

Federal GIS Conference

February 9–10, 2015 | Washington, DC



Designing and Using Cached Map Services

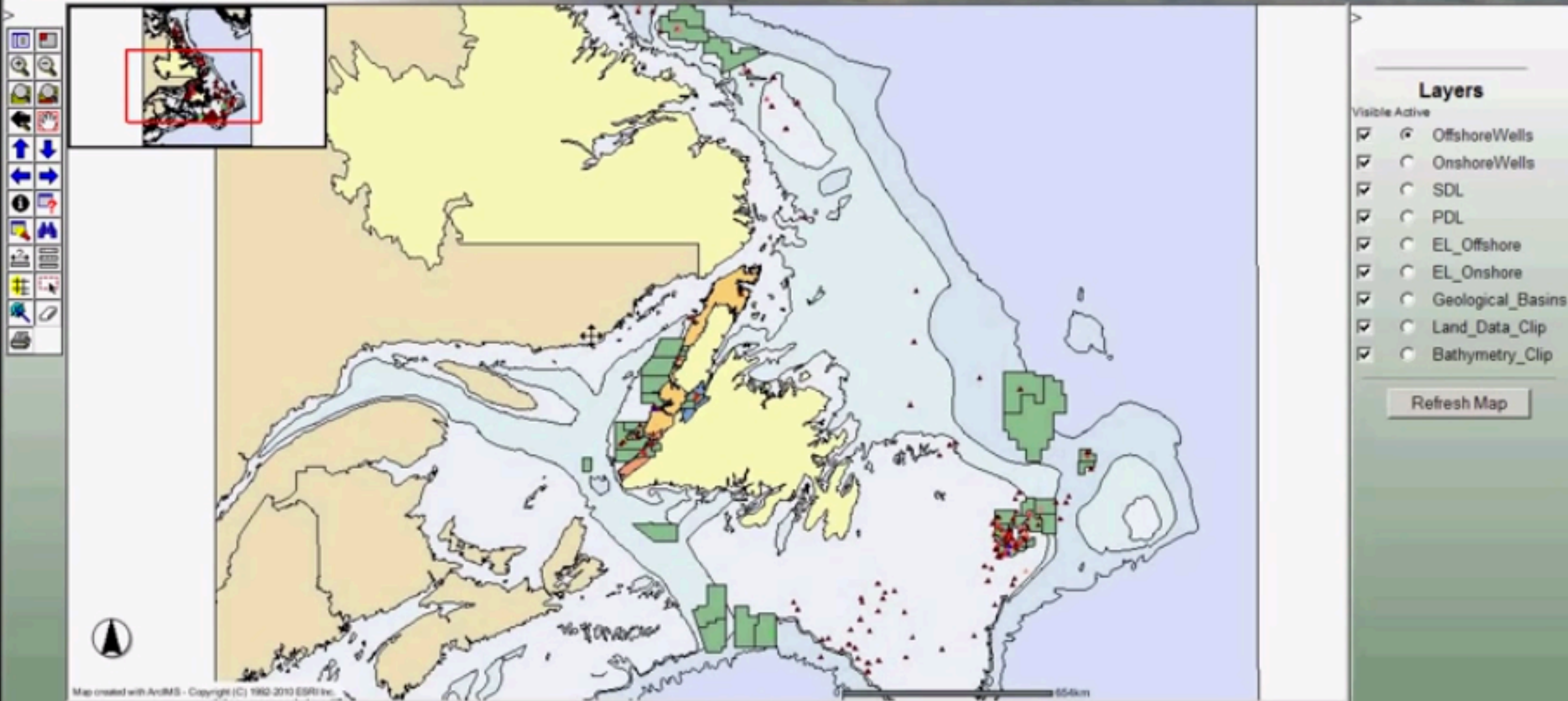
Frank Xia

What's covered in this session

- **Agenda**
 - **Why cache maps?**
 - **Map cache best practices**
 - **Map cache administration**
 - **Caching in the cloud**
 - **10.3 Performance Improvements**

Why Cache Maps

- **Understanding caching concepts**



Layers

- Visible Active
- OffshoreWells
 - OnshoreWells
 - SDL
 - PDL
 - EL_Offshore
 - EL_Onshore
 - Geological_Basins
 - Land_Data_Clip
 - Bathymetry_Clip

Refresh Map

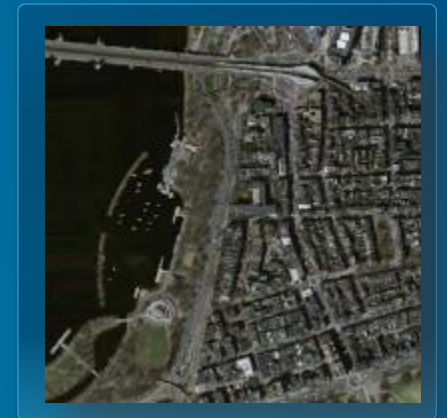
OffshoreWells is now the Active Layer

DEMO

- **Why cache maps?**
What should you cache?
How do you make a map cache?

Choosing image formats

- **Let the ArcGIS Service Editor choose for you!**
 - **Vector only caches (few colors)**
 - PNG (auto selects bit depth)
 - **Vectors only caches (many colors)**
 - PNG (auto selects bit depth)
 - **Imagery**
 - MIXED with 55 quality
 - **Vectors or labels + Imagery**
 - MIXED with 90 quality



Does Compression really make a difference?

- Large number of continuous colors
 - JPEG (start with quality = 55)
 - Mixed (if transparency required)

Which one looks better?



