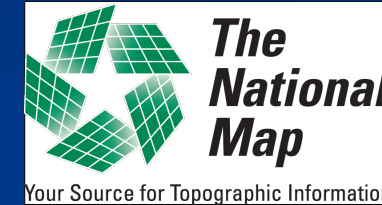


# Shared Imagery Hosting Across Government

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# A Collaborative Effort of Agencies



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# Government....sharing?

- Ronald Reagan: Executive Order 12591 (1987) -- aimed to break down silos between federal agencies and encourage them to work together and with other entities for more effective technology transfer.
- Since then, every president has issued similar directives towards encouraging federal agencies to share data and technology.
- The GeoData Act (2018): Created to improve the sharing of geospatial data between government agencies, reduce duplication, and establish guidelines on how government should share data.



# Geospatial Sharing Successes

Where have we succeeded with those directives?

- Vector data:

- Data.gov
- GeoPlatform.gov
- Some Fire applications...
  - NIFC
  - NMAC

- Imagery & Raster data:

- NAIP program
- Landsat (NASA & USGS)
- .....?



# What makes shared data solutions so difficult?

- Agency budgets are siloed (& difficult to transfer \$ across agencies)
- Requires a lot of collaboration and coordination!
- Territorialism amongst agencies (who owns & controls it?)
- Typical Gov't model: Top-down, forced 'solutions'
- Agency resistance to giving up autonomy and control of their data
- Technical hurdles:
  - Agency firewalls
  - Authority to Operate (ATOs) usually agency specific
  - Lack of solutions/technology capable of meeting scaling requirements
  - Cost prohibitive
- ...and on & on!

# Challenges of Hosting Imagery...

- Costly \$\$\$ – Expensive to host due to high storage & compute reqs
- Resources – ↑ expertise & infrastructure to be able to host imagery
- Maintenance – Data, system, & storage management is costly & inconsistent across agencies
- Security – Constantly expanding security requirements

## Result:

- No Sharing – Many agencies host streaming imagery services, but all are siloed and inaccessible to each other
- Data Duplication – Agencies host a lot of the same data sets (e.g. NAIP)

# Challenges for the Forest Service specifically

- Forest Service currently hosts >1PB of imagery to >12,000 users as 1,000+ Image Services (since 2004) (increases ~100+TB/yr)
- Data served:
  - All dates of NAIP (2004 - to current)
  - Lidar raster derivatives
  - Historic & current aerial photography
  - Satellite & UAS imagery
  - Topographic raster products
- These services have become vital to our users for a variety of uses!
- Fall 2019 – FITARA required Forest Service to migrate imagery hosting to the USDA data center in Kansas City – costs increased ~14x! (unsustainable)
  - Immediately went unfunded
  - Threat of being shut down



The Right Solution...

**Expand & Share!**

The Interdepartmental Imagery Publication Platform (IIPP) was born!

...or as ESRI folks have officially nicknamed it:

**I2P2**





# Interdepartmental Imagery Publication Platform

## The Mission of IIPP

Create a collaboratively shared imagery hosting system of government partners, combining resources, expertise, and operational datasets in order to reduce costs, eliminate duplication, and maximize availability of data to all users.





## The Scope of IIPP...

- Raster focused (especially high resolution, large data rasters)
- Continuous & thematic
- Preferably rasters that can be shared publicly or across agencies
- Streaming services focused (not downloading)
- Support for light server-side processing (raster function templates, analysis, etc...)
- ESRI ArcGIS Image Server based

