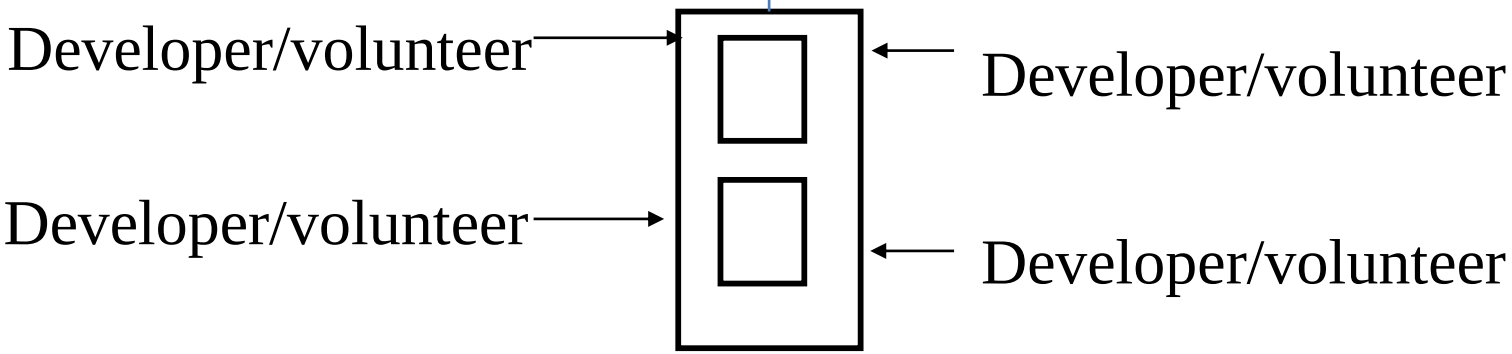
Introduction to open source – Grass, Fragstats

Dr. Bharath H Aithal
Centre for Sustainable Technology
Indian Institute of Science

Open Source?

Project lead



Open Source is a iterative development model & promotes free redistribution and access to an end product's design and implementation details

- It allows free re-distribution of the software without licensing fees to the deveoper
- It requires that source code be distributed with the software or otherwise made available for no more than the cost of distribution
- It allows anyone to modify the software or derive other software from it, and to redistribute the modified software under the same terms.

http://brie.berkeley.edu/~briewww/pubs/pubs/wp/wp140.pdf

- Open Source is a licensing distribution model
  - In many ways similar to commercial software
  - Users need to understand the restrictions and obligations

- There are many kinds of Open Source licensing models
  - GNU General Public License (“GPL”)
  - GNU Lesser General Public License (“LGPL”)
  - BSD, MIT, Apache
  - Mozilla, IBM, Apple, Sun

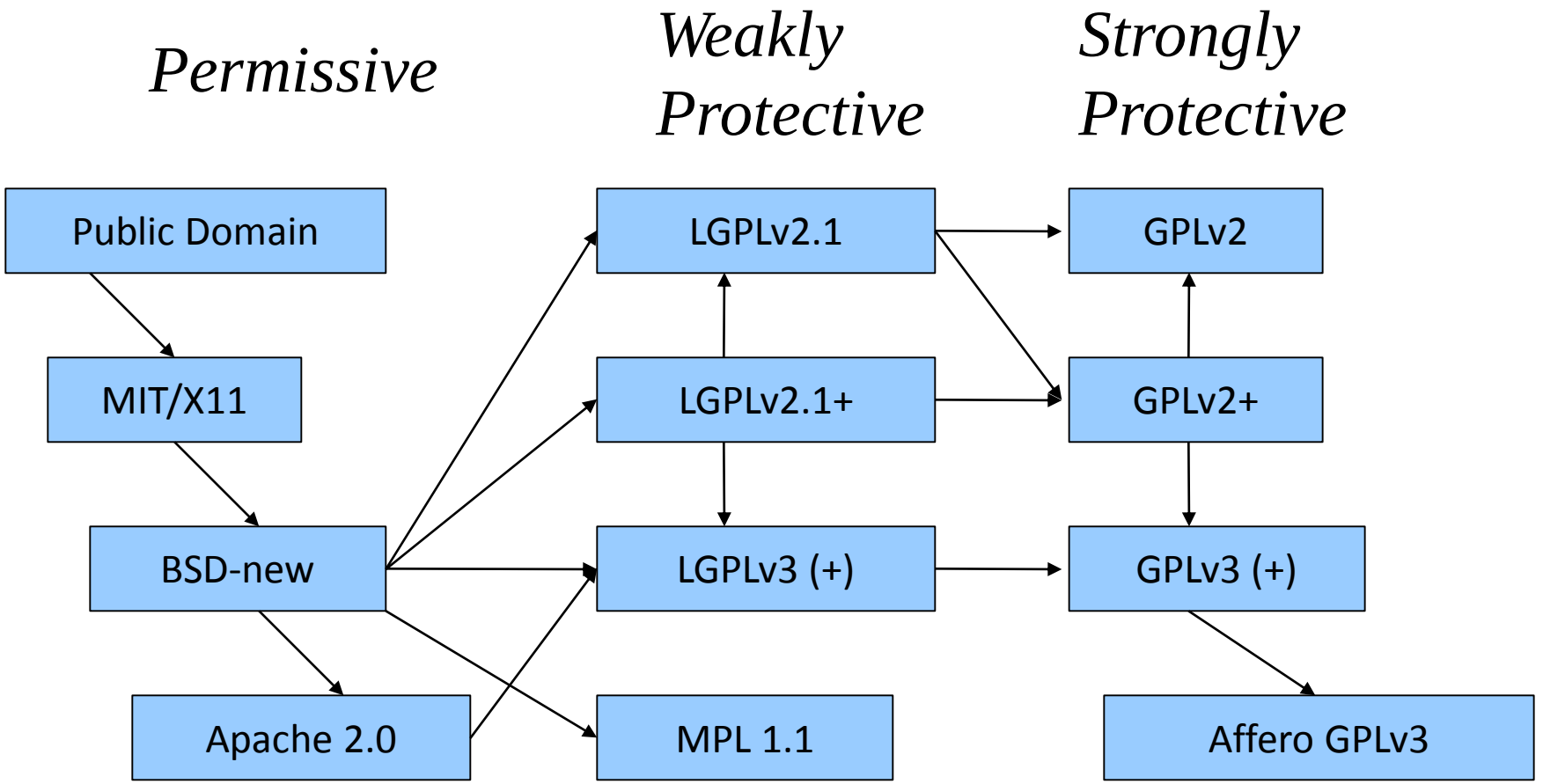
Common Open Source Models

- GNU General Public License ("GPL")
  - Grants right to copy, modify and distribute
  - Requires that source code be made available to future licensees
  - Disclaims Warranties
  - May blow-up in face of patent assertion

- GNU Lesser General Public License ("LGPL"):
  - Similar to GPL
  - Somewhat easier for licensees to combine the LGPL code with a separate program and distribute the combination under separate licenses
  - Often used with Open Source Libraries that are compiled into an application program

- BSD/MIT/Apache Style License:
  - More permissive licenses
  - Generally allow free distribution, modifying, and license change; much like public domain software
    - No future open source requirement
  - May require attribution
  - Variants may include non-standard restrictions
    - E.g., no military use – but not OSI-compliant
  - Disclaims Warranties
  - Subject to third-party patent claims

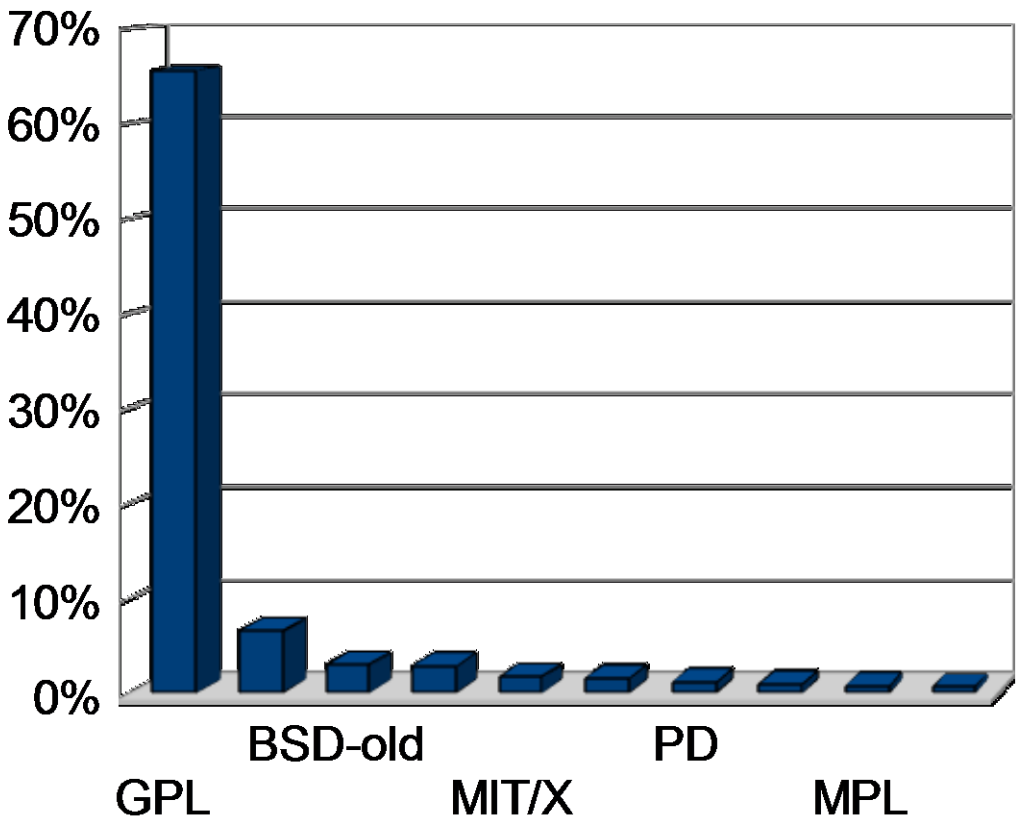
FLOSS License Slide: Determining License Compatibility



A→B means A can be merged into B

http://www.dwheeler.com/essays/floss-license-slide.html

Most Popular OSS Licenses



- Most OSS projects GPL
- GPL incompatibility (MPL, BSD-old)
- Over 3/4 OSS projects use a top 10 license
- "Do not write a new license if it is possible to use [an existing common one]... many different and incompatible licenses works to the detriment of OSS because fragments of one program can not be used in another..." - Bruce Perens

