Esri International User Conference
San Diego, California

Technical Workshops | July 20, 2012

Advanced Map Caching Topics

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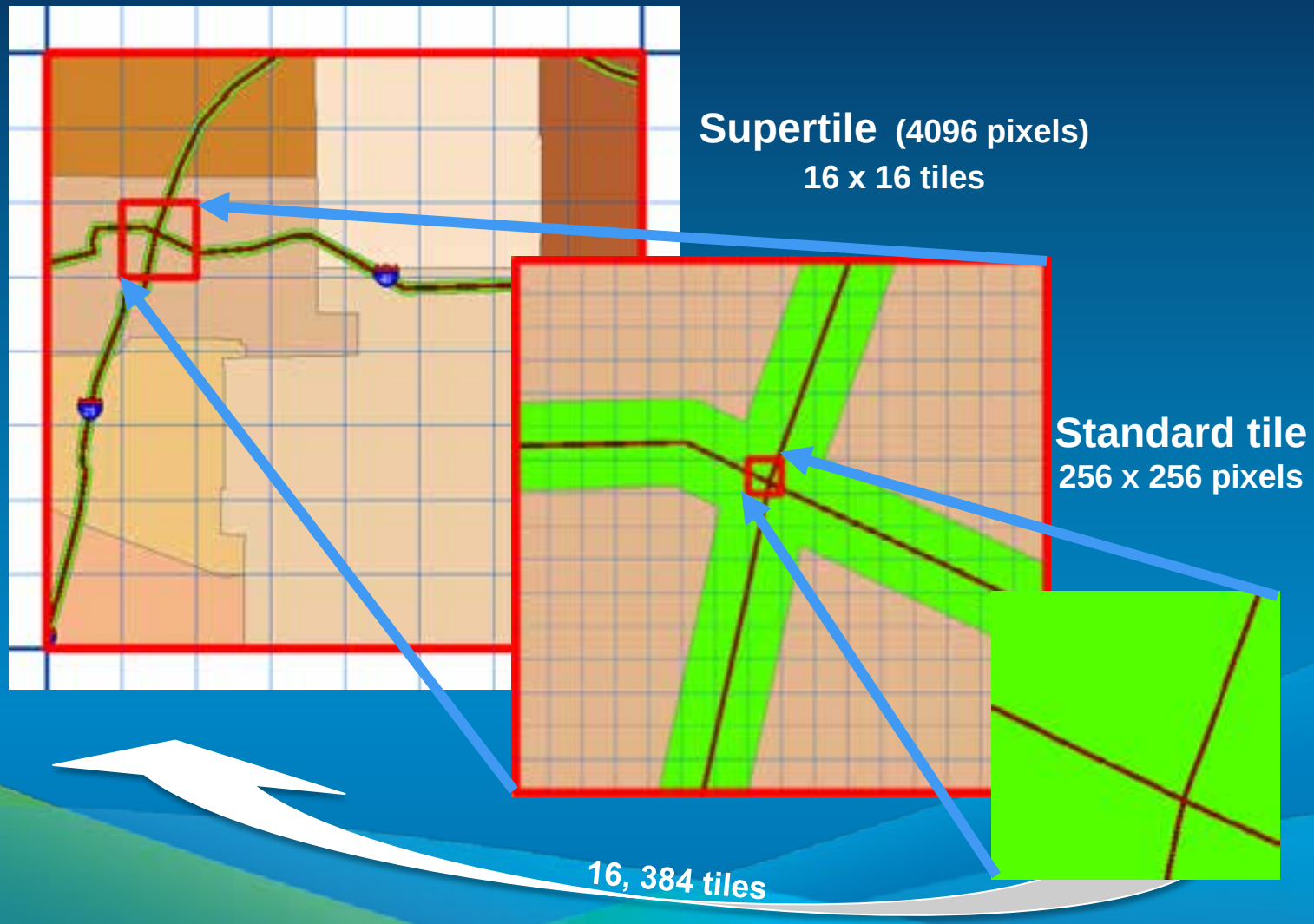
Agenda

- Advanced topics
  - Best practices
  - Update map caches
  - Caching architecture
  - Performance considerations
  - Caching in the Amazon cloud
  - Recovering from cache failures

