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The Outline of Open Source Geospatial Software and Data

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ABSTRACT: *The non-proprietary easily accessible software available to the public without any restrictions viz., time period, source code, etc is called Open Source Software. This* ***is*** *initiated in California by the Open Source Initiative (OSI), which was founded in 1998. The group is actively involved in Open Source community-building, education, and public advocacy to promote awareness and propagate the relevance of open source software. Open source provides a base and development method for software resulted from the peer review and open contribution process.*

The idea of sharing and collaborative improvement of software source code originated as early as software development itself. It got impetus with the publicity of Linux in Forbes and the release of the Netscape browser's source code. And the term "open source" as suggested by Christine Peterson came into existence shortly after the announcement Of the release of the Netscape source code. Geospatial world is not immune to the concept of open source thereby originated the Open Geospatial Consortium, Inc.® (OGC) a non-profit, international, voluntary consensus standards organization which is instrumental in developing and protecting of standards for geospatial and location based services.

Open Source Geospatial software is available under the GNU General Public License and Geospatial data is also available in public domain provided by various agencies across the globe. The most common and successful open source software available are Quantum GIS, GRASS (Geographic Resources Analysis Support System), uDig, gvSIG, MapWindow, ILWIS (Integrated Land and Water Information System), OpenEV, PostgreSQL/PostGIS for Spatial Data Base, et cetera are to name a few. The GeoSpatial database available in the public domain covering whole Earth is presently freely available in web sources suchas Google Earth, Microsoft Virtual Earth, NASA World Wind, ARC GIS Explorer, ERDAS TITAN, WikiMapia, OpenStreetMap are worth mentioning.

KEY WORDS: *ARC GIS, ERDAS, Geospatial, OGC, GRASS, ILWIS*

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I. Introduction

Open source doesn't only mean sharing source code but also **dissemination** and distribution for the betterment of the society and software itself. The open source efforts in quality, reliability, flexibility and free from dependency on proprietary software. Proprietary software are **(is)**sometimes made available to users free of charge. This software is called Free ware and the term cannot be used loosely or interchangeably with open source software. In a nutshell, the features of Free ware are as follows.

- Free ware is not unlicensed software
- Free ware licenses protect the rights of developers and users
- Proprietary licenses protect the ownership and restrict user rights

The discussions and deliberations created an opportunity to educate and **emphasize the superiority** of an open development process. It is like engaging the potential software developers to create and improve the source code by continuous participation and contribution. The organization Open Source Initiative shouldered the responsibilities for the growth and development of opens source software since 1999. It specifies **the open** source definition and enlists OSI-approved licenses. The **concept assumed new dimensions such as** creating the open standards requirements for software, building sustainable institution to represent the open-source community, etc. And by 2005 it became truly international organization and further deepened its ties with membership program and elected directors with Keyhole Logo which combines with "O" meaning open and a keyhole for unlocking the source code.

The distribution of the software doesn't merely provides the access but it is in compliance with the following concepts.

a. Redistribution

The software program doesn't restrict any party or user to use and share in the name of license or version of a part or an aggregate software containing programs from several sources. The usage or activation of the software doesn't require any payment or royalty during any part of the functional requirements. There is no risk of withdrawal at any point of time or stage of usage of the software. No license fee is involved during any stage of the implementation of the code.

b. Source Code

The software must include source code and its distribution both in source and compiled form. If a product is not distributed with source code, then it is available to the public via the Internet without charge. The programmer **can** manipulate the source code to ones preferred form.

c. Modifications

The product must allow changes and also allow them to be distributed under the same terms as the license norms of the original software.

d. Equality

The program must not discriminate the users or user groups. It should allow to make use in any specific field of endeavor viz, business or research. All the users who use the program through distribution are entitled to same rights and no additional mandate is required under any circumstances.

e. Independent

The open source software shall not encourage the utility of other licensed program during any part the application. For example, the licenses of all other programs distributed as a package must be open-source software.

