WS27: Unleash the power of GRASS GIS 7

Session 5 – GRASS GIS 7 vector intro

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ontains modified Copernicus Sentinel data [2016]/ESA/ir

Session Objectives



- Why a topological vector data model
- Topological vector data model in GRASS GIS 7
- Vector feature extraction
- Vector geometry dissolving
- Geometry editing/digitizing
- Import/export
- Capabilities of GRASS GIS' vector engine

What is vector topology?

Non-topological vector formats:

E.g. OGC Simple Features, ESRI shapefiles

Geometry types: points, lines, polygons

 \rightarrow Problem: replicated boundaries for adjacent areas

Faster computations, but extra work for maintenance

Non-topological

polygon map being generalized



What is vector topology?

True topological vector format:

- Areas are constructed from boundaries
- Boundaries are shared between adjacent areas

Slower computations, but less (nearly no manual) maintenance

Topological

polygon map being generalized





Native vector format

- Vector topology
- m:n mapping of geometry features to attributes
- Support of vector layers
- OGC Simple Features ←→ Topological Vector Conversion
- Database Management system (DBMS) with SQL support
- SQLite (default DB backend), PostgreSQL + PostGIS, MySQL, ODBC (, DBF)

GRASS GIS Vector model



Node

Vector geometry types

Point Centroid

Line

Boundary

Area (Boundaries + Centroid)

Face (3D Area)

[Kernel (3D Centroid)]

[Volumes (Faces + Kernel)]



Vertex

Line



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Basic geometry types, they can be edited **directly**:

- Point
- Centroid
- Line
- Boundary

A GRASS vector map can contain a combination of several different types

GRASS GIS Vector model (1): Basic geometry types

Types 1: Basic vector geometry types



GRASS GIS Vector model (2): Derived geometry types



Types 2: Derived vector geometry types

Derived geometry types, constructed from basic types

- Area (closed ring of boundaries + centroid)
- Isle (closed ring of boundaries, no centroid)
- Node (at both ends of lines/boundaries)

Isles and Nodes are not visible to the user



Extract by attributes

GRASS GIS module:

v.extract

Input: boundary_county Output: boundary_wake

Command:

```
v.extract input=boundary_county \
    output=boundary_wake \
    where="NAME = 'WAKE'"
```





Vector feature select operations: v.select (GEOS)





Extract with another vector

GRASS GIS module:

v.select

Input: boundary_wake, railroads Output: railroads_wake

Command:

```
v.select ain=railroads bin=boundary_wake \
    out=railroads_wake \
    atype=line btype=area \
    operator=overlap
```



Extract with another vector (clipping)

```
GRASS GIS module:
```

```
v.overlay
```

Input: boundary_wake, railroads Output: railroads_wake_clip

Command:

```
v.overlay ain=railroads bin=boundary_wake \
    out=railroads_wake_clip \
    atype=line btype=area \
    operator=and
```

```
try operator=not
```



Vector feature overlay operations



Boolean operators

GRASS GIS module:

v.overlay





Combination of several areas into one area based on common categories or attributes

Dissolving common boundaries between the two interior areas:





Exercise: Vector feature dissolving

Dissolving with categories

GRASS GIS module:

v.dissolve

Input: boundary_county Output: nc_boundary

Commands:

```
v.category in=boundary_county type=centroid \
            out=boundary_county_cat2 \
            layer=2 cat=1 step=0 option=add
v.db.addtable map=boundary_county_cat2 layer=2
v.dissolve in=boundary_county_cat2 out=nc_boundary \
            layer=2 column=cat
```

GRASS GIS topological vector digitizer







Import/export vector maps

v.in.* and v.out.*

v.out.ogr always exports the whole map

OGR supported formats: > 50

GRASS Vector data exchange

Import of vector maps

v.in.ogr module v.import (it also offers reprojection on the fly)!

Always the full map is imported.

Export of raster maps

v.out.ogr module

Always the full map is exported.

OGR supported > 80 vector formats



Creating a map from Spreadsheet file (MS Excel file, OpenDocument ODS, CSV file):

A new vector point map can be directly created from a selected sheet in a spreadsheet:

```
# the z coordinate is optional
v.in.db table=List1 x=long y=lat z=height \
    output=meteodata \
    driver=ogr datatabase=meteodata.xls
```

Note that in this example the key option is omitted (so the key column is then automatically added)



Example vector module groups

Topological geometry feature digitizing/editing

LiDAR analysis:

http://grasswiki.osgeo.org/wiki/LIDAR

Linear referencing (LRS) – v.lrs.*:

http://grasswiki.osgeo.org/wiki/Linear_Reference_System Network analysis – v.net.*:

http://grasswiki.osgeo.org/wiki/Vector_network_analysis