



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

Kurt Schwoppe, David Wright, Jeremy Schuyler

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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



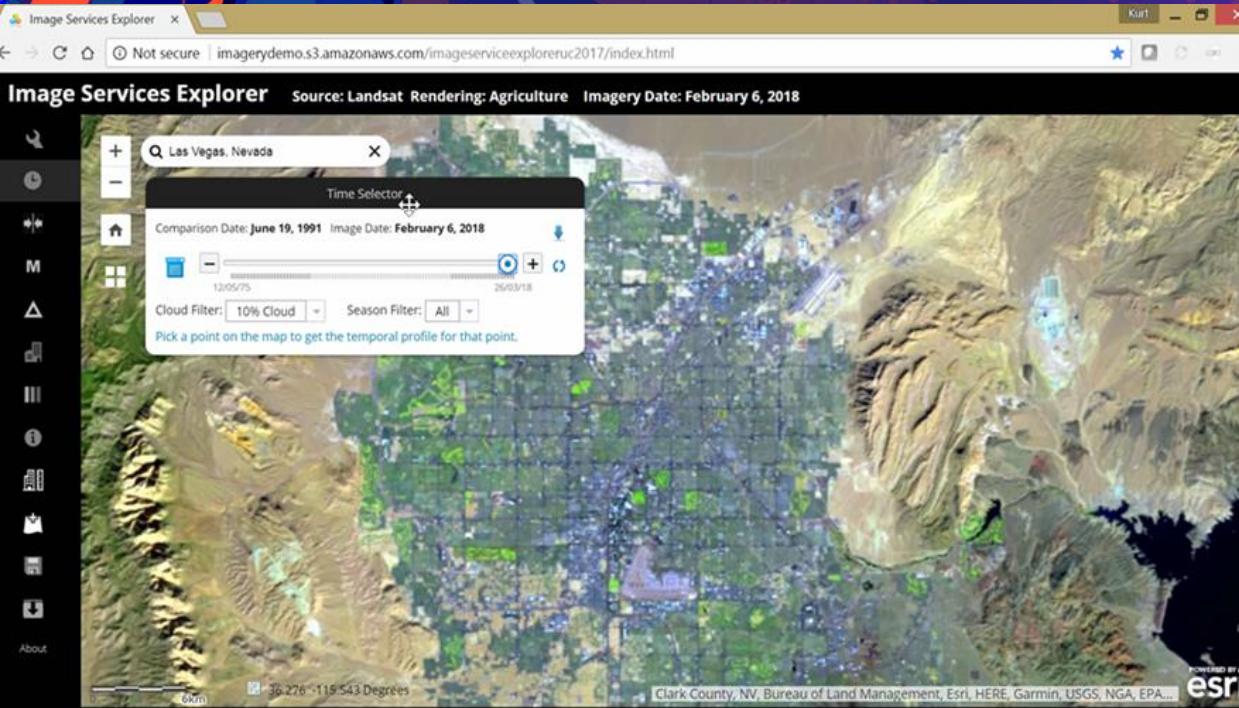


Capabilities vs Complexity

The Challenge of making complex things easy

— Capabilities
— Complexity

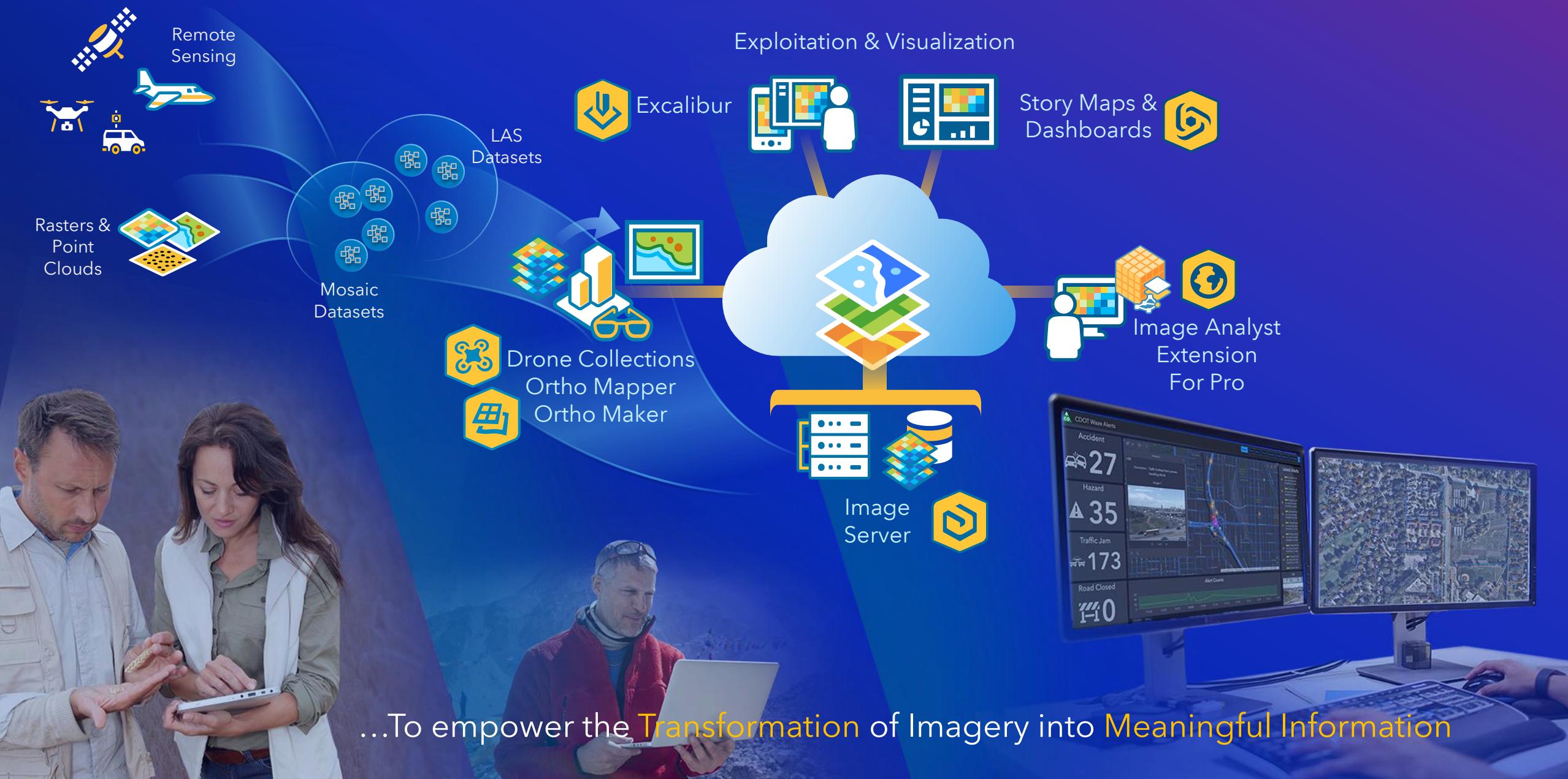




Sample Application

Esri Image Services Explorer

Imagery as Part of ArcGIS

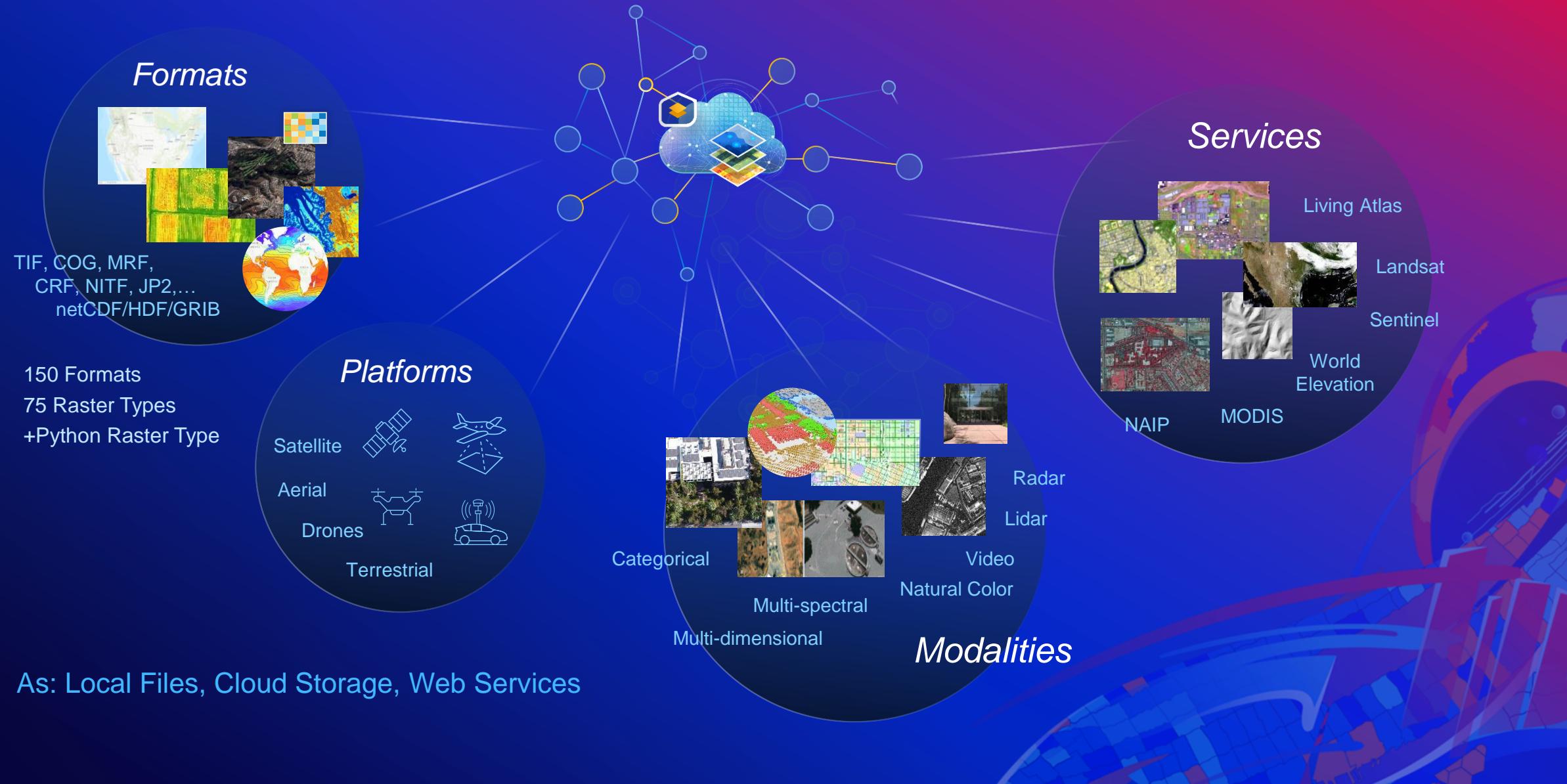


Imagery Management

Rapid access to massive amounts of remotely sensed content



Content – Support for All Imagery and Rasters



Sentinel-2 Views



NAIP (NDVI)



