GRASS GIS

Bringing advanced geospatial technologies to the world.

Introduction to GRASS

Geographic **R**esources **A**nalysis **S**upport **S**ystem

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Outline

1. Grass Features
2. GRASS Architecture
3. Command Structure
4. GUI or terminal

Open Source Concept

"Free software is a matter of liberty, not price. To understand the concept, you should think of free as in *free speech*, not as in free beer."

—Richard Stallman

Programmers can read, redistribute, and modify the source code

Access to source code increases transparency and reproducibility of science

GNU Operating System
open sources does not mean free !

https://grass.osgeo.org/: GRASS GIS is a powerful computational engine for raster, vector, and geospatial processing. It supports terrain and ecosystem modeling, hydrology, data management, and imagery processing. With a built-in temporal framework and Python API, it enables advanced time series analysis and rapid geospatial programming, optimized for large-scale analysis on various hardware configurations.

GRASS is Free Software/Open Source released under GNU General Public License

https://www.osgeo.org/

GRASS is an official project of the Open Source Geospatial Foundation

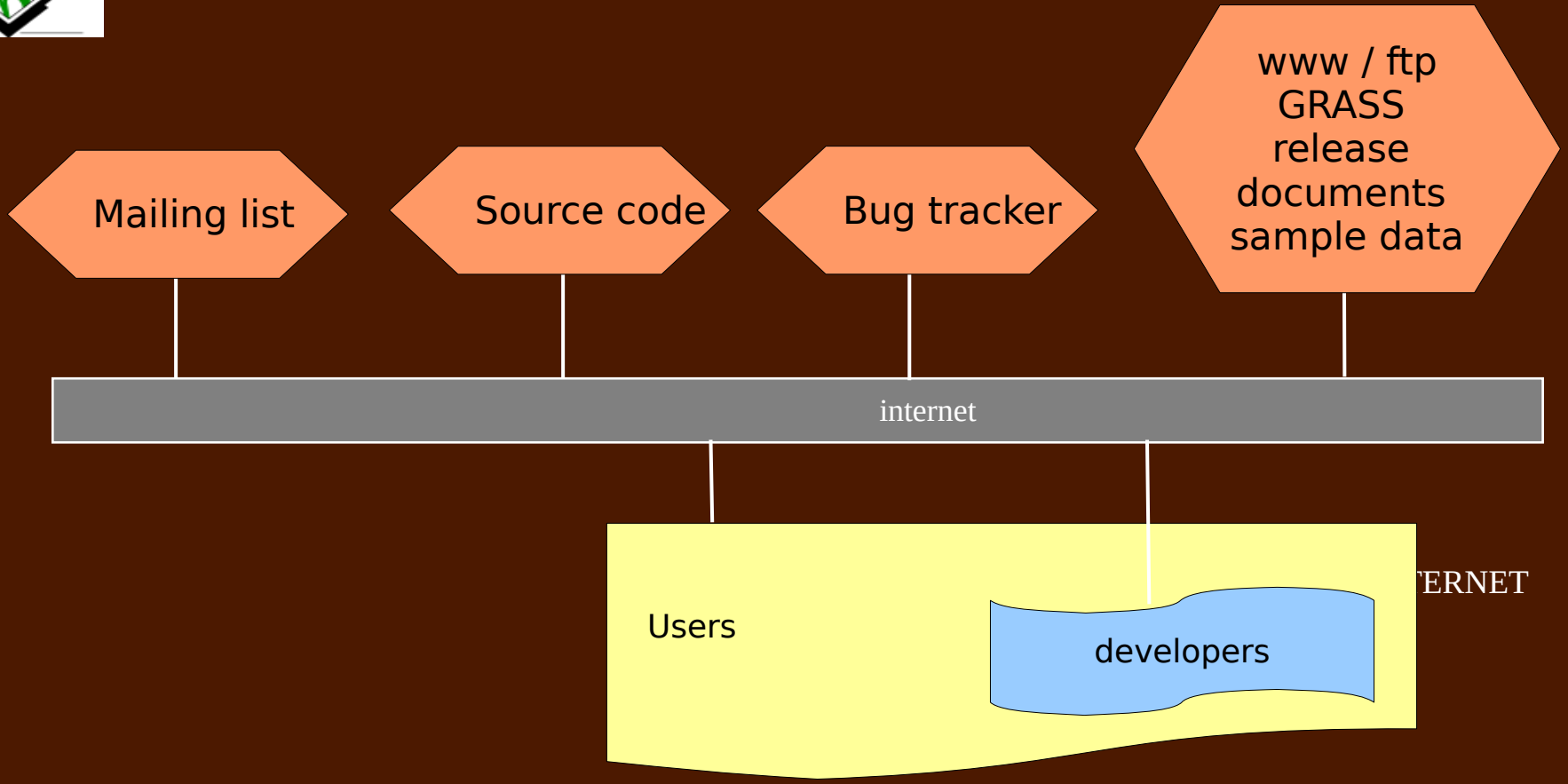
The Open Source Geospatial Foundation supports the highest-quality open source geospatial software. Our goal is to encourage the use and collaborative development of community-led projects.

