What's New in Imagery Management: *Introducing ArcGIS Online Imagery*

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2021 ESRI FEDERAL GIS CONFERENCE

Today's Speakers

Experts from Esri's Remote Sensing & Imagery Team

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Senior Solutions Engineer

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Project Manager

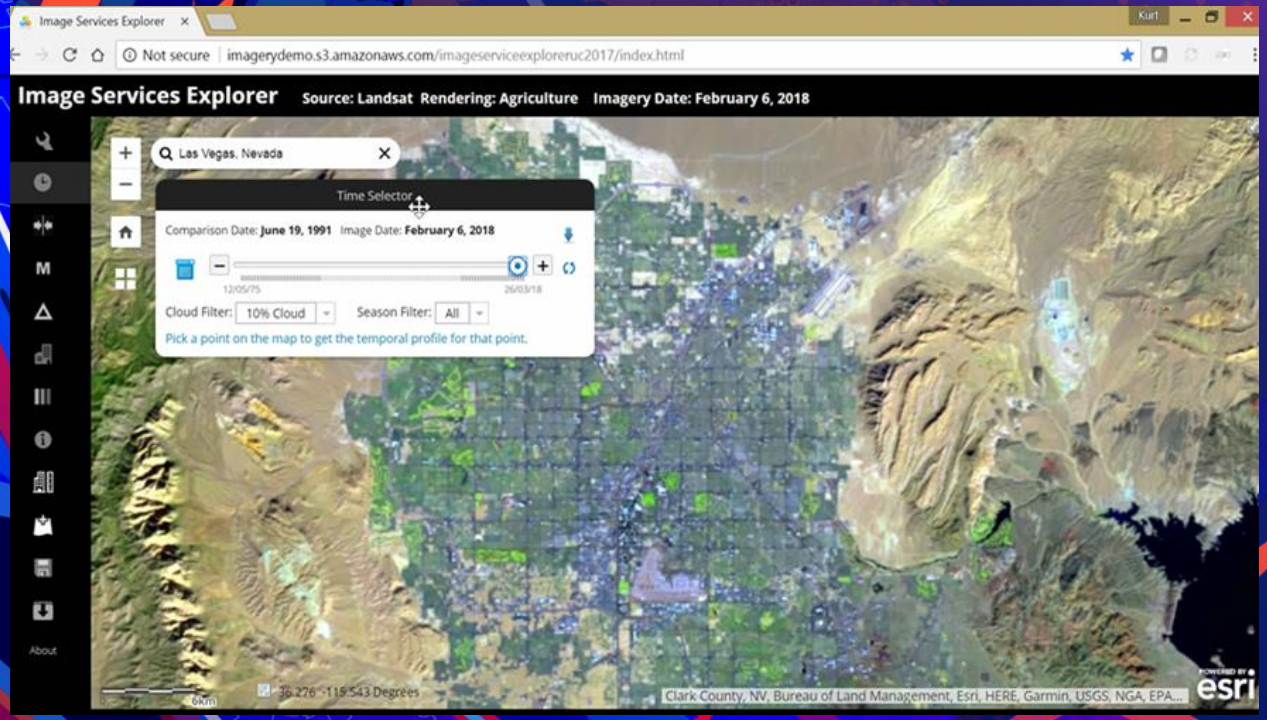
Turning Imagery Into Information

Remote Sensing is Foundational to GIS

Turning Imagery into Actionable Information

Capabilities vs Complexity

The Challenge of making complex things easy



Sample Application

Esri Image Services Explorer

Imagery as Part of ArcGIS

…To empower the Transformation of Imagery into Meaningful Information

ArcGIS Imagery Patterns

Transforming Imagery into Information

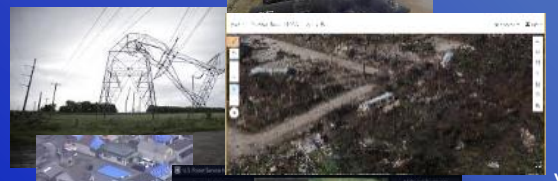
Analysis & Observations

Inspection

Monitoring

Loss of Infrastructure

HAZMAT

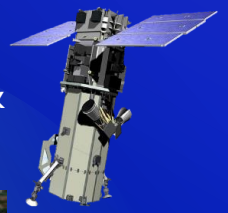


Debris Volume

Blue Roof Detection

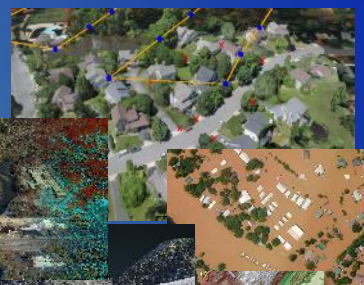
Damage Assessment

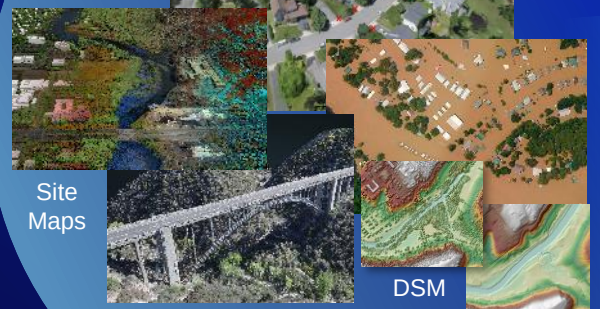
Precision Mapping & Reality Capture



Base Maps

Site Models





Blue & Grey Skies Ortho-Base

Flood Imagery

Site Maps

DSM

DTM

Terrain Analysis

Content

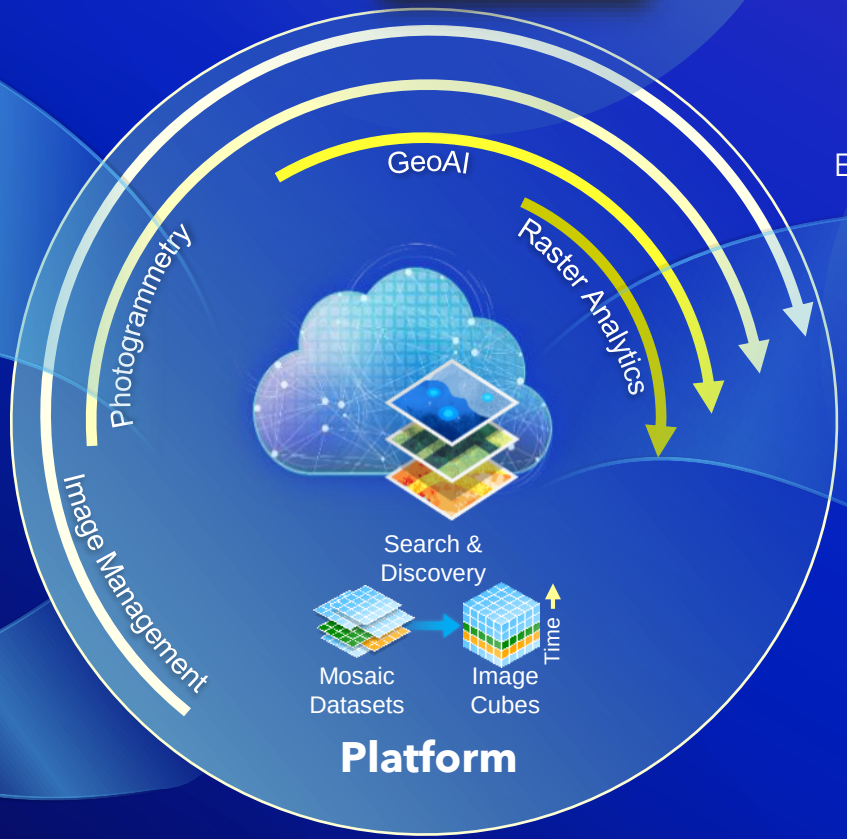
Images, Video & Point Clouds:

