



Caching Imagery Using ArcGIS

Hong Xu, Hua Wei

Technical Workshop

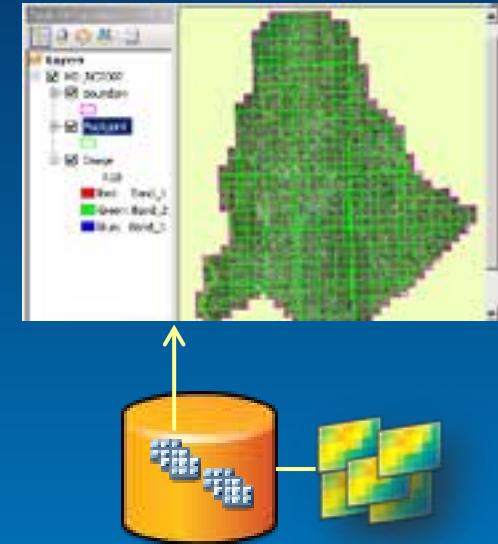
Presentation Outline

- **Why we cache imagery?**
- **Imagery caching methods**
- **Prepare mosaic dataset for caching**
- **Define caching scheme**
- **Typical caching workflows**
 - **Publish cached image service on premise**
 - **Publish hosted tile service on ArcGIS online**
- **Tips**

Types of Raster Data in ArcGIS

Three raster data model: raster dataset, mosaic dataset, and image service

- **Raster Dataset**
 - A single image: TIFF, JP2000, and HDF etc.
- **Mosaic Dataset**
 - A GDB model manages a collection of images
 - References images on disk, on-the-fly processing
 - Ortho-images (NAIP, DOQQ), Landsat, QuickBird, and etc.
- **Image service**
 - Serve raster data
 - Published from a raster dataset or a mosaic dataset
- **Used for**
 - Visual interpretation (basemap)
 - Analysis (classification, computation NDVI)



Properties of Raster Data: Mosaic Rule

Image Service and Mosaic Dataset

- Query rasters if AOI
- Sort based on mosaic methods
 - North west, By Attribute,
 - Seamline, etc
 - Close to center (Do NOT use for caching)
- Resolve overlaps with mosaic operators
 - First, Last, Mean



By center

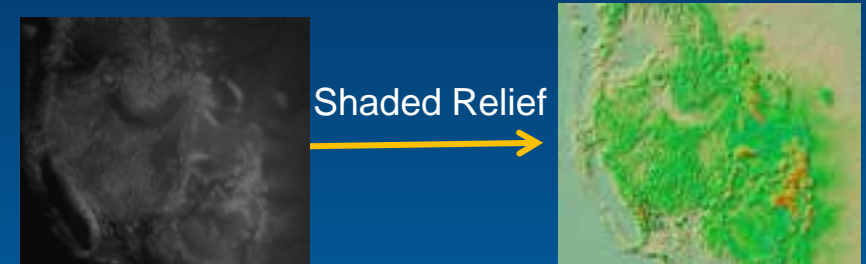


By Attribute

Properties of Raster Data – Raster Function Template (RFT)

Support on-the-fly processing

- A raster function defines a processing algorithm
 - Stretch, hillshade, NDVI, and etc.
- A RFT is a XML file that stores raster function(s)
 - Created in raster function template editor
 - Configure image service for on-demand server processing
 - Configure mosaic dataset (10.3)
- Define image service cache display
 - Save renderer as an rft.xml from Symbology page
 - Configure image service

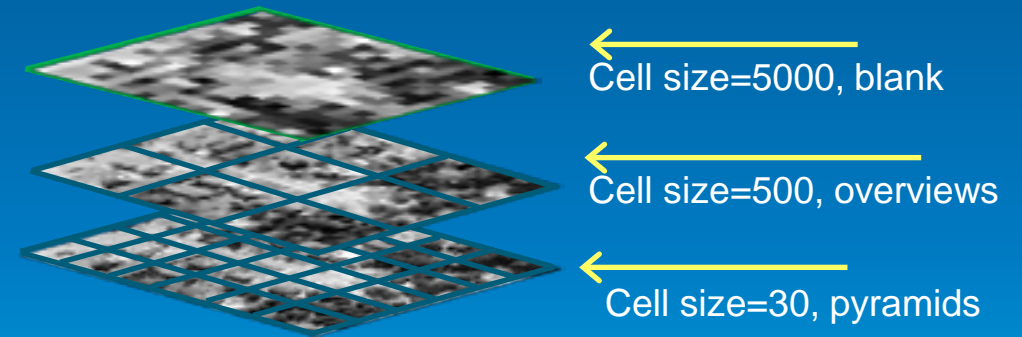


Mosaic Dataset and Image Service – Visible Ranges

Rasters are visible if displayed in a resolution within visible ranges

OID	Shape	Raster	Name	MinPS	MaxPS	LowPS	HighPS	Category	...
1	Polygon	<Raster>	P01.met	0	400	10	40	Primary	
2	Polygon	<Raster>	P02.met	0	400	10	40	Primary	
3	Polygon	<Raster>	filename1.tif	400	4000	400	400	Overviews	
4	Polygon	<Raster>	filename2.tif	400	4000	400	400	Overviews	

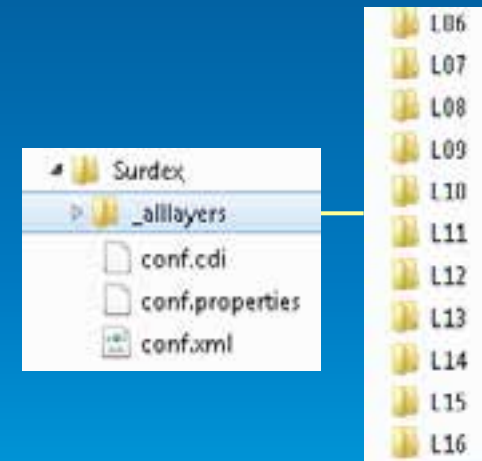
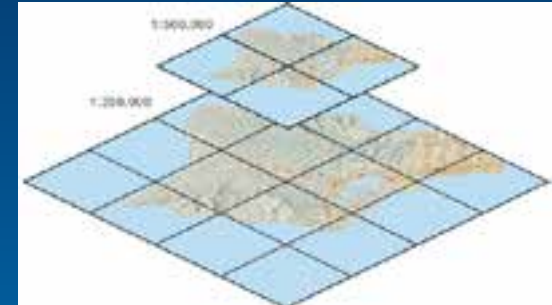
- MinPS and MaxPS define the visible ranges
- Pyramids resampled pixels added to sources images
 - Increase HighPS and MaxPS
 - Speed up display
- Overviews add new rows in the footprint table
 - Increase levels of details