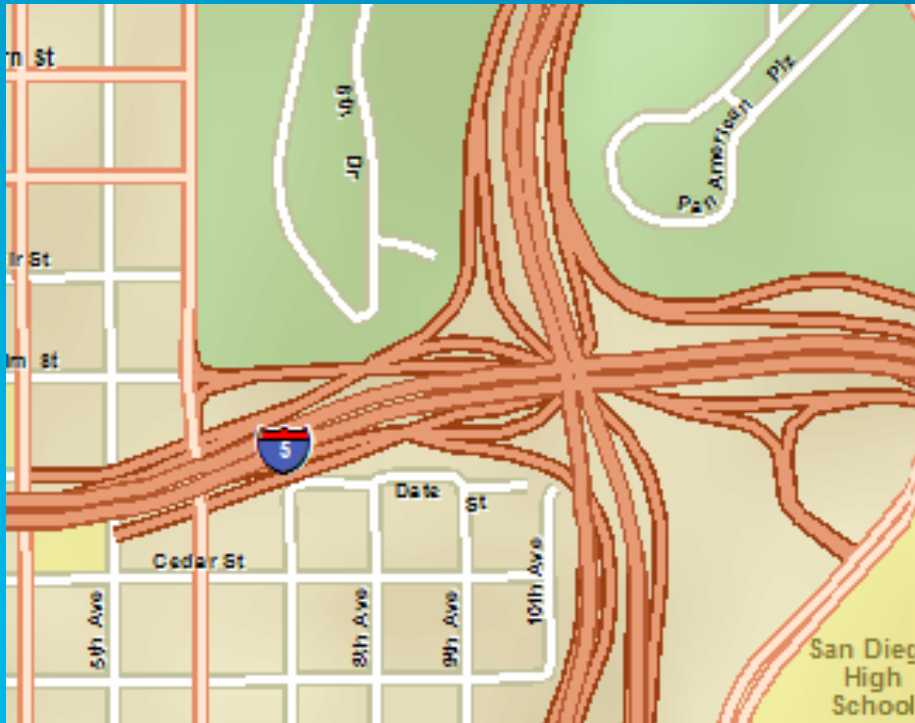
JPEG 96 – 25KB



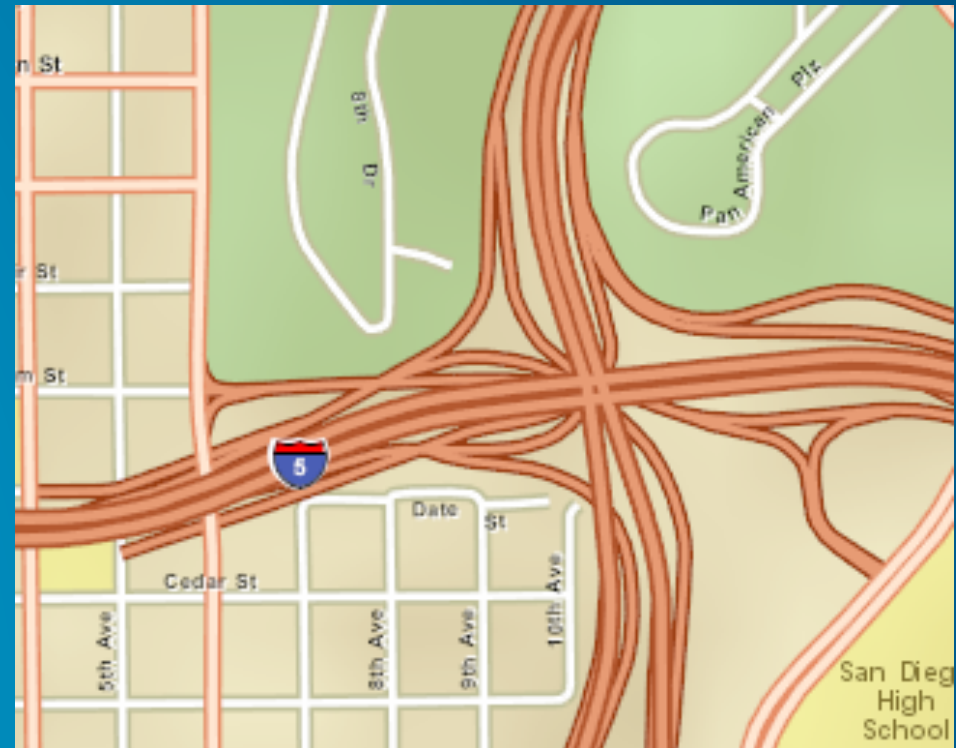
JPEG 96 – 30KB

Does antialiasing make a difference?

- High quality line/label rendering on vector maps
- Web standard (Google, Bing, AGOL)
- Takes LONGER to cache



No antialiasing



Best antialiasing

Demo Publish

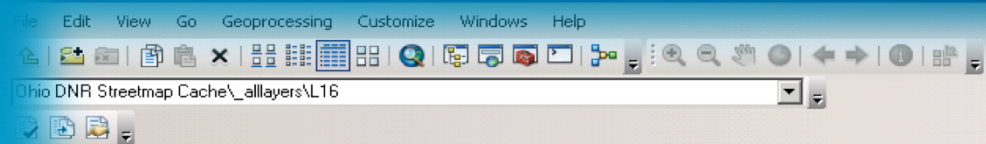
- **With ArcMap**

What you should cache?

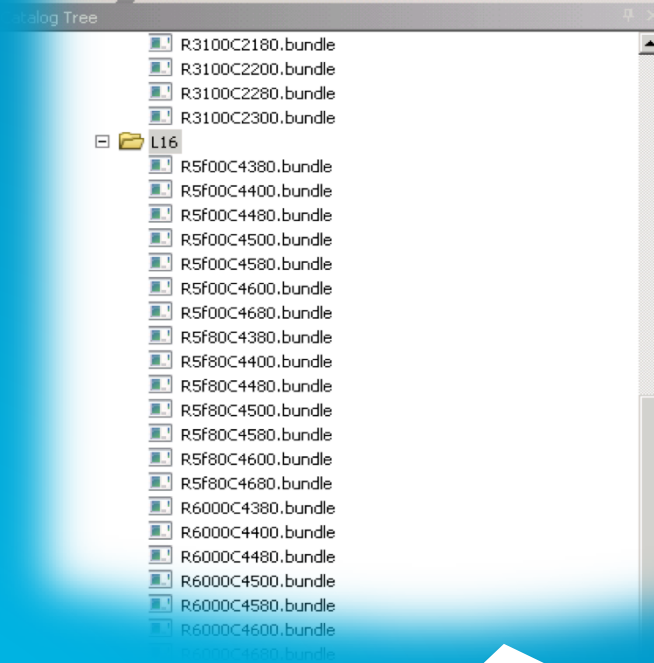
- **Base maps**
- **Data don't change very often**
- **Small scale maps**

Understanding cache structure

arcCatalog - D:\arcgisserver\directories\arcgiscache\UDNR_DDNR_Streetmap\Main Map\alllayers\L16