MODIS



Landsat 8

Content in the Living Atlas

Basemaps



Demographics and Lifestyle



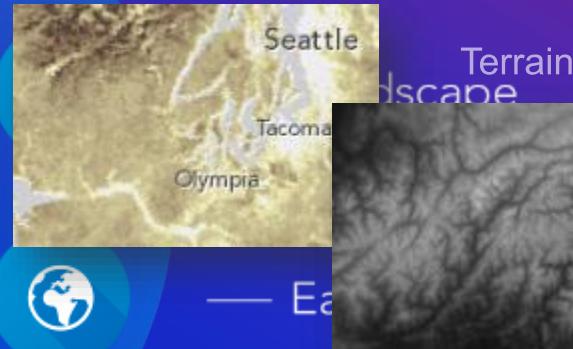
Transportation



Urban Systems



Imagery

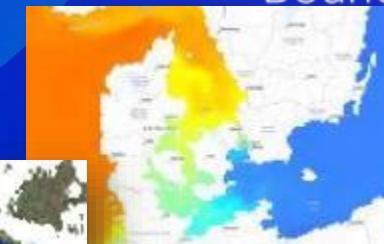


Terrain Landscape

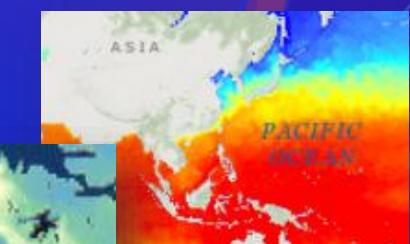
World Ecophysiological Land Units



Boundaries



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
- 3D Mesh
- Topo Maps

Base Maps

- Ortho Photos
- DSM
- DTM

Satellite and Drone

A large blue circular graphic on the left contains the text "Reality Mapping" and "Site Models" and "Base Maps". Inside the circle are icons for a satellite and a drone, along with various map and simulation images. A man in a white shirt is sitting at a desk, looking at a laptop screen.

Quality Check

Images	median of 38010 keypoints per image
Dataset	46 out of 47 images calibrated (97%), all images enabled
Camera Optimization	0.0% relative difference between initial and optimized internal camera parameters
Matching	median of 3819.84 matches per calibrated image
Georeferencing	yes, 9 GCPs (93D), mean RMS error = 0.134 m

Calibration Details

Number of Calibrated Images	46 out of 47
Number of Geolocated Images	47 out of 47
Initial Image Positions	47

Overlap

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.

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

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 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 3 for keypoint matches).

Number of overlapping images: 1 2 3 4 5+

SURE for ArcGIS

Automated Data Production System for Mapping and 3D

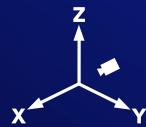
Inputs



Image Files



Lidar



Orientation Data



New

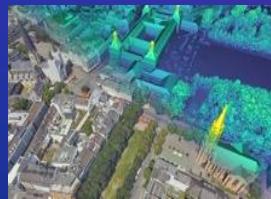


ArcGIS

- Pro
- Enterprise
- Online



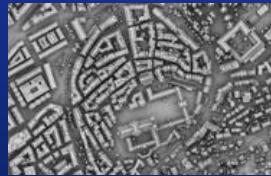
True Orthophotos



Textured Meshes



Point Clouds



Digital Surface Model

Data Products

Applications

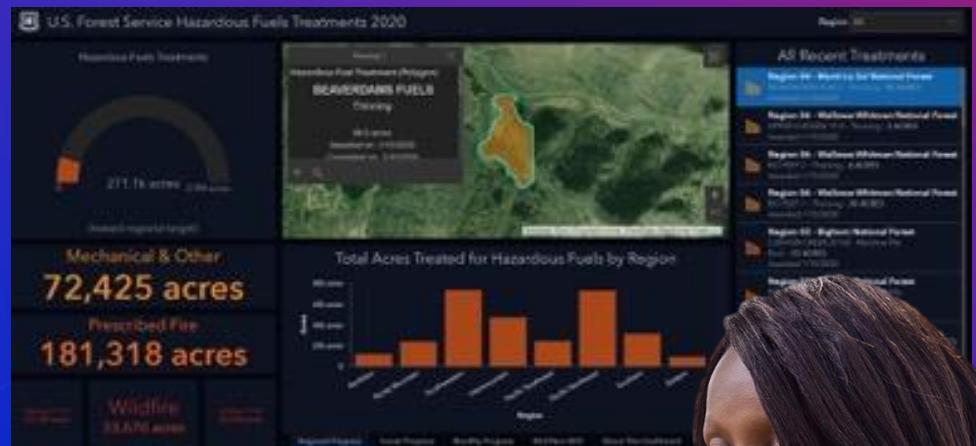
- Mapping
- 3D Visualization & Simulation
- Change Detection
- Surface Analytics

Fully Integrated with ArcGIS

Fast, Highly Accurate, Massively Scalable, and Cost Effective

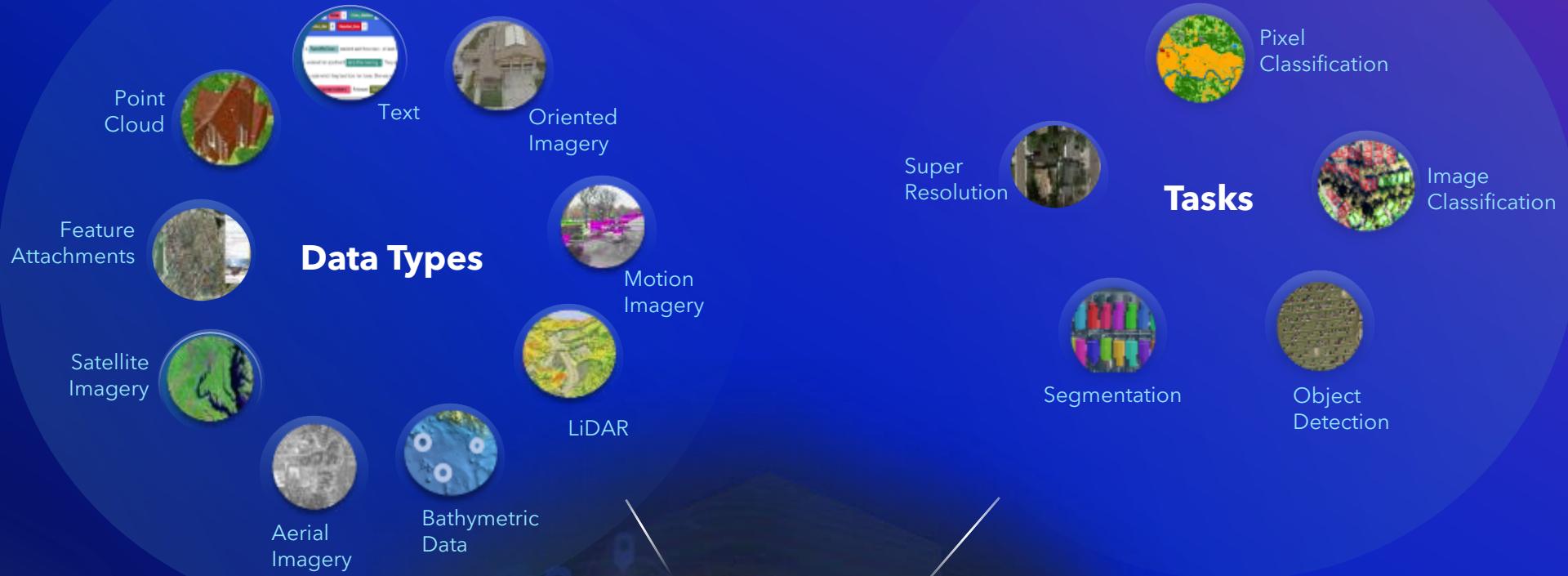
Observations On Demand

Automating targeted feature extraction from Imagery



Deep Learning in ArcGIS

Different data types, tasks and integration



Deep Learning models on the living atlas:

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

New

Finding Spatial Patterns

Raster Analytics at Scale

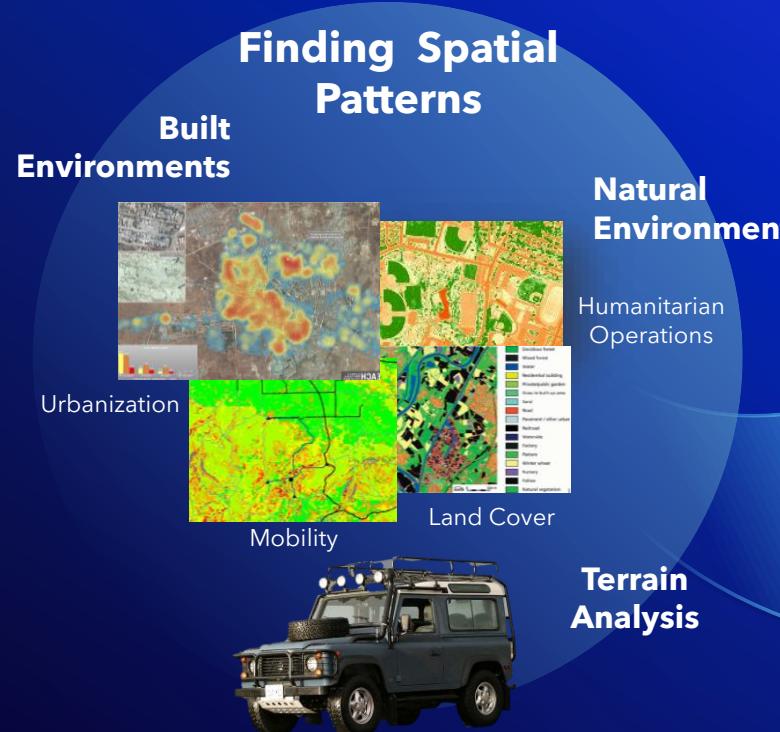


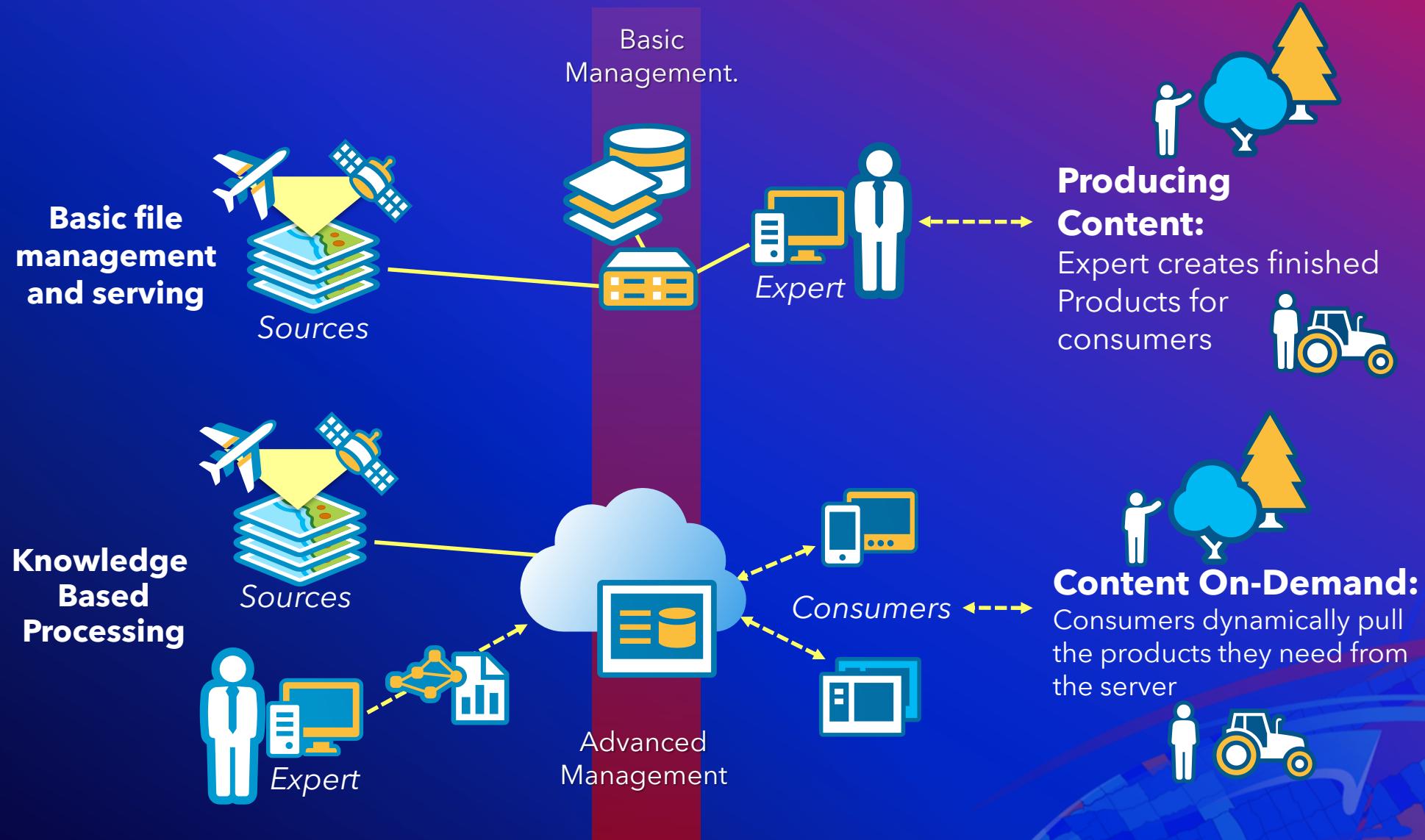
Image Analysis

Extracting Information from Imagery



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

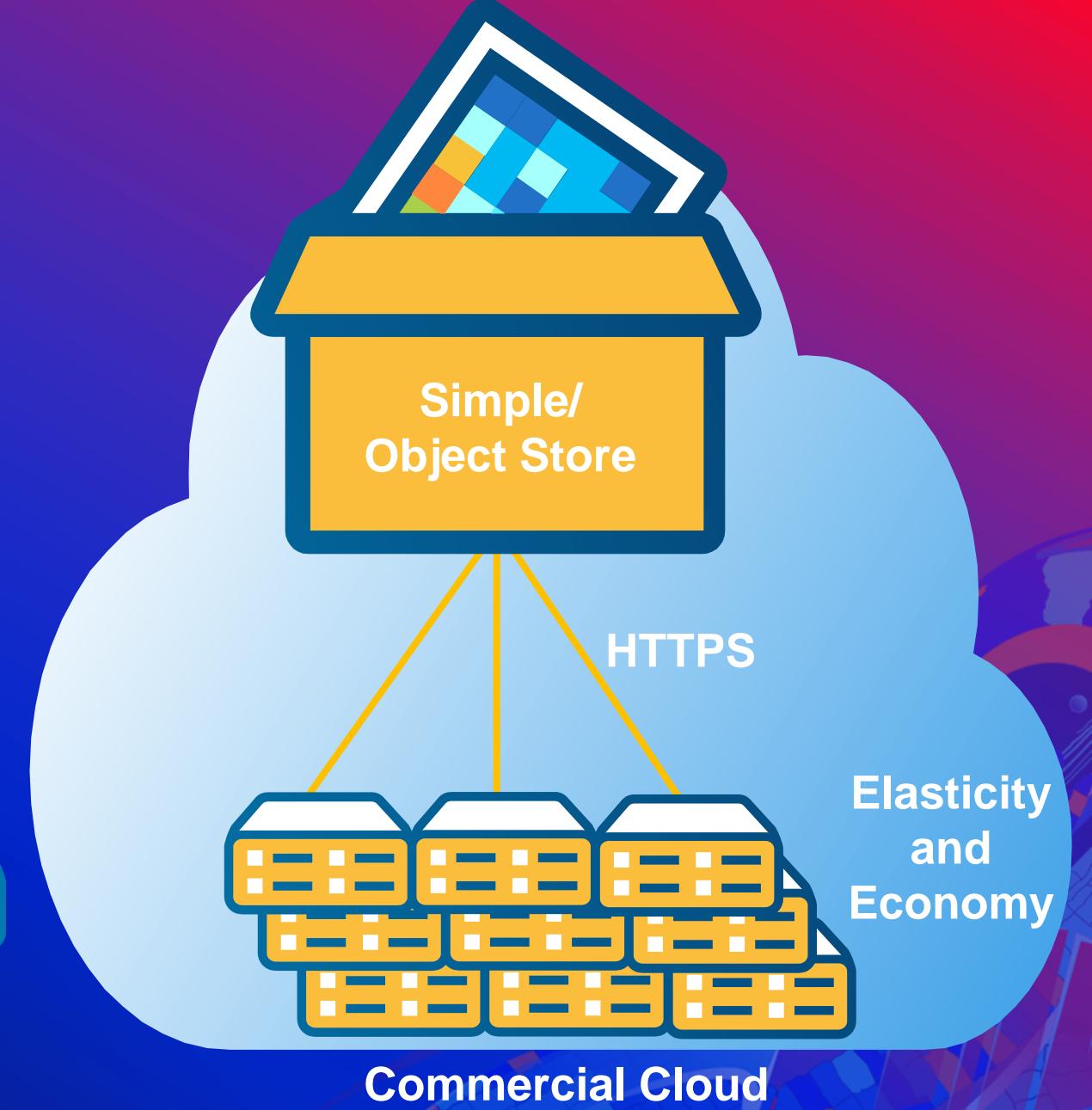
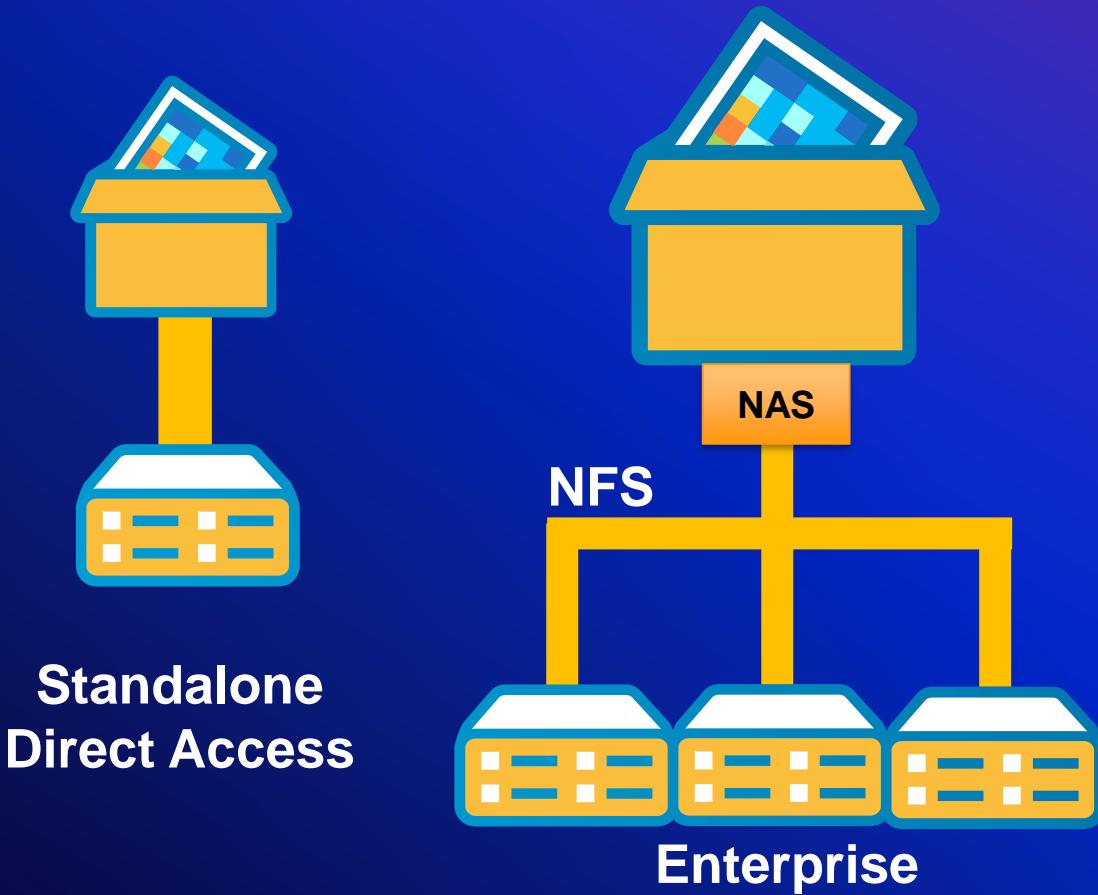
Mosaic Dataset