Tile Cache

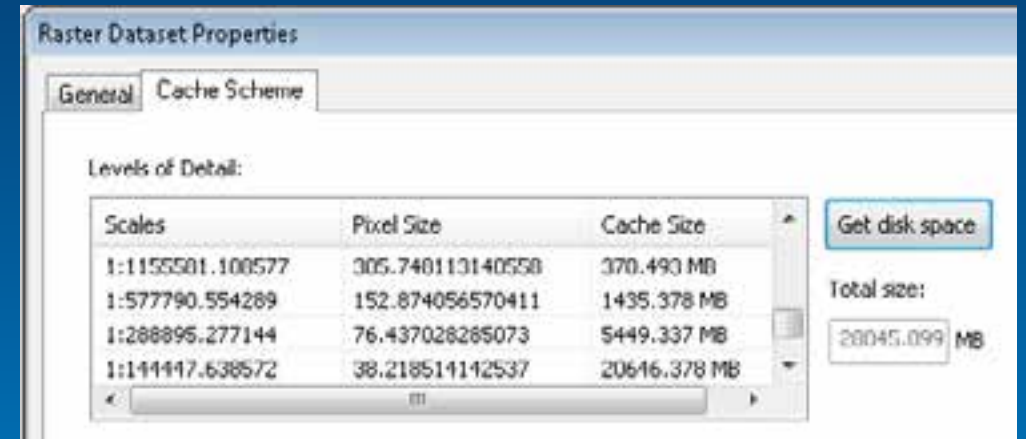
A format used to store tiled cache

- Break raster into small image tiles
- Tiles are created at given tiling scheme
 - Projection
 - Scales (cell size)
 - Tile size
 - Format
 - Cache extent
- Tiles are organized by sub folders
 - By scales



Tile Cache is a Raster Dataset

- A raster dataset
 - Browse in Catalog
 - Copy/Paste
 - Display in Map
 - 3 bands and 8 bit
- A way to store large raster dataset on disk
 - Compact and no size limit
 - Fast
 - An example
 - source images: 47.3G (3b, uncompressed, 0.6m),
cache size: 17G (level from 0.59, compression quality 75)



Why We Cache?

- **Speed up display**
 - **Burn process chain in cache tiles**
 - **Retrieve and draw image tiles directly, no additional process**
- **Reduce storage**
 - **Store tile in compressed/fast performed format**
- **Cache is a snapshot**
 - **Given mosaic method**
 - **Given renderer**
 - **Used for applications of less change**

Mosaic Dataset and Tile Cache



Presentation Outline

- Why we cache imagery?
- **Imagery caching methods**
 - **Review caching methods**
 - **Characteristics of caching imagery**
 - **Image service vs. map service caching?**
- Prepare mosaic dataset for caching
- Define caching scheme
- Typical caching workflows
 - Publish cached image service on premise
 - Publish hosted tile service on ArcGIS online
- Tips

Caching Methods

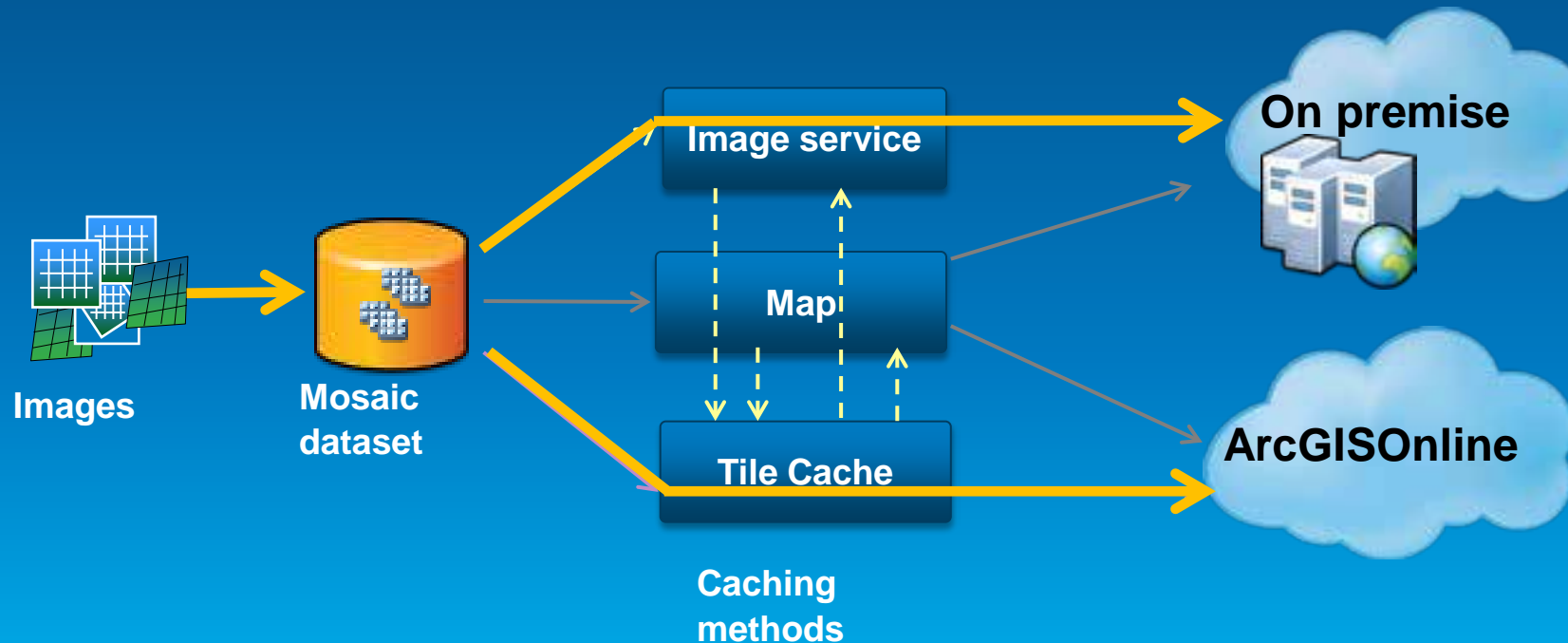
- **Cache using Desktop**
 - **Single machine, no need to use server**
 - **Cost effective**

- **Cache using ArcGIS Server**
 - **Image service and map service**
 - **Scalable, leverage multiple servers**

- **Cache online**
 - **Need to upload source data, not applied for large image collection**
 - **Consume ArcGIS online credit**

