State of JTS

Presented by:
James, Jody, Rob, (Martin)
Welcome

<table>
<thead>
<tr>
<th>Martin Davis</th>
<th>James Hughes</th>
<th>Jody Garnett</th>
<th>Rob Emanuele</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vivid Solutions</td>
<td>CCRi</td>
<td>Boundless</td>
<td>Azavea</td>
</tr>
</tbody>
</table>

Introducing JTS Topology Suite
What is JTS Topology Suite?

Java API for working with 2D Geometries
JTS is EVERYWHERE
JTS Project History

- 2000: 1.0
- 2001: 1.1
- 2002: 1.2
- 2003: 1.3
- 2004: 1.4
- 2005: 1.5, 1.6
- 2006: 1.7
- 2007: 1.8
- 2008: 1.9
- 2009: 1.10
- 2010: 1.11
- 2011: 1.12
- 2012: 1.13
- 2013: JTS 1.14
- 2014: 1.13
- 2015: 1.14
- 2016: 1.15
- 2017: 1.15
- 2018: 1.15
- 2019: JTS 1.14
- 2020: 1.15
JTS Topology Suite

Representations:
OGC Simple Features

- Point
- LineString
- LinearRing
- Polygon
- MultiPoint
- MultiLineString
- MultiPolygon
- GeometryCollection
JTS Topology Suite

Predicates (DE-9IM)

- Equals
- Disjoin
- Intersects
- Touches
- Crosses
- Within
- Contains
- Overlaps
- Covers
- CoveredBy
JTS Topology Suite

Overlays

- Intersection
- Union
- Difference
- SymDifference
JTS Topology Suite

Measurements

- Length
- Area
- Distance
JTS Topology Suite

IO:

- WKT
- WKB
- GeoJSON
- KML

```xml
<xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
  <Placemark>
    <name>Study site</name>
    <description>Forest inventory study</description>
    <Polygon>
      <outerBoundaryIs>
        <LinearRing>
          <coordinates>
            -94.765829,31.505864,0
            -94.762480,31.505656,0
            -94.763288,31.509076,0
            -94.766736,31.508471,0
            -94.765829,31.505864,0
          </coordinates>
        </LinearRing>
      </outerBoundaryIs>
      <innerBoundaryIs>
        <LinearRing>
          <coordinates>
            -122.65335738658904,
            45.512083676585156
          </coordinates>
        </LinearRing>
      </innerBoundaryIs>
    </Polygon>
  </Placemark>
</kml>
```
JTS Topology Suite

Algorithms

- Convex Hull
- Buffer
- Validation
- Dissolve
- Polygonization
- Simplification
- Triangulation
- Voronoi
- Linear Referencing
- and more...
JTS Topology Suite

Applications

- TestBuilder
- TestRunner
JTS 1.14 Released

January 2016

- LineDissolver
- edgegraph package
- Visvalingam-Whyatt simplification

Improvements:

- Improved thread-safety
- Fixed Java 7 compatibility
- Added Spatialite WKB
- CoordinateSequence
- many bug fixes and performance improvements

JTS I/O

- KML Writer
- GeoJsonReader/Writer
- Oracle SDO Performance
JTS 1.14 with Maven

JTS 1.14

<dependency>
  <groupId>com.vividsolutions</groupId>
  <artifactId>jts-core</artifactId>
  <version>1.14.0</version>
</dependency>

Published

Official release on SF
• Install into local repo

On Maven Central
• We do not know who did this!
JTS 1.15

• Focus on codebase
  • organization and packaging

• Some functionality improvements
  • K Nearest Neighbor search for STR-Tree
  • Improve handling of Quadtree queries with null Envelope
  • Intersects now supports GeometryCollection
  • JTSTestRunnerCmd command-line app
Sourceforge → GitHub

- Moving from SVN to GIT
- https://github.com/locationtech/jts
Why choose GitHub?

• High Visibility
• Great tools
  • Git tools
  • Issue tracking
  • Pull Requests
  • Continuous Integration
  • Website
• Easier for contributions
• Where the action is!
GitHub: JTS Project Activity

- **Pull Requests**
  - 76 accepted, 8 open
- **Issues**
  - 7 closed, 25 open
Mavenization

• Build chain now uses Maven instead of Ant
  • Easier to build and use
  • Easy Eclipse IDE configuration

• Unit tests run by Maven build
  • including XML tests

• Better release story
  • Code artifacts will be hosted on Maven Central
  • Apps built as fat-jars (TestBuilder, TestRunner)

• To Do
  • Work on packaging a distro with source, scripts, etc...
Modular Codebase

• Codebase organized into modules
  • jts-core - geometry implementation for use
  • jts-tests - extensive testing for correctness and stability
  • jts-io - read and write geometry
  • jts-example - examples of using the jts api
  • jts-lab - experimental playground use at your own risk
  • jts-app - test builder application for defining tests

• better clarity of internal dependencies
JTS Joins LocationTech

- LocationTech offers
  - project infrastructure
  - project visibility
  - stability, governance
- Immediate benefits
  - More team members
  - Synergy with other LocationTech projects
  - In-depth legal review for IP (Intellectual Property) cleanliness
- Initial Work
  - Project Application
  - License Change
  - LocationTech Incubation
- Long term hopes
  - Additional Contributors
  - Funding for JTS 2.0
  - Build Infrastructure
  - Official Maven Deployment
LocationTech Incubation