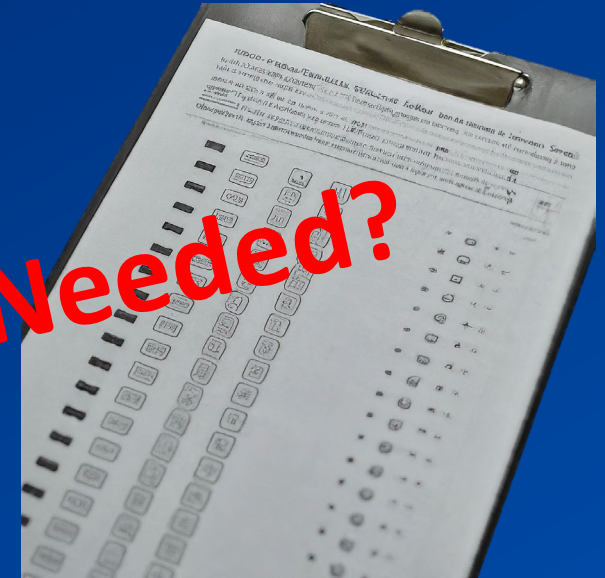
# How did we do it?

The journey to a complete shared imagery hosting solution

## • Phase 0: Investigations & Planning

- Surveyed 9 agencies that host imagery
  - Is a shared solution desired? (Yes!)
  - What do existing systems look like?
  - Req's from each agency for a shared solution?
  - Created collective picture
- Established 8 core requirements for best solution
  - ATOs, costs, capabilities, access, support, setup, security, data autonomy
- Analysis of Alternatives for best solution
  - 9 possible environments evaluated
  - **Best Solution: [AWS cloud through GeoPlatform.gov](#)**

Is It Needed?



# How did we do it?

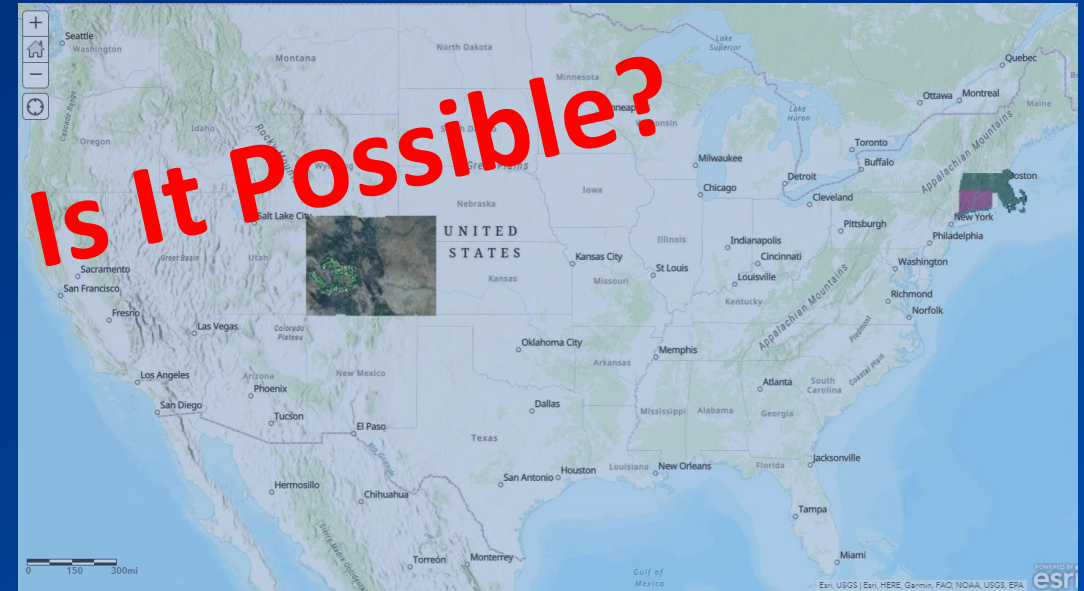
The journey to a complete shared imagery hosting solution