- 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

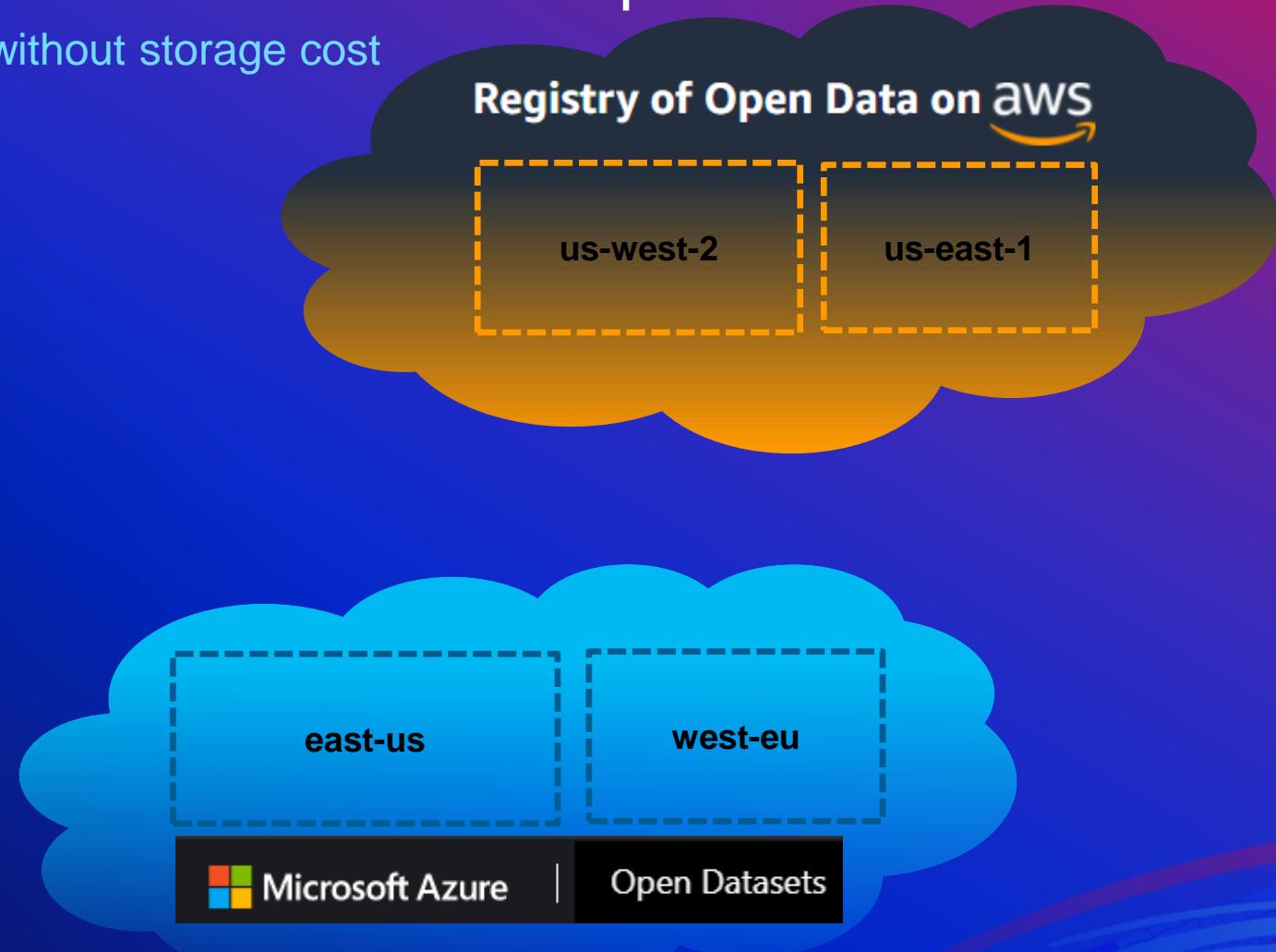
Use any or all that enable your workflows



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

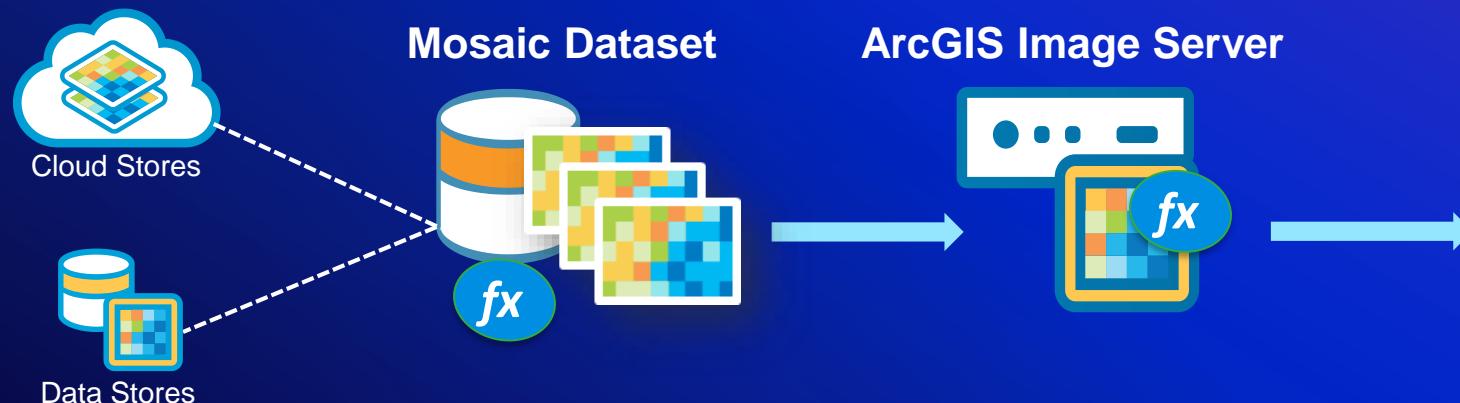


Image Service



Processing Templates

True Color



Color IR



MSAVI



Classified



etc...