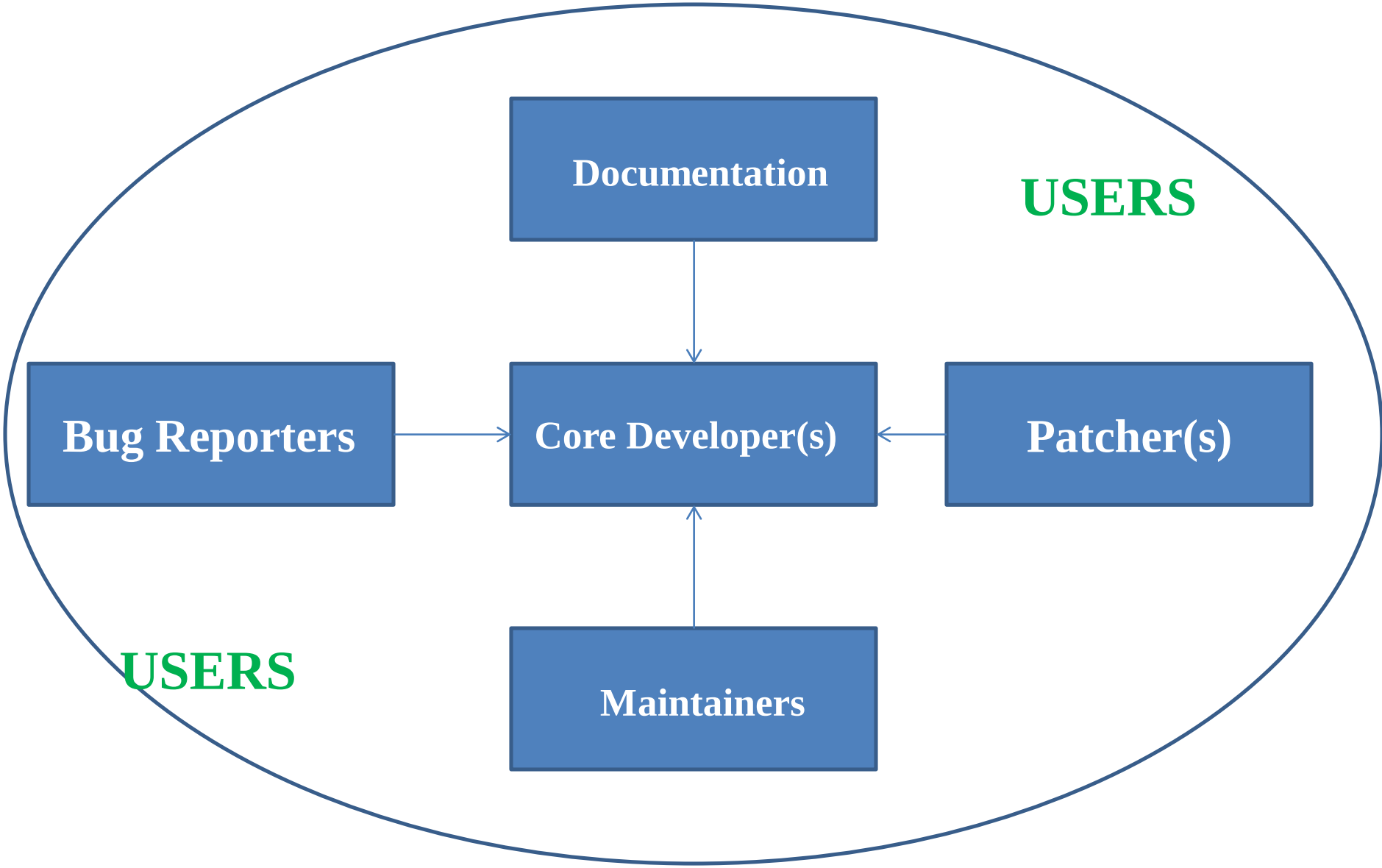
http://www.dwheeler.com/essays/gpl-compatible.html

Top ten licenses by project[Freshmeat 2010-07-31]

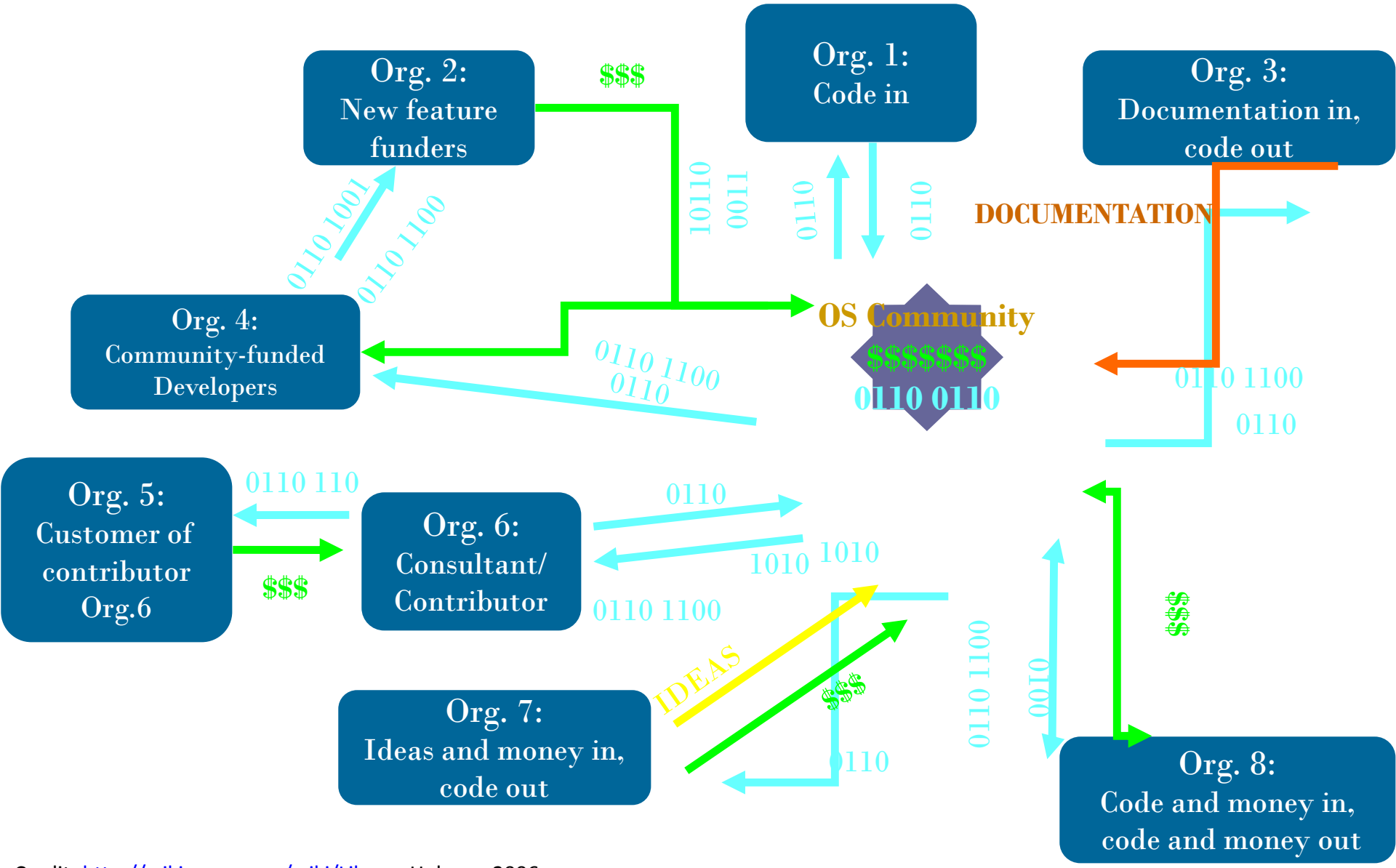
Historical leads of open source

- 1970s: UNIX operating system developed at Bell Labs later AT&T enforces intellectual property rights and “closes” the code
- 1983: Richard Stallman founds the Free Software Foundation
- 1993: Linus Torvalds releases first version of Linux
- 1997: Debian Free Software Guidelines released
- 1998: Netscape releases Navigator in source

Open source software development

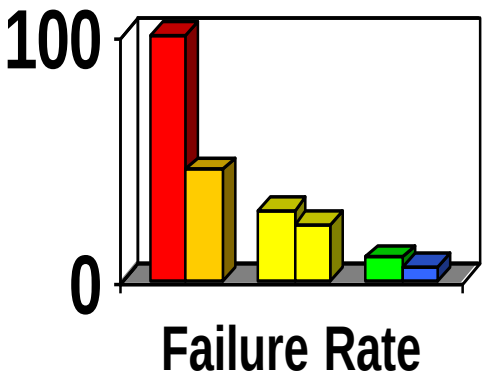


Open Source Dev. Model



Credit: http://wiki.osgeo.org/wiki/Library Holmes_2006a

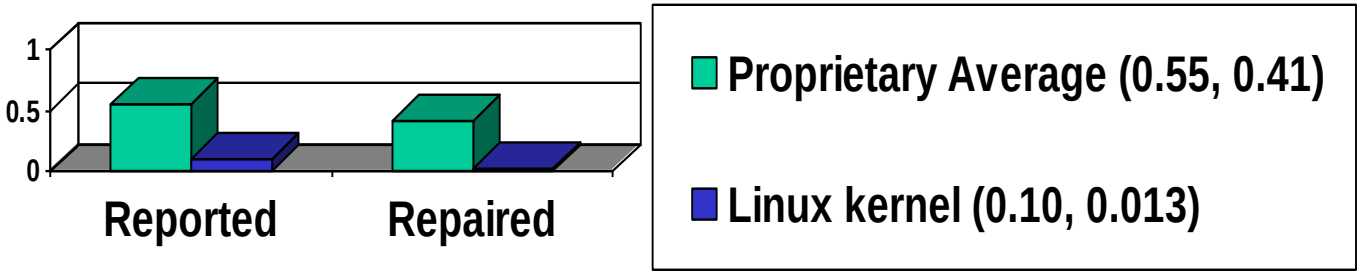
often very reliable



- **Fuzzy studies found OSS apps**

significantly more reliable [U Wisconsin]

  - **Proprietary Unix failure rate: 28%,23%**
  - **OSS: Slackware Linux 9%, GNU utilities 6%**
  - **Windows: 100%; 45% if forbid certain Win32 message formats**
- **IIS web servers >2x downtime of Apache [Syscontrol AG]**
- **Linux kernel TCP/IP had smaller defect density [Reasoning]**



[http://www.dwheeler.com/oss_fs_why.html]

Recent advances in the world

- Indian govt (CDAC, NCST) release Linux in 5 languages
- Red Hat revenues up 36% last quarter; profitable
- Sun releases Java Desktop System
- Virus fear could hurt Windows (WSJ headline)
- China, Korea, Japan working on open-source Asian OS
- Brazil recommends Linux in government
- Munich shifts 14,000 desktops to Linux
- Nutch: an open-source search engine under development
- Lindows PCs for USD 169-199
- Indian govt. shifts webside to Linux

Top corporate open source developer(s)

- Sun
  - uses Linux; supports some open source development efforts
  - Forte IDE for Java and the Mozilla web browser
- Apple
  - released core layers of Mac OS X Server as an open source BSD operating system called Darwin; open sourcing the QuickTime Streaming Server and the OpenPlay network gaming toolkit
- IBM
  - uses and develops Apache and Linux; created Secure Mailer and created other software on AlphaWorks

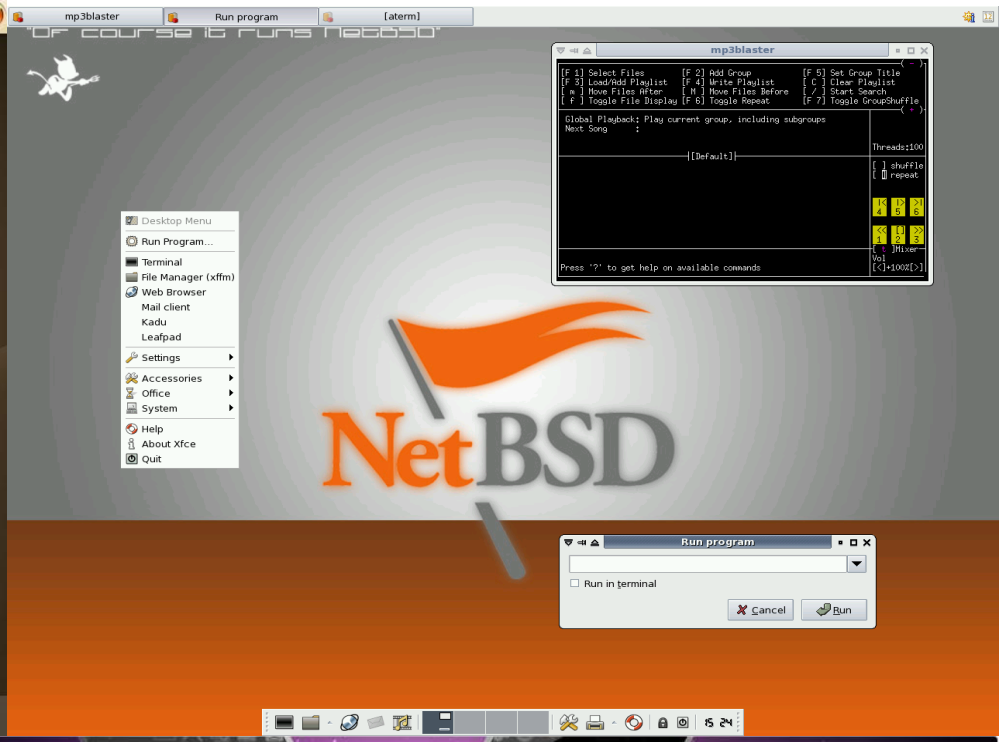
- Red Hat Software, Fedora, Ubuntu, SUSE, Linux Mint, Debian
  - Linux vendor

- ActiveState
  - develops and sells professional tools for Perl, Python, and Tcl/tk developers.

