Managing Imagery and Raster Data

Peter Becker

ArcGIS is a Comprehensive Imagery Platform

Empowering you to make informed decisions

Imagery : System of Engagement

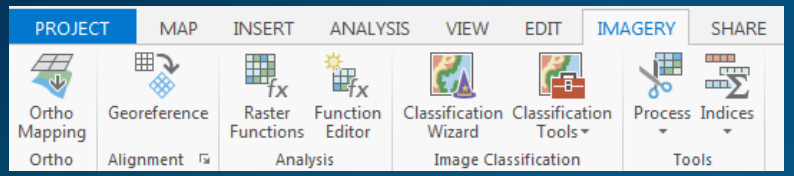
ArcGIS Applications Enable Intelligent Imagery

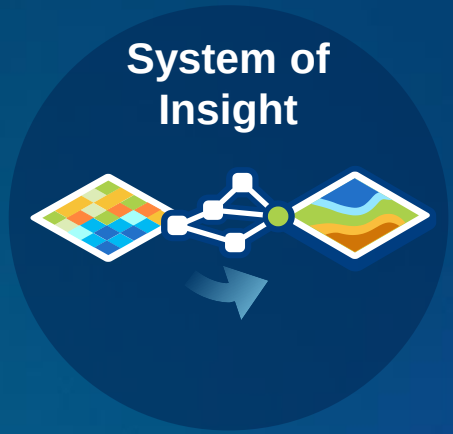
- Dynamic & Interactive
- Informative & Engaging
- Integrated

- Utilize Extensive ArcGIS APIs
- Develop applications to access Information Products

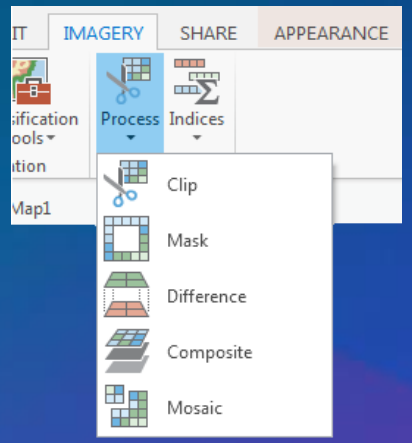
Imagery : System of Insight

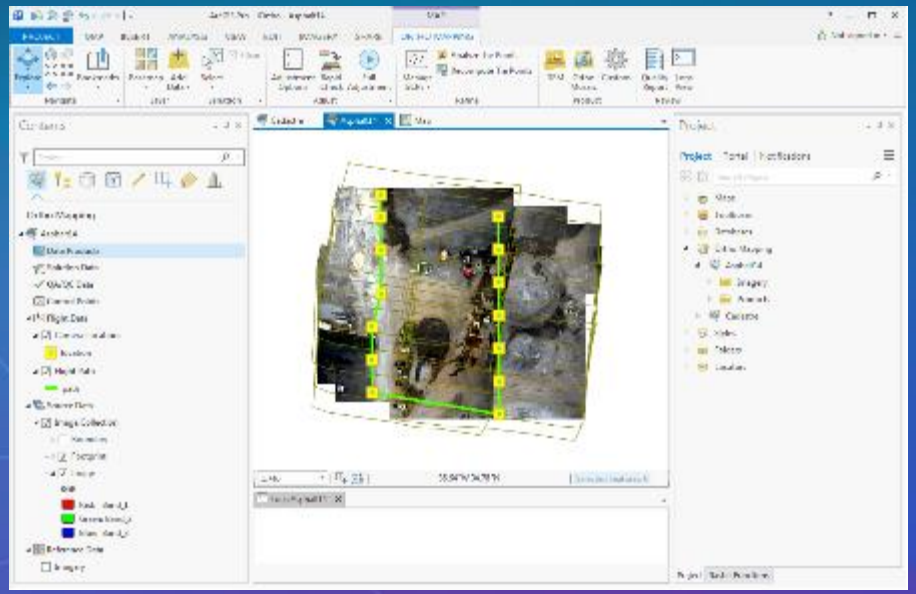
Information from Imagery





- **ArcGIS Pro 1.4**
  - **Imagery Tab – Access to many tools incl. Classification wizard**
  - **Georeferencing Tools**
  - **Orthomapping – Workflows for Satellite, Aerial and Drone sensors**
  - **Raster Function Editing with Raster Analytics**





Manage and Serve Imagery from a Wide Range of Sensors

ArcGIS Integrates imagery from multiple sources

Professional Imagery / Geospatial Analysts

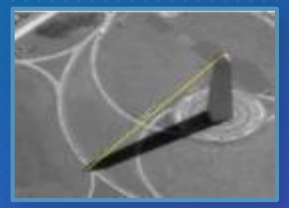
Server

Satellite

Aerial

UAS (Drone)

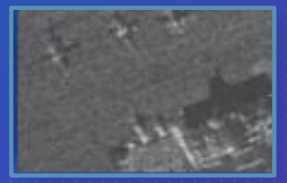
Full Motion Video (FMV)



Panchromatic

Multi-Spectral

Thermal



Radar

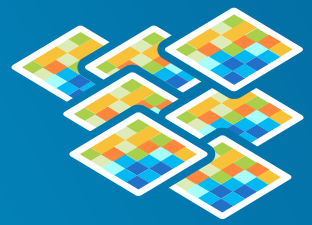
Lidar

Working with Imagery

Scaling from single local image to millions

- **One image at a time**
  - Individual Files

- **Collections of images**
  - Mosaic Datasets



- **Imagery as a Service**
  - Image Services

Raster Dataset

The primary information model to represents a basic image with simple behavior

- **Read and write images (pixels) and metadata**
- **Comprehensive Support**
  - 1 or N Bands
  - 1-64 bits per band
  - Compressed or uncompressed
  - > 80 formats supported
  - Pyramids (.ovr, internal, .rrd)
- **Read image files directly – no need to convert**

"It's what you get if you drag a GeoTIFF into ArcGIS Desktop."