Formats

Platforms

Modalities

Services



Platform

Finding Spatial Patterns

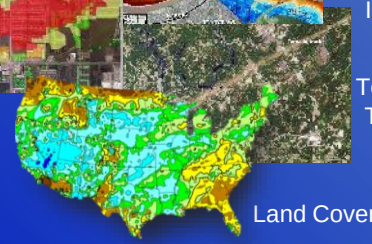
Built Environments

Natural Environments

Flood Impacts

Tornado Tracks

Recovery Logistics

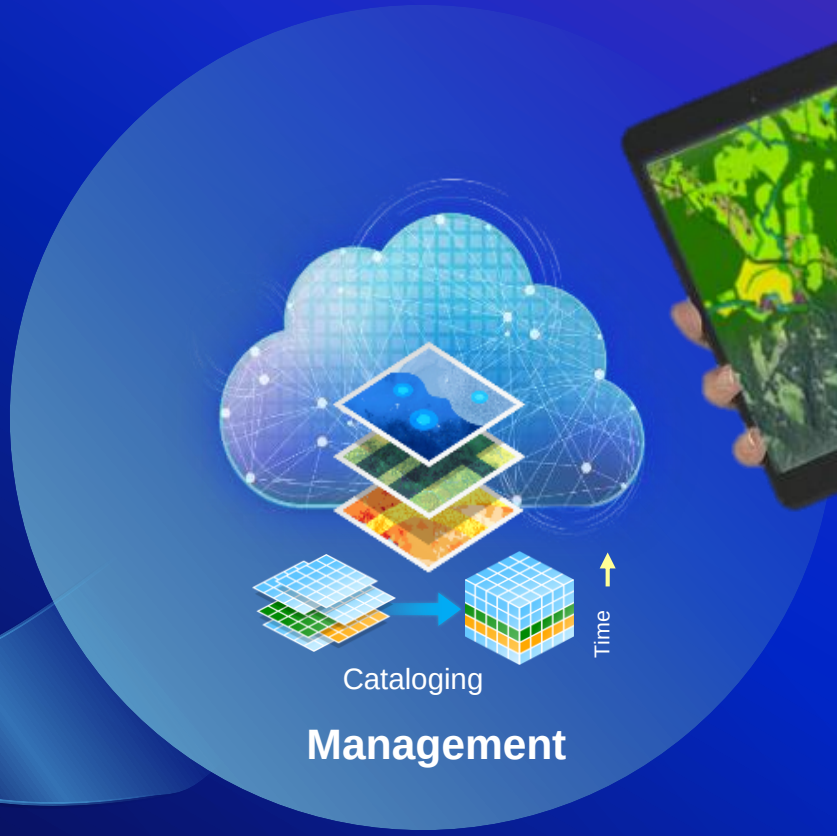


Land Cover

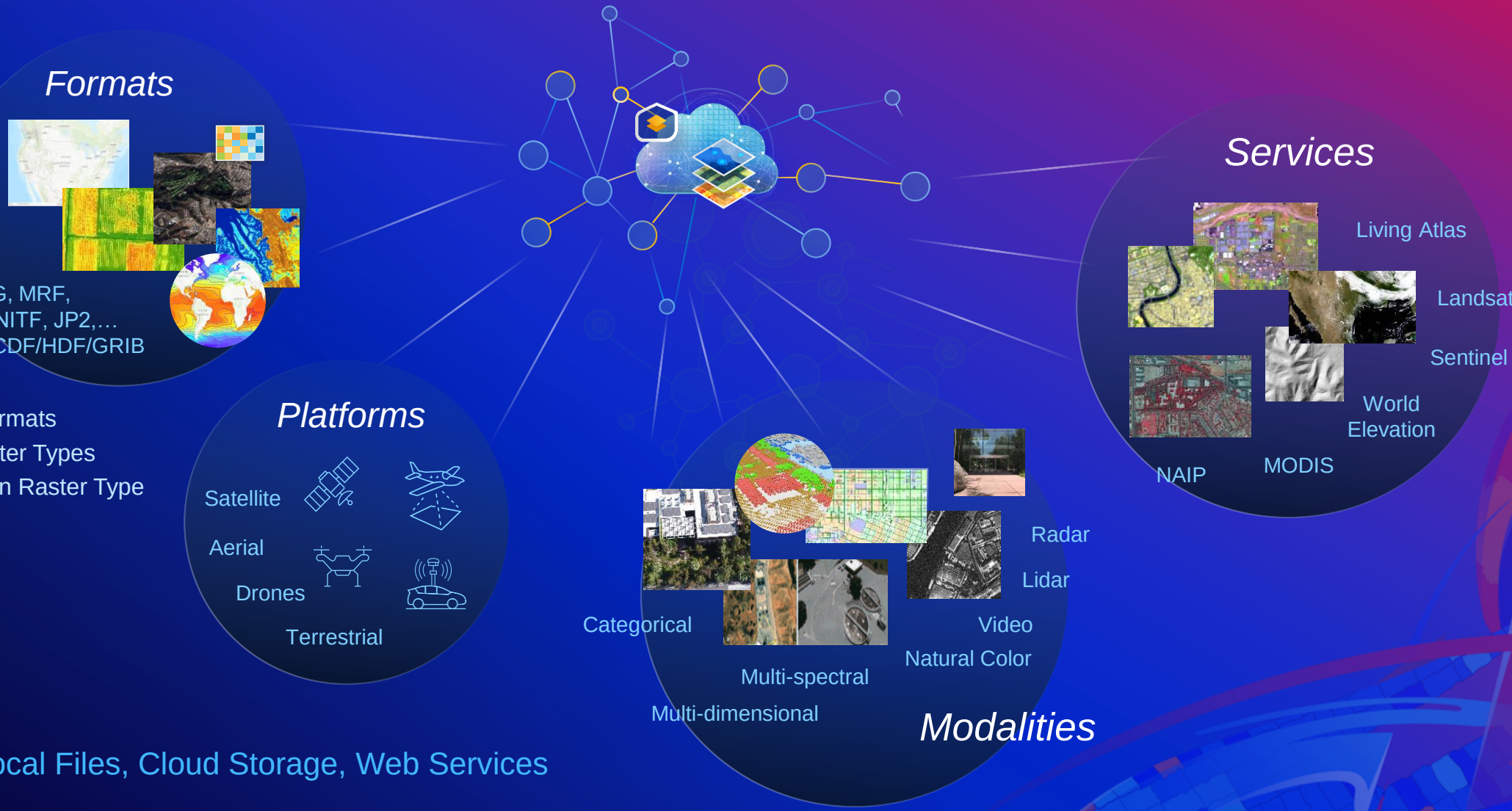
Ag Assessment

Imagery Management

Rapid access to massive amounts of remotely sensed content



Content – Support for All Imagery and Rasters



As: Local Files, Cloud Storage, Web Services

Content in the Living Atlas

Basemaps

Demographics and Lifestyle

Transportation

Urban Systems

Imagery

Sentinel-2 Views

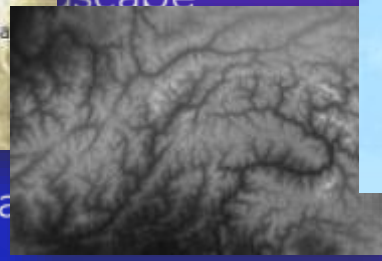
NAIP (NDVI)

MODIS

Landsat 8

USA Woody Biomass

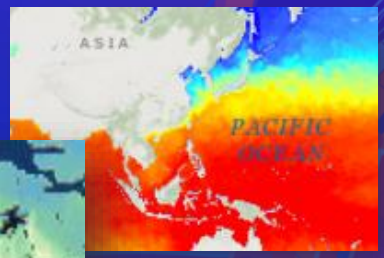
Terrain



World Ecophysiographic Land Units

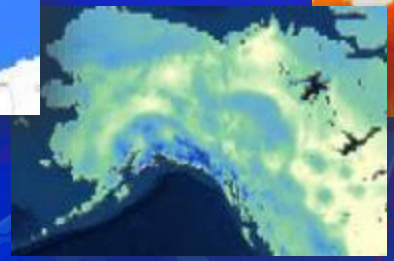
HYCOM Sea Water Salinity

Sea Surface Temperature



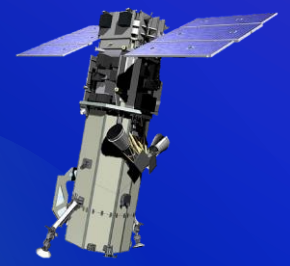
GLDAS Snowpack

GLDAS Soil Moisture



Mapping in Multiple Dimensions

Creating accurate and authoritative data from imagery



Reality Mapping

Site Models

Site Planning

Simulation

Base Maps

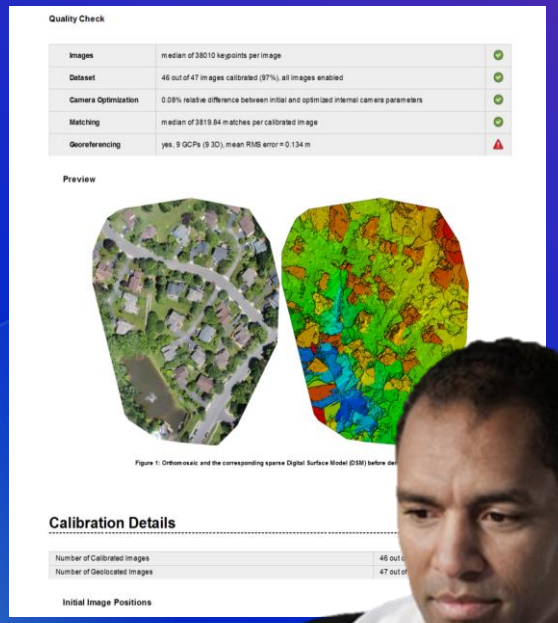
Ortho Photos

3D Mesh

DSM

Topo Maps

DTM



Quality Check

Images	median of 38010 keypoints per image	✓
Dataset	46 out of 47 images calibrated (97%), all images enabled	✓
Camera Optimization	0.08% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 3819.84 matches per calibrated image	✓
Georeferencing	yes, 9 GCPs (9 3D), mean RMS error = 0.134 m	⚠

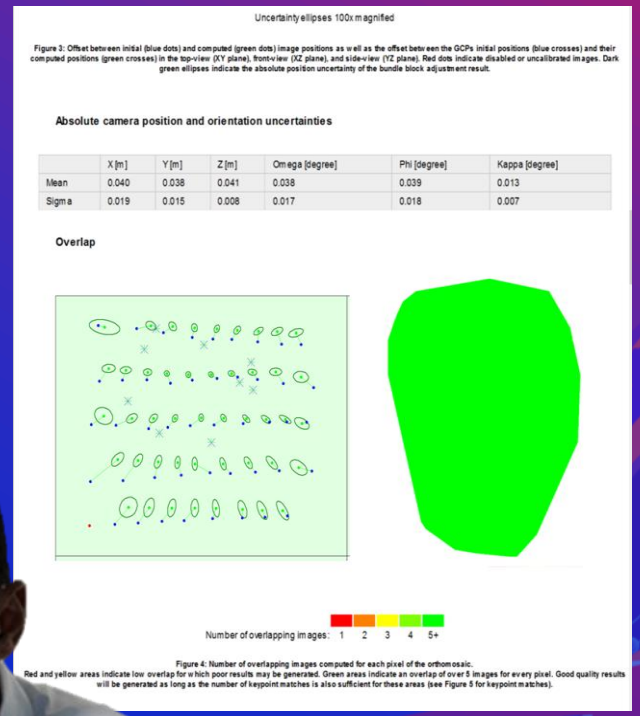
Preview

Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before de

Calibration Details

Number of Calibrated Images	46 out o
Number of Geolocated Images	47 out o

Initial Image Positions



Uncertainty ellipses 100x magnified

Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Red dots indicate disabled or uncalibrated images. Dark green ellipses indicate the absolute position uncertainty of the bundle block adjustment result.

Absolute camera position and orientation uncertainties

	X [m]	Y [m]	Z [m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.040	0.038	0.041	0.038	0.039	0.013
Sigma	0.019	0.015	0.008	0.017	0.018	0.007

Overlap

Number of overlapping images: 1 2 3 4 5+

Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint matches is also sufficient for these areas (see Figure 5 for keypoint matches).

SURE for ArcGIS

Automated Data Production System for Mapping and 3D

Inputs

Image Files

Lidar

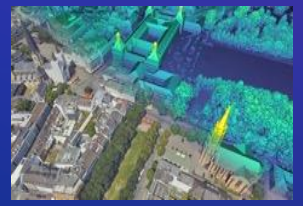
Orientation Data

New

ArcGIS

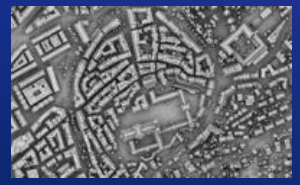
- Pro
- Enterprise
- Online

True Orthophotos



Textured Meshes

Point Clouds



Digital Surface Model

Data Products

Applications

- Mapping
- 3D Visualization & Simulation
- Change Detection
- Surface Analytics

Fully Integrated with ArcGIS

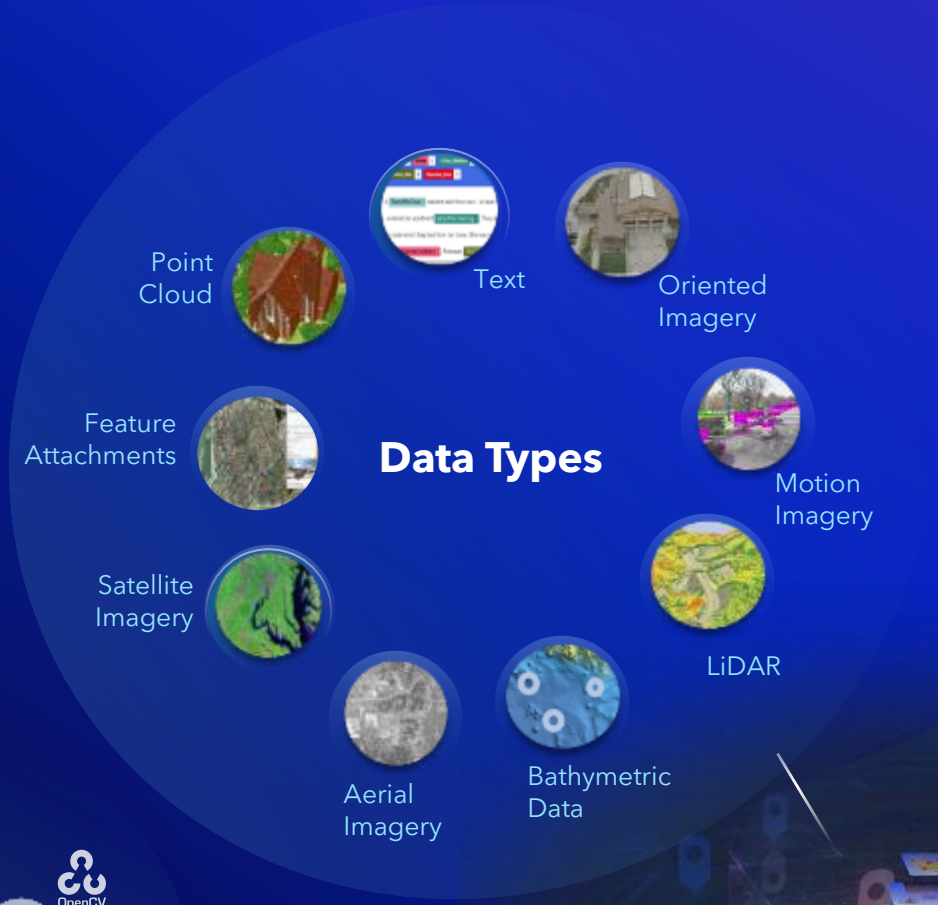
Fast, Highly Accurate, Massively Scalable, and Cost Effective

