Caching Imagery Using ArcGIS

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Presentation Goals

• Publish cached services from imagery on premise using ArcGIS server

• Publish tiled map services from imagery on ArcGIS Online

Discuss caching methods, workflows, best practices
Review of Imagery Caching Workflows

- Cache image service on premise using ArcGIS server
- Cache map service on premise and ArcGIS Online
- Cache on Desktop and publish on ArcGIS Online
- Cache using ArcGIS server and publish on ArcGIS Online
- Re-use tile cache for cached services on premise
Concept Review - Mosaic Dataset

A GDB data model used to manage and process a collection of images

- Add data using raster type
- Contain many items which reference images
- Process images on-the-fly using raster functions
- Mosaic images on-the-fly

• Authored from Desktop
  - Using Geoprocessing tool
  - ArcGIS Editor license
Concept Review - Image Service

- An ArcGIS Server service for serving raster data

**Sources of image service**
- Mosaic datasets, raster datasets
- Mosaic layer and raster layer
- Publish from mosaic dataset requires ArcGIS for Server Image Extension license

**A dynamic service**
- On-the-fly image processing
- Data for analysis
- Image cataloging

**A cached image service**
- Background layer
- Fast display
Function Template

• A template (.rft.xml) file stores a raster function
• Raster function – description of an image process
  - Processing pixels at run time
  - Stretch, Hillshade, Shaded Relief, Renderer functions, etc.
  - Add to the mosaic dataset or items
  - Produce good visualization for caching
• Register as server raster functions for image service
  - Cache generation takes the default function
  - Provide dynamically server side processing
Mosaic Dataset – Mosaic Method

- Define the display order of rasters in a mosaic dataset
  - North west,
  - By Attribute,
  - Seamline, etc
- Mosaic operators
- A property of mosaic dataset
- Affect cache display
Mosaic Dataset – Visible Ranges

<table>
<thead>
<tr>
<th>OID</th>
<th>Shape</th>
<th>Raster</th>
<th>Name</th>
<th>MinPS</th>
<th>MaxPS</th>
<th>LowPS</th>
<th>HighPS</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Polygon</td>
<td>&lt;Raster&gt;</td>
<td>P01.met</td>
<td>0</td>
<td>400</td>
<td>10</td>
<td>40</td>
<td>Primary</td>
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<tr>
<td>2</td>
<td>Polygon</td>
<td>&lt;Raster&gt;</td>
<td>P02.met</td>
<td>0</td>
<td>400</td>
<td>10</td>
<td>40</td>
<td>Primary</td>
</tr>
<tr>
<td>3</td>
<td>Polygon</td>
<td>&lt;Raster&gt;</td>
<td>filename1.tif</td>
<td>400</td>
<td>4000</td>
<td>400</td>
<td>400</td>
<td>Overviews</td>
</tr>
<tr>
<td>4</td>
<td>Polygon</td>
<td>&lt;Raster&gt;</td>
<td>filename2.tif</td>
<td>400</td>
<td>4000</td>
<td>400</td>
<td>400</td>
<td>Overviews</td>
</tr>
</tbody>
</table>

- **MinPS** and **MaxPS** define the visible ranges
- **Pyramids** resampled pixels added to sources images
  - Increase **HighPS** and **MaxPS**
  - Speed up display
  - Good for dynamic service
- **Overviews** add new rows in the footprint table
  - Increase levels of details
  - Good for dynamic service

Cell size=30, pyramids
Cell size=500, overviews
Cell size=5000, blank
Building Mosaic Datasets for Caching Tips

• Pyramids
  - Suggested for on-demand image service caching
  - Not required if mosaic dataset is only for pre-caching

• Statistics
  - Do not calculate for processed images (DOQQ, NAIP, etc)
  - Suggested for some sensor images (16bit)
    - Use 2x2 skip factor for Gram-Schmidt pansharpen method

• Use color correction and seamlines techniques to make good looking mosaic dataset
Building Mosaic Datasets for Caching Tips (continue)

- **Overviews**
  - Required for caching from map
    - mosaic dataset needs to be visible at all cache levels
  - Required for on-demand image service caching
  - NOT required for pre-caching from imagery

- **Adjust the renderer in Map for cache display**
  - Save a layer (.lyr)
    - Cache rendered pixels
    - Applies to image service and Desktop cache
  - Save a renderer function (.rft.xml)
    - Applied to image service only
Authoring a Mosaic Dataset
Why We Cache?

• Speed up display and data access
  - Burn process chain in cache tiles
  - Store tile in compressed/fast performed format
  - Reduce storage
  - Retrieve and draw image tiles directly

• Used for applications of less change
  - A snapshot of data at given time
  - A snapshot of given mosaic method
  - A snapshot of given renderer
Tile Cache

- A format stores cached tiles and used by image service cache, map cache, desktop Tile Cache tool

- A folder that contains cached image tiles
  - Stored as one sub folder per scale
    - Compacted or exploded
  - A tiling scheme at which these tiles are created
    - Projection, scales, tile size, format
Tile Cache – a Raster Dataset

- A raster dataset
  - Browse in Catalog
  - Copy/Paste
  - Display in Map

- A format that stores large raster dataset on disk
  - No size limit
  - Fast
  - Compact (save space)
  - Limited to 3 bands and 8 bit
Tilling Scheme for Imagery

• Projection
  - Web Mercator (ArcGIS Online)
  - Same as dataset
    - Use reference mosaic dataset to redefine if different
    - Add Reproject raster function

