An Open Architecture for
RESTful Geospatial Web Services

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City of Nanaimo

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Director of Technology  
Autodesk

FOSS4G Sydney 2009
Open Standards and Open Data
Open Standards
Open Standards

- International IT infrastructure
  - W3C, IEEE, IEC, ECMA, SQL…
- Spatial data standards
  - OGC (SFS, GML, WMS, CityGML), ISO (SQL spatial extensions), …
- Environmental data standards
  - INSPIRE
- Vertical industry standards
  - IFC, MultiSpeak, CIM,…
- Infrastructure data model standards
  - SDSFIE, DHS GDM, NIDM (Canada), …
Benefits of Open Standards and Open Source in DoD

**Open Standards**

- Increased security
- Interoperability
- Avoid vendor lock-in
- Supports best of breed procurement
- Encourages competition
- Lowers cost

**Open Source**

- Security
- Standards-compliant
- Flexibility and agility
- Quality
- Lower risk
- Reduced cost
Free and Open Data
Free and Open Data
Public Access to Govt Geospatial Data

- **Australia**
  Government of Queensland, Victorian Spatial Council

- **United States Federal**
  Geospatial data collected by the Federal government is available at no cost and is in the public domain

- **California**
  Legal precedent for free and open access to geospatial data

- **Canada**
  As of April 1, 2007, geospatial data from Natural Resources Canada and other Federal, Provincial, and Territorial Governments is available for free

- **South Africa**
  The National Government has adopted the principle that digital geospatial data is freely available.

- **Japan**
  Basic Law: data collected by the government available to the public at nominal cost

- **Brazil**
  It is mandatory for all Federal Government Agencies to publish geospatial data freely and free of charge to any identified user
Open Infrastructure Data

You can search for:
- an address
- a billing number
- road name
- school name
- park name

Step 1
Type into the search box above
A list of search results will be displayed below the search

Step 2
Click on the result you want
The details for your chosen result will be displayed here

Step 3
Use the Map/Report tool
More detailed information will be displayed in printable format in a new window
City of Vancouver

- Open and Accessible Data
  - The City of Vancouver will freely share with citizens, businesses and other jurisdictions the greatest amount of data possible while respecting privacy and security concerns.

- Open Standards
  - The City of Vancouver will move as quickly as possible to adopt prevailing open standards for data, documents, maps, and other formats of media.

- Open Source
  - The City of Vancouver, when replacing existing software or considering new applications, will place open source software on an equal footing with commercial systems during procurement cycles.
What does open geodata access mean and how best to provide it?
Benefits of Open Data

- Encourages citizen engagement
- Promotes transparency and accountability
- Leads to economic development
Geodata on the Web

- Tim Berners-Lee, in *Government Data Design Issues*, proposes
  - Geodata on the web in **raw form**.
  - Raw geodata must be **searchable**

- We suggest that **HTML web pages** are the best way of accessing geodata on the current web
What is REST?
UNIVERSITY OF CALIFORNIA, IRVINE

Architectural Styles and the Design of Network-based Software Architectures

DISSERTATION

submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in Information and Computer Science

by

Roy Thomas Fielding

2000

Dissertation Committee:
Professor Richard N. Taylor, Chair
Professor Mark S. Ackerman
Professor David S. Rosenblum
REST

- Representational State Transfer (REST)

- *Architecture style of networked systems*

- Relies on basic Web protocols HTTP and MIME

- Example is the Web
REST Constraints

- **Addressability**
  - Each resource has URI

- **Stateless**
  - Each request contain all information necessary to understand request

- **Representations**
  - Resources have different representations: KML, JSON,…

- **Connectedness**
  - Representations can contain URIs

Richardson and Ruby, *RESTful Web Services*, O’Reilly
RESTful Web Service

- HTTP Envelope
- URI
  - HTTP methods
    - GET, POST, PUT, DELETE
  - HTTP Header
  - HTTP Response Codes
  - Returns Mime: JSON, KML, PNG, …
Why REST?

- It’s Web
- Get all the services provided by the Web
  - Searching
  - Pass through firewalls
  - Caching
  - Scaling/load balancing
- Including rich internet applications (RIA)
  - Adobe AIR
  - Google Gears
  - Silverlight
GeoREST open source project
GeoREST is Open Source
(www.geoREST.org)

GeoREST is a web-centric framework for distributing geospatial data. It allows RESTful feature-based access to spatial data sources, including full editing capabilities, through a MapGuide server or directly via FDO.