- Phase 1: Proof of Concept Pilot

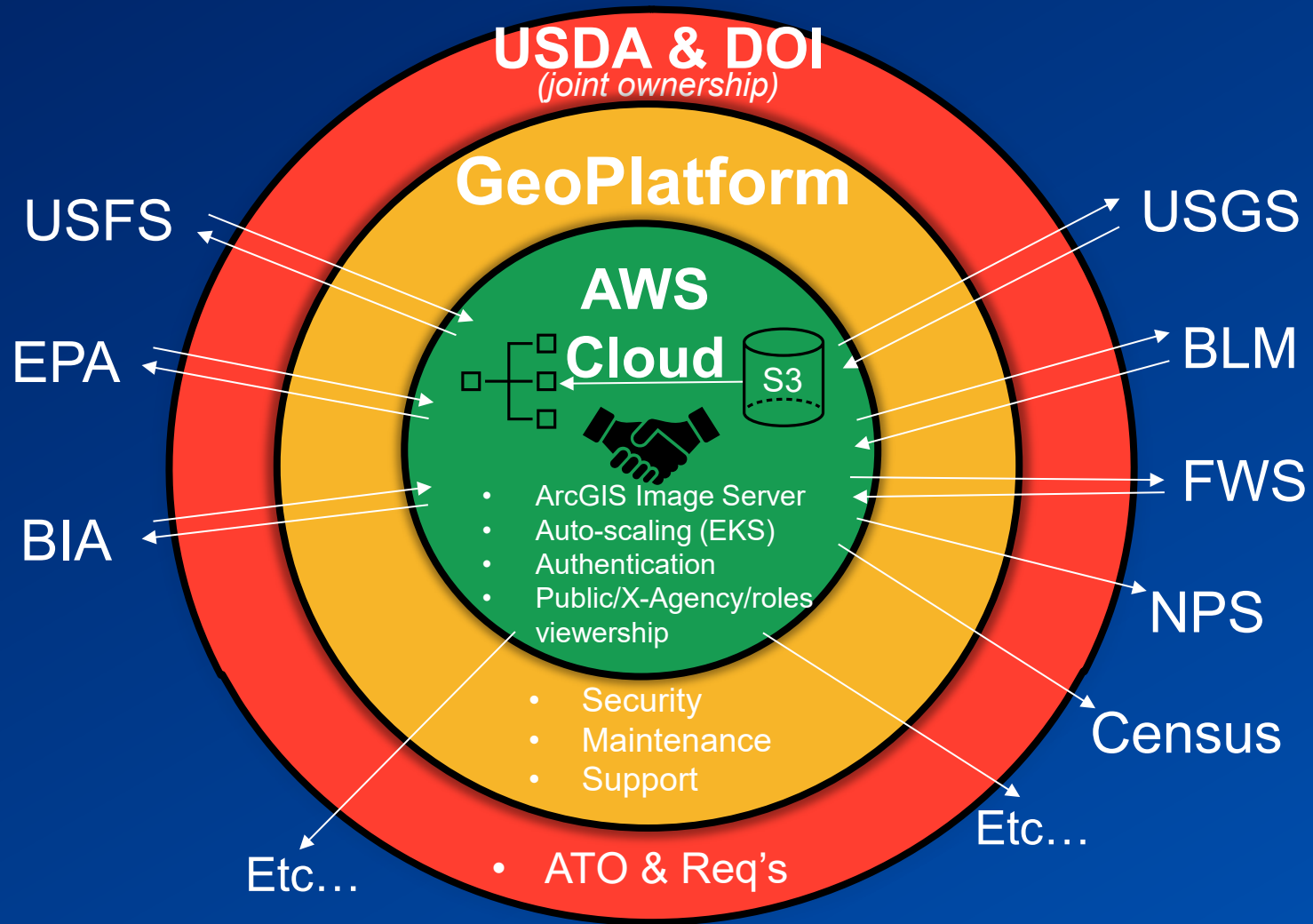
- Conducted May 20' – Aug 21'
- 8 datasets published successfully
- Performance better than expected
- Cost savings analysis promising

