
2. Source Code
3. Derived Works
4. Integrity of The Author's Source Code
5. No Discrimination Against Persons or Groups
6. No Discrimination Against Fields of Endeavor
7. Distribution of License
8. License Must Not Be Specific to a Product
9. License Must Not Restrict Other Software
10. License Must Be Technology-Neutral

OSI vs. FSF

The term “open source” software is used by some people to mean more or less the same category as free software. It is not exactly the same class of software: they accept some licenses that we consider too restrictive, and there are free software licenses they have not accepted. However, the differences in extension of the category are small: nearly all free software is open source, and nearly all open source software is free.

– Free Software Foundation,
<http://www.gnu.org/philosophy/categories.html>

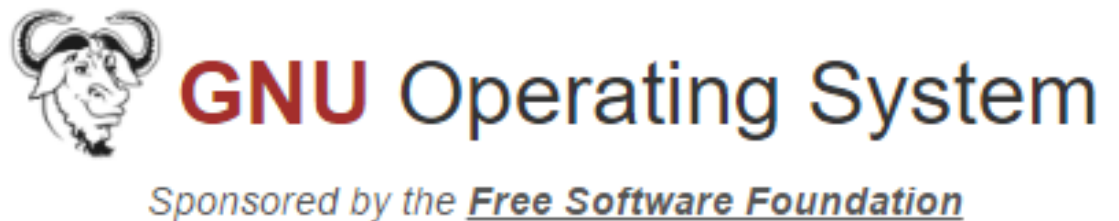
The nice thing about standards

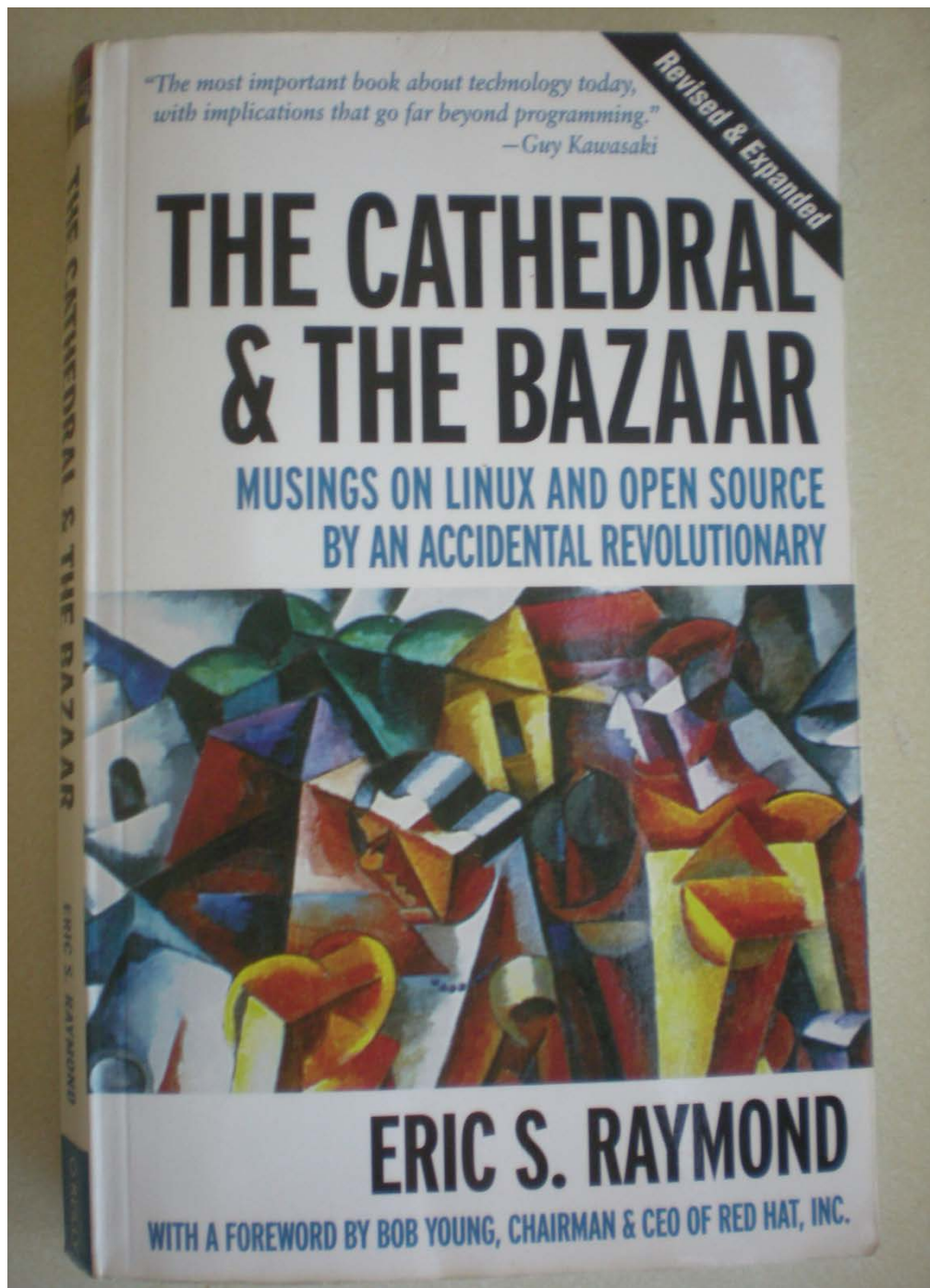
39 Open Source License types

40 Types in Free Software Community

Examples: Academic Free License,
Common Public License, GNU General
Public License, Zope Public License

Other standards: e.g. Copyleft, Media
Commons, Wiki, creative commons





First edition 1999
Web essays included the
“*Cathedral and the
Bazaar*” and “*Revenge of
the Hackers*” dating back
to 80s
Compares 'cathedral' top-
down model of software
development to 'bazaar'
model represented by
Linux



The Cathedral

- Central planning and design
- Takes years to build
- Divide and conquer approach
- Code for wages
- “Customer driven”
- Feature and version approach
- Teams and internal competition



The Bazaar

- Little planning at all
- Change is instantaneous
- Competition and cooperation
- Code for bragging rights
- Customers and shopkeepers
- Whatever works best

“Given enough eyeballs, all bugs
are shallow.”

Linus' Law

Open Source GIS