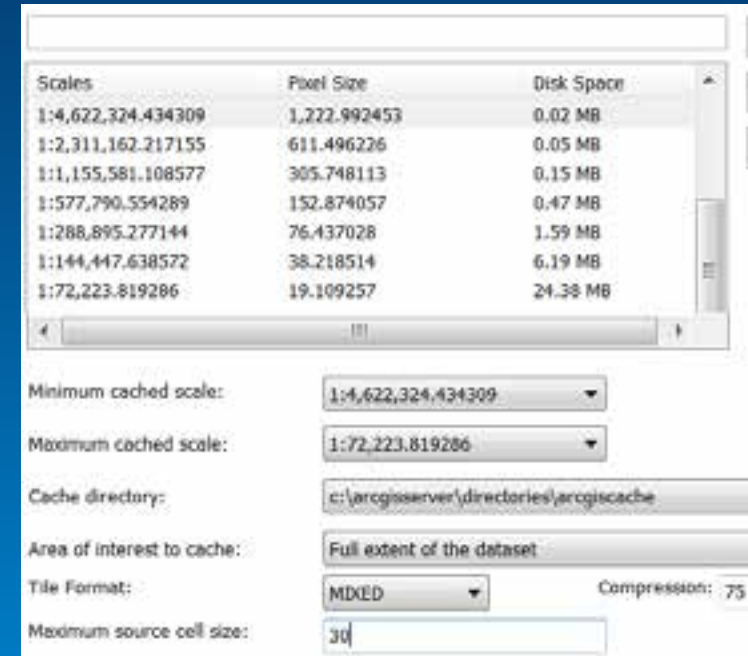
Imagery Caching Workflows

- 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

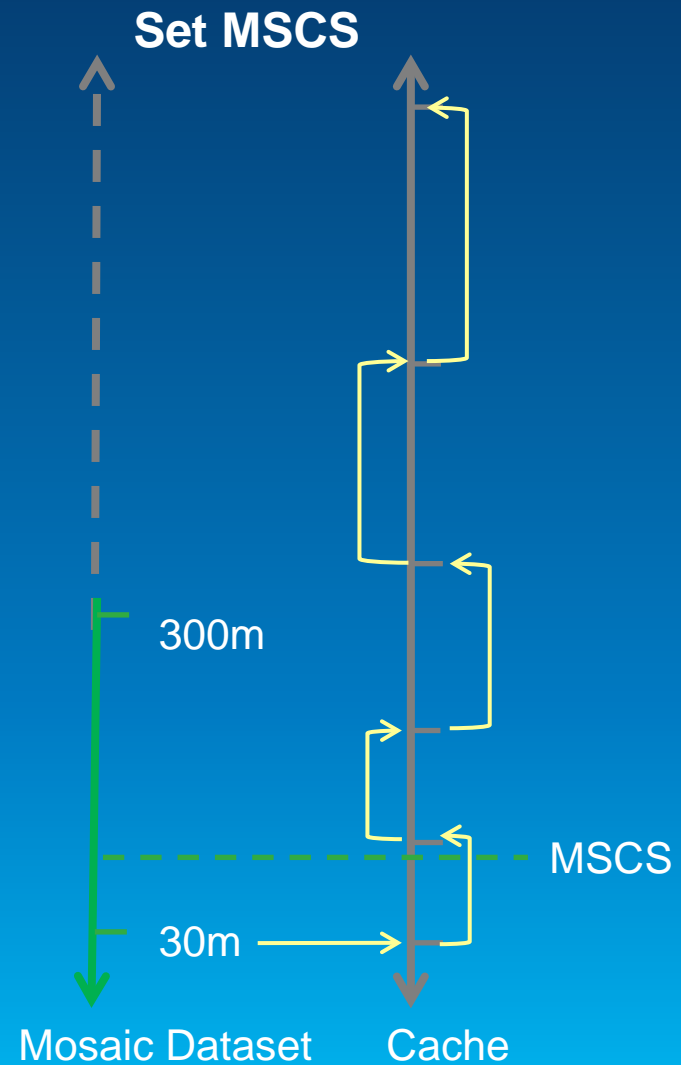
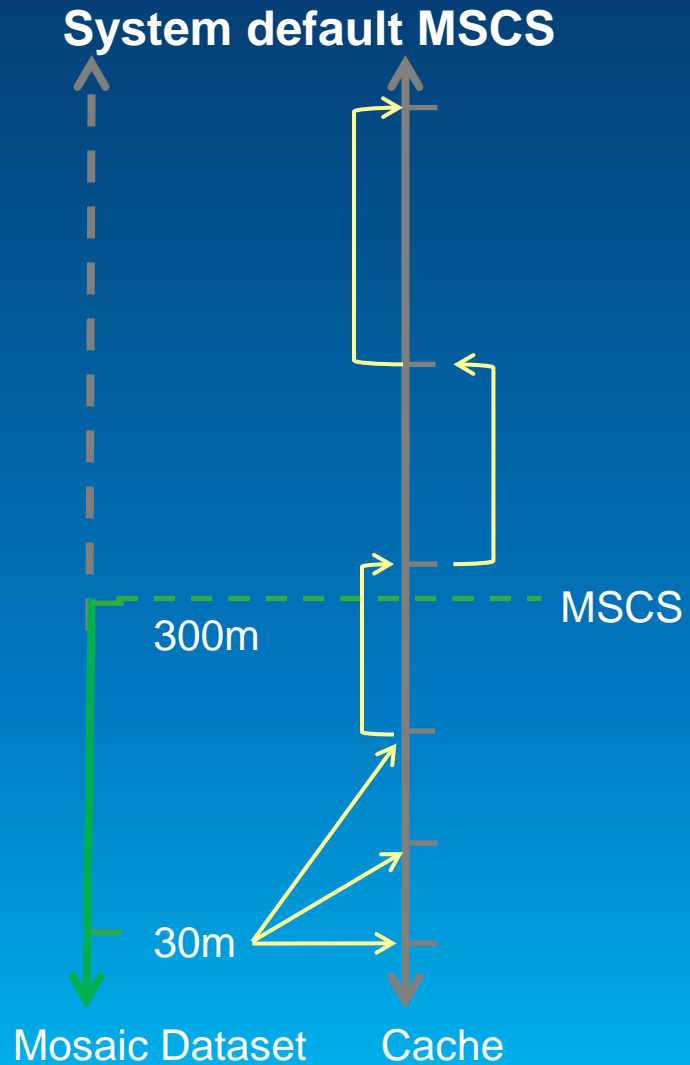


Cache Generation Process from Imagery

- **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)

