Free and Open Source Software for Geospatial Applications

(FOSS4G)

What is it?
Why should you consider it?

September 2015

Rafael Moreno
Department of Geography
and Environmental Sciences

University of Colorado Denver

Several of the resources used in this presentation can be found in:

- Article references at the end of these slides.

- Moreno-Sanchez, R. 2012. Free and Open Source Software for Geospatial applications (FOSS4G): A mature alternative in the geospatial technologies arena. *Transactions in GIS* 16(2): 81-88 http://geospatial.ucdenver.edu/foss4g/home-2

Main Messages

1. FOSS and FOSS4G are mature and capable.

2. There is a mature FOSS4G for every geospatial information need and niche.

3. Interest and resources to learn and use FOSS4G are growing exponentially.

4. Several myths and misunderstanding about FOSS/FOSS4G are not true.

5. FOSS/FOSS4G have strengths and weaknesses for specific contexts and purposes. There are opportunities for mutual benefit and complementarity with private/close solutions.

There are many dimensions to “Open”

- Open source software.
- Open data.
- Open standards.
- Open publishing.
- Open education resources.
- Open government.
- Open innovation.

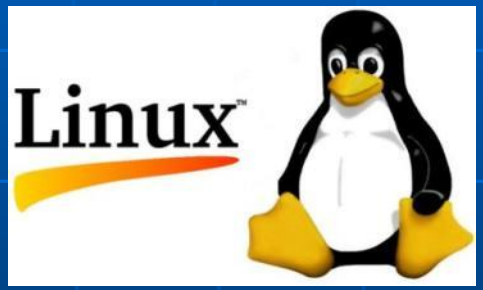
Free and Open Source Software (FOSS)

- Free Software refers to freedom, not price.
- It means that the program's users have the freedom to run the program for any purpose, access the code to study how it works and change it, redistribute copies, and redistribute copies of modified versions of the software.
- Software must offer more than just access to the source code, it must comply with 10 criteria listed in the Open Source Initiative.

GNU Project (http://www.gnu.org/philosophy/free-sw.html)
Open Source Initiative (http://www.opensource.org/docs/osd)

FOSS and FOSS4G

- Are not new…
- Are not rare…
- Have a history of 20-40 years…



1991

1995

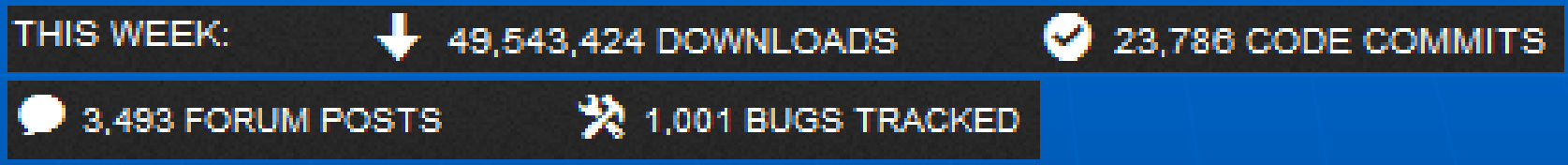
GRASS GIS

http://grass.osgeo.org/

Early 1980's

Sourceforge: (http://sourceforge.net)

Mon to Thurs Sept 14-17, 2015

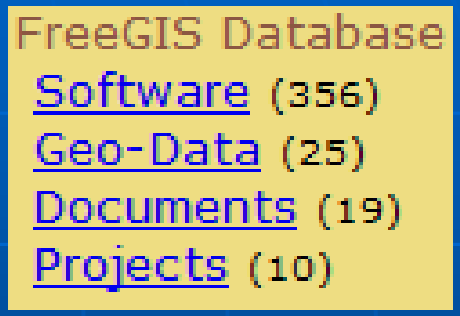


Most downloads over all time

Rank	Project Name	Downloads
1	Microsoft's TrueType core fonts	1.1B
2	VLC media player	896.3M
3	Notepad++ Plugin Manager	851.3M
4	eMule	680.6M
5	Vuze - Azureus	541.8M
6	7-Zip	407.0M
7	Ares Galaxy	403.6M
8	MinGW - Minimalist GNU for Windows	399.0M
9	FileZilla	385.3M
10	PortableApps.com: Portable Software/USB	343.9M

There is a mature FOSS4G project for every geospatial need and niche

FreeGIS.org
(http://freegis.org)



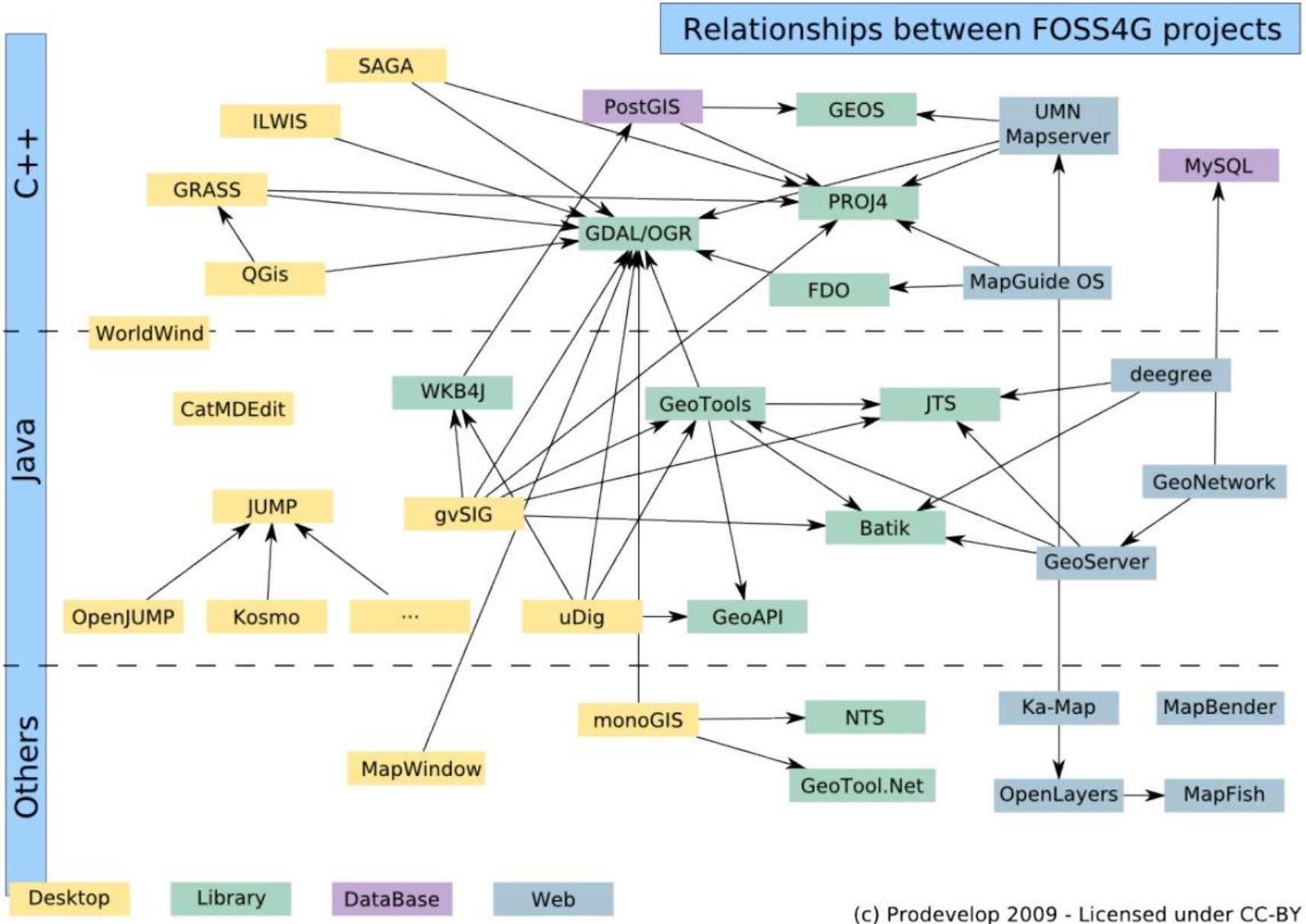
Open Source GIS
(http://opensourcegis.org)