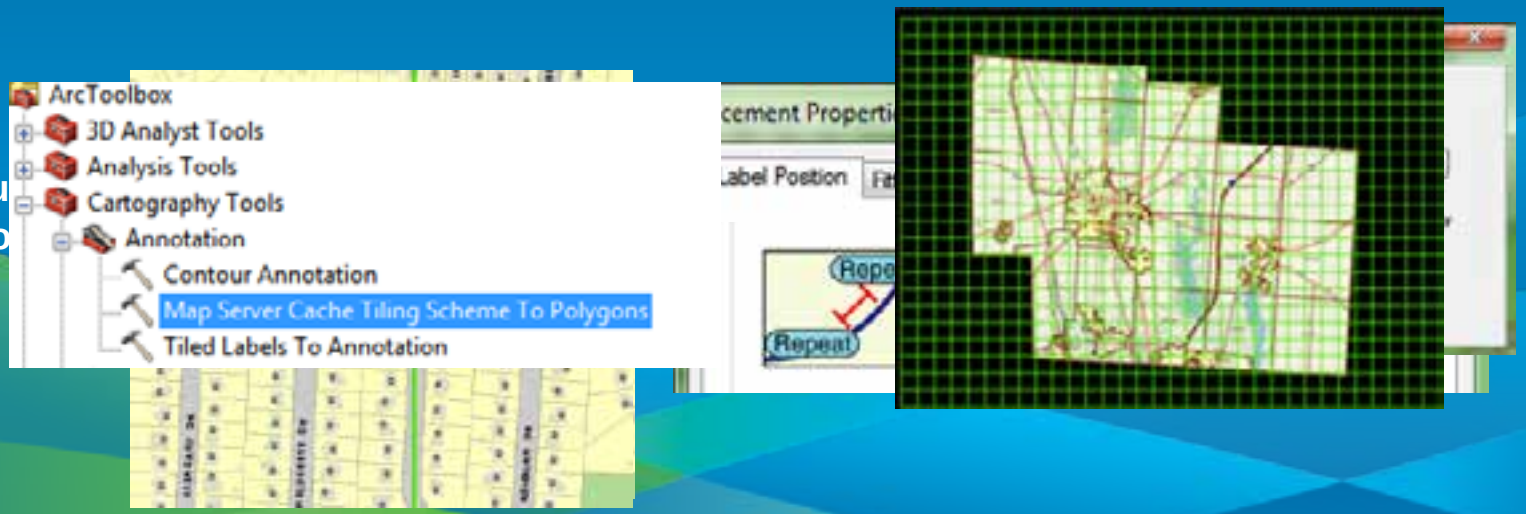
Best Practices

Understanding cache structure



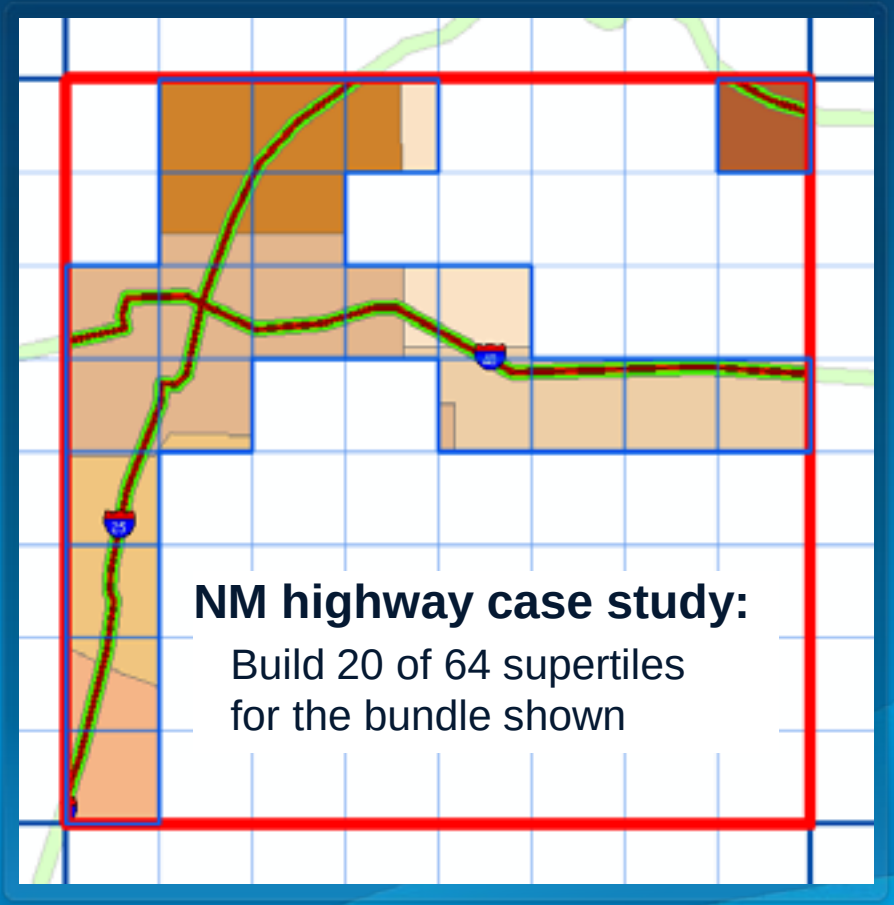
Supertiles and Labeling

- ArcGIS Server Draws Large Areas
  - Helps Reduce Duplicate Labels
  - Large Areas are Supertiles
  - Divided into Individual Tiles
- Duplication May Occur
  - Label Engine Not Aware of Labels on Adjacent Supertiles
  - Use Annotation or MapPlex Labels with Rules
  - Use Map Server Cache Tiling Scheme To Polygons



How much of a cache should you generate?

- Cache by feature
  - Geographic elements
  - Generates tiles for intersecting supertiles
- Saves on…
  - Generation time
  - Processor resource
  - Disk usage

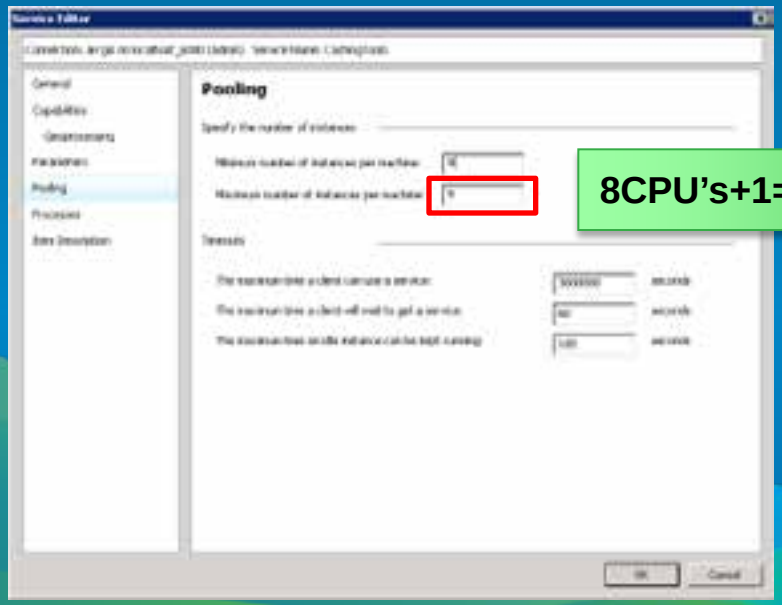


Creating a test cache

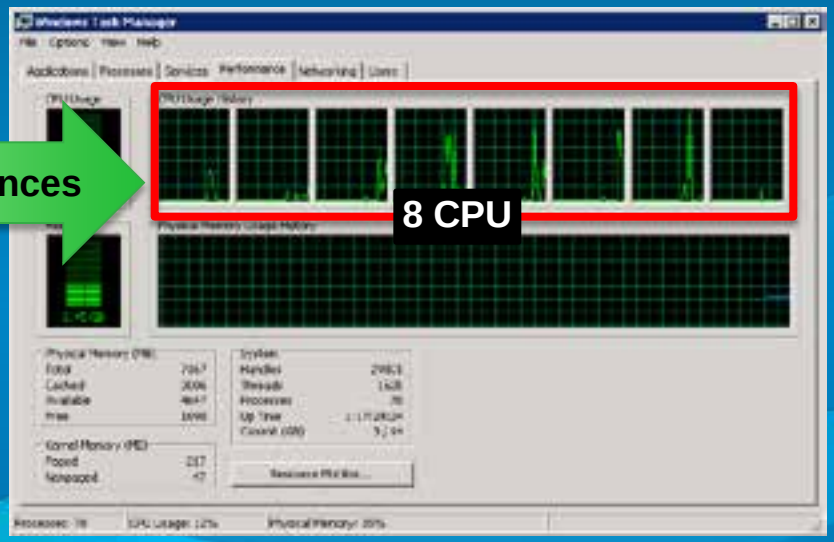
- Select test area location with most geographic complexity
- Create a simple feature class covering the test area
- Generate tiles at all scale levels based on this feature

Setting the Number of Instances

- Cache Tools Geoprocessing Service
  - Start with N + 1
    - N = the total number of CPU's per server in your site (workers)
    - 1 controller
  - Example: x2 - 4 Core GIS Servers/Site = 8CPU + 2 = 10 Instances
  - Max Instances should always be >2



8CPU's+1= 9 Instances

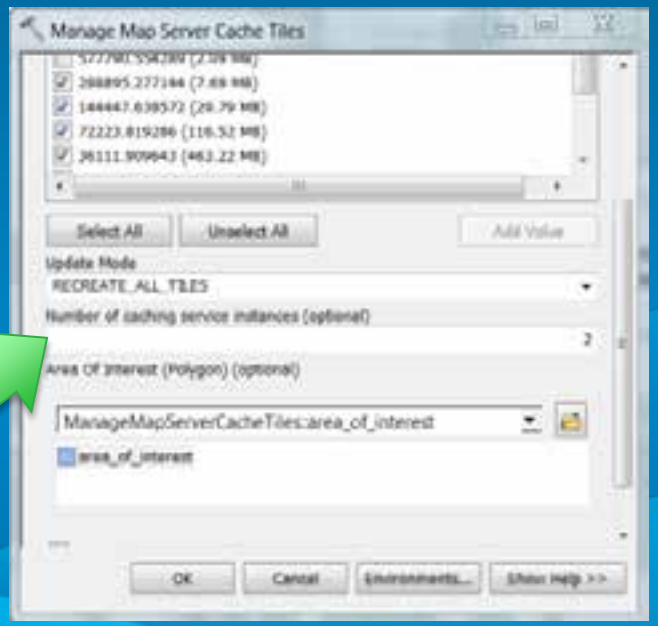


Controlling the # of instances for a job

- CachingTools service controls caching instance per machine
- Manage Map server Cache Tiles controls # of instances per job
  - Set to -1 to use all instances