Also Support:
GDAL/OGR, PostGIS, Quantum GIS, MapServer, OpenLayers

Geographic Resources Analysis Support System

- Open Source GIS, developed since 1984 (U.S. Army), since 1999 GNU GPL
- Portable code (multi-OS, 32/64bit)
- 400+ modules for management, processing, analysis and visualization (raster/image/vector)
- GIS backbone – links to:

GRASS Development



What GRASS can do?

- 2D raster analysis and 3D voxel (volumes) management
- 2D/3D vector engine with SQL based DBMS support
- Image processing modules
- Vector network analysis, Linear Referencing System
- Visualization of 2D, 3D maps and volumes
- Interoperable with standard raster and vector formats
- Works on GNU/Linux, Mac OS X, MS-Windows and other POSIX compliant platforms
- Modular architecture and scripting capabilities for batch processing

GRASS Architecture

/folder path

~/ost4sem/grassdb
GRASS DBASE FOLDER

/europe
LOCATION PROJECT(>8.4)

/PERMANENT
/Vmodel
/PCEM
MAPSET

GISDBASE

GRASS data are stored in a directory referred to as GISDBASE. This directory has to be created with mkdir or a file manager, before starting to work with GRASS. Within this DATABASE, the projects are organized by project areas stored in subdirectories called LOCATIONs.

LOCATION - PROJECT(>8.4)

Defined by its coordinate system, map projection and geographical boundaries. The subdirectories and files defining a LOCATION are created automatically when GRASS is started the first time with a new LOCATION. Every location has a PERMANENT MAPSET sub-directory which stores some basic information about the whole location.

MAPSET

Organize maps by theme/geography/projec/etc within MAPSETs. Every GRASS session runs in one MAPSET at a time. A LOCATION can have many MAPSETs.

GRASS DBASE - FOLDER

~/ost4sem/grassdb

LOCATION - PROJECT(>8.4)

/world

/asia

/spain

/europe

MAPSET

/PERMANENT

/Vmodel

/PCEM

/vector

/Country

/coor

/dbln

/head

/hist

/topo

/sidx

Volume maps

/grid3

/soil3d

/range

/cellhd

/cell

/cats

/dbf

/Country.dbf

Raster maps

/cats

/cell

/cellhd

/cell_misc

/colr

/fcell

/hist

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MAPSET sub-folders

cats/	Category values (e.g. color or temperature values) and attributes (classes with caption) of the individual raster maps
cell/	Individual raster maps
cellhd/	Header rows of the individual raster maps
cell_misc/	Statistical data of the individual raster maps
colr/	Color information of the individual raster maps
dbf/	Contains the internal vector attributes in DBASE format
fcell/	Raster maps with floating point numbers
hist/	Developing history of the individual raster maps
vector/	Contains the individual vector data (geometry, topology, etc.)
WIND	Data of the current REGION and the MAPSET projection

Grass Commands

prefix	function class	type of command	example
g.*	general	general data management	*g.rename: renames map*
d.*	display	graphical output	*d.rast: display raster map* *d.vect: display vector map*
r.*	raster	raster processing	*r.mapcalc: map algebra* *r.univar: univariate statistics*
v.*	vector	vector processing	*v.clean: topological cleaning*
i.*	imagery	imagery processing	*i.pca: Principal Components Analysis on imagery group*
r3.*	voxel	3D raster processing	*r3.stats: Voxel statistics*
db.*	database	database management	*db.select: select value(s) from table*
ps.*	postscript	map creation in PostScript format	*ps.map: PostScript map creation*

Grass syntax under bash

SYNOPSIS

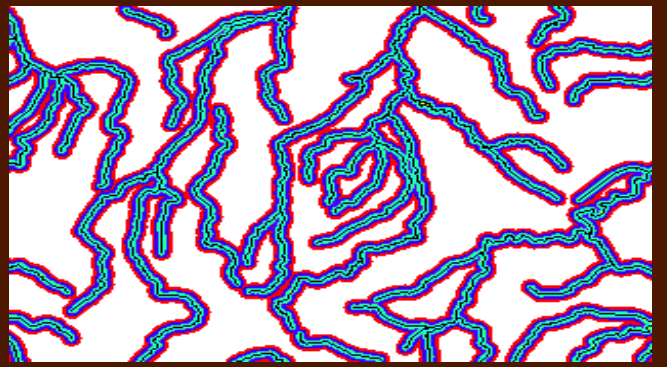
Command [flags or options] parameter [flags]

Grass syntax

Command [flags or options] parameter [flags]