contains about **350 FOSS4G projects.**

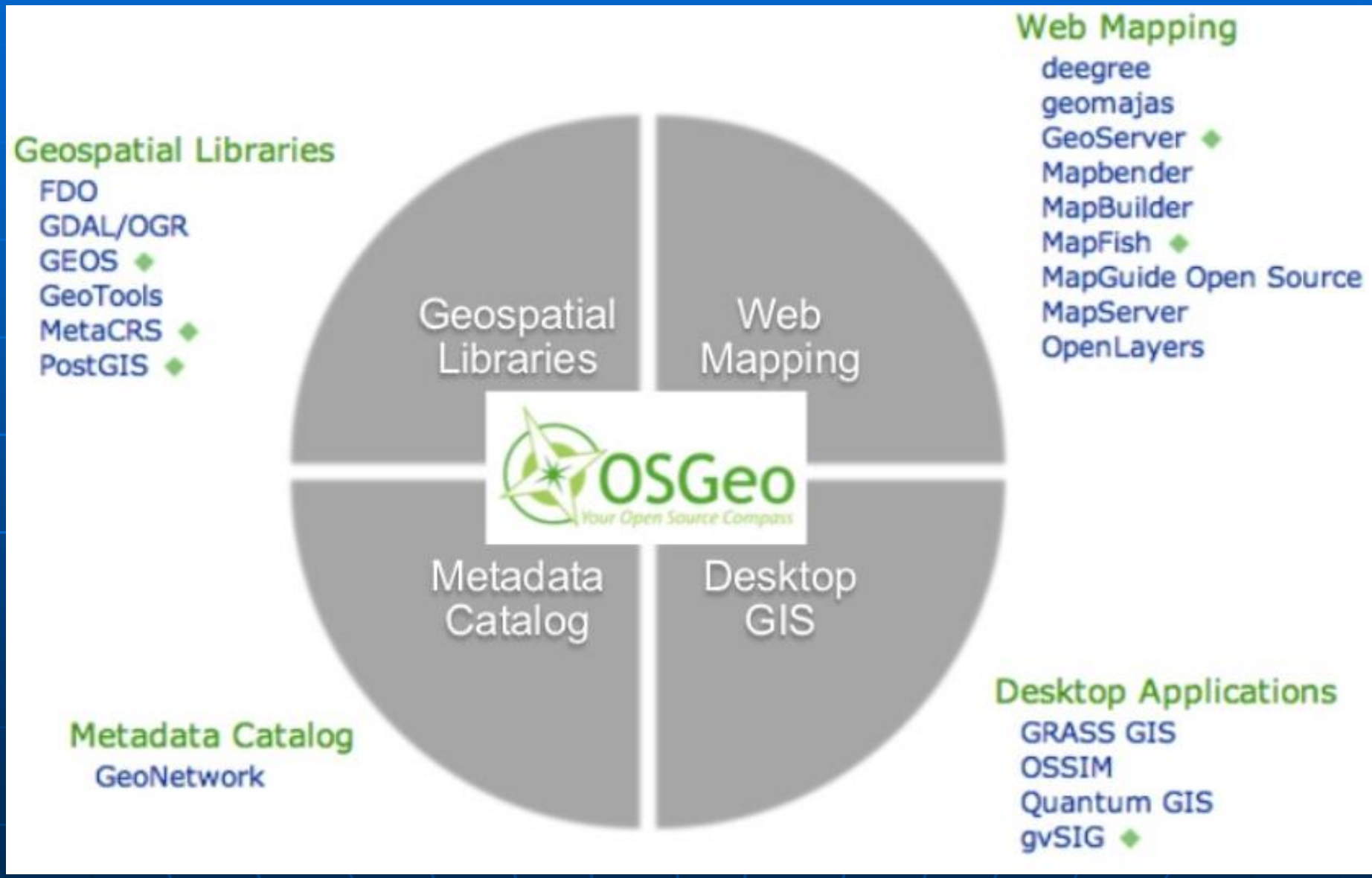
FOSS4G ECOSYSTEM

To become part of a larger ecosystem of FOSS tools.

http://osgeo.org/



FOSS4G projects under OSGeo umbrella



Source: Shin, Sanghee OSGeo Korean Chapter

FOSS4G stacks

OpenLayers™ Ext JS GeoExt

GeoServer GeoTools PROJ.4

ANSI C HTML 5 CSS 3 APACHE HTTP SERVER

GRASS GIS

ZOO Open WPS platform

ubuntu®

JavaScript python Apache Tomcat

SERVER SIDE STACK

Linux		
Web Server Apache 2		
Application Server Tomcat 7	CGI	
WMS / WFS / WCS Geoserver 2.3.1	WPS ZOO Project 1.3.0	
GeoTools	GRASS 7	
JAVA 6	Python 2.7	C ANSI

CLIENT SIDE STACK

Web Browser Chrome / Firefox / IExplorer / Opera / Safari		
Portale Helidem		
proj4js 1.1.0		
GeoExt 2.0		
OpenLayers 2.12		
ExtJS 4.1.1		
Javascript	HTML 5	CSS 3

www.helidem.eu

It is not a jungle... not really

(where to start exploring; how to choose)

Find who is doing what you want to do with FOSS4G

Network; Community; “The Way of the Hacker”

