Managing and Sharing Raster Data for Analysis

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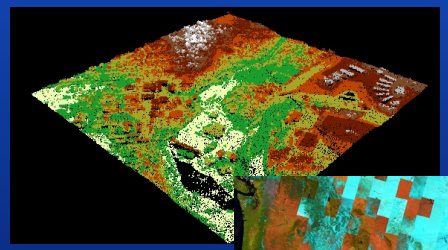
2021 ESRI
DEVELOPER SUMMIT

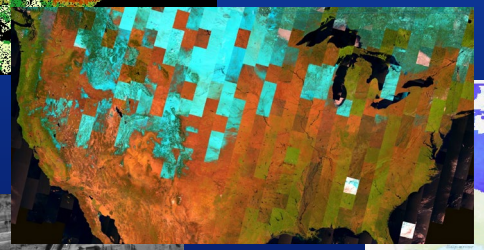
Agenda

- Raster Data supported in ArcGIS
- Data model and API
- Workflow to sharing your Raster/Imagery Data
  - Share a single Raster
  - Share a collection of raster
  - Convert and share cloud raster format
- Keep your shared raster data up to date
- Perform analysis on shared Raster Data and in scale

Raster and Imagery Data Support in ArcGIS



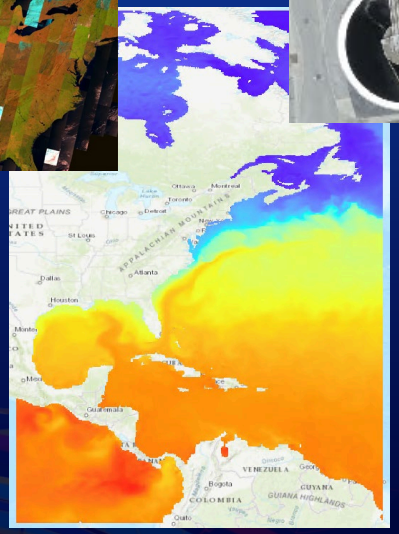
Lidar



Multi-spectral

RGB

Panchromatic



Scientific

Radar

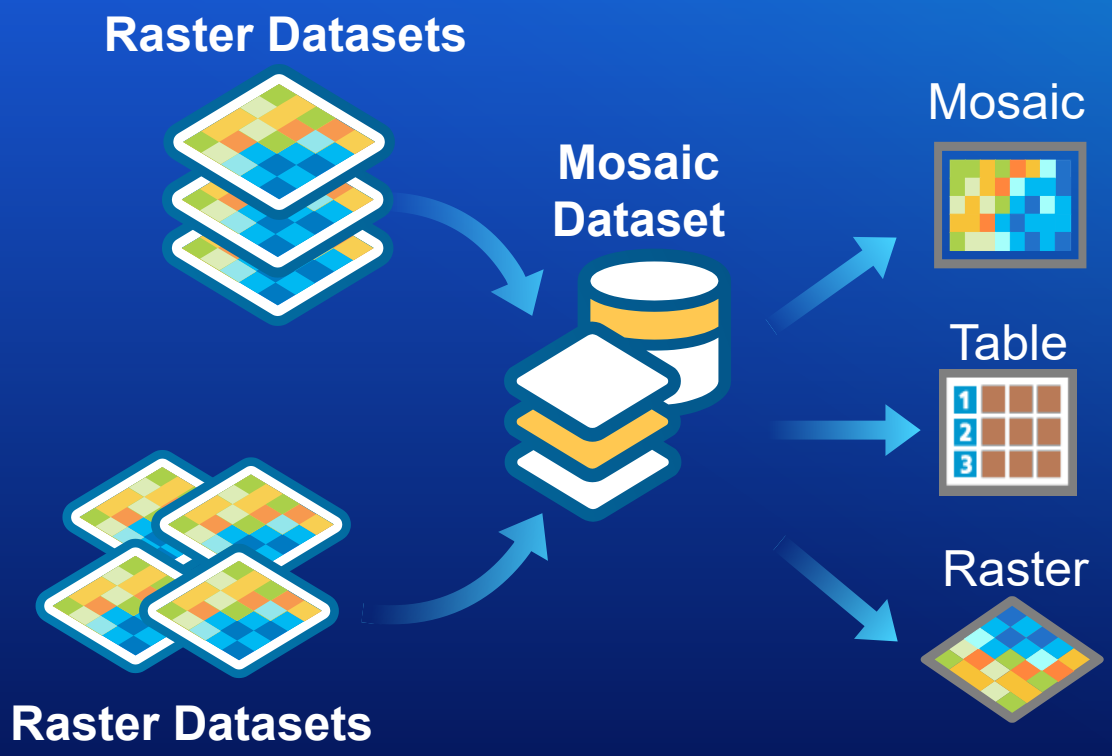
■ ■ ■

System of Record

Raster and Imagery Data in ArcGIS

Raster Data Management in ArcGIS

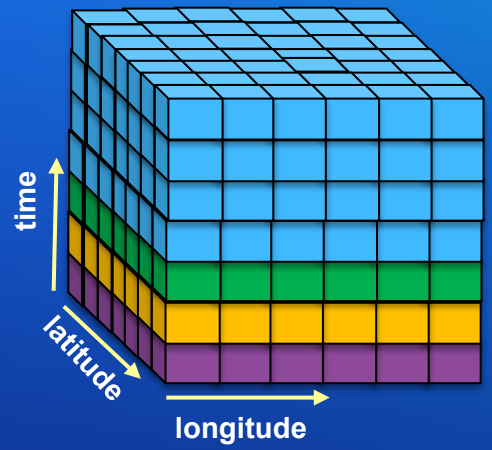
- **Raster Dataset**
  - Represent single dataset
- **Mosaic Dataset**
  - Dynamic mosaic of imagery collection
  - Table of records
  - A Raster Dataset
  - Lives in Geodatabase