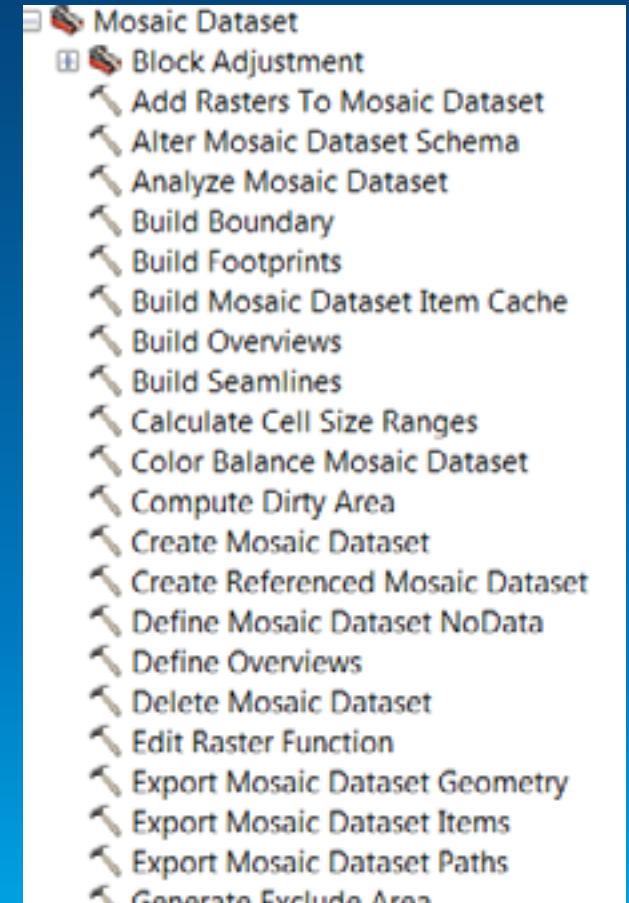


Presentation Outline

- Why we cache imagery?
- Imagery caching methods
- **Prepare mosaic dataset for caching**
 - **Pyramids and overviews**
 - **Make seamless mosaic**
 - **Techniques to define color for cache**
- Define caching scheme
- Typical caching workflows
 - Publish cached image service on premise
 - Publish hosted tile service on ArcGIS online
- **Tips**

Prepare Mosaic Dataset

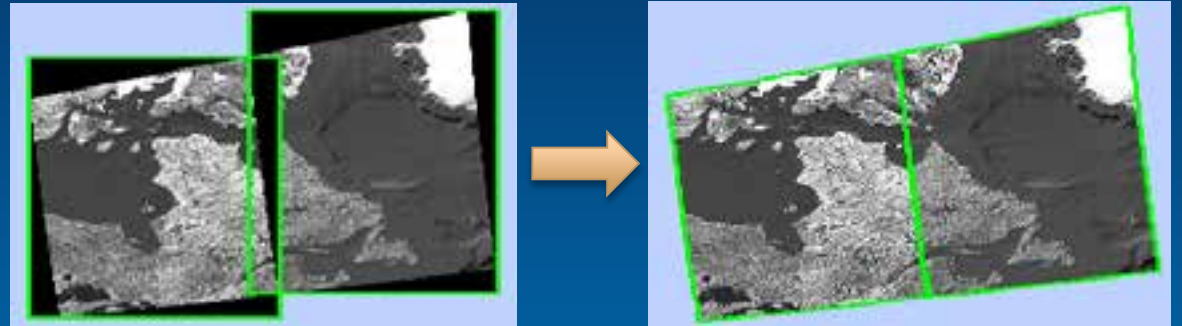
- **Create mosaic dataset**
 - **Web Mercator**
- **Add data**
 - **Do you build pyramids? Yes**
 - **Do you build statistics?**
 - **No for processed data: NAIP, DOQQ, etc**
 - **Yes for sensor data: Landsat, IKONOS, etc**



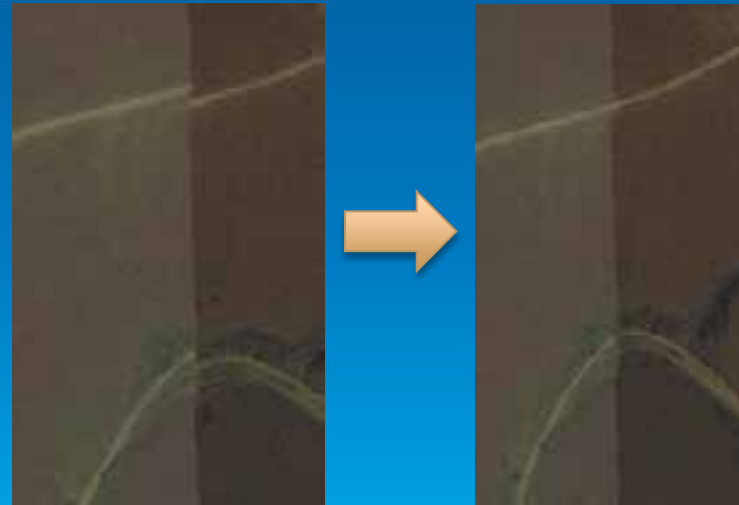
Prepare Mosaic Dataset

Perform operations to make it look good

- **Clip black corners using Build Footprint tool**



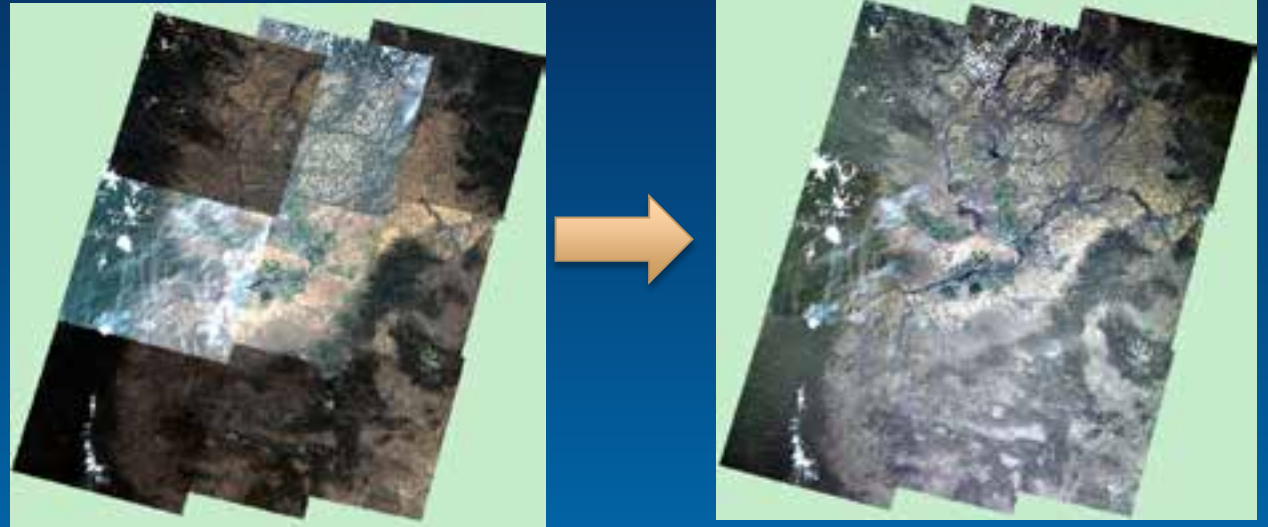
- **Resolve the shift using Block Adjustment toolset (new in 10.3)**