Forums; websites; reports; stories

More and more online tutorials and books

OSGeo
Your Open Source Compass

http://www.osgeo.org/

OSGeo Live

http://live.osgeo.org/en/index.html

https://github.com/FOSS4GAcademy

http://fossgeo.org/free-qgis-courses/

OSGeo-ICA-ISPRS-International Labs Network

www.geoforall.org

http://wiki.osgeo.org/wiki/Edu_current_initiatives

OSGeo

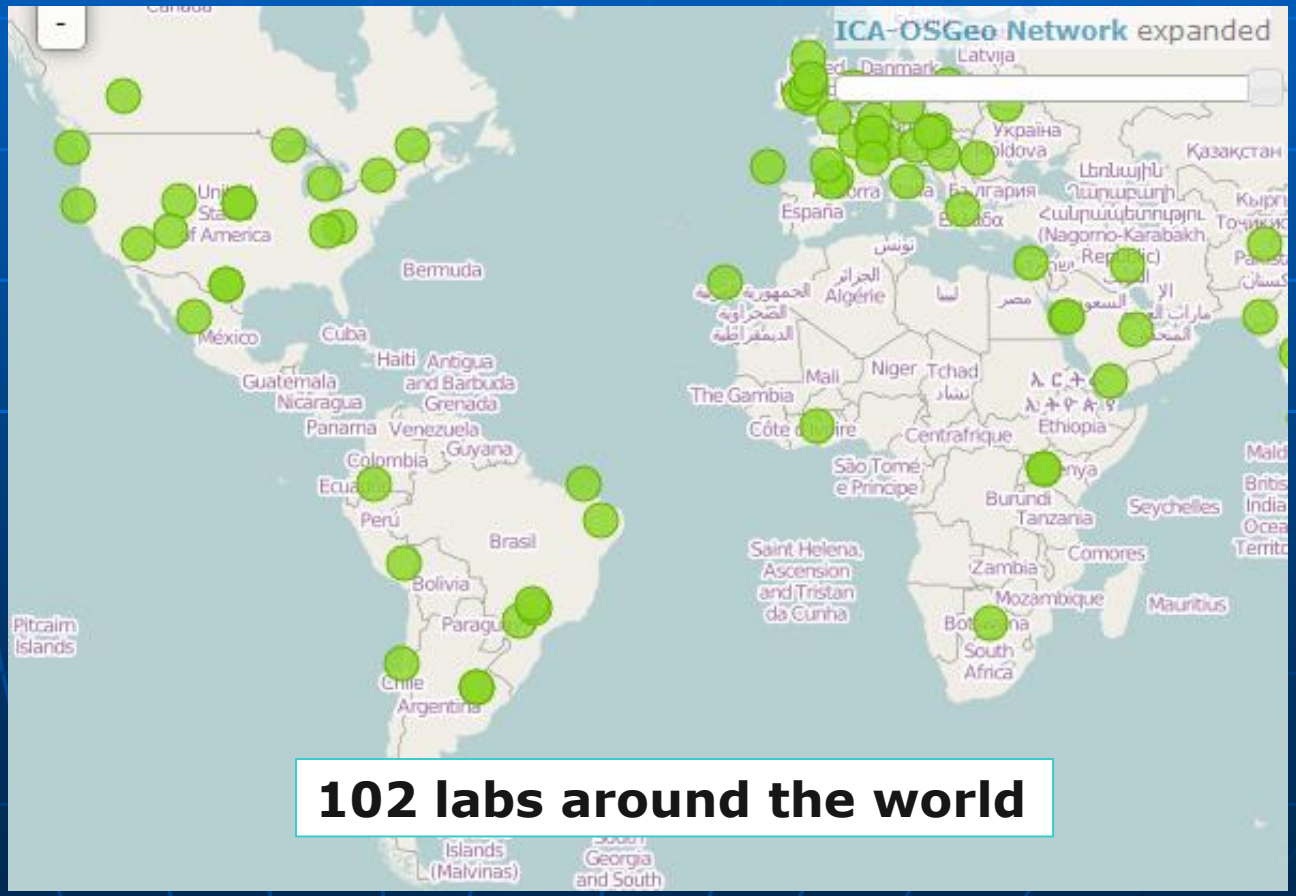
ICA

ACI

ICA-OSGeo MoU

isprs

Information from Imagery



UCD FOSS4G Lab

http://geospatial.ucdenver.edu/foss4g

Interest in FOSS/FOSS4G is growing exponentially

- Increasing attention from end users, developers, businesses, governments, educators, students and researchers around the world.

- FOSS/FOSS4G has been declared as crucial for the developing world.
  (Naronha 2002 and 2003, Rajani 2003, Schenker 2003, Wambui 2004, Holmes et al. 2005, Camara and Fonseca 2007).

- Also, developed countries are increasing their use of FOSS/FOSS4G:
  France (Marson 2005, Kaneshige 2008)
  Germany (Gillespie 2000)
  England (Lettice 2004)
  Australia (Coonan 2004)
  Italy …among others.

http://www.whitehouse.gov/open

White House Open Government Initiative

National Action Plan Initiatives

http://www.whitehouse.gov/sites/default/files/microsites/ostp/new_nap_commitments_report_092314.pdf

Bottom page 2:

Adopt an open source software policy. Using and contributing back to open source software can fuel innovation, lower costs, and benefit the public. No later than December 31, 2015, the Administration will work through the Federal agencies to develop an open source software policy that, together with the Digital Services Playbook, will support improved access to custom software code developed for the Federal government.

YouTube

Published on Jun 20, 2012
Open Source GeoSpatial in Federal IT

Open Source GeoSpatial in Federal IT - FOSS4G-NA 2012

USA

55 min

http://www.youtube.com/watch?v=rUR6DbNW2G4

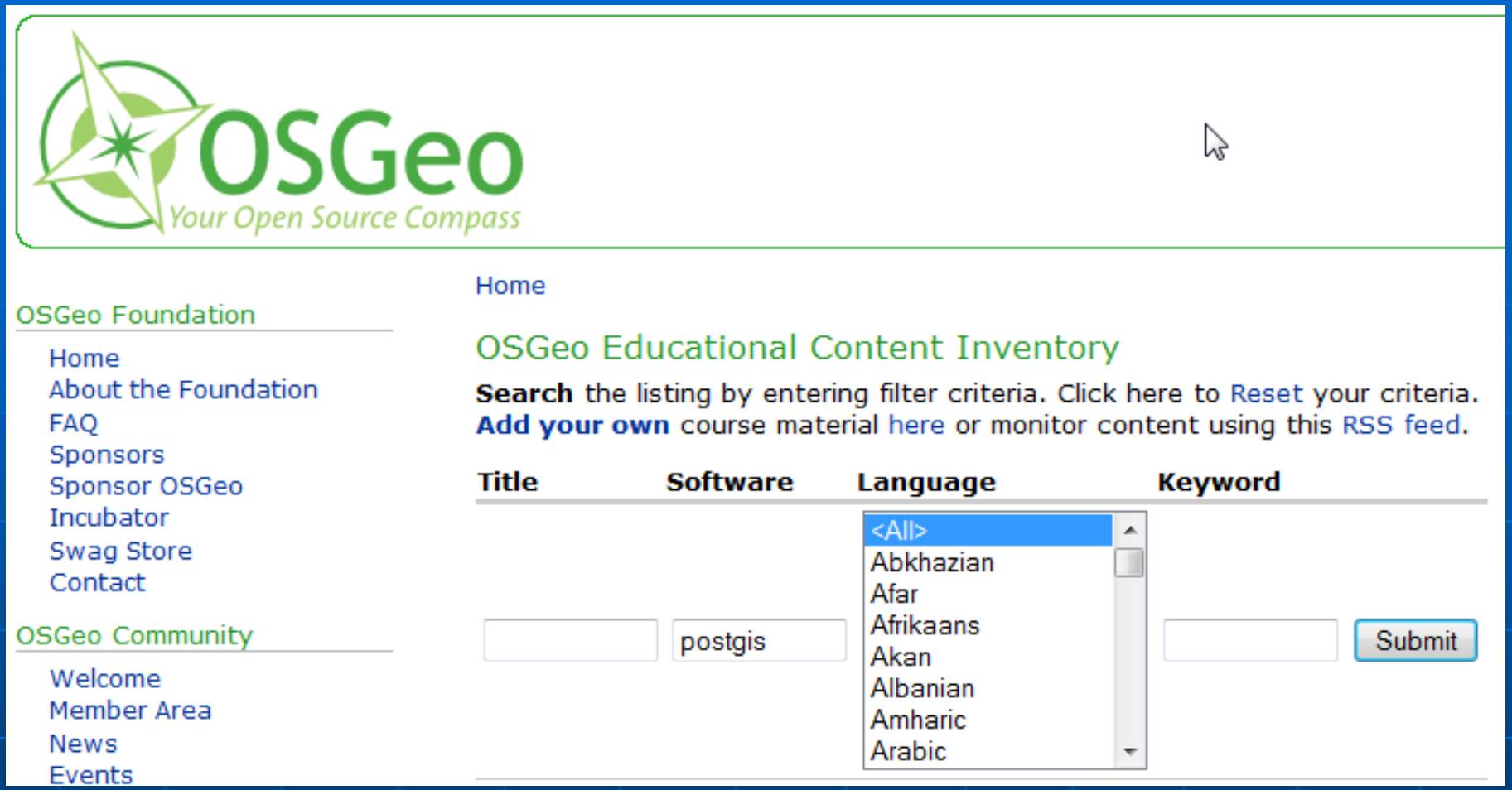
Concerns and Myths about FOSS/FOSS4G

Wheatley (2004) provides examples that help dispel the following myths:
http://www.cio.com/article/2439780/open-source-tools/open-source--the-myths-of-open-source.html

- "The principal attraction is its no-cost"
- "The savings are not real"
- "There is no tech support"
- "It is not for mission-critical applications"
- "FOSS is not ready for the desktop"
- "It can't be that good if it is free"
- "It is difficult to learn"
- "It is only for programmer/developers"
- " There are no learning materials or books about them".