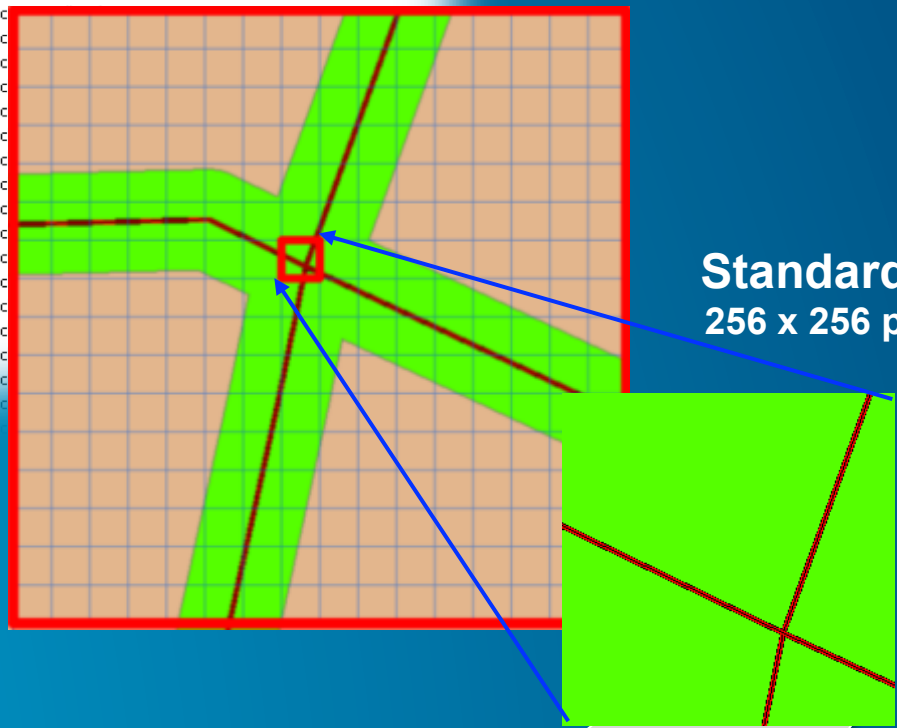


Bundle
8 x 8 Supertiles

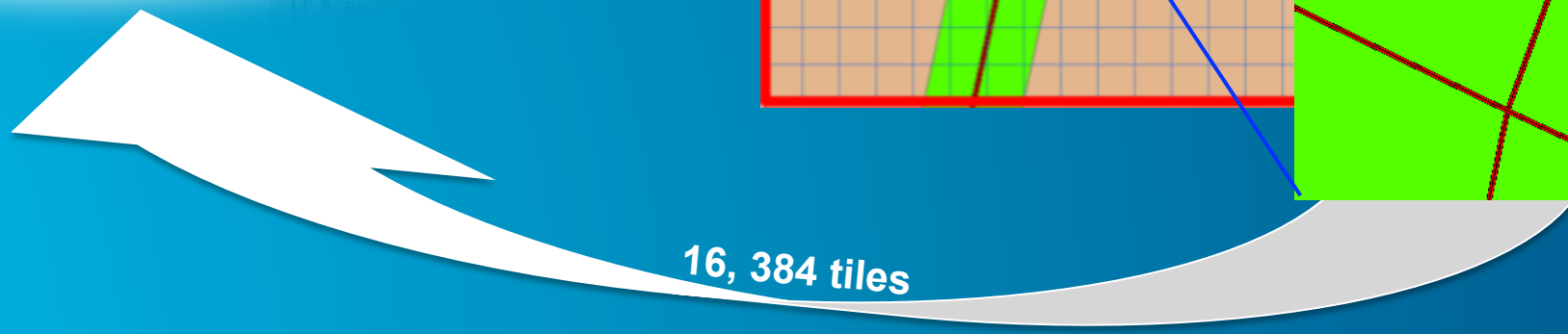


Name	Type
R5f00C4380.bundle	ArcGIS Server Cache Bundle File
R5f00C4400.bundle	ArcGIS Server Cache Bundle File
R5f00C4480.bundle	ArcGIS Server Cache Bundle File
R5f00C4500.bundle	ArcGIS Server Cache Bundle File
R5f00C4580.bundle	ArcGIS Server Cache Bundle File
R5f00C4600.bundle	ArcGIS Server Cache Bundle File
R5f00C4680.bundle	ArcGIS Server Cache Bundle File
R5f80C4380.bundle	ArcGIS Server Cache Bundle File
R5f80C4400.bundle	ArcGIS Server Cache Bundle File
R5f80C4480.bundle	ArcGIS Server Cache Bundle File
R5f80C4500.bundle	ArcGIS Server Cache Bundle File
R5f80C4580.bundle	ArcGIS Server Cache Bundle File
R5f80C4600.bundle	ArcGIS Server Cache Bundle File
R5f80C4680.bundle	ArcGIS Server Cache Bundle File
R6000C4380.bundle	ArcGIS Server Cache Bundle File
R6000C4400.bundle	ArcGIS Server Cache Bundle File
R6000C4480.bundle	ArcGIS Server Cache Bundle File
R6000C4500.bundle	ArcGIS Server Cache Bundle File
R6000C4580.bundle	ArcGIS Server Cache Bundle File
R6000C4600.bundle	ArcGIS Server Cache Bundle File
R6000C4680.bundle	ArcGIS Server Cache Bundle File
R6080C4380.bundle	ArcGIS Server Cache Bundle File
R6080C4400.bundle	ArcGIS Server Cache Bundle File
R6080C4480.bundle	ArcGIS Server Cache Bundle File
R6080C4500.bundle	ArcGIS Server Cache Bundle File
R6080C4580.bundle	ArcGIS Server Cache Bundle File
R6080C4600.bundle	ArcGIS Server Cache Bundle File
R6080C4680.bundle	ArcGIS Server Cache Bundle File