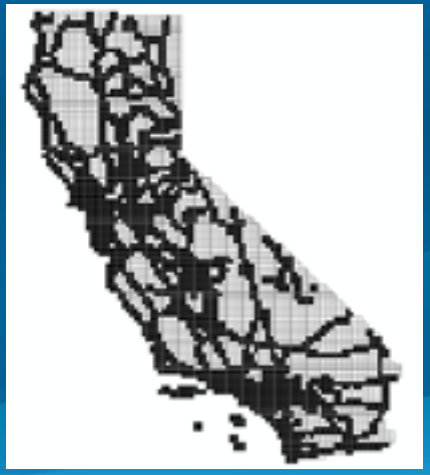
Per machine

Per job



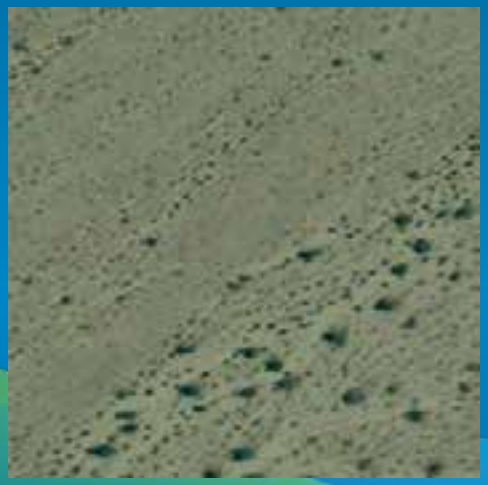
Strategic cache creation

- Feature class covers about 25% of California
- Contains about 97% of California's population
- Caching with this layer saves:
  - 943,000 tiles
  - 9.3 GB of space
  - 17 hours of caching time
- Bing analysis of access
  - http://hotmap.msresearch.us



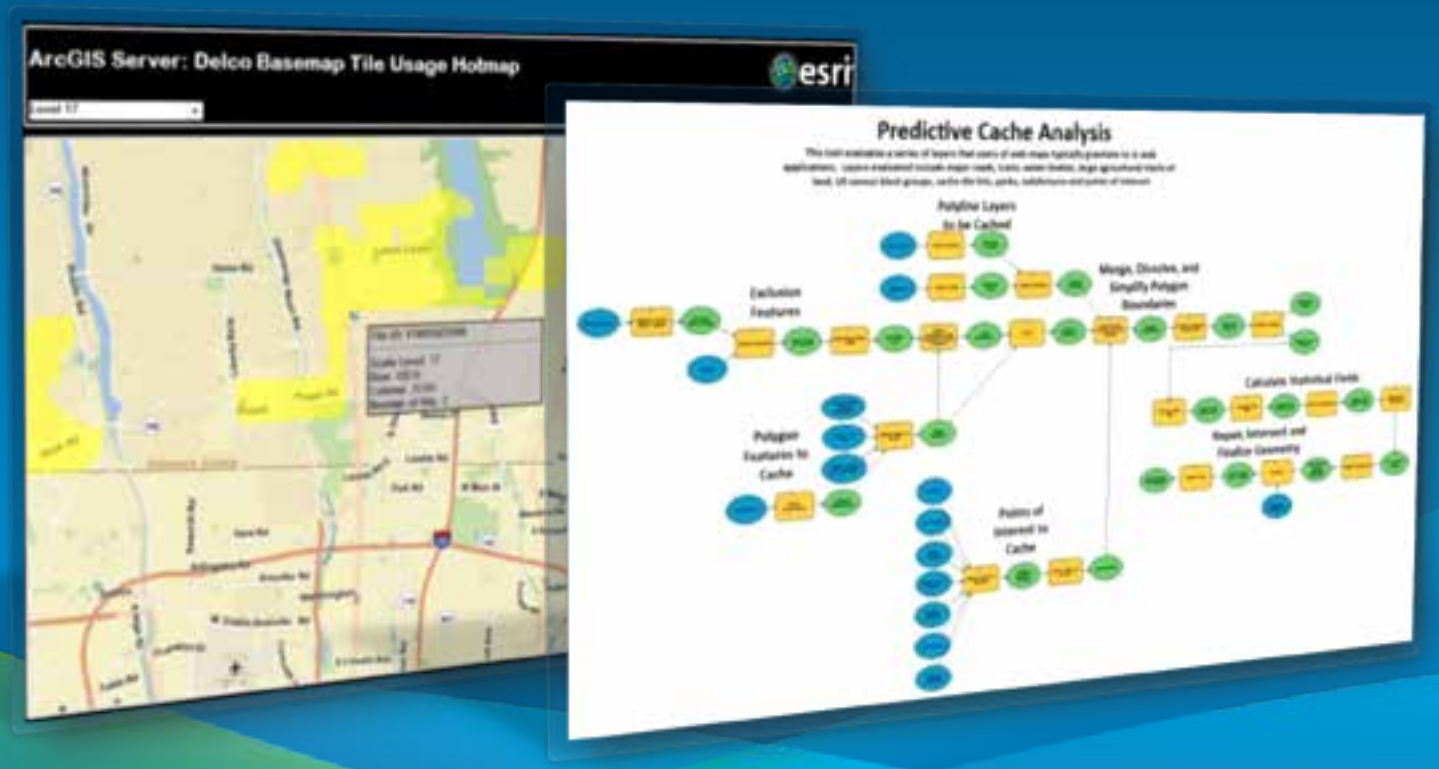
The ideal tiles to cache on demand

- Few simple features
  - Barren homogenous area
  - Rarely accessed
- Draw relatively fast
- Large scales only



ArcGIS Server Descriptive Tile Analysis

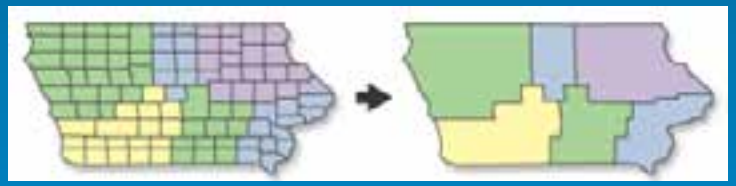
- Tile Usage Heat map
- ArcGIS Server descriptive tile analysis



More tips for caching by feature class

- Map is automatically published in WGS 84 Web Mercator with Auxiliary Sphere
  - You can create your own tiling scheme