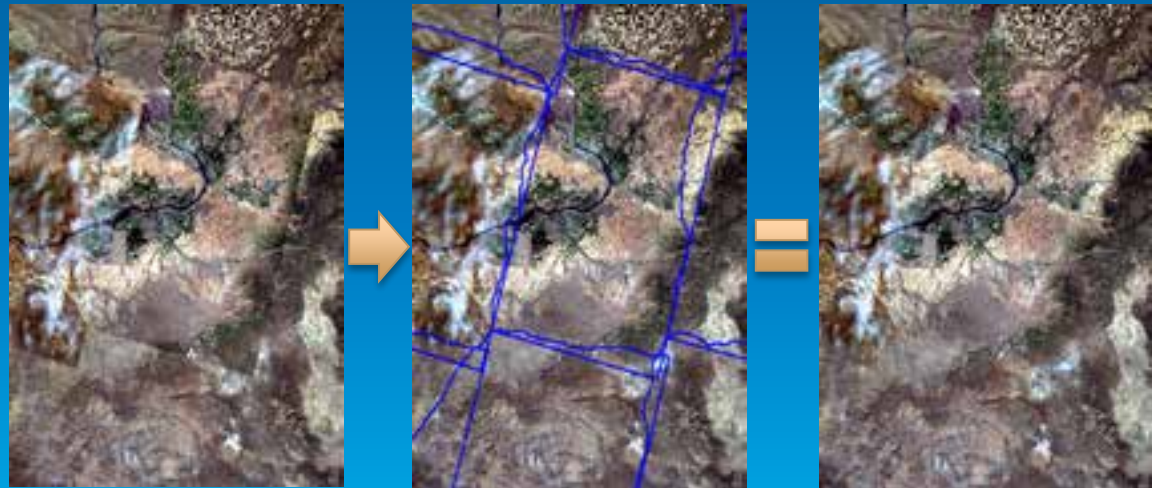
Prepare Mosaic Dataset

Perform operations to make it look good

- **Color correction using Color Balance Mosaic Dataset tool**



- **Generate Seamlines using Build Seamline GP tool**



Prepare Mosaic Dataset

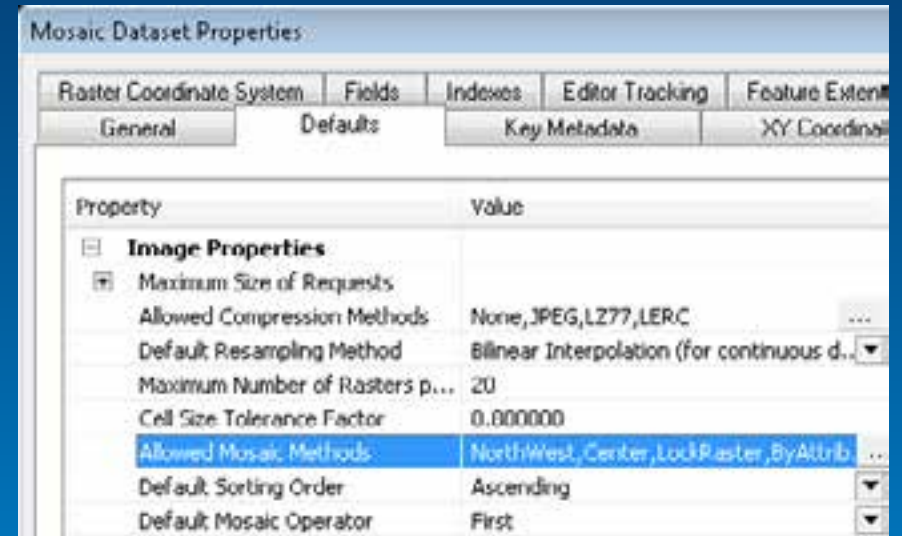
Overviews

- **Do I need to build overviews?**
- **Image service cache or desktop cache from mosaic dataset**
 - **No**
 - **Up level cache can be generated from previous cache level**
- **Map service cache or cache generated from .mxd**
 - **Yes**
 - **Mosaic dataset has to be visible at all cache levels**