Examples

- Operating Systems
  - Linux(Redhat, Fedora, Ubuntu, Suse, Linux Mint etc.,)
  - FreeBSD, OpenBSD, and NetBSD: The BSDs are all based on the Berkeley Systems Distribution of Unix, developed at the University of California, Berkeley.
  - Another BSD based open source project is Darwin, which is the base of Apple's Mac OS X.


Applications
Places
System
Sunday April 29th, 2007 3:59pm
ubuntu
Desktop 2
Mozilla Firefox
connected to :T-mobile (wireless)
1
2
3
4


mp3blaster
Run program
[aterm]
"Of course it runs NetBSD"
Desktop Menu
Run Program...
Terminal
File Manager (xffm)
Web Browser
Mail client
Kadu
Leafpad
Settings
Accessories
Office
System
Help
About Xfce
Quit
NetBSD
Run program
Run in terminal
Cancel
Run


fedora
Copyright © 2003-2006 Red Hat, Inc. All Rights Reserved.
Nautilus


Mac OS X Snow Leopard
The world's most advanced operating system. Finely tuned.

Programming Tools

- PHP is a very popular engine behind the "live content" on the World Wide Web.
- Languages: Perl, Python, Tcl/Tk
- GNU compilers and tools: GCC, Make, Autoconf, etc.,

Open Office

Leading open-source office software suite

- for word processing
- spreadsheets
- presentations
- graphics
- databases

Other features:

Available in many languages

Stores all your data in an international open standard format

Read and write files from other office software packages (MS Office, King soft)

You can download and use it completely free of charge for any purpose.

Neo Office

Most popular open source office application for Mac OS X.

- Word Processing
- Spreadsheet
- Presentation
- Drawing
- Database

Based on the OpenOffice.org office suite, NeoOffice has integrated

dozens of native Mac features and can import, edit, and exchange files

with other popular office programs such as Microsoft Office.

OPALS

(Open-source Automated Library System)

A cooperatively developed, Web-based, open source program providing Internet access to information databases and library collections. There is no need to install software or purchase expensive computer hardware for this powerful Internet accessed system.

Open Source Software

Web Browser and Email

- Mozilla –- http://www.mozilla.com/en-US/
- Firefox and Thunderbird

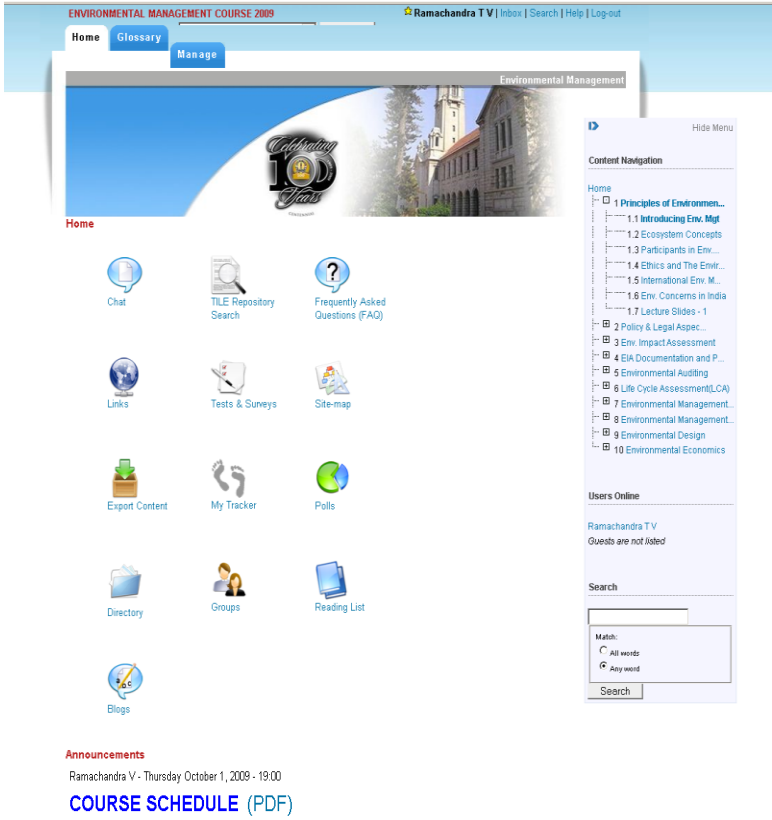
Digital Collections Management

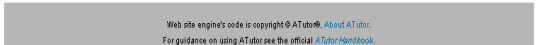
- DSpace - http://www.dspace.org/
- Greenstone - http://www.greenstone.org/

Blogs and
Content Management Systems

- WordPress - http://wordpress.org/download/
- Joomla - http://www.joomla.org/download.html
- Plone - http://plone.org/products/plone
- ModX - http://modxcms.com/
- Drupal - http://drupal.org/project/drupal
- Atutor - http://atutor.ca/

Atutor Based Internet Classroom at IISc





Course Server

Environmental Management System

Home | Forums | Glossary | File Storage | Manage

Tuesday September 18, 2007 - 11:38

Home

Hide


Forums


File Storage


Glossary


Chat


TILE Repository Search


Frequently Asked Questions (FAQ)

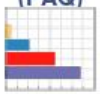

Links


Tests & Surveys


Site-map


Export Content


My Tracker


Polls


Directory


Groups


Reading List


Blogs

Announcements

Welcome To ATutor

Tuesday September 18, 2007 - 11:20 This is a welcome announcement. You can access additional help by using the Help link available throughout ATutor.

Content Navigation

Home
1 Welcome To ATutor

Related Topics

None Found.

Users Online

Uttam Kumar

Guests are not listed

Glossary

N/A

Search

Match:
All words

Course Server

Environmental Management System

Home | Forums | Glossary | File Storage | **Manage**

Tuesday September 18, 2007 - 11:38

Manage

Hide

- **Announcements** : Add Announcement
- **Assignments** : Add Assignment
- **Backups** : Create Upload
- **Chat** : Start/Stop Transcript
- **Content** : Create Content Import/Export Content TILE Repository Search Content Usage
- **Course Email**
- **Enrollment** : Export Course List Import Course List Create Course List
- **File Manager** : Create New File
- **Forums** : Create Forum
- **Frequently Asked Questions (FAQ)** : Add Topic Add Question
- **Glossary** : Add Glossary Term
- **Groups** : Create Groups
- **Polls** : Add Poll

Content Navigation

Home
1 Welcome To ATutor

Related Topics

None Found.

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Uttam Kumar

Guests are not listed

Glossary

N/A

Search

Match:
All words
Any word

Content : Create Content Import/Export Content TILE Repository Search Content Usage

Course Email

Enrollment : Export Course List Import Course List Create Course List

File Manager : Create New File

Forums : Create Forum

Frequently Asked Questions (FAQ) : Add Topic Add Question

Glossary : Add Glossary Term

Groups : Create Groups

Polls : Add Poll

Properties : Delete Course Authenticated Access

Reading List : Resources

Statistics

Student Tools : Side Menu

Tests & Surveys : Create Test/Survey Question Database Question Categories

Users Online

Uttam Kumar

Guests are not listed

Glossary

N/A

Search

Match:
All words
Any word
Search

Polls

None Found.

Forum Posts

None Found.

Go to Top

Welcome to Free & Open Source Software (FOSS) at CES, IISc, Bangalore, India

- Home
- GRASS Mirror site in India
- GRDSS
- Geovisualisation
- What is FOSS ?
- FAQs
- Scripting Language
- Open Web Server
- Open Source Database
- Open Content Management System
- Open Source Libraries
- Statistical Softwares
- GIS Softwares
- Useful Softwares
- List of Free Software
- Free Operating Systems
- Linux Command Help
- FOSS by OSGeo-India
- FOSS Foundation
- FOSS Group
- Contact Us
- Energy Research Group
- Centre for Ecological Sciences
- Indian Institute of Science
- Search

Home

E-mail

Geographic Resources Analysis Support System

Geographic Resources Decision Support System

GEOVISUALISATION OF CHERUVANNUR VILLAGE PANCHAYAT, KOZHIKODE, KERALA, INDIA

NEW

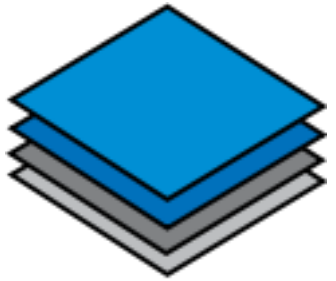
Good Morning! The time is 11:27 am (IST). Saturday, 18 September, 2010.

Best viewed under Browsers: Firefox 2.0+, IE 7 at 800 x 600 and above.

Web designed by Uttam, Energy Research Group, CES, IISc.

FOSS4G:
Free and Open Source Software for Geospatial

OSGEO:
The Open Source Geospatial Foundation



All of the products we'll talk about today are both free and open-source

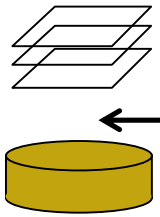
Example Desktop System

Portability, interoperability

Geostatistics
Predictive modeling

View
Interact
Teach

External data



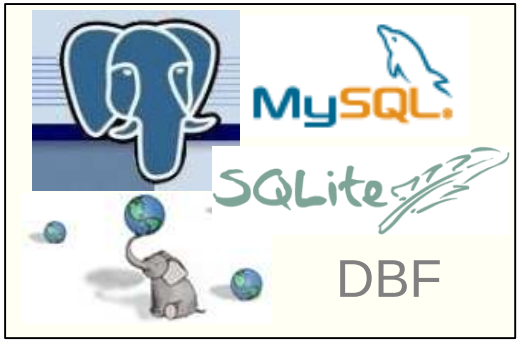
raster

vector

GRASS

Spatial
Analysis
Modeling

Database engine: Tables, attributes



Visualize

OSSIM

Open Source Software Image Map

C++ software library that provides advanced remote sensing, image processing, and geo-spatial
functionality

Includes orthorectification, precision terrain correction, rigorous sensor models, very large mosaics, and cross sensor fusions, a wide range of map projections and datums, and a large range of commercial and government data formats

OSSIM Planet - an accurate 3D global geo-spatial viewer that is built on top of OSSIM

GDAL, OGR

GDAL is a translator library for raster geospatial data formats...It also comes with a variety of useful commandline utilities for data translation and processing.

The OGR Simple Features Library is a C++ open source library (and commandline tools) providing read (and sometimes write) access to a variety of vector file formats including ESRI Shapefiles, S-57, SDTS, PostGIS, Oracle Spatial, and Mapinfo mid/mif and TAB formats.

GRASS GIS - The World Leading *Free GIS* Software, one of the world's biggest open source project, official project of the Open Source Geospatial Foundation

Welcome to GRASS GIS

You are at an official GRASS site (other mirror sites)
This site is updated daily: 11 Jan 2011

Search

Advanced search

Intro | Docs | **Download** | Community | Applications | Development | Sponsors

About GRASS

Screenshots

Download

Wiki - help site | FAQ

Mirror sites

Mailing lists | IRC

Translating

Newsletter

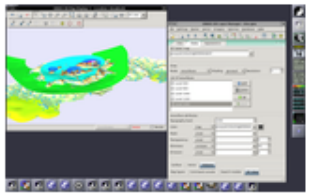
Get involved!

GRASS in the Press

Bug/Feature trackers

Donate

Celebrating 27 years!



GRASS User map (without pop-up)

Geographic Resources Analysis Support System

Commonly referred to as GRASS, this is free Geographic Information System (GIS) software used for geospatial data management and analysis, image processing, graphics/maps production, spatial modeling, and visualization. GRASS is currently used in academic and commercial settings around the world, as well as by many governmental agencies and environmental consulting companies. GRASS is an official project of the Open Source Geospatial Foundation.

Module of the day:
g.findfile Searches for GRASS data base files and sets variables for the shell.