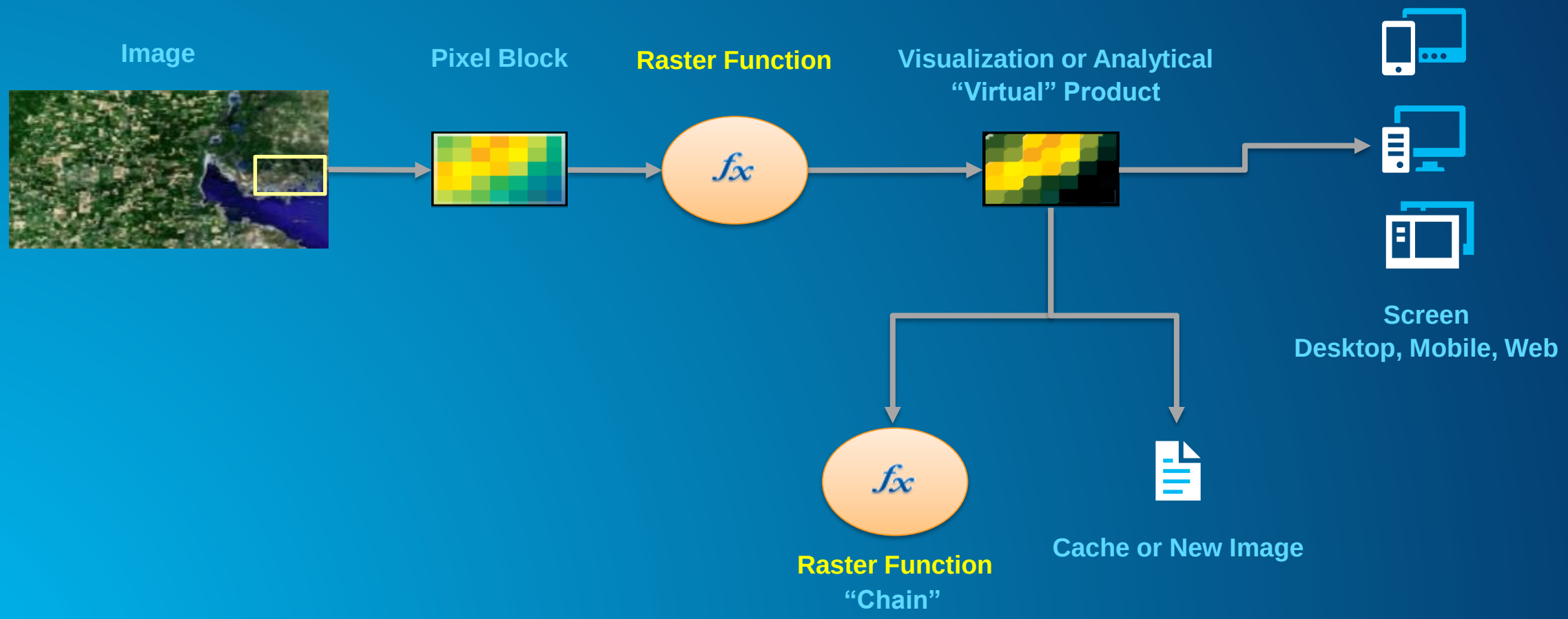
Raster Function

Primary information model component which processes image data

- **Takes input pixels and produces altered output pixels**
- **A Raster Function**
  - processes a single pixel or block of pixels (not the full image)
  - can make geometric modifications to the pixels (orthorectify, project, clip,…)
  - can make radiometric modifications to the pixels (enhance, band math, convolution filters, Tasseled Cap,…)
- **Raster Functions are chained together to create simple or advanced processing chains**
  - pixels that flow through the chain are virtual in nature (“on-the-fly” processing)
- **100+ Raster Functions**

Raster Function

Enable On-The-Fly processing



Raster Functions or Geoprocessing Tool?

Two Options for Processing Pixels

- **Raster Functions**
  - Processes pixel block on demand. Typically at screen resolution
  - For visualization or analysis
  - Have limited ‘scope’ (Local or Regional)

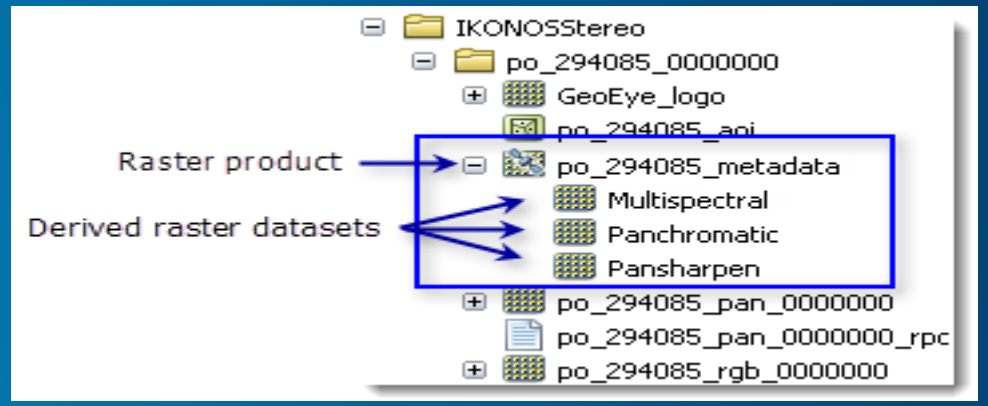
- **Geoprocessing Tools**
  - Processes complete datasets
  - Can invoke complex relations (Local, Regional or Global)
  - Run asynchronously

Raster Product

Applying Raster Functions based on Metadata

- **Transforms a collection of files into product information**
  - Defines the default processing chains
  - Defines the georeferencing (sensor model + parameters)
  - Defines pixel storage and metadata schema
  - Defines the rules for ingesting imagery into ArcGIS

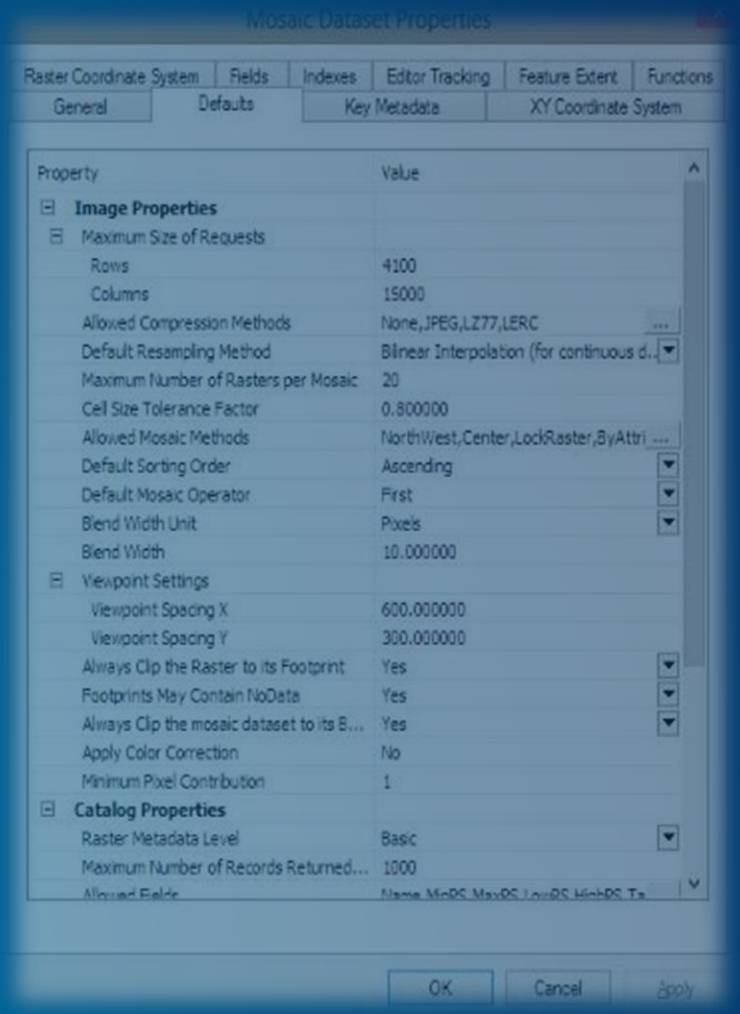
- **Enables interface shortcuts to well known band combination and processing chains**
- **Allows the user to think about products not files**
- **Sensor and/or Format Specification specific**
- **Visible in ArcMap Catalog window / ArcCatalog**