- Phase 2: Implementation Pilot

- Conducted Sept 21' – Dec 22'
- Fully autoscaling architecture implemented
- Authentication established (login.gov)
- Multi-agency publishing of services successful
- More accurate cost analysis – still as expected



# Conceptual Diagram of IIPP

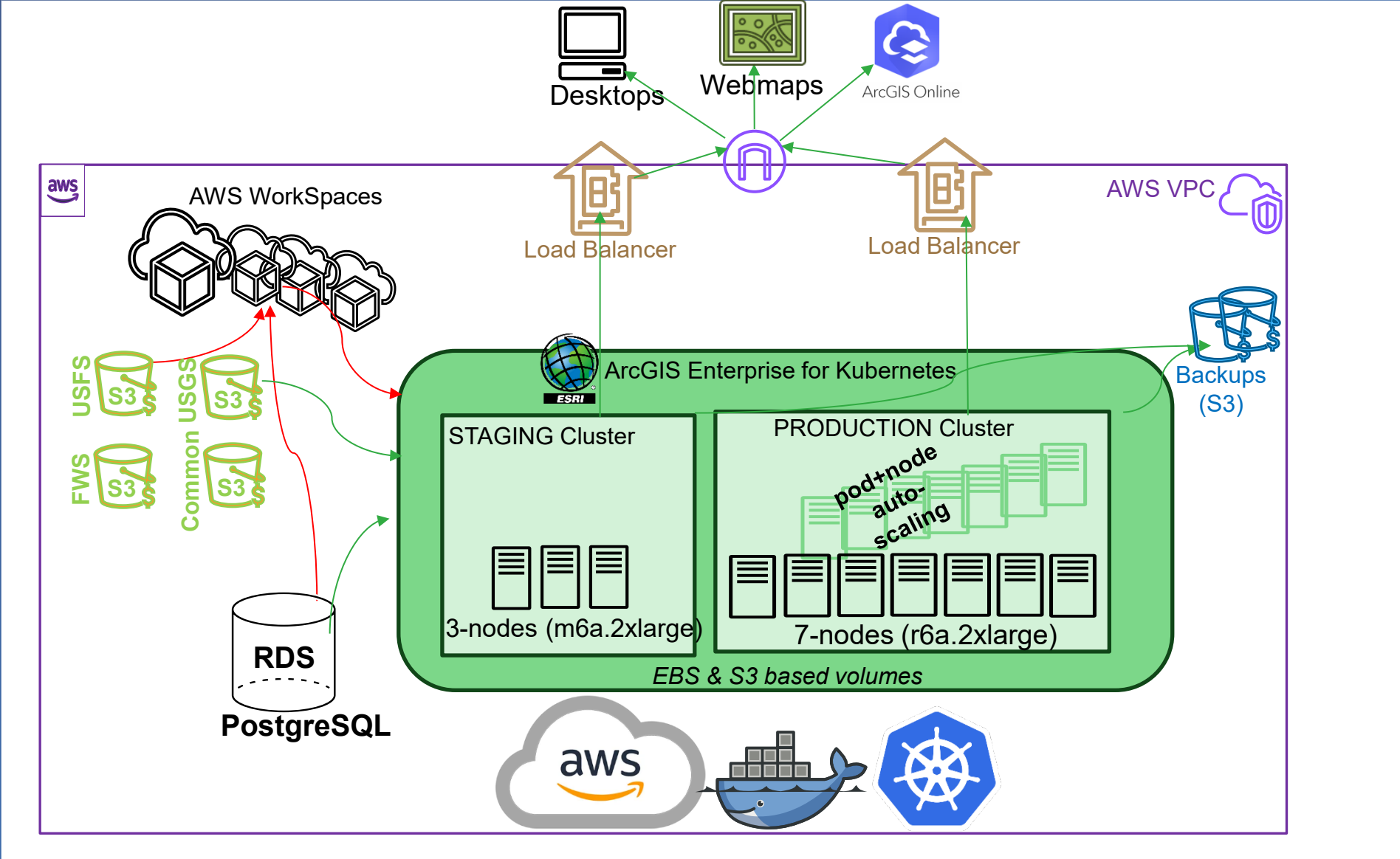


# Interdepartmental Imagery Publication Platform System

## Quick Specs:

- AWS East-1 via GeoPlatform.gov
- ArcGIS Enterprise for Kubernetes
- 7-node PROD deployment (to 14)
- 3-node Staging deployment (to 4)
- Postgres RDS
- S3 buckets/agency + a common
- AWS Workspaces on-demand clients for publishing
- Published services time-enabled & include RFTs where possible