FOSS4G Resources and Education are growing rapidly

There is an increasing number of commercial support services, on-line tutorials, books, forums, user-group meetings and education resources to help FOSS/FOSS4G users to choose the right software and use it.



http://www.osgeo.org/education

http://www.osgeo.org/educational_content

Self-contained package that allows you to try a wide variety of FOSS4G.

http://live.osgeo.org/es/index.html

OSGeo-ICA-ISPRS-International Labs Network

www.geoforall.org

http://wiki.osgeo.org/wiki/Edu_current_initiatives

OSGeo

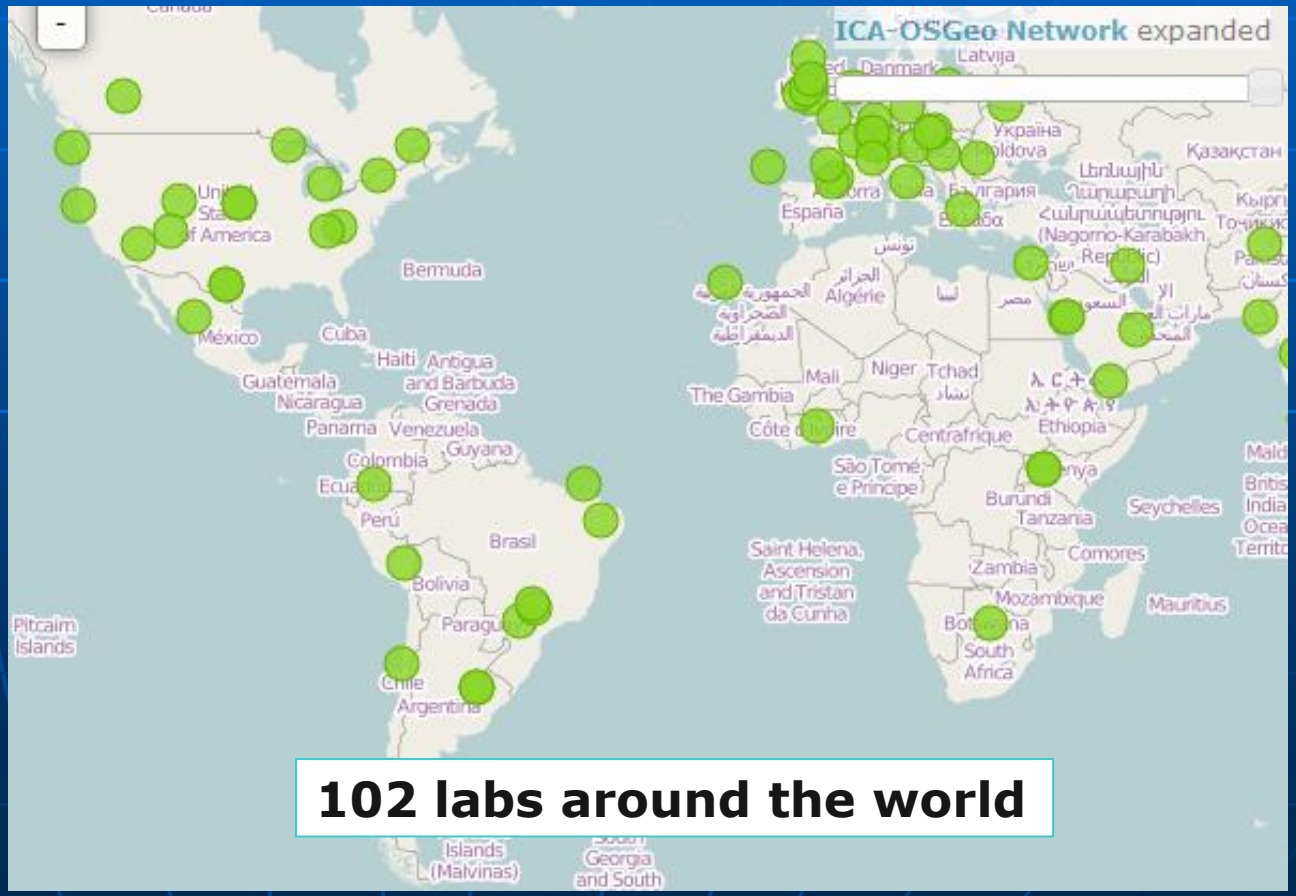
ICA

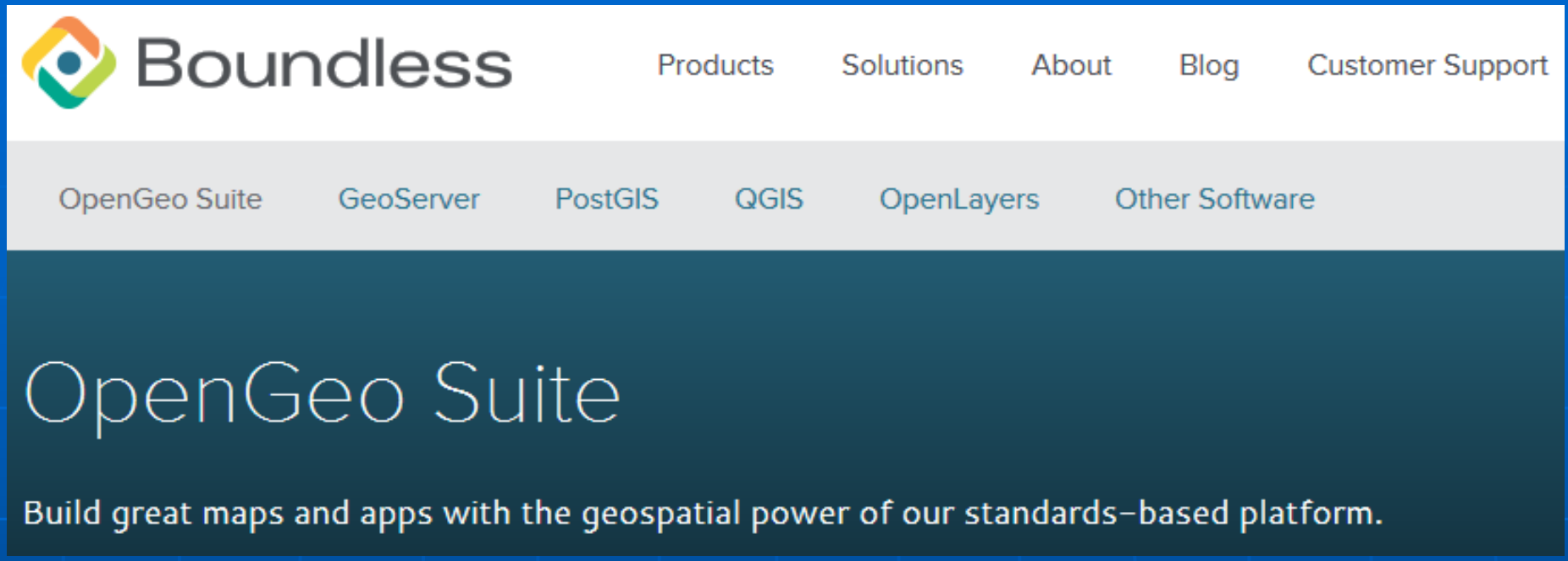
ACI

ICA-OSGeo MoU

isprs

Information from Imagery





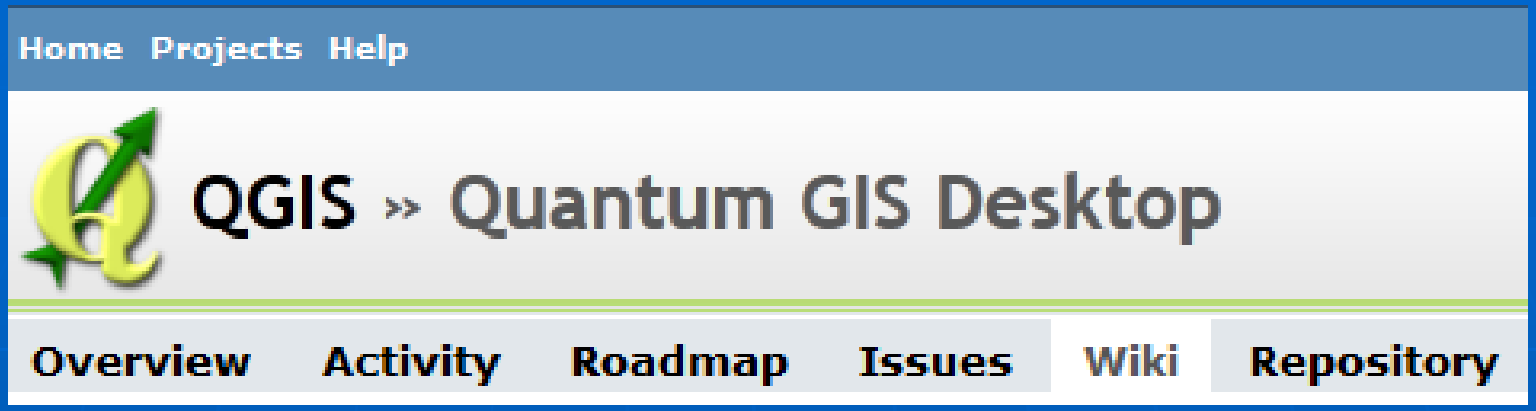
Commercial and consulting services

http://boundlessgeo.com/solutions/opengeo-suite/

Forums

User Groups

(“Your Tech Support”)



Forums

- Official QGIS forum in English
- QGIS forum in Polish
- QGIS forum in Russian
- QGIS forum in Japanese

Special interest groups

- Ecology Tools
- Transportation Tools
- Hydrology and Hydraulic modelling
- UK Ordnance Survey Users

http://hub.qgis.org/wiki/quantum-gis/Users_Corner

postgis-users -- PostGIS Users Discussion

GRASS: Community