Mosaic Dataset

Primary information model to manage massive collections of imagery

- **Databased structure containing:**
  - **For each record (item)**
    - **References to source imagery/rasters data**
    - **Footprint defining extent**
    - **Metadata about each raster**
    - **Function chains for each item**
  - **Overviews**
    - **Additional Rasters used at small scales**
  - **Properties of the mosaic datasets**
    - **Function chains to apply to all rasters**
    - **Boundary, Extent, …….**
- **Scalable (1 to millions of images)**
- **Acts as a catalog of similar imagery**
- **Homogeneous or heterogeneous collections (one sensor or a mix)**



Raster Type

Logical Equivalent of Raster Product for Collections

- Provides the logic for how to ingest collections of Raster Dataset or Raster Types.
- Crawler for Raster Products
- Sensor and/or Format Specification specific
- 60+ Raster Types

- Applanix
- CADRG
- ECRG
- CIB
- DMCii
- DTED
- Formosat-2
- GeoEye-1
- HRE
- IKONOS
- ISAT
- Kompsat-2
- Landsat 1-5 MSS
- Landsat 1-5 TM
- Landsat 7 ETM+
- Landsat 8
- LAS
- NITF
- Pleiades-1
- Quickbird
- RapidEye
- Radarsat 2
- SOCET (SUP)
- SPOT 5
- SPOT 6
- WorldView-1
- WorldView-2
- WorldView-3
- …

Creating a Mosaic Dataset

- Create New GeoDatabase
- Create Mosaic Dataset
- Add Rasters
- Define Overviews
- Build Overviews
- Set Properties – Eg Mosaic Method

- Optional
  - Use lower resolution imagery as Overview
  - Define additional functions
  - Utilize Extensive Tools to refine
    - Seamlines, Color Balancing, …….

