Alternative Approach to Caching with ArcGIS Server for the Air Force

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AF GeoBase Program

Mission: Attain, maintain, and sustain one geospatial infrastructure to address installation requirements.

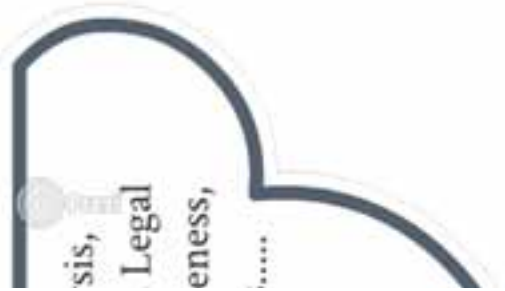
~ A GIS and associated staff, data, applications, procedures, workflow, and standards to support an AFB's missions and operations.

ommand

Air Force Materiel Command (AFMC)

- Conducts research, development, testing, evaluation, and provides acquisition services and logistics support to Air Force weapons systems.

- Comprised of 9 Main Bases and multiple geographically separated units across the US.



9 Installations across the US with varied geographies and missions

HQ AFMC

Standards, Certification & Accreditation, Technical Support, Program Management, Policy, Contracting, etc.

- Arnold AFB
- Edwards AFB
- Eglin AFB
- Hanscom AFB
- Hill AFB
- Kirtland AFB
- Robins AFB
- Tinker AFB
- Wright-Patterson AFB

Data Maintenance, Analysis, Visualization, Map Support, Legal Mandates, Situational Awareness, Environmental Concerns..... MISSION SUPPORT

- Comprised of 9 M
across the US.

HQ AFMC

THE PROBLEM:

HQ AFMC needs to access and visualize data for all 9 Installations....

... and not just vector data. AFMC needs to host, display, and interact with large quantities of raster data as well.

THE PROBLEM:

AFMC has some

LARGE

Bases

To further complicate things...

...most AFMC Bases have 6" and
3" resolution imagery base-wide

This all adds up to a substantial amount of raster imagery of a very high resolution.

Situation:

- Variety of tif's, sid's, ArcSDE rasters, ecw's, etc.
- Large database footprint
- Slow response in web applications
- Slow response in ArcMap

NOTE: The AF network is not known for it's speed.
It's probably better known for its latency.*

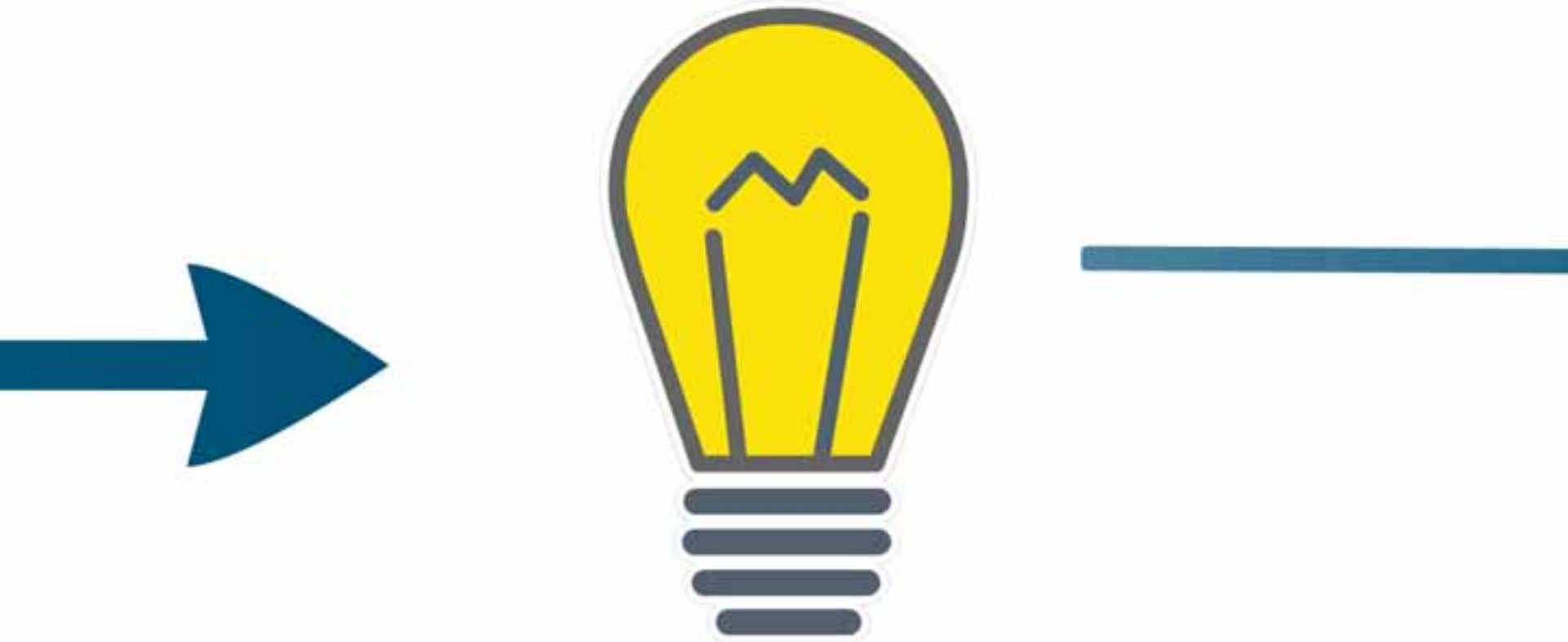
* Although for a valid reason, as security is paramount