Observations On Demand

Automating targeted feature extraction from Imagery

Deep Learning in ArcGIS

Different data types, tasks and integration



Integration

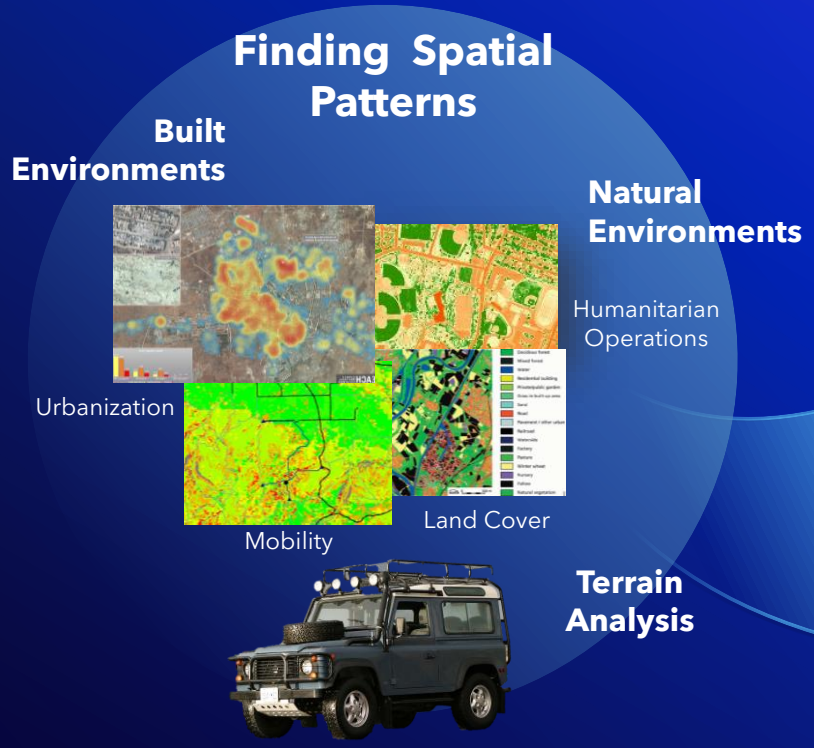
New

Deep Learning models on the living atlas:

- Building footprint extraction
- Tree classification from LiDAR
- Land cover classification

Finding Spatial Patterns

Raster Analytics at Scale



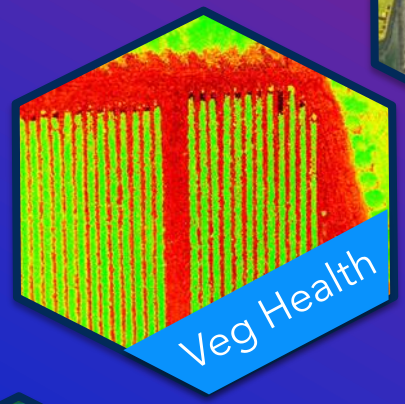


Image Analysis

Extracting Information from Imagery

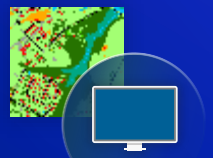
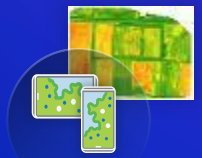
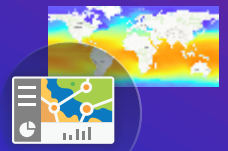


Image Classification

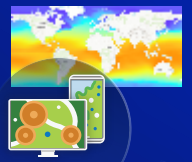

Spectral Analysis


Change Detection

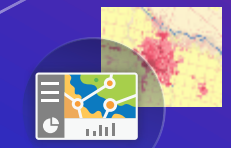

Multidimensional Analysis


Advanced Raster Functions

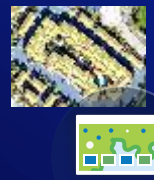

Map Algebra

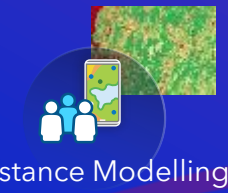

Pixel Classification


Object Classification


Suitability Analysis


Hydrological Modelling


Instance Segmentation


Distance Modelling


Object Detection


Terrain Analysis


Image Analyst


ArcGIS Pro


Spatial Analyst

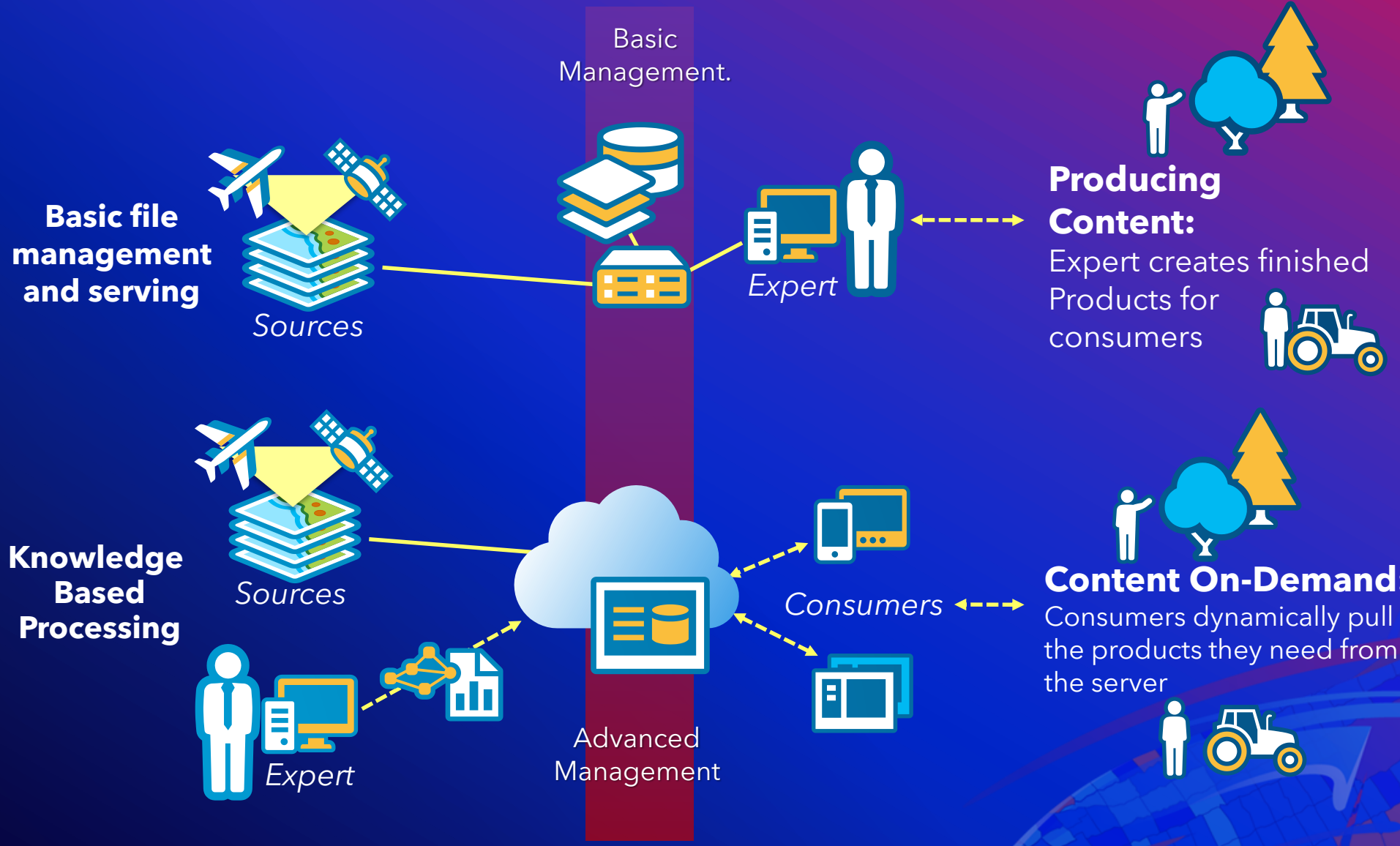

ArcGIS API for Python


Image Server


Map Viewer

Analytics as a Component of Imagery Management

Building tradecraft into the data management process



ArcGIS Online Imagery for Hosted Imagery Layers and Analysis

David Wright | Senior Solution Engineer | Imagery & Remote Sensing

Increasing imagery value in the organization

Mosaic Dataset

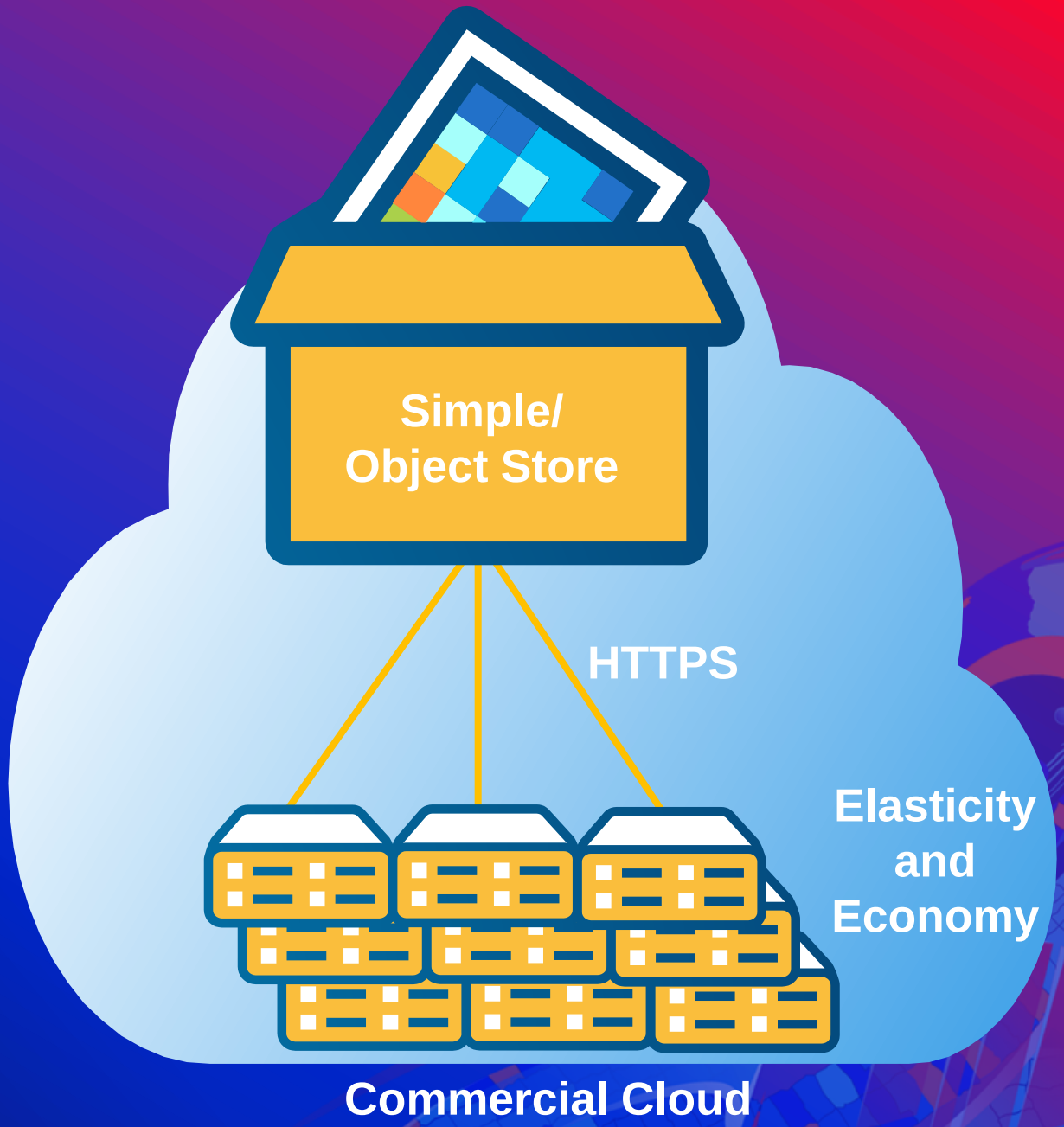
- References source data
  - Satellite scenes
  - Aerial images
  - Categorical
  - Terrain
- Recognizes provider raster types, formats, bands, pixel sizes, bit depth
- Defined in a geodatabase with metadata
  - Catalog
- Specifies processing to be applied on-the-fly
  - Dynamic mosaicking rules
  - Over 150 Raster Functions
  - Viewed as mosaic or individual images
- One storage footprint – many applications in visualization and analysis