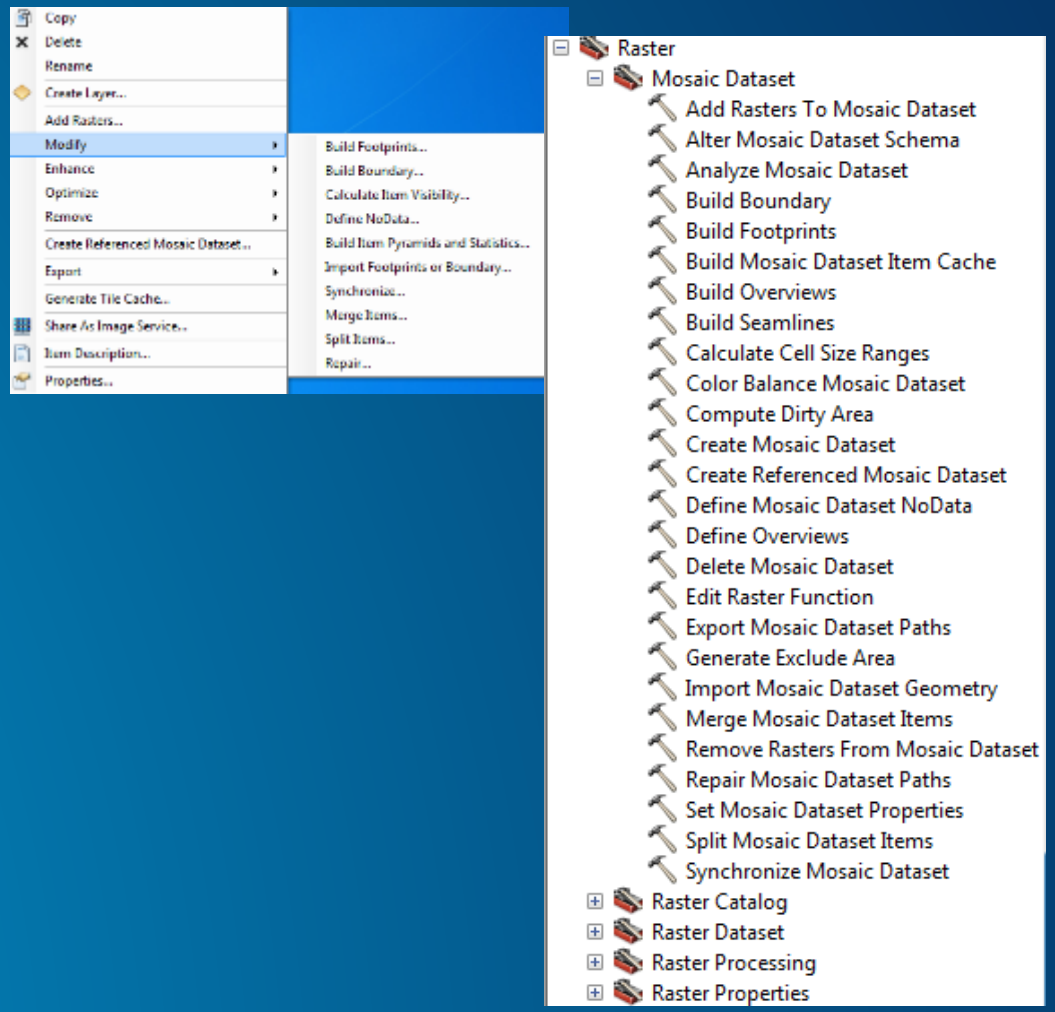


Image Management Using Mosaic Datasets

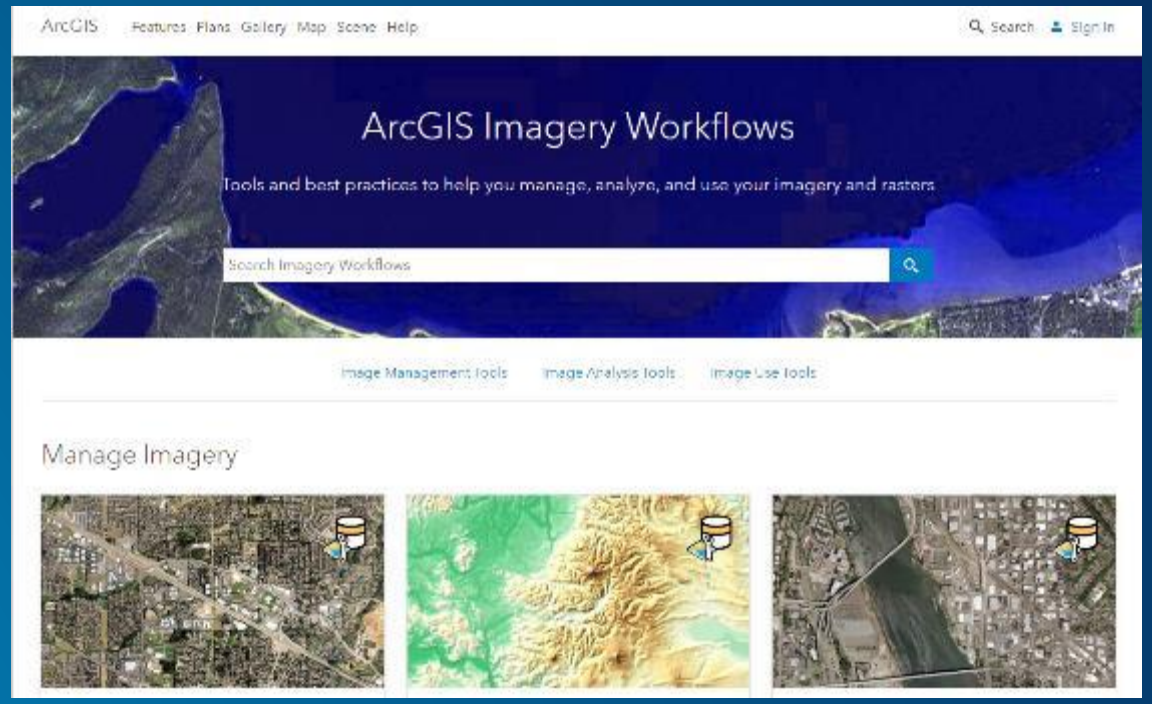
An information model for managing large image and raster collections

- **Create Mosaic Dataset**
  - Reference Sources
  - Ingest & Define Metadata
  - Define Processing to be Applied
    - On-the-fly
    - Dynamic Mosaicking
  - Create Overviews
- **Use directly in Desktop**
- **Serve as Image Service**
  - Access from: Desktop, Web & Mobile Apps
  - Refine processing to be applied by Server

Image Management Workflows

Best Practices & Automation for Mosaic Dataset Creation

- **Best Practice Documentation**
- **Templates**
  - **Geoprocessing Tools**
  - **Sample Data**
  - **Automation Scripts**



http://esriurl.com/ImageManagement

- **Focused on different types of imagery**

  Processed Orthophotos

  High Resolution Satellite **Multispectral Satellite**

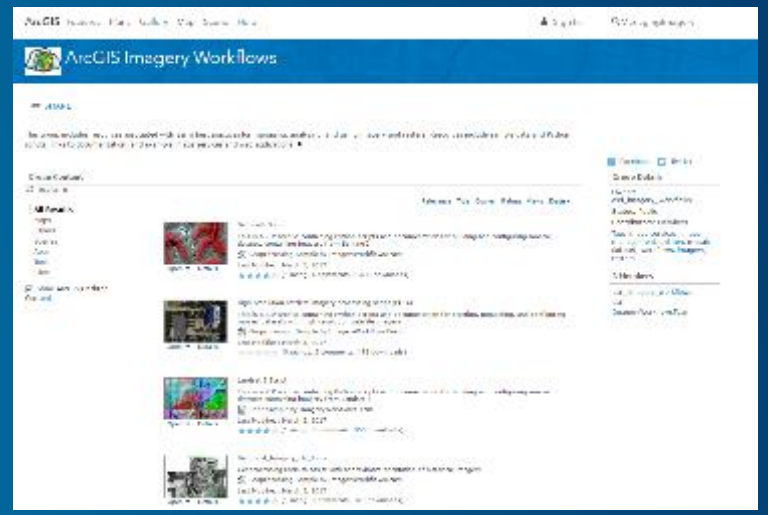
  Elevation / Lidar

  Browse

  Aerial **Drones**

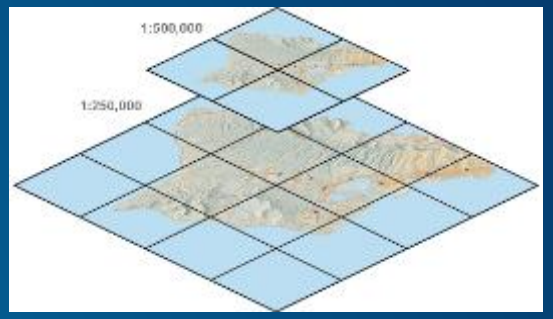
  Historic Aerial **Oblique**

  Scientific

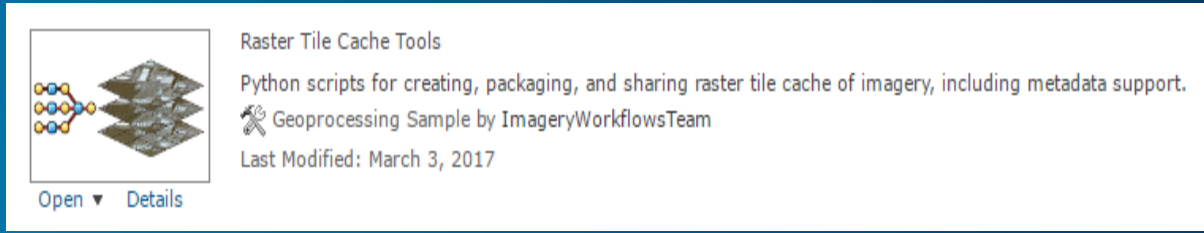


Tile Cache

Provide Simple Background Basemaps



- Process images into single background image
- Useful if imagery is only as a static background
- Create from Mosaic Datasets using:
  - ‘Manage Tile Cache’ Geoprocessing Tool
  - Raster Tile Cache Tools



- Direct Access in Desktop/Pro
- Convert to TilePackage for use in Mobile
- Can be uploaded and served through ArcGIS Online
- Served through ArcGIS Server