• Scales (cell sizes)
  - Minimum cell size of cache should be comparable to the cell size of the data

• Format
  - Mixed (default), JPEG
  - Default compression quality = 75
Cache Generation Process from Imagery

- **From bottom up**
  - Tiles can be resampled from previous cache levels
  - Speed up cache generation
  - Overviews are not required

- **Maximum source cell size**
  - Above it, tiles resampled from existing cache tiles
  - Below it, tiles computed from source data
  - Not set, system to compute

- **Not applicable for .mxd input**
  - Mosaic dataset be visible at all cache levels
Maximum Source Cell Size (MSCS)

System default MSCS

Set MSCS

MSCS

Mosaic Dataset

Cache

300m

MSCS

MSCS

Mosaic Dataset

Cache

300m

30m

30m
Create a Tile Cache Using Desktop

- **Tile Cache tools on Desktop**
  - Does not need server license
  - Parallel processing

- **Generate tile cache from**
  - mosaic dataset, raster dataset, .lyr
  - .mxd (10.2)

- **Step to generate**
  - Define scheme using Generate Tile Cache Tiling Scheme tool (optional)
  - Generate using Manage Tile Cache tool
    - Optionally to use default tiling scheme
Create Tile Cache using Desktop Tools
### On Premise: Image Service Cache vs. Map Service Cache

<table>
<thead>
<tr>
<th>Method</th>
<th>RRD</th>
<th>OVR</th>
<th>Resample from cache</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image service</td>
<td>optional</td>
<td>Not required</td>
<td>Maximum source cell size</td>
<td>dynamic and cached services</td>
</tr>
<tr>
<td>Map service</td>
<td>optional</td>
<td>yes</td>
<td>No</td>
<td>Mixed layers</td>
</tr>
</tbody>
</table>

- **Image service cache**
  - Save time on overview generation, fast in generating cache tiles
  - One service serve both dynamic and cached service

- **Map service cache**
  - Can combine cache with feature layer for metadata
  - Building overviews for mosaic dataset takes additional time
On Premise: Publishing a Cached Image Service

1. From the mosaic dataset created, save a renderer function template

2. Publish an image service
   Mosaic method
   Set server function
   …

3. Define tiling scheme
   Web Mercator, Mixed format, scales
   Maximum source cell size
4. Generate cache using Map Cache tools
   - All tools support image service
   - Caching status

• Other ways to generate cache
  - Generate during publishing
  - Generate on-demand
    - Mosaic dataset must be visible at all defined scales (overviews)
On Premise: Publishing a Cached Map Service Using a Tile Cache

1. Publish a map service that contains feature class layer
2. Importing the tiling scheme from the tile cache
   Conf.xml
3. Publish and use “generate later” option
4. Import the tile cache
   - Or Copy the tile cache folder to ArcGIS server map cache folder
   - Rename to be “Layers”
Create an image service cache
ArcGIS Online: Two Ways to Publish Tile Service

• Publish from map and cache tiles at ArcGIS Online
  - Simple to use
  - Copy source images and overviews
  - Store source images and cache tiles
  - Useful for image data of small size

• Create tile cache and upload the cached tiles
  - Create tile cache using Desktop tool
    - Or use ArcGIS Server
  - QA the cache tiles before uploading
  - Only store cached tiles at ArcGIS Online
  - Useful for caching sensor data and image of large volume
ArcGIS Online: Publish from Tile Cache

1. Create a tile package from a tile cache
   - Use Export Tile Cache tool

2. Push the tile package to ArcGIS Online
   - Use Share Package tool
ArcGIS Online: Publish from Tile Cache (Continue)

- Log on to ArcGIS Online account
- Publish the item as a tiled map service
- Optionally, delete the tile package to save space
Share Imagery to ArcGIS Online
Tip #1: Use Tile Cache as Mosaic Dataset

Overviews

• Skip building overviews during authoring mosaic datasets
• Cache it using Tile Cache tool or image service
• Add the tile cache back to mosaic dataset

• Applied to images of 3 bands
Tip #2: Avoid Generating Cache for NoData Area Using Mosaic Dataset Boundary

- Export mosaic dataset boundary as a feature class
- Generate cache at the designed scales with the exported boundary as AOI
Tips #3 Getting Metadata from Mosaic Dataset for Cached Services

- Use feature class to provide the metadata for the cache
  - A layer in cached map service on premise
  - A feature service to create a web map with the cache layer on ArcGIS Online

- Getting the feature class from mosaic dataset
  - Join footprint table and seamline table
  - Export rows that contains seamlines
  - Remove the fields that are not needed
Tip #4 Updating Cache

• Use Generate Dirty Area tool to produce the AOI polygon
• Update cache for the area of AOI
  - Manage Tile Cache
  - Manage Map Service Cache tools

• Handling mosaic dataset expansion
  - Cache has extent defined at the beginning
  - Won’t update automatically with the source data change
  - Define a larger boundary when authoring the mosaic dataset
Tip #5 Improve Performance

- Avoid caching over the network
  - Generate cache on the same machine as source images
  - External driver is faster than over network

- Number of processes vs. disk speed
  - Limited by disk speed
Demo of Large AGS Online Service
Summary

- Image service cache is faster to generate for services on premise
- Generate Tile cache on Desktop is recommended way to publish cached service on ArcGIS Online
- Tile cache can be used to store large mosaic in file system
- Using maximum source cell size can really improve your caching speed from image data
Thank you…

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