Supertile
16 x 16 tiles



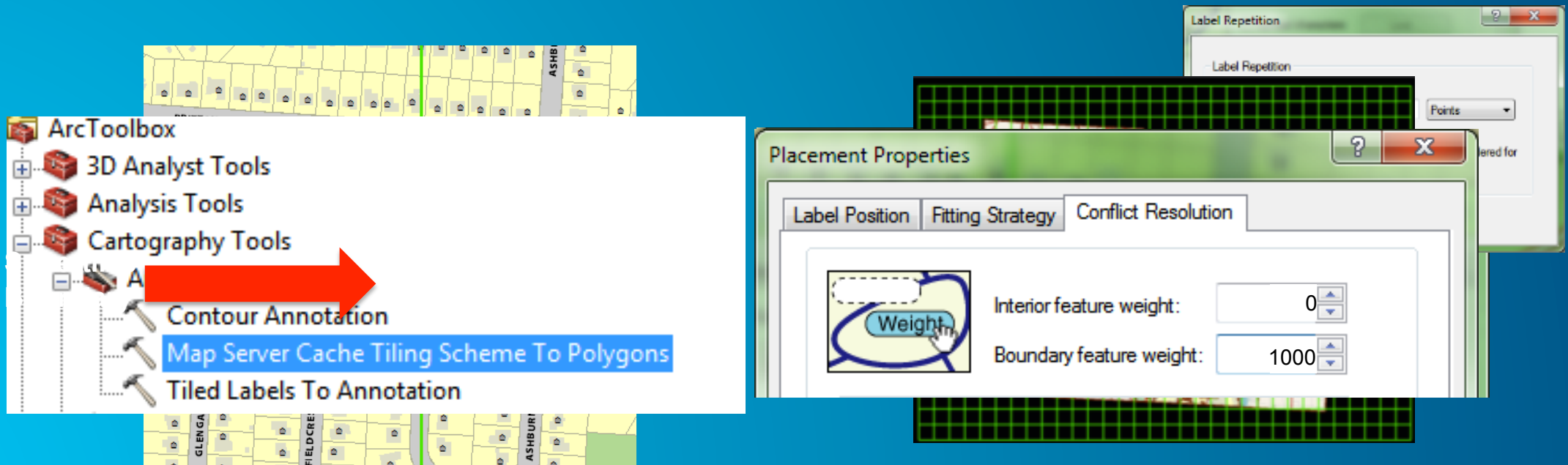
Standard tile
256 x 256 pixels



16,384 tiles

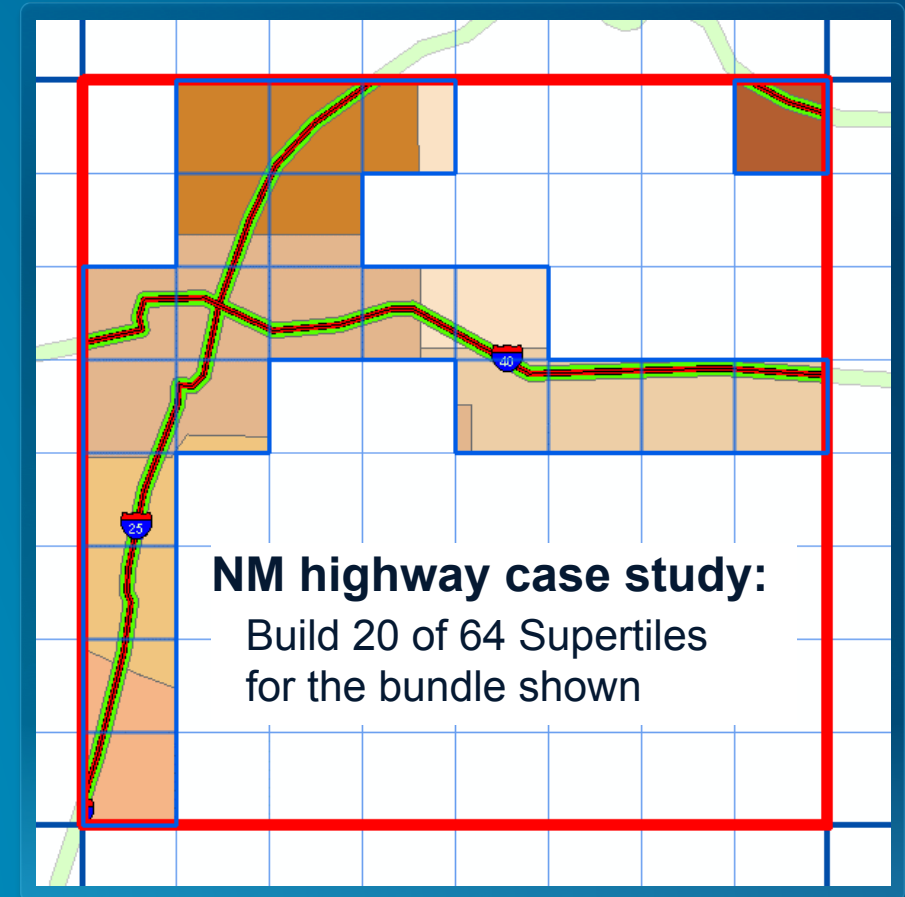
Supertiles and Labeling

- ArcGIS Server Draws Large Areas
 - Reduces duplicate labels
- Duplication May Occur
 - Use Annotation or MapPlex Labels with Rules
 - Use Map Server Cache Tiling Scheme To Polygons



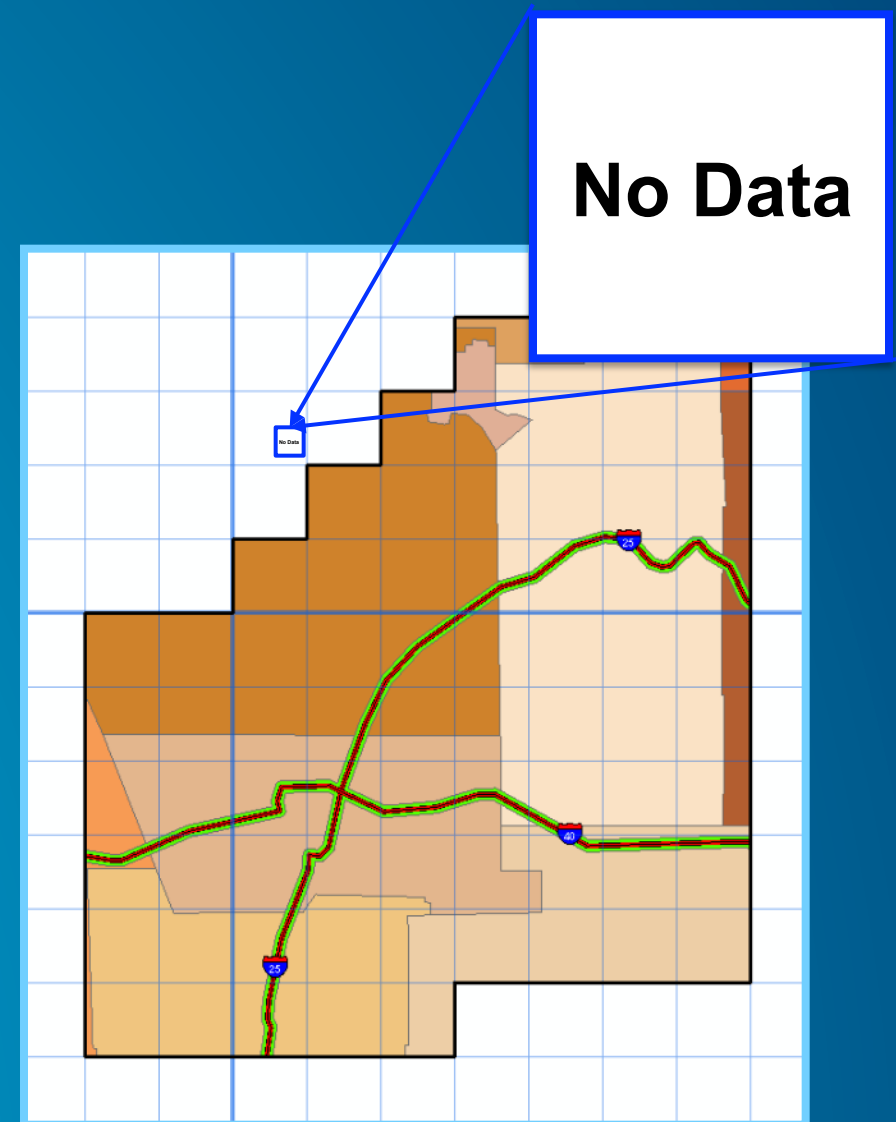
You don't need to generate everything

- Cache by feature
 - Polygon features
 - Generates all tiles for intersecting supertiles
- Saves on...
 - Generation time
 - Processor resource
 - Disk usage