- Basis in standards: OGC critical, but others e.g. GeoVRML, X11
- Includes code level tools, scripts, libraries, and utilities
- Clearinghouses for information: e.g. opensource.org
- Support fora, wikis, lists, etc
- Whole GIS systems e.g. GRASS, QGIS
- Whole web-based support systems e.g. MapServer



Making location count.

Have an Idea? INSPIRE What is the OGC?

- Home
- Standards ▾
- Programs ▾
- Participate ▾
- News & Events ▾
- About OGC ▾
- Member Login

Search

Geospatial and location standards for:

- Aviation
- Built Environment & 3D
- Business Intelligence
- Defense & Intelligence
- Emergency Response & Disaster Management
- Geosciences & Environment
- Government & Spatial Data Infrastructure



Sample code libraries

cgal.org: CGAL Open Source Project to provide easy access to efficient and reliable geometric algorithms in the form of a C++ library

OGR: Simple features library, C++ open source library (and commandline tools) providing R/W access to vector file formats

GEOS: Geometry Engine - Open Source, C++ port of the Java Topology Suite (JTS)

GTK: graphics Toolkit, with UI, libraries etc

OpenGL, OpenCV: C and C++ libraries

CGAL

The screenshot shows the CGAL website interface. At the top, there is a navigation bar with the CGAL logo and links for Project, Download, Documentation, Packages, Support, and More. Below this is a dark banner with the text "The Computational Geometry Algorithms Library". The main content area features a large image of a hand with a semi-transparent green mesh overlaid on it. The text "Surface Reconstruction" is centered over the image. Below the text, a code snippet is displayed in a white box: `CGAL::Mesh_3 tet_mesh = CGAL::make_mesh_3();`. At the bottom of the page, there is a "Latest News" section with a bullet point: "September 2016 CGAL 4.9: CGAL 4.9 released". The Windows taskbar is visible at the very bottom of the image.