Intro	Docs	Download	Community	

National & Regional user groups

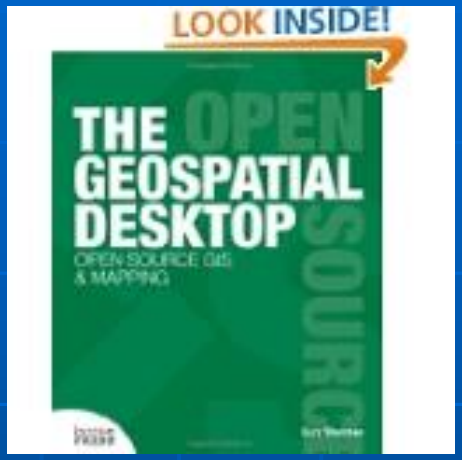
- Canada: Ottawa GRASS User's Group (merged with MapServer grou
- China: Forum
- Czech Republic: Českésdružení uživatelů GISu GRASS
- Germany: GRASS Anwender-Vereinigung e.V.
- India: India Chapter of OSGeo
- Italy: Sito degli utenti italiani di GRASS
- Korea: User group at Chinju National University
- Poland: GRASS Poland
- Poland: Wrocławska Grupa Użytkowników GRASS
- Russia: GRASS Forum
- Spain: Spanish web forum about GRASS
- USA: Los Angeles Area GRASS Users Group (spatial data/GIS)
- USA: GRASS Users Group of Davis, CA
- WORLD: Open Source Geospatial Foundation (OSGeo Foundation)

FOSS4G local user groups

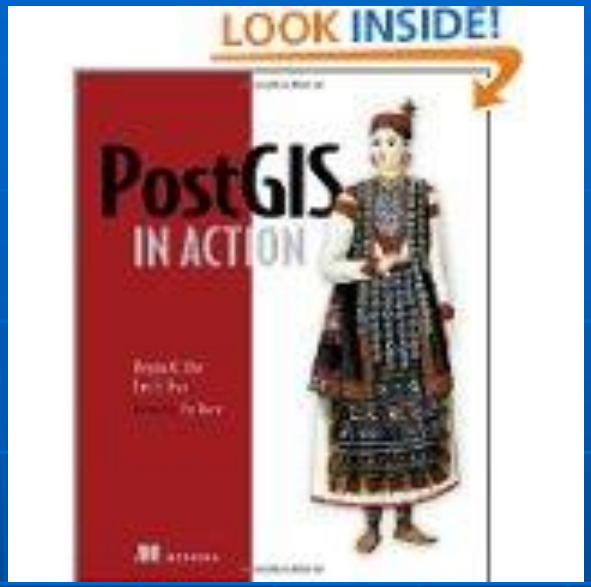
Geospatial Amateurs - Denver

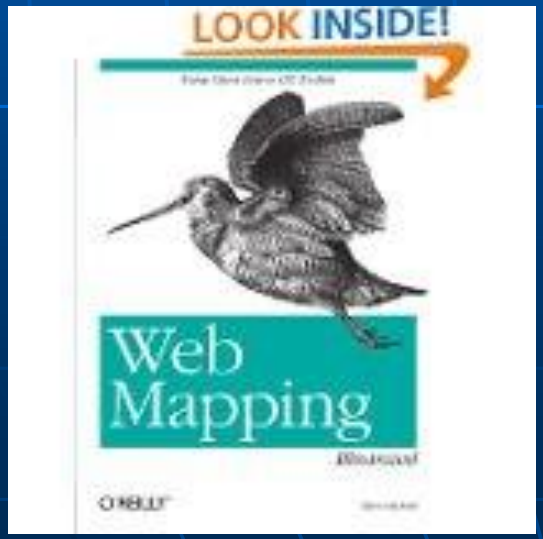
http://www.meetup.com/geospatial-amateurs-denver/

Books

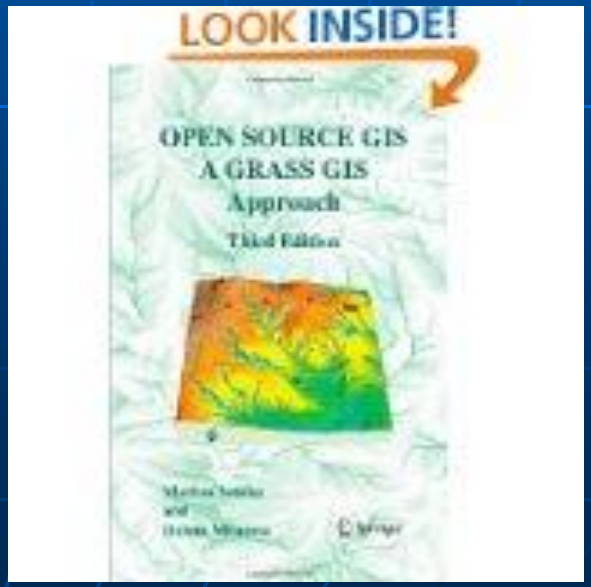

LOOK INSIDE!
THE OPEN SOURCE GEOSPATIAL DESKTOP
OPEN SOURCE GIS & MAPPING


LOOK INSIDE!
Open Source Approaches in Spatial Data Handling


LOOK INSIDE!
PostGIS IN ACTION


LOOK INSIDE!
Web Mapping


LOOK INSIDE!
OpenStreetMap


LOOK INSIDE!
OPEN SOURCE GIS
A GRASS GIS Approach
Third Edition

Why FOSS4G?

