Geoprocessing in the Web Browser

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Introduction
Geoprocessing Operations

Client-Server Model
A Tiny Bit about Browsers

High Performance Browser Network
http://chimera.labs.oreilly.com/books/1230000000545

# Web Browsers

<table>
<thead>
<tr>
<th>Browser</th>
<th>Browser Version</th>
<th>JavaScript Engine</th>
<th>Developed By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrome</td>
<td>33</td>
<td>V8</td>
<td>Google</td>
</tr>
<tr>
<td>Opera</td>
<td>20</td>
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<td>27</td>
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<td>Mozilla</td>
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<td>11</td>
<td>Chakra</td>
<td>Microsoft</td>
</tr>
<tr>
<td>Safari</td>
<td>6</td>
<td>SquirrelFish Extreme (SFX) aka Nitro</td>
<td>Webkit</td>
</tr>
</tbody>
</table>
JavaScript Mapping Libraries

Mapbox

Leaflet

OpenLayers
JavaScript Geoprocessing

- atlefren / njord.js
- turf
  a fast and fully featured open gis engine written in javascript
- bjornharrtell / jsts
- chelm / shapely.js
- jQuery Geo
  write less, map more
Geoprocessing Library

JTS Topology Suite ➔ JSTST Topology Suite
Research Questions

1. How do the various web browsers compare in geoprocessing performance?

2. How do client computers with different operating systems, processors, and memory sizes compare in geoprocessing performance?

3. How do the various client test configurations compare to server-side geoprocessing performance?

4. Are client geoprocessing times in an acceptable range for incorporation into web applications?
Methods
Testing Application Requirements

1. Common geoprocessing operations.
2. Suite of data sizes.
4. Various operating systems, processors, and memory sizes.
5. Same geoprocessing operations on a server for comparison.
Data – LA County GIS

ADDRESS POINTS

BUILDING FOOTPRINTS

ROAD CENTERLINES

10 Vertices – 100,000 Vertices
444 Bytes – 3.8 Megabytes
Natural Earth

**Large scale data, 1:10m**

The most detailed. Suitable for making zoomed-in maps of countries and regions. Show the world on a large wall poster.

1:10,000,000
1" = 158 miles
1 cm = 100 km

**Medium scale data, 1:50m**

Suitable for making zoomed-out maps of countries and regions. Show the world on a tabloid size page.

1:50,000,000
1" = 790 miles
1 cm = 500 km

**Small scale data, 1:110m**

Suitable for schematic maps of the world on a postcard or as a small locator globe.

1:110,000,000
1" = 1,736 miles
1 cm = 1,100 km

50,000+ vertices | 10,000 - 50,000 vertices | 10 - 10,000 vertices
Client – JavaScript Libraries

- bjornharrtell / jsts
- caolan / async
- microajax
- yahoo / boomerang
Server – Amazon EC2 Linux
Client

Start Test

Send Request

Network

Server

Retrieve WKT

Parse Input

Geoprocess

Parse Output

Test Complete

Return WKT
# Web Browsers

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Client – Testing Platforms
Performance Measure

Faster processing times (milliseconds) == better performance

Browser unresponsive scripts, timeouts, crashing.

Performance determined by web usability metric:

1,000 Milliseconds
10,000 Milliseconds*

Results & Discussion
How do various web browsers compare in geoprocessing performance?
Web Browsers

WEB BROWSER PERFORMANCE ENDING AT 5 MIN.
TESTING ON WINDOWS LAPTOP AND VORONOI DIAGRAMS

PROCESSING TIME (MILLISECONDS)
DATA SIZE (VERTICES)
How do client computers with different operating systems, processors, and memory sizes compare in geoprocessing performance?
CLIENT PLATFORM RESULTS ENDING AT 5 MINUTES
TESTING WITH CHROME AND VORONOI DIAGRAMS
BENCHMARK SCORE IN PARENTHESES

- Apple Desktop (2708)
- Apple Laptop (2732)
- Windows Desktop (1637)
- Windows Laptop (2478)
- Linux Desktop (1715)
- Linux Laptop (1397)
How do the various client test configurations compare to server-side geoprocessing performance?
Browsers vs Server

WEB BROWSER AND SERVER PERFORMANCE ENDING AT 5 MIN.
TESTING ON WINDOWS LAPTOP AND VORONOI DIAGRAMS

- Chrome
- Firefox
- Internet Explorer
- Opera
- Safari
- Server
Client Platforms vs Server

CLIENT PLATFORM AND SERVER RESULTS ENDING AT 5 MIN.
TESTING WITH CHROME AND VORONOI DIAGRAMS
BENCHMARK SCORE IN PARENTHESIS

- Apple Desktop (2708)
- Apple Laptop (2732)
- Windows Desktop (1715)
- Windows Laptop (2478)
- Linux Desktop (1715)
- Linux Laptop (1397)
- Server
Are client geoprocessing times in an acceptable range for incorporation into web applications?
Web Browsers

<table>
<thead>
<tr>
<th>Browser</th>
<th>1 sec (vertices)</th>
<th>1 sec (kb)</th>
<th>10 sec (vertices)</th>
<th>10 sec (kb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrome</td>
<td>2000</td>
<td>80</td>
<td>8000</td>
<td>318</td>
</tr>
<tr>
<td>Opera</td>
<td>3000</td>
<td>119</td>
<td>10000</td>
<td>398</td>
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<tr>
<td>Firefox</td>
<td>1000</td>
<td>40</td>
<td>7000</td>
<td>278</td>
</tr>
<tr>
<td>Internet Explorer</td>
<td>1000</td>
<td>40</td>
<td>4000</td>
<td>159</td>
</tr>
<tr>
<td>Safari</td>
<td>1000</td>
<td>40</td>
<td>5000</td>
<td>199</td>
</tr>
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Conclusion

The server was faster than the client in all testing scenarios. *

*Single User

Web browsers limited to data about 7,000 to 10,000 vertices
Thank you!
Special thanks to the Trewartha Research Grant

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Appendix
Client – Testing Platforms

<table>
<thead>
<tr>
<th>Brand</th>
<th>Operating System (OS)</th>
<th>OS Version</th>
<th>Processor</th>
<th>CPU (GHz)</th>
<th>Memory (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lenovo Y480</td>
<td>Windows</td>
<td>7 Home Premium Service Pack 1 (64-bit)</td>
<td>Intel(R) Core(TM) i7-3610QM</td>
<td>2.3</td>
<td>8</td>
</tr>
<tr>
<td>Lenovo T61</td>
<td>Linux Mint</td>
<td>16 “Petra” Cinnamon (32-bit)</td>
<td>Intel Centrino Core 2 Duo CPU</td>
<td>2.5</td>
<td>6</td>
</tr>
<tr>
<td>MacBook Pro</td>
<td>Mac OS X</td>
<td>10.7.5</td>
<td>Intel Core i7</td>
<td>2.8</td>
<td>8</td>
</tr>
<tr>
<td>MacMini</td>
<td>Mac OS X</td>
<td>10.9.1</td>
<td>Intel Core i7</td>
<td>2.3</td>
<td>4</td>
</tr>
<tr>
<td>Custom Built</td>
<td>Linux Mint</td>
<td>13 “Maya”</td>
<td>2x Intel(R) Core(TM)2 Duo CPU</td>
<td>3.0</td>
<td>8</td>
</tr>
</tbody>
</table>