

JTS Topology Suite

State of the Lib

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What is JTS?

- API for representing and processing **2D linear vector Geometry**
- Implemented in Java; licensed under LGPL
- Provides the full OGC **Simple Features for SQL** geometry specification:
 - Points, Linestring, Polygons, collections
 - **Metrics:** Length, Area, Distance
 - **Predicates:** intersects, contains, etc.; relate for DE-9IM
 - **Overlay:** intersection, union, difference, symDifference
 - **Algorithms:** Convex Hull, Buffer
- Other features:
 - Validation, Polygonization, Simplification, Linear Referencing, etc.

Project History

- **Version 1.0** - May 2001
- ...
- **Version 1.9** - January 2008
- **Version 1.10** - December 2008
- **Version 1.11** - March 2010
- **Version 1.12** - June 2011
- **Version 1.13** - December 2012
- **Version 1.14** - *Coming Soon!*

JTS Ports & Bindings

- **Ports**

- **GEOS** (C++)
- **Net Topology Suite** (C#)
- **JSTS** (JavaScript)

- **Bindings (on JVM)**

- Groovy, Scala, Jython, JRuby, Clojure, etc

- **Bindings (to GEOS)**

- Shapely (Python)
- RGeo (Ruby)
- R-GEOS (R)

GEOS Geometry Engine Open Source



This repository Search



NetTopologySuite / NetTopologySuite



This repository Search



bjornhartell / jsts

Where is JTS used ?

JTS



A word cloud of software projects that utilize the JTS library. The words are arranged in a roughly circular shape and vary in size and color (shades of blue and purple). The most prominent words include GeoServer, JASPA, Conflation, OGC, MoxieMedia, GeoScript, GeoTools, OpenJUMP, Puzzle-GIS, JCSSuite, and HatBox.

deegree
geoKettle
RoadMatcher
deeJUMP
Puzzle-GIS
JCSSuite
GIS
GeoTools
JAI-Tools
SWECDF
Mapyrus
JUMP
GeoScript
Straightedge
OpenJUMP
GIS
GeoTools
IMF
Conflation
OGC
JASPA
MoxieMedia
SkyJUMP
gvSIG
uDig
HibernateSpatial
Geomajas
GeoServer
Sextante
JEQL
Kosmo



A word cloud of software projects that utilize the GEOS library. The words are arranged in a roughly circular shape and vary in size and color (shades of green). The most prominent words include MapServer, WebProcessingServer, MapWindow, MapGuide, PostGIS Open, Shapely, Quantum, RGeo, and SpatiaLite.

OGR
Source
R-GEOS
FME
MapServer
WebProcessingServer
MapWindow
MapGuide
PostGIS Open
Shapely
Quantum
RGeo
SpatiaLite

GEOS

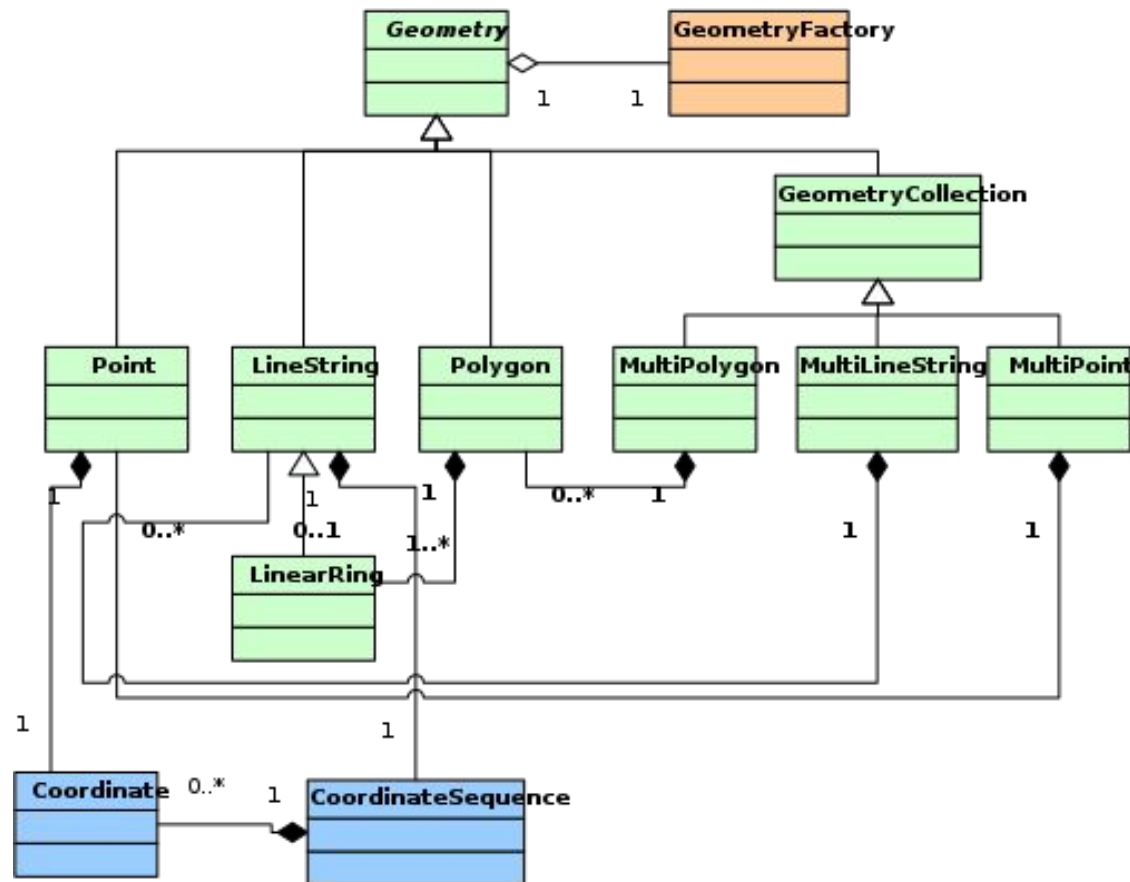
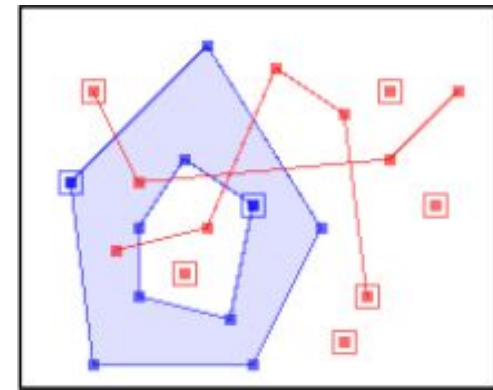
Overview of **JTS**

