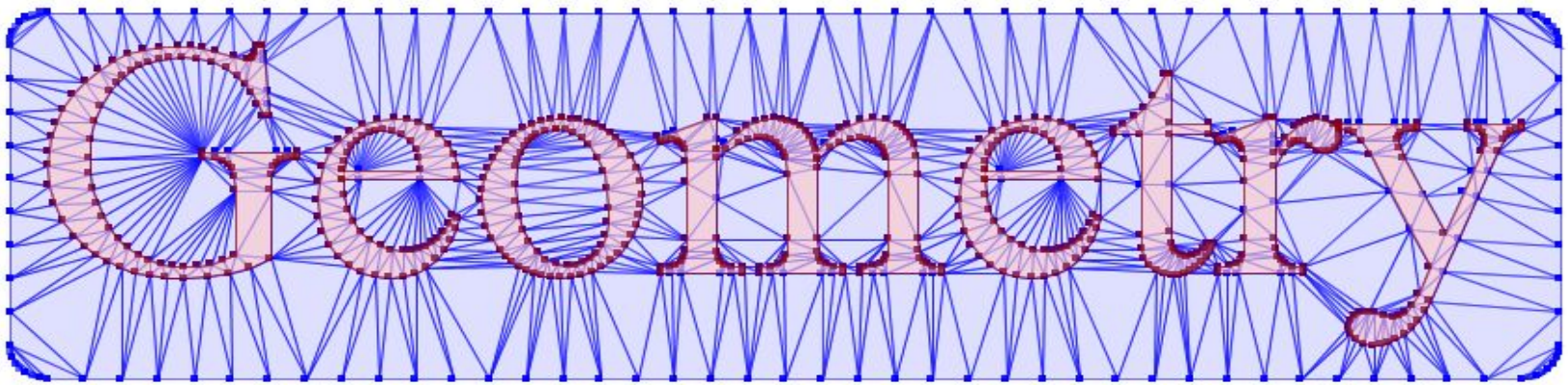


Libraries for Fun and Profit

Martin Davis

March 3, 2011

What?

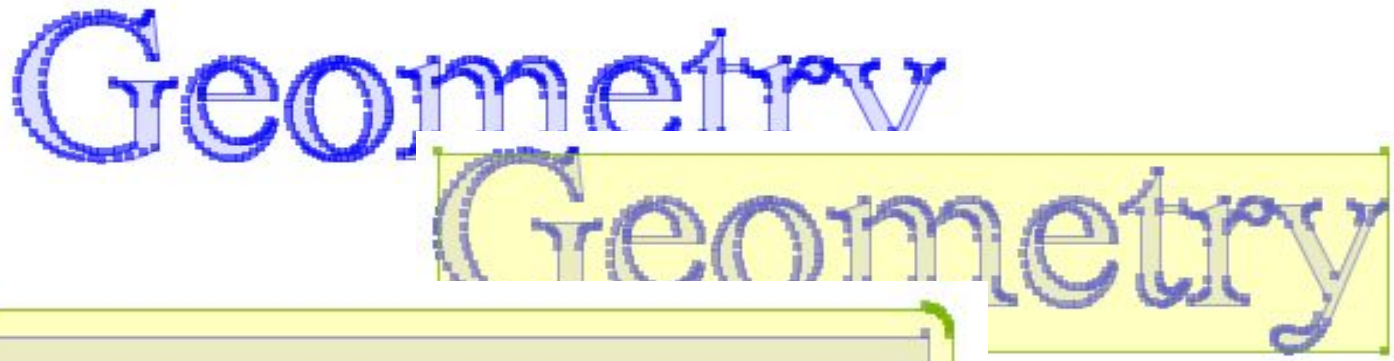
- Code base providing:
  - geometric data types
  - algorithms for processing geometry
    - construct
    - analyze
    - transform
  - input/output/conversion
- Vector libraries *only* covered
  - Raster is a different world!
- Standards?
  - *Open Geospatial Consortium*
    - *Simple Features For SQL* specification

What?