# IIPP Architectural Overview

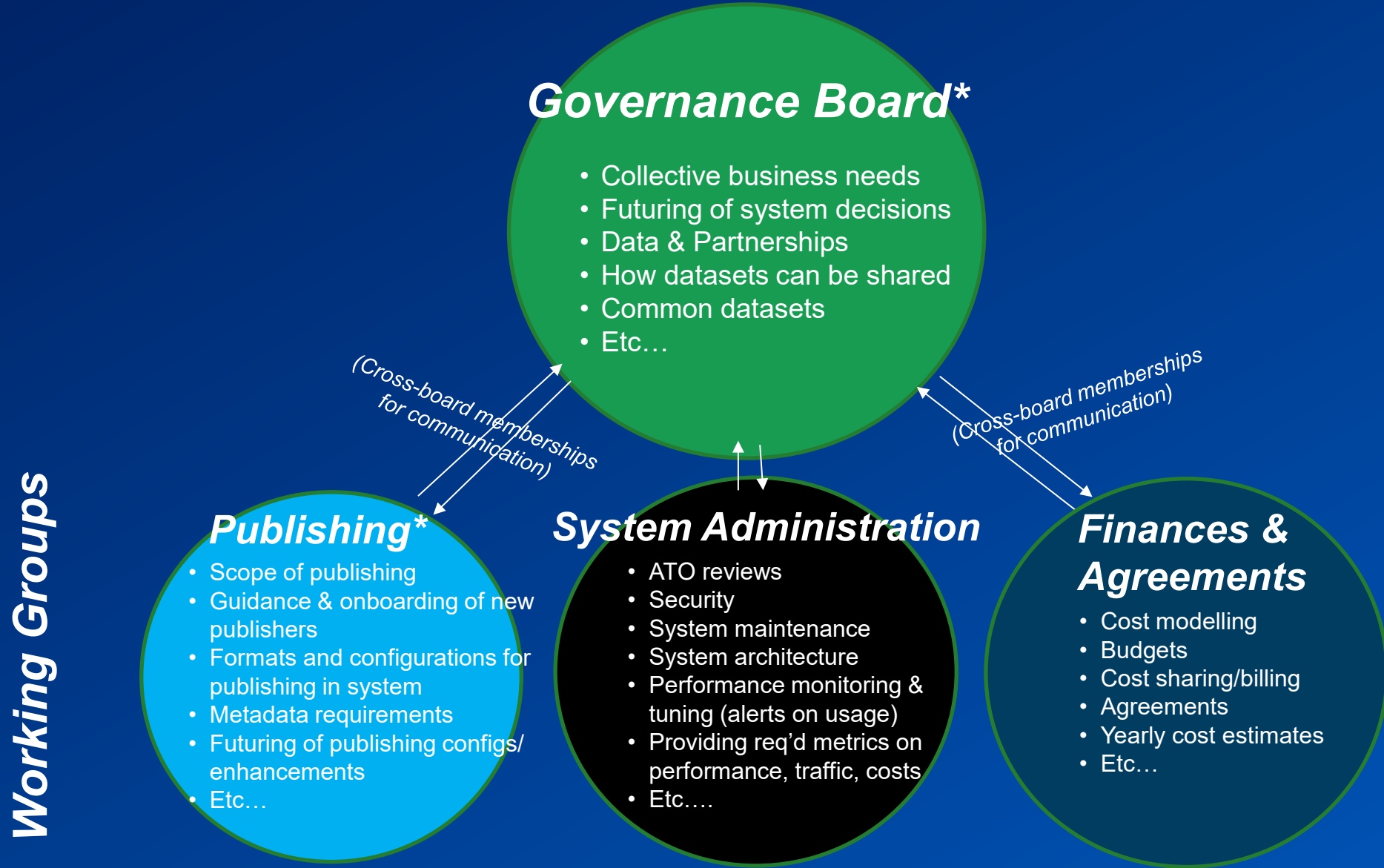


# IIPP Architecture: Why Enterprise for Kubernetes?

- Fully cloud native design and components
- Extremely dynamic scaling
  - Horizontal Pod auto-scaling in ~90 seconds (scaling at image service level)
  - Entire Server/Node scaling in ~6 minutes (full server cluster expansion)
  - Spins down as quickly, saving \$\$\$ when resources not needed
- Puts more control into GIS Administrator's role, rather than IT department
  - GIS Admins are often SME's on services, IT admins are usually not
  - Allows GIS Admin to easily fine-tune scaling on all services w/o IT tickets
  - GIS Admin can also maintain backups, upgrades, data stores, etc...
  - More tasks and labor on GIS Admin side = better SME support and reduced costs overall



