Free and Open Source Software for Geoinformatics
- Present Status and Future Prospects -

Venkatesh Raghavan[1], **Shinji Masumoto**[1] **and David Hastings**[2]

[1]Osaka City University 3-3-138 Sugimoto, Sumiyoshi-ku Osaka 558-8585, Japan

[2]United Nations Economic and Social Commission for Asia and the Pacific, UN Bldg., Rajadamnern Nok Ave., Bangkok, Thailand

Corresponding Authors Email: Venkat at osgeo dot org

ABSTRACT

Free and Open Source Software for Geoinformatics (FOSS4G) has grown in scope and popularity. Many individuals, institutions and private companies have found a good business case for FOSS4G. In this paper we highlight relevance of FOSS4G and also discuss about the benefits of FOSS4G solutions in the Asian context. Further, we discuss some of the major tasks that have been undertaken to promote the use of FOSS4G in Asia that include;

- *Software Internationalization and Localization*
- *Development of prototype applications to demonstrate FOSS4G capabilities to local and regional audiences*
- *Software Packaging and Customization for local and regional needs*
- *Training, Support and Development of e-Learning Contents in local languages*
- *Support Open standards and Open access to geospatial data in region*

The above activities have not only complemented and strengthened collaborative efforts initiated by the Open Source Geospatial Foundation (OSGeo) but also helped in increasing awareness about FOSS4G and speed-up adoption in education, industry, government and non-profit organizations in Asian region.

Proprietary software vendors have been very successful in harnessing the rich pool of talent that is available in the Asia region. Some collective thought needs to be focused on ways and means of canalizing the creativity and ingenuity of software developers in the Asian region into developing FOSS4G solutions. Our experience over the past decade in research and teaching using FOSS4G has led us to firmly believe that has the potential not only to support capacity building but also to stimulate indigenous software enterprises in Asia, and thereby enriching input to the global FOSS4G community.

1. INTRODUCTION

Over the last decade, many Geoinformatics technologies have evolved to fully operational status. They are being used, and have additional potential, to support social and humanitarian needs. Geoinformatics technologies for building and delivering geo-referenced information over computer and communication networks can provide much-needed conduits for bringing benefits of spatial data and information to a wider audience.

FOSS4G has grown tremendously in scope and popularity. FOSS4G has created new opportunities for implementing spatial data infrastructures. Whether as a means (1) for economizing compared to expensive proprietary closed-source software licensing and maintenance arrangements, (2) for knowing exactly what your software is doing (by directly inspecting the source code), (3) for teaching software development at a university by working

on open-source code, or (4) for running a business developing and customizing software rather than just teaching how to make a map, FOSS4G may be part of your solution. Several current FOSS4G tools can be tailored to develop, manipulate, assess and map spatial databases. We present an overview of available software tools and solutions. FOSS4G offers capabilities for interoperable and solution-oriented (rather than software oriented) development strategies. In this paper, we highlight some of the recent initiatives to promote wider use of FOSS4G solutions.

2. FREE AND OPEN SOURCE SOFTWARE AND OSGeo

FOSS4G solutions have become increasingly popular and dynamic over the past decade. They protect intellectual property through copyright, yet foster sharing, distributed development, bug-fixing, training, support, customization, etc. While some people try to differentiate between "free software" (www.gnu.org) and "open source software" (www.opensource.org), FOSS4G in this paper refers primarily to software whose source code is openly accessible, whose ownership may be copyright and include collaborative development and/or adoption. FOSS has become a leading environment for operating systems, Web servers, Web browsers, and other applications. Many currently popular proprietary capabilities (e.g. many projection change routines) and packages owe their existence to predecessor open-source software efforts/packages.

Several FOSS4G tools are available (Table 1) that can be readily used. Prudent integration of FOSS4G tools would enable the implementation of customizable, scalable and distributed spatial database systems.

Table 1: Some FOSS4G projects

FOSS Project	Geoinformation Service
GRASS	GIS
QGIS, OpenEv, jGRASS	Desktop GIS
GDAL	Data translation
PostgreSQL/PostGIS	Spatially enabled DBMS
PROJ4	Coordinate transformation
OSSIM, Open-Dragon	Image Processing
MapServer, GeoServer, Mapguide, Deegree	Web Mapping Engine
GRASSLinks	Web GIS
PrimaGIS	Spatially Enabled Content Management System
Mapscript, CartoWeb, Maplab, Chameleon, AppforMap, Worldkit	Web Mapping Application Development Environment
GPSdrive	GPS Navigation
GPSBabel	GPS Format Conversion
Gpsd (DGPS)	GPS TCP Daemon Service
GPSTk	GPS Application Development Toolkit
Geospatial Clearinghouse	Isite Z39.50, Geonetwork

FOSS4G projects listed in Table 1 offer interoperable Geographic Information Services based on internationally accepted standards. They have open architectures enabling ready

access to software and data by other software, such as external or customized modeling routines. Several of the FOSS4G tools that we use in our research have been certified by the OGC (Open Geospatial Consortium) compliance testing program. Indeed, OGC was originally the Open Grass Foundation, supporting GRASS-oriented institution-building.