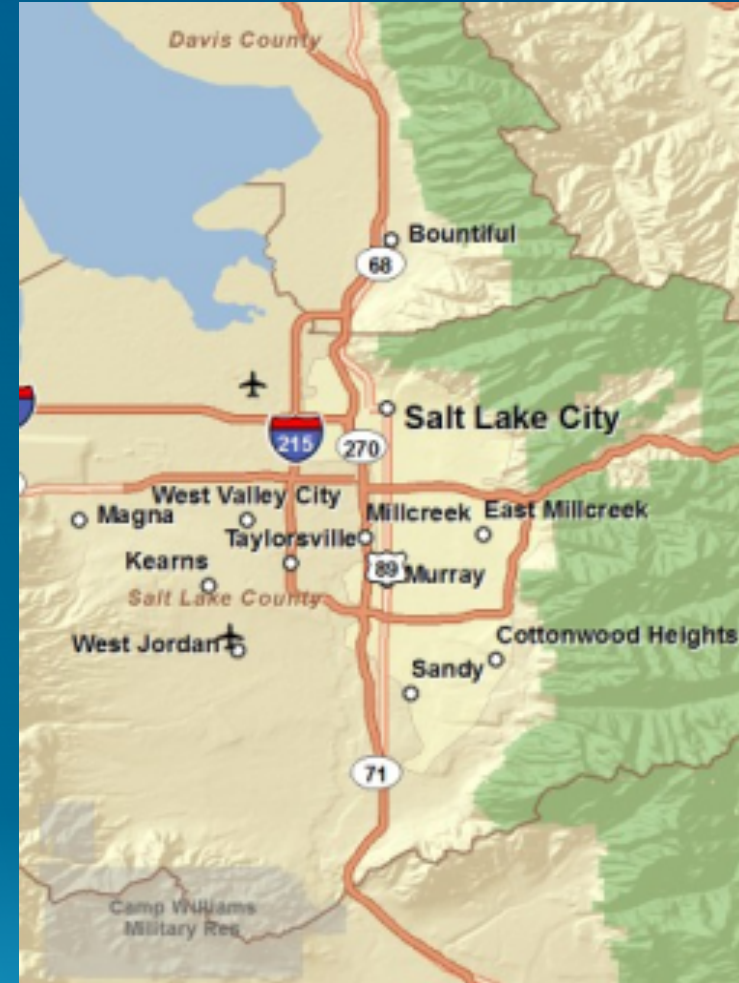
Handling tiles you do NOT create

- Create “No Data” tile
 - Same image format (JPG or PNG)
 - Same size (256 x 256)
 - Save in cache folder
...\`<dataframe>`_alllayers
- How to
 - Knowledge base article [36939](#) has sample files



Build a test cache and note the following

- Creation time
- Appearance
- Client performance
- Cache size validation



Tracking cache status & fixing errors

The image shows a screenshot of the ArcGIS ReportingTools service status and the Cache Status dialog box. The ReportingTools service is running, and the Cache Status dialog box shows that 49.1% of the tiles are present. The Cache Status dialog box also displays a table of job IDs and their statuses.

ReportingTools (Geoprocessing Service)
The ReportingTools service is used by ArcGIS Image service caches.
Status: Started
Instances Running: 0
Instances in Use: 0
Maximum Instances: 3

Cache Status --- Streetmap
Summary: 49.1% of the tiles are present.
Status: Tile generation is not in progress.

Job ID	Status	Errors
jbc6a2010feda43f5be4c9a14a0475e80	Done	14:37
j8e6114a1874b462a97aba4e787815c37	Done	44:14
j8e6114a1874b462a97aba4e787815c37	Done	44:14

Cache Status Table:

Job ID	Actual Tiles	Start Time
1	1	6/24/2013 6:58:08 PM
1	1	6/24/2013 6:58:08 PM
2	2	6/24/2013 6:58:08 PM
4	4	6/24/2013 6:58:08 PM
9	9	6/24/2013 6:58:08 PM

Cache Status Dialog Box Options:

- Cancel Job
- Complete Job
- Report Errors...
- Fix Errors
- Export Errors to File...
- Details...

Map cache administration

- **Generate and update techniques**

Setting the Number of Instances

- Cache Tools Geoprocessing Service
 - Start with N
 - N = CPU's per server
 - See cloud session for Amazon recommendations

The image displays two screenshots side-by-side. The left screenshot is the 'Service Editor' window for the 'CacheTools' service. In the 'Pooling' tab, the 'Maximum number of instances per machine' is set to 8, which is highlighted with a red box. A green arrow points from this box to the right screenshot. The right screenshot is the 'Windows Task Manager' Performance tab, showing 'CPU Usage History' with 8 individual graphs, each representing a CPU core. A red box highlights these 8 graphs, and a black box with the text '8 CPU' is overlaid on them. Below the graphs, system statistics are visible, including Physical Memory (2.45 GB) and System handles (29801).

Service Editor

Connection: arcgis on localhost_8080 (admin) Service Name: CacheTools

General

Capabilities

Geoprocessing

Parameters

Pooling

Processes

Item Description

Pooling

Specify the number of instances:

Minimum number of instances per machine: 9

Maximum number of instances per machine: 8

Timeouts

The maximum time a client can use a service: 3000000 seconds

The maximum time a client will wait to get a service: 60 seconds

The maximum time an idle instance can be kept running: 100 seconds

OK Cancel

Windows Task Manager

File Options View Help

Applications Processes Services Performance Networking Users

CPU Usage

CPU Usage History

Physical Memory Usage History

2.45 GB

8 CPU

Physical Memory (MB)

Total	7167
Cached	3006
Available	4647
Free	1698

Kernel Memory (MB)

Paged	217
Nonpaged	47

System

Handles	29801
Threads	1625
Processes	78
Up Time	1:17:24:24
Commit (GB)	3 / 14

Resource Monitor...

Processes: 78 CPU Usage: 12% Physical Memory: 35%

System caching services

- System services
 - Caching Tools: Sets caching instance per machine
 - Caching Controllers: Assign cache jobs to instances
- Manage Map server Cache Tiles
 - Controls instances per job
 - Set to -1 to use all instances

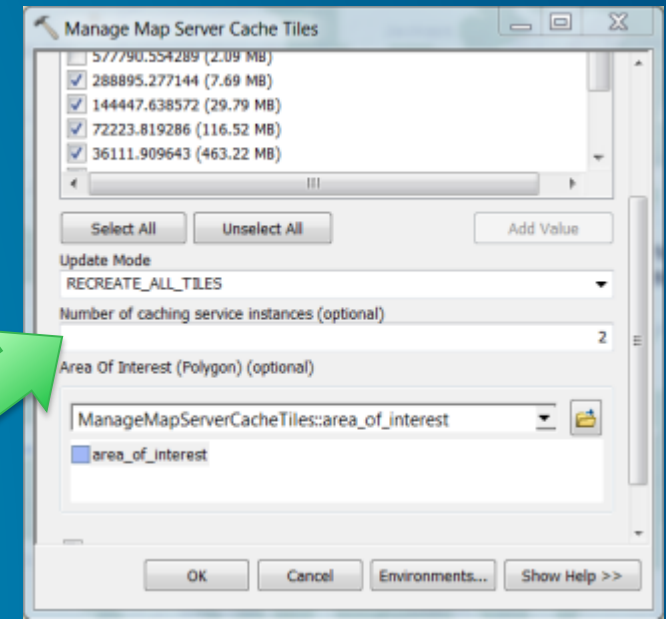


CachingTools (Geoprocessing Service)
The CachingTools service is used by ArcGIS Server Image service caches.
Status: Started
Instances Running: 0
Instances in Use: 0