The Computational Geometry Algorithms Library

Surface Reconstruction

```
CGAL::Mesh_3 tet_mesh = CGAL::make_mesh_3();
```

Latest News

- September 2016 CGAL 4.9: CGAL 4.9 released

CGAL is a software project that provides easy access to efficient and reliable geometric algorithms in the form of a C++ library. CGAL is used in various areas needing geometric computation, such as geographic...



Shapelib: C library

Shapefile C Library

shapelib.maptools.org

Shapefile C Library

Purpose

The Shapefile C Library provides the ability to write simple C programs for reading, writing and updating (to a limited extent) ESRI Shapefiles, and the associated attribute file (.dbf).

Supporting Information

- [Shapefile API Docs](#)
- [DBF/xBase API Docs](#)
- [Shapefile Tools Docs](#)
- [Release Notes](#)
- [Shapelib File Manifest](#)
- [Shapelib Licensing Terms](#)

What is a Shapefile?

If you don't know, you probably don't need this library. The Shapefile format is a working and interchange format promulgated by [ESRI](#) for simple vector data with attributes.

An excellent [white paper](#) on the shapefile format is available from ESRI, but it is .pdf format, so you will need Adobe Acrobat to browse it.

The file format actually consists of three files.

XXX.shp - holds the actual vertices.
XXX.shx - hold index data pointing to the structures in the .shp file.
XXX.dbf - holds the attributes in xBase (dBase) format.

Download

Source code, and some other odds and ends can be downloaded from <http://download.osgeo.org/shapelib>.

Shapelib is available for anonymous CVS access:

```
cvs -d :pserver:cvsanon@cvs.maptools.org:/cvs/maptools/cvsroot login
Password: (hit enter)
cvs -d :pserver:cvsanon@cvs.maptools.org:/cvs/maptools/cvsroot co shapelib
```

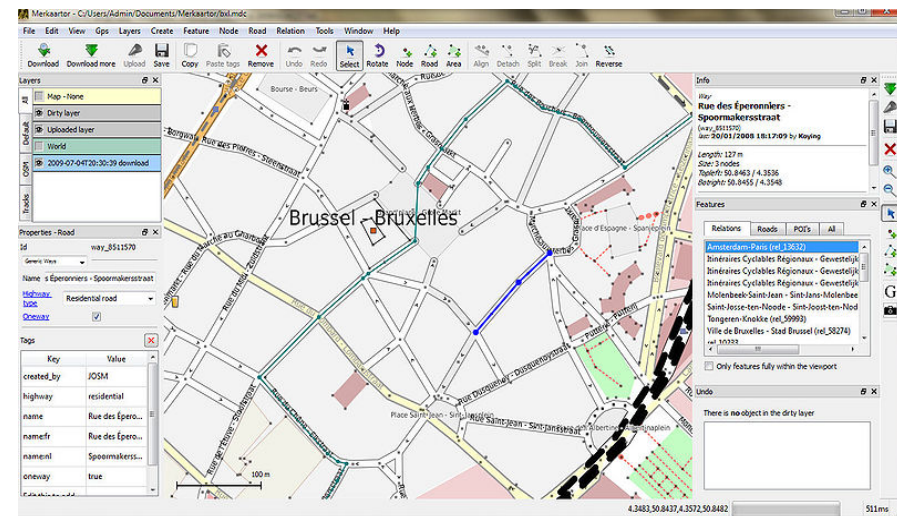
11:07 AM
2/13/2017

Sample software tools

TARDEM, A suite of programs for the Analysis of Digital Elevation Data

Merkaartor is an OpenStreetMap editor distributed under the GNU General Public License

Worldwind: browser tool for geospatial data



Sample freeware

FlexProjector: Java

MapShaper: Java tools using shapelib

LandSerf: Java

MicroCAM

MicroDEM

Many open versions of common packages, e.g.
ArcGISOnline, LAStools, etc: Payment unlocks
parts of code unavailable to simple download

