Designing, Deploying, and Using Cached Map Services

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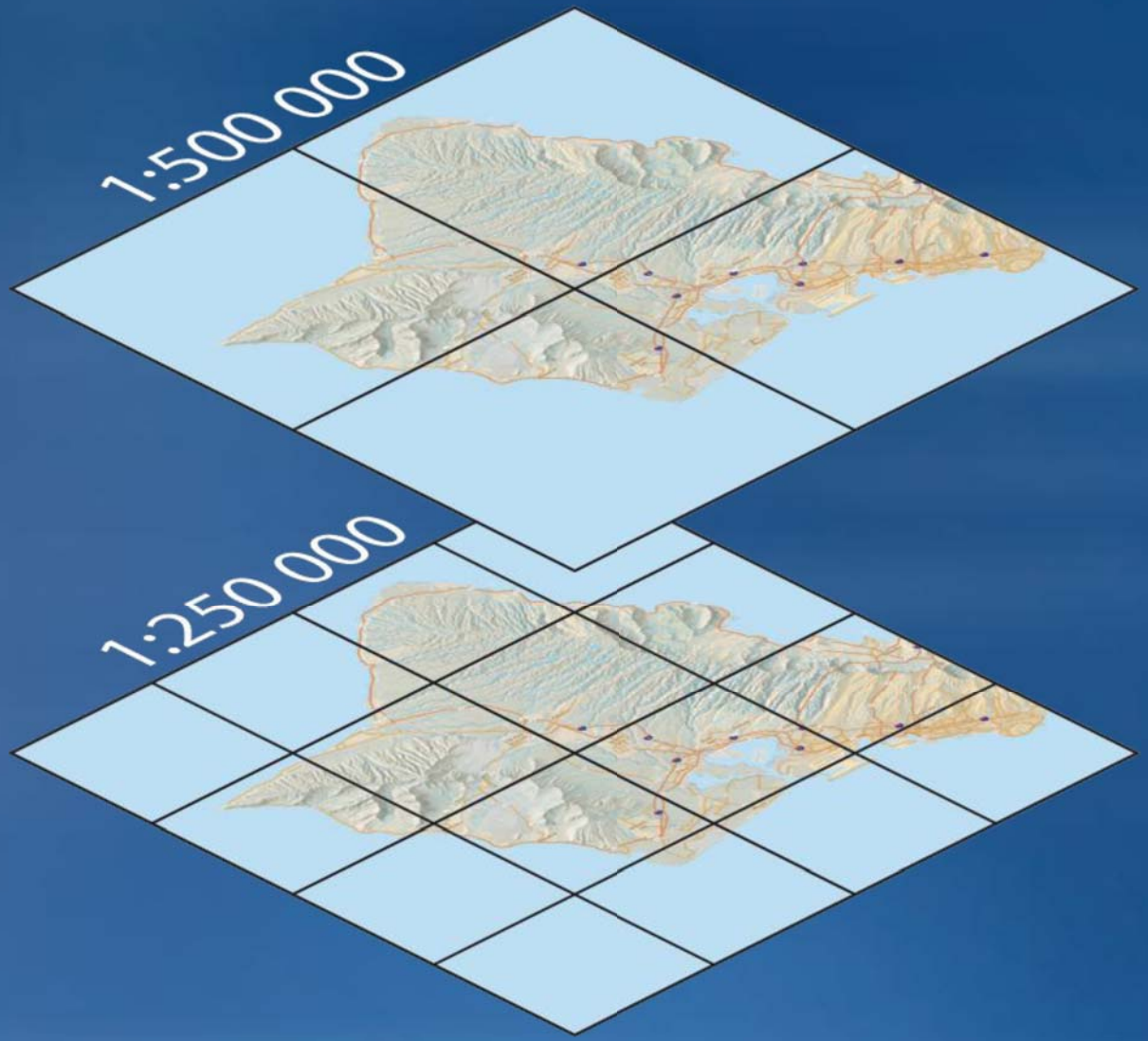
What should you expect in this session?

- Basic to advanced topics
- Outline
  - What is map caching?
  - Why should I cache?
  - How to create a cache
  - Caching strategies
  - More 9.3 improvements
  - Questions?

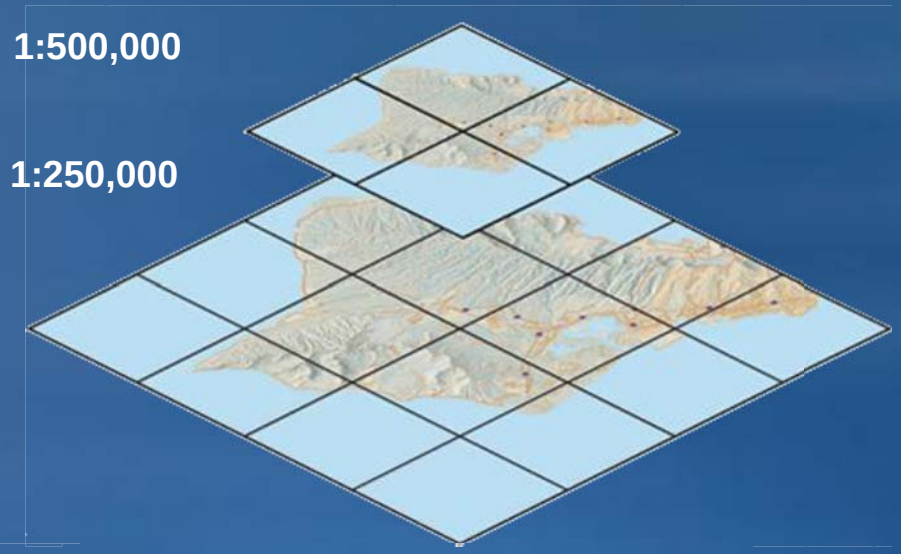
What is map caching?

What is a Cache?