GRASS

Geographic Resources Analysis Support System

- Geospatial data management
- Analysis
- Image processing
- Graphics/maps production
- Spatial modeling
- Visualization
- Tons of tools + functions = Very complex analysis
- Now there's a simple user interface through QGIS

Commonly referred to as GRASS, this is a Geographic Information System (GIS) used for geospatial data management and analysis, image processing, graphics/maps production, spatial modeling, and visualization. GRASS is currently used in academic and commercial settings around the world, as well as by many governmental agencies and environmental consulting companies. GRASS is an official project of the Open Source Geospatial Foundation.

http://grass.osgeo.org/

1984 developed at USArmy CERL as land management support system, evolved into general purpose GIS

1999 GPL, international team of developers

Portable: all common OS, 32/64bit, code in C

Interoperability: through GDAL

Web-based infrastructure: SVN with on-line source code browser, bug reports, users and programmers manual, wiki, IRC

GRASS – DEVELOPMENT MODEL

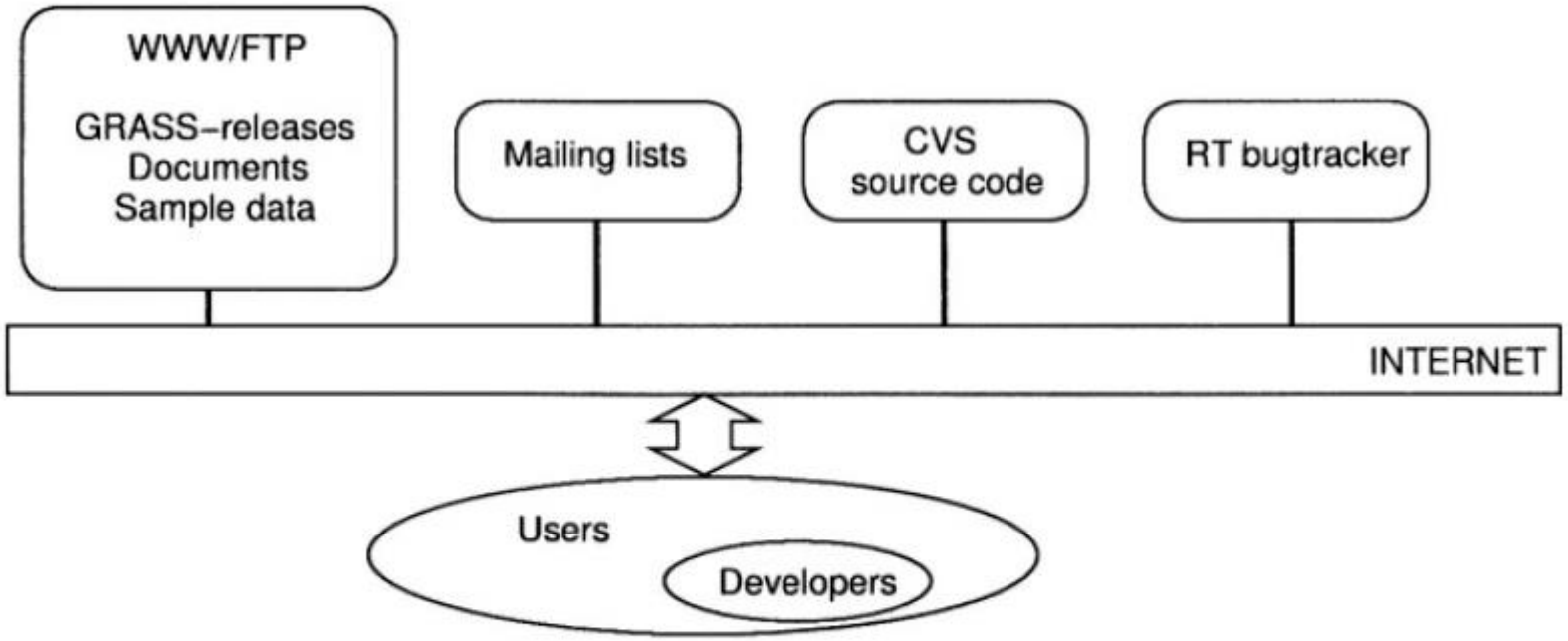
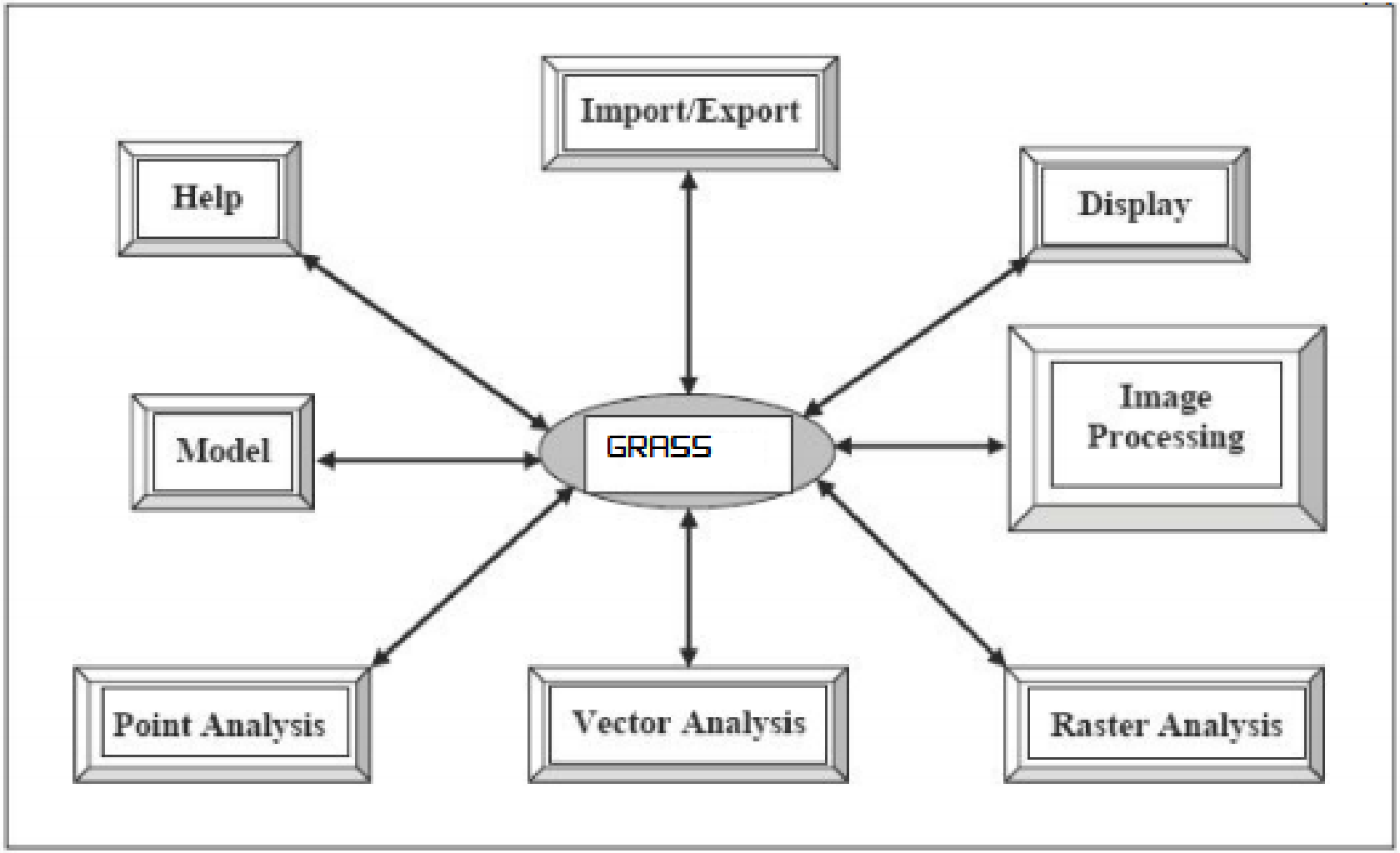
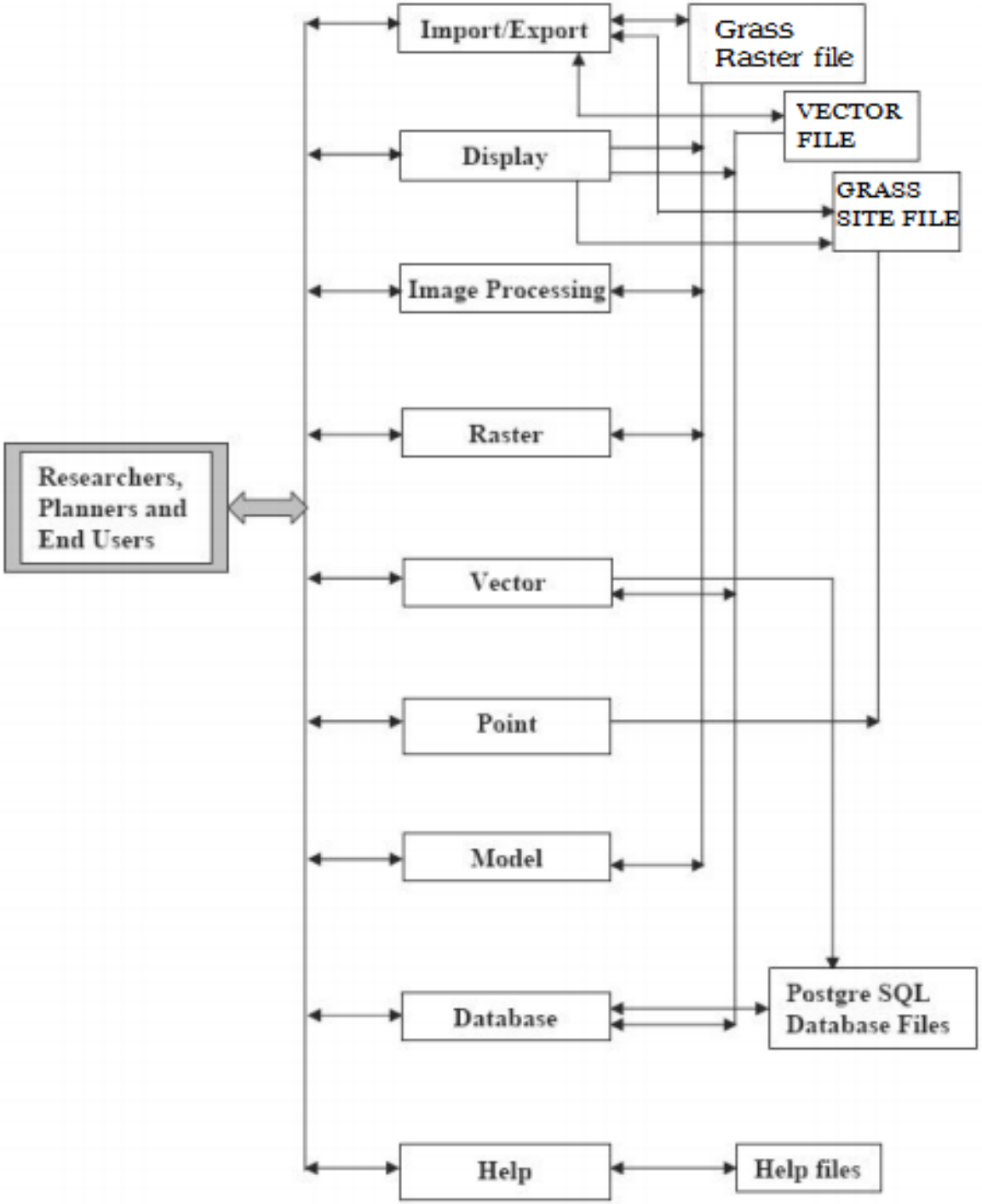