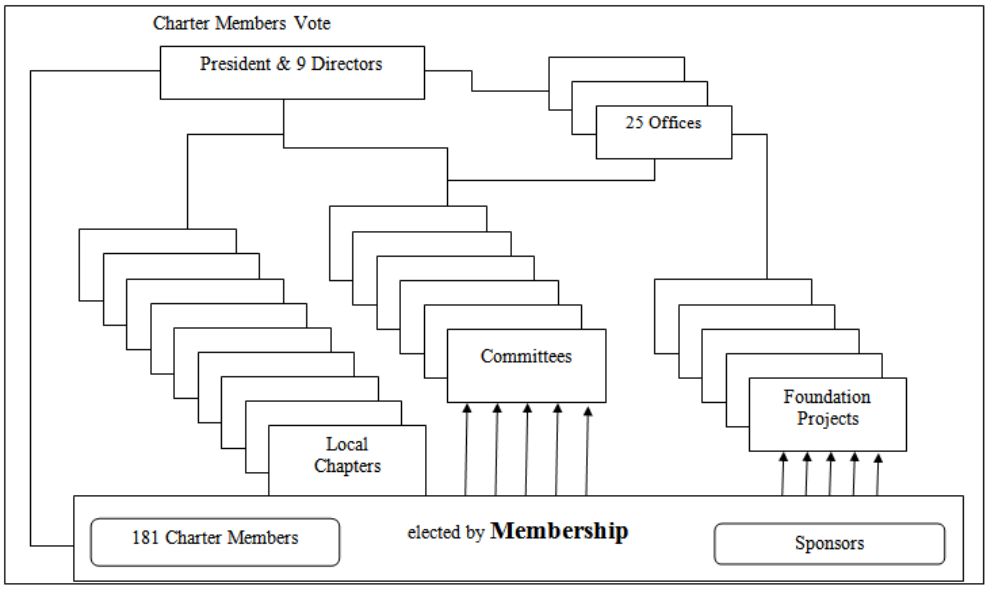
For a non-developer the open source software is, **free of cost, user –friendly and hassle-free**. No restrictions as discussed earlier are imposed either for use or for sharing among the peer group. The burden or responsibility in the use of open source is shifted to the user as there is no automatic commercial support unlike commercial software. No guarantee / warranty or legal protection for the use of open software in the user business is assured.

II. Description

a. Open Geospatial Consortium

In consonance with the developments of Open Source Initiative (OSI),Open Geospatial Consortium (OGC) became a major force to reckon with, in the Geospatial world. It is a non-profitable, international, voluntary consensus standards organization that is leading the development of standards for geospatial and location based services. The consortium today comprises 381companies, governments and universities striving to develop the specifications. These Specifications support interoperable solutions that "geo-enable" the Web, wireless and location-based services and are intended to empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications. The OSGeo Foundation is again a non-profit organization which works in mission mode to support and promote highest quality open source geospatial software. It provides financial, organizational and legal support to the open source geospatial community.

OSGeo's Structure



Source OSGeo

b. The License Proliferation

During initial days of Open Source movement, there were limited projects with fewer licenses that met the criteria Viz, the GNU General Public License, the BSD license (old and new varieties), the MIT license, the Mozilla Public License, and a few others. Later to expand the breadth and depth of Open Source software, OSI encouraged companies, projects, and individuals writing software to consider using an Open Source license. The license must be **genuine and authentic**, must be clearly written, simple, and understandable and reusable.The "open standard" must satisfy that there are no **hidden**secrets, freely available to public and should be royalty-freefor unrestricted use without agreement. The implementation must not require any other technology or software in part or in total for completion of the project.

Precisely, these open source licenses are the result of contribution made by communities with development and service utility of the software to the user community. The product of this community liberates users from the pain of upgrade cycles and continuing license permissions without straining the purse. It is up to the users to continue with commercial software or use open source software. **It is ambiguous to decide upon the utility**for either commercial or open source software models owing to their contemporary relevance.

c. Open Source GIS Software availability

Quantum GIS or commonly known as QGIS is a user friendly Open Source Geographic Information System (GIS) licensed under the GNU General Public License. QGIS is the most successful and an official project of the Open Source Geospatial Foundation (OSGeo). It runs on Linux, Unix, Mac OSX, and Windowsand supports numerous vector, raster, and database formats and functionalities. QGIS provides a continuously growing number of capabilities provided by core functions and Plugins. One can visualize, manage, edit, analyze data and compose printable maps. Quantum GIS is a volunteer driven project. It welcomes contributions from volunteers in the form of code contributions, bug fixes, bug reports, contributed documentation, advocacy and supporting other users on mailing lists and the QGIS Forum. If one is interested in actively supporting the project, one can find more information under the development menu and on the QGIS Wiki.