CachingControllers
The CachingController...
Status: St...
Instances Running: ...
Instances in Use: ...
Maximum Instances: 3

Per machine

Per job



Manage Map Server Cache Tiles

- 577790.554289 (2.09 MB)
- 288895.277144 (7.69 MB)
- 144447.638572 (29.79 MB)
- 72223.819286 (116.52 MB)
- 36111.909643 (463.22 MB)

Select All Unselect All Add Value

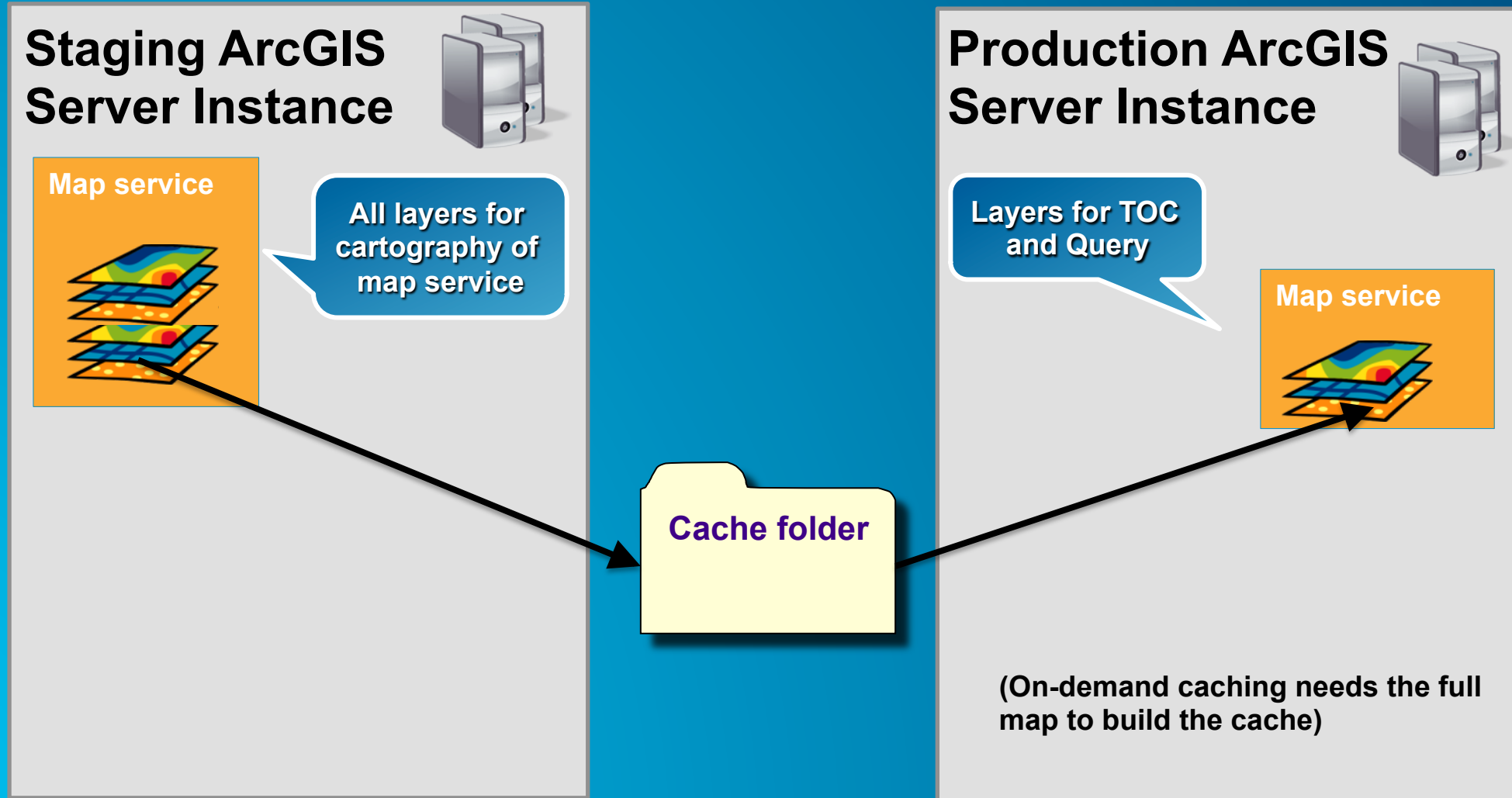
Update Mode
RECREATE_ALL_TILES

Number of caching service instances (optional) 2

Area Of Interest (Polygon) (optional)
ManageMapServerCacheTiles::area_of_interest
area_of_interest