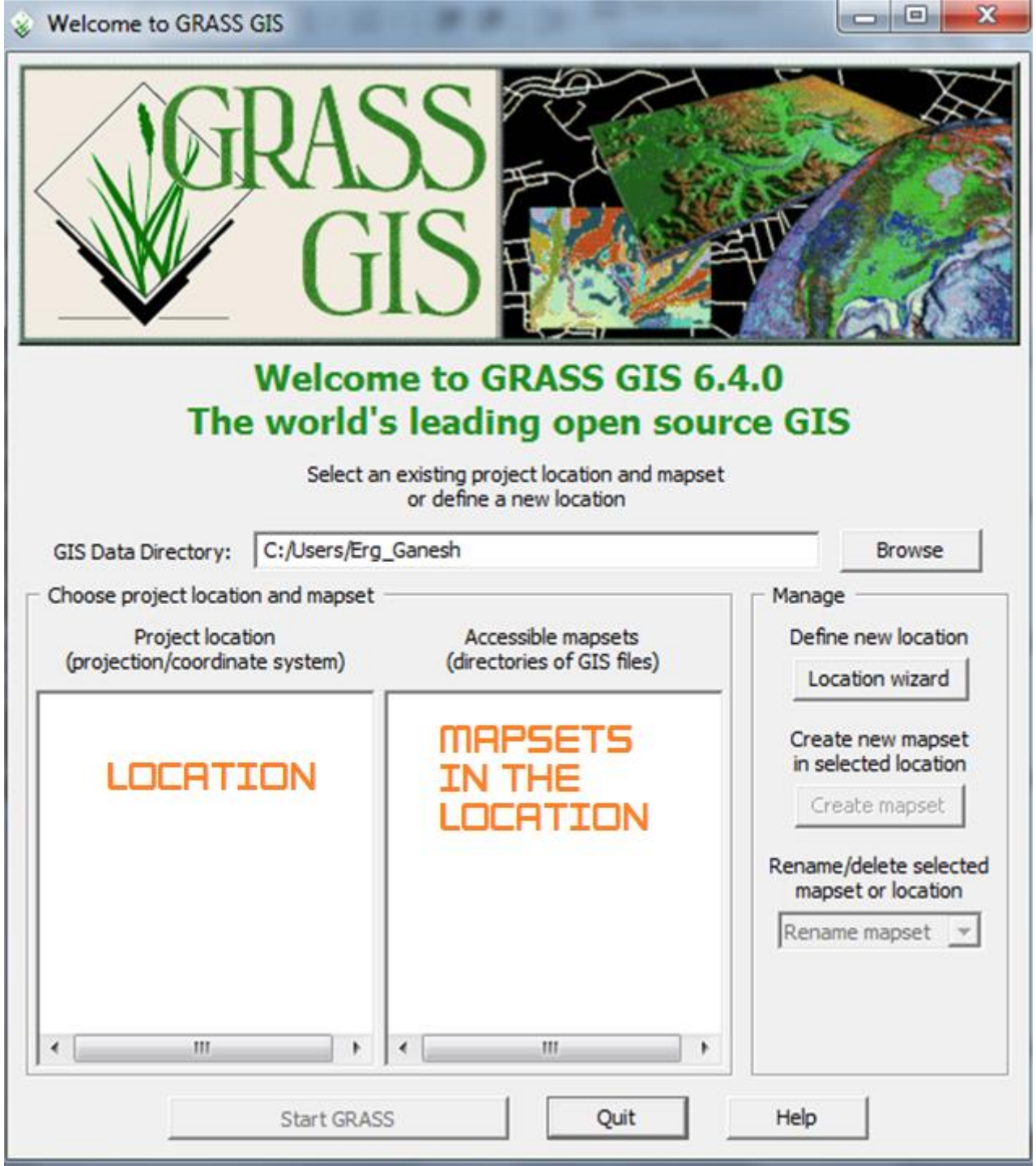
Figure 1.1. GRASS Development Model: Developers' and users' interaction with semi-automated development tools over Internet

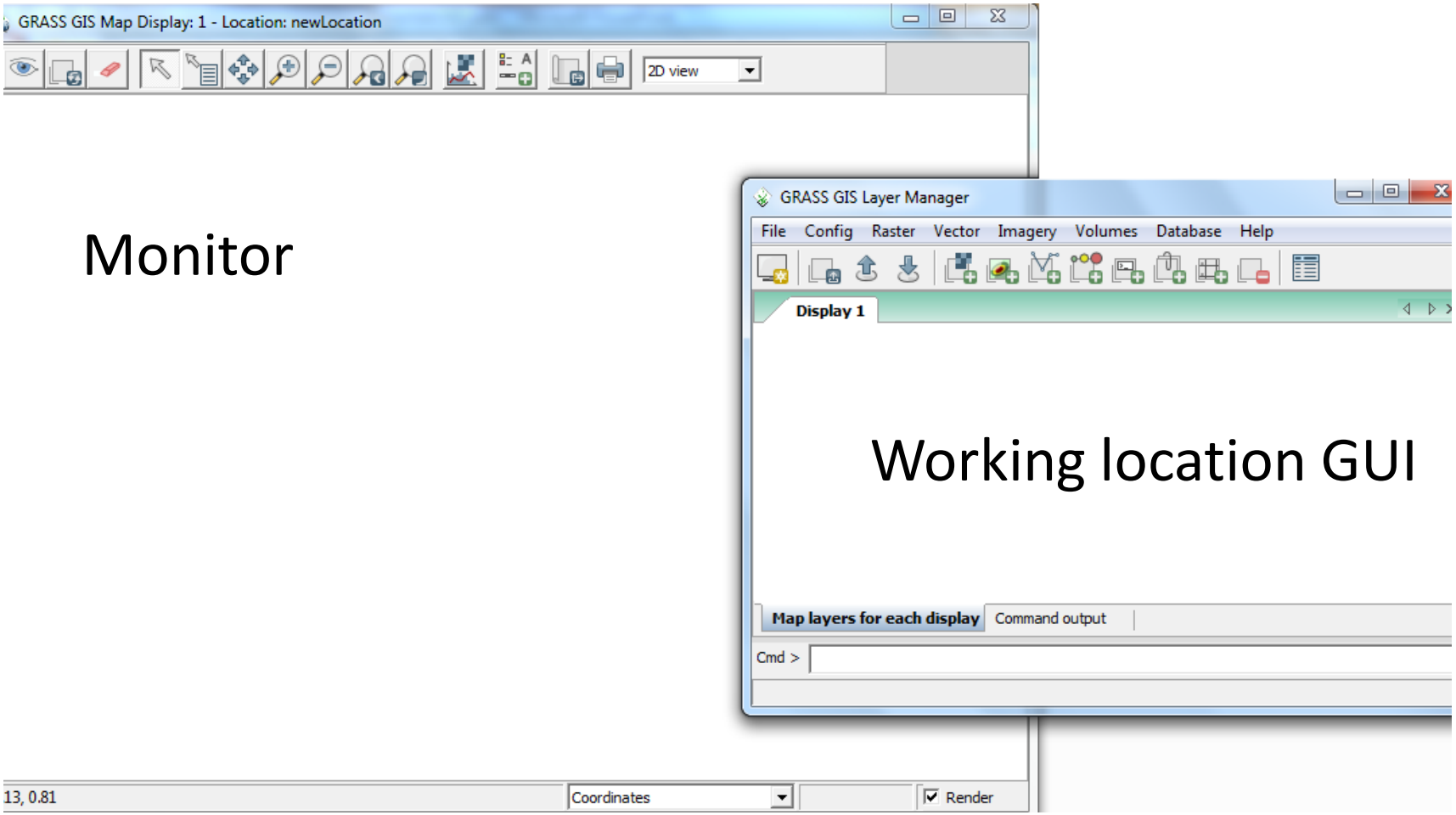

Import/Export
Help
Display
Model
GRASS
Image Processing
Point Analysis
Vector Analysis
Raster Analysis


Import/Export
Grass Raster file
VECTOR FILE
Display
GRASS SITE FILE
Image Processing
Raster
Researchers, Planners and End Users
Vector
Point
Model
Postgre SQL Database Files
Database
Help
Help files

Before u start with processing…

- Creating the location and the mapset for the data:
- Various GRASS commands are used for carrying out various operations in GRASS.
- Initially a LOCATION and MAPSET is to be created for holding the data in GRASS.
- A LOCATION is some geographic extent of interest that contains data sets that must all be in the same coordinate system.
- Every location has a PERMANENT directory which stores basic information about the whole location.
- A MAPSET is a geographical subset. Every grass session runs under a particular mapset.


Welcome to GRASS GIS
GRASS GIS
Welcome to GRASS GIS 6.4.0
The world's leading open source GIS
Select an existing project location and mapset
or define a new location
GIS Data Directory:
C:/Users/Erg_Ganesh
Browse
Choose project location and mapset
Project location
(projection/coordinate system)
Accessible mapsets
(directories of GIS files)
LOCATION
MAPSETS
IN THE
LOCATION
Manage
Define new location
Location wizard
Create new mapset
in selected location
Create mapset
Rename/delete selected
mapset or location
Rename mapset
Start GRASS
Quit
Help


GRASS GIS Map Display: 1 - Location: newLocation
2D view
Monitor
GRASS GIS Layer Manager
File Config Raster Vector Imagery Volumes Database Help
Display 1
Working location GUI
Map layers for each display
Command output
Cmd >
13, 0.81
Coordinates
Render

FRAGSTAT

Introduction

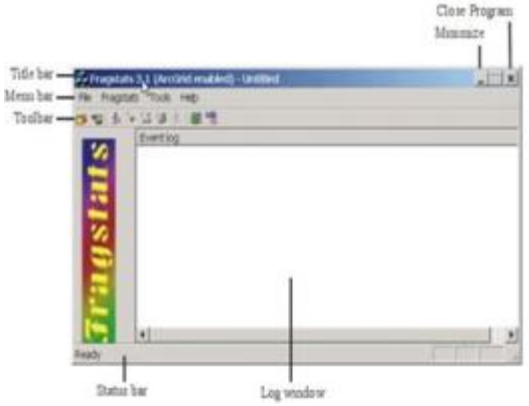
- FRAGSTATS is a spatial pattern analysis program for categorical maps.
- It simply quantifies the areal extent and spatial configuration of patches within a landscape.
- It does not limit the scale (extent or grain) of the landscape subject to analysis.
- Landscapes of extreme extent and/or resolution may result in rather cumbersome numbers and/or be subject to rounding errors.
- FRAGSTATS outputs data files in ASCII format that can be manipulated using any database management program to rescale metrics or to convert them to other units.

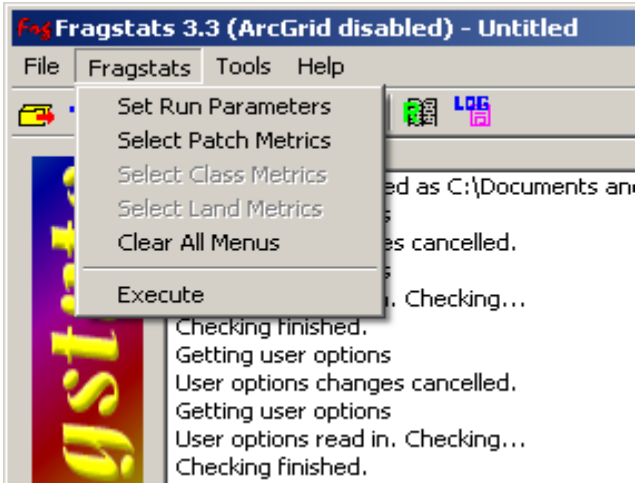
Basic steps in running FRAGSTATS

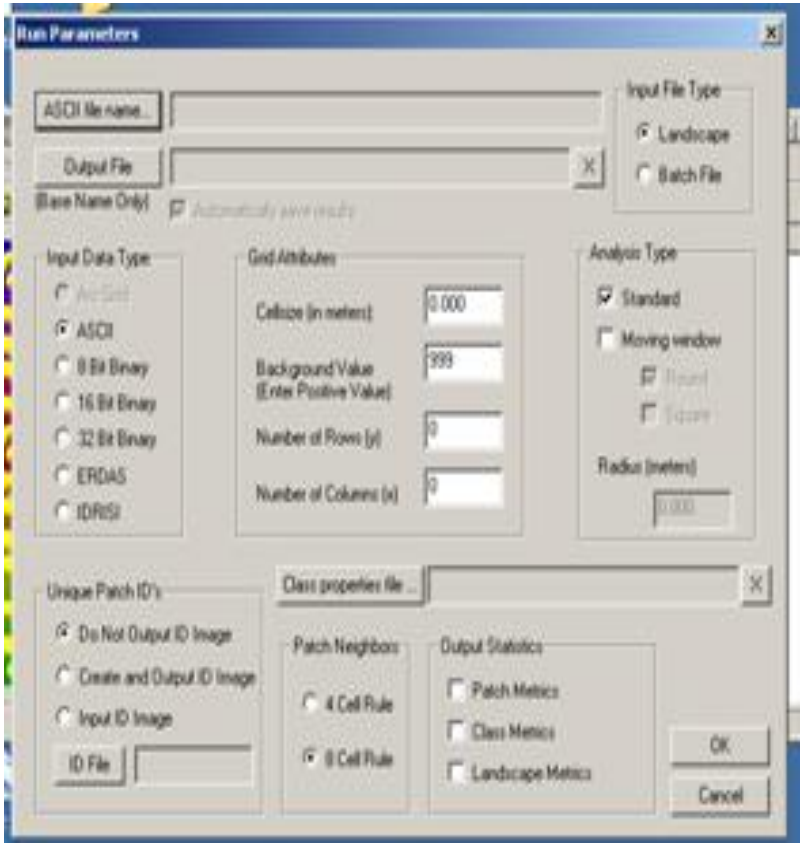
Step1.