- `

Image Services

Provides *Imagery as a Service*

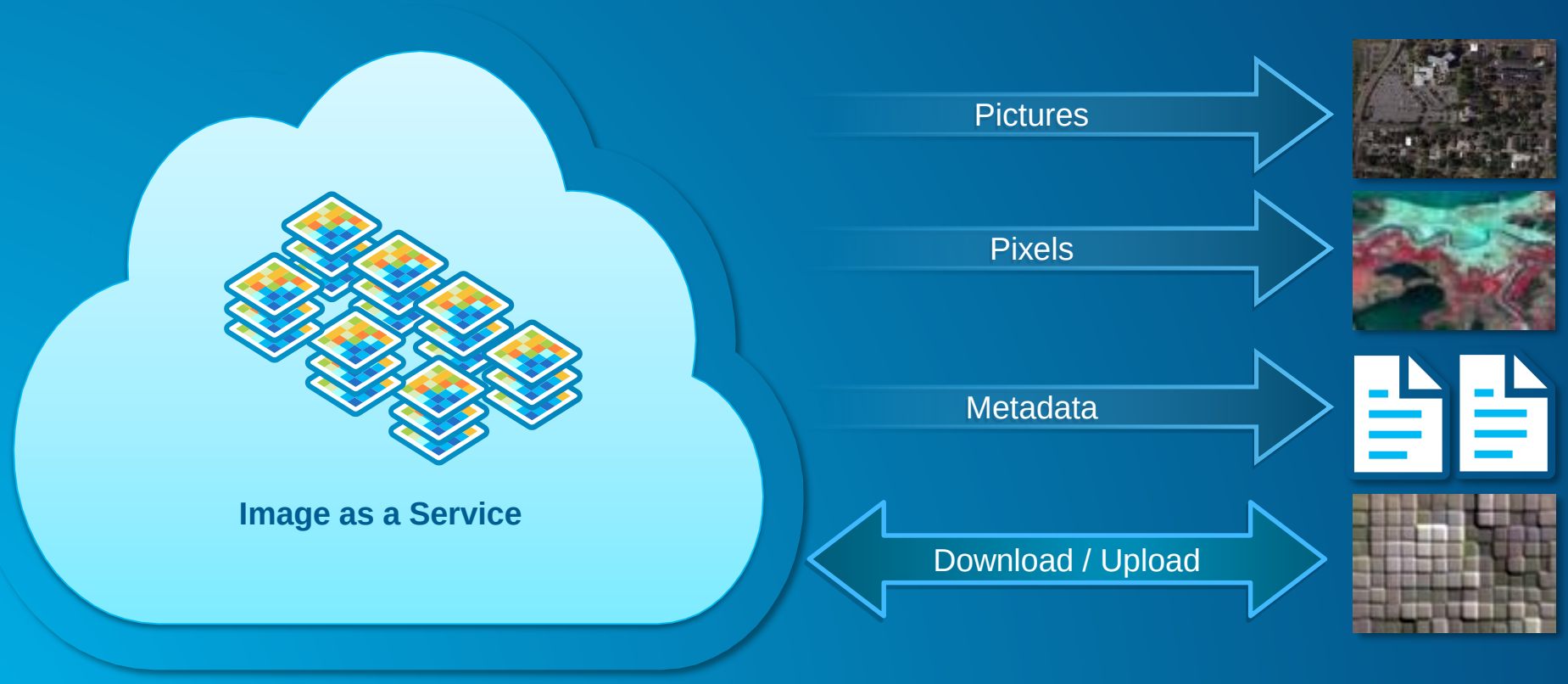
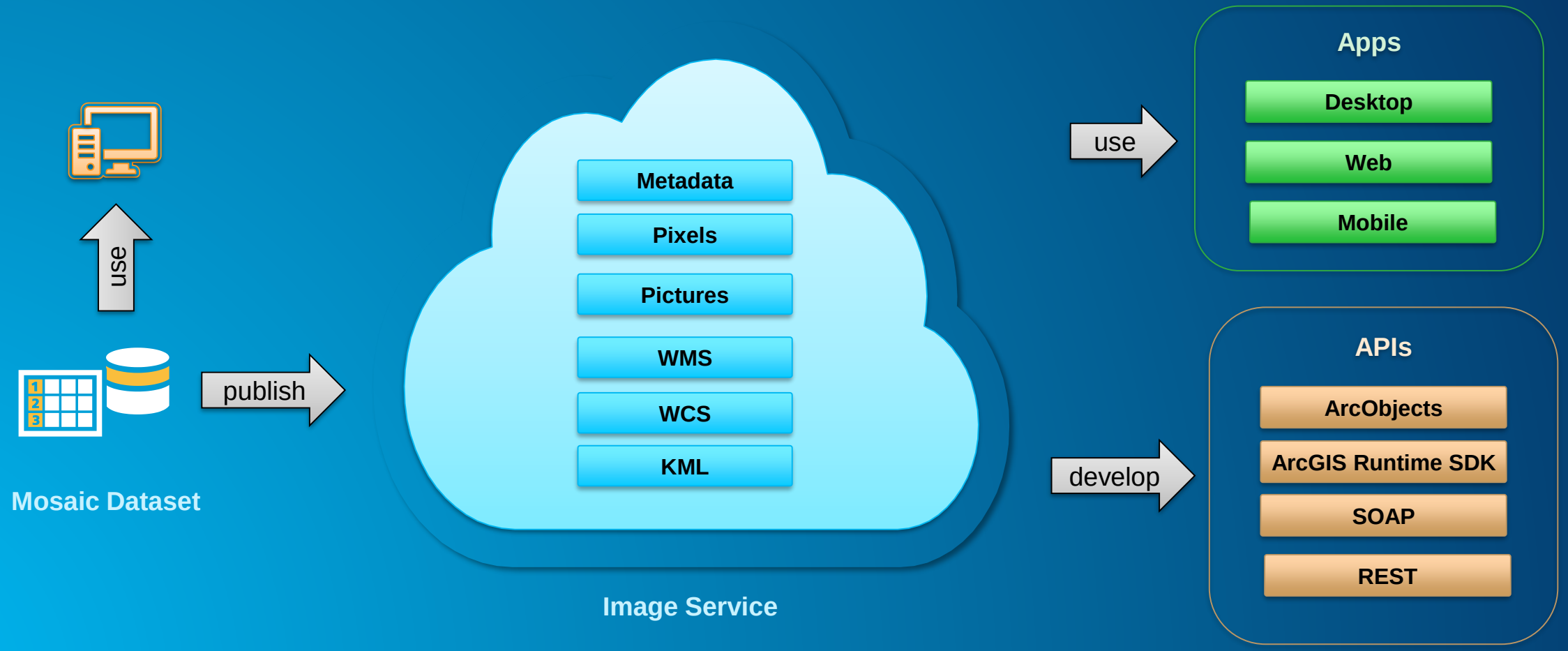