Example:

r.buffer - Creates a raster map layer showing buffer zones surrounding cells that contain non-NULL category values.



r.buffer [-zq] input=name output=name distances=float[,float,...] [units=string]
[--overwrite] [--verbose] [--quiet]

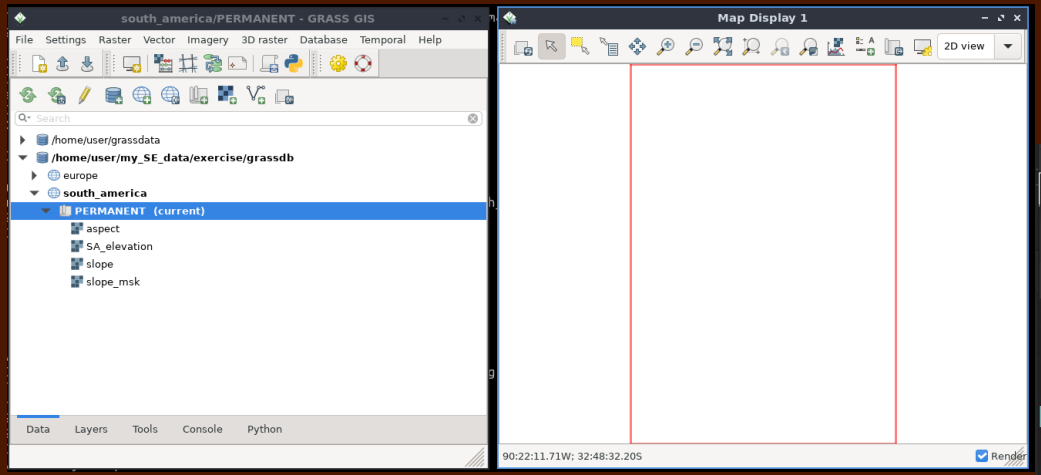
-z: Ignore zero (0) data cells instead of NULL cells

r.buffer -z input=roads output=roads.buf distances=100,200,300,400,500 units=kilometers --overwrite

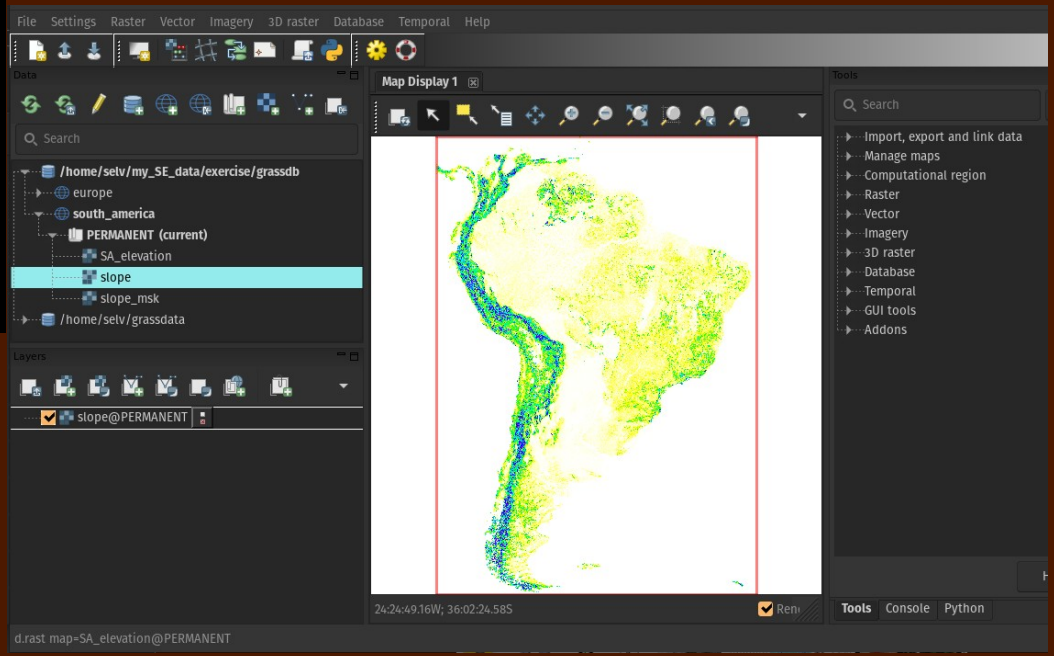
```
import grass.script as gs;
gs.run_command("r.buffer", input="roads", output="roads.buf", distances="100,200,300,400,500", units="kilometers", flags="z",
overwrite=True)
```