- Avoid numerous small features
  - Aggregate Polygons tool
  - Dissolve tool

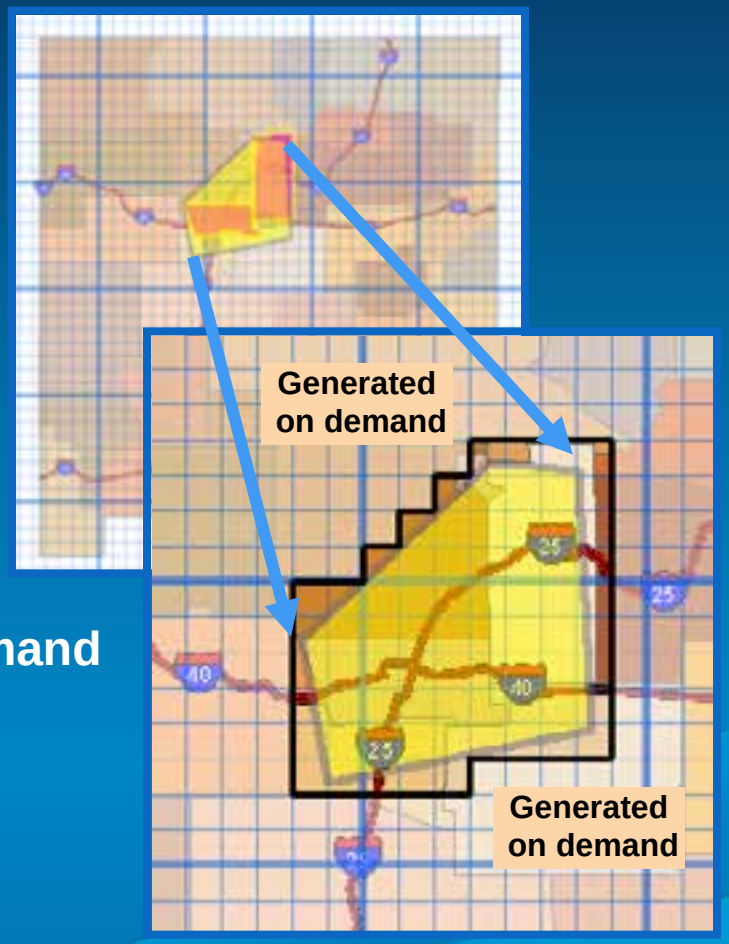


- Avoid excessive vertices
  - Simplify Polygons tool

- Tips for caching by feature class blog post

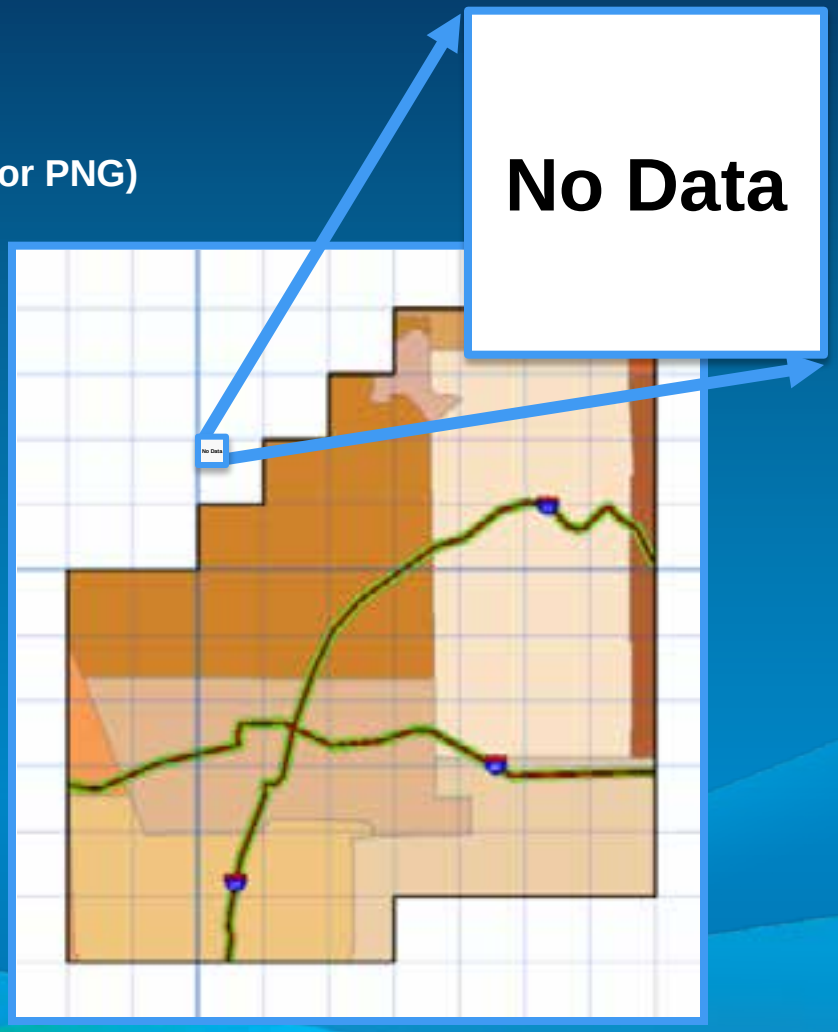
Pre-create coupled with cache on demand

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



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
- Knowledge base article 36939 has sample files



Updating Map Caches

Updating a cache

- Architecture
  - Using a staging server
  - Using a cluster
- Implementation
  - Geoprocessing

Cache update strategies

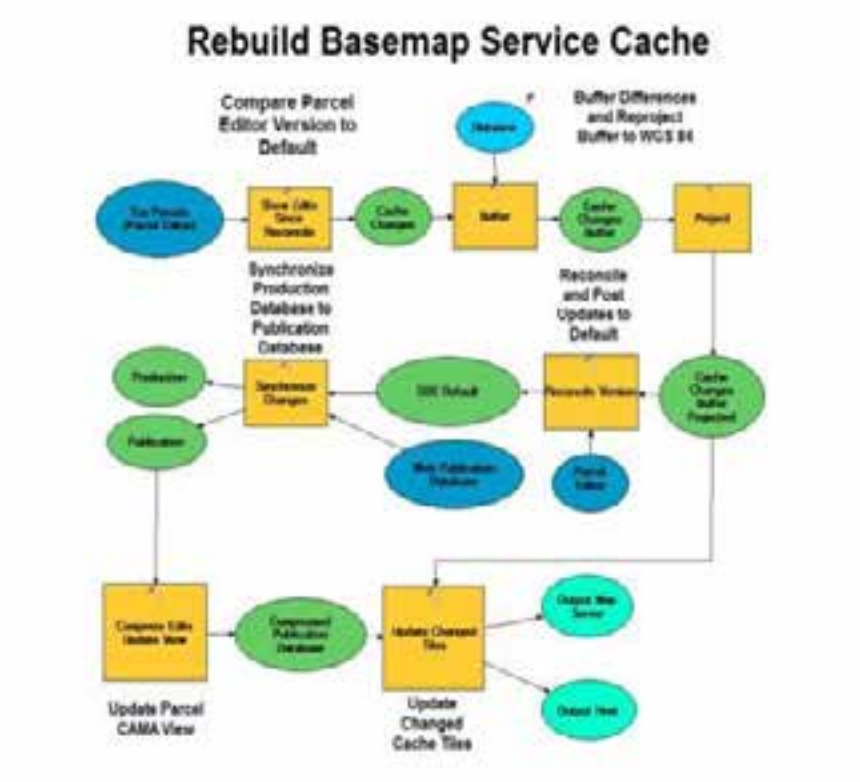
- Rebuild the entire cache
  - Size of cache
  - Time to cache
- Rebuild specific tiles
  - Rebuild at specific scales
  - Rebuild areas based on change detection