It wasn't uncommon to completely remove or "un-check" imagery in web applications.

... grumbling from end users.

AFMC has a wealth of high resolution imagery, but we can't use it successfully.

Use Cache!



AFMC Bases start experimenting with cached imagery.

But unfortunately, problems still exist.....

- Cache creation takes a substantial amount of time
- Cache takes up a substantial amount of space
- DoD mandated reboots
- DoD mandated scanning procedures
- The person building the cache has to understand configurations and limitations....

projections

scales

levels

format

integration with applications

Back story

- Woolpert developed a capability known as Smartview Connect
- Smartview connect is an application that allows clients to review and QC collected aerial imagery over the web prior to delivery
- This capability is reliant on cached imagery
- We had discussions with the Smartview connect POCs to review AFMC's issues.

and came up with a plan....

Solution:

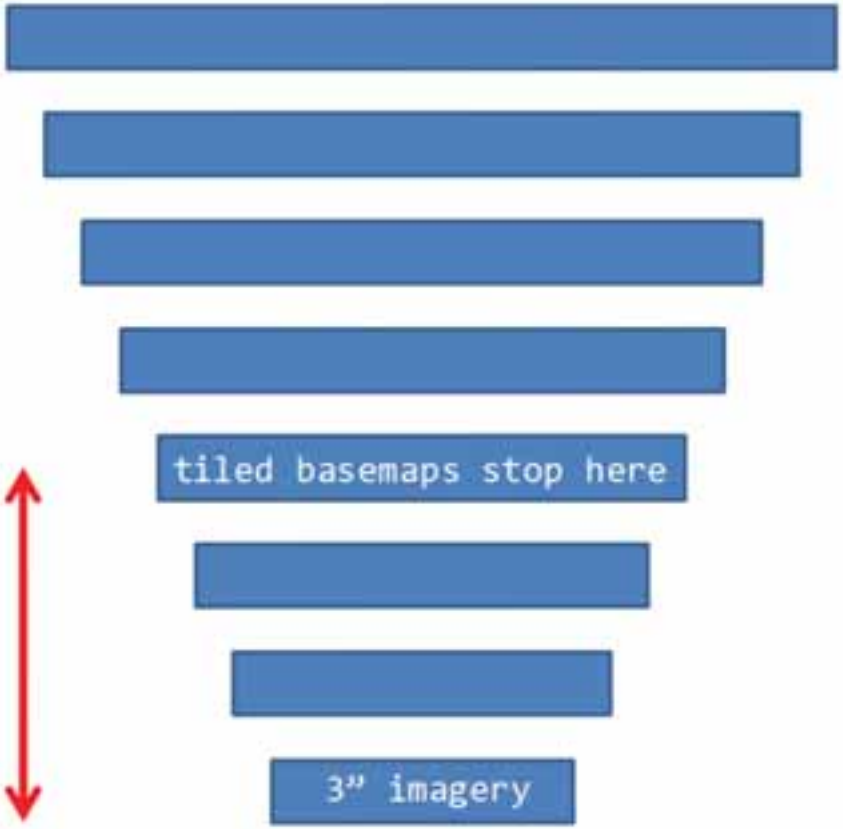
- Build the cache offsite, where latency and scanning concerns are not a factor
- Instead of delivering tif's only, deliver cache directories along with it
- Optimize the cache for use in legacy web applications