ArcGIS Raster Data Management Model

Raster can be Multidimensional

- Spatial, temporal, and vertical dimensions
- Contains one or multiple variables in one file
  - A variable is cube or cubes
  - A variable has a time and/or depth
  - Each slice is a 2D array
- Multidimensional Raster
  - A Mosaic Dataset
  - Or a Raster Dataset

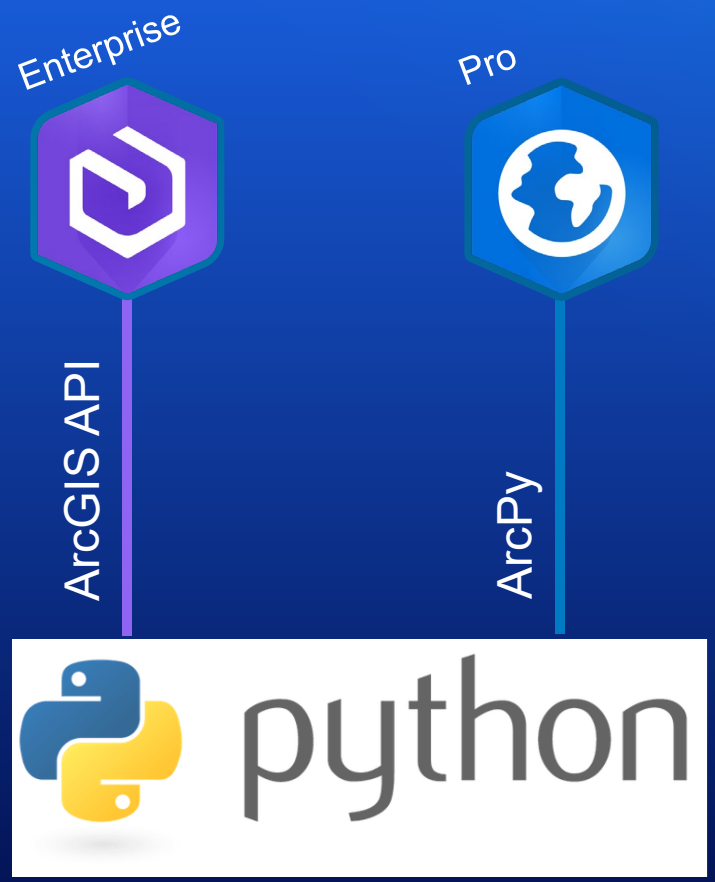


Raster Can be Multidimensional

Use Python API to Automate Management/Sharing workflow

- **ArcGIS API**
  - **Work with ArcGIS Enterprise/ArcGIS Online**
  - **Remote processing**

https://developers.arcgis.com/python/



- **ArcPy**
  - **Requires Desktop App (ArcGIS Pro/ArcMap)**
  - **Or Available in Hosted Notebook Server Advanced Runtime**
  - **Local processing**

https://pro.arcgis.com/en/pro-app/arcpy

Data Sharing Scenario 1

Single Raster

Share Single Raster

- Any supported raster format *
- Sharing does not required Image Server Extension License
- Share from
  - ArcGIS Pro Image Service Publishing Wizard
  - ArcGIS Portal Create Imagery Layer UX
  - ArcGIS Server admin REST API
- Upload raster to Hosted Data Store (by value) or share folder with Enterprise (by ref)

** Except certain format (e.g. ECW) requiring additional license*

Share one Raster

```
In [7]: demis = agsEnterprise.content.search('demo_singledemimage')
        demis = demis[0]
        render_demis = demis.layers[0]
        render_demis
```

Out[7]:

Data Management and Sharing Scenario 2

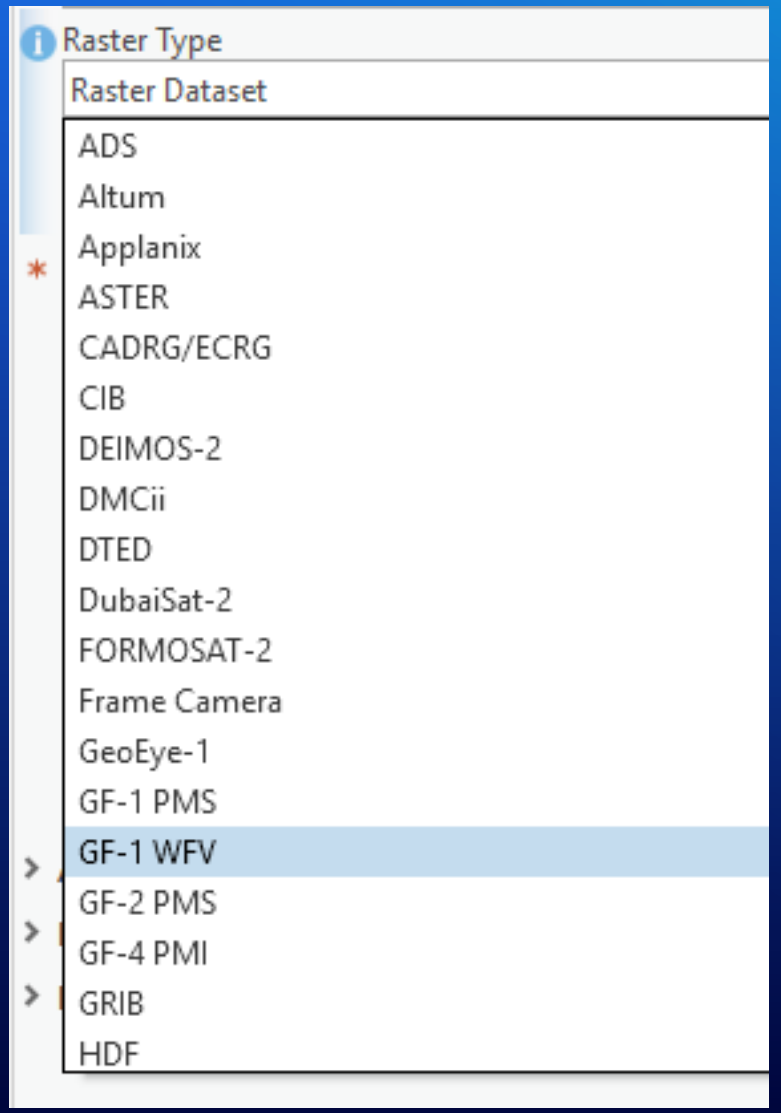
Mosaic Dataset

Raster Type and Mosaic Dataset

- Raster Type identifies Metadata of a type of Raster data (e.g. Sentinel-2)
- Also applies preset processing template to Raster data (e.g. Pansharpened)

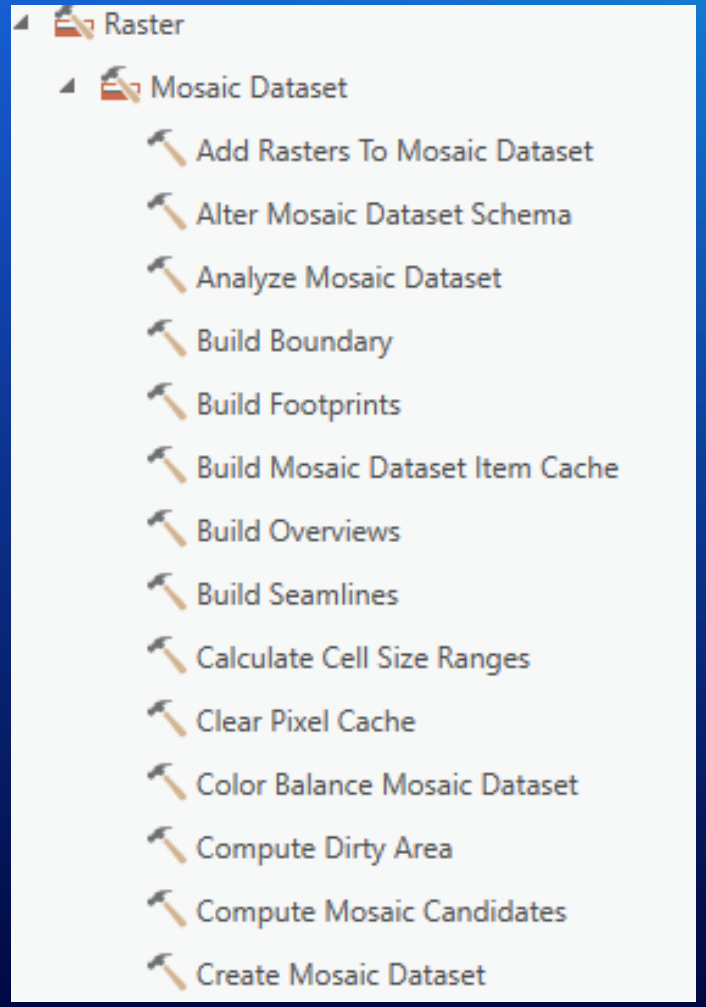
Raster Type and Mosaic Dataset

- Over 70 Raster Types
  - Satellite
  - UAV
  - Aerial/Scan
  - Scientific
  - Radar
  - Lidar
  - GIS services
- Choose appropriate Raster Type to Add Raster to Mosaic Dataset
- Raster Type is extendable with Python