Raster Analytics

Distributed processing and analysis

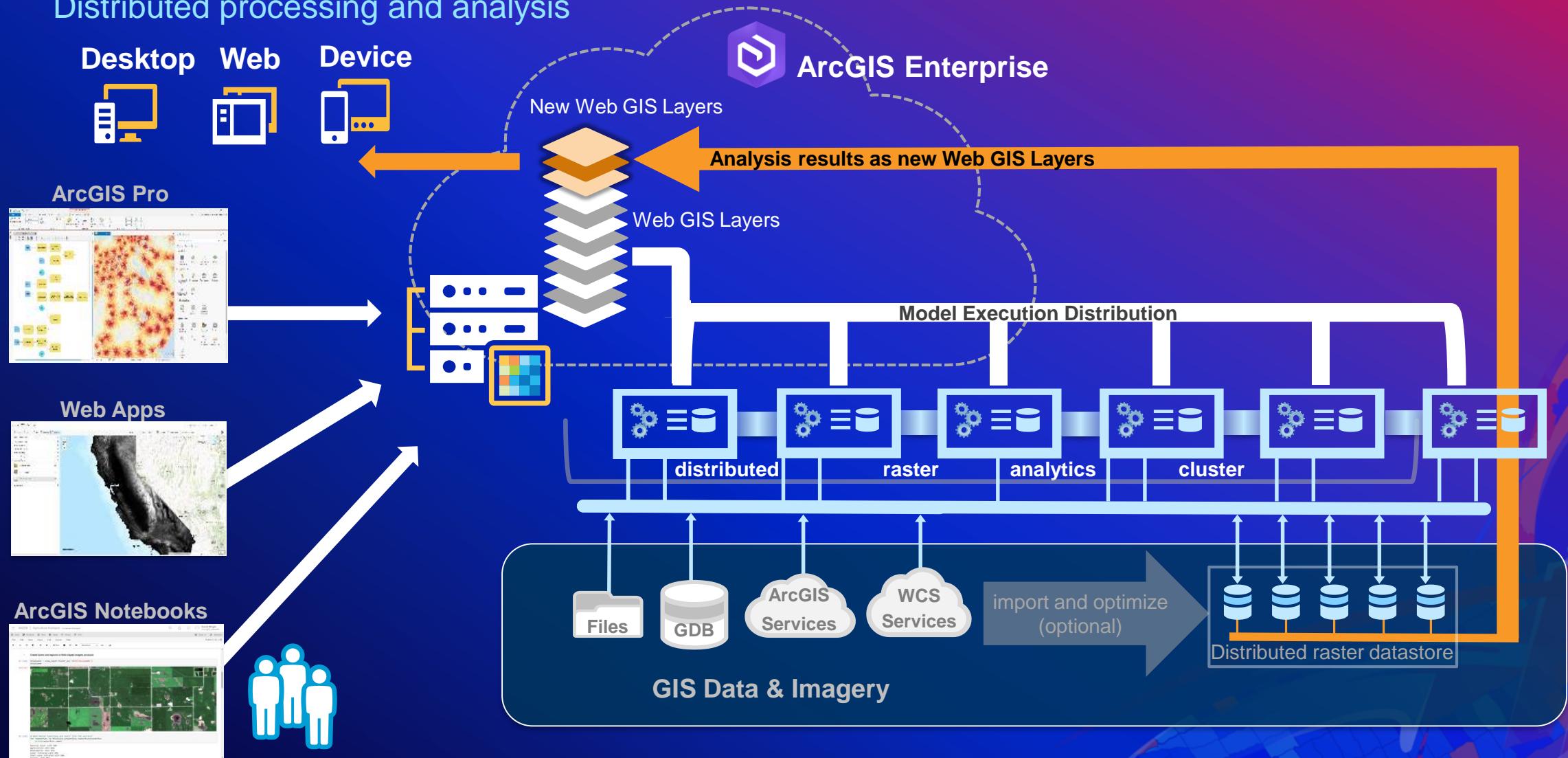
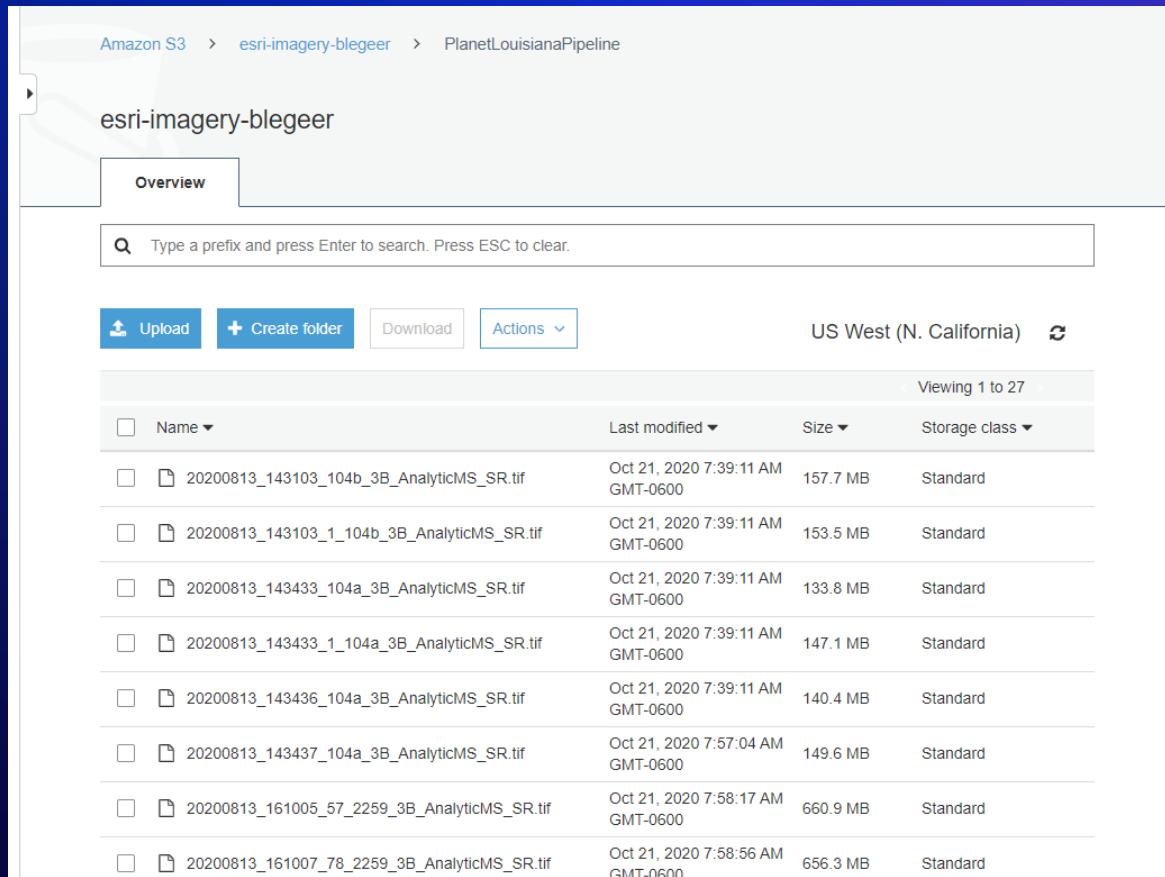


Image Service publishing from cloud storage

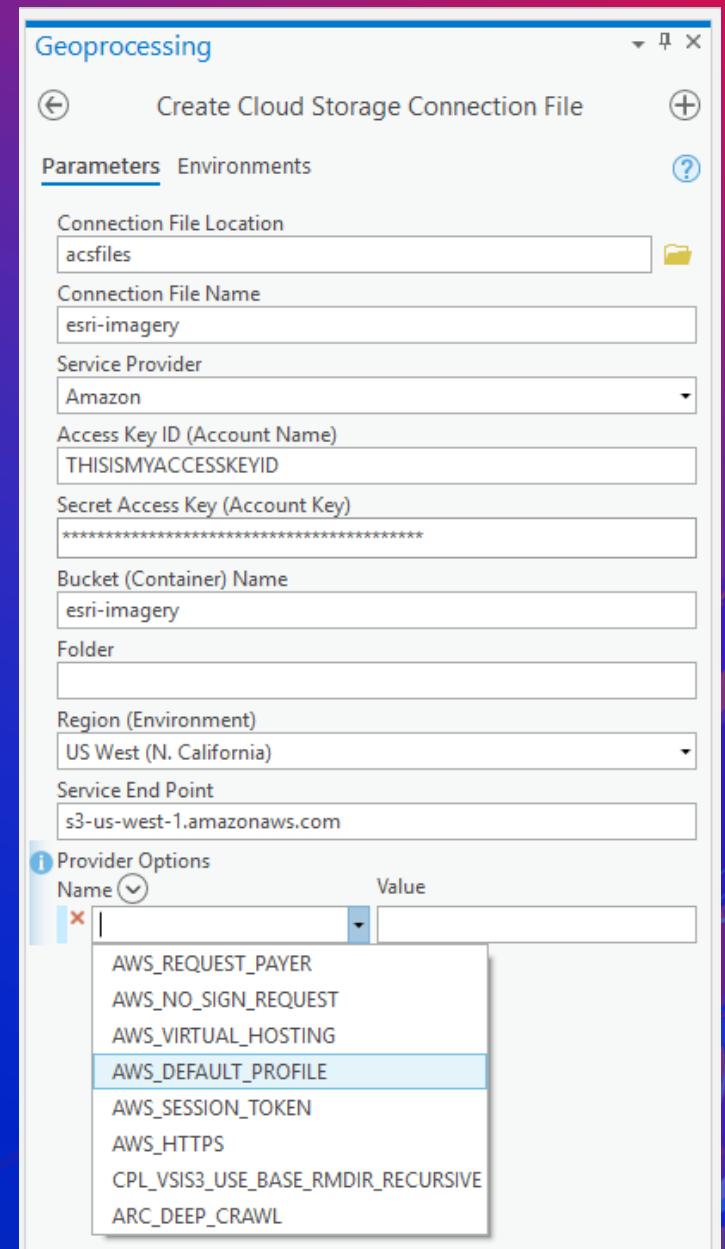
Made easy with latest versions of ArcGIS Pro

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



The screenshot shows the AWS S3 console interface. The top navigation bar shows 'Amazon S3' > 'esri-imagery-blegeer' > 'PlanetLouisianaPipeline'. The main content area is titled 'esri-imagery-blegeer' and shows an 'Overview' tab selected. Below the tabs is a search bar with the placeholder 'Type a prefix and press Enter to search. Press ESC to clear.' Under the search bar are buttons for 'Upload', '+ Create folder', 'Download', and 'Actions'. The 'Actions' dropdown is currently open, showing 'US West (N. California)' and a refresh icon. The main list area is titled 'Viewing 1 to 27' and contains a table with 10 rows of file information. The columns are 'Name', 'Last modified', 'Size', and 'Storage class'. The files listed are all 'AnalyticMS_SR.tif' files with various names and modification dates between Oct 21, 2020, and Oct 22, 2020.