Image Services Make Imagery Accessible

Provide Web Access to Imagery for All Applications



Information Flow for an Image Service

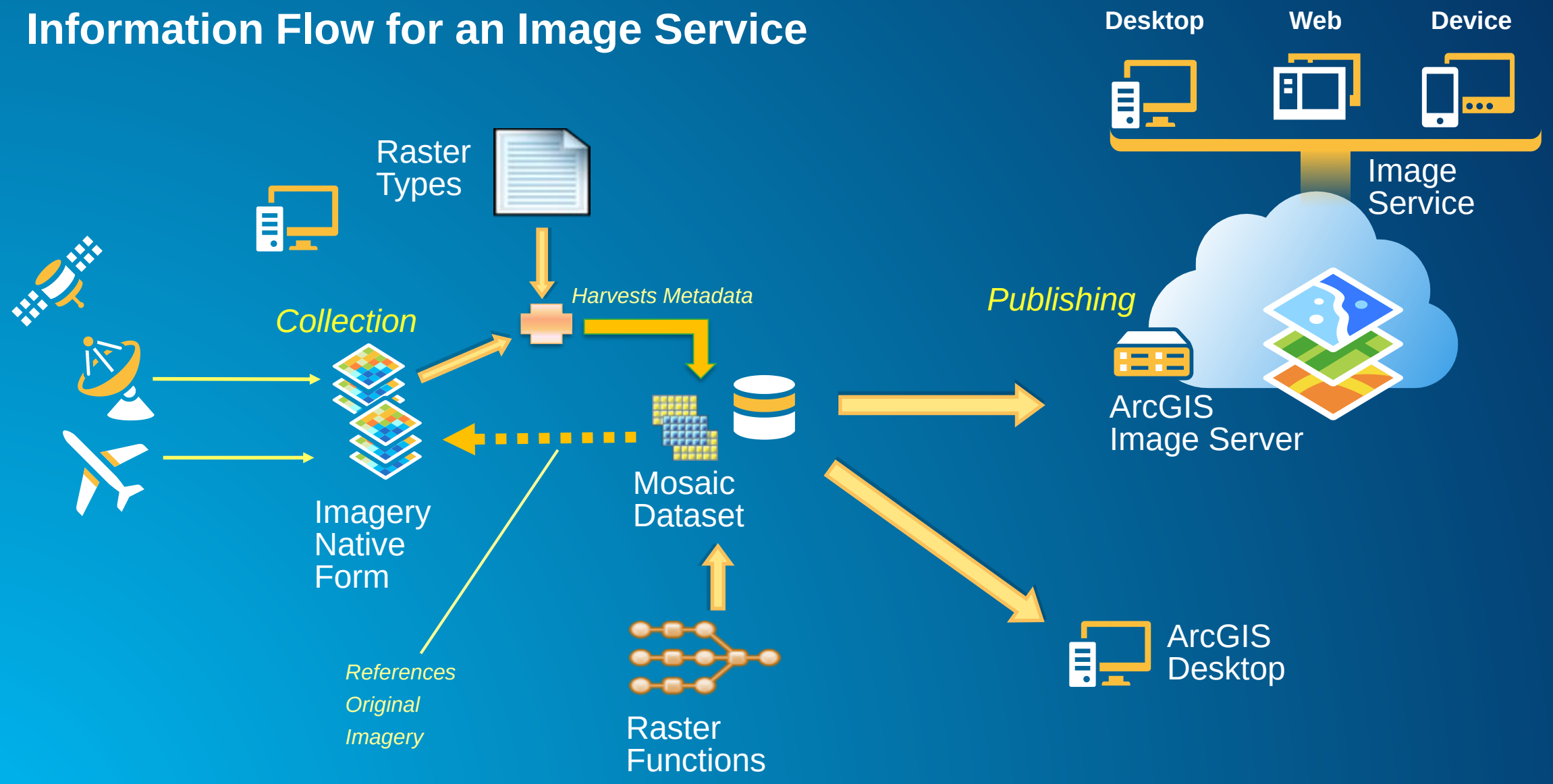


Image Extension vs Image Server

ArcGIS Server (<= 10.4)

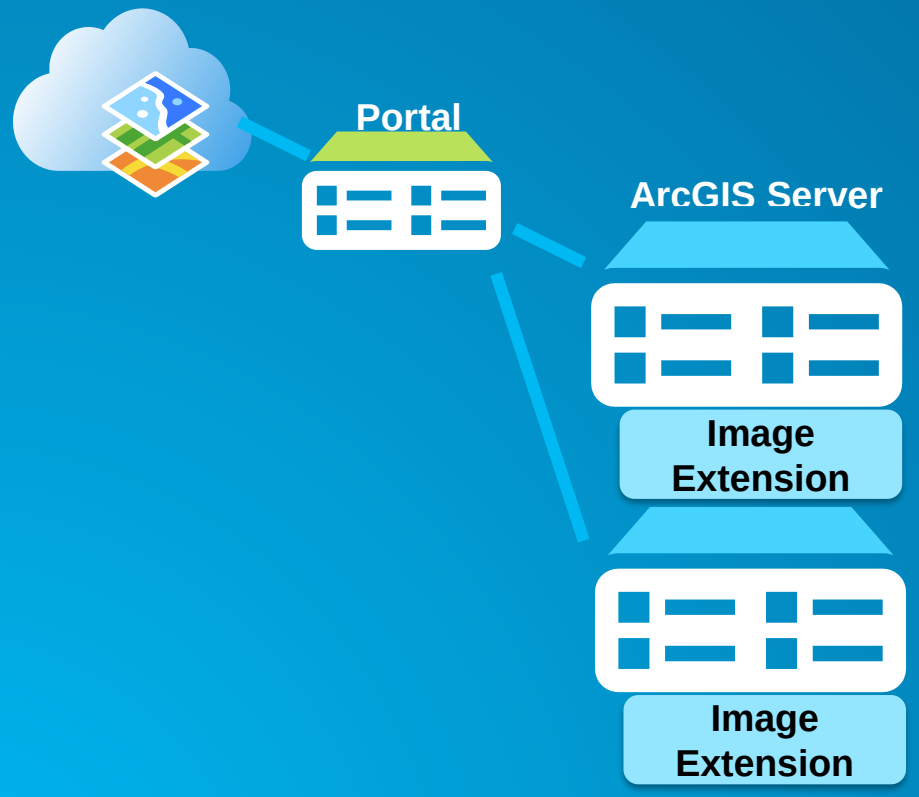


Image Extension provides: Dynamic Image Services

ArcGIS Enterprise (> 10.5)