A new License
• Eclipse Public License
• Eclipse Distribution License
  (BSD-3 Clause License)

A new home:
• Project Website
• Mailing List
• Build Server
• GitHub repo

Challenges:
• Contact assorted contributors
  (because we did not have a CLA)
• changing package names
• Opportunity to work together
• Maintaining codebase history
LocationTech Project Site

- www.locationtech.org/projects/technology.jts
JTS 1.15-SNAPSHOT

• Packaging
  • org.locationtech.jts

• GitHub repo
  • https://github.com/locationtech/jts

• Snapshots Available via LT Nexus
  • https://repo.locationtech.org/
Using JTS 1.15 with Maven

JTS 1.14

<dependency>
  <groupId>com.vividsolutions</groupId>
  <artifactId>jts-core</artifactId>
  <version>1.14.0</version>
</dependency>

JTS 1.15.0-SNAPSHOT

<dependency>
  <groupId>org.locationtech.jts</groupId>
  <artifactId>jts-core</artifactId>
  <version>1.15.0-SNAPSHOT</version>
</dependency>

<repositories>
  <repository>
    <id>locationtech-snapshots</id>
    <url>https://repo.locationtech.org/content/groups/snapshots</url>
    <snapshots>
      <enabled>true</enabled>
    </snapshots>
  </repository>
</repositories>
Migration to JTS 1.15

• **New module structure**
  - jts-core
  - jts-io-common - GeoJSON
  - jts-io-ora - Oracle support
  - jts-io-sde - SDE support
  - jts-tests - XML Tests & TestRunner

• **Change package names**
  - `org.locationtech.jts.*`

• **Change Maven reference**
  - *To be determined*…
Team Code Sprints

• Dates
  • January 25-27, 2016
  • November 3-4, 2016

• Achievements
  • Sourceforge → GitHub
  • Mavenization
  • New Committers
  • Addressed IP review questions
JTS 1.15 Coming Soon!

- Coming soon to a repo near you!
  - Incubation is nearly complete

- LocationTech Release process
  - Final IP issues being resolved
    (checking in new icons for the test builder application)
  - Two week release review

- Deploy to Maven Central (and LocationTech repo)
Roadmap / Wishlist
Algorithm Improvements

- **Goal**: improve some key JTS algorithms
  - **Overlay**
    - Snap-rounding (no more TopologyExceptions!)
    - Support PreparedGeometry for caching
    - Fast & robust Clip to Rectangle
  - **Spatial Predicate improvements**
    - Streaming / Lazy evaluation with short-circuiting
    - User-defined precision model
    - Less sensitive to valid geometry (e.g. Intersects)
  - **Distance**
    - Support cached PreparedGeometry
New Algorithms

- Concave Hull
- Polygon Triangulation
- Polygon Cleaning ("MakeValid")
- Split Geometry by Line
- Polygon Coverage Simplification

Concave Hull
Polygon Triangulation
New API - JTS 2.0

• Concept for a redesign of JTS
• Key Goals
  • Interface-based Geometry access
  • Immutable Geometry objects
  • Geodetic (WGS84) support, with some basic algorithms
  • Pluggable/discoverable Geometry operation framework
  • Coordinate extensions (XY, XY+M)
• Non-goals
  • Backwards compatibility
  • Improving geometry algorithms
Join JTS Topology Suite

Shape the Future
Contributing to JTS

• Register as a Contributor
  • Sign the Eclipse Contributor Agreement
  • https://www.eclipse.org/legal/ECA.php

• Develop a patch, making sure to include
  • Javadoc
  • Unit Tests - JUnit and/or JTS XML tests

• Make a Pull Request on GitHub
  • Acknowledge code is IP clean by signing-off each Git commit
  • Make sure the Travis CI validation tests pass

See also https://github.com/locationtech/jts/blob/master/CONTRIBUTING.md
Questions?
Project Resources

• Source Code repo
  • https://github.com/locationtech/jts

• Issue Tracker
  • https://github.com/locationtech/jts/issues

• Mailing List
  • https://dev.locationtech.org/mailman/listinfo/jts-dev

• Project website
  • https://locationtech.github.io/jts

• Javadoc
  • https://locationtech.github.io/jts/javadoc
Thank you from the JTS Team
What is JTS Topology Suite

- Java API for **2D Geometry**
  - linear vector geometry
  - representing and processing

- Featuring:
  - Validation, Polygonization, Simplification, Linear Referencing, etc.

- Apps
  - TestRunner
  - TestBuilder

- OGC Simple Features for SQL
  - full geometry specification:
    - **Geometry**:
      - 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
JTS in LT projects (and others)

- LocationTech projects using JTS
  - GeoMesa - geoanalytics for big data
  - GeoTrellis - geoprocessing for big data
  - Spatial4J - geodetic geometry API

- Also by some interesting research projects
  - GeoSpark (https://github.com/DataSystemsLab/GeoSpark)
  - Simba - Spatial In-Memory Big data Analytics
    (https://github.com/InitialDLab/Simba)
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