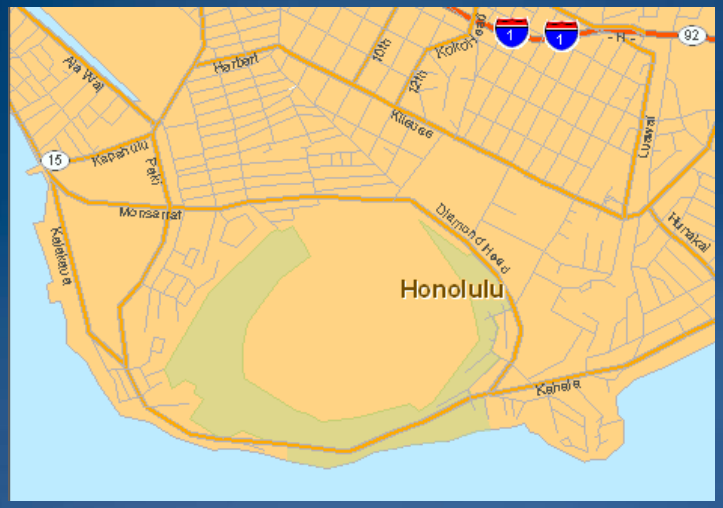
What does it mean to cache a map service?

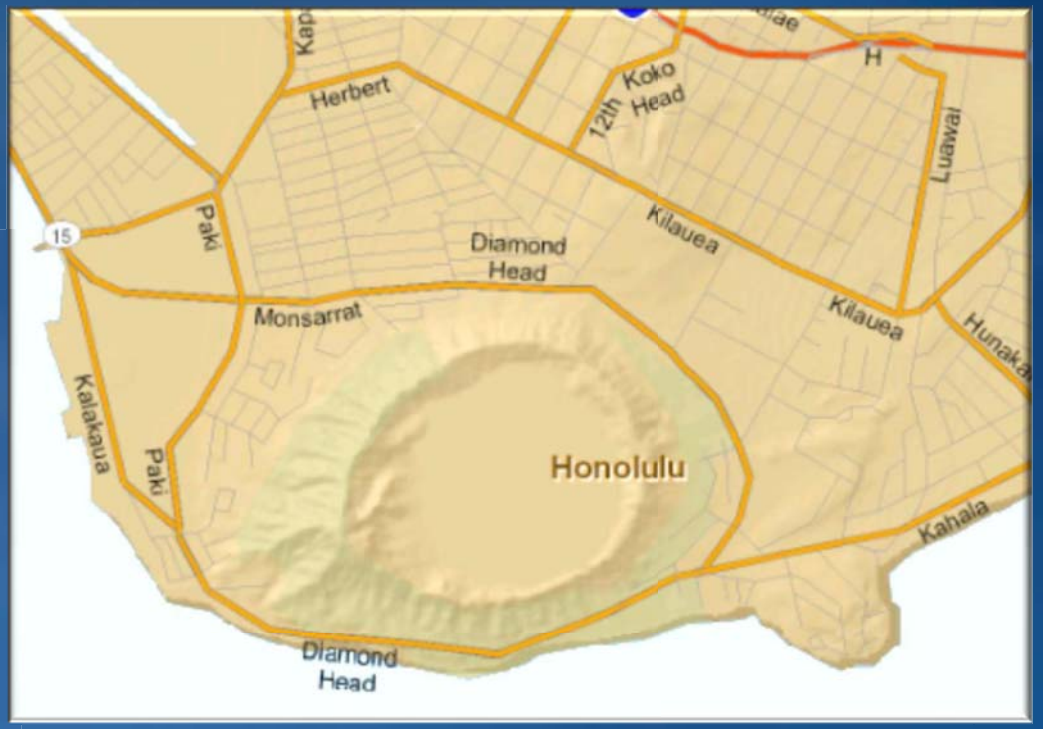
- A cached service has a set of map images that have been pre-rendered for rapid display.



- Created at pre-determined scale levels
- Tiles stored on web server for fast retrieval

Why Cache Maps?





World-Class Cartography
Best Performance & Scalability

Internet users expect the performance of cached maps

What users expected 10 years ago

- Dynamically drawn map
- Slow
- Compromised cartography

What users expect today

- Cached map
- Fast
- Beautiful cartography

Demo

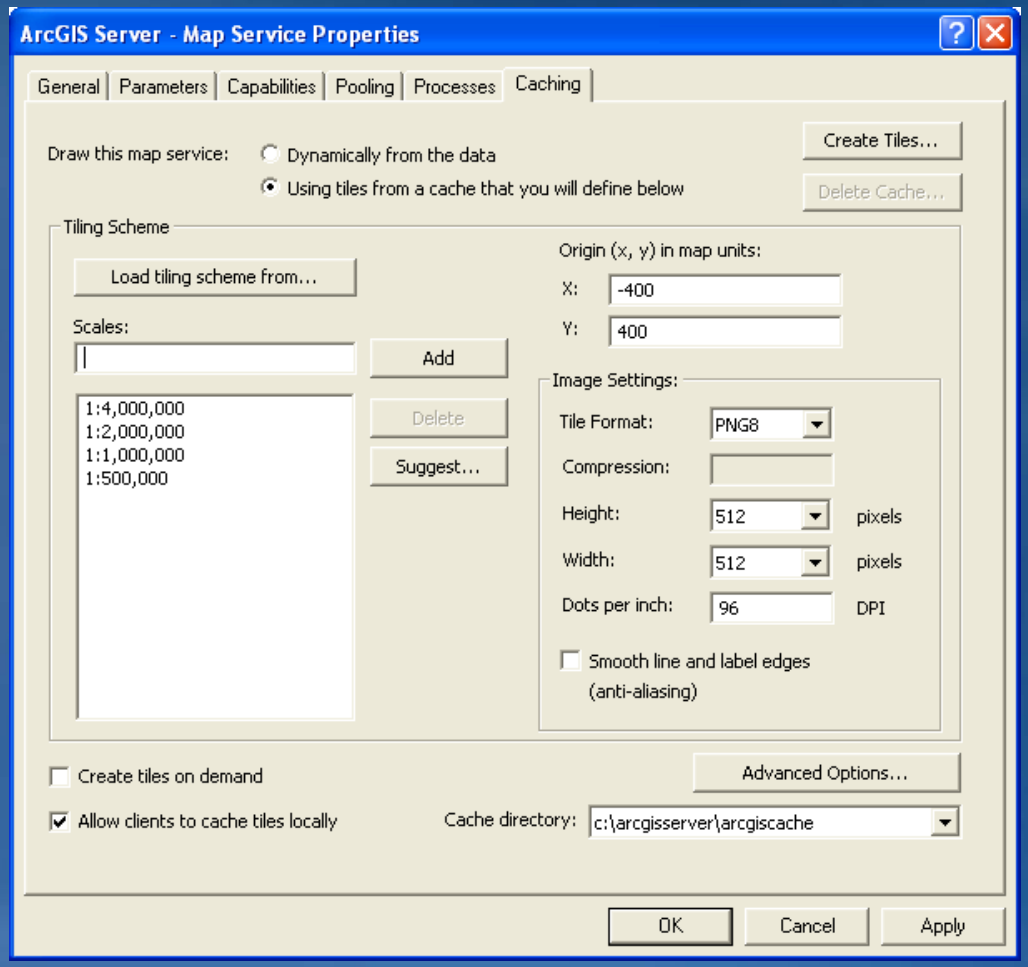
- Java Script Extension for VE
- http://resources.esri.com/help/9.3/arcgisserver/apis/javascript/ve/sdk/index.htm#showme