Cache Update Automation

- Use Model Builder to script Cache Update Automation
  - Rebuild Specific Tiles
  - Export to Python
  - Schedule Run Time

Compare feature classes

Show edits since reconcile

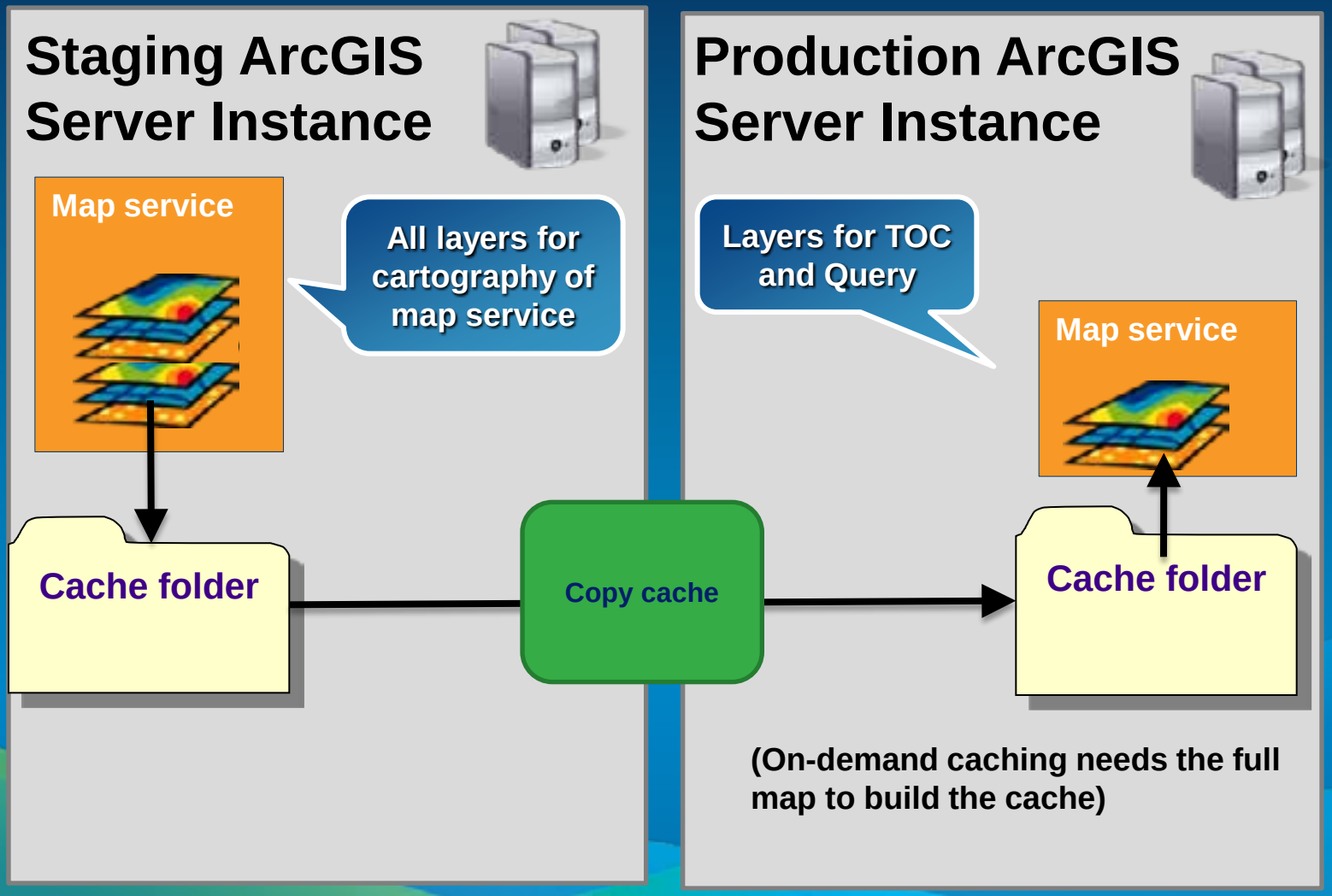


DEMO

Strategic cache updates

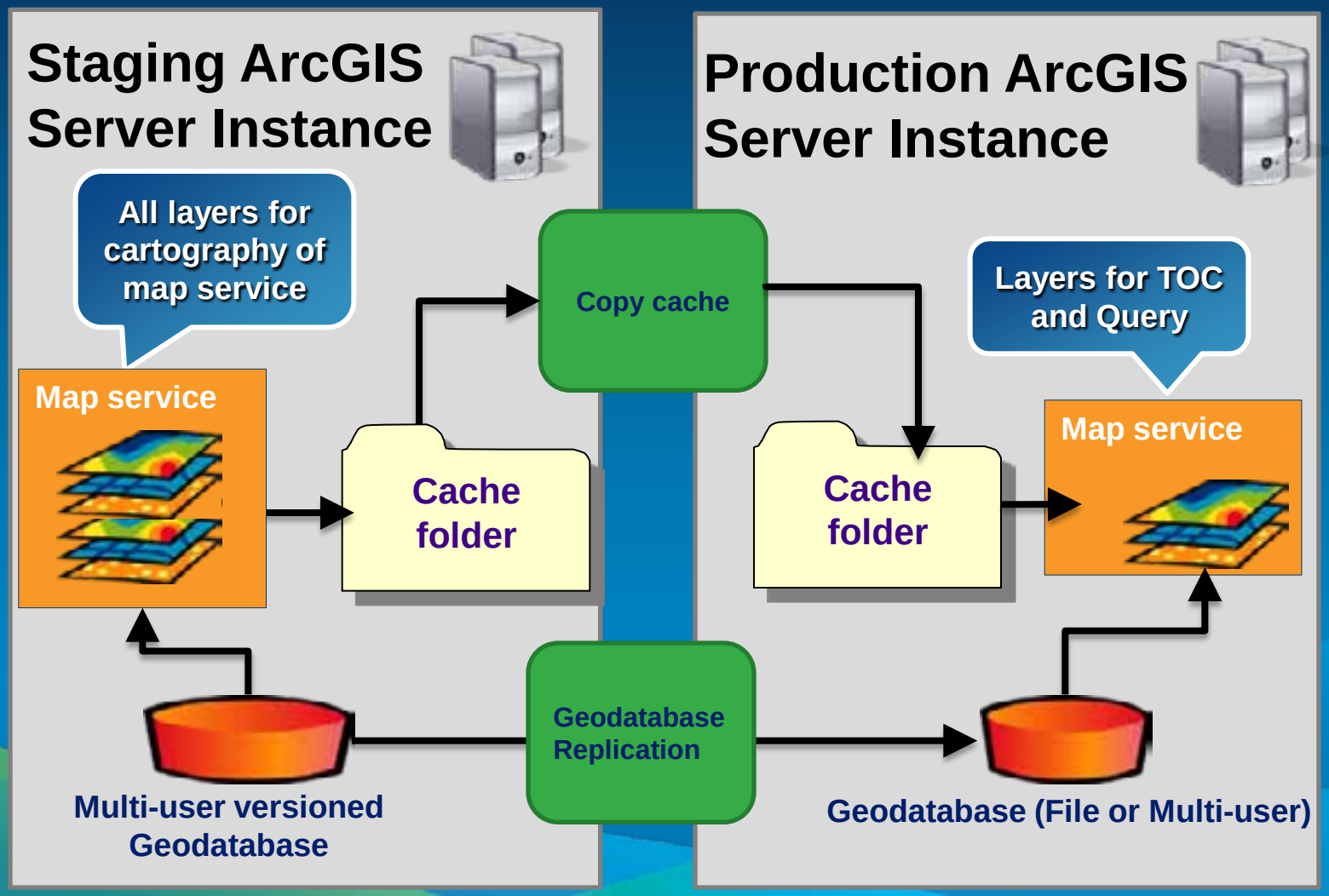
System architecture for caching

Update a cache using a staging server



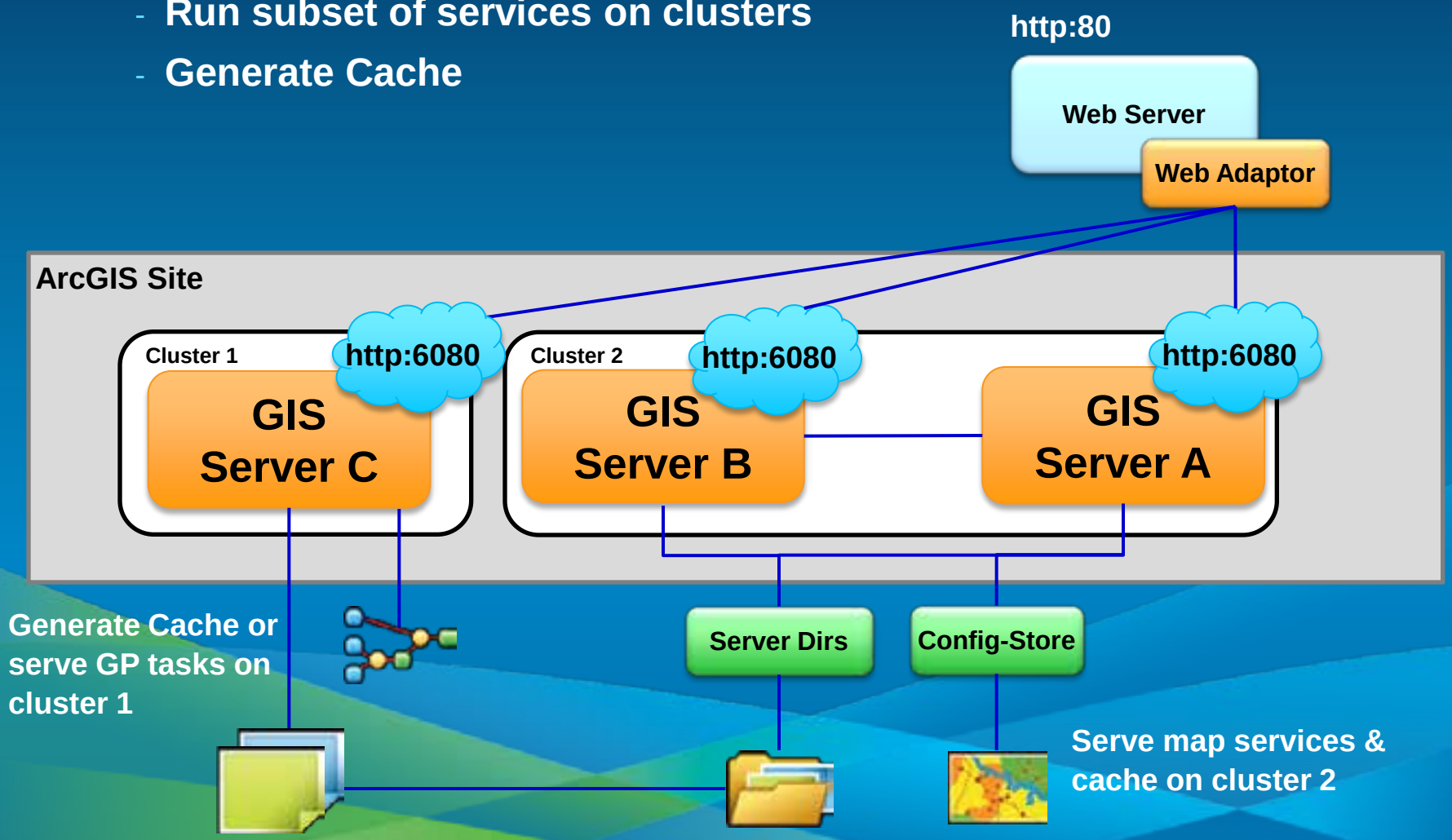
State of Indiana Imagery With Metadata

Update a cache and data using a staging server



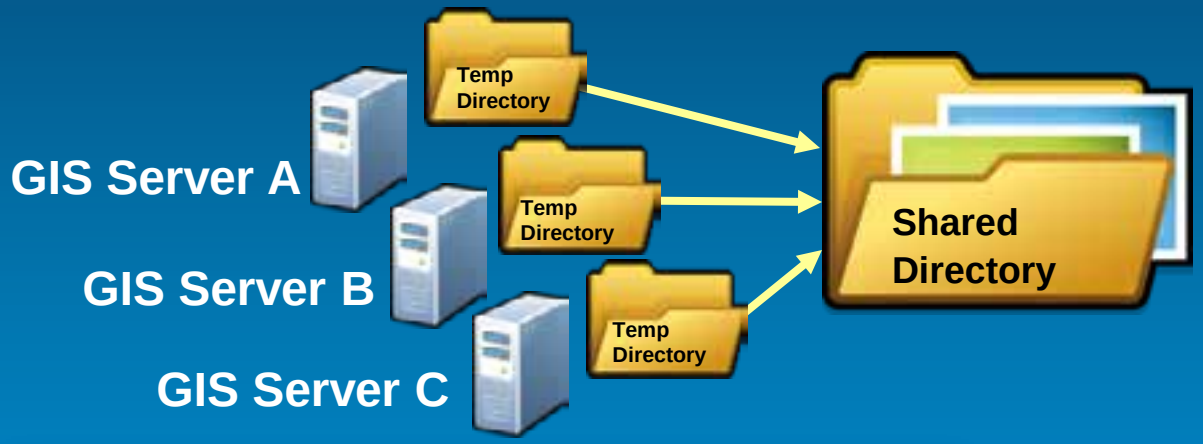
Multi-Machine Deployment With Web Adaptor & Clusters

- Organize GIS Servers into Groups or Clusters
  - Run subset of services on clusters
  - Generate Cache



Generate using multiple LAN hosts

- Configure instances for CPU's on all SOC hosts
- Enable *"Use local cache directory…"*



Caching in the Amazon Cloud

ArcGIS Server Cloud Builder

for Amazon Web Services

- Quickly provision Amazon Web Service Instances
  - Linux - This Is Awesome !!!!
  - Windows
- Supports Auto Scaling
  - Set capacity thresholds
    - Scale up new EC2 instances when needed
    - Scale down EC2 instances when finished
- Did I mention Linux?