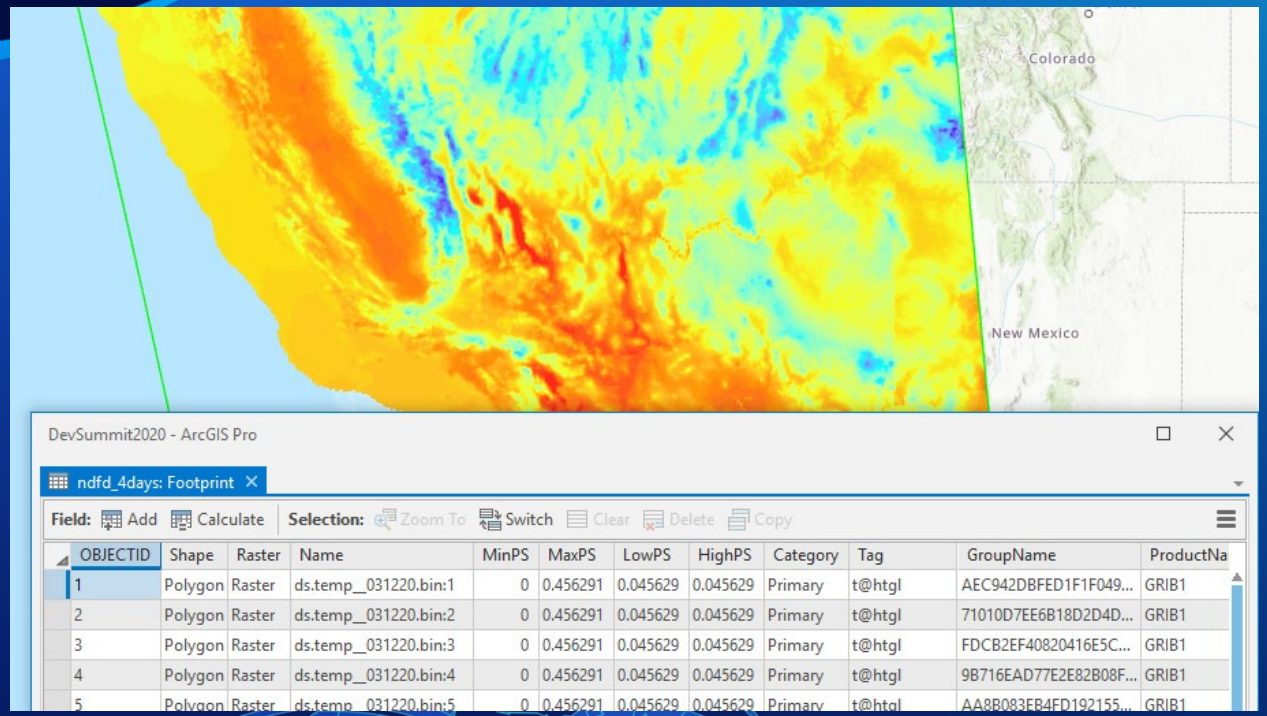
Create Mosaic Dataset with Geoprocessing

- Raster is referenced (not copied) in Mosaic Dataset
- 32 tools to work with Mosaic Dataset
  - Creation
    - e.g. Create Mosaic Dataset, Add Rasters to Mosaic Dataset
  - Modify
    - e.g. Build Footprints, Define Nodata
  - Enhancement
    - e.g. Build Seamlines, Color Balance Mosaic Dataset
- Additional ArcPy API to work with Table view
  - e.g. arcpy.da.UpdateCursor



Share Mosaic Dataset

- Require Image Server Extension
- Share from
  - ArcGIS Pro Image Service Publishing Wizard
  - ArcGIS Portal Create Imagery Layer UX
  - ArcGIS Server admin REST API
- Image Server needs access to Mosaic Dataset and Raster Data