Recently, Open Source Geospatial Foundation, or OSGeo, has been created support and build the highest-quality geoinformatics software. OSGeo aims to encourage the use and collaborative development of community-led projects. The establishment of OSGeo is an important in bringing FOSS4G projects and communities under one umbrella in order to effectively promote distributed innovation in FOSS4G solutions. OSGeo draws governance inspiration from several aspects of the Apache Foundation, including a membership composed of individuals drawn from foundation projects who are selected for membership status based on their active contribution to foundation projects and governance. OSGeo consists of the nine board of directors and officers. The foundation has 45 members from the broader open source geoinformatics community through a public nomination and election process. Official Chapters of OSGeo have presently been established in Japan, China, India, and Ottawa. The operative body OSGeo currently comprises of the following projects;

Open GeoData

The vital component of any geoinformatics solution is the data. OSGeo is committed to promoting open licenses for geographic data. OSGeo advocates public access and contribution to national geodata and maintain repository of open licensed data

Education

OSGeo has initiated the collection, development and promotion of educational material to support the goals of the foundation. Availability under Free licenses, strengthen both user and developer communities. Geoinformatics concepts and applications can be effectively conveyed and grasped using a up to date software stack and working with freely available geodata.

Software Projects

The main stimulus to establish OSGeo and core activities was a strong desire to provide support, infrastructure and visibility for FOSS4G projects. The initial stack comprising of GeoTools, Mapbender, MapBuilder, MapGuide, MapServer, GDAL/OGR, GRASS, and OSSIM covers all major areas of geoinformatics software

OSGeo does require that software projects to be licensed under any one particular open source license, but will require that all OSGeo software be released under an open source license approved by the Open Source Initiative (OSI; http://www.opensource.org/). The long term goal is to encourage licenses that allow the different foundation projects to work better together and permit for code exchange among them. OSGeo incubation incorporates contribution and intellectual property policies designed to avoid the inclusion of proprietary or patented code in OSGeo projects. Foundation projects are focused on interoperability - both with one another at the library level, and with other proprietary and open source projects through the use of open standards.

2. SITUATIONS WHERE FOSS GEOINFORMATICS IS USEFUL

The following scenarios describe situations in which FOSS4G software may be useful.

The University Campus

A new lecturer at a University in the Geography Department claims that Geoinformatics software is part of the discipline of geography. His colleagues in the Computer Science program claim that Geoinformatics is software development. Both are correct. They know that there are jobs for GIS programmers, but don't know how to give experience for their students. They have heard that at OSGeo students can get involved in the software project as programmers, writing training material and so on. They discover that English is the language used at OSGeo and they are not very comfortable with it. But, how to do this in Asia and in a language that one is comfortable with? The answer is simple: work with FOSS4G and join the local OSGeo Chapter! If there isn't one in your linguistic or geographic preference, look around, get self-organized start a local OSGeo Chapter. Are you interested in innovative data structures, such as 3-dimensional or temporal GIS? Work with the GRASS Development Team in this area! Are you interested in Web mapping? Work on Mapserver development! With OSGeo collaboration cultures, you can join a software development team from anywhere.

The Governmental Research and Development Lab

A new researcher joined his government's R & D lab in disaster risk management. He is part of the team assigned to use Geoinformatics to develop risk maps for landslides, floods, tsunamis and other disasters that the country has targeted to "solve." He needs to integrate flood modeling software with GIS and image processing. But none of the proprietary packages do exactly what his laboratory needs. Also, the government is promoting the development of a local software development community. His solution? OSGeo software has open architecture as well as open source. He can use GRASS GIS to attack his existing problems, and also hire staff (at a fraction of the costs of software licenses and maintenance agreement costs for high-end commercial software) to customize the software to better serve his needs.