This pushes the time/resources needed for cache creation from the government function to the contractor providing the imagery... ultimately saving time and resources for the government

Optimized Cache:

- Tailor cache for target environment: ArcGIS Server & the Flex API
- Use the Web Mercator projection for caches used in web applications - this allows seemless integration between AFMC cache and other online resources (arcgisonline, bing, etc.)
- Ensure that the appropriate levels of cache are used - you may want to add additional levels of cache to support the native resolution of the imagery
- If online resources are available outside the cache, consider creating "mixed" cache to enable transparency
  - jpeg's should be used for interior tiles - as they have the faster performance and smallest file size
  - png's should be used for exterior files to support transparency

<lod resolution="2.38865713397468" scale="9027.977411"/>



<lod resolution="0.0186613838529761" scale="70.5310735"/>

```
<lods>
    <!-- only show a few levels -->
    <lod resolution="156543.033928" scale="591657527.591555"/>
    <lod resolution="78271.5169639999" scale="295828763.795777"/>
    <lod resolution="39135.7584820001" scale="147914381.897889"/>
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    <lod resolution="38.2185141425366" scale="144447.638572"/>
    <lod resolution="19.1092570712683" scale="72223.819286"/>
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    <lod resolution="4.77731426794937" scale="20000.954822"/>
    <lod resolution="2.38865713397468" scale="9027.977411"/>
    <lod resolution="1.19432856685505" scale="4513.988705"/>
    <lod resolution="0.597164283559817" scale="2256.994353"/>
    <lod resolution="0.298582141647617" scale="1128.497176"/> <!-- tiled basemaps stop here -->
    <lod resolution="0.1492910708238085" scale="564.248588"/>
    <lod resolution="0.0746455354119043" scale="282.124294"/>
    <lod resolution="0.0373227677059522" scale="141.062147"/>
    <lod resolution="0.0186613838529761" scale="70.5310735"/>
</lods>
```

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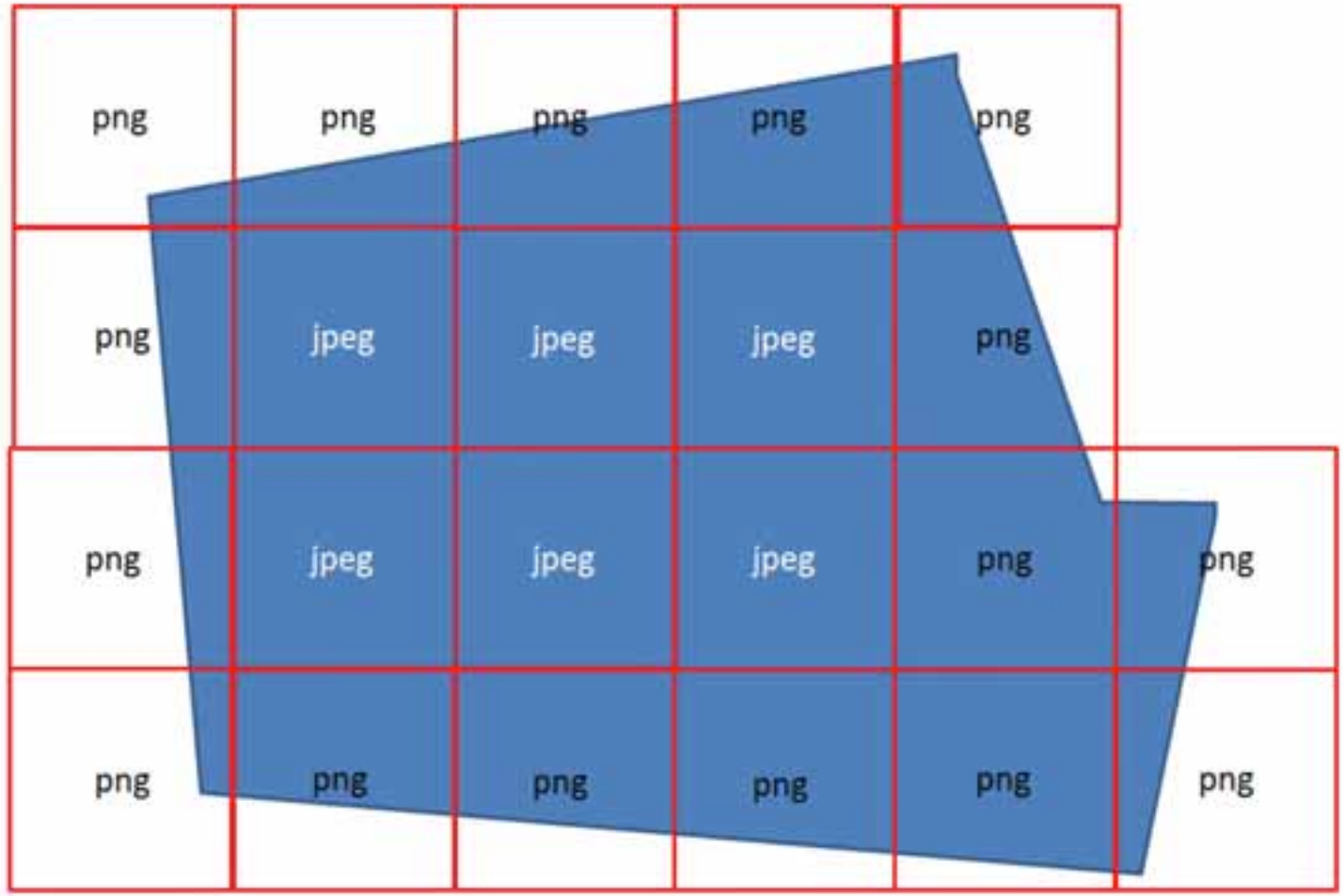
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Stand up the cache on site:

Benefits:
• Once
• Ca

- Create an empty mxd that references the cache
- Publish that mxd as a map service
- Use some copy method to transfer the created cache (and the associated cache config file) into the ArcGIS server cache directory
- Restart the map service

Following these steps, AFMC was able to stand up the pre-configured cache.

Hint: command line copies are preferred in cases of large file transfers:

robocopy /mt:12 /s /z /ns /nc /nfl /ndl /np [source] [dest]

Benefits:

- Once cache is created, very little time is needed to implement
- Cache is MUCH faster than previous alternatives... "I can't even pan a paper map this fast." - Robins AFB POC
- The raster cache routinely outperforms local vector data
- As a general rule, the cache directories are approximately a tenth of the size of the raw tif's. If a Base's aerial imagery amounted to 88 GB, the cache only requires ~ 9 GB of storage space. So, it's faster AND smaller.
- AFMC doesn't need to expand its database footprint to support rasters.
- It's extremely simple for other Bases to utilize...

```
<basemaps>

  <layer label="Streets" type="tiled" visible="true"
         url="http://server.arcgisonline.com/ArcGIS/rest/services/World_Street_Map/MapServer"/>

  <layer label="Aerial"  type="tiled" visible="false" format="jpgpng"
         url="https://yourserver.af.mil/ArcGIS/rest/services/Cached_Robins_AFB/MapServer"/>

  <layer label="Topo" type="tiled" visible="false"
         url="http://server.arcgisonline.com/ArcGIS/rest/services/World_Topo_Map/MapServer"/>

</basemaps>
```

- Are we in the cloud?

Cloud??

- All AFMC imagery can be hosted from a single HQ AFMC server and utilized by all 9 AFMC locations.* As imagery gets better/bigger, this point will become more important.
- Since that server exists in a DoD environment, we already have CAC-integration, SSL concerns, Certification & Accreditation concerns, and other DoD security policy in place.
- AFMC has one single centralized environment for raster needs - reducing hardware cost, licensing cost, and support cost.
- And this centralization of imagery has had a positive impact on performance - For example, if the cache imagery stored on HQ AFMC servers (in Dayton, Ohio) is accessed from Tinker AFB (in Oklahoma City, OK), it outperforms the vector data local to Tinker.

*edits to the web server's cross domain file may to needed to obtain *.mil access

Conclusions

By:

- Creating the cache off site
- Optimizing the cache for anticipated usage
- Standing up on HQ AFMC servers

AFMC was able to:

- Increase performance
- Reduce resources
- Reduce needed storage space

And effectively stand up their own secure raster cloud for usage by all AFMC Installations.

Thanks to:

Brenda Martin: HQ AFMC GeoBase Program
Chris Morabito: Woolpert Labs

Questions?

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