Storage options

Use any or all that enable your workflows

Standalone
Direct Access

Enterprise

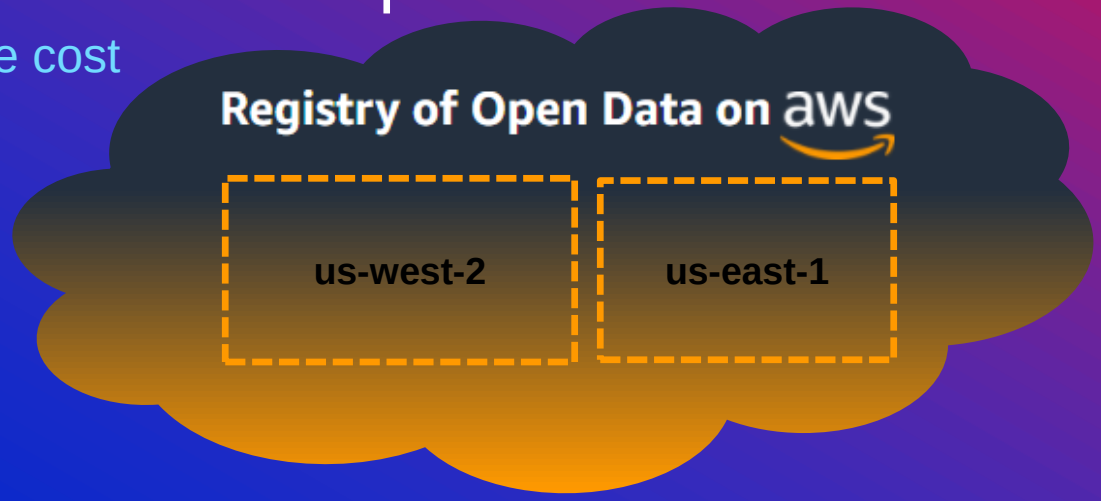


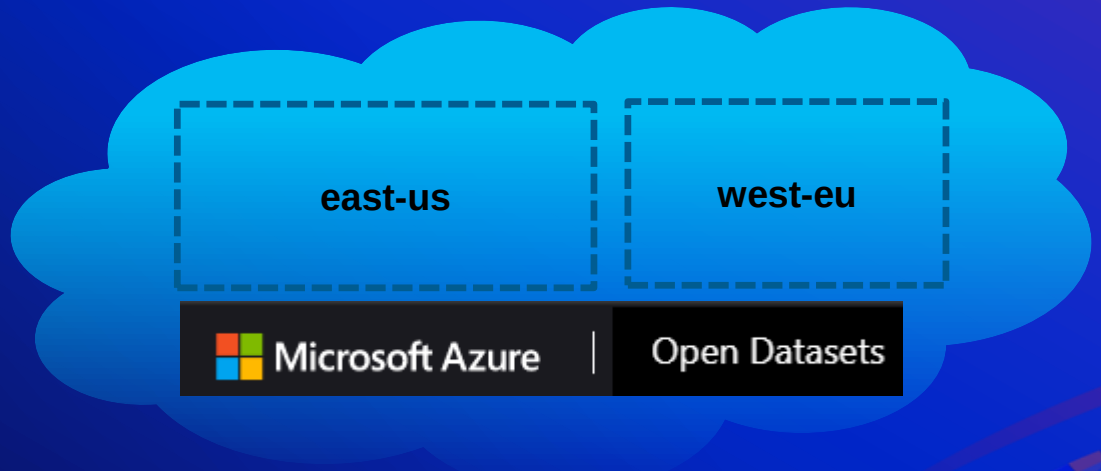
Commercial Cloud

Open datasets from commercial cloud providers

Leverage massive archives without storage cost

- Landsat
- Sentinel-2
- Sentinel-1, Sentinel-5P
- MODIS
- VIIRS
- NAIP
- DEM / DSM
- Daymet
- etc.

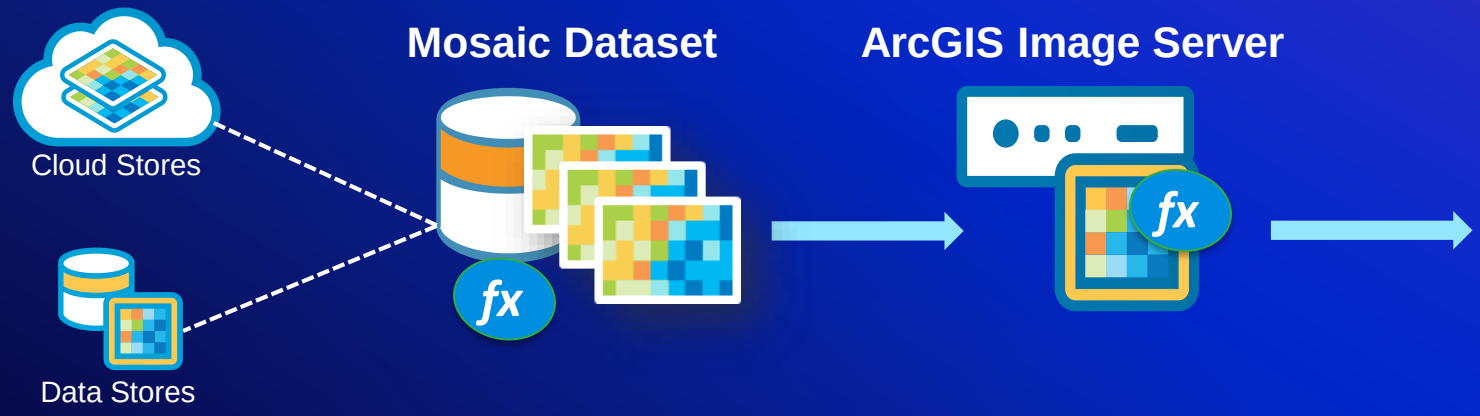


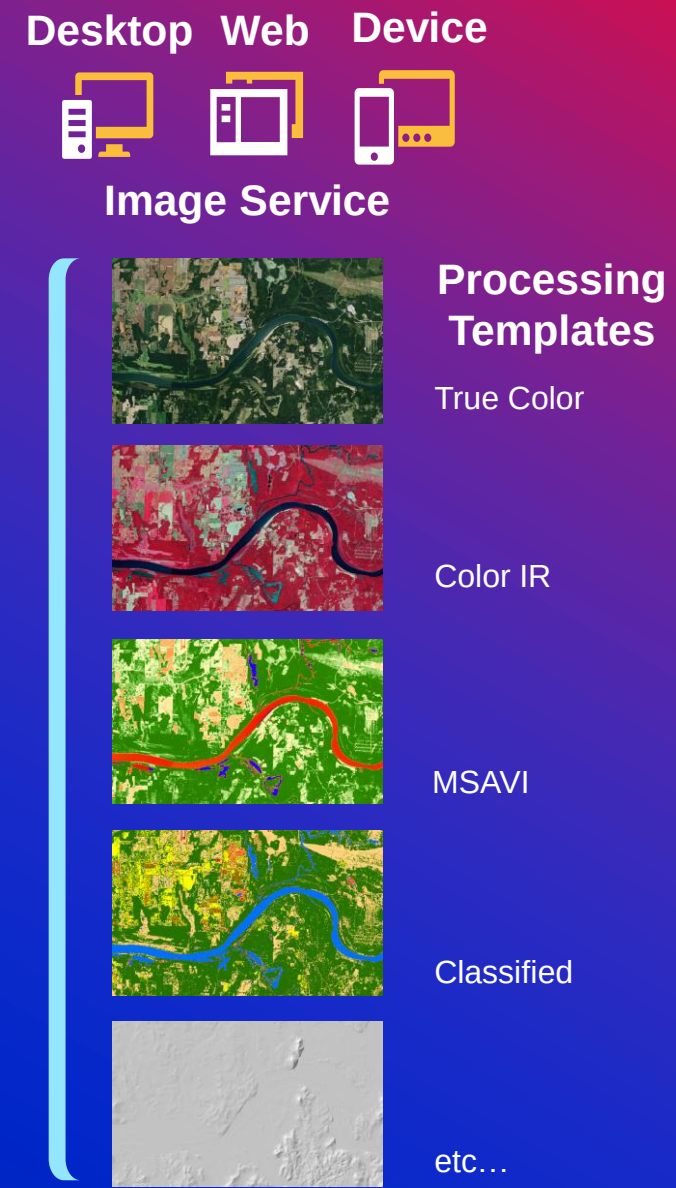


Service enablement with ArcGIS Image Server

Enterprise solution for sharing imagery and remote sensing data

- Part of ArcGIS Enterprise
- Powerful enabler for sharing large imagery collections
- Extends Mosaic Dataset access beyond user desktop
  - Additional users, applications, and devices
  - Scaled processing with Raster Analytics