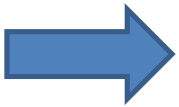
Starting the FRAGSTATS

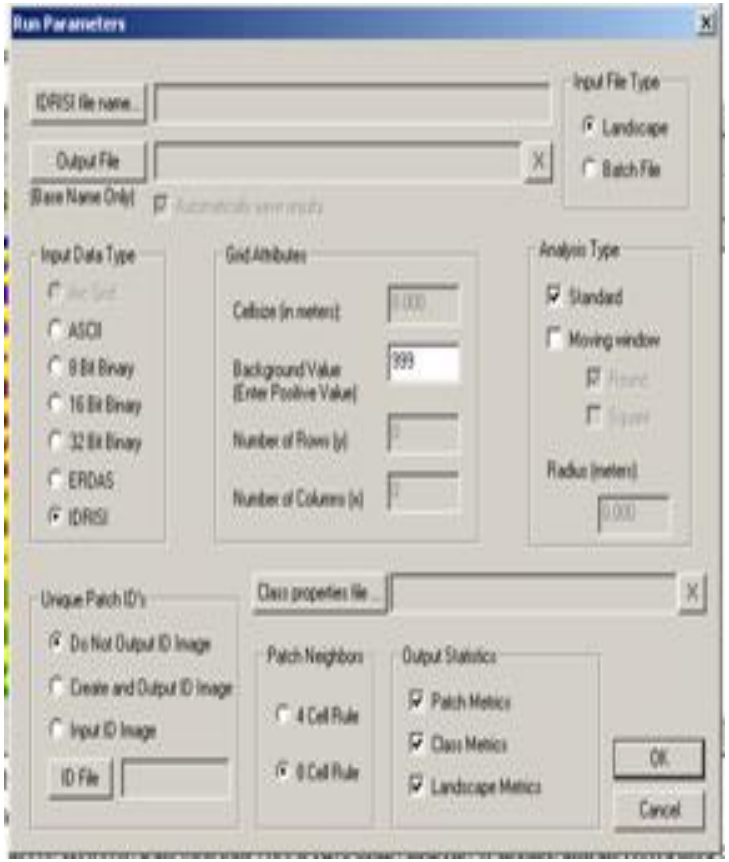
1. File Menu
    i) New
    ii) Open
    iii) Save
    iv) Exit
2. Fragstat Menu
    i) Set Run Parameters











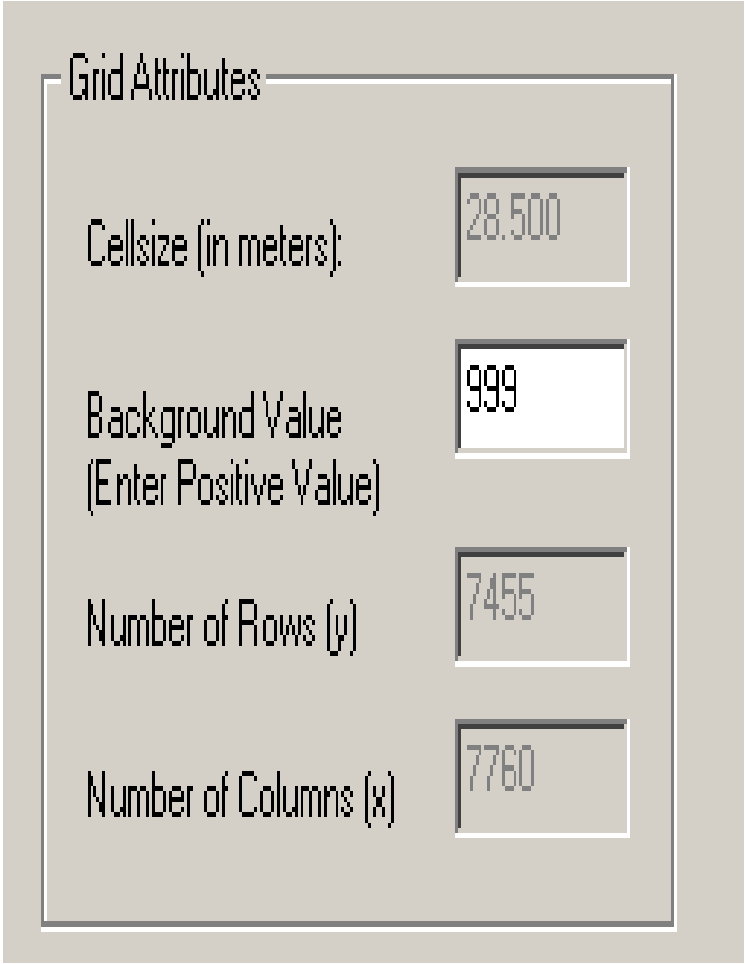
Input file type:

Landscape.--If Landscape mode is selected, then FRAGSTATS expects the designated input file to be a single raster image; FRAGSTATS will produce the conventional output for that landscape.

Batch File.--If Batch mode is selected, then FRAGSTATS will run the batch file specified in the Input File text box and produce output for all of the landscapes designated in the batch file.

Grid Attributes

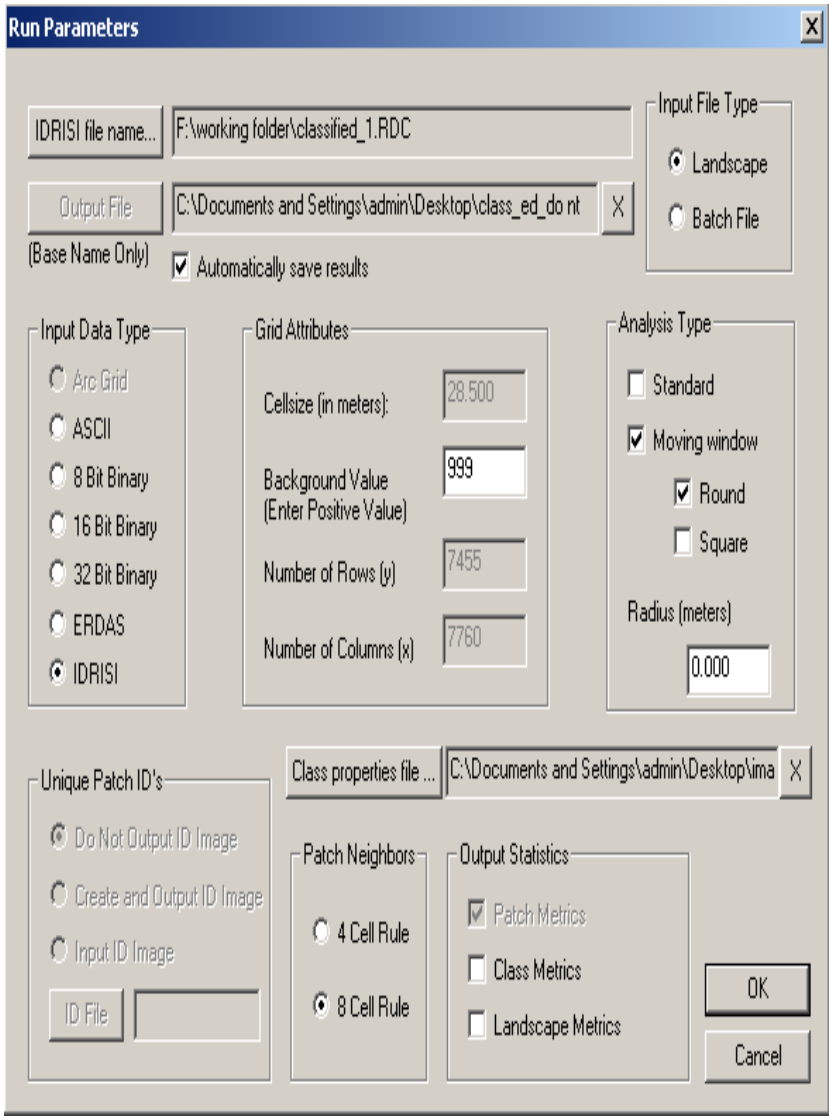
1. **Cell Size** (in meters)–Enter the size of cells in meters in the input image.
2. **Background Value**.–[Optional] Enter the value to be used for background cells. This is only required if there are cells interior or exterior to the landscape of interest that you want to treat as background
3. **Number of Rows**.–Enter the number of rows in the input image. This is only required if Input Data Type is ASCII or Binary.
4. **Number of Columns**.–Enter the number of columns in the input image. This is only required if Input Data Type is ASCII or Binary.