Examples of data sources:
- SHP
- SDF
- SQLite (FDO)
- PostGIS
- Oracle Spatial
- Microsoft SQL Server Spatial
- MySQL
- Any other FDO vector data source

Example output formats:
- GeoJSON
- XML
- PNG (MapGuide layers only)
- HTML (Template)
- KML (Template)
- GeoRSS (Template)
- CSV (Template)
- Any other templatable text-based format
GeoREST is Web Services

- Exposes FDO as web services
- Provides 3rd party application access to FDO data
FDO Enables Data sharing

**FDO** Allows you to connect natively to multiple spatial sources

- Parcel data from Oracle® databases
- Utility data from an SDF file
- Property data SQL Server™
- Zoning data ESRI® ArcSDE®
- Aerial photos

**FOSS4G Sydney**
GeoREST Architecture
Open Source
Geospatial Foundation

**Web Mapping**
- deegree
- Mapbender
- MapBuilder
- MapGuide Open Source
- MapServer
- OpenLayers

**Geospatial Libraries**
- FDO
- GDAL/OGR
- GEOS
- GeoTools

**Desktop Applications**
- GRASS GIS
- OSSIM
- Quantum GIS
- gvSIG

**Metadata Catalog**
- GeoNetwork

**Website**
WWW.OSGEO.ORG

FOSS4G
Examples of GeoREST applications
Slovenian Water Company
(JP Vodovod-Kanalizacija d.o.o.)

- Company required by government to report any problems with water
- Citizen can go to web site
- Identify the city ward or suburb in which he/she lives
- Find notifications of problems
http://share.vo-ka.si/iskanje/

Enter address to identify water region

## Vodooskrbna območja glede na četrtnje skupnosti

### Seznam najdenih četrtni

<table>
<thead>
<tr>
<th>Številka</th>
<th>Ime četrtni</th>
<th>Vodooskrbno območje</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>četrtna skupnost Bežigrad</td>
<td>Kleče, Hrastje, Jarški prod</td>
</tr>
<tr>
<td>46</td>
<td>četrtna skupnost Bežigrad</td>
<td>Kleče</td>
</tr>
<tr>
<td>47</td>
<td>četrtna skupnost Bežigrad</td>
<td>Jarški prod</td>
</tr>
</tbody>
</table>

Choose water region
http://share.vo-ka.si/mgrest/rest/data/cetrt/.html?
filter_1_and_like_D42_UIME=Šentvid&count=25&start=1 &submit=Išči

VODOOSKRBNABNA OBMOČJA GLEDE NA ČETRTNE SKUPNOSTI

SEZNAM NAJDENIH ČETRTI

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<th>Vodooskrbno območje</th>
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</thead>
<tbody>
<tr>
<td>53</td>
<td>Četrtna skupnost Šentvid</td>
<td>Šentvid</td>
</tr>
<tr>
<td>54</td>
<td>Četrtna skupnost Šentvid</td>
<td>Šentvid</td>
</tr>
<tr>
<td>55</td>
<td>Četrtna skupnost Šentvid</td>
<td>Šentvid</td>
</tr>
<tr>
<td>56</td>
<td>Četrtna skupnost Šentvid</td>
<td>Šentvid</td>
</tr>
<tr>
<td>57</td>
<td>Četrtna skupnost Šentvid</td>
<td>Kleče</td>
</tr>
</tbody>
</table>

Nazaj na iskanje

Retrieve problem reports
Retrieve water district maps

http://share.vo-ka.si/mgrest/rest/data/vodarna/H.html
http://share.vo-ka.si/mgrest/rest/data/vodarna/H.xml

XML

Retrieve water district maps
http://share.vo-ka.si/mgrest/rest/data/vodarna/H.json

Retrieve water district maps
http://share.vo-ka.si/mgrest/rest/data/vodarna/H.png

PNG

Retrieve water district maps
Use Google CTemplate Files

- cetrt.tpl is template for single result for one city ward
- cetrti.tpl is result when query returned multiple city wards
- vodarna.tpl is result html template for single water district
Nanaimo Geodata Reporting

Business Problem

• Reporting – simple, no programming access to geodata in NanaimoMap

• Support Google Search - Provide users to search for public geodata without having to learn a new query system

• Open data access - Provide geospatial data in a variety of "Neo-Geography" formats like KML, GeoJSON, …
Nanaimo Geodata Reporting

Solution

• RESTful web services architecture of GeoREST

• Access to data configured via XML and Google CTemplate to deliver multiple representations (KML, GeoJSON, …) of the same feature with no programming.