Prepare Mosaic Dataset

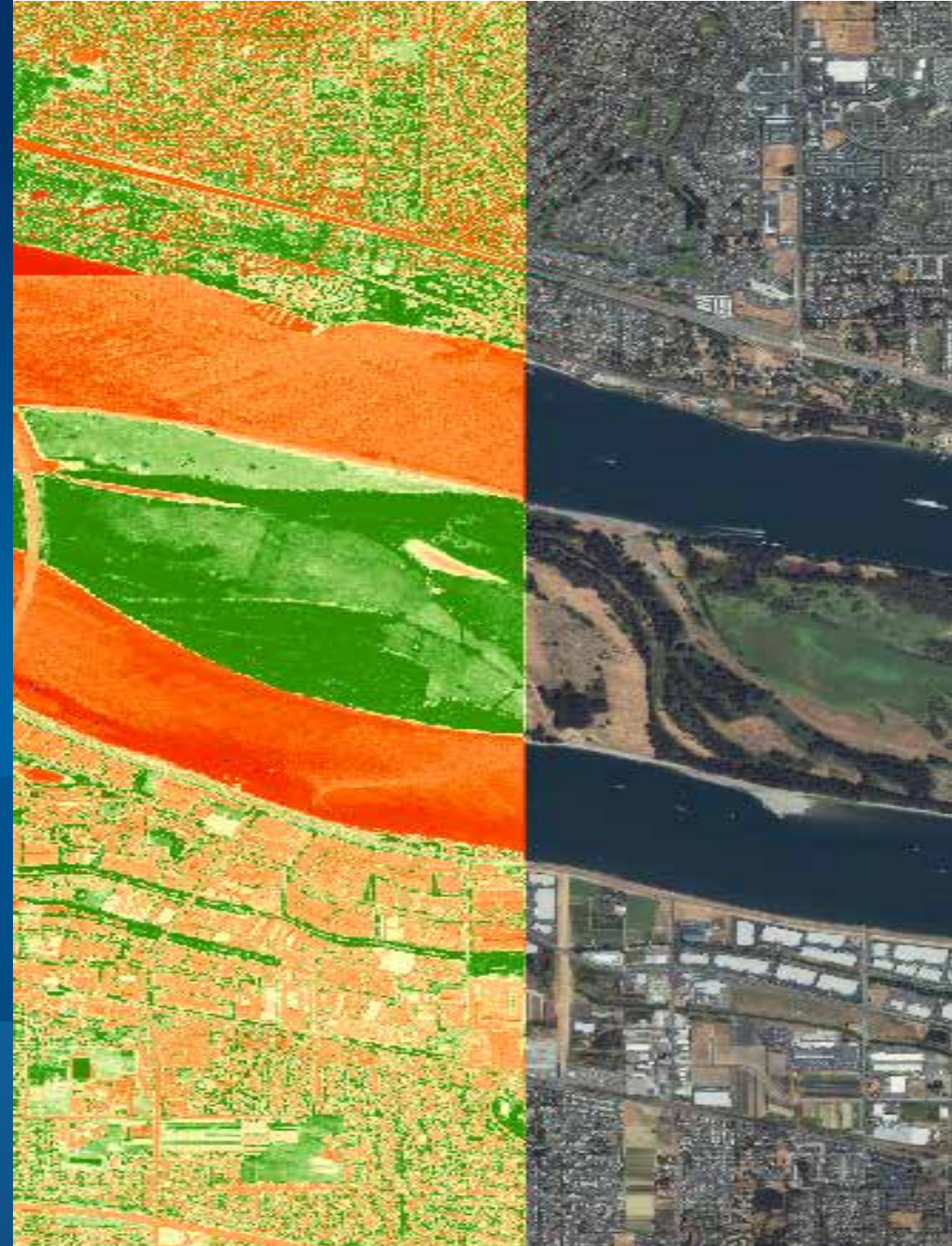
Design cache display

- **Set a default mosaic method**
- **Define 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)**
 - **Set to image service**
 - **Service can be accessed as dynamic and cached**



Demo

Authoring a Mosaic Dataset



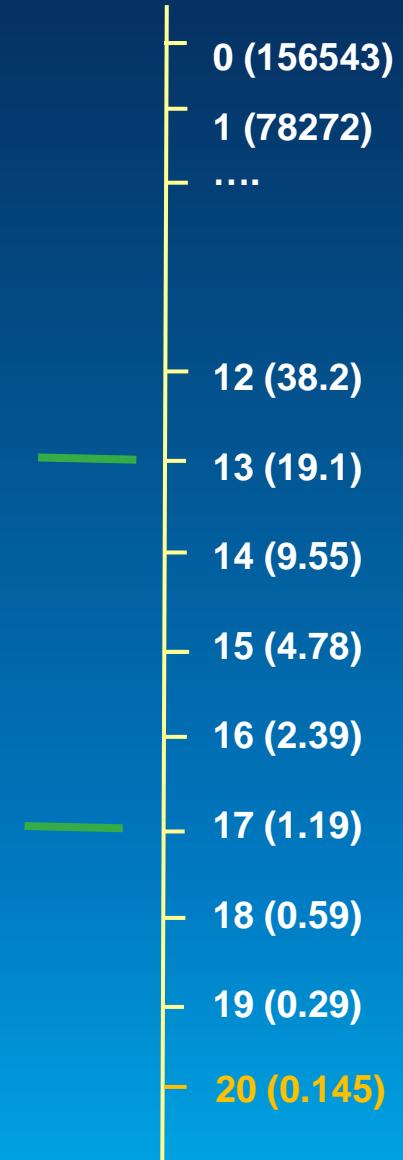
Presentation Outline

- Why we cache imagery?
- Imagery caching methods
- Prepare mosaic dataset for caching
- **Define caching scheme**
- Typical caching workflows
 - Publish cached image service on premise
 - Publish hosted tile service on ArcGIS online
- Tips

Define Caching Scheme

Scales

- Define levels based on your data
 - ArcGIS online scheme 20 levels
 - Snap to the closet scale
- Higher resolution data
 - Modify the scheme file, add 20th (0.145) level
 - (<http://esriurl.com/CacheTools>)



Design Cache Scheme

Tile format and compression

- **Format**
 - **Mixed - compressed and handle transparency**
 - **JPEG – compressed**
 - **Compression quality**
 - **Default = 75**
 - **Recommended: 80**
 - **LERC - compressed and for elevation**

Compression quality	Cache size (mb)	Display quality
100	3550	original
90	1090	good
85	941	good
80	898	good
75	784	ok
40	398	poor



Source image has 4 bands with a size of 3660 MB

Presentation Outline

- Why we cache imagery?
- Imagery caching methods
- Prepare mosaic dataset for caching
- Define caching scheme
- **Typical caching workflows**
 - **Publish cached services from imagery on premise**
 - **Publish hosted tile service from imagery**
- Tips

Cache Imagery using ArcGIS Server

Cache through image service vs. map service

Method	Pyramids	Overviews	Resample from cache	Usage
Image service	optional	Not required	Max source cell size	dynamic and cached
Map service	optional	yes	No	Mixed layers

- **Image service cache**
 - Save time on overview generation
 - Fast in generating cache tiles
 - One service serve both dynamic and cached service
- **Map service cache**
 - Combine with other layers
 - Can combine cache with feature layer for metadata