Geometry Model

- Complete model for 2-D linear geometry (OGC SFS model)

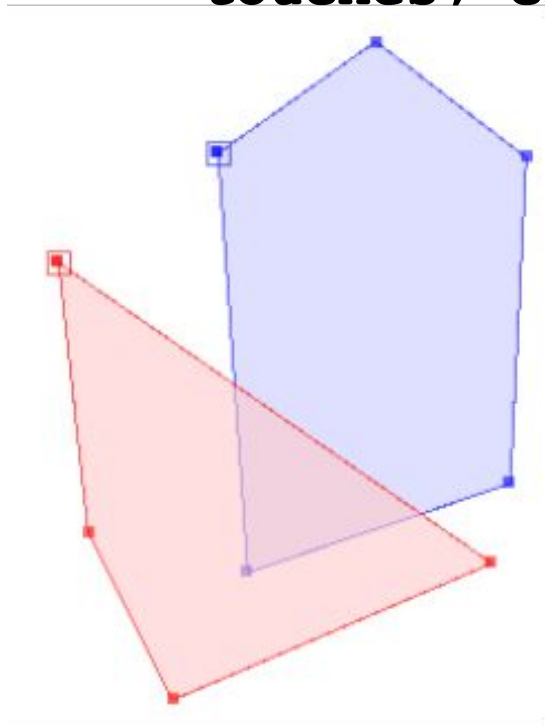
- Point
- LineString, LinearRing
- Polygon (with holes)
- MultiPoint, MultiLineString, MultiPolygon
- GeometryCollection

- User-defined coordinate representation



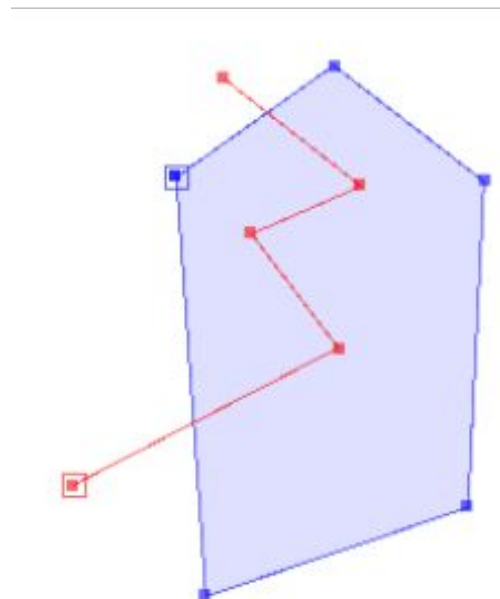
Spatial Predicates

- Determines the spatial relationship of two Geometries
- Uses the *Dimensionally Extended 9-Intersection Model (DE-9IM)*
 - Computes dimension of intersection of Interior, Boundary, Exterior
- General function
 - `relate(IMpattern)`
- Named predicates
 - `intersects`, `contains`, `within`, `equals`, `disjoint`, `touches`, `crosses`, `overlaps`, `covers`, `coveredBy`



	B		
	Int	Bdy	Ext
Int	2	1	2
A Bdy	1	0	1
Ext	2	1	2

Binary Predicates		
	AB	BA
Equals	F	F
Disjoint	F	F
Intersects	T	T
Touches	F	F
Crosses	F	F
Within	F	F
Contains	F	F
Overlaps	T	T

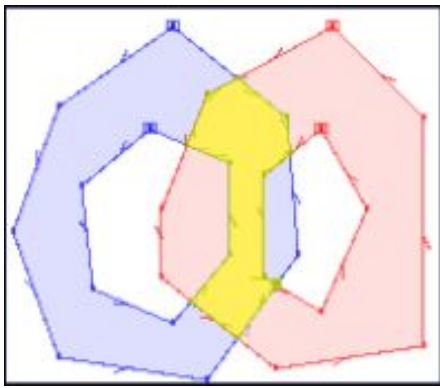


	B		
	Int	Bdy	Ext
Int	1	F	2
A Bdy	0	F	1
Ext	1	0	2

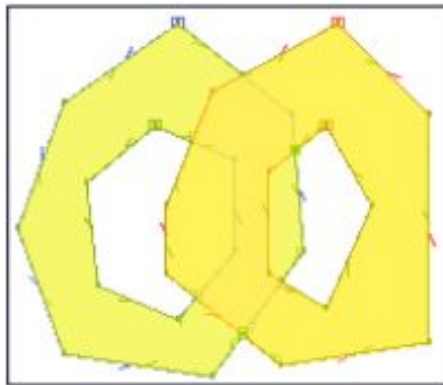
Binary Predicates		
	AB	BA
Equals	F	F
Disjoint	F	F
Intersects	T	T
Touches	F	F
Crosses	T	T
Within	F	F
Contains	F	F
Overlaps	F	F