How to create a cache

- Cache creation tools
- Properties of a cache
  - Tiling scheme
    - Tile Size
    - DPI
    - Scales
    - Origin
  - Image format and compression
  - Anti-aliasing
  - Fused or multi-layer

New caching workflow at 9.3

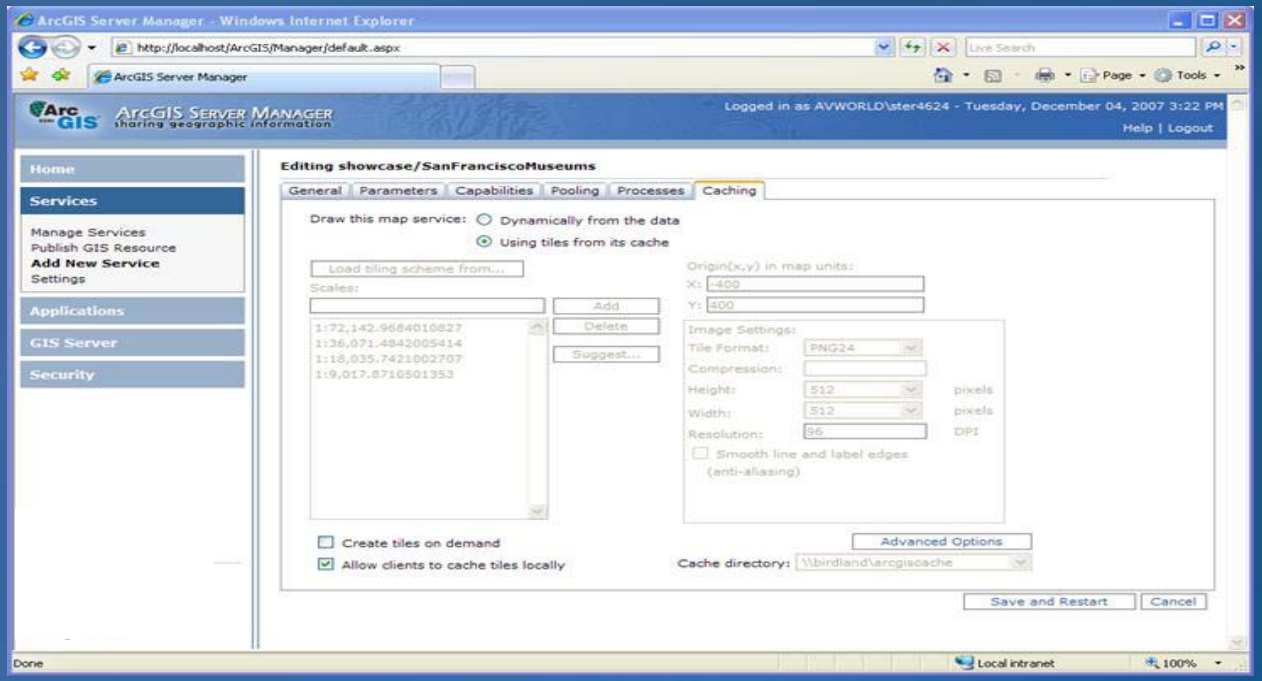
- Set the tiling scheme, then create the tiles
  - Use Manage Map Server Cache Tiles tool for both Create and Update
  - Cannot change tiling scheme after clicking OK or Apply



Caching tab is also available in Manager in 9.3

- You can use it to:
  - Define the tiling scheme for a service
  - Enable cache on demand

- You cannot use it to launch the caching tools



Set the tiling scheme

- Choose from well-known tiling schemes of Web map services
  - ArcGIS Online
  - Google Maps & Virtual Earth
- Import from file or service
- Create your own

Choosing the scales for a tiling scheme

- Build just the scales you need
  - Determine closest required scale
  - Double scale denominator until full extent is reached
  - Adjust smallest scale to full extent of map service
- Always prototype your cache
  - Set custom full extent of map data frame to a small area
  - Use as a guide for cache appearance, creation time, and size

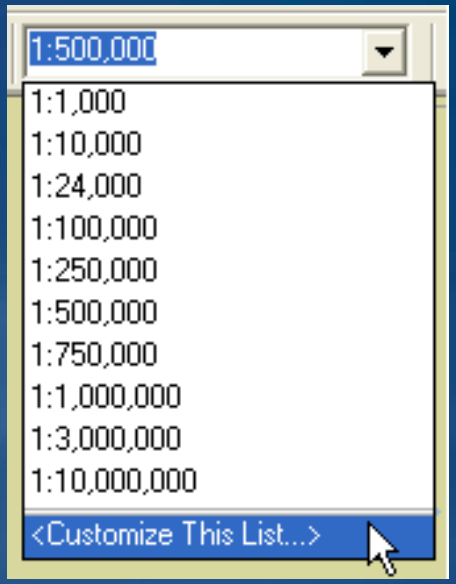
Sample 10 level cache

Level	Scale	Tiles	% of total
1	1:16,000,000	1	0.000%
2	1:8,000,000	4	0.001%
3	1:4,000,000	16	0.005%
4	1:2,000,000	64	0.018%
5	1:1,000,000	256	0.073%
6	1:500,000	1,024	0.293%
7	1:250,000	4,096	1.172%
8	1:125,000	16,384	4.688%
9	1:62,500	65,536	18.750%
10	1:31,250	262,144	75.000%