GRASS (Geographic Resources Analysis Support System) is also open source geographical information system (GIS) software developed by GRASS development team. It **was developed in 1982 and released under the GNU General Public License (GPL) and it** can be used on multiple platforms, including Mac OS X, Microsoft Windows. **GRASS GIS**is capable of handling raster, topological vector, image processing, and graphic data.

uDig 1.1.0 is also a user-friendly Desktop Internet GIS open sources software. This software is available using the GNU Lesser General Public License (LGPL). This product includes software developed by the Eclipse Foundation, Geotools and the Apache Software Foundation. For more details one can visit http://udig.refractions.net

gvSIG is open source GIS software known for having a user-friendly interface. It can access the most common formatsboth vector and raster ones. It features a wide range of tools for working with geographic-like

information (query tools, layout creation, geoprocessing, networks, etc.), which turns gvSIGinto the ideal tool for users working in the geography realm. Its interface is translated into more than ten languages and it is platform independent.It runs on MicrosoftWindows, GNU/Linux and Mac. OSgvSIGis an official project of the Open Source Geospatial Foundation (OSGeo) available for download at http://www.gvsig.org/web/catalog.

MapWindowproject includes a free and open source desktop geographic information system (GIS). It has the extensible plugin architecture, a GIS ActiveX control and C# GIS programerslibrary called DotSpatial.MapWindowis "Programmable Geographic Information System" that supports manipulation, analysis, and viewing of geospatial data and associated attribute data in several standard GIS data formats. MapWindowis a mapping tool, a GIS modeling system, and a GIS Application Programming Interface (API) all in one convenient redistributable open source form.MAPWINDOW is an official project of Idaho State University, US.

ILWIS , an Integrated Land and Water Information Systemwas initially developed and distributed by ITC Enschede (International Institute for Geo-Information Science and Earth Observation) in the Netherlands for use by its researchers and students. But since 1st July 2007 it has been distributed under the terms of the GNU General Public License and is thus open source software. The current version of ILWIS 3.5 Open is available for download through World Institute of Conservation and Environment (WICE). It is Microsoft Windows operating system dependent and runs on windows 98 and higher.

OpenEVis an open source application for viewing and analysingraster and vector geospatial data in 2D and 3D. More information, and source code can be found at http://openev.sourceforge.net/.

GISDatabase: PostgreSQL/PostGISis spatially enabled DBMS. To be able to perform spatial operations PostgreSQL can be extended with geographic data types and functions **which are implemented** in the language extension PostGIS. This is a piece of software that has a specifically geographic focus. The downloads and support is available at http://www.postgresql.org/ and http://post gis.refractions.net/.

d. Open Source Geosspatial database availability

Internet based Geospatial database covering whole Earth is presently freely available in the following web pages

i. Google Earth - http://earth.google.com/download-earth.html
ii. Microsoft Virtual Earth - http://maps.live.com, download Virtual Earth 3D(Beta)
iii. NASA World Wind - http://worldwind.arc.nasa.gov/download.html
iv. ARC GIS Explorer - www.esri.com/software/arcgis/explorer/index.html
v. ERDAS TITAN - www.erdas.com/Products/ERDASProductInformation/tabid/84/currentid/1061/default.aspx
vi. WikiMapia - http://www.wikimapia.org/
vii. OpenStreetMap - http://www.openstreetmap.org/

e. Open Geospatial data availability for Learning, Research and Development

1. Elevation data

a. SRTM 90 meter grid with 16 meter vertical accuracy

SRTM (SHUTTLE RADAR TOPOGRAPHIC MISSION) data Projection/Datum is in Geographic Coordinate System/ WGS84, the data is available up to 60 degrees north and south in 5 deg x 5 deg tiles . The 90m spatial resolution Digital Elevation Data for the entire world (for over 80% of the globe) with vertical error reported to be less than 16m. is available.This data is provided with an objective to promote the use of geospatial science and applications for sustainable development and resource conservation in the developing world. The data currently being distributed by NASA/USGS (finished product) contains "no-data" holes where water or heavy shadow prevented the quantification of elevation. **They**are generally small holes, which nevertheless render the data less useful, especially in fields of hydrological modeling.

