Best Practices for Designing Effective Map Services

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• Web Mapping & Service Types
• Open Data Service Best Practices
• Matt Sokol: MD iMap Services
• Performance Tips
• Advanced Capabilities
Web Mapping Services
Step 1: Organize data into logical groupings

**Operational Layers**
- Show a focused item of interest
- Support functionality of the application
- Displayed on top of base map

**Basemaps**
- Geographic frame of reference
- Contain static vector and raster data
- Reusable in multiple applications
## Web Map Layer Options

<table>
<thead>
<tr>
<th>Layer groups in WebMap</th>
<th>Options to display map service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basemap layers</td>
<td>As tiled/cached map service</td>
</tr>
<tr>
<td></td>
<td>- Pre-drawn map tiles</td>
</tr>
<tr>
<td></td>
<td>- Industry standard for basemaps (e.g. ArcGIS Online, Google, Yahoo, Bing Map etc.)</td>
</tr>
<tr>
<td>Operation layers</td>
<td>As tiled/cached map service (some limitations)</td>
</tr>
<tr>
<td></td>
<td>As dynamic map service</td>
</tr>
<tr>
<td></td>
<td>- Server retrieves data, draws an image, sends image to client</td>
</tr>
<tr>
<td></td>
<td>As Feature Layer (aka client side graphics)</td>
</tr>
<tr>
<td></td>
<td>- Drawn on the client side</td>
</tr>
<tr>
<td></td>
<td>- Server sends features with geometries and attributes</td>
</tr>
</tbody>
</table>
Image caching

- Pre-Render map as a series of smaller images
- Best Performance & scalability
- Tiles leverage fast browser retrieval
- Complex cartography with no user time delay

Disadvantages of Caching:
- Additional server-side storage
- Additional workflow steps to incorporate data updates (recreate the cache)

Best for datasets that aren’t updated often
Vector Tiles

• **Vector data can remain vector**
• **Display quality**
  - Best possible resolution for Retina displays
  - Small efficient format
• **Dynamic labeling**
  - Clearer, more readable text
  - On the fly labeling for heads up display
• **Map Styling**
  - Streets, Topo, Canvas from one tileset
  - Day and Night mode
  - Restyling
What should you use dynamic map service for?

• Benefits
  - No additional overheads upfront
    - and when data gets updated

• Ideals:
  - For real-time or frequently changing data
  - To serve medium volume of traffic

• Disadvantages
  - Additional expense to read data and generate images for each request
Feature layer / Client side graphics

- Features drawn in browser as vectors

- Benefits
  - Server off loads works to the client app

- Ideals:
  - Interactive operational layers for mashups
  - Query or geoprocessing results
  - Layers that need to be thematically symbolized on the fly
  - Web editing: Feature Services

- Disadvantages
  - Not suitable for larger dataset

- Source Service types:
  - Map services
  - Feature services
Open Data Services
Open Data Considerations

• Data-centric view
• Access to Features
  - Table
  - Map
• Download & API links
Getting data ready from ArcMap

- Humanize your attributes: use attribute aliases
Getting data ready from ArcMap

- Humanize your attributes: use attribute aliases
- Hide unnecessary or empty fields
  - Keep ObjectID
This service contains fish attractors. The attractors (points) contain attributes that provide detail about each attractor.

**DATASET ATTRIBUTES**

- **DD_XCOORD**
  - Type: Number
  - min: -94.79, max: -90.28, avg: -93.31, count: 3,580

- **DD_YCOORD**
  - Type: Number
  - min: 36.24, max: 40.5, avg: 37.27, count: 3,580

- **DMS_XCOORD**
  - Type: Text
  - min: 0, max: 2,014, avg: 1,398.09, count: 3,572

- **DMS_YCOORD**
  - Type: Text

- **GENERATE_I**
  - Type: Text

- **year_place**
  - Type: Number

- **material**
  - Type: Text

- **GPS_Date**
  - Type: Date or Time
  - 01/10/1111 to 02/19/2014

- **utm_x**
  - Type: Number
  - min: 348,366, max: 742,523.27, avg: 472,944.73, count: 3,580

- **utm_y**
  - Type: Number
  - min: 4,011,181.22, max: 4,484,293.22, avg: 4,125,121.86, count: 3,580

**TAGS**
- MDC | Department of Conservation | fish attractors | fishing | Missouri lakes

**DATASET FOUND IN**
- Tilmanns Open Data Example
- Open Data Institute Queensland
Getting data ready from ArcMap

- Humanize your attributes: use attribute aliases
- Hide unnecessary or empty fields
  - Keep ObjectID
- Enable Static Layer IDs
Enabling Static Layer IDs

In ArcMap, set *Data Frame Properties* ...

.... this will ensure that Layer IDs are unique (as usual) and will preserve the IDs originally assigned.

By default the option is unchecked.

In the *Layer Properties* you can assign your own ID if you like. ArcGIS will ensure it is unique.
Let’s talk server and services

- Latest is greatest (but definitely need 10+)
- Service parameters
  - Max record count should be less than 5,000
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- Service capabilities
  - Enable WMS, WFS, WCS (where applicable)
  - Turn off feature access if not needed
Let’s talk server and services

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• Organize datasets into multiple services
  - No more than 20 to a service
  - A unique title for each dataset

• Must be publicly accessible
Registering data and editing metadata

- Register individual layers over full services
  - Gives greater and easier control of metadata
- Title, description, access and use constraints (license), tags
- License: Creative Commons is ideal!
- Add structured metadata on ArcGIS Online
  - Accessible from dataset page and included in shapefile downloads
MD iMAP

EXPANDING THE REACH OF MARYLAND’S GIS DATA AND SERVICES

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WHAT IS MD iMAP?