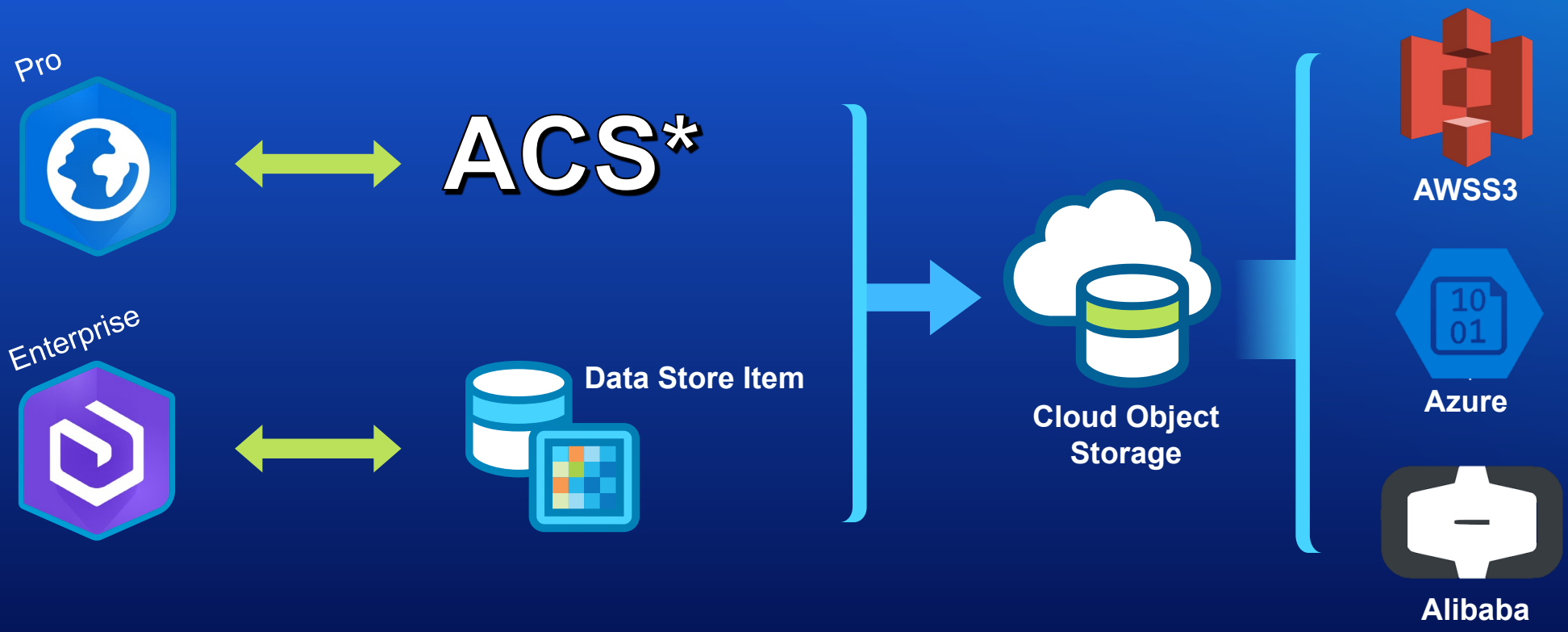


Share Mosaic Dataset

Data Sharing Scenario 3

Cloud Raster Data

ArcGIS Read/Write Raster Data in Cloud Storage



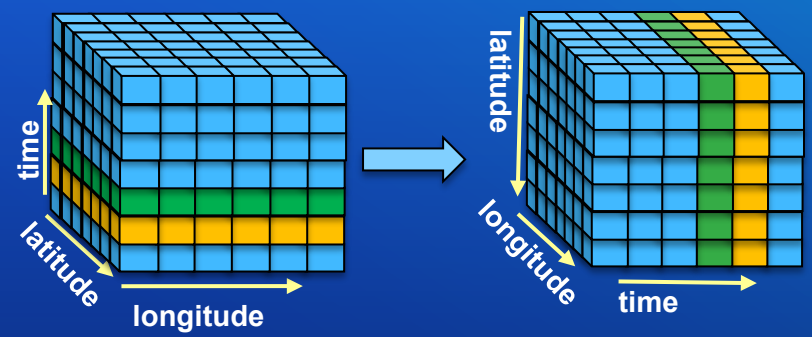
** ArcGIS Cloud Store Connection File*

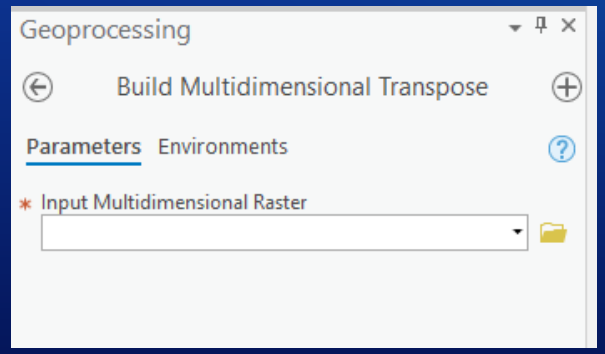
Raster Data In Cloud Storage

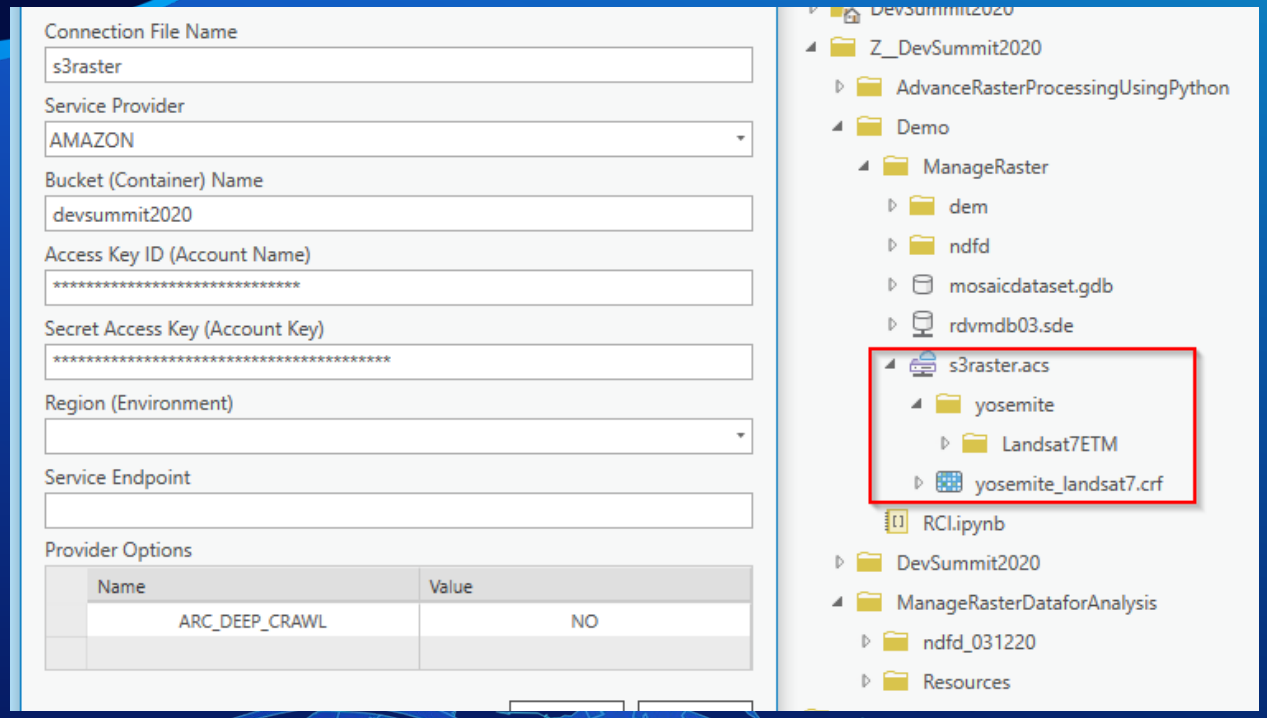
- Read any supported Raster Format
- Write Raster to Cloud Store
  - Transfer Files
  - Copy Raster – Convert Raster Data to Cloud Raster Format
- Mosaic Dataset can reference Cloud Raster
- Best Practice
  - Analysis close to the Storage
  - Use Cloud optimized format (e.g. Cloud Optimized GeoTIFF, Cloud Raster Format)