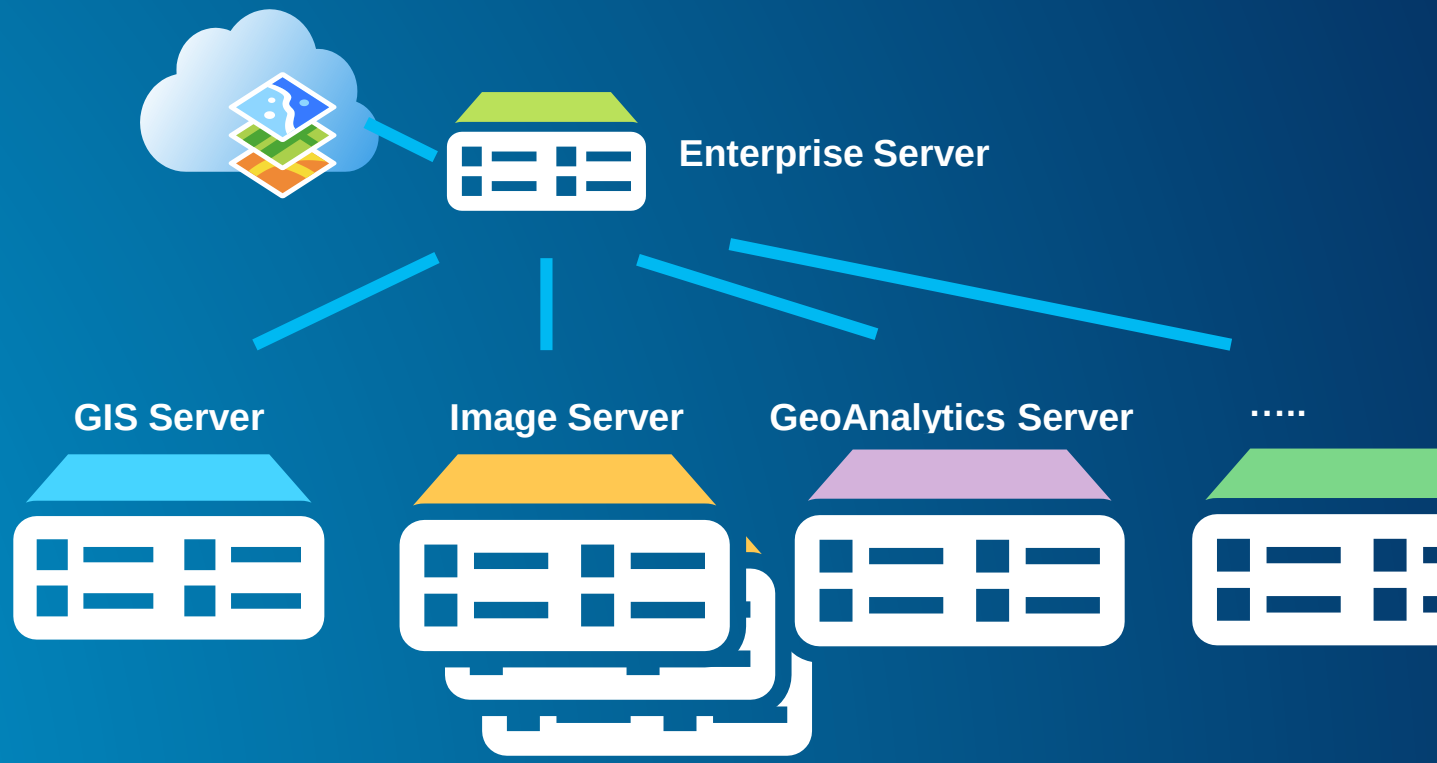


Image Server Provides: Dynamic Image Services + Raster Analytics

For more detail on Raster Analytics - Come to Image Server: Imagery and Raster Analytics 4:15- 5:15

Image Server – Stand Alone

Possible for users wanting backward compatibility with 10.4

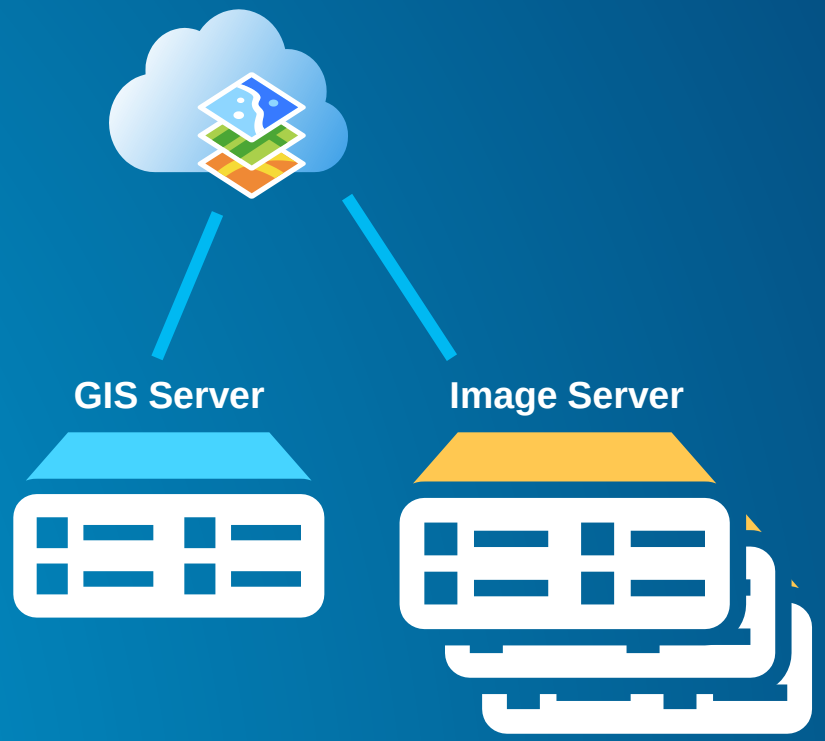


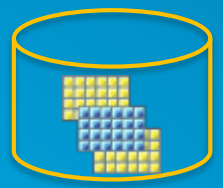
Image Server Provides: Dynamic Image Services ~~+ Raster Analytics~~