Final level is always ~75% of the total

Design for your cache scales in ArcMap

- Choose a set of scale levels and design at those
  - ArcGIS Online, Google Maps, VE scales, or your own?
  - Add the scales to the ArcMap dropdown list
  - Make the map look good at each scale
- Copy layers
  - Can set a different scale range and symbology for each copy
- Group layers by scale level
  - Only have to set the scale range at the group layer level



Demo

- Load Scales for ArcGIS Online
- Publish Map Document
- Caching Parameters

Map authoring tips

- Background color
  - Data Frame (ArcMap) Background = transparency color
  - Transparent color defaults to near-white (253, 253, 253)
  - Avoid using a background color that's already in your map
- Use the Maplex labeling engine

Tile size and DPI

- Tile size
  - Pixel dimensions of each image
  - 256x256 and 512x512 are defacto standards
    - ArcGIS Online uses 512 X 512
    - Google Maps and Virtual Earth use 256 X 256
    - Use caution outside these sizes
  - Larger dimensions are faster to build, but tiles take longer to download

- DPI
  - Resolution of the cache tiles that the server will generate
  - Set higher than default (96) if clients printing cached services
    - Use caution when changing default
    - Symbol sizes are affected by DPI

Choosing output image type

	Transparency	# of colors	Storage	Best for
JPEG	No	16 million	Lossy (1%-100% compression)	Raster
PNG8	Yes	256	Lossless	Vector
PNG32	Yes	16 million	Lossless	Raster / Vector
PNG24	Yes (No in IE 6)	16 million	Lossless	Raster / Vector

- Use PNG8 for overlay services
  - –Boundaries, Street network for overlaying imagery, etc.
- Use JPG image format for base maps
  - –Compression quality = 90 is a good choice
- Avoid PNG24 with Web applications
  - –IE6 does not honor transparency in PNG24

Anti-aliasing

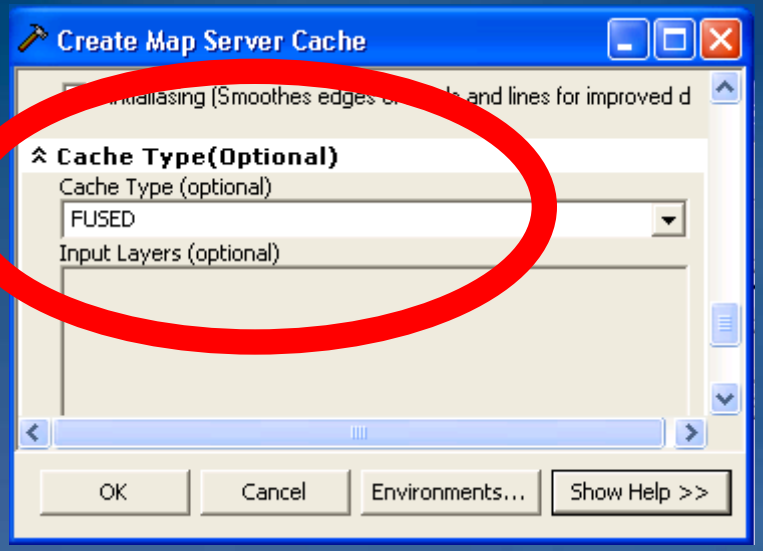
- Smoothes edges of labels and lines by blending them with the background
  - Choose background color carefully!
- Cannot set this up in ArcMap. Use the caching tools.
- Takes longer to cache

Fused or Multi-layer

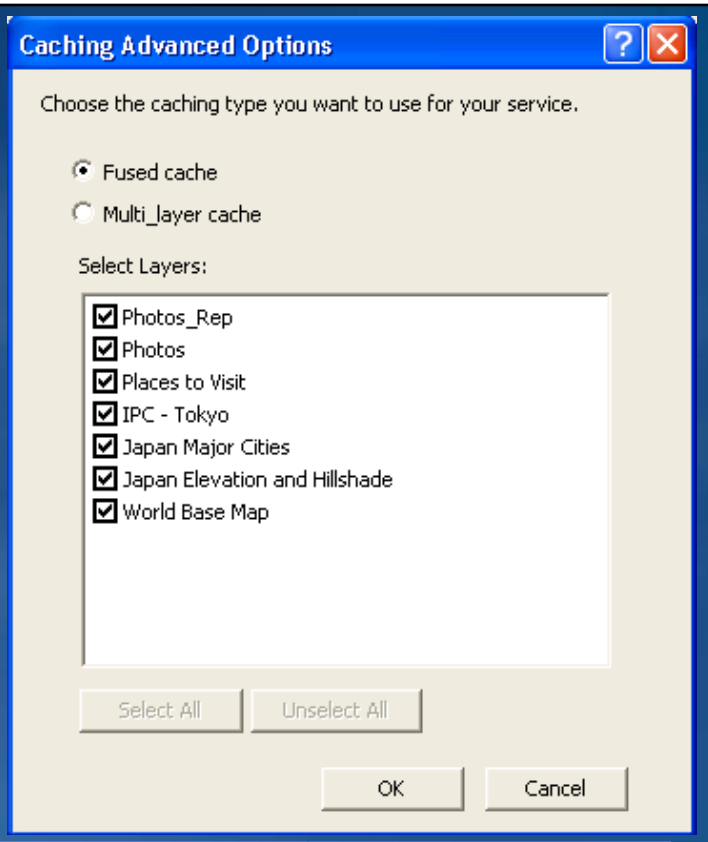
- Fused
  - Single image tiles for all map layers at each scale level
  - Best performance
  - No control over individual layer visibility
- Multi-layer
  - Image tile for each map layer at each scale level
  - Only practical with ArcMap clients
  - Avoid with web applications
    - Blending on web tier reduces scalability and performance
    - Internet users expect the performance of fused cached maps

Fused vs. Multi-layer Caches

Create Map Server Cache tool



Advanced Cached Service Properties



Fused caches are recommended for the full performance benefits of Server caching.