Raster Analytics

Distributed processing and analysis

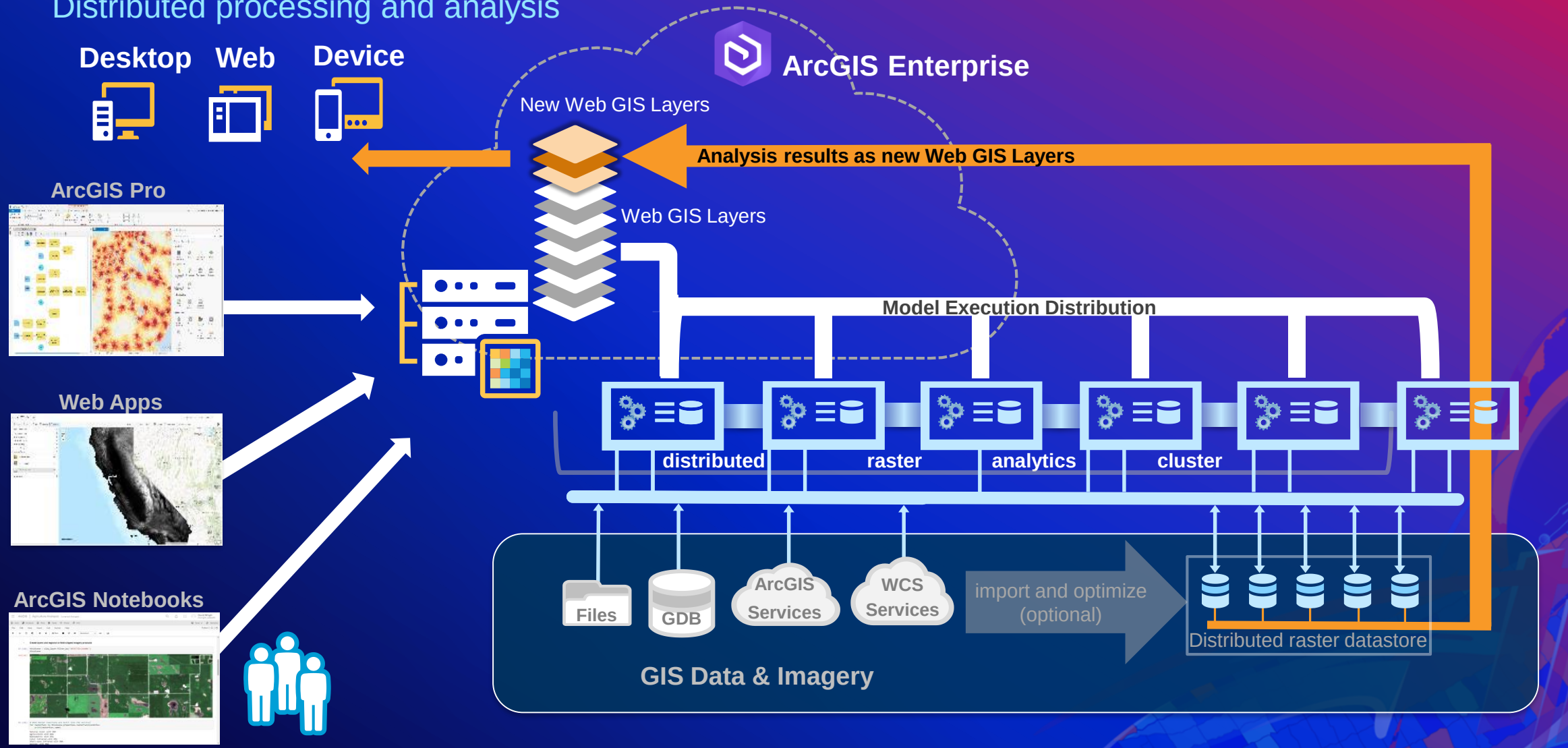
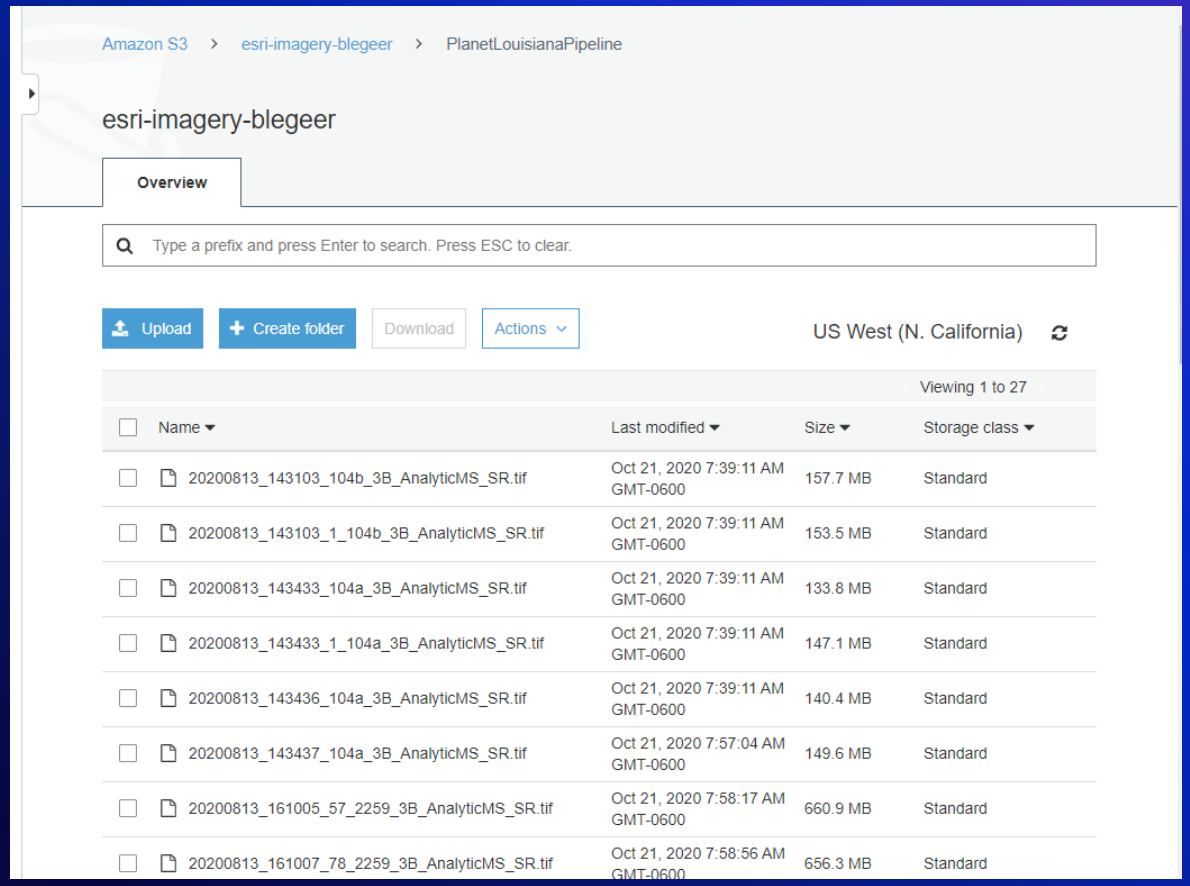


Image Service publishing from cloud storage

Made easy with latest versions of ArcGIS Pro

- With imagery delivered to cloud bucket or container
  - Create Cloud Storage Connection File in ArcGIS Pro



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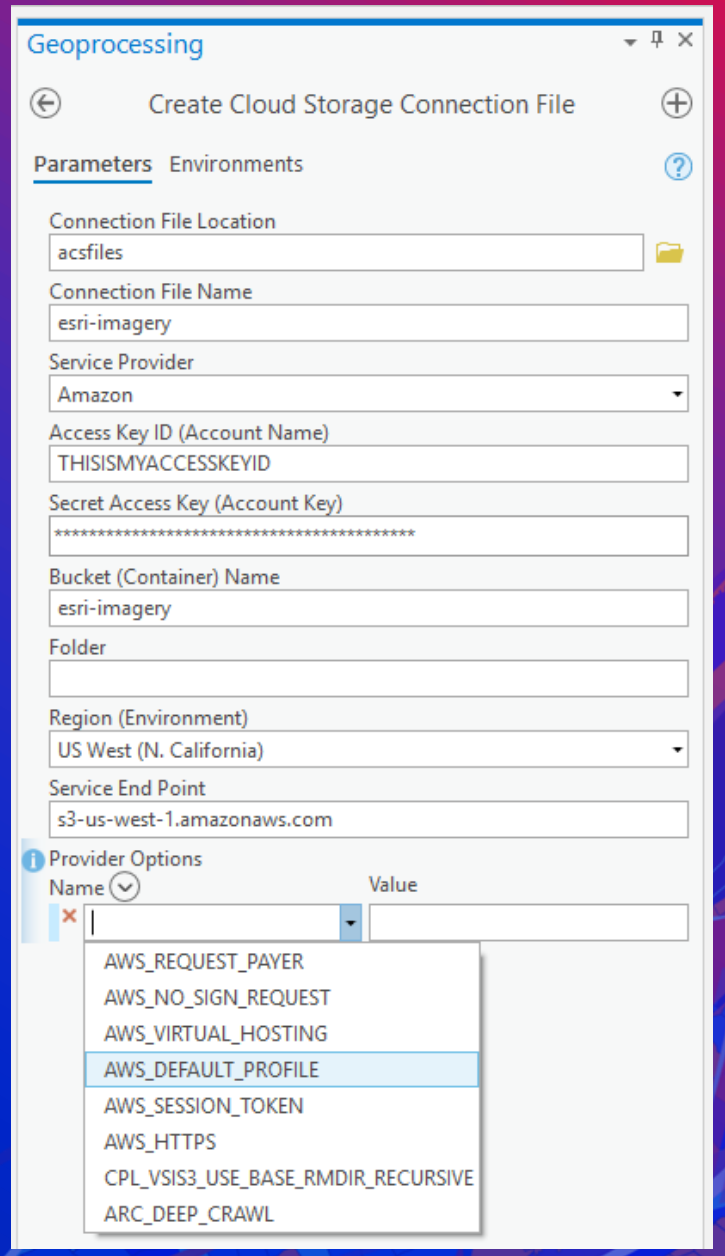
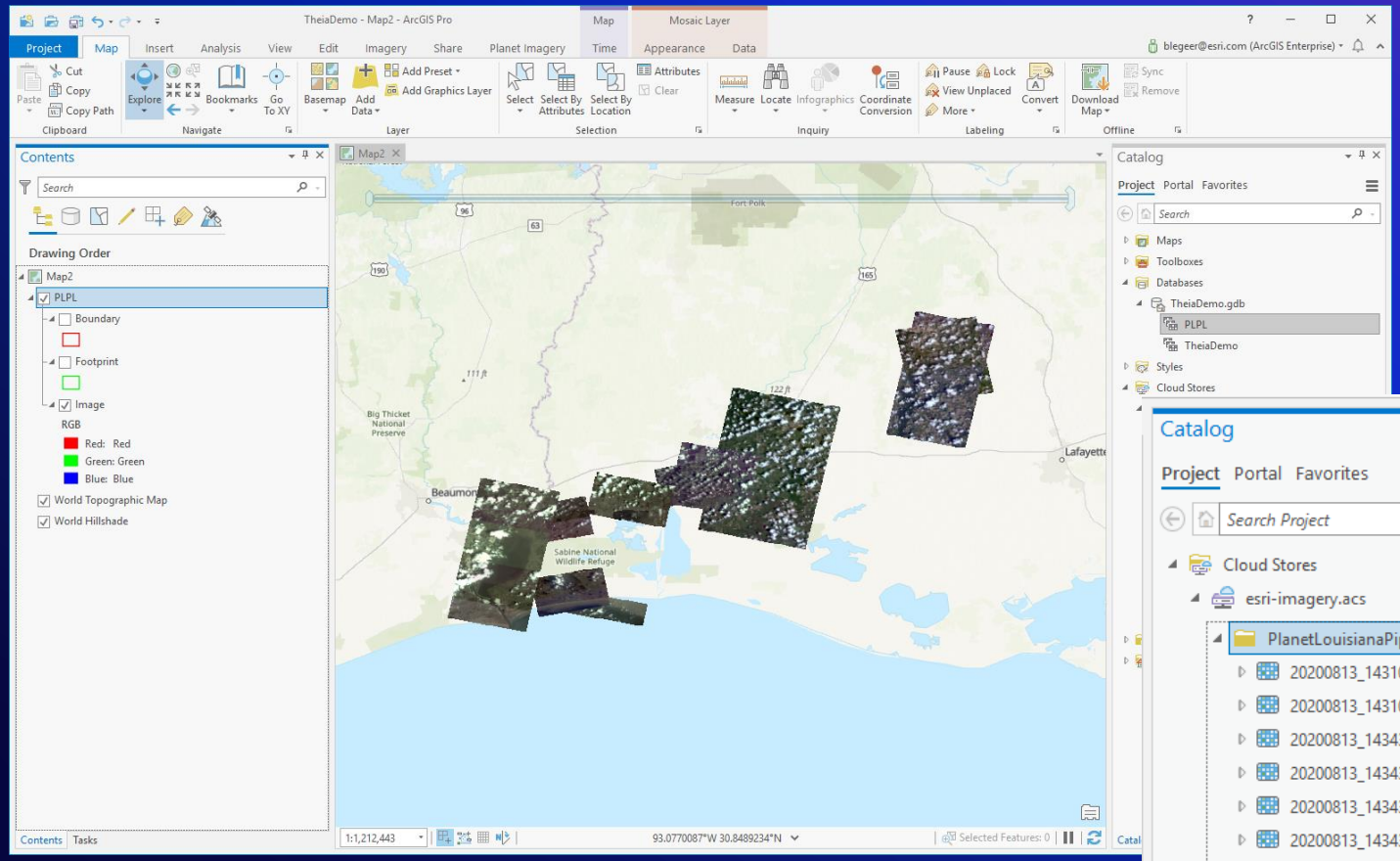
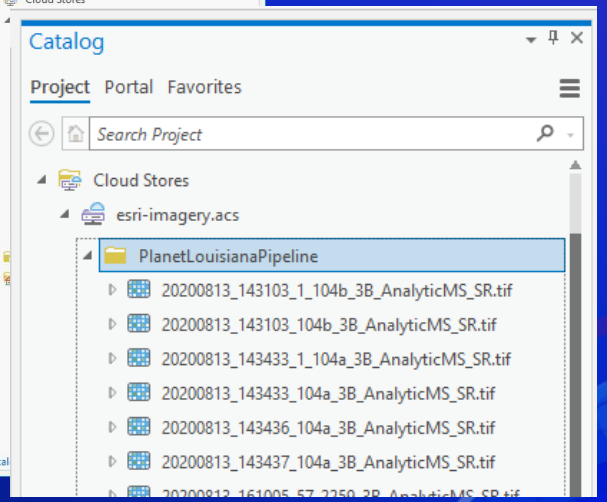