Often make student version free

Open Source Tools Clearinghouses

<http://opensourcegis.org/>

<http://freegis.org/>

http://en.wikipedia.org/wiki/List_of_geographic_information_systems_software

<http://www.geotools.org/> (Java libraries)

<http://mapnik.org/>

<http://mapguide.osgeo.org/>

www.mapserver.org

The screenshot shows a web browser window with the URL `mapserver.org`. The browser's address bar and tabs are visible at the top. The website's header features the MapServer logo, which consists of a stylized green and blue map icon next to the text "MapServer" and the tagline "open source web mapping". To the right of the logo is a navigation menu with links for "Home", "Products", "Issue Tracker", "Service Providers", "FAQ", and "Download". Below the header is a dark blue navigation bar with "Home" on the left and "next | index" on the right. The main content area is divided into several sections: a "Quick search" box on the left, a "Welcome to MapServer" section with introductory text, a "MapServer Suite Home" section with links to "MapServer", "MapCache", and "TinyOWS", a "Download the MapServer Suite" section with a "Download the suite" link, and a "Recent Announcements" section with a news item dated "2017-01-16" regarding the release of MapServer versions 7.0.4, 6.4.5, 6.2.4, and 6.0.6. On the left side of the page, there is a "Navigation" menu with links for "About", "Products", "Community", "Development", "Downloads", "Documentation", "FAQ", and "PSC". Below this menu is the "OSGeo Project" logo and the text "MapServer is a project of the Open Source Geospatial Foundation." The Windows taskbar is visible at the bottom of the screen, showing various application icons and the system clock displaying "11:09 AM 2/13/2017".

Welcome to MapServer

MapServer is an [Open Source](#) platform for publishing spatial data and interactive mapping applications to the web. Originally developed in the mid-1990's at the University of Minnesota, MapServer is released under an [MIT-style license](#), and runs on all major platforms ([Windows](#), [Linux](#), [Mac OS X](#)). MapServer is not a full-featured GIS system, nor does it aspire to be.

The MapServer [Project Steering Committee \(PSC\)](#), sanctioned by [OSGeo](#), manages and administers the project which is maintained, improved, and supported by developers and users from around the world. See the [community activities](#) page for mailing lists, etc.

[More about MapServer](#)

MapServer Suite Home

[MapServer](#), [MapCache](#), [TinyOWS](#) home

Download the MapServer Suite

[Download the suite](#)