b. Aster 30 meter grid data with 20 meter vertical accuracy

ASTER (Advanced Space Borne Thermal Emission and Reflection Radiometer)is a cooperative effort between NASA and Japan's Ministry of Economy Trade and Industry (METI), with the collaboration of scientific and industry organizations in both countries. It is in GeoTIFF format with geographic lat/long coordinates and a 1 arc-second (30 m) grid of elevation postings and WGS84/EGM96 geoid. The data covers 83°N and 83°S and is composed of 22,600 1°-by-1°tiles.

c. Bhuvan30 Meter grid data with 8 meter vertical accuracy

NRSC Open EO Data Archive (NOEDA) is available through Cartosat-1 DEM 30 meter grid data in bhuvan-noeda.nrsc.gov.in/download/download.php. User registration is required and the interested area can be selected by interactive selection of the tiles. Only 10 tiles can be downloaded in a day rest can be saved in the

backlog for future download. Selection of check box is necessary to save in backlog. All the files are downloaded in Zip format and to be unzipped after download.

NRSC/ISRO Bhuvan as GeoServer provides open data and product archive to browse and download data that is orthorectified and georeferenced from the IMS-1: Hyperspectral Imager, Ocensat -2: OCM and Scatterometer, Resourcesat-1: LISS III and AWiFS.

Bhuvan also provides various thematic services in the form of Web Map Service and Web Feature Service. Bhoosampada through www.applications.nrsc.gov.in is available to view in 1:1M without user registration and with registration to view in 1:250000. Digital Database of Land Use Land Cover at 1:250000 scale using multi-temporal Advanced Wide Field Sensor (AWiFS) datasets to provide on annual basis net sown area for different cropping seasons is available for download (Clip & Ship through FTP) under Bhuvan-Thematic Services.

2. Multispectral Data

Orthorectified LANDSAT Multispectral Data : The orthorectified dataset was produced by the EarthSat Corporation under contract with NASA. Three types of products are available

a. ETM+ (ENHANCED THEMATIC MAPPER PLUS)

The Spectral Bands are 3 Visible, 1 NIR, 2 SWIR, 1 Panchromatic and 2 Thermal IR with Range -0.45 -12.5 µm. The temporal resolution is 16 days. The Image Size: 183 km X 170 km with Swath: 183 km in Projection/Datum:UTM / WGS84. The Pixel size (Meters):14.25(PAN), 28.5(REF) and 57 (THM) with absolute Positional Accuracy:50 meters RMS.

b. TM (THEMATIC MAPPER)

The Spectral Bands are 3 Visible, 1 NIR, 2 SWIR and 1 Thermal IR in Projection/Datum:UTM / WGS84 with Pixel size of 28.5 meters. The absolute Positional Accuracy is 50 meters RMS. The data are spatially and spectrally unenhanced.

c. MSS (MULITSPECTRAL SCANNER)

The Spectral Bands are 2 visible and 2 NIR in Projection/Datum:UTM / WGS84 with Pixel size of 57.0 meters and absolute Positional Accuracy is 100 meters RMS. The data are spatially and spectrally unenhanced.

III. Conclusions

The open source software **gradually** picked up the pace in utility and now increased multifold with the efforts and contributions made by the Open Source Initiative (OSI). Open Geospatial Consortium (OGC) made its strides in the Geospatial World leading the development of standards for geospatial and location based services.The efforts of the consortium didn't go unrecognized and therefore several organizations and governments are now part and parcel of the open source movement. The open source GIS Software made available to the public are Quantum GIS, GRASS (Geographic Resources Analysis Support System), uDig, gvSIG, MapWindow, ILWIS (Integrated Land and Water Information System), OpenEV and PostgreSQL/PostGIS for Spatial Data Base. Open Geospatial data availability for Learning, Research and Developmentcovering whole Earth is presently freely available in Google Earth, Microsoft Virtual Earth, NASA World Wind, ARC GIS Explorer, ERDAS TITAN, WikiMapia and OpenStreetMap.

It is thus suggested and encouraged among the student and research fraternity liberally to explore and use GIS Software and Geospatial database for quick results. The scope is unlimited in the utility of the application and development through open source software in general and geospatial world in particular.

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