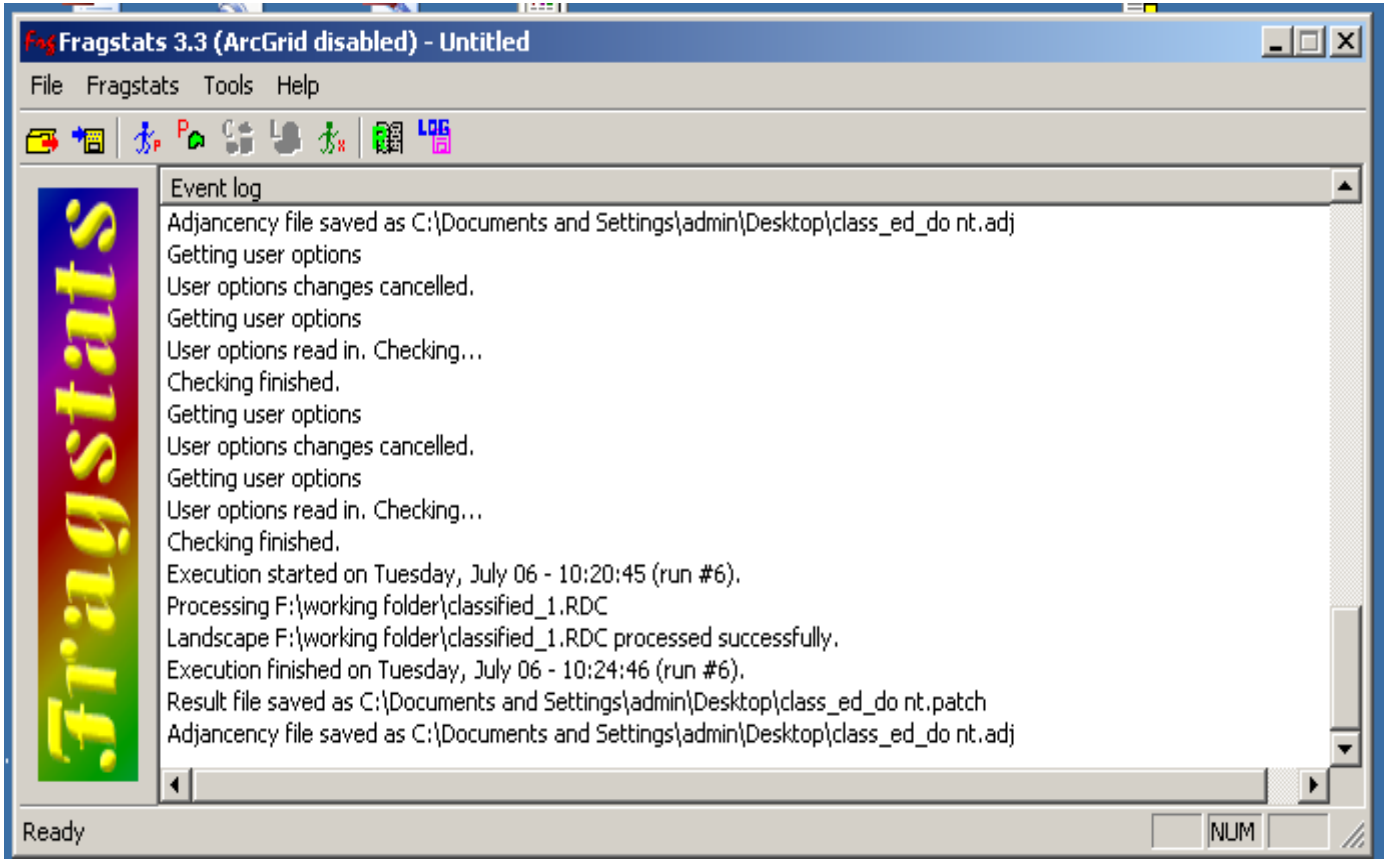


Analysis Type

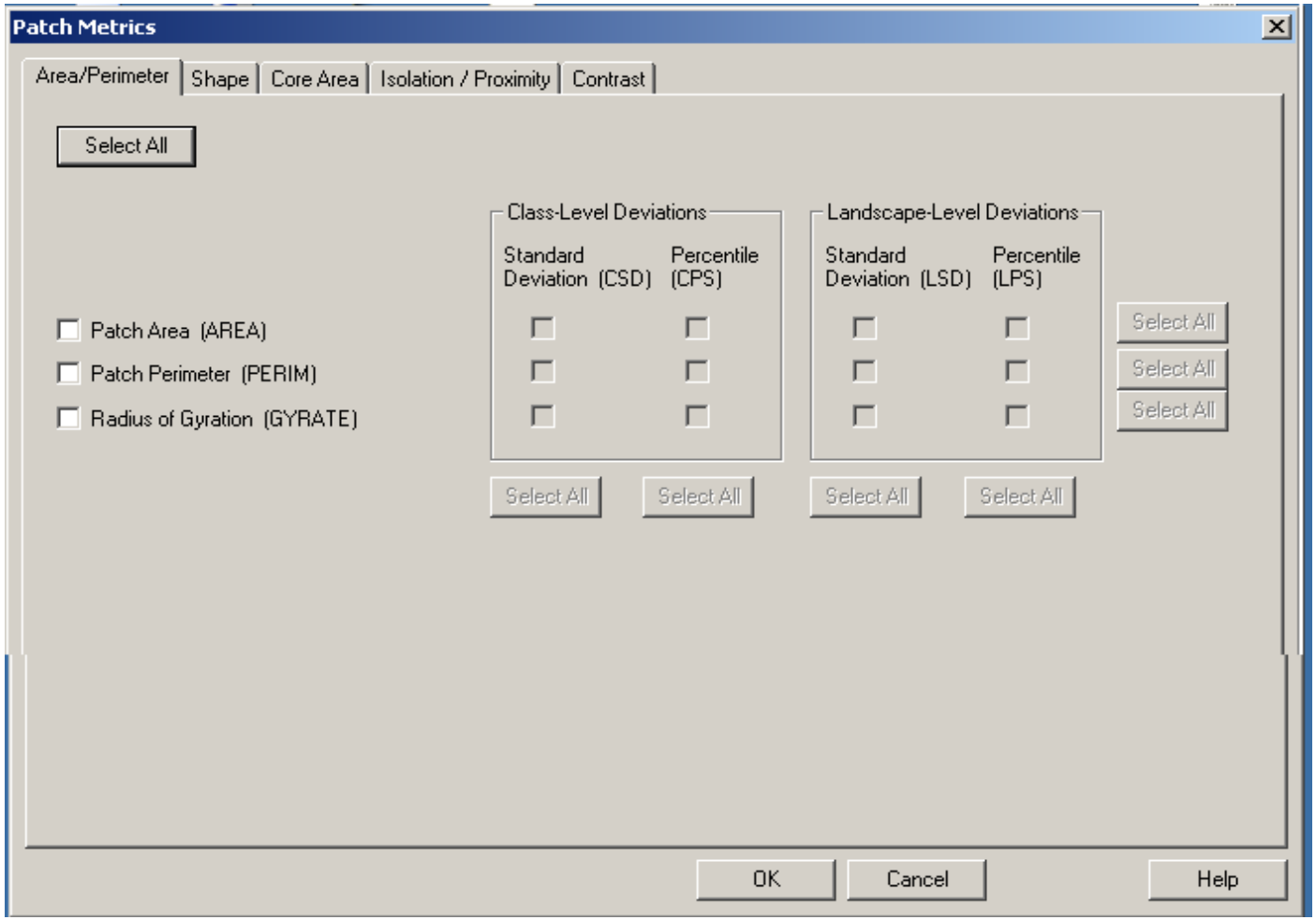
1) **Standard**.--If Standard mode is selected, then FRAGSTATS will produce the conventional output for the input landscape(s) consisting of the .patch, .class, and .land files corresponding to the patch, class, and landscape metrics.

2) **Moving Window**.-- A window of the specified shape and size is passed over every positively valued cell in the grid. However, only cells in which the entire window is contained within the landscape are evaluated




Fragstats 3.3 (ArcGrid disabled) - Untitled
File
Fragstats
Tools
Help
Event log
Adjancency file saved as C:\Documents and Settings\admin\Desktop\class_ed_do nt.adj
Getting user options
User options changes cancelled.
Getting user options
User options read in. Checking...
Checking finished.
Getting user options
User options changes cancelled.
Getting user options
User options read in. Checking...
Checking finished.
Execution started on Tuesday, July 06 - 10:20:45 (run #6).
Processing F:\working folder\classified_1.RDC
Landscape F:\working folder\classified_1.RDC processed successfully.
Execution finished on Tuesday, July 06 - 10:24:46 (run #6).
Result file saved as C:\Documents and Settings\admin\Desktop\class_ed_do nt.patch
Adjancency file saved as C:\Documents and Settings\admin\Desktop\class_ed_do nt.adj
Fragstats
Ready
NUM

Patch Metrics



Contd….

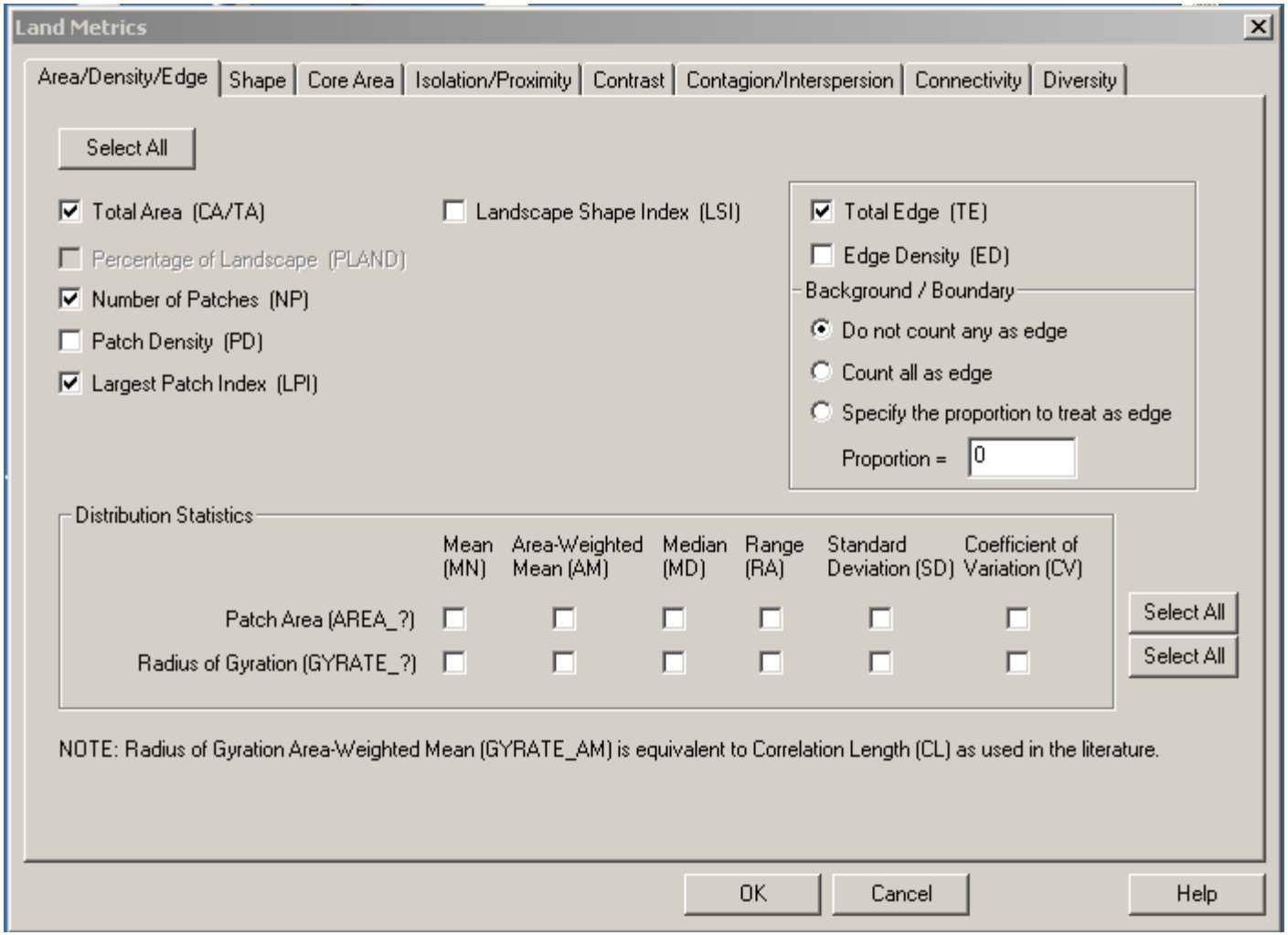
1. Patch Area
   It equals to the area (m^2) of the patch, divided by 10,000 (to convert to hectares).
   The choice of the 4-neighbor or 8-neighbor rule for delineating patches will have an impact on this metric.
2. Patch Perimeter
   PERIM equals the perimeter (m) of the patch, including any internal holes in the patch, regardless of whether the perimeter represents 'true' edge or not.

Importance: The relationship between patch perimeter and patch area is the basis or most shape indices.

3. Radius of Gyration(GYRATE)
   GYRATE equals the mean distance (m) between each cell in the patch and the patch centroid.
   Range of Gyrate: GYRATE ≥ 0, without limit.
   It is a measure of patch extent; thus it is effected by both patch size and patch compaction.

4. Perimeter-area ratio
   It is a simple measure of shape complexity.
   Patches with elongated shapes have higher perimeter-area ratios than patches of the same area with compact shapes and unbroken parameters.

Landscape Metrics



Contd……..

1. Total Area(TA/CA)

   TA equals the total area (m^2) of the landscape, divided by 10,000 (to convert to hectares). Note, total landscape area (A) includes any internal background present.

   It defines the extent of the landscape.

2. Number of Patches(NP)

   NP equals the number of patches in the landscape. Note, NP does not include any internal background patches (i.e., within the landscape boundary) or any patches at all in the landscape border, if present.