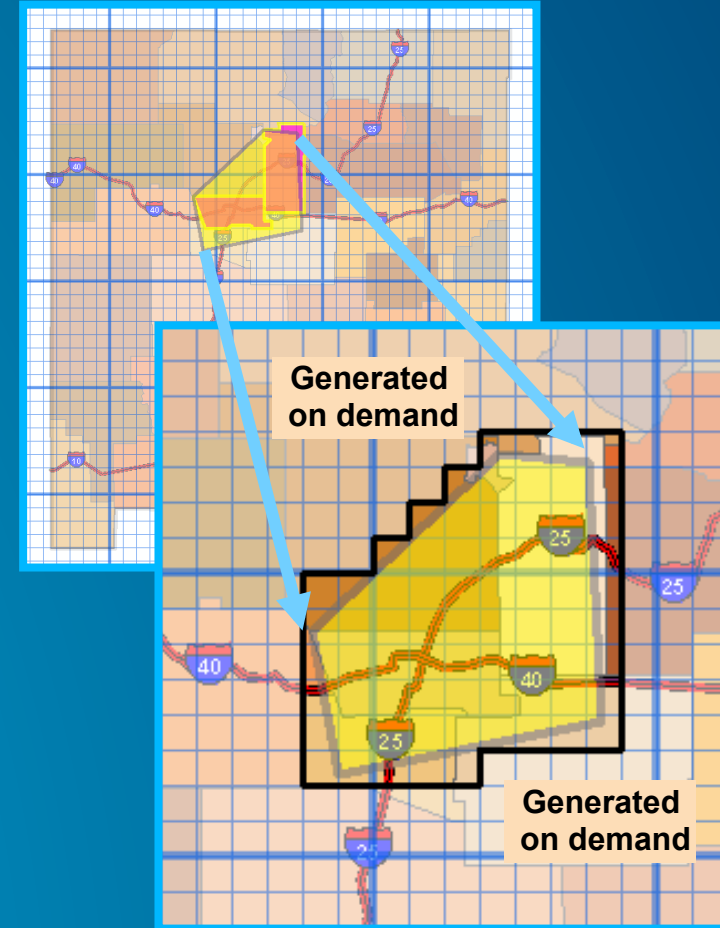
OK Cancel Environments... Show Help >>

Update a cache using a staging server



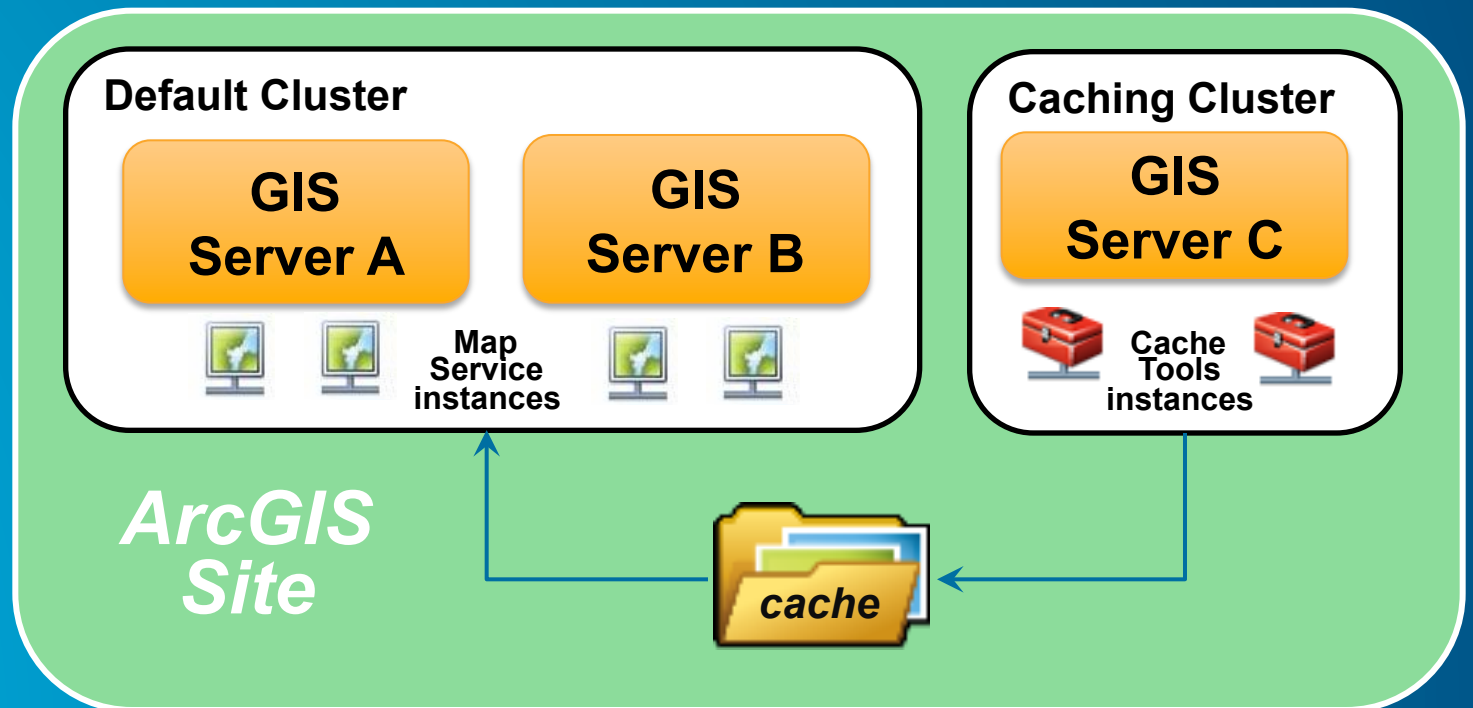
Pre-create coupled with cache on demand

- Pre-create high use areas
 - Population centers
 - Parks, roads, attractions
- Features
 - Cover popular extent
 - Generate key tiles
 - All others generated on demand



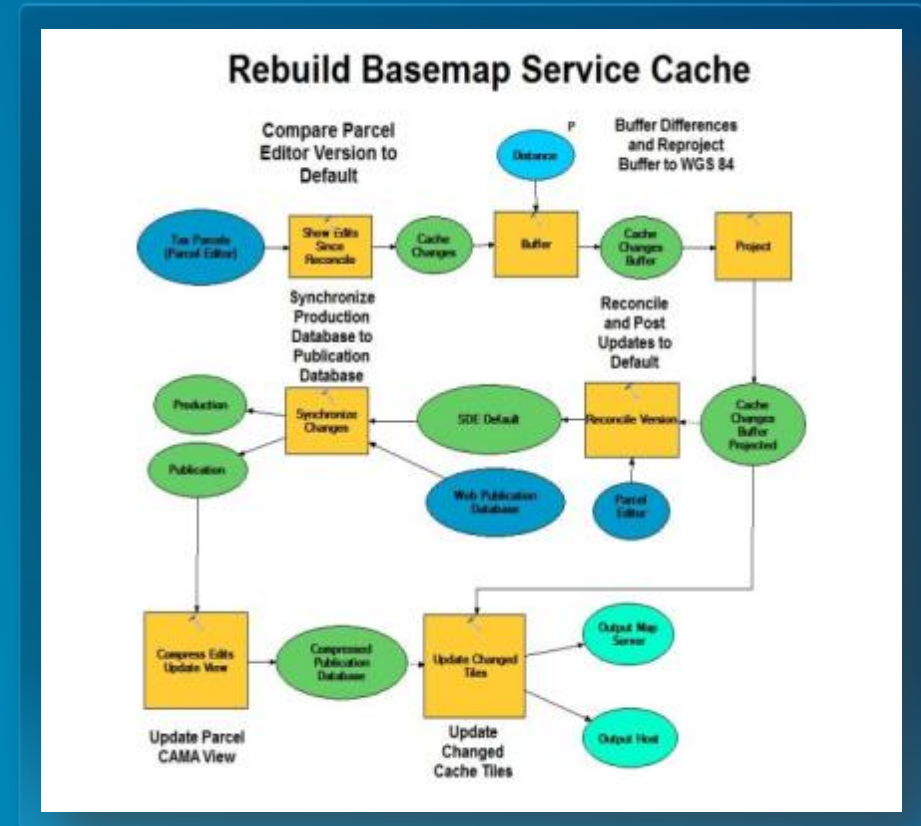
Isolate caching to certain servers

- Organize GIS Servers into Clusters
 - Generate Cache on its own cluster
 - Scale or reconfigure while caching