Create tiles

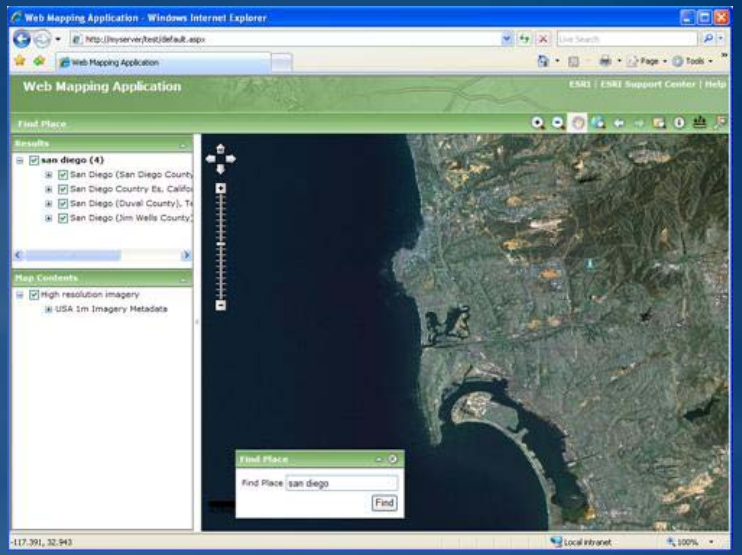
- Manage Map Server Cache Tiles
  - New tool at 9.3
  - Similar to Update Map Server Cache Tiles at 9.2
  - Allows fine-grained control over scales that are cached
- Launch this tool from:
  - ArcCatalog by clicking “Create tiles” or “Update tiles” in the Caching tab of Service Properties
  - ArcToolbox
  - Command line
  - Scripting environment such as Python
- Service must be started to create tiles
- Use N+1 instances where N = the number of sockets on server

Demonstration: Cached Map Services

- Portland (Notification):
  http://mapapps.esri.com/serverdemos/mailinglist/index.html
- ArcGIS Online (Site Selection):
  http://mapapps.esri.com/serverdemos/siteselection/index.html
- Fiddler

Clients to Cached Map Services

- ArcMap (2D)
- ArcGlobe and ArcGIS Explorer (3D)
- ArcGIS Web Mapping Applications
  - .Net , Java, JavaScript
- ArcGIS for AutoCAD
- OGC clients
- Google Maps, VE and Google Earth



Using caches in Web applications

- Navigation limited to the tiling scheme scales
- Tiles cannot be reprojected
- ArcGIS Online mashups
  - Map must use WGS 1984 coordinate system
  - Must use ArcGIS online tiling scheme
- Google Maps and Virtual Earth mashups
  - Map must use WGS 1984 Web Mercator coordinate system
  - Must use Microsoft Virtual Earth / Google Maps tiling scheme
  - May need to apply appropriate transformation to get data to align
    - WGS_1984_Major_Auxiliary_Sphere_To_WGS_1984
    - See KB article 34749

Using caches in Desktop

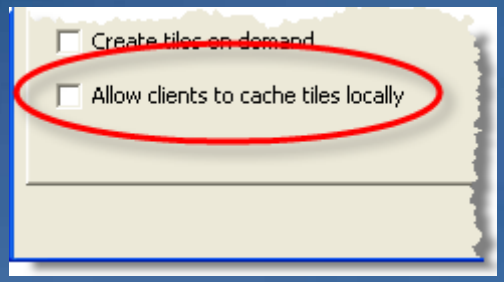
- ArcMap
  - High level of control over tile appearance
    - Continuous zoom
    - Reprojection
  - Can easily overlay with other services and data
- ArcGIS Explorer
  - Can overlay 2D cache on globe surface
  - ArcGIS Online tiling scheme recommended
- Must clear local cache after update

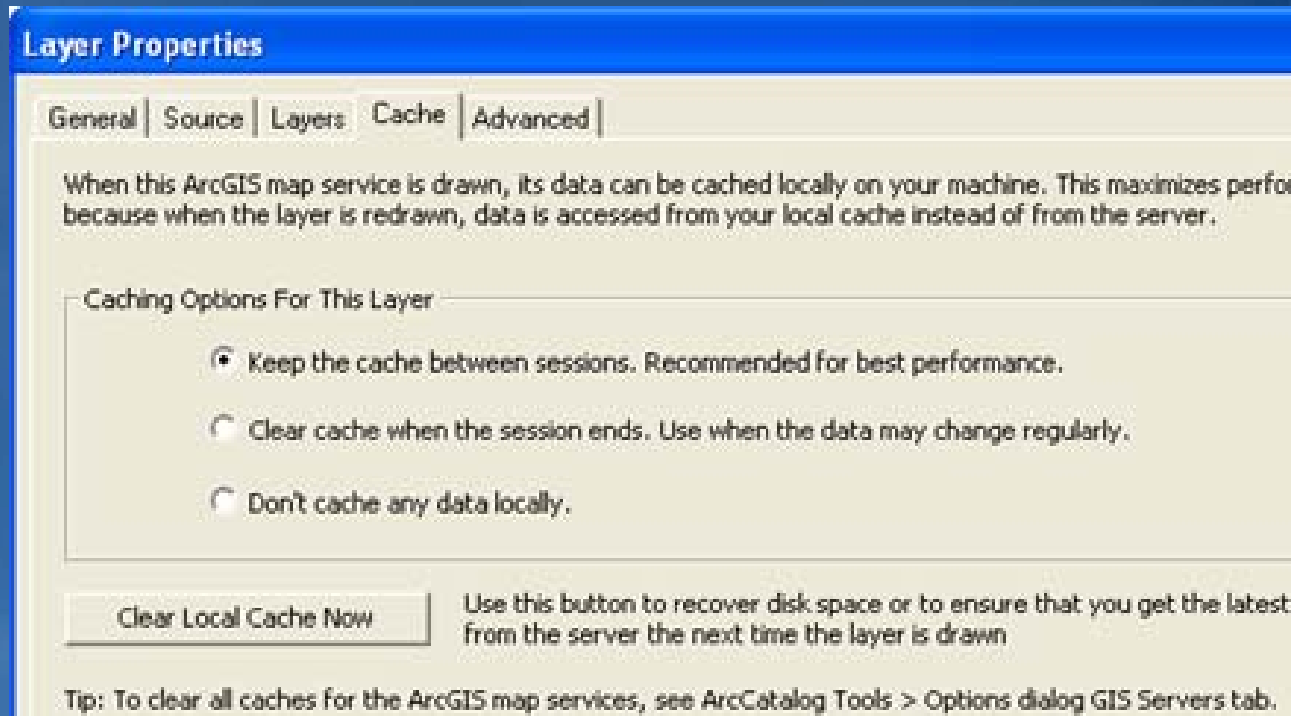
Desktop clients and cache updates

- ArcGIS Desktop and ArcGIS Explorer maintain local caches
- Users must clear local cache to see updates
- User can disable local caching
- Server administrator can also disable local caching
  - New at 9.3
  - Overrides client settings