Overlay functions

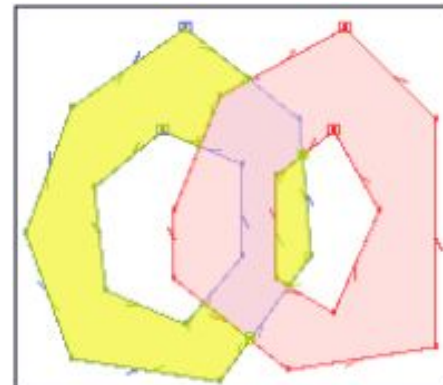
- AKA Boolean functions, Set-theoretic functions



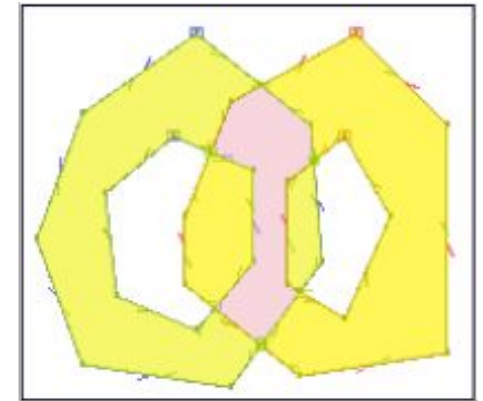
Intersection



Union

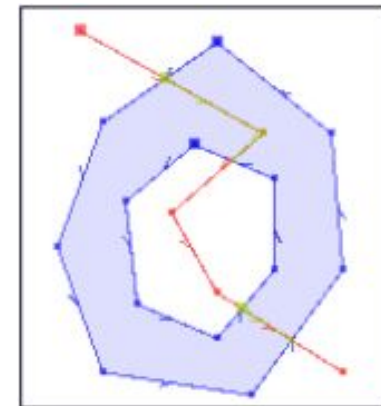


Difference



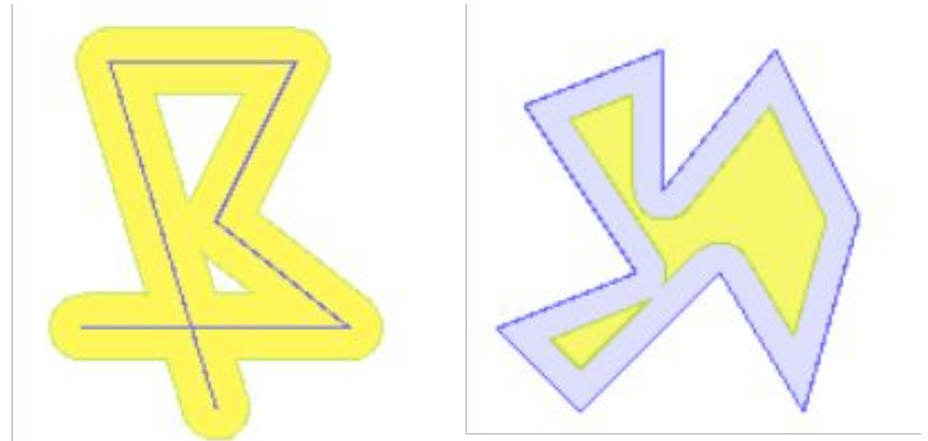
Symmetric Difference

- Heterogeneous – all geometry types supported

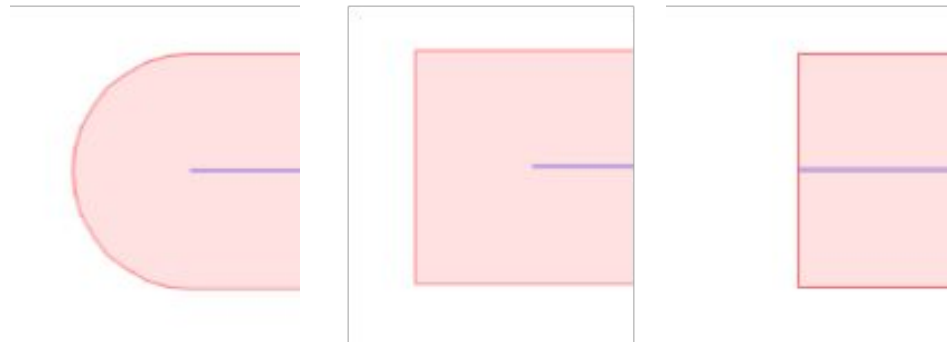


Buffers

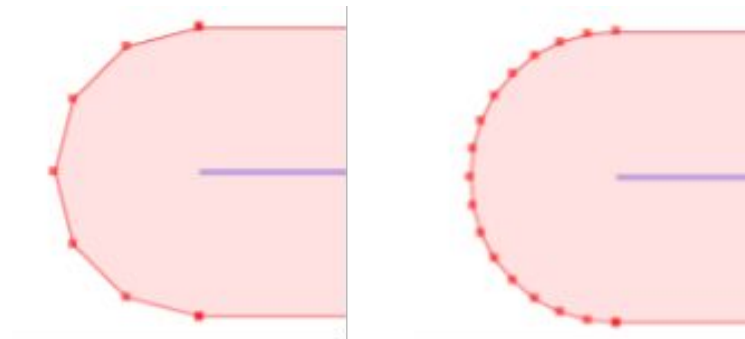
- **Positive & Negative buffers**
 - All Geometry types
 - Robust, efficient algorithm