The Small Consulting Business

Two young friends decided to form a partnership, to better pursue their interests in IT engineering business. They have both worked for other small businesses, conducting training courses for people learning office automation, including map making. However, they both want more. They decide to try developing a small business customizing OSGeo software to develop solutions for clients. They decide that, besides adapting Mapserver and GRASS applications for clients, they can join the development teams for the software, and enhance the software itself to better meet client needs. They find more satisfaction in this approach, and develop a modest but enjoyable relationship with clients that want their services. They also find a small number of eager programmers and applications developers that want to join them. Business grows.

The Larger Corporation

A big name in software engineering has been assigned to reassess the IT strategy of a large corporation. The corporation has been a regular customer of proprietary software, but has had some difficulties with responsiveness of call centers, especially related to bugs and other problems with the security and functionality of the software. They have heard that OSGeo software is more robust, with quicker bug fixes and more responsiveness to user needs due to greater user involvement in software development. They thus explore the possibility of reallocating some of their software licensing and maintenance budget to hiring programmers to adapt FOSS4G for their needs. They find that native functionality of those FOSS4G packages is adequate, once they get past the initial resistance of staff to change software. They also find that, after they reallocate half their savings on software licensing and maintenance agreements to hiring new programmers, they get quicker response to complaints, and can devote programmer time to strengthening the software. Now they offer Web mapping solutions to clients in several Asian languages, and are increasing their customer base. They are very happy with their switch to FOSS4G for providing geoinformatics solutions.

3. PROMOTING AND NURTURING FOSS FOR GEOINFORMATICS

International conferences and training programs devoted to FOSS4G solutions have been receiving enthusiastic response and patronage. The following list of conferences and the related online resources may provide the readers with a better understanding of the present status of FOSS for Geoinformatics.

- Open Source Free Software GIS - GRASS Users Conference (www.ing.unitn.it/~grass/ conferences/GRASS 2002/).
- Open Source GIS Conference 2004 (www.omsug.ca/osgis2004/)
- Free and Open Source Software for Geoinformatics: GRASS Users Conference (FOSS/GRASS 2004) (gisws.media.osaka-cu.ac.jp/grass04/.
- Open Source Geospatial '05 (mapserver.gis.umn.edu/community/conferences/MUM3)
- FOSS4G 2006 www.foss4g2006.org
- The Websites for FreeGIS (www.freegis.org) and open remote sensing (www.remotesensing.org).
- The Websites of specific packages such as GRASS (grass.itc.it), and Mapserver (mapserver.gis.umn.edu).

Major tasks for promoting and nourishing FOSS4G may be considered as follows:

a) Software packaging

In the past, implementing FOSS4G solutions was an arduous task for novice users and required installation configuration of several FOSS libraries and packages. With the recent availability of packaged solutions such as FGS, MS4W and Fwtools (see maptools.org) and commercial support, such obstacles have been largely overcome. Additional efforts need to be made to develop more generic packages that are tested and improved for use on a wide variety of operating systems and hardware platforms. The situation would improve further with increased standardization of software development tools.

b) Language Internationalization and localization

As a part of the project supported by Information-technology Promotion Agency in Japan, the Internationalization (i18n) of GRASS GIS and Mapserver Web Mapping Engine have been completed and multi-language capabilities have been incorporated in the current version of these software. Additional efforts need to be focused on translation of online help files, manuals and so on.

c) Training and Support

A wealth of training materials for teaching, self-learning and developing FOSS4G solutions is now available. As a part of recent capacity building and technology transfer initiatives, several international training courses and workshops have been conducted. FOSS4G capacity building initiatives need to be further strengthened through accredited training and testing mechanism and development of core curriculum for FOSS4G based education.

4. CONCLUSIONS

In order to promote the utilization of spatial datasets, it is necessary to foster national capacities in Geoinformatics and encourage domestic capacity building in software development and support services. Successful dissemination and prudent use of data on the regional and spatial scale depends on the availability of trained manpower and experienced personnel. In addition, suitable software tools that are aptly customized and localized to meet area-specific needs must also be made available to local application users. Our experience in using FOSS4G suggests that many basic tools are already available while others are undergoing rapid development. Existing FOSS4G projects have the potential for providing necessary information and communication technology services. Widespread use of FOSS4G would not only stimulate further development of FOSS4G projects but could also foster indigenous capabilities. Global initiatives such as OSGeo and support of local communities could provide necessary impetus for sustainable and clean software development for geoinformatics. The FOSS4G communities must also learn how proprietary software vendors have been successful in harnessing the rich pool of talent that is available in the Asia region. Some collective thought needs to be focused on ways and means of canalizing the creativity and ingenuity of software developers in the Asian region into developing FOSS4G solutions.