Client-side ArcMap Parameters

- ArcMap creates a local cache
  - Located: %temp%\esrimapcache\
  - Can get out of sync with server side cache
  - Administrator can allow/disallow client caching
  - ArcMap users can also control caching behavoirs





Caching strategies

Cache size affects strategy

- Small caches
  - Create all tiles
  - Update all tiles frequently
- Large caches
  - Create the most accessed areas first
  - Create tiles on demand
  - Update strategically

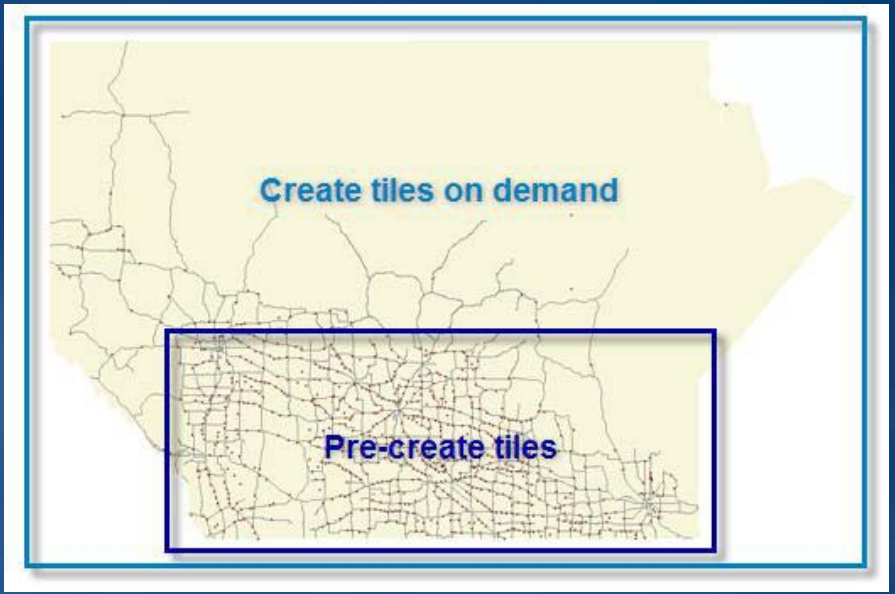
Cache by feature class

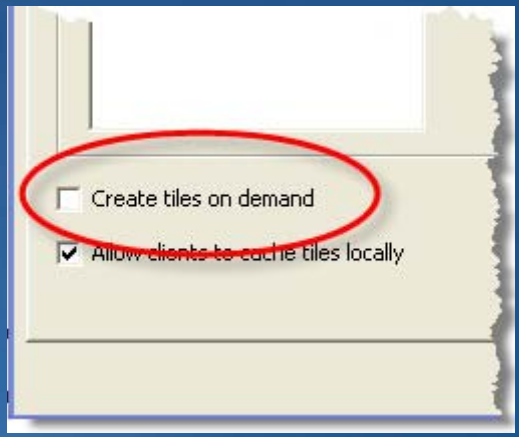
- Cache only within boundary of features you supply
  - You can supply a feature class with just one feature
  - Avoid numerous features or geographically small features
  - Saves time and diskspace
- Optionally, track the status of which features have been cached

- http://blogs.esri.com/Dev/blogs/arcgisserver/archive/2009/02/05/Tips-for-caching-by-feature-class.aspx

On-demand caching

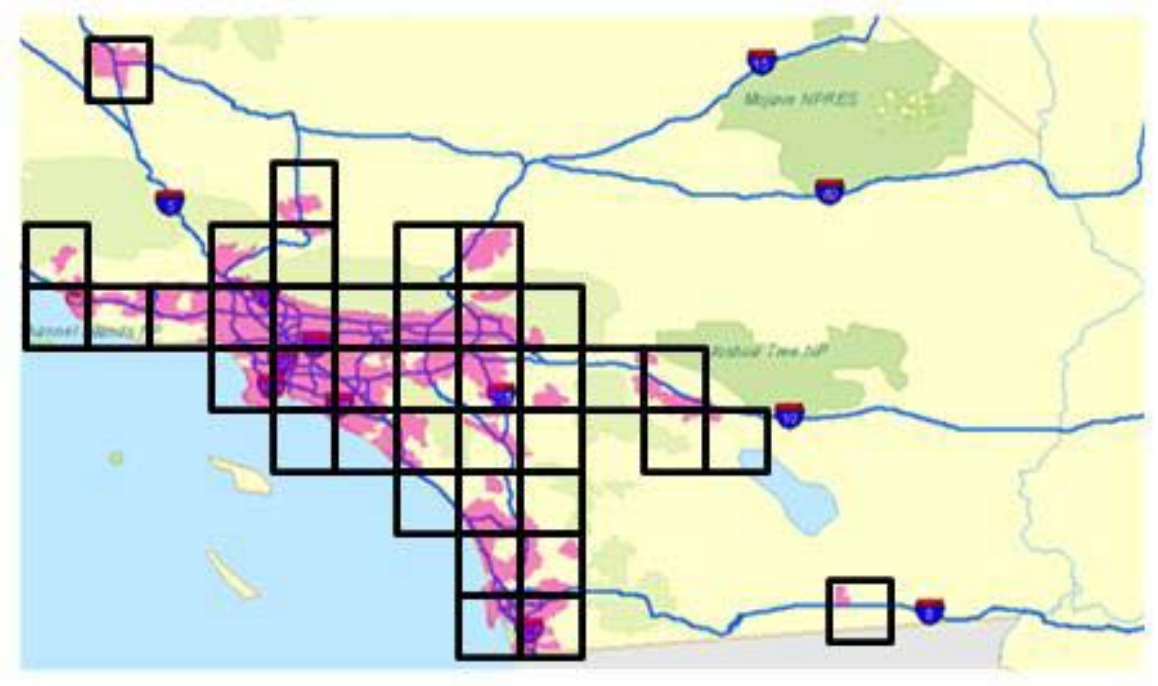
- Creates tiles as they are visited by users and adds them to your cache
- First visitor to an area must wait for tiles to be created
- Pre-create tiles for areas that you anticipate will be most popular
- Set as a service property in ArcCatalog or Manager