There are many reasons, among them:

- FOSS4G is more appropriate for certain applications in certain technological, socio-cultural, economic and institutional contexts.
- Fosters innovation and collaboration (distributed development; compliance with Open Specs).
- Helps to develop a different way of learning, thinking, and solving IT and spatial problems. “The way of the hacker”.
- Sustainable Development tenets: “Develop local capacity”. “Self-reliance” “Resilience” “Reduction of risks” “Stability” “Democracy” “Equal access” “Strengthening of social networks” “Cooperation”

There are many reasons …

- *Potential* cost reductions.
- Whole SDI can be built on FOSS/FOSS4G.
- Because of growth in interest and applications, GISc&T professionals are expected to at least be acquainted with FOSS4G.
- The future of GISc&T will be more diverse.

The reasons for FOSS/FOSS4G adoption vary from pragmatic to ideological, but they should be based not only on their:

- technical merit,
- no-cost feature, or
- access to the source code.

FOSS/FOSS4G should be evaluated at par with commercial private/closed software in terms of:

- Their technical features;
- Reliability;
- Ease of use;
- Documentation;
- Technical support;
- Customizability and extensibility;
- Costs of training;
- Support and maintenance; and
- Management requirements (e.g. budget, in-house development team expertise, long-term maintainability).

(Wang and Wang 2001, Woods and Guliani 2005, Ven et al. 2008).

The evaluation of FOSS4G also should include the following questions (Ramsey 2005):

- Is the software well documented?
- Is it clear who the core development team is?
- Is the software modular?
- How wide is the development community?
- How wide is the user community?

Positive answers to these questions indicate a healthy and mature FOSS4G project which provides a greater degree of confidence in its use.

Sample of Mature FOSS4G

Holmes et al. 2005, Bruce 2007, Saenz-Salinas and Montesinos-Lajara 2009, Steininger and Bocher 2009, Garbin and Fisher 2010, Tsou and Smith 2011, Steinger and Hunter 2011, OSGeo-Live DVD http://live.osgeo.org/en/index.html

1.Desktop GIS:

- KOSMO (http://www.opengis.es/)
- gvSIG (http://www.gvsig.com)
- uDig (http://udig.refractions.net/)
- Quantum GIS (QGIS) (http://www.qgis.org/)
- GRASS (http://grass.osgeo.org/)

2. Remote Sensing:

- ImageJ (http://rsbweb.nih.gov/ij/)
- OSSIM (www.ossim.org)
- OpenEV (http://openev.sourceforge.net/)
- ILWIS Open (http://www.ilwis.org/)
- Opticks (http://opticks.org/confluence/display/opticks/Welcome+To+Opticks)

3. Web GIS servers and clients:

SERVERS:

- MapServer (http://mapserver.org/)
- GeoServer (http://geoserver.org/)
- MapGuide Open Source (http://mapguide.osgeo.org/)

CLIENTS:

- OpenLayers (http://openlayers.org/)
- Mapfish (http://mapfish.org/)

Server Side

. . . . .

Client Side

. . . . .

4. Spatial extensions to Database Management Systems.

- PostGIS (http://postgis.refractions.net/) extension for PostgreSQL.
- MySQL Spatial Functions (https://dev.mysql.com/doc/refman/5.0/en/spatial-function-reference.html)

5. Code libraries and software frameworks

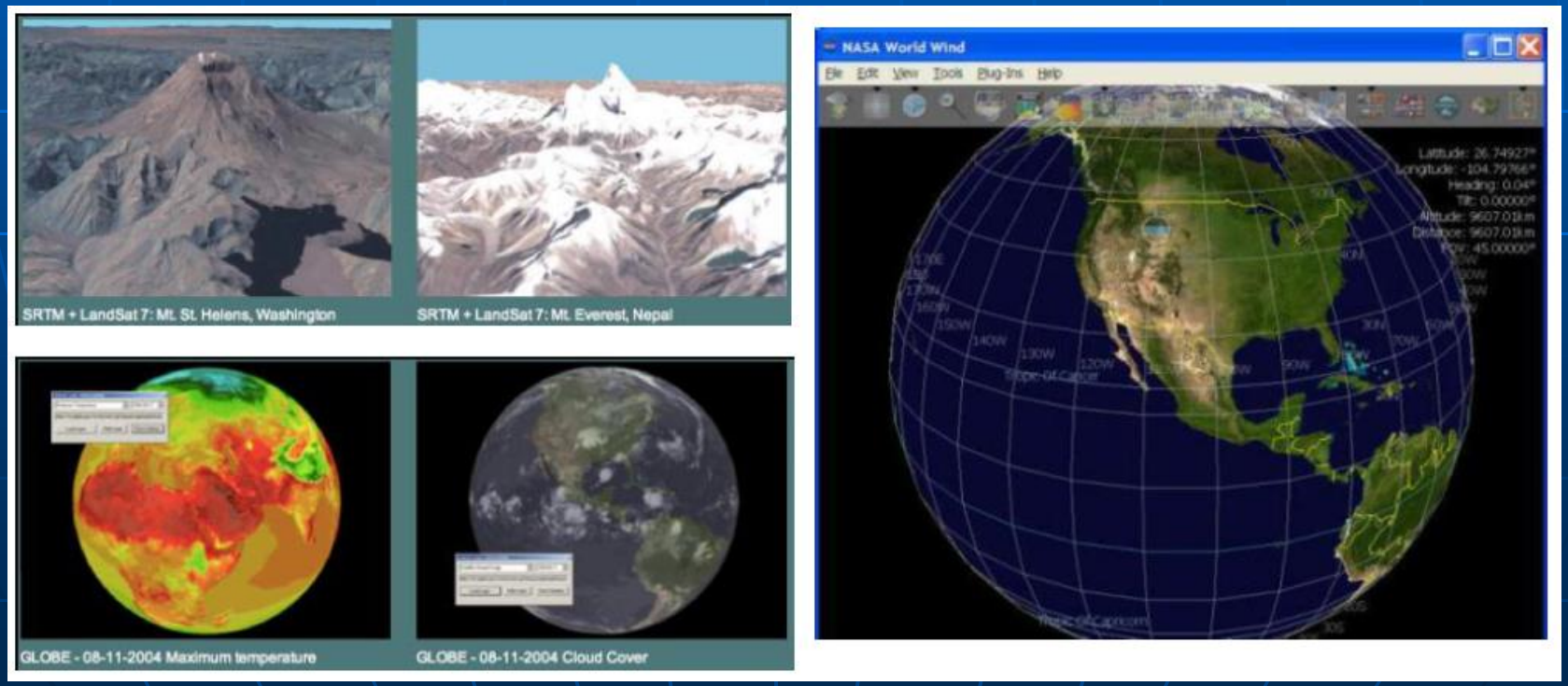
- GDAL/OGR (http://www.gdal.org/)
- PySAL (https://pysal.readthedocs.org/en/latest/)
- NASA CODE (http://ti.arc.nasa.gov/opensource/projects/code/)