# IIPP Governance Structure



\*--At least 1 member and 1 backup from each partnering agency.

# IIPP Cost Savings Potential

Through the combination of:

- ✓ the sharing of collective resources
- ✓ efficiency in scaling & use of latest technologies
- ✓ deduplication of redundant data & labor
- ✓ a highly cost-effective environment

Example: **USFS**  
expects ~90% cost  
reduction after the  
first year.\*

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= Most agencies that partner into IIPP should see a cost reduction compared to current operations. *\*--Savings will vary per agency*

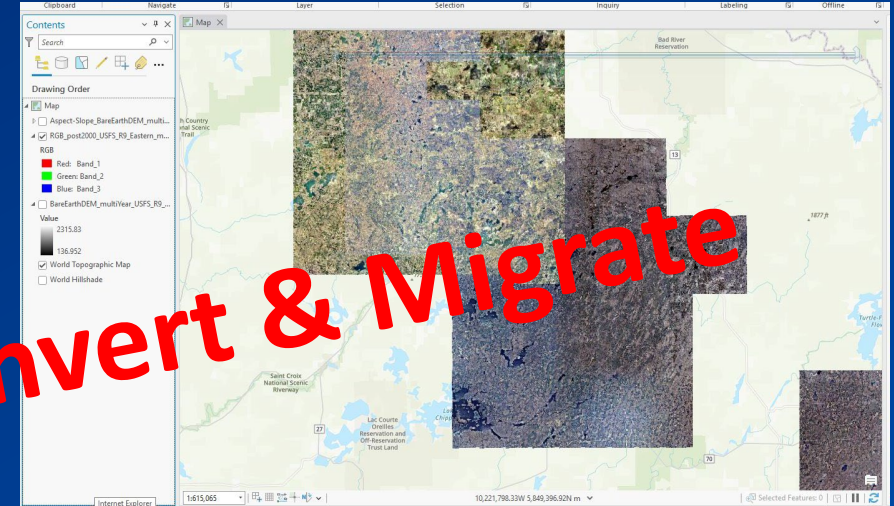
All agencies will experience a significant increase in ROI from the addition of vastly more datasets instantly available to their users.