Image Service publishing from cloud storage

Made easy with ArcGIS Pro

- Add Rasters to Mosaic Dataset
  - Cloud Store registered in ArcGIS Enterprise





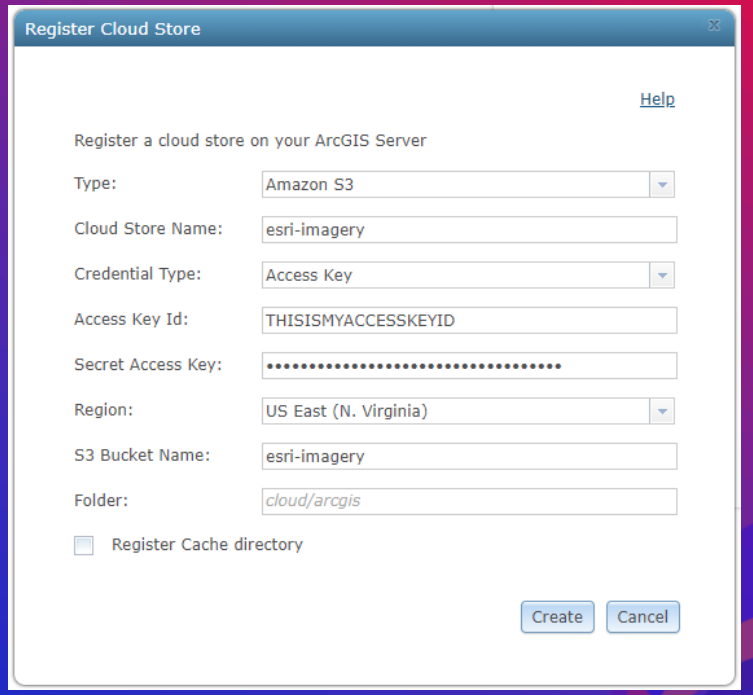
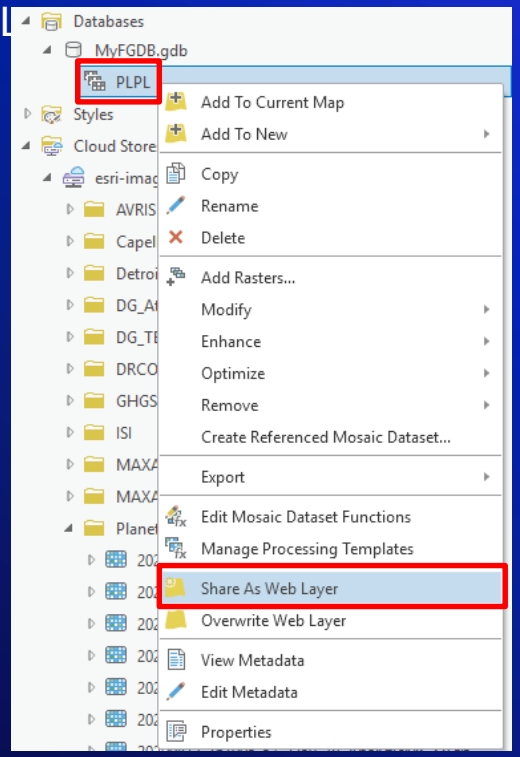
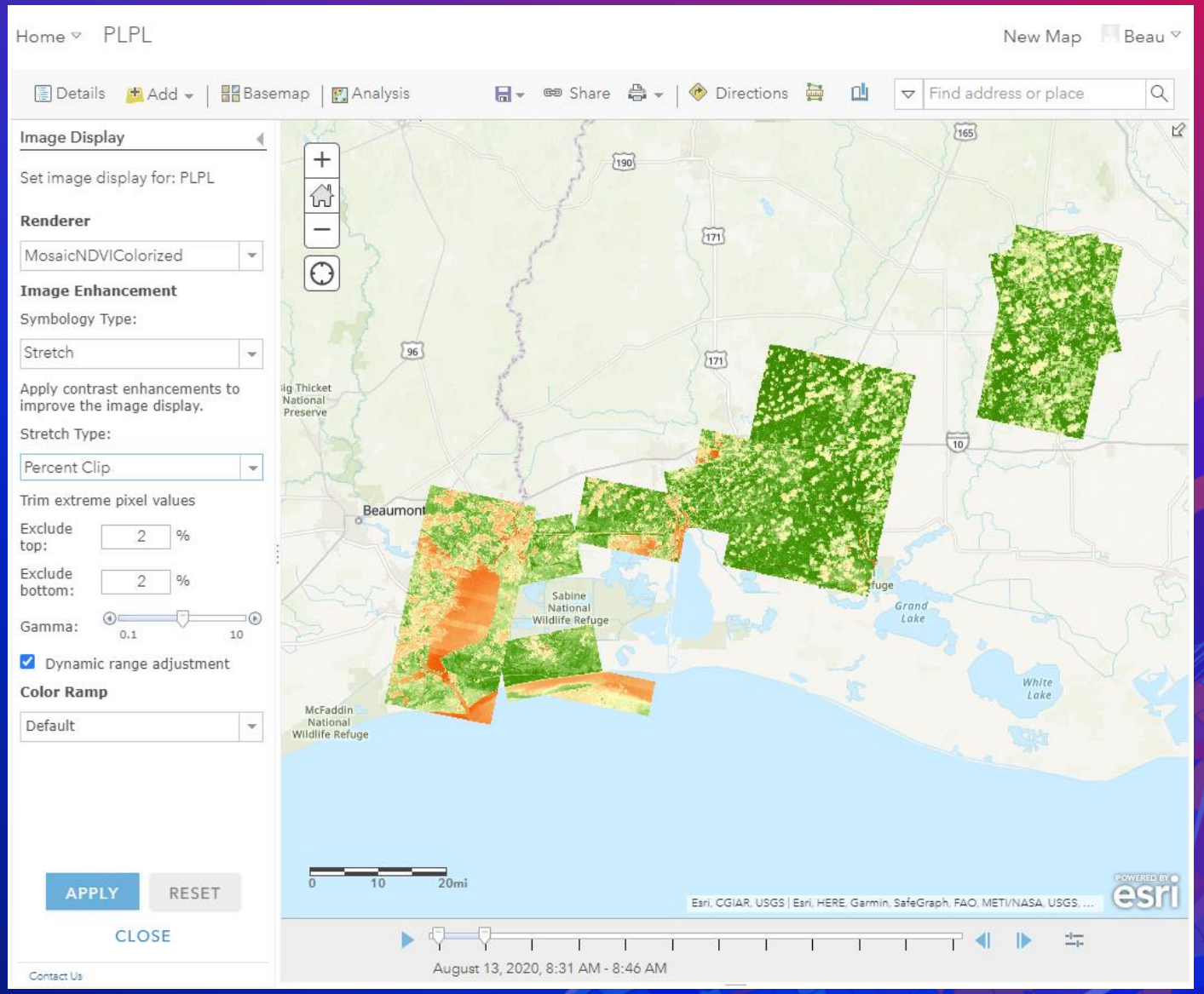


Image Service publishing from cloud storage

Made easy with ArcGIS Pro

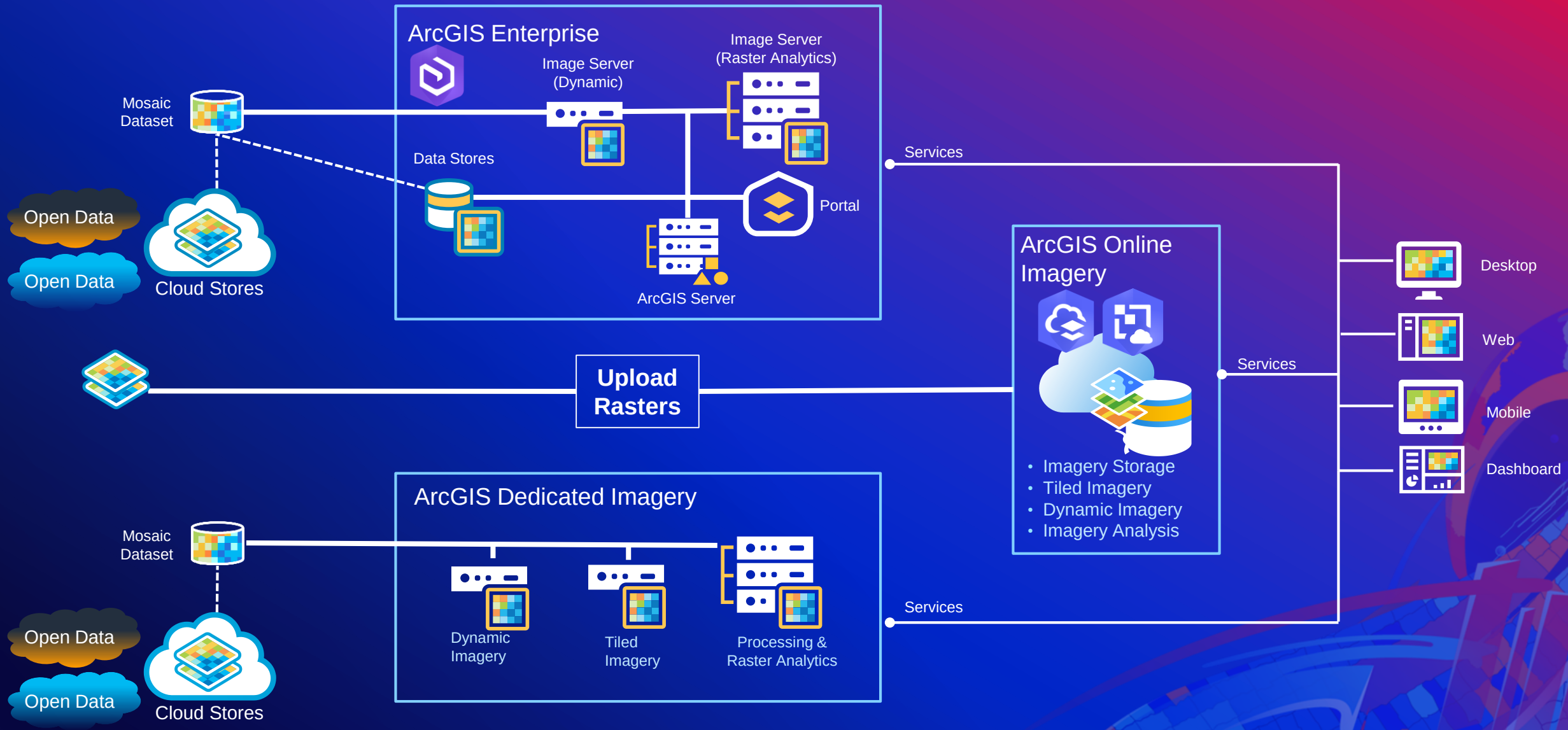
- Share Mosaic Dataset as Web





- Image Service available for all clients
  - Processing templates
  - Time enablement

