Redesigned EnviroMapper

A Services-Based Web Mapping Application of EPA Office of Water

Thomas (Tod) Dabolt
EPA Office of Water
Legacy EnviroMapper

- Developed using MapObjects 2.1
- Not easily integrated with web services
- Not designed to display multiple map resources
- Usage ≈ 870,000 hits/month ≈ 29,000 hits/day
- Some difficulties with maintenance & stability
- Costly to add enhancements
EnviroMapper for Water

- EPA Office of Water environmental management and geospatial analysis tool
- Integrated platform for generating maps and exchanging data with program web services
- Supports cross-program analysis
- Helps assess progress against Office of Water strategic goals and performance measures
- Publicly accessible
EnviroMapper for Water

- Web-based mapping application in ArcGIS Server 9.2
- Displays Office of Water & other geospatial data
  - National Hydrography Dataset
    - Watersheds, Catchments, Surface Water
  - EPA Office of Water program data
    - Water Quality Standards, Assessed Waters, Impaired Waters, Fish Consumption Advisories, etc.
  - EPA Regulated Facilities
  - Water Monitoring Stations
    - EPA STORET, USGS Surface & Ground Water
Redesigned EnviroMapper

• Look and feel of a Portal Application
• Interactive panels
• Dynamic callbacks to web services
• Seamless mapping functions
• Enhancement friendly architecture
Redesigned EnviroMapper

- Geospatial Query & Analysis Tools
  - Feature Selection by Point, Rectangle, or Polygon
  - Feature Identification with Complete Attribute Data

- Other Useful Tools
  - Return to PreviousExtent
  - Download Map Image, Print Map

- Full Metadata Records for Each Layer

- Integration with XML Web Services
High-Level System Architecture

XML Web Services

EnviroMapper

ASP.NET 2.0

ArcGIS Server

ArcMap

Documents

OGC WMS Service

Shapefiles

ArcSDE

ArcIMS
## Data Sources

### Spatial Feature Sources:

<table>
<thead>
<tr>
<th>Features &amp; Layers</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA Program System Data (RAD)</td>
<td>RAD/ArcSDE</td>
</tr>
<tr>
<td>National Hydrography Dataset (NHD)</td>
<td>RAD/ArcSDE</td>
</tr>
<tr>
<td>EPA Facility Registry System (FRS)</td>
<td>FRS ArcIMS Service</td>
</tr>
<tr>
<td>FWS National Wetlands Inventory (NWI)</td>
<td>OGC WMS Service</td>
</tr>
<tr>
<td>GlobeXplorer Satellite Imagery</td>
<td>OGC WMS Service</td>
</tr>
<tr>
<td>EPA Water Monitoring Stations (STORET)</td>
<td>RAD/ArcSDE</td>
</tr>
<tr>
<td>USGS Water Monitoring Stations</td>
<td>XML Web Service</td>
</tr>
<tr>
<td>Ecological Boundaries</td>
<td>Shapefiles</td>
</tr>
<tr>
<td>Transportation &amp; Political Boundaries</td>
<td>NAVTEQ &amp; Census Shapefiles</td>
</tr>
</tbody>
</table>
**Query Result Sources:**

<table>
<thead>
<tr>
<th>Feature Queries</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA Water Monitoring Stations (STORET)</td>
<td>STORET XML Web Service</td>
</tr>
<tr>
<td>USGS Water Monitoring Stations</td>
<td>USGS XML Web Service</td>
</tr>
</tbody>
</table>
HTTP user launches EMR

EMR web server specifies available web services

EMR sends request to each web service to know their list of available methods

XML response from the web services on their available methods
HTTP user launches EMR

EMR web server specifies available web services

EMR sends request to each web service to know their list of available methods

XML response from the web services on their available methods

HTTP/HTTPS/FTP user executes Report Query which calls specified program web service method

Program Web Service method returns report query results in XML/HTMOL format
Detailed System Architecture

1. HTTP user launches EMR
2. EMR web server specifies available web services
3. EMR sends request to each web service to know their list of available methods
4. XML response from the web services on their available methods
5. HTTP/HTTPS/FTP user executes Report Query which calls specified program web service method
6. Program Web Service method returns report query results in XML/HTMOL format
7. Interaction between query results and maps; EMR highlights and zooms to selected features on Map Canvas (if required)
8. HTTP/HTTPS/FTP user clicks on link or button to filter query results, which executes another program web service method and repeats steps 6 and 7
Feature Identification

Clicking the map displays attribute data for all features found at that point.

User can select and zoom to each of the identified features.
Feature Selection by Polygon

STORET XML Web Service
Response

U.S. Environmental Protection Agency
Integration with XML Web Services

- Standards-based web services are pluggable through application config
- Interoperability and data sharing using HTTP, AJAX, SOAP, XML Stylesheets, JavaScript Object Notation (JSON)
- Supports and encourages integration of data within EPA’s service-oriented architecture
Integration with XML Web Services

Selecting features on the map triggers the option to run reports.
Integration with XML Web Services

Results from XML Web Services can be identified and shown on the map.
Development Challenges

• **Caching in ArcGIS Server**
  – ZoomLevel tool requires a cached service
  – Time and disk space requirements are prohibitive

• **ArcIMS Services**
  – ArcIMS API differs in subtle ways from ArcGIS Server API
  – Scale dependencies are not displayed in TOC

• **GlobeXplorer WMS Service**
  – Direct connection in ADF doesn’t work, must use .mxd
Future Enhancements

• **Performance**: Monitor server load and move ArcGIS Server onto separate machine

• **Web Services**: Add more interfaces to external web services and build in tighter integration

• **Database Design**: Provide ‘generalized’ layers from highly detailed spatial features for display at lower zoom scales

• **Data Exchange**: Generate KML and pass to Google Maps with attribute data in info window
Thanks for Coming

Tod Dabolt
EPA Office of Water
dabolt.thomas@epa.gov
202-564-1450
Zoom to Geographic Features

- **Latitude/Longitude**
- **State**
- **County**
- **Watershed**
- **Zipcode**

Additional slide for any future presentation.