Publish a Cached Image Service

Supports both dynamic image analysis and fast cache display

You have created the mosaic dataset created and a renderer function template

2. Publish the mosaic dataset and set RFT

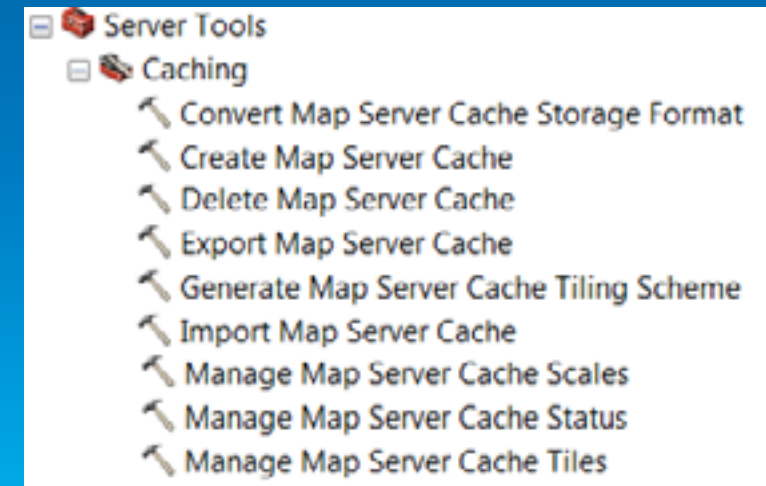
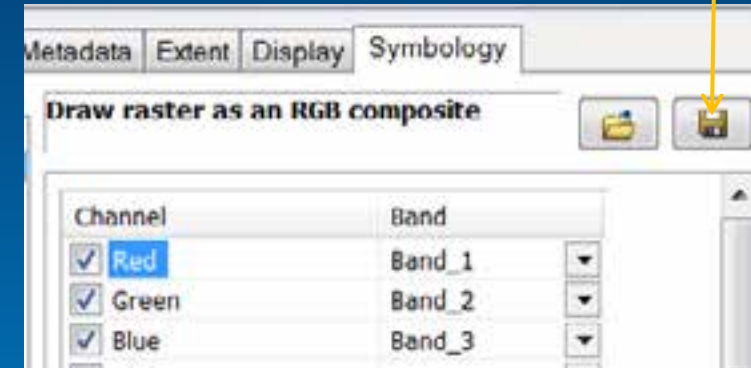
3. Define tiling scheme

- Web Mercator, Mixed format, scales
- Maximum source cell size

4. Generate cache

- Using Map Cache tools
- Automatically during publishing

Export a function template



Publish a Cached Map Service

For fast display and metadata information

1. In ArcMap add the following

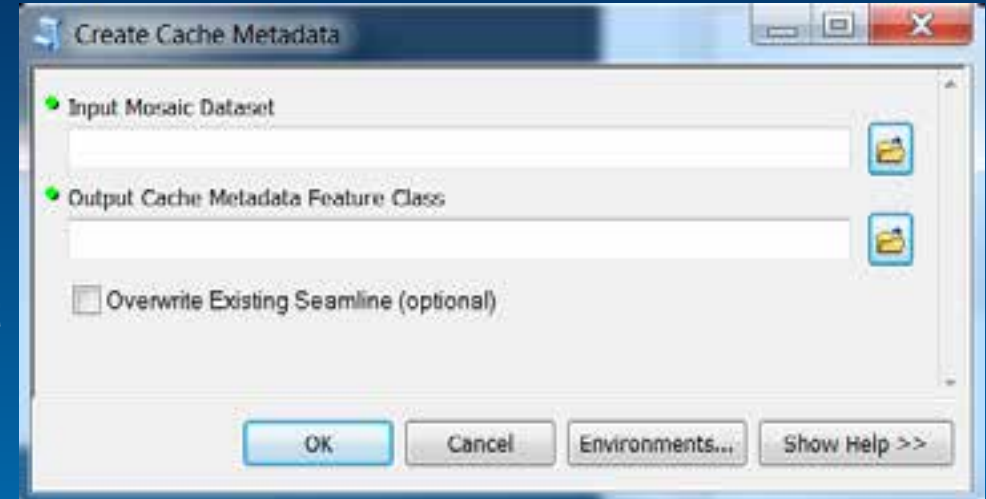
- the tile cache created
- the feature class generated from the mosaic dataset (<http://esriurl.com/CacheTools>)

2. Publish the map and import same tiling scheme

- Do not generate cache

3. Import the tile cache

- Or Copy the tile cache folder to ArcGIS server map cache folder
- Rename the folder to be “Layers”



Demo

Create an image service cache



Publish Hosted Tile Service from Imagery

Upload data or upload cache?

- **Use map, cache imagery at ArcGIS Online**
 - Copy source images and overviews
 - Store source images and cache tiles
 - Simple, useful for image data of small size
- **Cache imagery on desktop and upload the cached tiles**
 - You can make sure the cache tiles good before uploading
 - Only store cached tiles online ArcGIS Online
 - Useful for caching sensor data and image of large volume

Publish Hosted Tile Service from Using Desktop

1. Create tile cache using Desktop's Tile Cache toolset

- **Tile Cache tools on Desktop**

- **Generate tile cache from**
 - mosaic dataset, raster dataset, .lyr, .mxd (10.2)
- **Does not need server license**
- **Parallel processing**



- **Generate using Manage Tile Cache tool**

- **Use default ArcGIS Online tiling scheme**
- **If different, define using Generate Tile Cache Tiling Scheme tool**

Publish Hosted Tile Service from Using Desktop

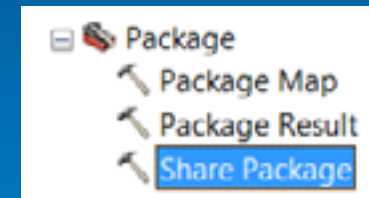
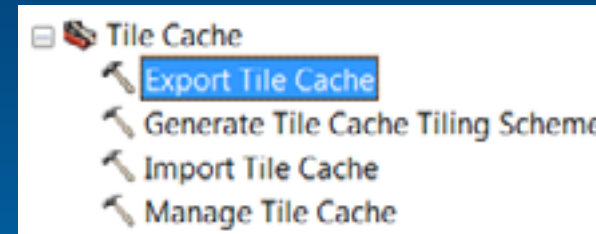
2. Create and upload tile package