Making Imagery Accessible



Key Differences in ArcGIS Online Hosted Layers

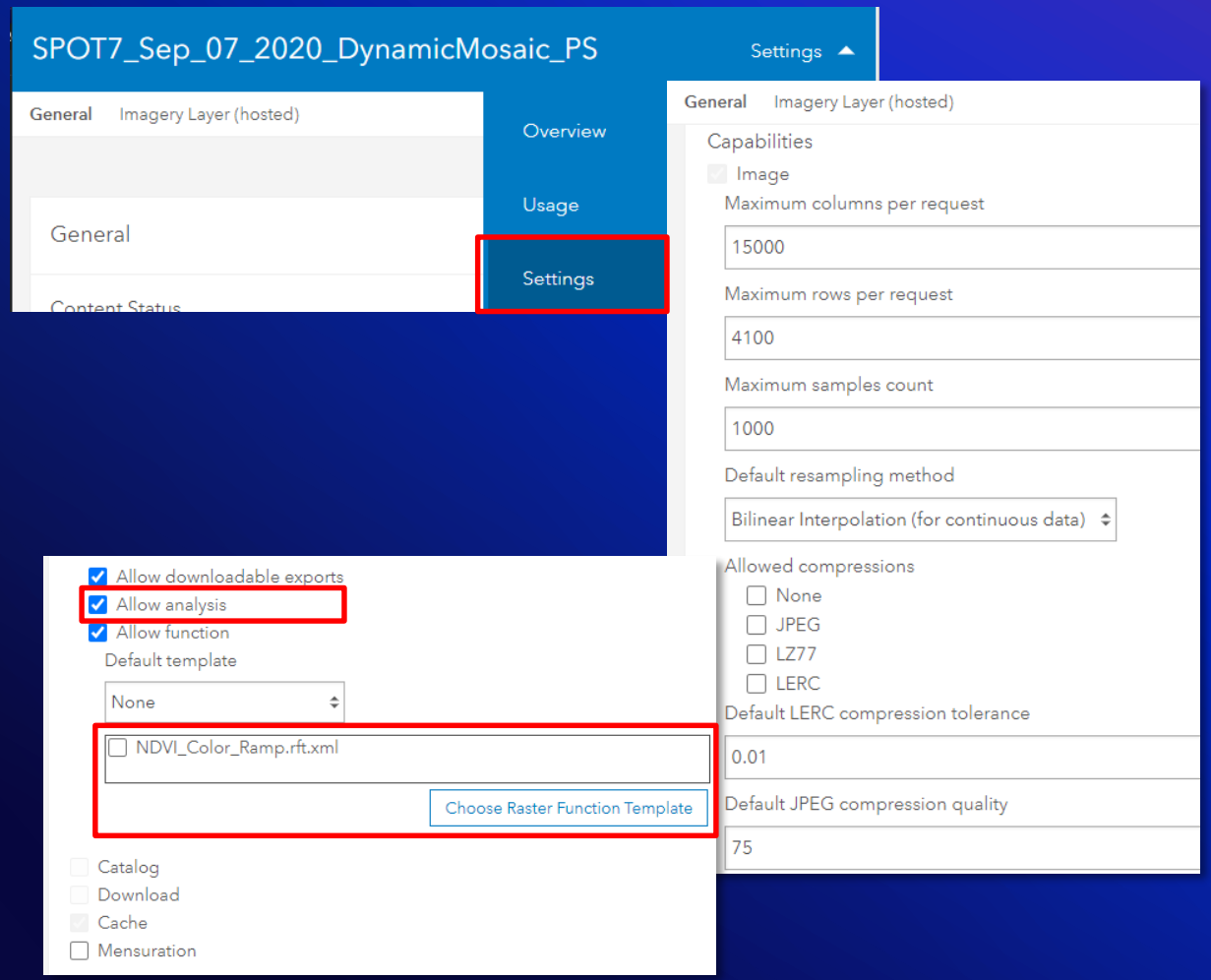
Tiled Layer	Tiled Imagery Layer (New)	Dynamic Imagery Layer (New)
No server-side processing	No server-side dynamic processing or image access	Server-side dynamic mosaicking, image processing, and access (projections, rendering, band sub-setting, raster functions, and more)
Static tiles	Static tiles	Dynamic mosaicking and image access
Does not support image collections	Does not support image collections	Supports image collections (analogous to mosaic datasets)
1 or 3 band JPG/PNG tiles	Full pixel depth, band count CRF tiles	Full pixel depth, band count CRF tiles
No client-side processing	Supports client-side processing	Supports client-side processing
Visualization	Visualization and analysis	Visualization and analysis

- Tiled Imagery Layer can be republished as Dynamic Imagery Layer and vice versa

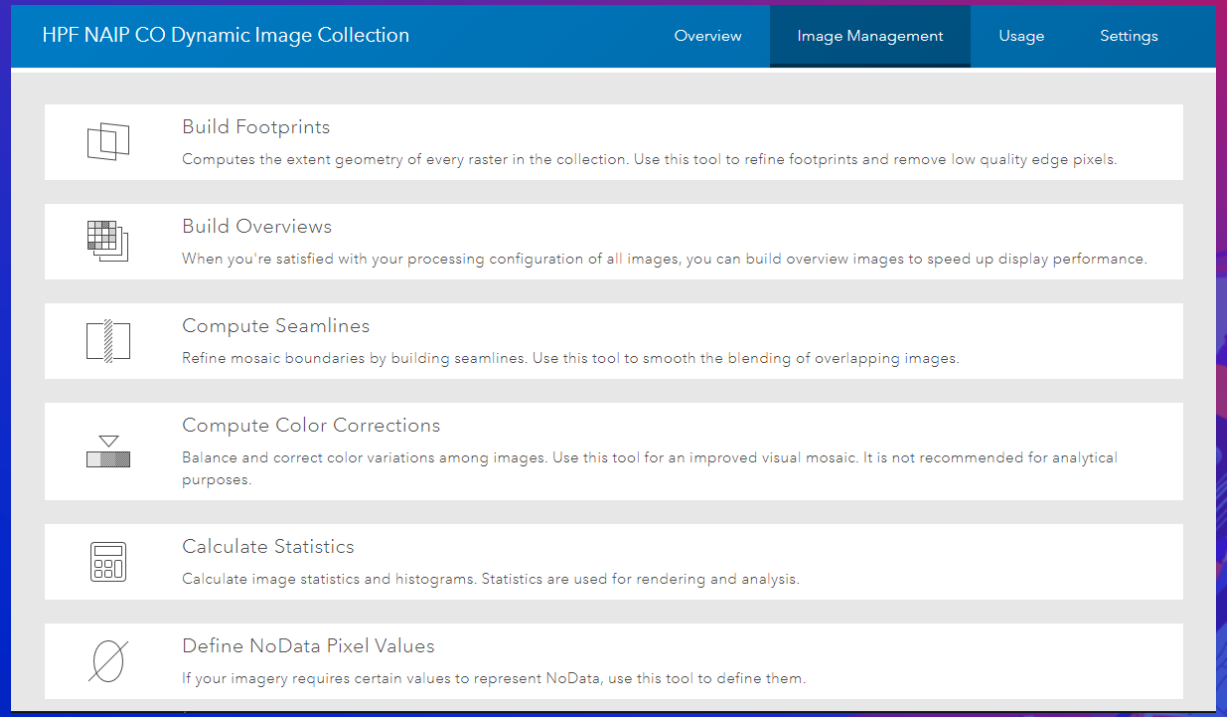
Dynamic Imagery Layer control

Additional operations on Dynamic Imagery Layers

- Editing of service configuration



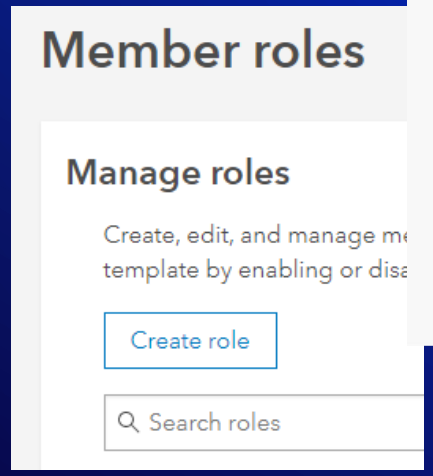
- Additional tools for Image Collection layer configuration

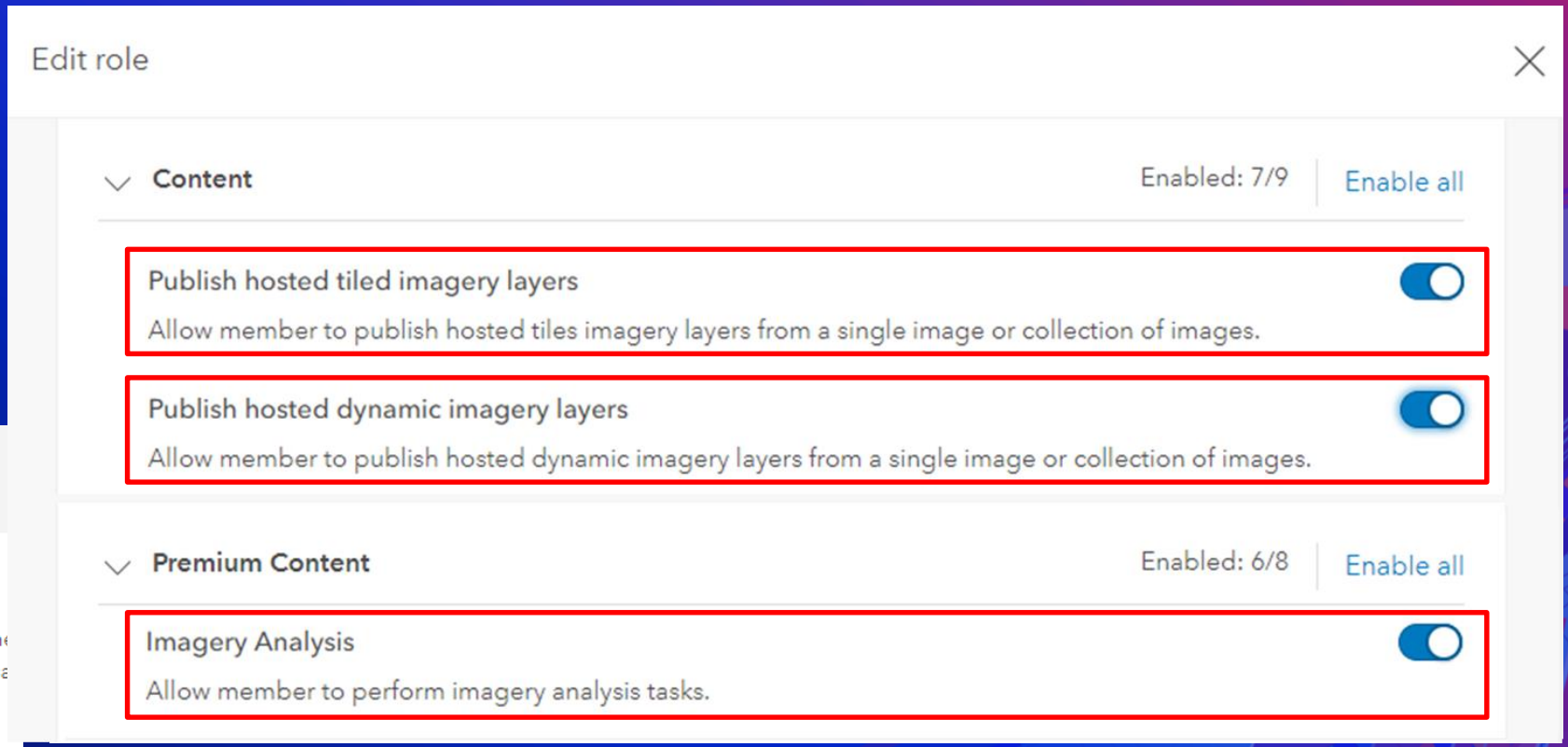


Enabling Hosted Imagery Capabilities

Access Control

- Organization Administrator grants permission at Role (User level)
- Role privilege requirements
  - Create Hosted Imagery Layers
    - Content
      - Publish Tiled Imagery layers
      - Publish Dynamic Imagery layers
  - Enable Raster Analytics
    - Premium Content
      - Imagery Analysis