6. Spatial statistics

R for spatial analysis (www.spatial.ly/r/ ; http://www.columbia.edu/~cjd11/charles_dimaggio/DIRE/resources/spatialEpiBook.pdf)

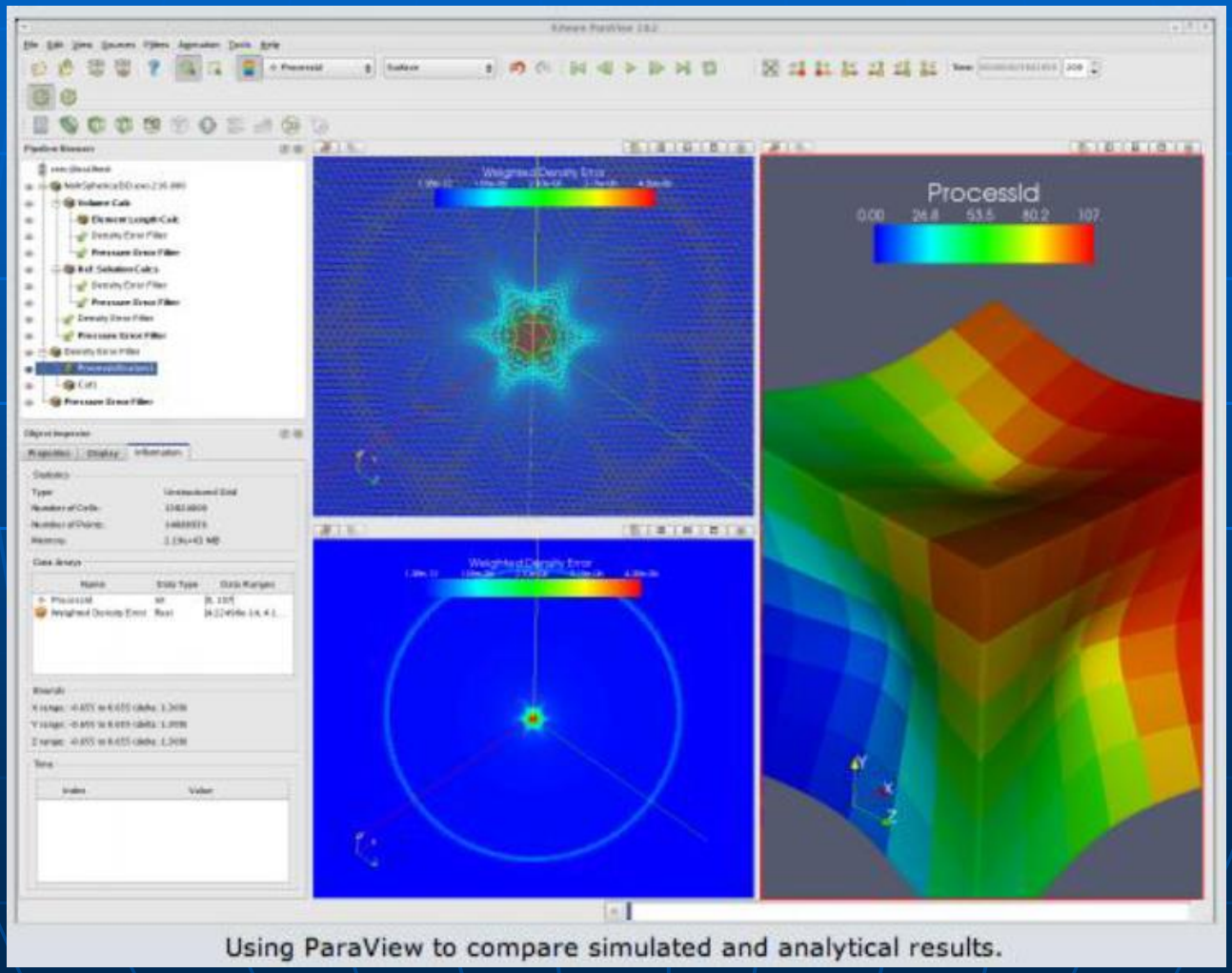
7. Virtual Globes

- NASA World Wind (http://worldwind.arc.nasa.gov/download.html)
- ossimPlanet (http://trac.osgeo.org/ossim/wiki/OssimPlanet)



8. Tools for visualization and analysis.

- ParaView (http://www.paraview.org/)



Using ParaView to compare simulated and analytical results.

Close/private software and companies are interested in FOSS4G
Why?

ESRI and Open Source
http://www.esri.com/news/arcnews/spring11articles/open-source-technology-and-esri.html

Can Open Source save HP?
http://www.infoworld.com/article/2617869/open-source-software/can-open-source-save-hp-.html

GIS Industry Trends and Outlook 2012
http://www.gislounge.com/gis-industry-trends/ :

"Growth areas for the GIS Industry in 2012 are: Open source GIS will continue to grow and start to take its place among the commercial options as preferred desktop, mobile, and online mapping software"

References and sources of information:

Babcock C 2006 Open Source Software: Who gives and who takes? *Information Week* (May 15, 2006; available at http://www.informationweek.com/news/187202790)

Bitzer J, Schrettl W, and Schroder P J H 2007 Intrinsic motivation in open source software development. *Journal of Comparative Economics* 35: 160-69

Bruce R 2007 A survey of Open Source geospatial software. Presentation for the Association of Professional Engineers and Geoscientists of the Province of Manitoba (APEGM) (available at http://www.apegm.mb.ca/pdf/PD_Papers/os-geospatial-sw.pdf)

C/NET News 2005 Year in review: Open Source 2005 highlights. C/Net News.com (available at http://news.com.com/Year+in+review+The+open-source+effect+spreads/2009-7344_3-5992992.html)

Camera G and Fonseca F 2007 Information policies and Open Source Software in developing countries *Journal of the American Society for Information Science and Technology* 58: 121-32

Coonan H 2004 *Government Leads the Way on Open Source Software.* Canberra, ACT, Australian Government Information Management Office, Minister for Communications, Information Technology and The Arts Media Release (available at http://www.minister.dbcde.gov.au/coonan/media/media_releases/media139)

CRM-Reviews 2006 50 Open source success stories in business, education and government. CRM Articles (31 October, 2006; available at http://www.crm-reviews.com/50-open-source-success-stories-in-business-education-and-government/)

Crowston K, Wei K, Howison J, and Wiggins A 2012 Free/Libre Open Source Software development: What we know and what we do not know. *ACM Computing Surveys* 44: in press

Daffara C 2007 Estimating the number of active and stable FLOSS projects. Commercial Open Source Software Blog (23 August, 2007; available at http://robertogaloppini.net/2007/08/23/estimating-the-number-of-active-and-stable-floss-projects/)

De Longueville B 2010 Community-based geoportals: The next generation? Concepts and methods for the geospatial Web 2.0. *Computers, Environment and Urban Systems* 34: 299-308

DiBona C, Ockman S, and Stone M (eds) 1999 *Open Sources: Voices from the Open Source Revolution.* Sebastopol, CA, O'Reilly and Associates

DiBona C, Stone M, and Cooper D (Eds) 2005 *Open Sources 2.0: The Continuing Evolution*. Sebastopol, CA, O'Reilly and Associates

Erlich Z and Aviv R 2007 Open Source Software: Strengths and weaknesses. In St. Amant K and Still B (eds) *Handbook of Research Open Source Software: Technological, Economic and Social Perspectives*. Hersey, PA, IGI Global: 184-96