Create a tile package from a tile cache

- Use Export Tile Cache tool

Push the tile package to ArcGIS Online

- Use Share Package tool



Publish Hosted Tile Service from Using Desktop

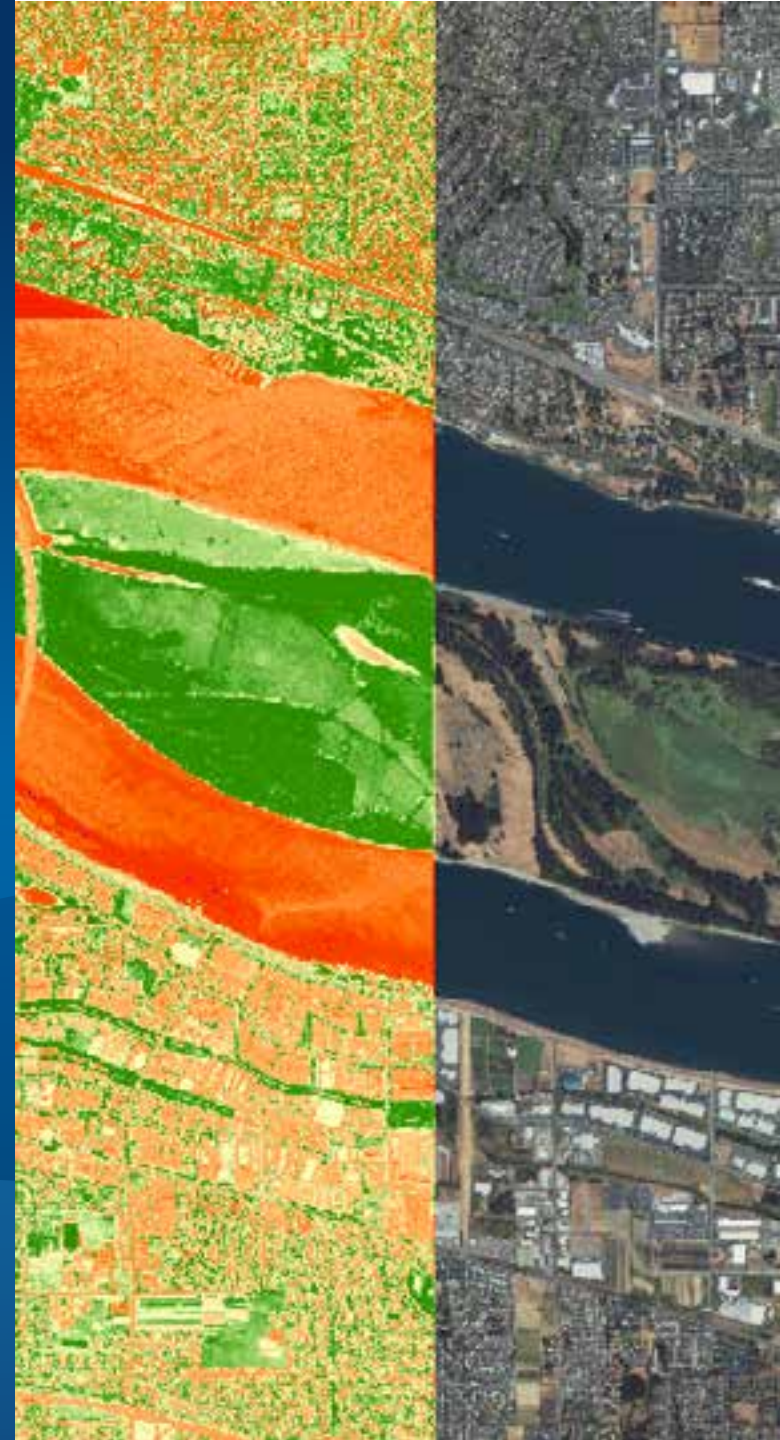
Publish the tile package

- Log on to ArcGIS Online account
- Publish the item as a tiled map service
- Optionally, delete the tile package to save space



Demo

Share Imagery to ArcGIS Online



Presentation Outline

- **Why we cache imagery?**
- **Imagery caching methods**
- **Prepare mosaic dataset for caching**
- **Define caching scheme**
- **Typical caching workflows**
 - **Publish cached image service on premise**
 - **Publish hosted tile service on ArcGIS online**
- **Tips**

Tip #1 Update Cache

Update existing cache

- **Use Generate Dirty Area tool to produce the AOI polygon from mosaic dataset**
- **Generate cache for AOI**
 - **Desktop: Manage Tile Cache**
 - **Image service cache/Map cache: Manage Map Service Cache tools**

Tip #2 Update Cache

Expanding cache

- **Data expended beyond the cache extent**
- **Mosaic dataset boundary updated after adding data**
- **How to handle cache expansion?**
- **Desktop tile cache**
 - Cache new data and import to existing cache
- **Image service cache**
 - Publish the updated mosaic as a new service
 - Copy `conf.cdi` to your cache
 - Run the *Manage Map Server Cache Status* tool to update cache status
 - Generate empty tiles or AOI tiles
- **Online: no solution**

Tip #3 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 #4: Avoid Creating Tiles for NoData Area

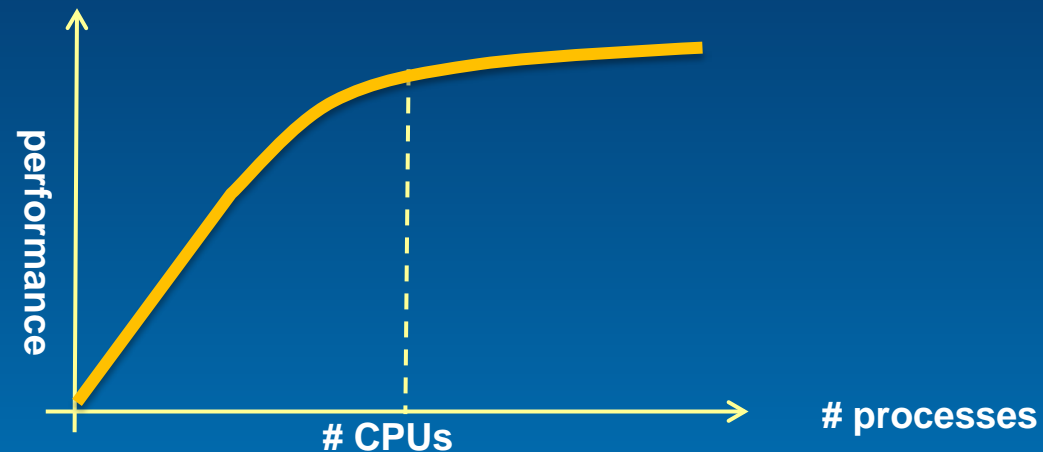
Using Mosaic Dataset Boundary

- Export mosaic dataset boundary as a feature class
- Generate cache at the designed scales with the exported boundary as AOI



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



Caching Imagery Using ArcGIS

Demo of Large AGS Online Service



Summary

- **Author mosaic dataset for caching**
- **Generate cache from image service or mosaic dataset is faster**
 - Leverage maximum source cell size setting
- **Generate Tile cache on Desktop is recommended way to publish hosted tile service from imagery**
- **Additional Help**
 - **CACHE tools:** <http://esriurl.com/CacheTools>
 - **LTS for image caching is at** <http://esriurl.com/ImageCacheLTS>

Thank you...

- **Please fill out the session survey:**

Offering ID: 1149

Online – www.esri.com/ucsessionsurveys

Paper – pick up and put in drop box



Understanding our world.