• Maryland’s Enterprise GIS Platform
• Collaborating with Maryland partners to provide...

  ◦ Map Services
  ◦ Portal
  ◦ Imagery
  ◦ ArcGIS Online
  ◦ LiDAR

  ◦ Composite Locator
  ◦ API Driven Applications
  ◦ Dashboards
  ◦ Open Data
  ◦ Mobile
UNDERSTANDING YOUR USER BASE

Who Are My Users?
- Government
- University & Regional
- Private

How Do They Access Data?
- Software
  - ArcGIS Desktop
  - Open Source GIS
  - Google Products
  - CADD
- Web
  - API Driven Applications
  - Open Data Platforms

What Do They Do With Data?
- Research, Planning and Analyze
- Build Custom Applications
- Maintain Safety and Operations
• Metadata is Key!

• Minimum, Standard Items
  ◦ Owner, Description/Summary, Last Updated
  ◦ Keywords/Tags
  ◦ Access Use and Constraints ... i.e., the fine print

• Levels of Metadata in MD iMAP
  ◦ Feature Class
  ◦ Feature Dataset
  ◦ Layer
  ◦ Service
SERVICE CAPABILITIES

• Expose Data and Services to Our Customers
  ◦ Esri
    – Map Services with Dynamic Workspaces
    – Feature Services with Query Capability
  ◦ OGC
    – WMS
      • Web Mercator, WGS 1984, State Plane (Meters/Feet)
    – WFS
      • Downloadable
  ◦ KMZ/KML
FEDERATION WITHIN MARYLAND

MD iMAP REST Services
geodata.md.gov/imap

GIS Data Catalog (ArcGIS Open Data)
data.imap.maryland.gov

MD Open Data Portal
data.maryland.gov
FEDERATION BEYOND MARYLAND GIS

GIS Data Catalog
(ArcGIS Open Data)
data.imap.maryland.gov

GIS Inventory
NSGIC Data Catalog
gisinventory.net
TYING IT ALL TOGETHER

Metadata

Layer Level
Feature Class Level
Feature Dataset
Service Level

Capabilities

OGC
Esri Feature Service
KMZ/KML

Sharing

ArcGIS Open Data
ArcGIS Online
Socrata Open Data
Open Source

Applications

ArcGIS Desktop
Open Source
CADD
Web APIs

MAXIMUM ACCESSIBILITY TO YOUR CUSTOMERS
Performance Tips
Performance Tips – Mapping

- Cache
- Prefer Annotation over dynamic labeling
- Avoid on-the-fly projection
- Scale dependent layer visibility
Performance Tips – Geodatabase

- Use File Geodatabase over Enterprise Geodatabase
  - Use local copy on GIS server over network share

- For joins
  - Keep both target and destination tables in the same database

- Enterprise Geodatabase tips
  - Tune e.g. update statistics
  - Use direct connection
Index

- Update Spatial Index

- Have indexes on Field(s)
  - Used in attribute query
  - Used as ‘primary’ or ‘foreign’ fields in a join

- Note:
  - Indexes are ignored when a field is used in a SQL methods etc.
  - e.g. WhereClause is “month(date) = 10”
Query tips

- Avoid requesting all attributes unless you have to
Automating publishing map services

- Python – ArcGIS’s scripting language
  - Arcpy.mapping – automate publishing
  - ArcRest, AGO-tools – work with Server Admin API to control services
- Automate publish, start, stop map services
  - http://tinyurl.com/nnz4obq
  - http://tinyurl.com/opp2glg
  - http://tinyurl.com/nqj5h43
- The Server Admin Toolkit
  - http://tinyurl.com/78hg32c
Advanced Capabilities
Dynamic layers

- Simple updates to the map service
  - Remove layers or reorder layers

- Thematic mapping
  - Updates to renderers
  - Change data sources – including joins

- Adding content to the map service
  - Add data from registered workspaces
  - Including query layers

- per-request changes to the map
  - Server side change
  - Stateless

- Optional capability of map services
Server Object Interceptors (SOI)

ArcGIS Pro  
Operations Dashboard  
ArcGIS Collector  
ArcGIS Explorer

Server Object **Interceptor**

Web services
Potential use-cases

**Security**
- Layer-level or operation-level access control
- Extent/AOI-based masking
- Query response trimming/enriching
  - Attribute or Geometry
- Watermarks, classifications, personalization
- Auditing, logging

**Data and business integration**
- Integrate external data and business systems
- Input validation and output (post-)processing
- Inject advanced, custom functionality
  - Switch implementation – route specific operation to external entity
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Scroll down to find the survey

Complete Answers and Select “Submit”
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Smithsonian National Museum of the American Indian

Thursday, 6:30 p.m. – 9:30 p.m.
Bus pickup on L Street
Print your customized Certificate of Attendance
Print stations located in the 140/150 Concourse