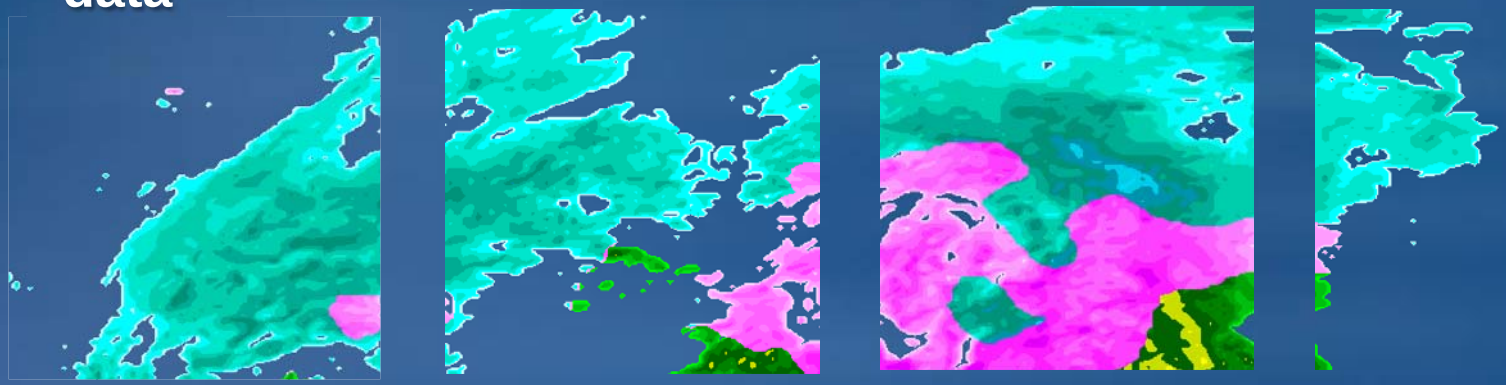
Cache by feature class + cache on demand

- Southern California populated places example



Updating the cache

- Necessary if you want to see changes in your data
- Gives you the performance benefit of caching, even with changing data

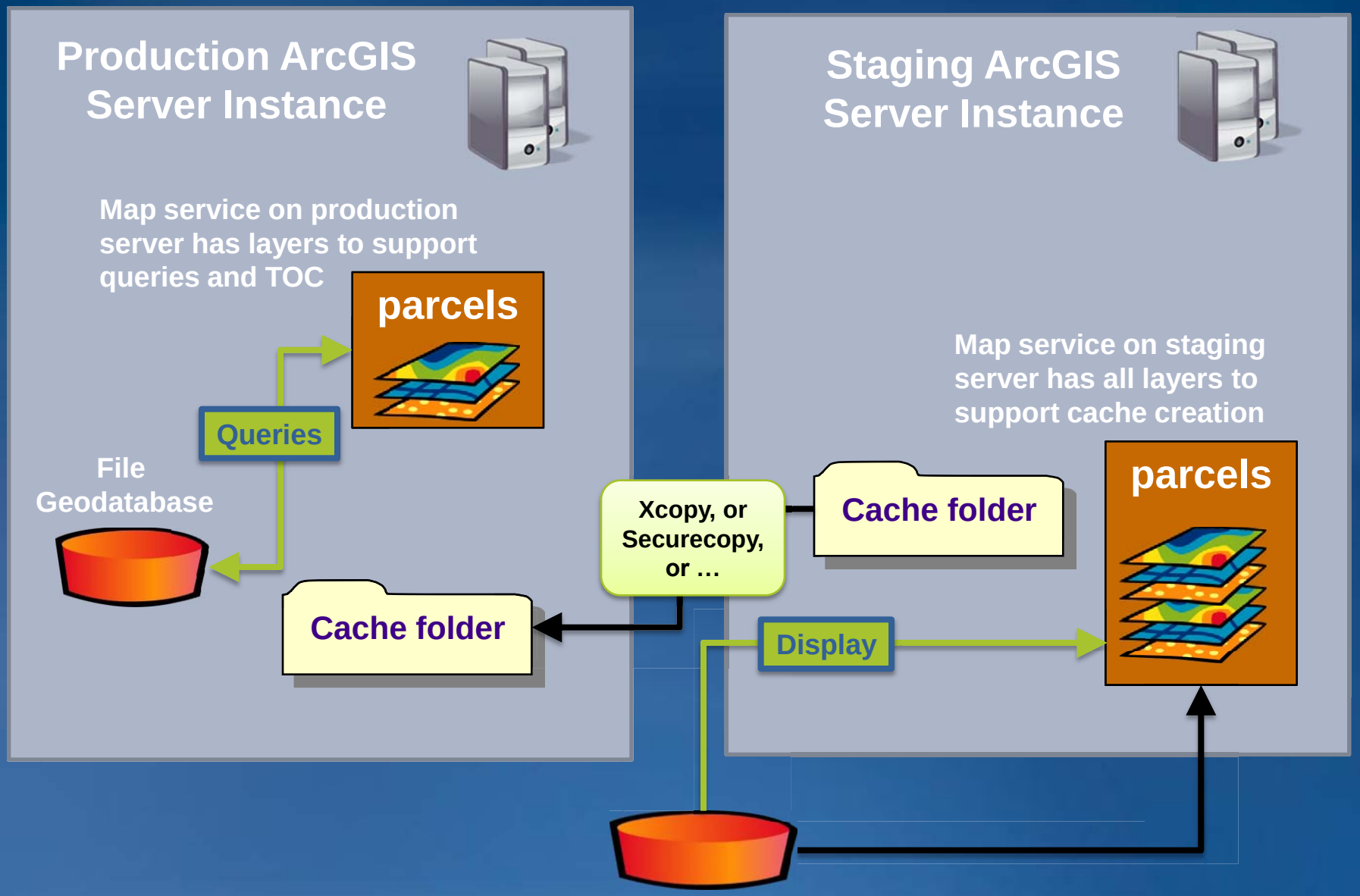


- Update with Manage Map Server Cache Tiles tool
  - Execute manually or via a scheduled script
  - See the Help for an example Python script