Name	Last modified	Size	Storage class
20200813_143103_104b_3B_AnalyticMS_SR.tif	Oct 21, 2020 7:39:11 AM GMT-0600	157.7 MB	Standard
20200813_143103_1_104b_3B_AnalyticMS_SR.tif	Oct 21, 2020 7:39:11 AM GMT-0600	153.5 MB	Standard
20200813_143433_104a_3B_AnalyticMS_SR.tif	Oct 21, 2020 7:39:11 AM GMT-0600	133.8 MB	Standard
20200813_143433_1_104a_3B_AnalyticMS_SR.tif	Oct 21, 2020 7:39:11 AM GMT-0600	147.1 MB	Standard
20200813_143436_104a_3B_AnalyticMS_SR.tif	Oct 21, 2020 7:39:11 AM GMT-0600	140.4 MB	Standard
20200813_143437_104a_3B_AnalyticMS_SR.tif	Oct 21, 2020 7:57:04 AM GMT-0600	149.6 MB	Standard
20200813_161005_57_2259_3B_AnalyticMS_SR.tif	Oct 21, 2020 7:58:17 AM GMT-0600	660.9 MB	Standard
20200813_161007_78_2259_3B_AnalyticMS_SR.tif	Oct 21, 2020 7:58:56 AM GMT-0600	656.3 MB	Standard



The screenshot shows the ArcGIS Pro Geoprocessing pane with the 'Create Cloud Storage Connection File' tool selected. The 'Parameters' tab is active. The parameters are as follows:

- Connection File Location: 'acsfiles'
- Connection File Name: 'esri-imagery'
- Service Provider: 'Amazon'
- Access Key ID (Account Name): 'THISISMYACCESSKEYID'
- Secret Access Key (Account Key): '*****'
- Bucket (Container) Name: 'esri-imagery'
- Region (Environment): 'US West (N. California)'
- Service End Point: 's3-us-west-1.amazonaws.com'

The 'Provider Options' section is expanded, showing the following provider options:

Name	Value
AWS_REQUEST_PAYER	
AWS_NO_SIGN_REQUEST	
AWS_VIRTUAL_HOSTING	
AWS_DEFAULT_PROFILE	
AWS_SESSION_TOKEN	
AWS_HTTPS	
CPL_VSIS3_USE_BASE_RMDIR_RECURSIVE	
ARC_DEEP_CRAWL	

Image Service publishing from cloud storage

Made easy with ArcGIS Pro

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

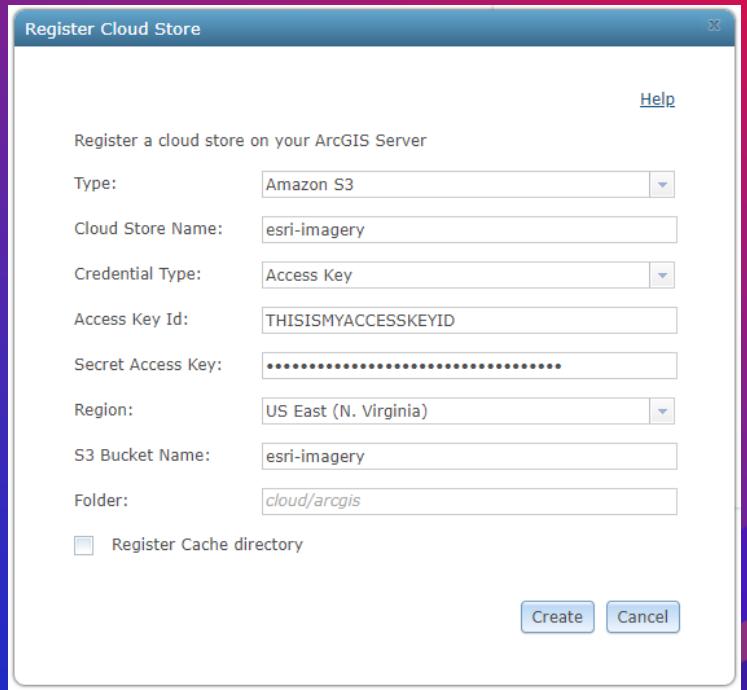
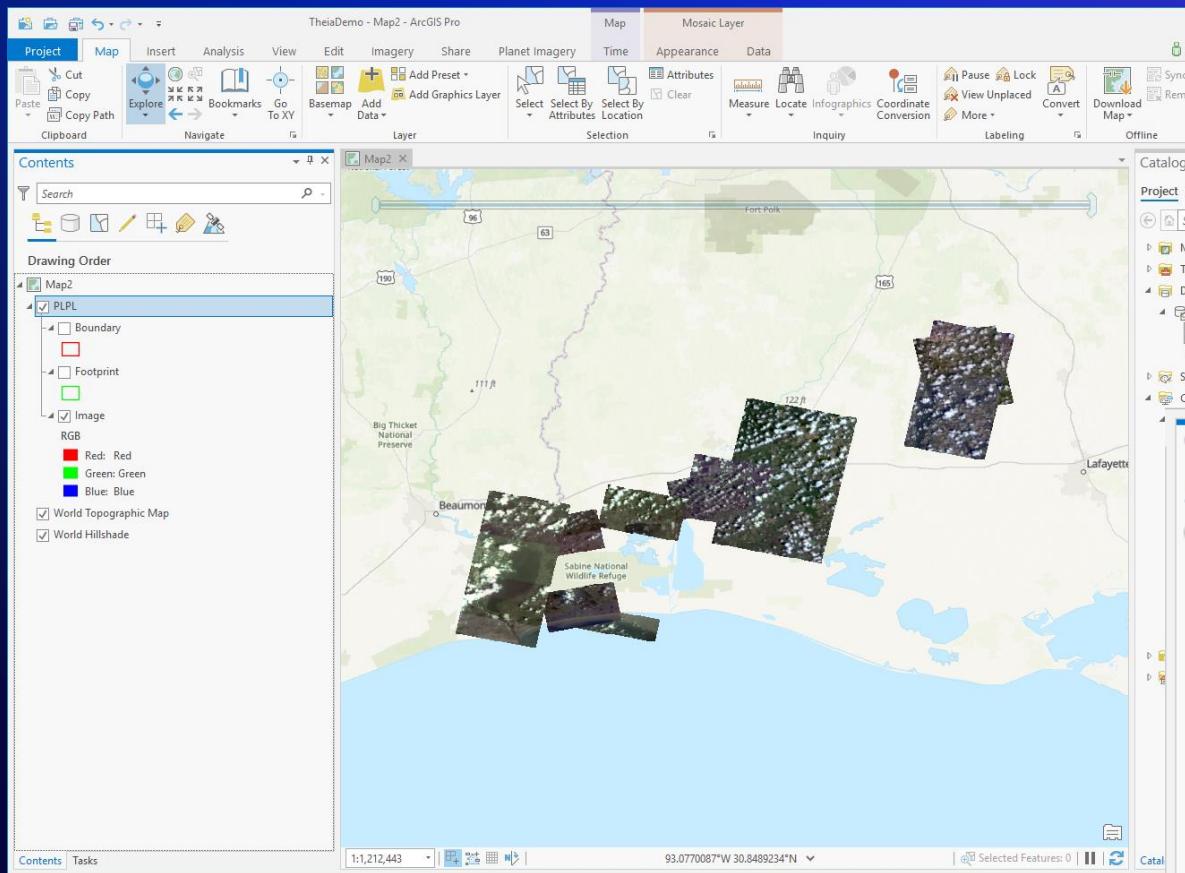
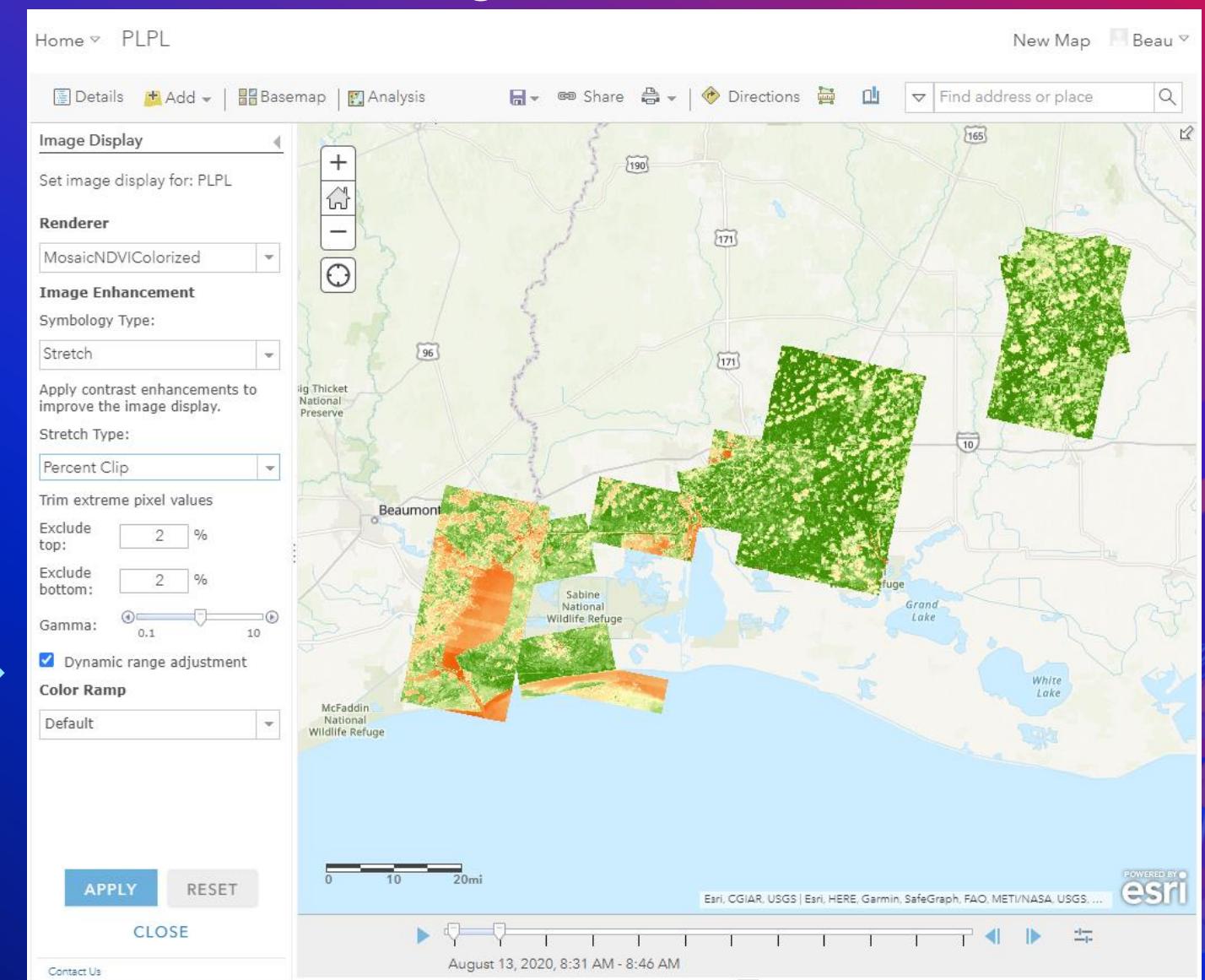
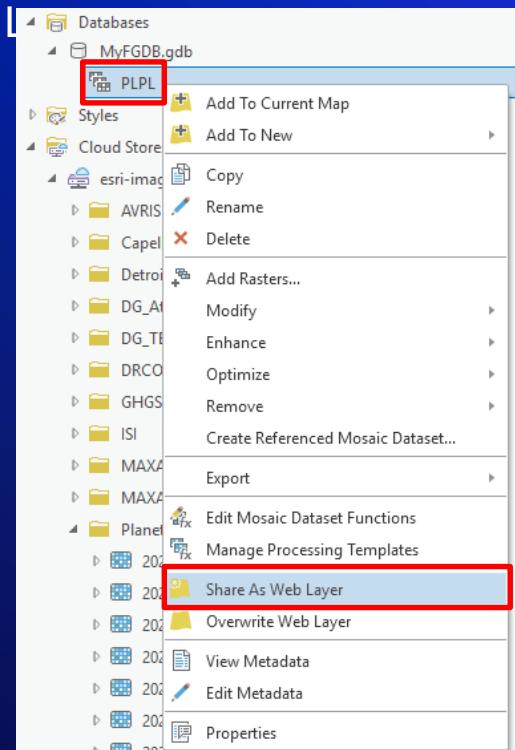