- **Choice of End Cap Styles**
 - Round, Square, Butt



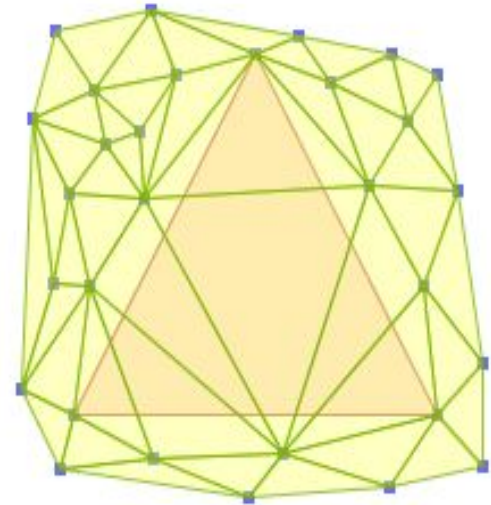
- **Curve Quantization is user-controllable**



Delaunay Triangulation, Voronoi Diagram

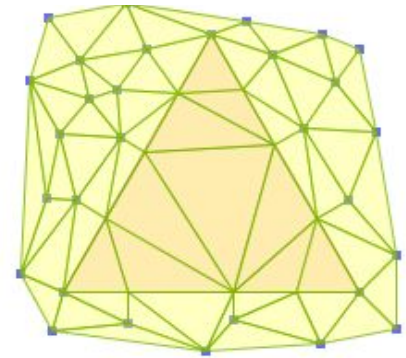
- **Delaunay Triangulation**

- Optimal triangulation of point sets
- Efficient, robust algorithm



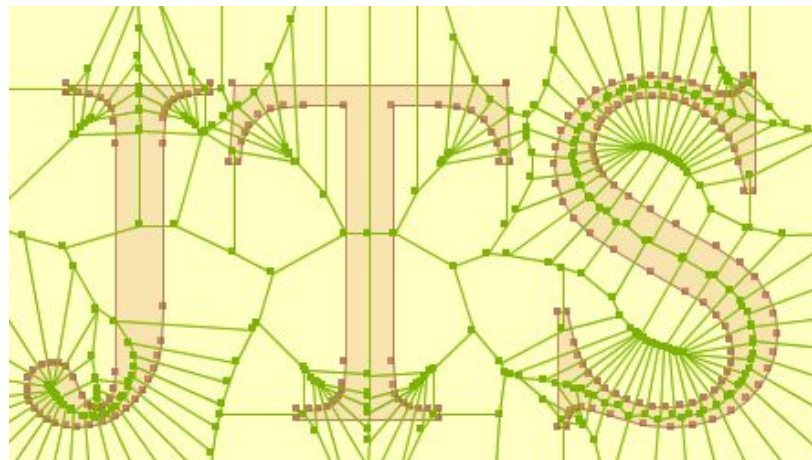
- **Conforming Delaunay Triangulation**

- includes (approximated) linear constraints



- **Voronoi Diagram**

- dual of Delaunay



JTS TestBuilder

The screenshot displays the JTS TestBuilder application window. The title bar reads "JTS TestBuilder". The menu bar includes "File", "View", "Edit", "Options", "Tools", and "Help". The toolbar contains icons for adding, deleting, undo, redo, zoom, pan, and other editing functions. The main workspace shows a grid with two overlapping polygons: a blue rectangle and a red polygon. The left sidebar contains several panels: "Geometry Functions" and "Scalar Functions" tabs, an "Edit" tab with "Valid/Mask" and "Predicates" sub-tabs, an "Edit Mode" section with radio buttons for "No Edit", "Edit A", and "Edit B" (selected), an "Erase" button, a "Grid Spacing" input field set to 10, a "Set Precision Model..." button, a "Magnify Topology" checkbox, and a "Stretch Distance" input field set to 5. The bottom status bar shows "Case 2 of 2", "PM: Floating", and coordinates "-8, 317". The bottom panel displays test data for two polygons, A and B, with their respective WKT coordinates.

Geometry Functions | Scalar Functions

Edit | Valid/Mask | Predicates

Edit Mode

No Edit

Edit A

Edit B

Erase

Grid Spacing: 10 Set

Set Precision Model...

Magnify Topology

Stretch Distance: 5

Case 2 of 2 | PM: Floating | -8, 317

Tests

A POLYGON ((50 300, 250 300, 250 150, 50 150, 50 300))

Input

Result

Value

Stats

B POLYGON ((310 270, 95 256, 90 70, 180 190, 290 80, 310 270), (200 230, 270 240, 280 150, 200 230))