Faber S 2007 Geoserver and Open Standards: A success story. In *Proceedings of FOSS4G 2007*, Victoria, British Columbia (available at http://2007.foss4g.org/presentations/view.php?abstract_id=8)

Garbin D and Fisher J L 2010 Open Source for enterprise Geographic Information Systems. *IT Professional* (November/December 2010): 38-45

Gillespie R 2000 German federal government to support Open Source Software. Internetnews.com (5 July, 2000; available at http://www.internetnews.com/bus-news/article.php/408271/German+Federal+Government+to+Support+Open+Source+Software.htm)

Holck J, Persen M K, and Larsen M H 2005 Open Source Software acquisition: Beyond the business case. In *Proceedings of the Thirteenth European Conference on Information Systems,* Regensburg, Germany (available at http://csrc.lse.ac.uk/asp/aspecis/20050130.pdf)

Holmes C, Doyle A, and Wilson M 2005 Towards a Free and Open Source Spatial Data Infrastructure. In *Proceedings of the Faraohs to Geoinformatics FIG Working Week 2005 and GSDI-8*, Cairo, Egypt (available at http://www.fig.net/pub/cairo/papers/ts_26/ts26_05_holmes_etal.pdf)

Host M and Orucevic-Alagic A 2011 A systematic review of research on open source software in commercial software product development. *Information and Software Development* 53: 616-24

Kaneshige T 2008 Open source: What should you learn from the French. *InfoWorld* (28 August, 2008; available at http://www.infoworld.com/d/developer-world/open-source-what-you-should-learn-french-461)

Krogh von G and Hippel von E 2003 Editorial: Special issue on open source software development. *Research Policy* 32: 1149-57

Lagesse D 2002 Out the Windows: Breaking with Microsoft gets a little easier. *US News & World Report* (14 January, 2002): 54-56 (available at http://www.usnews.com/usnews/culture/articles/020114/archive_020018.htm)

Lettice J 2004 Open Source ready prime time in UK.gov, says OGC. *The Register* (28 October, 2004; http://www.theregister.co.uk/2004/10/28/ogc_oss_pilot_report/)

Lowe J 2002 Spatial on a shoestring: Leveraging free Open Source Software. *Geospatial Solutions* 12: 42-45

Maguire D J and Longley P A. 2005 The emergence of geospatial portals and their role in spatial data infrastructures. *Computers, Environment and Urban Systems* 29: 3-14

Marson I 2005 Europe and the US philosophically divided on open source? *ZDNet UK* (28 November, 2005; available at http://insight.zdnet.co.uk/software/linuxunix/0,39020472,39235707-4,00.htm)

Mitasova H and Neteler M 2004 GRASS as Open Source Free Software GIS: Accomplishments and Perspectives. *Transactions in GIS* 8: 145-54

Moody G 2002 *Rebel Code: Inside Linux and the Open Source Revolution*. New York, Perseus Press

Moreno-Sanchez R, Anderson J, Cruz J, and Hayden M 2007 The potential for use of Open Source Software and Open Specifications in creating web-based cross-border health spatial information systems *International Journal of Geographical Information Science* 21: 1135-63

Naronha F 2002 Open Source Software opens new windows to third-world. *Linux Journal* (3 May, 2002; available at http://www.linuxjournal.com/article/6049)

Naronha F 2003 Developing countries gain from Free/Open Source Software. *Linux Journal* (20 May, 2003; available at http://www.linuxjournal.com/article/6884)

PITAC (President's Information Technology Advisory Committee) 2000 Report to the President: Developing Open Source Software to Advance High End Computing. WWW document, http://www.nitrd.gov/Pubs/pitac/pres-oss-11sep00.pdf

Ramsey P 2005 The State of Open Source GIS. WWW document, http://www.refractions.net/white_papers/

Rajani N, Rekola J, and Mielonen T 2003 Free as in Education Significance of the Free/ Libre Open Source Software for Developing Countries. Helsinki, Finland, Ministry of Foreign Affairs, Finland (available at http://www.itu.int/wsis/docs/background/themes/access/free_as_in_education_niranjan.pdf)

Raymond E S 2001 *The Cathedral and the Bazaar Musings on Linux and Open Source by an Accidental Revolutionary.* Sebastopol, CA, O'Reilly and Associates

Rossi M A 2004 Decoding the "Free/Open Source (F/OSS) Software puzzle": A survey of theoretical and empirical contributions. Quaderni n. 424 Universita degli Studi di Siena, Dipartimento di Economia Politica (available at http://flosshub.org/system/files/rossi.pdf)

Saenz-Salinas J and Montesinos-Lajara M 2009 Current panorama of the FOSS4G ecosystem. *UpGrade* 10(2): 43-51 (available at http://www.cepis.org/upgrade/files/issue%20II-2009-sanzsalinas.pdf)

Schenker J L 2003 Open Source Software gets boost at UN. *International Herald Tribune, The IHT Online* (11 December, 2003; available at http://www.iht.com/articles/2003/12/11/dividea_ed3_.php

Schweik C M, English R, and Haire S 2009 Factors leading to success or abandonment of Open Source Commons: An empirical analysis of Sourceforge.net projects. *South African Computer Journal* 43: 58-65

Spenellis D and Szyperski C 2004 How is Open Source affecting software development. *IEEE Software* (January/February): 28-33

Steinger S and Bocher E 2009 An overview on current free and open source desktop GIS developments *International Journal of Geographical Information Science* 23: 1345-70

Steninger S and Hunter A J S 2011 Free and Open Source GIS software for building a Spatial Data Infrastructure. WWW document, http://superb-dca2.dl.sourceforge.net/project/jump-pilot/w_other_freegis_documents/articles/sstein_hunter_fosgis4sdi_v10_final.pdf)

Tsou M-H and Smith J 2011 Free and Open Source software for GIS education. Unpublished White Paper Prepared for the GeoTech Center (available at http://www.iapad.org/publications/ppgis/tsou_free-GIS-for-educators-whitepaper.pdf)

Ven K, Verelst J, and Mannaert H 2008 Should you adopt Open Source software. *IEEE Software* (May/June): 54-59 (available at http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4497765)

Wade T 2005 Brazil reshapes debate on intellectual property. *Reuters Foundation, Alert Net* (1 February, 2005; available at http://www.freepress.net/news/6503)

Walli S, Gynn D, and Von Rotz B 2005 The Growth of Open Source Software in Organizations: A Report. WWW document, http://www.novell.com/news/press/pressroom/wp_optaros_oss_usage_in_organizations.pdf)

Wambui M 2004 *Africa Should Make More Use of Free and Open Source Software.* Nairobi, Kenya, United Nations Economic Commission for Africa (available at http://www.uneca.org/eca_resources/news/042805disdcodi_dna.htm)

Wang H and Wang C 2001 Open Source software adoption: A status report. *IEEE Software* 18: 90-95

Weber S 2004 *The Success of Open Source* Cambridge, MA, Harvard University Press

Wheatley M 2004 The Myths of Open Source. *CIO Magazine* (1 March, 2004; available at http://www.cio.com/article/32146/Open_Source_The_Myths_of_Open_Source?page=1&taxonomyId=3042)

Wheeler D A 2007 Why Open Source Software/Free Software (OSS/FS)? Look at the Numbers! WWW document, http://www.dwheeler.com/oss_fs_why.html

Williams S 2002 *Free as in Freedom: Richard Stallman's Crusade for Free Software* Sebastopol, CA, O'Reilly and Associates

Woods D and Guliani G 2005, *Open Source for the Enterprise Managing Risks, Reaping Rewards*. Sebastopol, CA, O'Reilly and Associates