Strategic updates

- Geoprocessing model can be used to update only areas that have changed
- Custom Geoprocessing tool: Show Edits Since Reconcile
  - Use geodatabase versioning to track changes
  - Generate a feature class of where changes have occurred
  - Update the cache using feature class output
- Repeat on a regular basis

Update a cache using a staging server (scenario)



Globe caches

- 3D globe caches give optimal performance in ArcGlobe and ArcGIS Explorer
- Image format and tiling scheme is pre-configured
- Requires a globe service and use of globe caching tools

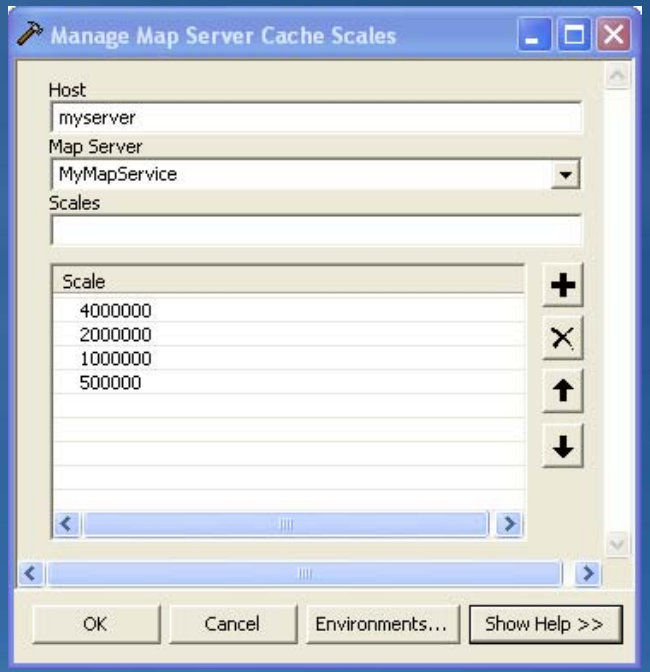
Creating a 3D globe cache from a 2D map cache

- Create a 3D cache from a globe containing a draped 2D map cache
  - Gives better cartographic quality and performance than you would get if you authored the .3DD in ArcGlobe
  - This is how ESRI created the ArcGIS Online globe caches
  - For instructions see ArcGIS Server Development Blog post: Creating a 3D globe cache from a 2D map cache
  - http://blogs.esri.com/Dev/blogs/arcgisserver/archive/2007/05/30/Creating-a-3D-globe-cache-from-a-2D-map-cache.aspx

9.3 improvements

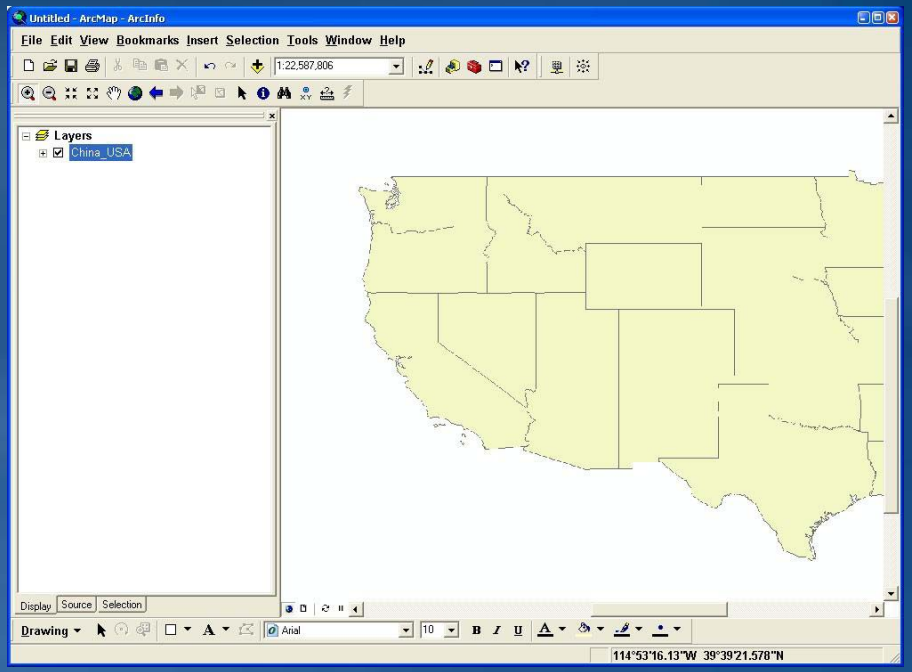
Add and remove scales from an existing cache

- Use the Manage Map Server Cache Scales tool
- Edits the cache configuration and the cache folders on disk



Improvements to ArcMap as a client

- Improved display of resampled cached tiles
  - Improves the look of ArcGIS Online Street Map
  - Helps eliminate issues like “disappearing boundaries”:



WMS services take advantage of cache

1. Enable WMS capability on a cached map service
2. WMS service uses cached images instead of generating an image on the fly

- Only uses cache when there is no need to change projection, layer order, layer visibility, background, etc.

Updated documentation

- Caching Help greatly expanded between 9.2 and 9.3
- Web help is constantly updated
  - Web Help is available at 9.3 Beta (requires a login): http://webhelp.esri.com
- ArcGIS Server Development Blog posts address specific problems and are later moved to the web help
  - http://blogs.esri.com/Dev/blogs/arcgisserver/archive/2007/07/12/Strategies-for-large-caching-jobs.aspx

Training

- ArcGIS Server: Web Administration Using the Microsoft .NET Framework
  - Two full lessons on map caching
- Free Live Training Seminar
  - Implementing and Optimizing ArcGIS Server Map Caches
    - Demo-driven
    - Focuses on strategies
    - Offered at 9:00 AM, 11:00 AM, and 3:00 PM Pacific Time
- Visit training.esri.com for more information

Questions?

- (Please fill out session surveys!)