Building cache in the cloud

- Likely it is more efficient to build the cache in the cloud
  - Transfer options: ArcGIS Server, RDP, S3, FTP, AWS Import/Export
- Use Large instances
  - High-memory instances
- Auto-scaling?
  - Maybe if you can’t monitor the job very closely

DEMO

Building cache in the cloud

Copying caches

- Compact cache
  - RoboCopy or RichCopy
- Exploded cache
  - Windows Copy/Paste inefficient for large caches
  - Use RichCopy or RoboCopy command
    - Use Multiple Directory Copy Threads
    - /D switch will only copy new tiles

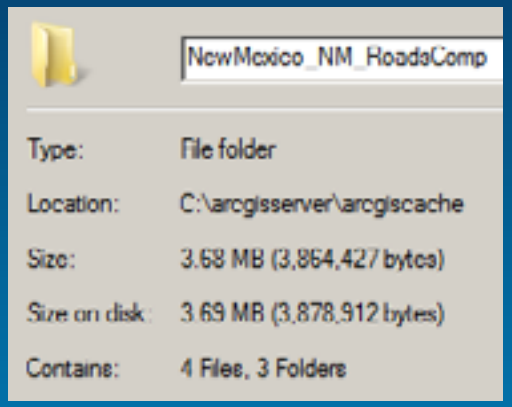
*Multiple Threads: 40 **Directory Copy Threads: 40

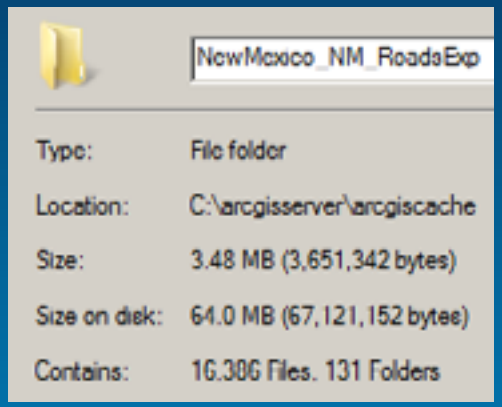
Cache Type	Size on Disk	Size	Number of Files	RoboCopy*	XCopy	Windows Copy/Paste	Rich Copy**
Compact Cache	1.43 GB	1.43 GB	115	2:08	2:28	2:26	2:12
Exploded Cache	2.22 GB	1.43 GB	508,716	3:44:34	6:41:02	6:32:58	2:39:16

Performance Considerations

Disk maintenance

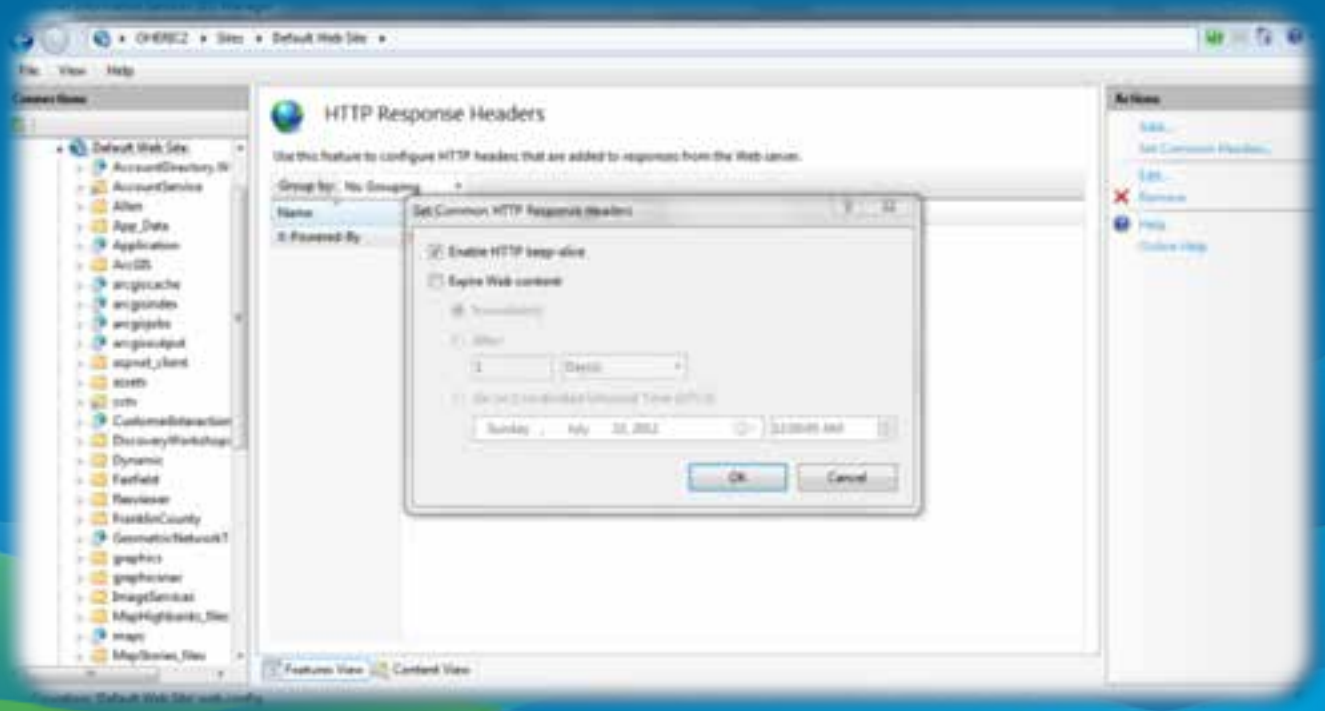
- Turn off backup
- Turn off virus scanning





HTTP connections

- Turn On HTTP KeepAlive for best performance
  - Multiple image requests don’t need to open a new connection
  - Biggest benefit with one host (~2-3 times faster tile requests)
- Apache: KeepAlive directive
- IIS



Cache distribution

- HTTP 1.1 spec constricts browsers to two simultaneous downloads
- Improve cache retrieval performance by using multiple hosts
  - Can be one server with multiple DNS entries (cache1.mydomain.com, cache2.mydomain.com)
- Geographically distribute ArcGIS Server instances

Using multiple domains

- With multiple services
  - Use a different domain for each services
- With one service
  - API's support multiple web services endpoints for a single layer

```
var layer = new esri.layers.ArcGISTiledMapServiceLayer(
      "http://www.mydomain.com/ArcGIS/rest/services/myservice/MapServer",
      { tileServers: [
      " http://cache1.mydomain.com/ArcGIS/rest/services/myservice/MapServer ",
      " http://cache2.mydomain.com/ArcGIS/rest/services/myservice/MapServer "]
      });
```

- Use with small cache tiles
- Can reduce browser caching and result in more HTTP connections

Switching to a Dynamic Request

- Supported by Map Service & the Web API's
- Force a Cached Service to Render Dynamic
  - Use ArcGISDynamicMapServiceLayer(Cached Service URL)
- Render cached tiles from smaller scales levels 0 – 15
- Render dynamic services at larger scale levels 16 – 19
  - Large scales = less area to draw features = faster