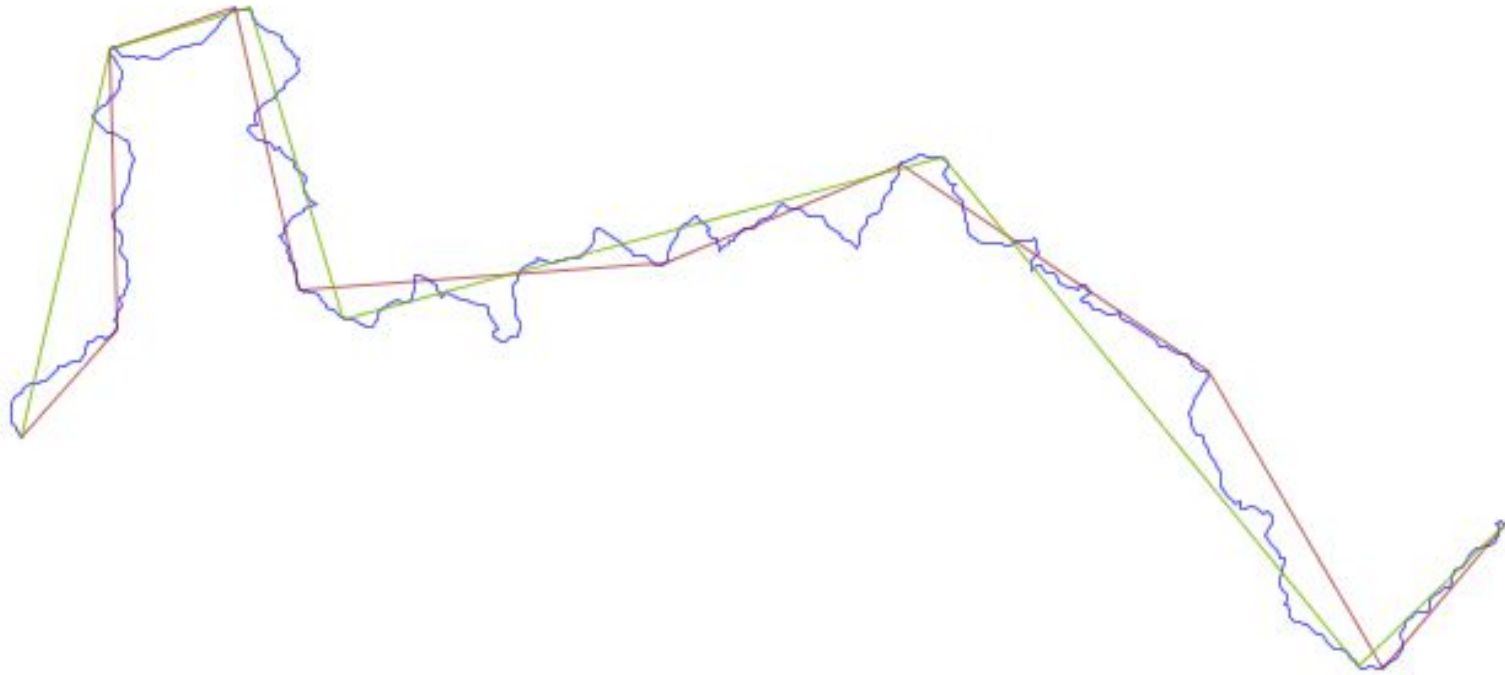
Info

Layers

What's New in **JTS**

Visvalingam-Whyatt Simplifier

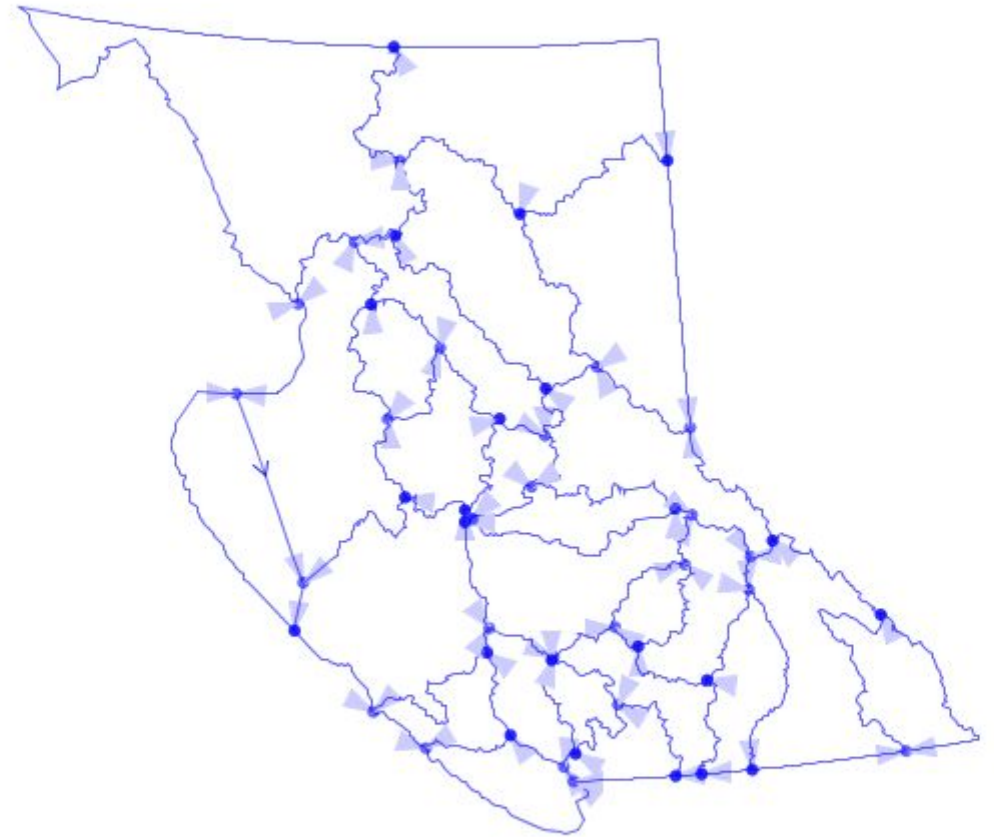
Visvalingam-Whyatt VS **Douglas-Peucker**