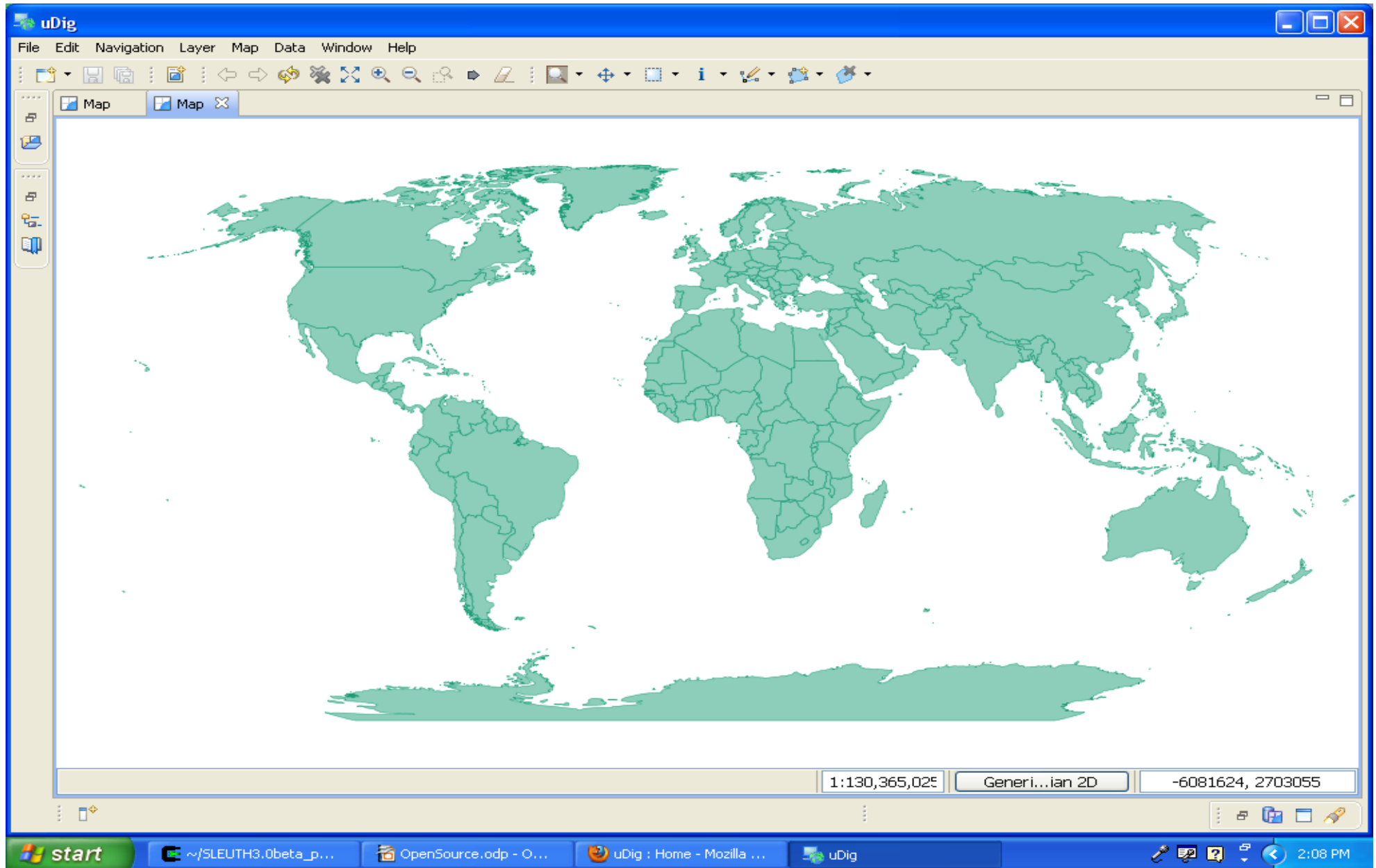
Recent Announcements

2017-01-16 - MapServer 7.0.4, 6.4.5, 6.2.4, and 6.0.6 are released

Open Source GIS

QGIS	Quantum GIS—QGIS is a user friendly Open Source GIS that runs on Linux , Unix , Mac OS X, and Windows.	http://www.qgis.org/
MapWindow GIS	Free, open source GIS desktop application and programming component.	http://www.mapwindow.org/
ILWIS	Integrated Land and Water Information System. Integrates image, vector and thematic data.	http://www.itc.nl/ilwis/
uDig	uDig is an open source desktop application framework, built with Eclipse Rich Client technology.	http://udig.refractor.net/
JUMP GIS / OpenJUMP-(O	Java Unified Mapping Platform. OpenJUMP, SkyJUMP, deeJUMP, and Kosmo emerged from JUMP.	http://www.jump-project.org/
Capaware rc1 0.1	General purpose virtual worlds 3D viewer. A free software project started in 2007 to promote the development of free sc	http://www.capaware.org/
Kalypso	An Open Source GIS (Java, GML3) that focuses on water management. Supports modeling and simulation.	http://www.ohloh.net/p/kalypso
TerraView	Desktop GIS that handles vector and raster data stored in a relational or geo-relational database, a frontend for TerraLib.	http://www.dpi.inpe.br/terracview/index.php
GeoServer	GeoServer is an open source software server written in Java that allows users to share and edit geospatial data. Design	http://geoserver.org/display/GEOS/Welcome
WebMap Server	Open source protocol and tools for serving GIS data over the Internet.	http://teraserver-usa.com/ogc/wms.aspx
MapGuide Open Source	Web-based platform that enables users to quickly develop and deploy web mapping applications and geospatial web se	http://mapguide.osgeo.org/
MapServer	Web-based mapping server, developed by the University of Minnesota.	http://mapserver.org/
PostGIS	Spatial extensions for the open source PostgreSQL database, allowing geospatial queries.	http://postgis.refractor.net/
H2Spatial for	Spatial extension for an open source DBMS H2_(DBMS).	http://geosys.in.iict.ch/irstv-trac/wiki/H2spatial/Download
SpatialLite for SQLite	SpatialLite extension enables SQLite to support spatial data in a way conformant to OpenGis specifications.	http://www.gaia-gis.it/spatialite-2.0/index.html
MySQL Spatial	MySQL spatial extensions following the specification of the Open Geospatial Consortium.	http://dev.mysql.com/doc/refman/5.0/en/spatial-extensions.html