Scale Levels 10 – 17 Cached

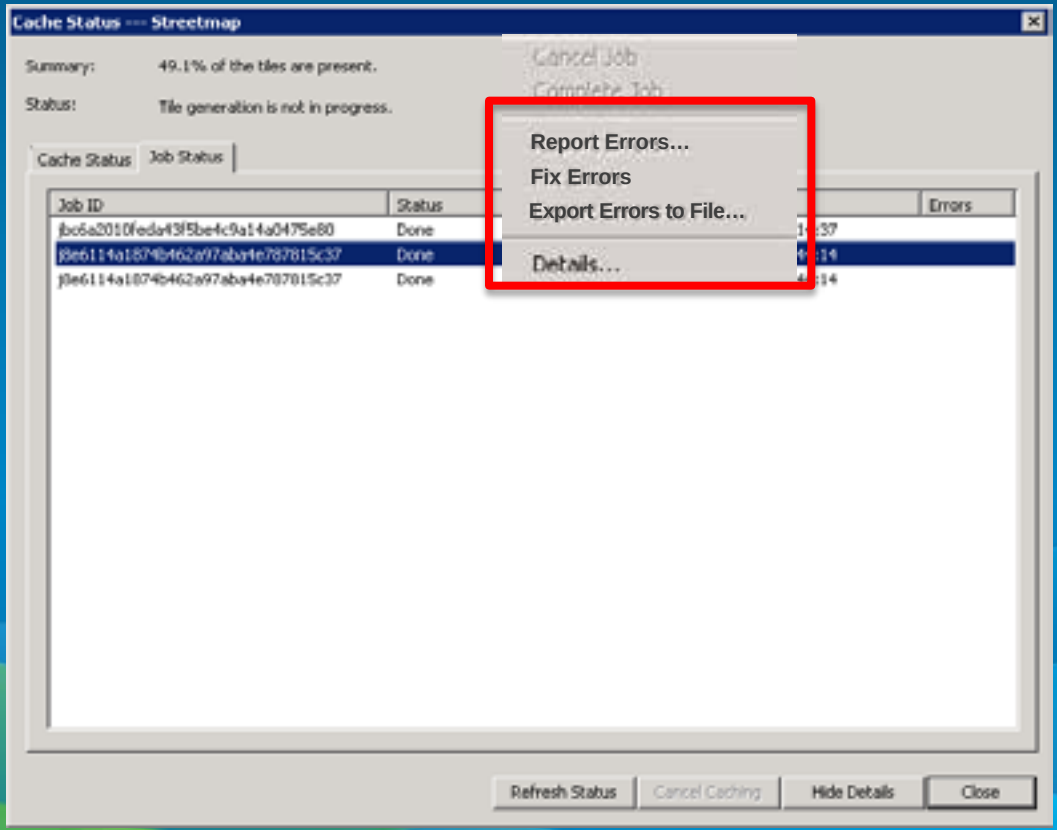
Scale Levels 18 – 19 Forced Dynamic Draw

Java Script API – Dynamic Draw

Recovering from Cache Failures

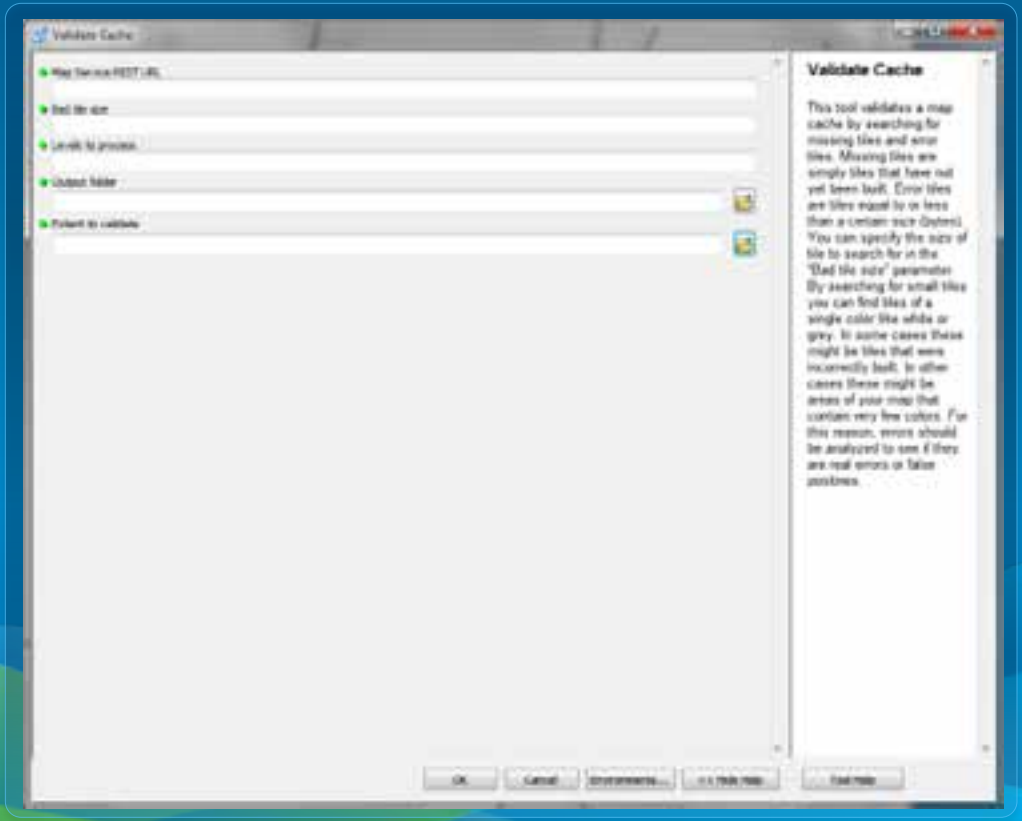
Cache failure & recovery – Out of the box

- Out of the box tools
  - Course Grained for locating extents
  - Fix errors re-caches extents where errors were reported



Cache failure & recovery – sample tools

- Cache Validation Tools
  - Fine grained for locating tiles by file size



Other Caching Resources

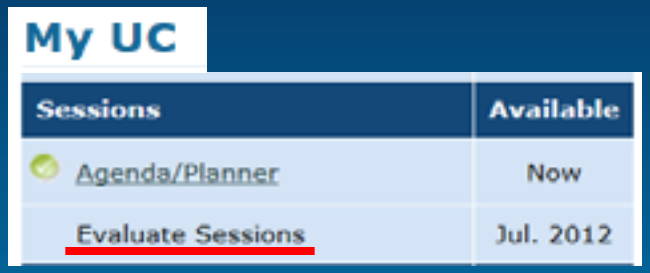
- Compare feature classes
- Show edits since reconcile
- Derive map service statistics from the ArcGIS Server logs
- Write requested map extents to a feature class
- Tile Usage Heat map
- ArcGIS Server descriptive tile analysis
- Web GIS Blog

Relevant Sessions

- Publishing Image Services in ArcGIS
  - Thu 7/26/2012 -- 8:30 AM - 9:45 AM Room 28D
- Advanced Map Caching Topics
  - Thu 7/26/2012 -- 8:30 AM - 9:45 AM Room 10
- Best practices for caching imagery in services
  - Thu 7/26/2012 -- 11:00 AM - 11:30AM Demo Theater
- Publishing Image Services in ArcGIS
  - Thu 7/26/2012 -- 3:15 PM - 3:35 AM Room 28D
- Map Caching: Tips from ArcGIS Online Team
  - Wed 7/26/2012 – 3:15 PM – 3:35 PM Room 01B

Steps to evaluate UC sessions

- My UC Homepage >
  "Evaluate Sessions"



- Choose session from planner

OR

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- Thank you for attending
- Have fun!
- Open for Questions

- Please fill out the evaluation:

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