Line Dissolver



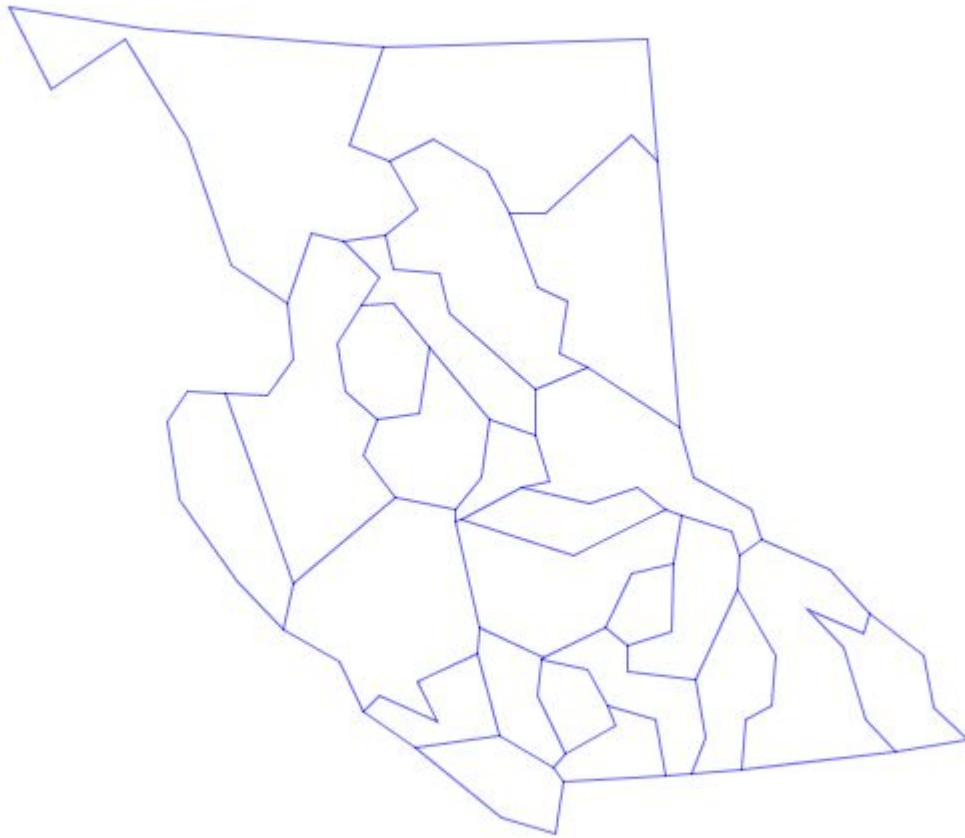
25 Polygons
949,625 vertices



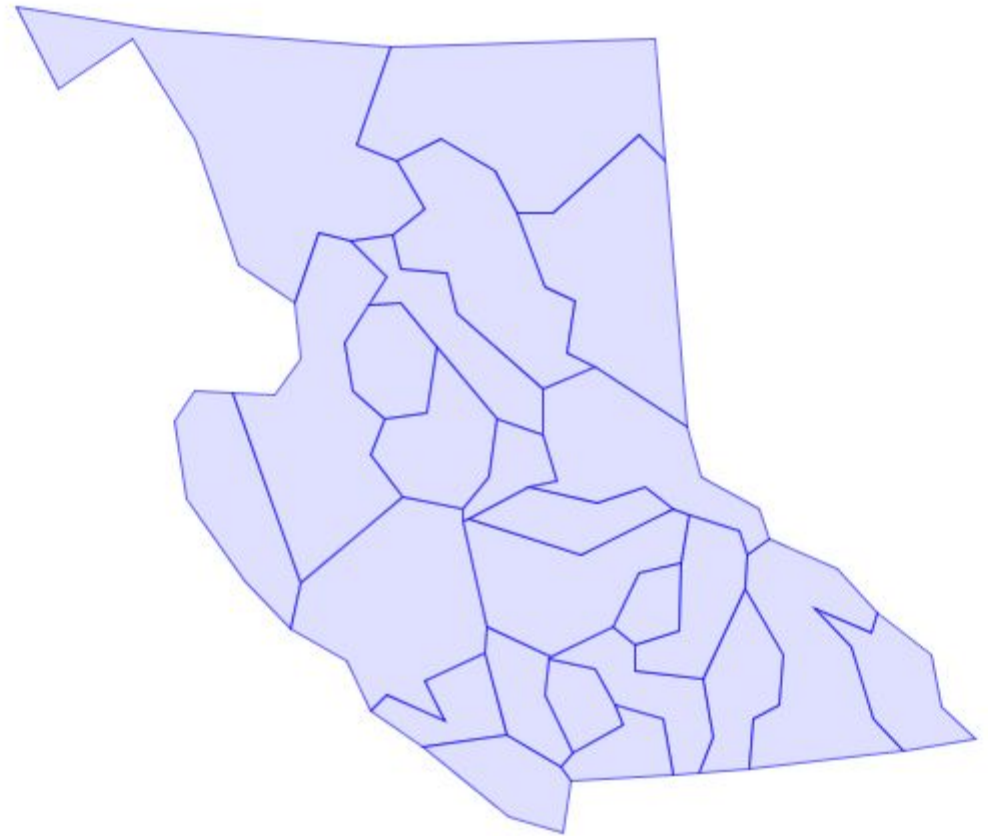
72 LineStrings
505,615 vertices

Example: Polygonal Coverage Simplification

- **Line Dissolve -> VW Simplify -> Polygonize**



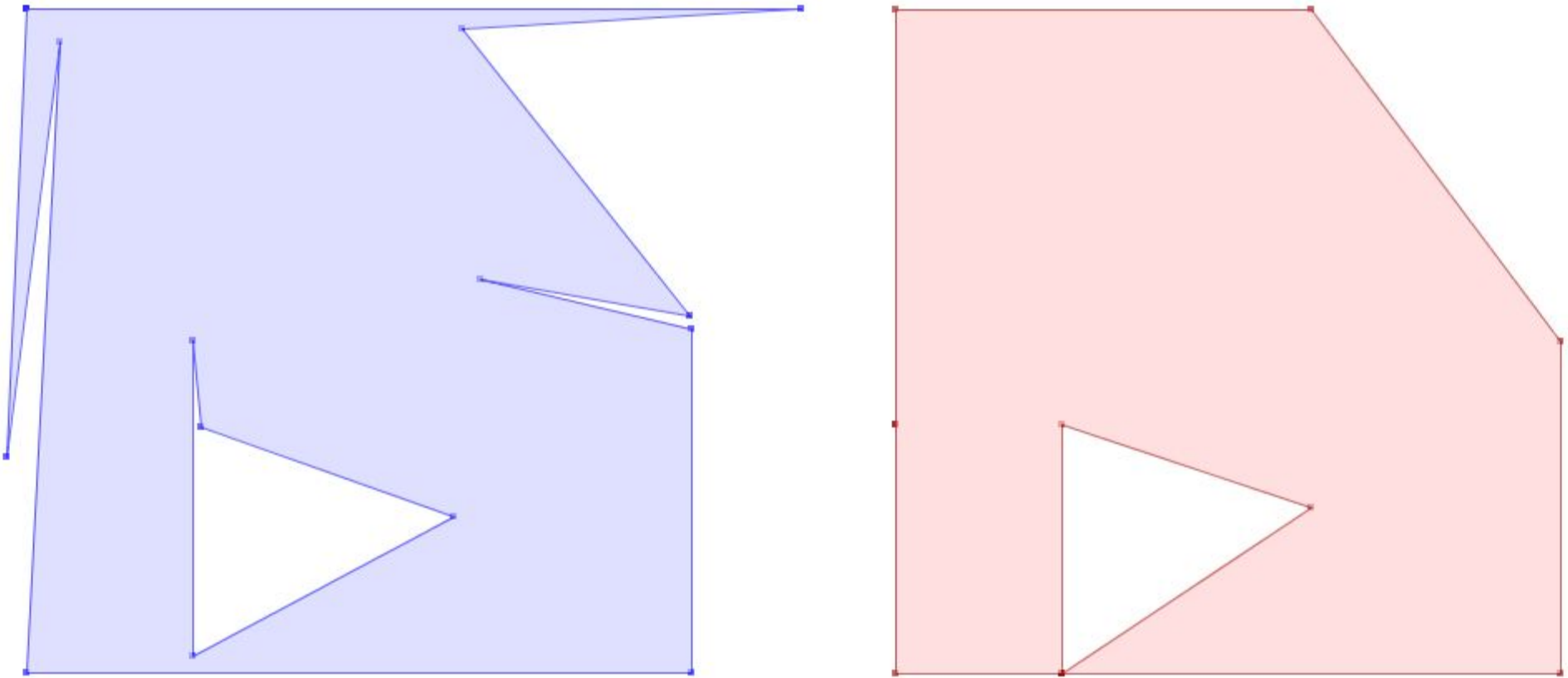
72 LineStrings
209 vertices



25 Polygons
262 vertices

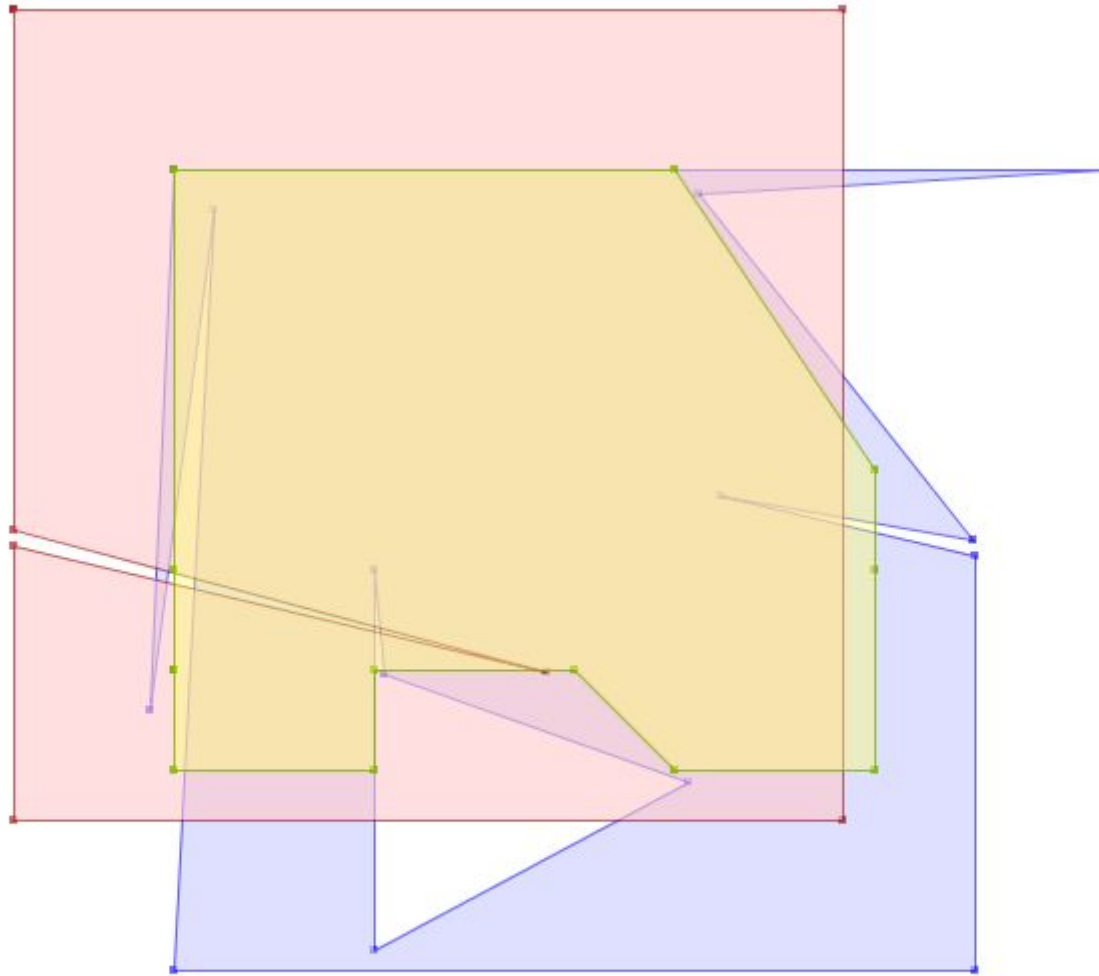
Snap-Rounded Geometry

- Snap-round geometry to precision grid