- Geometric data types
  - 2D Linear - Point, LineString, Polygon, Multi<geom>
  - Geodetic (AKA Geography, AKA Spheroidal)
  - Curves
  - 3D
  - Topologic Structures
- Operations
  - Spatial Relationships (intersects, contains, etc)
  - Overlay operations (intersection, union, etc)
  - Length, Area
  - Distance between
  - Buffer
- I/O
  - OGC Well-Known Text, Well-Known Binary
  - GML, KML, Shapefile etc.

How?

1. Glyph Polygons



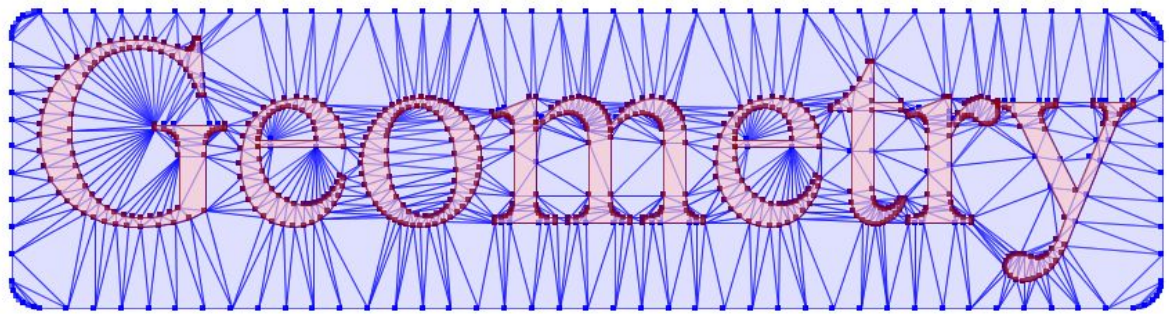
2. Envelope

3. Buffer

4. Densify

5. Combine

6. Conforming Delaunay Triangulation

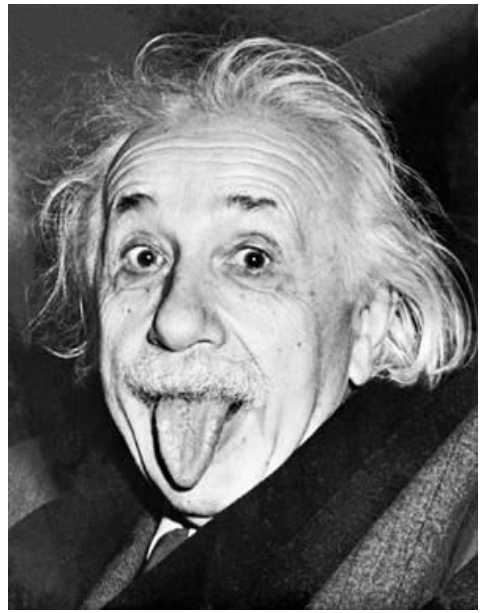


Why?

- **Convenience**
  - Geometric Data structures and algorithms designed to work together
  - Many, many possible geometric algorithms
- **Performance**
  - Essential for large data
    - Naive algorithms are O(N^2) - FAIL
- **Robustness**
  - Operations compute "reasonable" results for all inputs
  - Spatial data exhibits a high degree of variability
    - If there's a problem, your data will find it...
- **Reliability**
  - A good library has extensive unit tests
  - Many users make all bugs shallow (or at least visible)

Why... not build your own?

- Designing & implementing geometric algorithms is HARD
- Designing performant algorithms is HARDER
- Designing robust algorithms is REALLY REALLY HARD

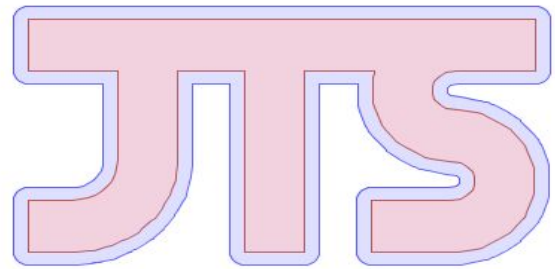


Who?