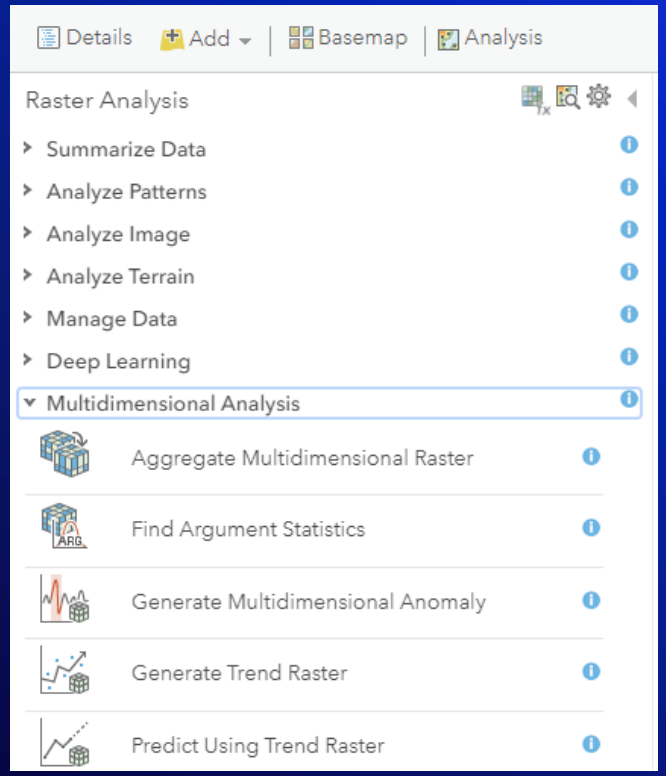


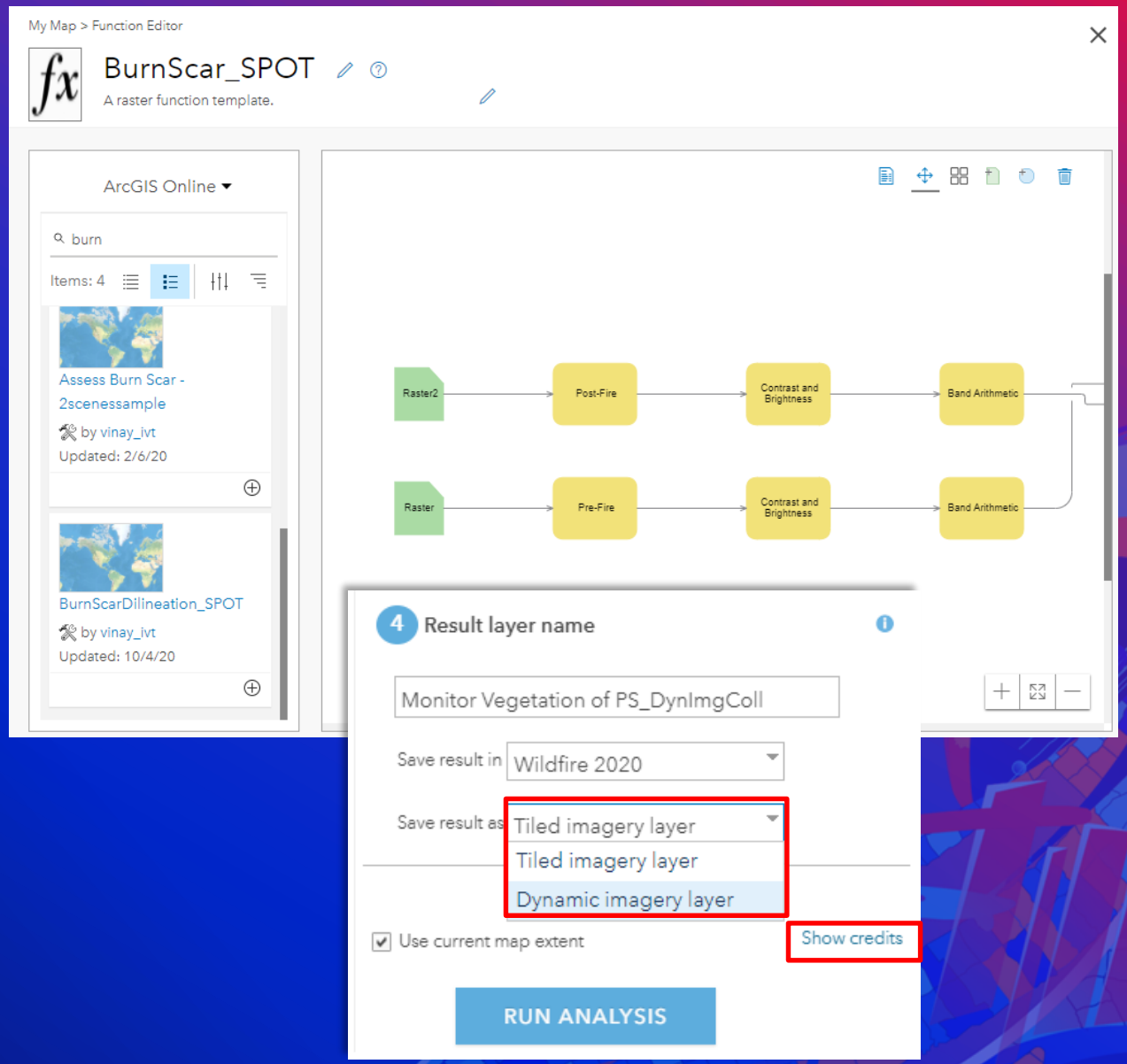


Raster Analysis

Powerful set of Raster Analytics to leverage

- 18 ready to use tools under Perform Analysis pane
- 150+ Raster Functions / Function Editor UI
- Output to new Hosted Imagery Layers
- Credit consumption estimate



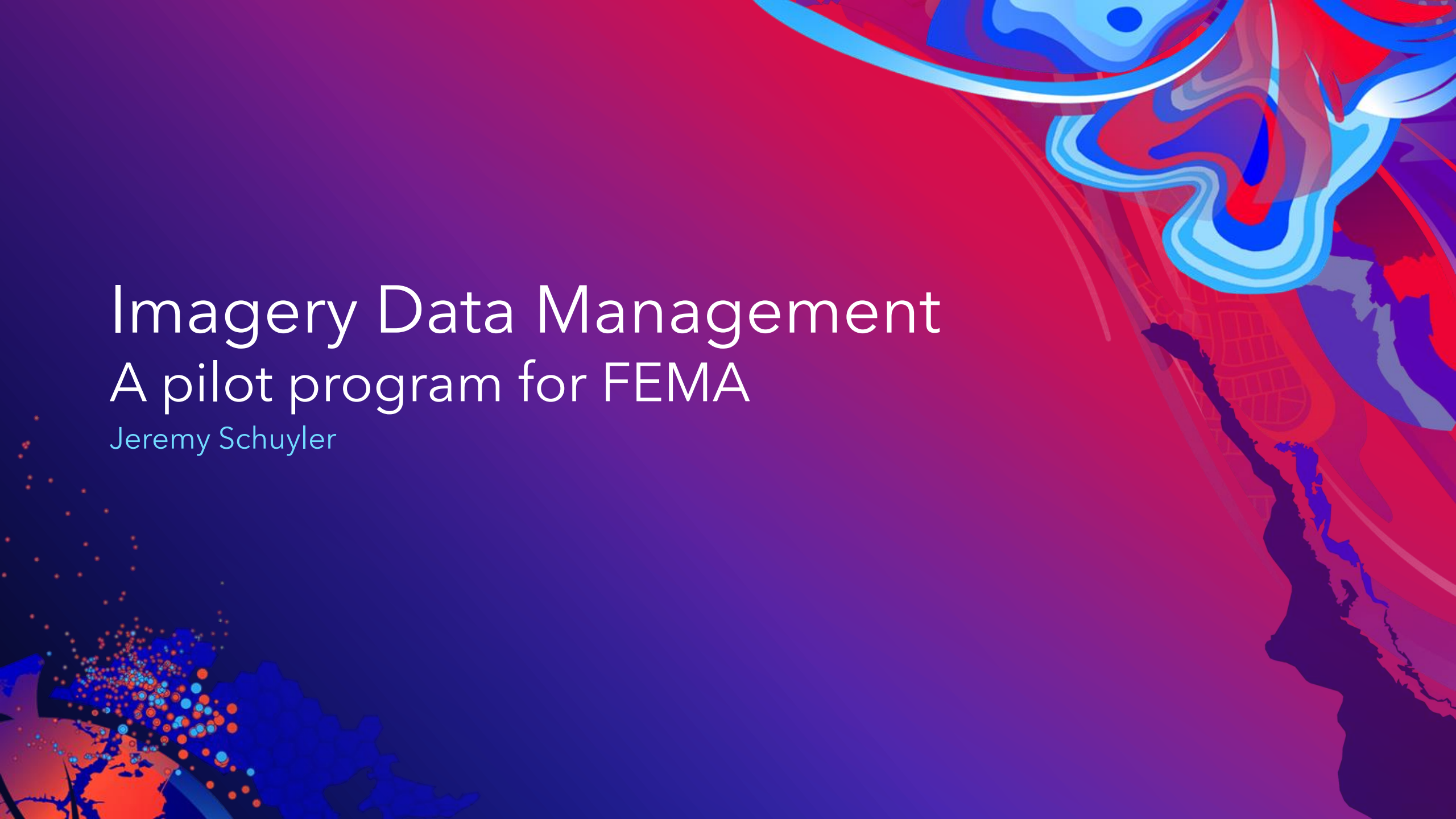


Demonstrations

Imagery Data Management

A pilot program for FEMA

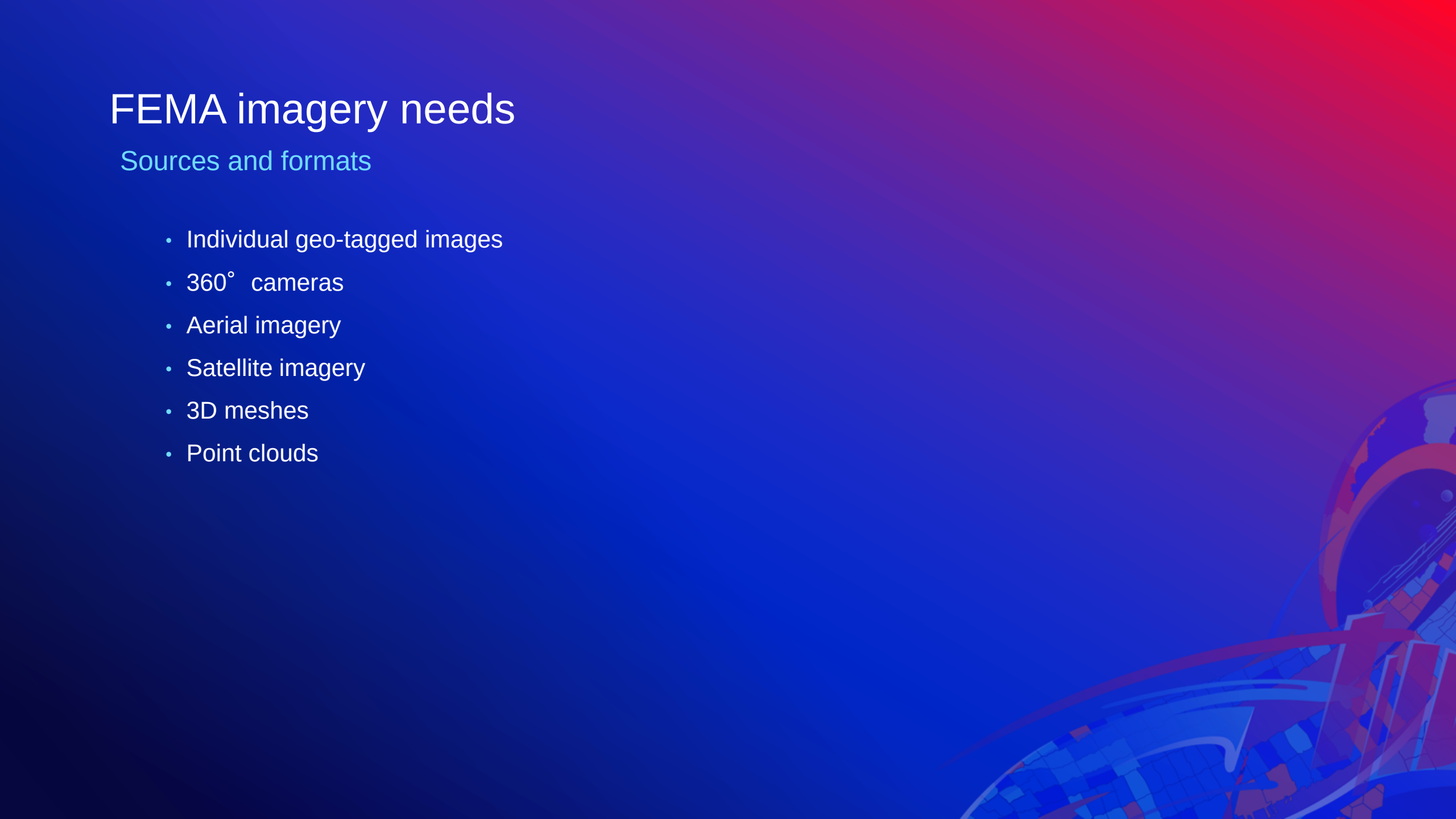
Jeremy Schuyler



FEMA imagery needs

Sources and formats

- Individual geo-tagged images
- 360˚ cameras
- Aerial imagery
- Satellite imagery
- 3D meshes
- Point clouds



Demonstrations

Imagery Data Management at FEMA

Steps to success

- Rapid access to wide variety of sources and types
- Centralized storage and dissemination for easy discovery
- Provide analysis ready image services
- Application ready services
- Manage access