- Topology collapses are cleaned so output is valid



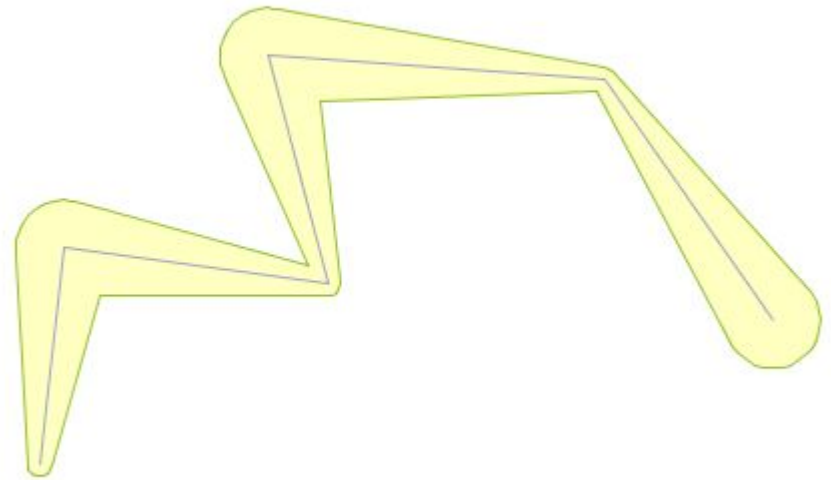
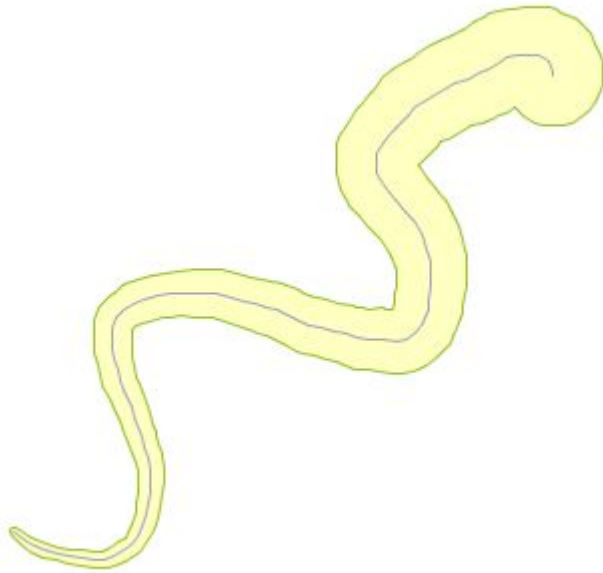
Snap-Rounded Overlay

- 100% Robust !



Variable-Width Buffer

- **Variable-Width Buffer**
 - e.g. for styling linear river networks



Future Plans

- **Functionality**

- Computation in Geodetic coordinate systems
- Measures on coordinates

- **Deployment**

- Split packaging into Core and Algorithms
- Move to Maven

- **Governance**

- Move to LocationTech
- License change to BSD + EPL

- **JTS 2.0...**

- Refactor `Geometry` classes to use interfaces
- allows alternate geometry representations

Distribution & Support

- **JTS available from SourceForge**

<http://sourceforge.net/projects/jts-topo-suite/>

- **Mailing List**

<https://lists.sourceforge.net/lists/listinfo/jts-topo-suite-user>

- **Other JTS resources**

- Javadoc
- References
- FAQ

<http://tsusiatsoftware.net/jts/main.html>