Cache update automation

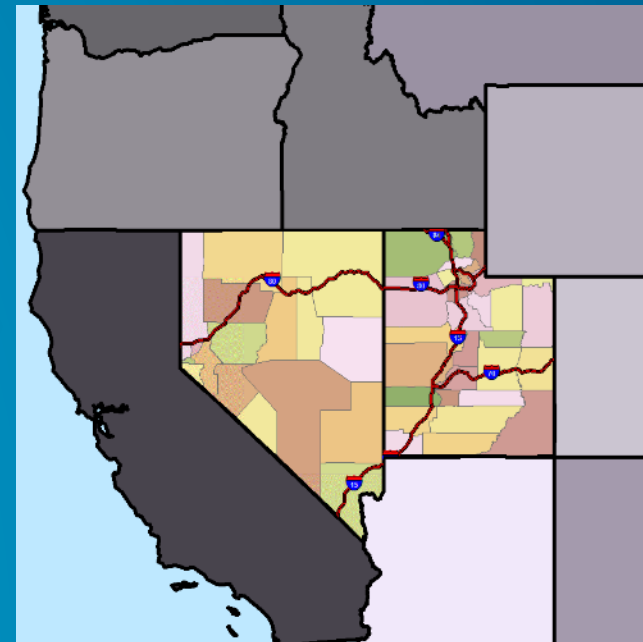
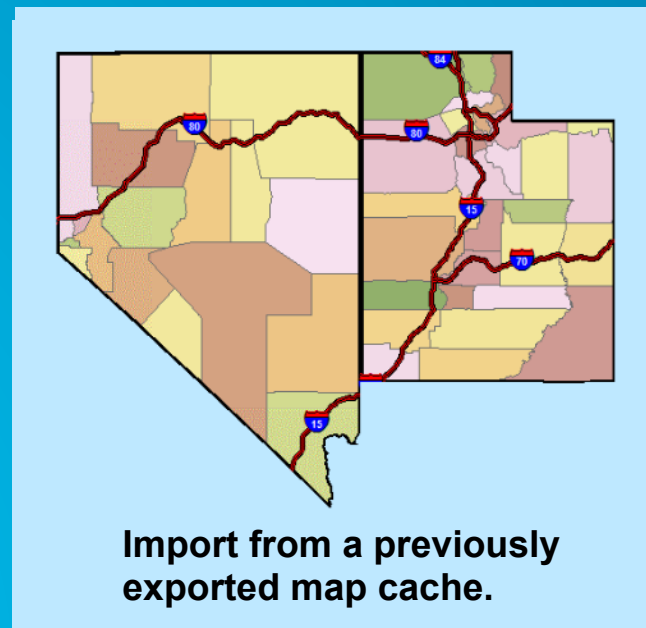
- Use Model Builder to script update automation
 - Rebuild Specific Tiles
 - Export to Python
 - Schedule Run Time
- Useful update tools
 - [Compare feature classes](#)
 - [Show edits since reconcile](#)
- Sample available on GitHub
 - <https://github.com/Erodenberg/UpdateTileCache>



Cache export & import tools

- ~~Export~~ Export tiles

- Based on extent or polygon features
- ~~Most versatile storage format~~ Most versatile storage format
- Use for cache import or as a disconnected cache



Caching in the Cloud

- **ArcGIS Online Map Caching**

Caching in ArcGIS Online

- ArcGIS Online subscription allows for caching
- No need to worry about capacity
- Charged by tile creation and storage
- Two approaches
 - Upload data to AGOL
 - Build and store cache with AGOL
 - Upload tile package to AGOL
 - Build cache on premises (ArcMap) but store with AGOL
- Understanding credit usage:
<http://www.esri.com/software/arcgis/arcgisonline/credits>

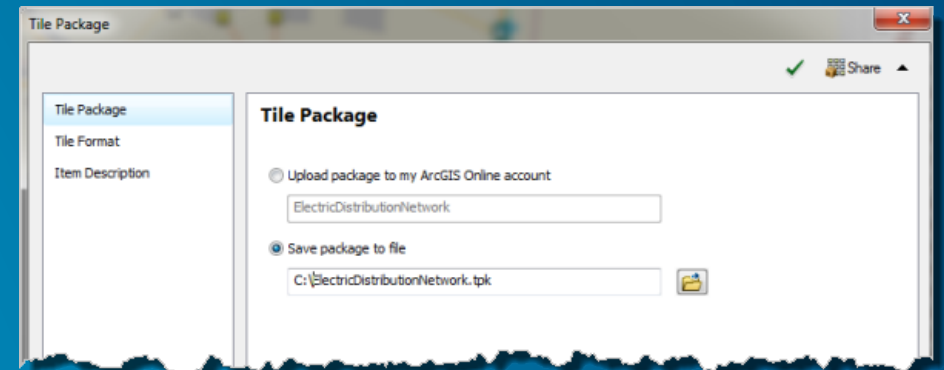
Why create a tile package?

- Local cache for Desktop, Runtime and productivity applications (Collector)
- Transport a map cache
- Upload a map cache to ArcGIS Online



Creating a tile package

- ArcMap Options > Sharing > Enable ArcGIS Runtime tools
- Three options for creation
 - Create tile package within ArcMap
 - Single processor
 - File > Share As > Tile Package
 - Create Cache with ArcMap & Geoprocessing
 - Parallel Processing
 - Data Management > Tile Cache Toolset
 - Manage Tile Cache
 - Export Tile Cache
 - Create cache with ArcGIS Server
 - Tile Cache > Export Tile Cache
 - Uses Parallel Processing Factor Geoprocessing Environment setting



Cache Consumption Performance Improvement in 10.3

In ArcGIS 10.3 Server

- **Reengineered the compact cache storage format**
 - Provides faster performance when consuming cached map/ image services
 - Reduces the number of files created in the cache directory.
- **These performance optimizations are supported with**
 - New caches created using 10.3
 - Existing (compact/exploded) caches that are upgraded using the “Upgrade Map Server Cache Storage format” tool
- **Existing caches will continue to work in 10.3**
- **Cache format change does not impact clients compatibility to consume cache served out by the Server.**

Faster Performance when consuming caches

- **45%** better than 10.2.2 over UNC
- **40%** better than 10.2.2 on local drive
- Secured services with GIS tier security at par with anonymous services.
10 times better than 10.2.2
- WMTS is more than **5 times** better than 10.2.2

Should I upgrade my existing cache?

- If your caches meet your existing demands, No.
- Benefits only for very large caches. Consider the trade-offs.
 - Upgrade takes 20% of the time taken to generate the cache.
 - QA/QC your new caches/subject to failures

Note:

- Performance improvements of secured cache services & WMTS are **independent** of version of compact storage format

Questions?

Example Credit Usage

- ArcGIS Online Tile storage = 1.2 credits per 1 GB per month
 - 1 Credit is 10 cents or less
- This cache = 100 MB
- Credits per month
 - $100 \text{ MB} / 1024 \text{ MB} * 1.2 \text{ Credits} = 0.117$
 - $0.117 \text{ Credits} * 10 = 1.17 \text{ Cents}$
- $1.17 \text{ cents per month} * 12 \text{ months} = 14.06 \text{ cents per year}$
- ... In 20 years this cache will cost you less than 3 dollars



Understanding our world.