Image Service publishing from cloud storage

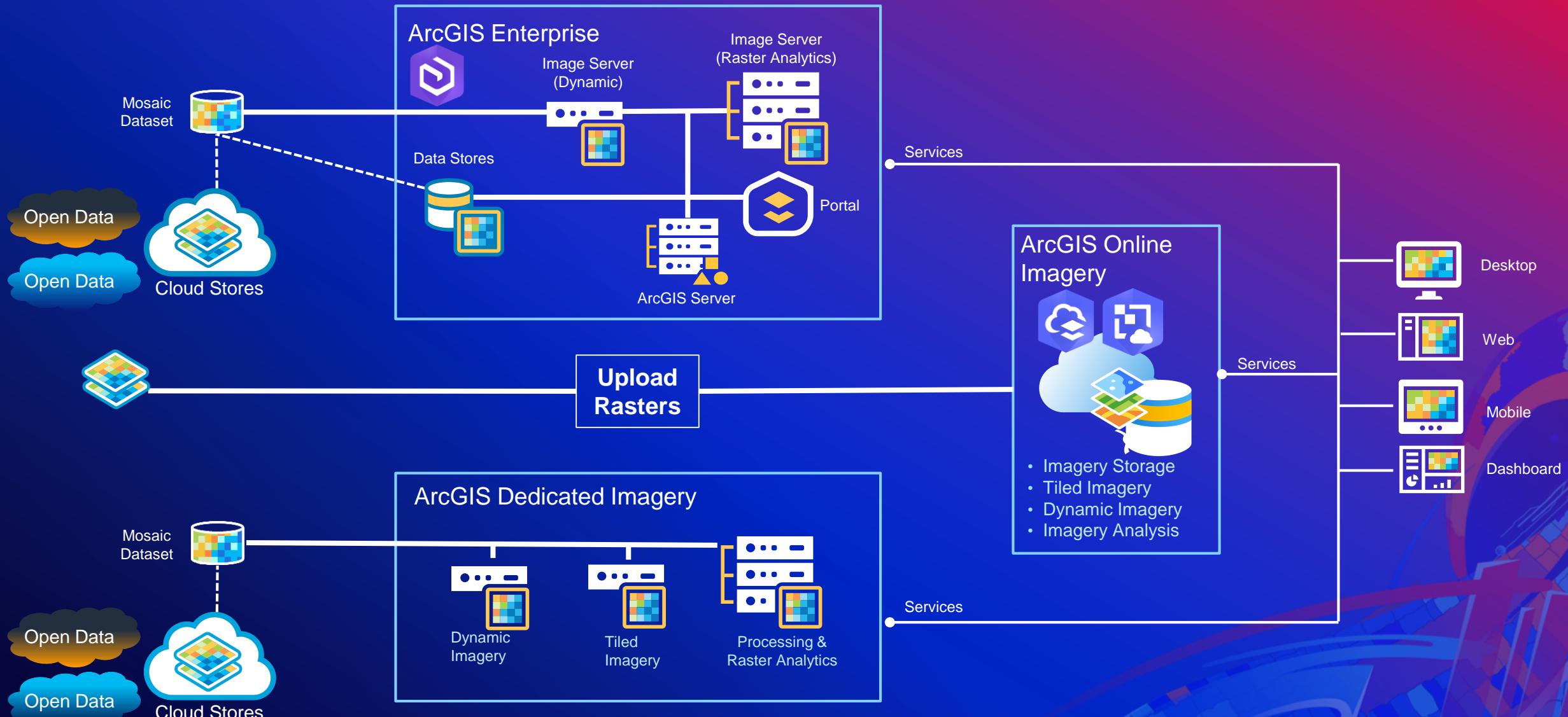
Made easy with ArcGIS Pro

- 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

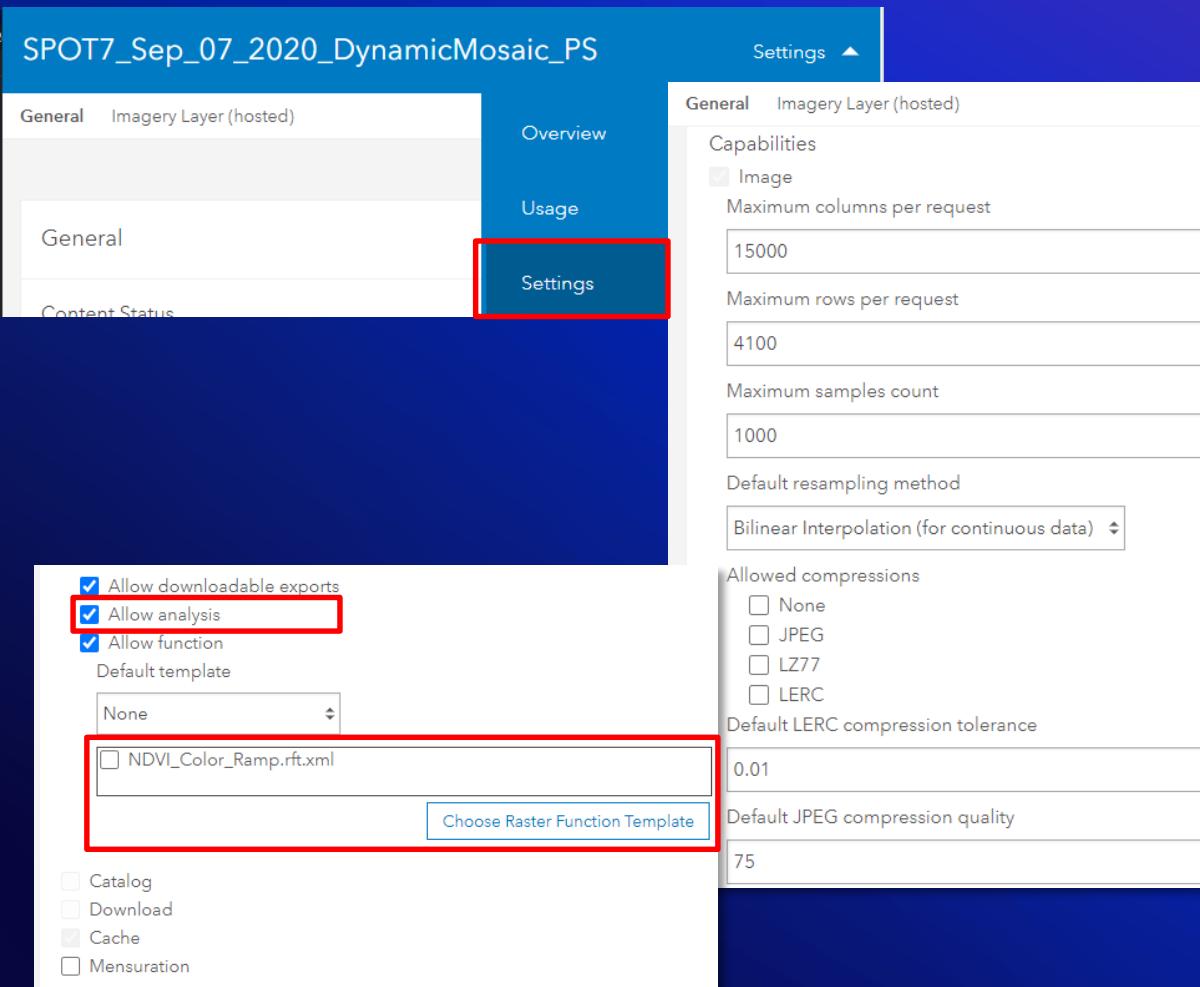
Tiled Layer	Tiled Imagery Layer (New)	Dynamic Imagery Layer (New)
No server-side processing	No server-side dynamic processing or image access	Server-side dynamic mosaicking, image processing, and access (projections, rendering, band sub-setting, raster functions, and more)
Static tiles	Static tiles	Dynamic 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



SPOT7_Sep_07_2020_DynamicMosaic_PS

General Imagery Layer (hosted)