# How did we do it?

The journey to a complete shared imagery hosting solution

- Phase 3: Full Implementation/Migration

- *Conducted Jan 23' – Dec 23'*
- Full operational system implemented (Enterprise for Kubernetes 11.2)
- USFS, USGS, & FWS migrated imagery, cloud-optimized datasets, & republished services



- Phase 4: Operational rollouts

- *Conducting Jan 24' – Dec 24'*
- Final testing and phased rollouts to initial 3 partner agencies
- Open to additional agency partnerships after first 3 agency rollouts (*both publishing and consumption-only partnerships available*)

**Go Live!**

# Current Status of IIPP



- Successfully rolled out to Forest Service users in May!
- USGS & FWS rollouts in-progress
- Currently discussing partnerships with numerous additional agencies
- Additional enhancements already started (STAC, security add-ons, scaling & monitoring upgrades, etc...)
- Investigating Raster Analytics integration for enhanced server-side processing, deep learning, modelling, classification, etc...

# Benefits of IIPP to Agencies and their Users of Imagery

The journey to a complete shared imagery hosting solution

<b>Dynamic, Scalable System</b> (↑ & ↓)	<b>↑ Capacity &amp; Capabilities</b> (server-side gp, analysis, etc...)	<b>Robust &amp; Searchable</b> (Portal, STAC, etc...)
<b>↓ Learning Curve for Publishers</b>	<b>Cost-effective</b> (significant ↓\$ for many agencies)	<b>Cost Avoidance</b> (redundant data, maint., security)
<b>↑ Standardization &amp; Consistency</b> (svcs, data, maint.)	<b>Latest Technologies</b> (w/o the personnel)	<b>↑ Data Availability for All Users</b>

# How partnerships work in IIPP

The journey to a complete shared imagery hosting solution

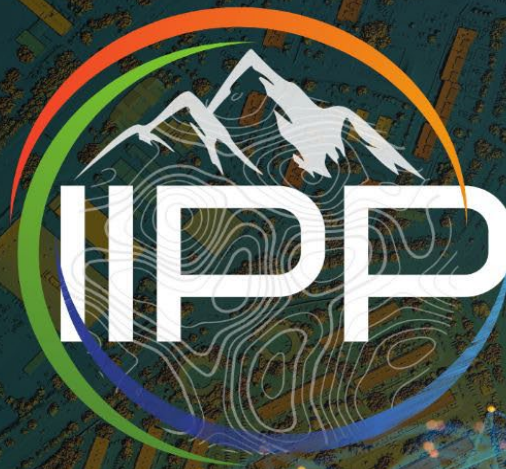
- Run like a Co-Op: Joining is voluntary as it makes sense for each agency's ROI
- Base Access Membership: Agency's users all get consumption access to all streaming services shareable to their agency, department, and all\_gov't groups (currently >1PB of data & growing)
- Publishing Add-On: Full publishing access, while maintaining full autonomy of own data
- Voting seats on IIPP Governance Board and working groups
- Publishing team support: guides, multi-agency team support, etc...
- Finances and agreements support

# IIPP Future: What's planned ahead?

The journey to a complete shared imagery hosting solution



- Public-facing services (as possible)
- STAC catalogs
  - Full STAC integration for IIPP
  - Integration into other STAC indexing systems
- Partnering & onboarding additional federal agencies
  - ↑ data, ↓ costs, & ↑ ROI for all
- Adding Raster Analytics
  - More powerful analytics, server-side processing, deep learning, modelling, classification, etc...



## Interdepartmental Imagery Publication Platform

The Interdepartmental Imagery Publication Platform (IIPP) provides federal agencies with a cloud-based, shared raster hosting solution. Its mission is to provide a collaboratively shared system, made up of government partners coming together to combine their resources, expertise, and operational datasets in order to reduce costs, eliminate data duplication, and maximize the availability of large imagery and thematic raster datasets to all users. IIPP provides greater cost-effectiveness, functionality, storage capacity, dynamic scaling, processing capabilities, and future-proofing than current siloed solutions.



US Department of Agriculture



Department of the Interior



US Forest Service



US Geological Survey



US Fish and Wildlife Service

<https://imagery.geoplatform.gov/IIPP/home>

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# Questions?



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