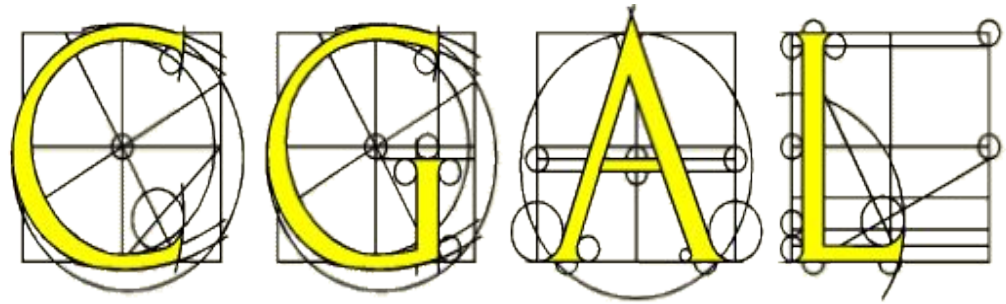
Open Source

JTS family:

- JTS Topology Suite - Java
- GEOS - C/C++
  - also Python (Shapely), Ruby
- NET Topology Suite - C#



Java2D API



C++

- CGAL
  - some limitations on licensing
- Boost.Geometry (AKA Generic Geometry Library)
  - <templates>!

Who?

Open Source (*cont'd*)

Object Pascal

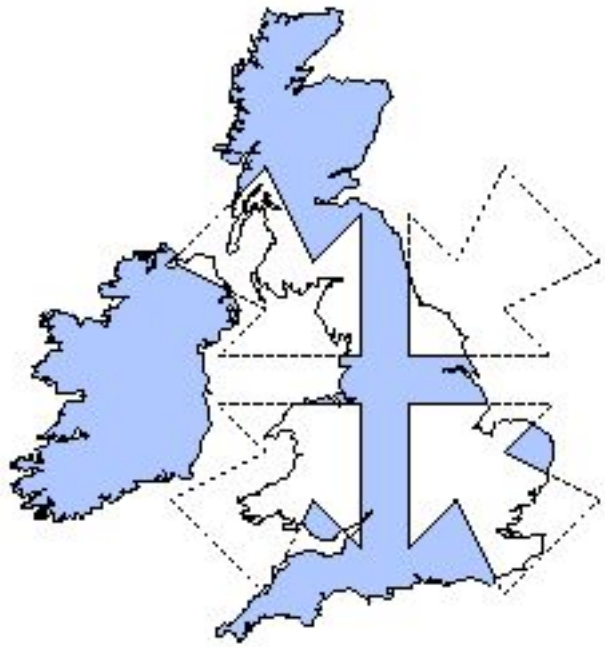
- FastGeo

JavaScript

- ???
- maybe OpenLayers?

Lots of polygon overlay libraries...

- Clipper
  - C++, C#, Delphi
- GPC (General Polygon Clipper)
  - C, Java, Delphi
  - free for non-commercial use only



Who?

Commercial

- CGAL (also)
- All major commercial RDBs
  - e.g. Oracle, MS SQL Server, IBM
- Microsoft SQL Server spatial API ??
- GIS Vendors
  - e.g. ESRI ArcObjects
- probably others
  - but why bother?

Where?

Every GIS/geospatial/geometric system in existence!

- JTS
  - GeoTools/GeoServer
  - Batik
  - GIS Clients (JUMP, uDig, Puzzle...)
- GEOS
  - PostGIS, SpatialLite
  - MapServer, MapGuide OpenSource
  - QuantumGIS
  - FME
  - Shapely (Python), Ruby
- NET Topology Suite
  - SharpMap