Development

• SL-King and City of Nanaimo
http://maps.nanaimo.ca/data/property/

<table>
<thead>
<tr>
<th>Property Search</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nanaimo Properties by Street</strong></td>
<td></td>
</tr>
<tr>
<td><strong>House Number:</strong></td>
<td>(example: 455)</td>
</tr>
<tr>
<td><strong>Street Name:</strong></td>
<td>(example: Wallace)</td>
</tr>
<tr>
<td><strong>Search</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Nanaimo Properties by Folio Number</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Folio:</strong></td>
<td>(example: 8096)</td>
</tr>
<tr>
<td><strong>Search</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Nanaimo Properties by Legal Plan Number</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Plan Number:</strong></td>
<td>(example: 584)</td>
</tr>
<tr>
<td><strong>Search</strong></td>
<td></td>
</tr>
</tbody>
</table>
http://maps.nanaimo.ca/data/property/.html?filter_1_and_equal_house=2323&filter_2_and_like_street=Rosstown&count=20&submit=Search
Google Search

Google Search Query: 2323 Rosstown

Results 1 - 10 of about 487 for 2323 Rosstown. (0.25 seconds)

2323 ROSSTOWN ROAD, Nanaimo, BC Property Report (05536130)
Map of 2323 ROSSTOWN ROAD, Nanaimo BC View as KML (Google Earth). Folio:
2323, Plan: 2434 Size: 29 ACRES. Legal Description: LOT 7, SECTION 18 AND ...
maps.nanaimo.ca/data/property/116737.html - 6k - Cached - Similar pages

Nanaimo Property Search Results:
2323 ROSSTOWN ROAD, 05548065, Property Report - A-3. 2321 ROSSTOWN ROAD,
05536130, Property Report - D-3. 2323 ROSSTOWN ROAD, 05536130, Property Report ...
maps.nanaimo.ca/data/property/116737.html - 6k - Cached - Similar pages

Need help with a geeky movie shoot? - Page 2 - God Hates Fraggles ...
2323 Rosstown Rd. It's the second bus stop after you turn left off of ... 2323 Rosstown Road.
Take the #44 if you're a busser, and it's the second stop ...
godhatesfraggles.net/forum/showthread.php?p=38677 - 64k - Cached - Similar pages

May 2nd Meeting - God Hates Fraggles Forums
I went every last one of you to come to my house at 2323 Rosstown Road, stay overnight, and ...
have one last HELL OF A NIGHT to remember before my soul gets ...
godhatesfraggles.net/forum/showthread.php?p=453934 - 70k - Cached - Similar pages
More results from godhatesfraggles.net

Lewisberry, Pennsylvania new and used car dealers - Chevrolet ...
425 Rosstown Rd, Lewisberry, PA. Dressler's Electric Service (717) 938-4955 ... (717) 938-2323 2050 Old Trail Rd, Etters, PA. Dicks Radiator Service ...
pennsylvania-cars-sale.com/lewisberry/ - 15k - Cached - Similar pages
http://maps.nanaimo.ca/data/property/116707.html

### 2323 ROSSTOWN ROAD - PROPERTY REPORT

#### GENERAL INFORMATION

<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>2323 ROSSTOWN ROAD, NANAIMO, BC</td>
</tr>
<tr>
<td>Folio</td>
<td>05536.130</td>
</tr>
<tr>
<td>Plan</td>
<td>27484</td>
</tr>
<tr>
<td>Size</td>
<td>.29 ACRES</td>
</tr>
<tr>
<td>Legal Description</td>
<td>LOT 7, SECTION 18 AND 19, RANGE 7, MOUNTAIN DISTRICT, PLAN 27484</td>
</tr>
</tbody>
</table>

#### EXTENDED INFORMATION

<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoning</td>
<td>RS-1 - SINGLE FAMILY RESIDENTIAL ZONE</td>
</tr>
<tr>
<td>Garbage Pick-Up</td>
<td>Route: D-3</td>
</tr>
<tr>
<td></td>
<td>Number of Cans Allowed: 2</td>
</tr>
<tr>
<td>Sewer Benefitting Area</td>
<td>YES</td>
</tr>
<tr>
<td>GIS Link</td>
<td>116707</td>
</tr>
<tr>
<td>Location</td>
<td>49.19552, -123.9979</td>
</tr>
</tbody>
</table>

View other properties on ROSSTOWN ROAD, or search for other Nanaimo properties.
Summary

• Open data in government
  - encourages citizen engagement
  - promotes transparency and accountability
  - leads to economic development

• GeoREST provides web searchable access to raw geospatial data

• GeoREST API that can be used by web developers to embed open data access in their applications.
Building for a sustainable future