GRASS Graphical User Interface

GRASS 8.3



GRASS 8.4



Command line

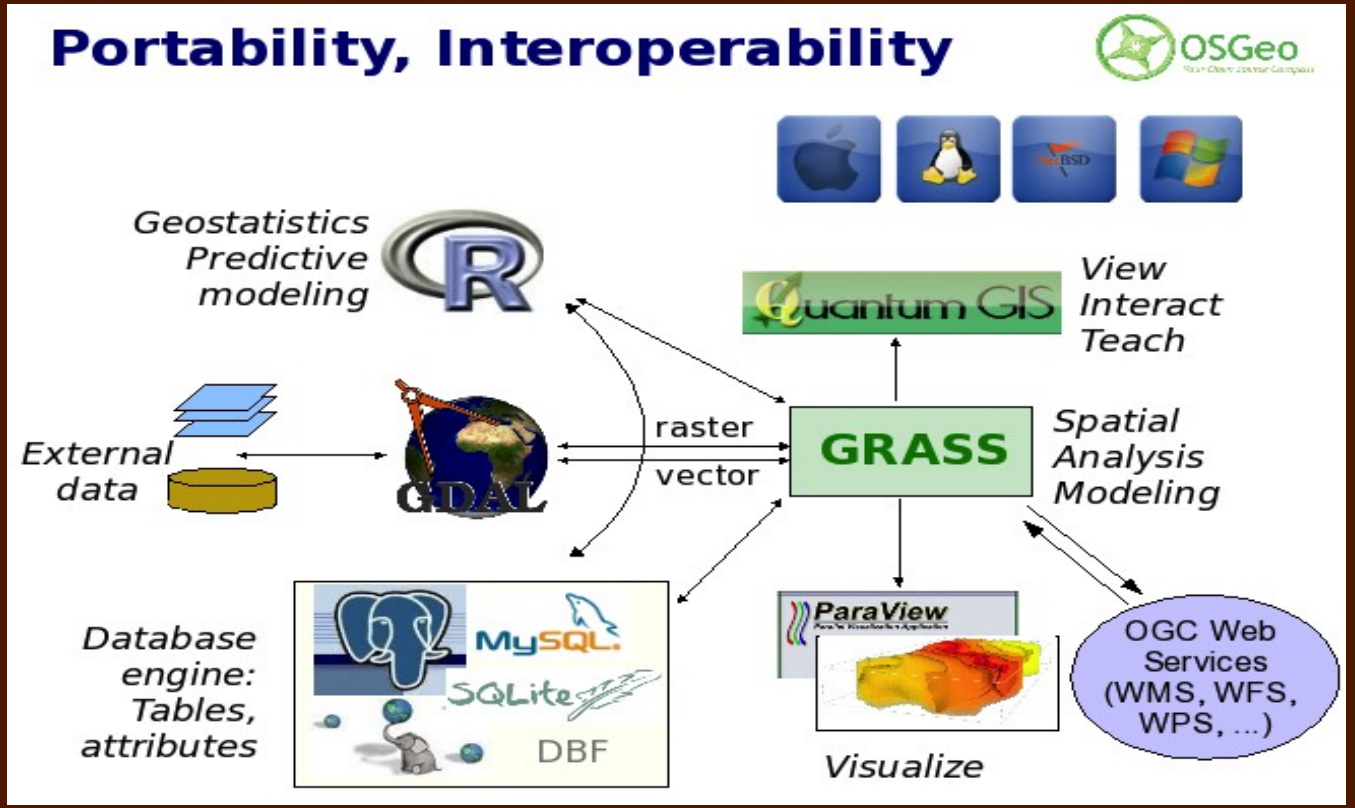
```
user@osgeolive:~$ grass --text  my_SE_data/exercise/grassdb/south_america/PERMANENT/
Starting GRASS GIS...
Cleaning up temporary files...


          __________  ___   __________    _________________
         / ____/ __ \/   | / ___/ ___/   / ____/  _/ ___/
        / / __/ /_/ / /| | \__ \\_  \    / /_   / / \__ \
       / /_/ / _, _/ ___ |___/ /__/ /   / /_/ // / ___/ /
       \____/_/ |_/_/  |_/____/____/    \____/___//____/

Welcome to GRASS GIS 8.2.1
GRASS GIS homepage:                      https://grass.osgeo.org
This version running through:            Bash Shell (/bin/bash)
Help is available with the command:      g.manual -i
See the licence terms with:              g.version -c
See citation options with:               g.version -x
Start the GUI with:                      g.gui wxpython
When ready to quit enter:                exit

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

GRASS south_america/PERMANENT:~ >
GRASS south_america/PERMANENT:~ >
```



Portability, Interoperability
OSGeo
Geostatistics
Predictive
modeling
R
Quantum GIS
View
Interact
Teach
External
data
GDAL
raster
vector
GRASS
Spatial
Analysis
Modeling
Database
engine:
Tables,
attributes
MySQL
SQLite
DBF
ParaView
Visualize
OGC Web
Services
(WMS, WFS,
WPS, ...)

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GRASS – GIS section