Settings ▾

General

Content Status

Usage

Settings

Allow downloadable exports

Allow analysis

Allow function

Default template

None

NDVI_Color_Ramp.rft.xml

Choose Raster Function Template

Capabilities

Image

Maximum columns per request

15000

Maximum rows per request

4100

Maximum samples count

1000

Default resampling method

Bilinear Interpolation (for continuous data) ▾

Allowed compressions

None

JPEG

LZ77

LERC

Default LERC compression tolerance

0.01

Default JPEG compression quality

75

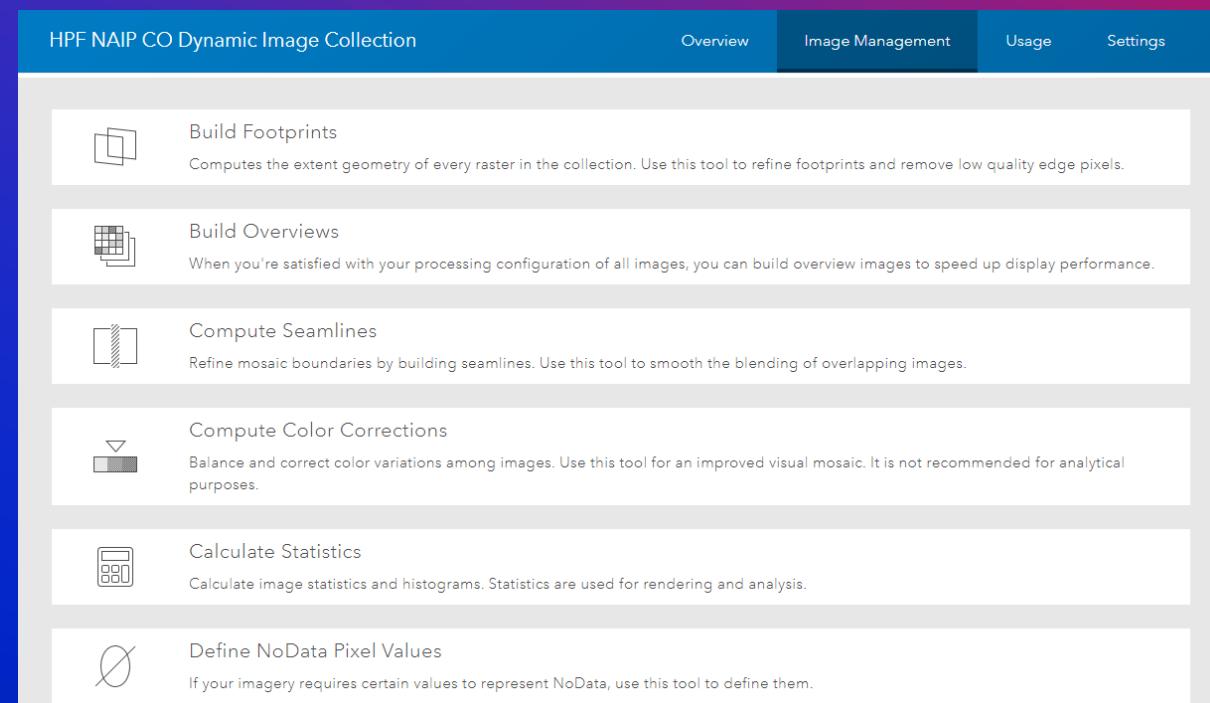
Catalog

Download

Cache

Mensuration

- Additional tools for Image Collection layer configuration



HPF NAIP CO Dynamic Image Collection

Overview Image Management Usage Settings

Build Footprints

Computes the extent geometry of every raster in the collection. Use this tool to refine footprints and remove low quality edge pixels.

Build Overviews

When you're satisfied with your processing configuration of all images, you can build overview images to speed up display performance.

Compute Seamlines

Refine mosaic boundaries by building seamlines. Use this tool to smooth the blending of overlapping images.

Compute Color Corrections

Balance and correct color variations among images. Use this tool for an improved visual mosaic. It is not recommended for analytical purposes.

Calculate Statistics

Calculate image statistics and histograms. Statistics are used for rendering and analysis.

Define NoData Pixel Values

If your imagery requires certain values to represent NoData, use this tool to define them.

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

The image shows two screenshots of a software interface for managing user roles. The top screenshot is a 'Edit role' dialog box. It has a header 'Edit role' and a close button 'X'. Below the header, there is a section titled 'Content' with a status 'Enabled: 7/9' and a 'Enable all' button. Under 'Content', there are two items: 'Publish hosted tiled imagery layers' and 'Publish hosted dynamic imagery layers', both of which have blue toggle switches and descriptive text below them. The bottom screenshot is a 'Member roles' page. It has a header 'Member roles' and a sub-header 'Manage roles'. It includes a 'Create role' button and a 'Search roles' input field. Below these, there is a section titled 'Premium Content' with a status 'Enabled: 6/8' and a 'Enable all' button. Under 'Premium Content', there is one item: 'Imagery Analysis', which has a blue toggle switch and descriptive text below it. Both the 'Content' and 'Premium Content' sections in the 'Edit role' dialog are highlighted with red boxes.

Edit role

Content

Enabled: 7/9 | Enable all

Publish hosted tiled imagery layers
Allow member to publish hosted tiles imagery layers from a single image or collection of images.

Publish hosted dynamic imagery layers
Allow member to publish hosted dynamic imagery layers from a single image or collection of images.

Premium Content

Enabled: 6/8 | Enable all

Imagery Analysis
Allow member to perform imagery analysis tasks.

Member roles

Manage roles

Create, edit, and manage member roles template by enabling or disabling permissions.

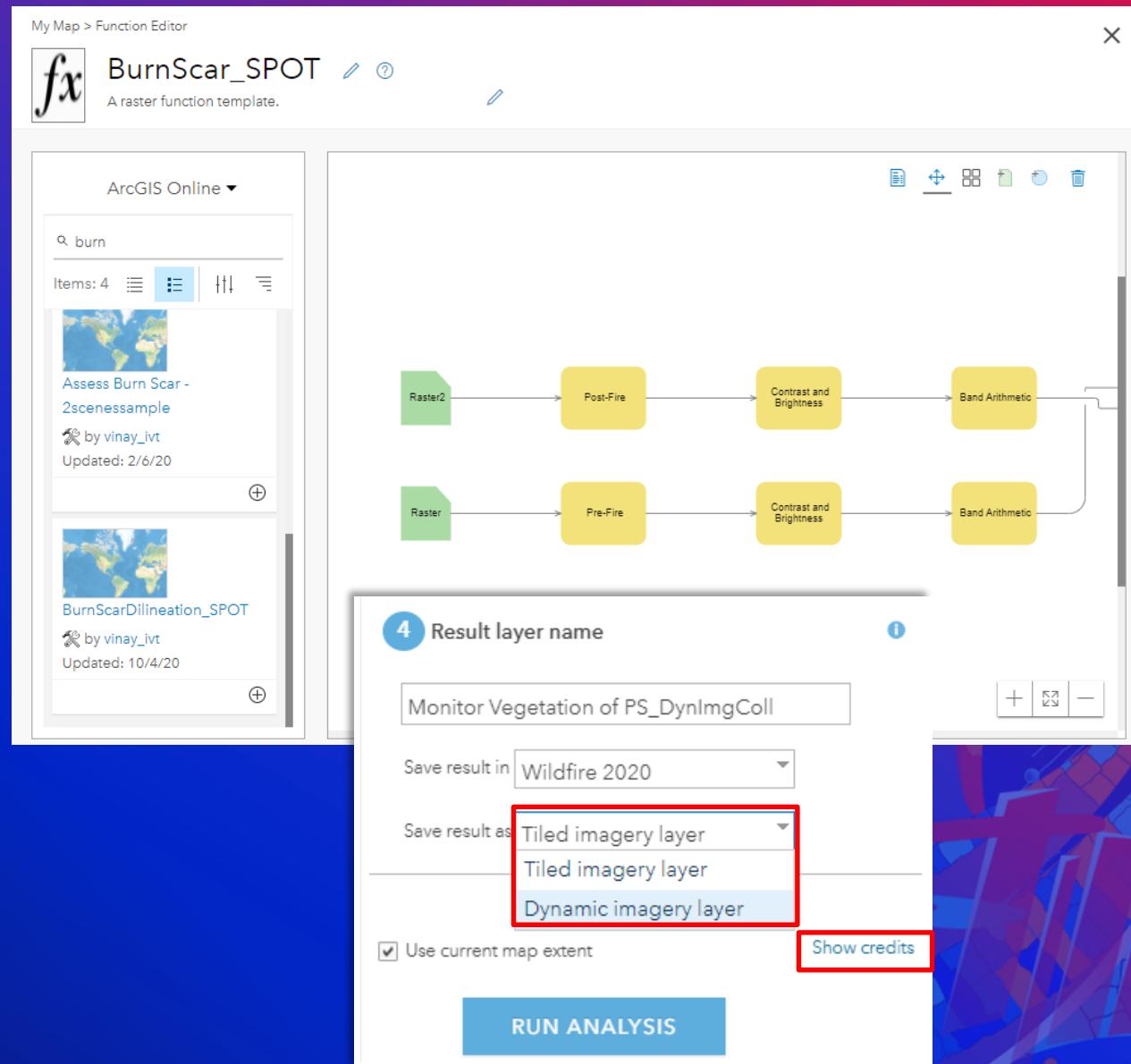
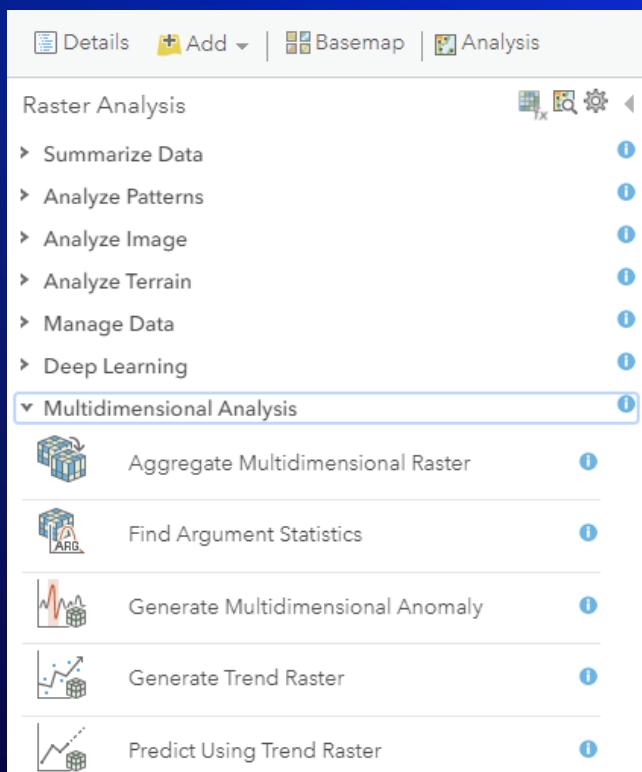
Create role

Search roles

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



Demonsrations

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

Demonsrations

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





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THE
SCIENCE
OF
WHERE®