For example: uDig



For example: Quantum GIS

The screenshot displays the Quantum GIS 0.9.1-Ganymede interface. The title bar reads "Quantum GIS - 0.9.1-Ganymede ('Ganymede') SantaBarbaraLU". The menu bar includes "File", "View", "Layer", "Settings", "Plugins", and "Help". The toolbar contains various icons for file operations, navigation, and editing. On the left, the "Legend" panel shows four layers: "southcoast_lu75", "southcoast_lu67", "southcoast_lu61", and "southcoast_lu54". The "Identify Results" dialog box is open, showing the following data:

Feature	Value
(clicked coordinate)	-119.85639526, 34.424176
AREA	5.09703e-05
(Derived)	
Area	0.000 sq.deg.
AREA	5.09703e-05
L75_DDWGS8	1036
L75_DDWG_1	4029
LANDUSE_CO	63
PERIMETER	0.0434185

The main map area shows a land use map with various colored polygons. A red box highlights a specific area on the map. The status bar at the bottom right shows "Scale 1:43102", coordinates "-119.8862,34.3791", and a "Render" button.

Graphics editors

GIMP2.0: Raster editor, filters etc. Versatile read/write capability

InkScape: vectors tools with support for SVG

SVG: Scalable Vector Graphics

XML standard to allow multiscale feature redraw

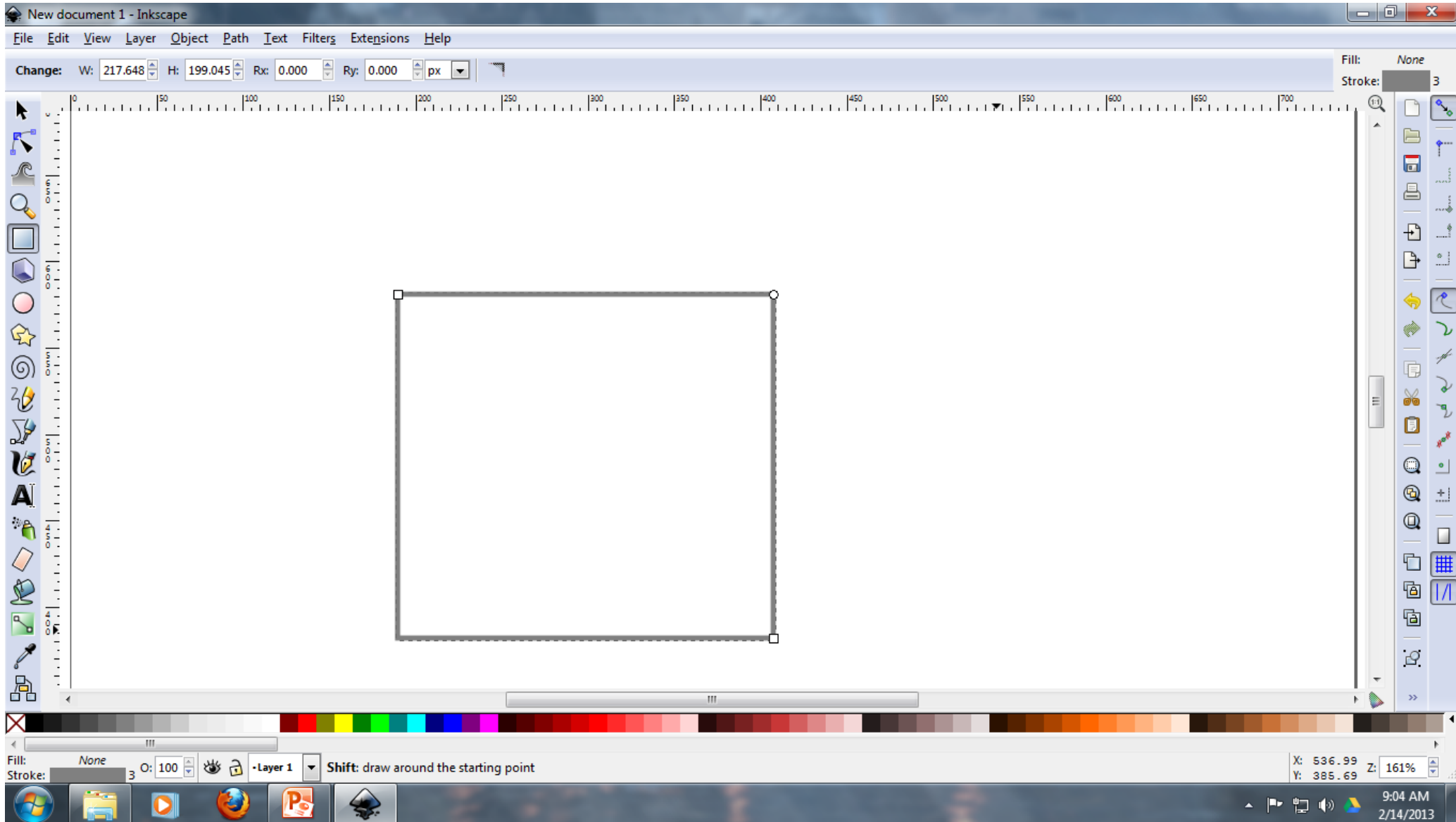
Simple specification, but large files



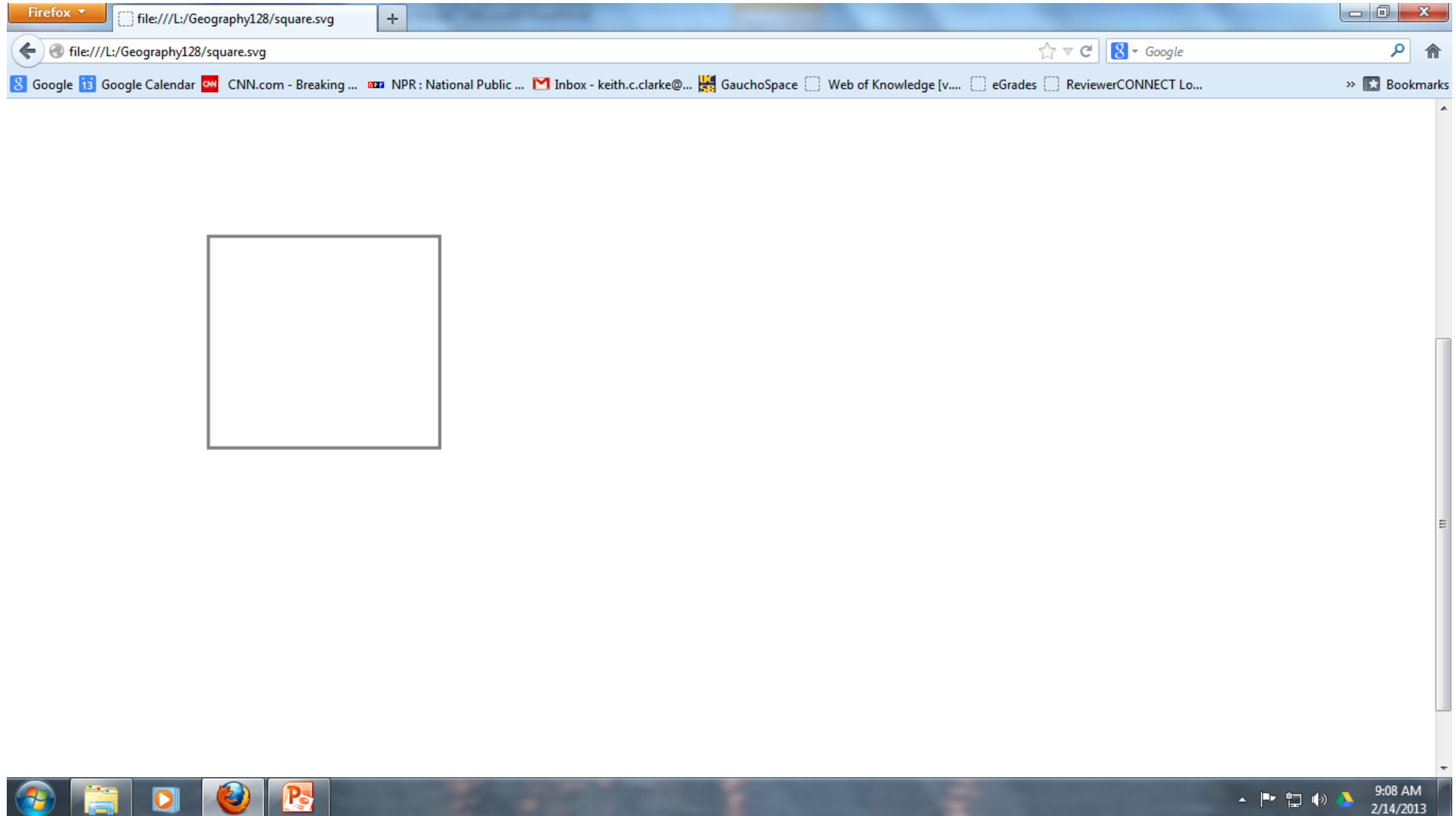
Inkscape.app



A square in Inkscape



square.svg: Open file in Firefox



File header metadata

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>  
<!-- Created with Inkscape (http://www.inkscape.org/) -->  
<svg  
  xmlns:dc="http://purl.org/dc/elements/1.1/"  
  xmlns:cc="http://creativecommons.org/ns#"  
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"  
  xmlns:svg="http://www.w3.org/2000/svg"  
  xmlns="http://www.w3.org/2000/svg"
```

Page and document description

```
xmlns:sodipodi="http://sodipodi.sourceforge.net/DTD/sodipodi-0.dtd"  
xmlns:inkscape="http://www.inkscape.org/namespace/inkscape"  
width="744.09448819"  
height="1052.3622047"  
id="svg2"  
version="1.1"  
inkscape:version="0.48.4 r9939"  
sodipodi:docname="New document 1">
```

Draw description

```
<rect
  style="fill:none;stroke:#808080;stroke-width:3;stroke-
  miterlimit:4;stroke-dasharray:none;stroke-dashoffset:0"
  id="rect2985"
  width="217.64763"
  height="199.04527"
  x="189.74409"
  y="471.34842" />
</g>
</svg>
```

Cathedral & the Bazaar: Why?

- Release early and often vs. Versioning
- Delegate everything vs. Control everything
- Restrict nothing vs. License everything
- Copy and reuse vs. Stovepipe
- Interest rises and falls vs. Discontinued products
- Open algorithms vs. Proprietary solutions
- Toolboxes, libraries, code vs. Object modules and documentation
- Bug-free vs. Buggy

The Future



- Large software companies relying more on Open Source, microprojects abound!
- Price will converge on zero, Quality/Quantity should increase
- No more dongles or license servers
- Cyberinfrastructure, geoservices, mashups
- New social infrastructure and reward model
- Client server model to cloud and web model
- Geography can move on to spatial knowledge and learning
- Programming (and scripting) will be much more central

Summary

- Defined open source, freeware, etc
- Software as a spectrum
- The cathedral and the bazaar
- GIS, mapping software
- GIS, mapping toolkits and resources
- Advantages of OS
- Examples of Inkscape, GIMP, SVG
- The future of OS