3. Patch Density(PD)

$$PD = \frac{N}{D}(10{,}000)\,(100)$$

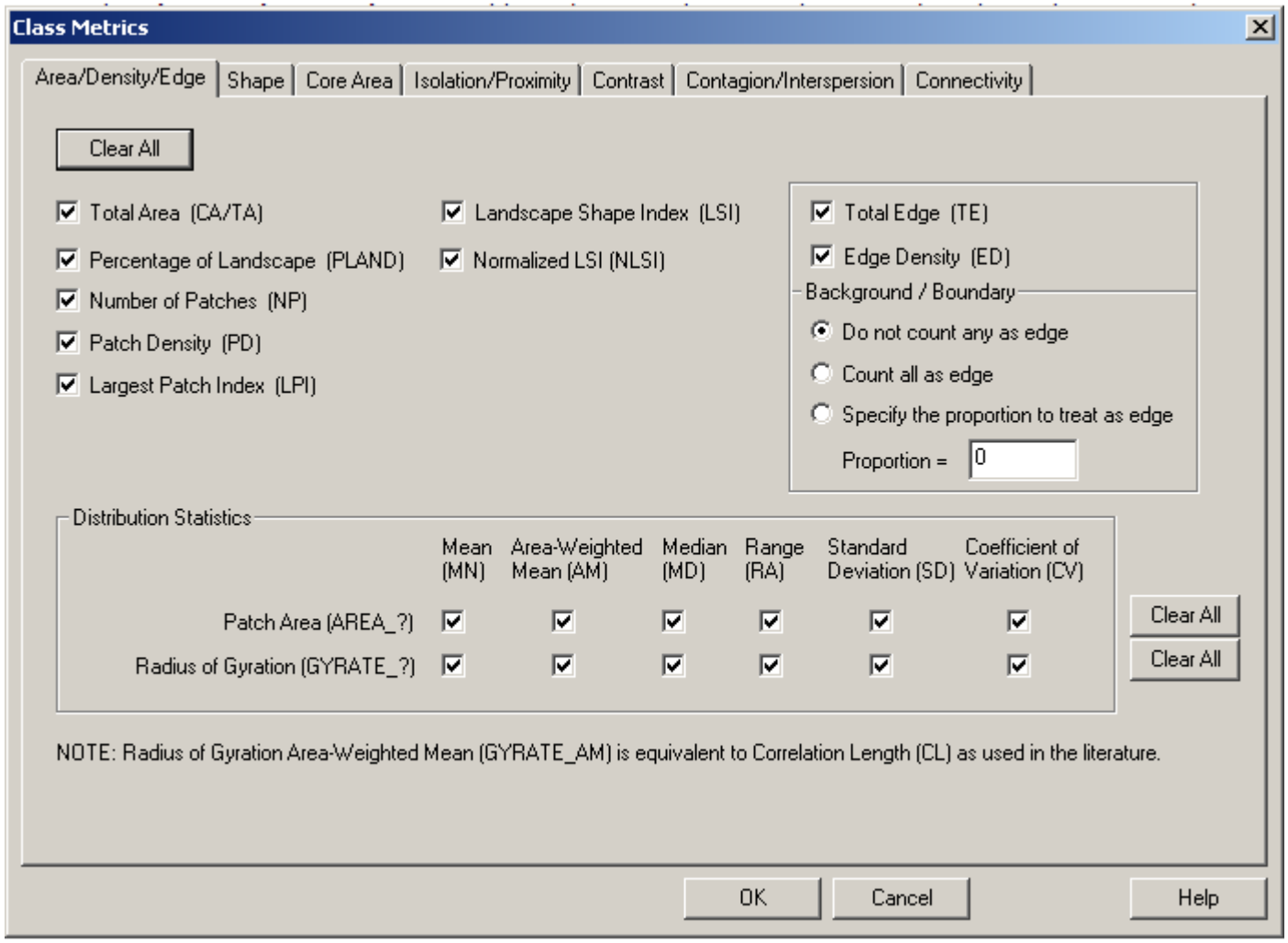
   Unit: Number per 100 hectares

Importance: Patch density is a limited, but fundamental, aspect of landscape pattern.
It expresses number of patches on a per unit area basis that facilitates comparisons among landscapes of varying size.
If total landscape area is held constant, then patch density and number of patches convey the same information

4. Largest Patch Index(LPI)
   It equals to the percent of the landscape that the largest patch comprises.
   Range: $0 < LPI \leq 100$
   Importance: It is a simple measure of dominance.

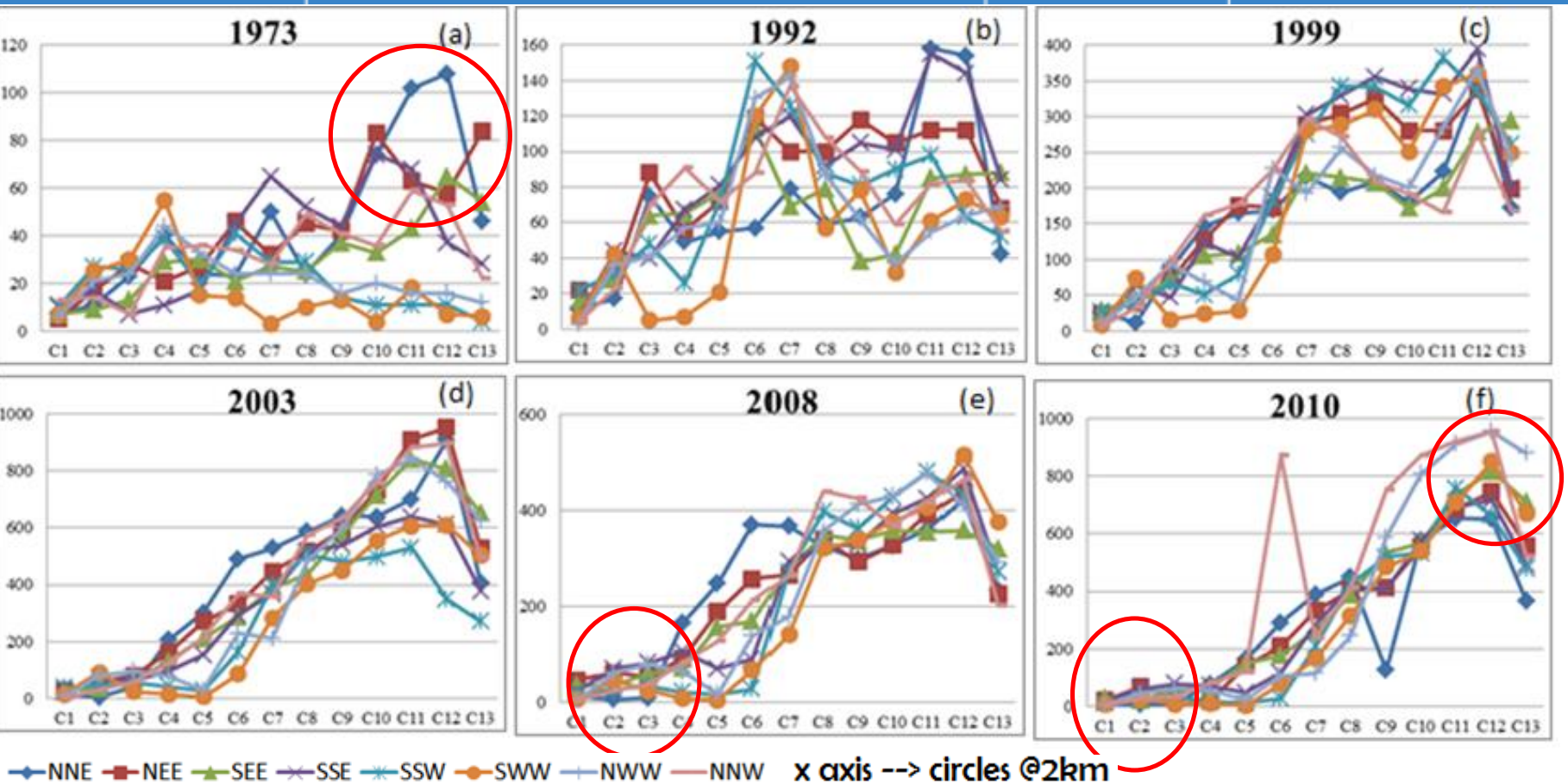
5. Total Edge (TE)
   TE equals the sum of the lengths (m) of all edge segments involving the corresponding patch type.

Class Metrics



Landscape Metrics Analysis for Bangalore

Number of Urban Patches	$NPU = n$ NP equals the number of patches in the landscape.	NPU>0, without limit.	It is a fragmentation Index. Higher the value more the fragmentation



PROS & CONS of open source

Total cost of ownership

- ✓ Open source has a much lower price
  - ✓ Free is a very good price
- ✓ The total cost of open source is lower
  - ✗ Expertise vs Certified Experts
  - ✓ Vendors are starting to offer guaranteed open source solutions.
- ✓ Some software isn't compatible with open source
  - ✓ The number of Linux desktops is meager compared to Microsoft Windows.
  - ✓ By choosing a Linux desktop, a user forecloses on some software because it may never be created for or ported to Linux.

Features & quality

- Open source is more
  - Reliable
  - Secure
    - ✓ With both open source and proprietary software, effective security depends on thoughtful deployment, regular monitoring, and timely upgrades or other modifications.
- Proprietary software
  - ✓ Has more features
    - ✓ It may be easier to use peripherals like digital cameras with proprietary software
  - More user friendly
    - × A cloned program may be just as user friendly as the original
- Open source
  - × Is not mature enough
    - ✓ Much of the software has been used and improved for years

Features & quality (cont.)

- Powerful (Speed&Scale)
  - ✓ Some open source programs are generally faster and scale larger than proprietary alternatives,
  - × Open Office

✓ Network friendly

- ✓ Apple builds its OS X on BSD. The Internet is a critical reason: Apple recognizes they can't privately innovate Internet functionality as well or as fast as the open source community

✓ Customizable

- ✓ By it's very nature, any user with enough expertise can tailor software to their needs.

✓ Better formats

- ✓ Open source usually uses open formats.
- ✓ The open source movement is partly a response to incompatibility in proprietary software.

Deployment & maintenance

- Open source
  - ✓ License management easier
    - ✓ Install any number of copies,
    - ✓ open source companies don't bother with complicated licenses
    - ✓ no risk of illegal copies or license audits,
    - ✓ anti-piracy measures (CD keys, product activation)
- Open source is harder to deploy
  - ✓ Some open source software is just as easy to deploy as proprietary alternatives.
  - ✓ Solutions like Red Hat Linux offer installers with GUI...

Deployment & maintenance(cont)

- ✓ Greater independence from companies
  - ✓ Even if a software company goes bankrupt, the community still has the source code.
  - ✓ "end of life" decisions or undesirable new features can't be forced on the users.

- Proprietary software offers better service & support
  - For both open source and proprietary software, experts depend on email lists and community Web sites as well as contracted support.
  - The quality and availability of help is proportional to interest and use, especially in open source.

Users and Migration

- ✓ Some open source software is just as easy to learn how to use
  - × For better or worse, most users are more familiar and more comfortable with proprietary software.
  - ✓ many open source solutions are overtly cloning proprietary interfaces and environments.

- Migration is too expensive
  - ✓ There may be unforeseen problems, as when existing hardware isn't actually sufficient or when data isn't easy to migrate.
- It’s difficult to integrate open source & proprietary solutions
  - ✓ Integrating any two programs is often challenging.
  - ✓ It may be difficult to integrate some open source and proprietary solutions.

Principles and rights

- ✓ Open source is more empowering
  - ✓ Any user can fix the bugs or add the features that matter most to them.
  - ✓ Open source frees the users to decide for themselves.

- ✓ Open source is community driven and community serving
  - ✓ A large community of motivated, generous programmers work together.

Bottom line

- **Neither OSS nor proprietary always better**
  - But clearly many cases where OSS *is* better
  - By definition, OSS gives more rights to its user community
- **Policies must not ignore or make it difficult to use OSS where applicable**
  - Can be a challenge because of radically different assumptions & approach
- **Include OSS options when acquiring, then evaluate**
  - Consider both reusing existing and developing new OSS
  - Considering OSS is the law... and it's a good idea

Open source software sites

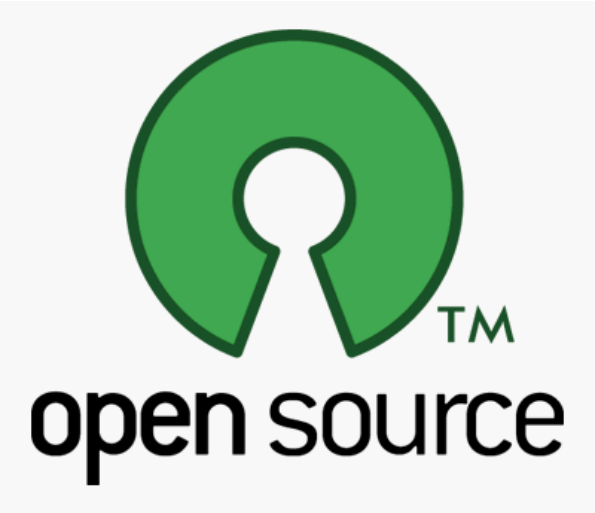
- Open Source Initiative www.opensource.org
- Free Software Foundation www.fsf.org
- SourceForge.net
- Bioinformatics.org
- www.apache.org;
- www.cpan.org; etc.,

The Next Tsunami..

- When a change in how some element of one's business is conducted becomes an order of magnitude larger than what that business is accustomed to, then all bets are off. There's wind and then there's a typhoon, there are waves and then there's a tsunami.

  - Andy Grove (Intel)

Is Open-Source the Software Industry's Tsunami?



Thank you!

Reference Material

- Dr. T.V. Ramachandra, Principles of remote sensing in environmental Management, IISc
- Landsat.org
- Tutorials, CCRS, Canada
- ITC, Netherlands
- OSGEO
- OPEN SOURCE STANDARD HANDBOOK