Why Cloud Raster Format?

- Cloud Raster Format (aka. CRF)
  - Tiled Raster Dataset with predefined tiling scheme
  - Raster Dataset optimized for Distributed Analysis
    - Parallel Read/Write
    - Local Caching
  - Optimized for “fat” Web Client
    - Support accelerated client processing and rendering
  - Enhancement for Multidimensional Raster
    - Fast slicing operation
    - Transposed for optimal profiling operation







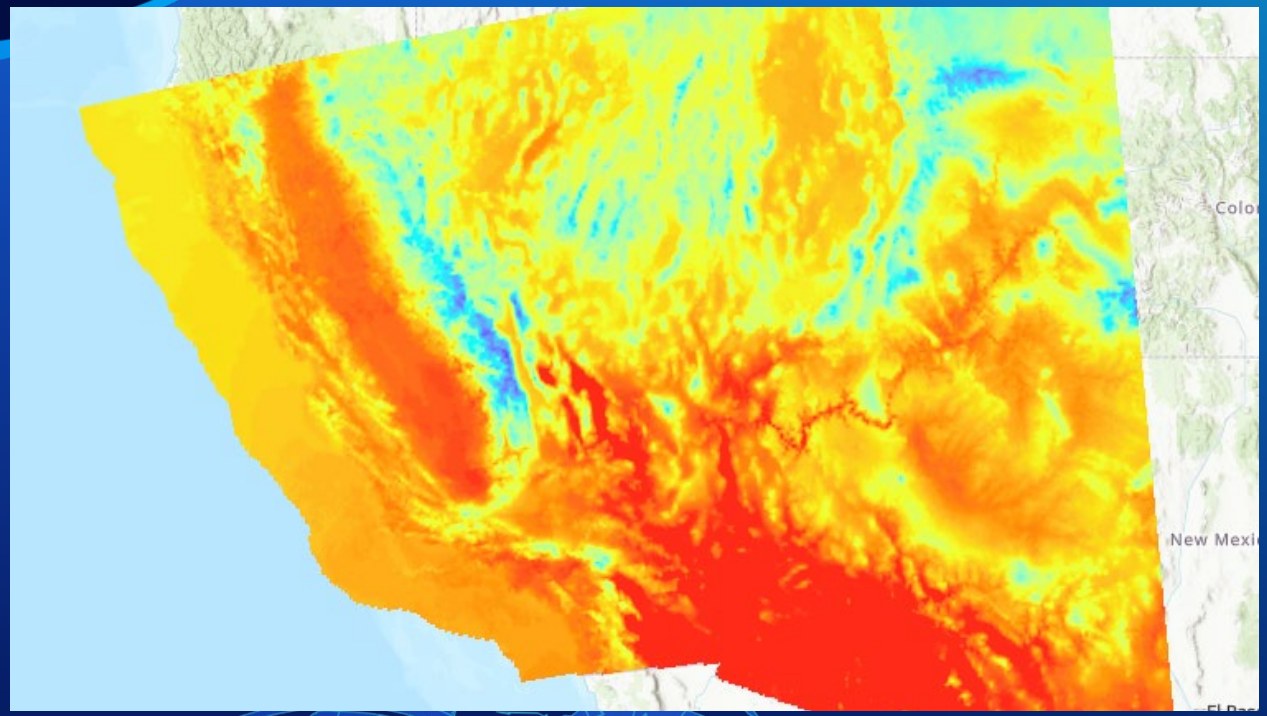
Share Cloud Raster

Live Update Image Service

Live Update Raster shared as Image Service

- Demand to update Shared Raster Data without service interruption
  - Update existing raster with new version
  - Append new data to the collection

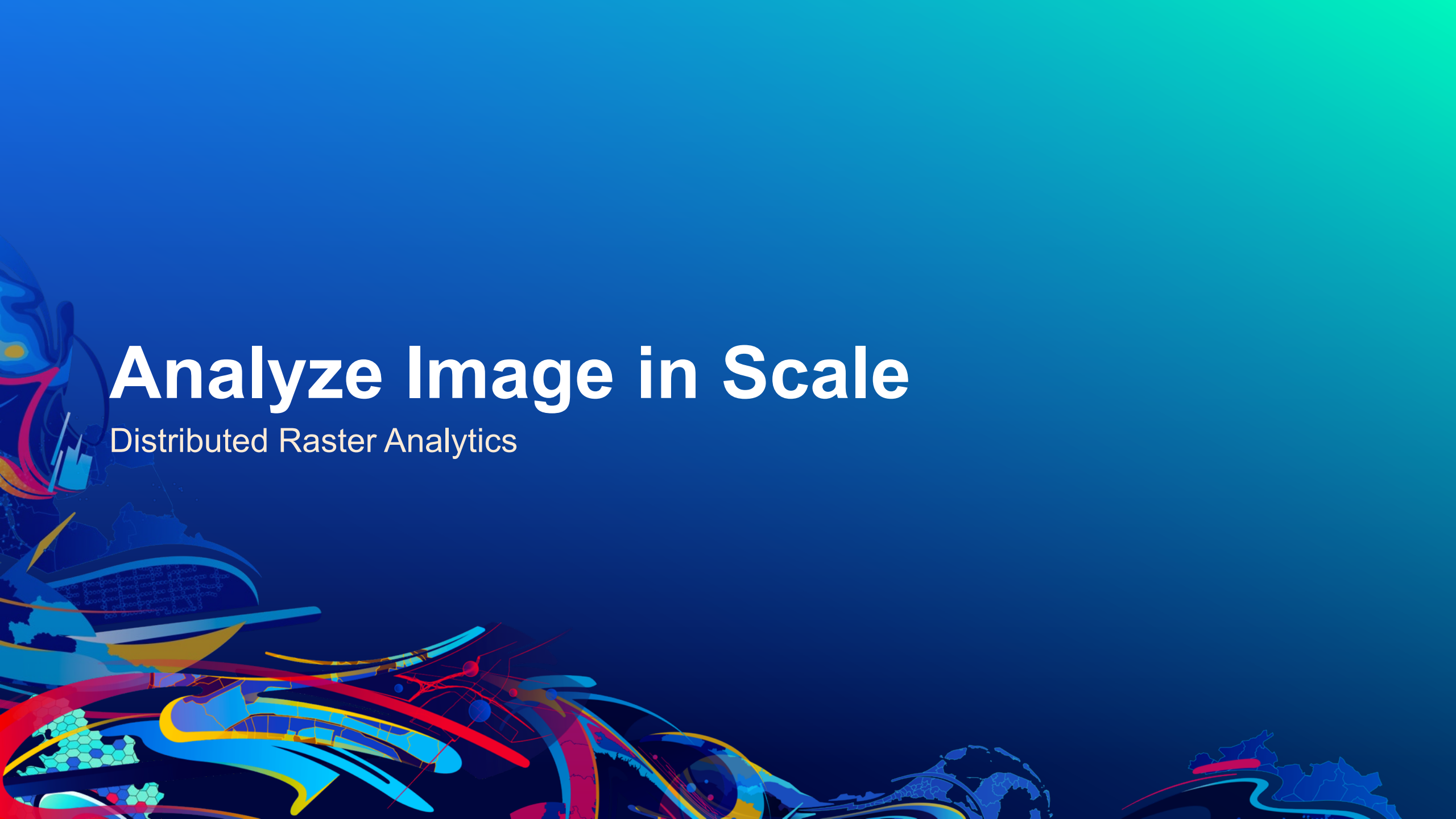
- What Raster Data Support Live update
  - Mosaic Dataset
    - Must created in Enterprise Geodatabase
    - Cannot change Table Schema after share
    - Remove/Add records in table without stopping service
  - Cloud Raster Format Raster (coming soon)



Live Update Image Service

Analyze Image in Scale

Distributed Raster Analytics



Comprehensive suite of Raster Analytic Functions

Multiband Math

Arithmetic
Band Arithmetic

Analysis: Band Math & Indices

NDVI / NDVI Colorized
SAVI / MSAVI / TSAVI
GEMI
GVI (Landsat TM)
PVI
Tasseled Cap (Kauth-Thomas)
Binary Thresholding
Heat Index
Wind Chill

Statistics

ArgStatistics

Visualization & Appearance

Contrast and Brightness
Convolution
Pansharpening
Resample
Statistics and Histogram
Stretch

Correction

Apparent Reflectance
Geometric Correction
Speckle Filtering (Lee,Frost,Kuan)
Thermal noise
Radiometric Calibration

Data Management & Conversion

Raster to Vector
Vector to Raster
Colormap
Colormap To RGB
Complex
Grayscale
Remap / Reclass
Spectral Conversion
Unit Conversion
Vector Field
LAS to Raster
LAS Dataset to Raster
Clip
Composite
Extract Bands
Mask
Mosaic Rasters
Rasterize Features
Reproject
Region Group
Lookup

Interpolation

Interpolate Irregular Data
- Nearest Neighbor
- IDW
- EBK
Swath

Surface Generation & Analysis

Aspect
Curvature
Elevation Void Fill
Hillshade
Shaded Relief
Slope
Contour

Python

Custom Algorithms

Analysis: Image Segmentation & Classification

Segmentation (Mean Shift)
Training (ISO, SVM, ML, Random trees)
Supervised Classification

Analysis: Overlay

Weighted Sum

Statistics:

Zonal Statistics
Cell Statistics
Focal Statistics *

Math

Calculator
Abs
Divide
Exp
Exp10
Exp2
Float
Int
Ln, Log10
Log2
Minus
Mod
Negate
Plus
Power
Round Down
Round Up
Square
Square Root
Times
ACos
ACosH
ASin
ASinH
ATan
ATan2
ATanH
Cos
CosH
Sin
SinH
Tan
TanH
Con
Set Null
Bitwise
And
Left Shift
Not
Or
Right Shift
Xor
Boolean
And
Not
Or
Xor
Equal To
Greater Than
Greater Than
Equal
Is Null
Less Than
Less Than
Equal
Not Equal

Analysis: Distance & Density

Euclidean Distance
Cost Distance
Least Cost Path
Kernel Density
Path Allocation
Path Distance
Corridor
Path Distance backlink

Analysis: Hydrology

Fill
Flow Accumulation
Flow Direction
Flow Distance
Stream Link
Watershed

Analysis: Overlay

Weighted Overlay

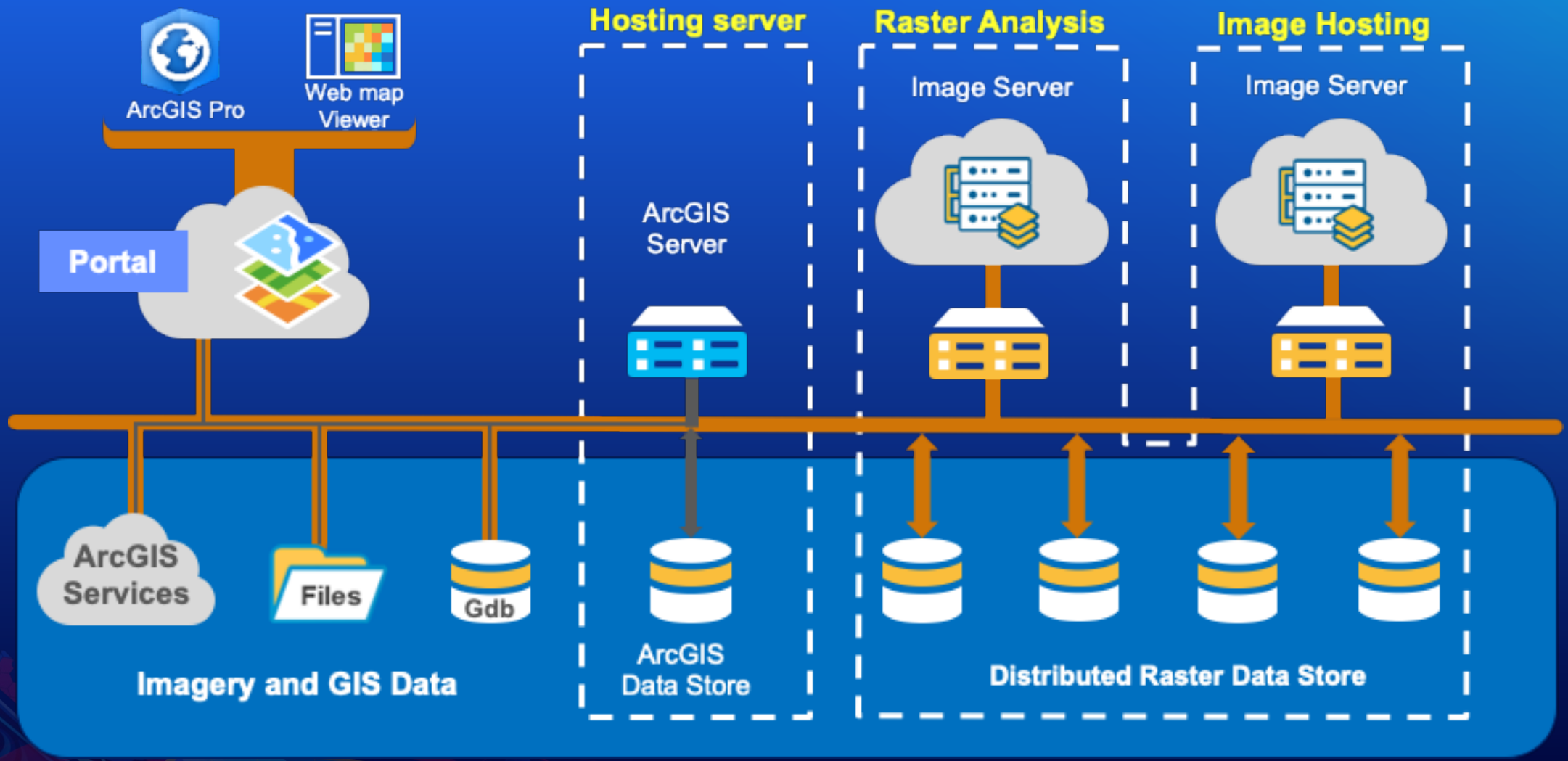
Surface Generation & Analysis

Viewshed

Data Management

Nibble

Scale Analytic workflow with ArcGIS Enterprise



Demo Source Code

- Demo 1: Sharing Single Raster
- Demo 2: Manage Raster with Mosaic Dataset and Share Mosaic Dataset
- Demo 3: Manage Cloud Raster with Mosaic Dataset and Share Mosaic Dataset
- Demo 4: Share and Live Update Image Service

https://github.com/rsjiezhang/imagery-demo/tree/master/devsummit2020/ManageRasterForAnalysis

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