Implementation Architectures

On Premises

Desktop

Image Server



DAS or
Enterprise GeoDatabase

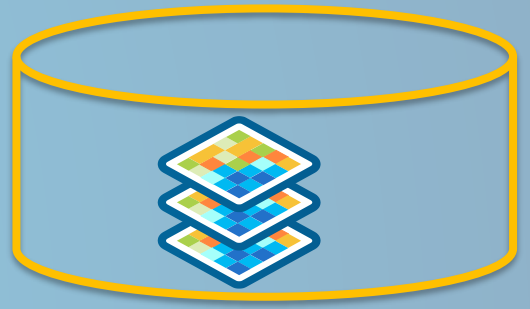
Collections
of Imagery
& Rasters

SAN/NAS

Upload

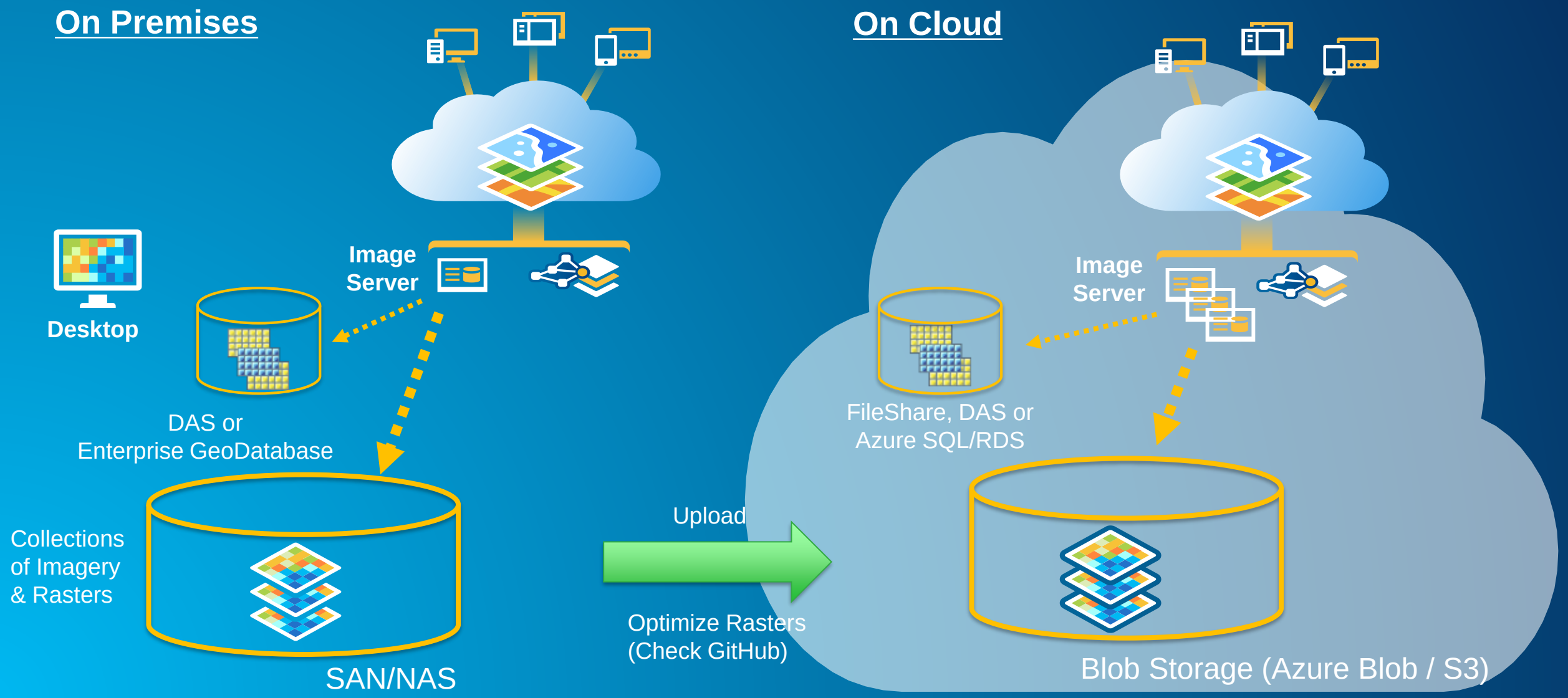
Optimize Rasters
(Check GitHub)

On Cloud



Blob Storage (Azure Blob / S3)

Implementation Architectures



Optimize Rasters

Format and Structure and Storage of Raster has Biggest Effect on Performance

- **Optimum Formats:**
  - **TIF**
    - **Internal tiles (256x256)**
    - **With Pyramids (Internal External)**
    - **Compression: None, LZW, JPEG** (YCbCr for Natural Color), (12bit JPEG also available)
  - **MRF – (Meta Raster Format)**
    - **Optimize for Cloud storage (Also optimizes performance on SAN/NAS)**
    - **Pyramids**
    - **Compression: None, LERC, JPEG** (YCbCr for Natural Color), (12bit JPEG also available)
- **Use Optimize Rasters to Convert**
  - **Fast Batch Conversion**
  - **Maintains all Metadata files**
  - **Option to Upload to Cloud Storage**

Questions?

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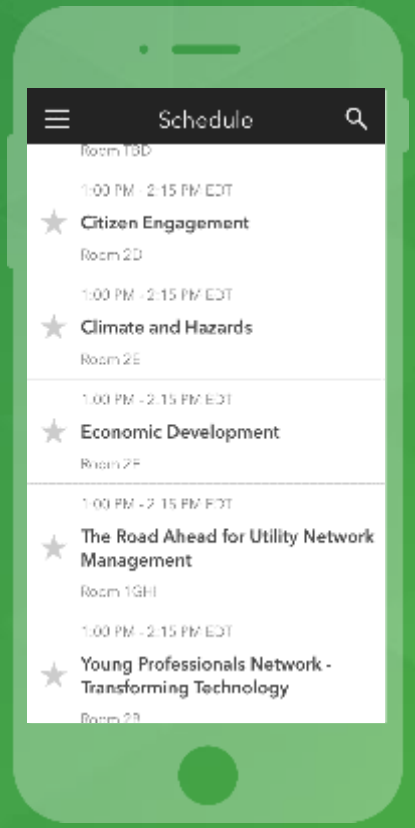
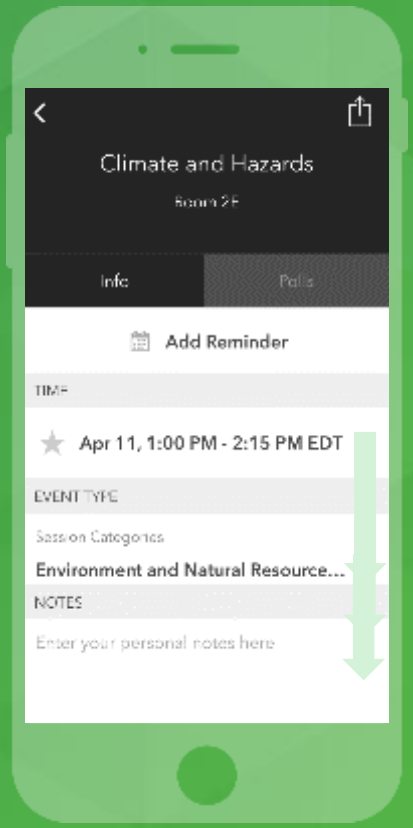
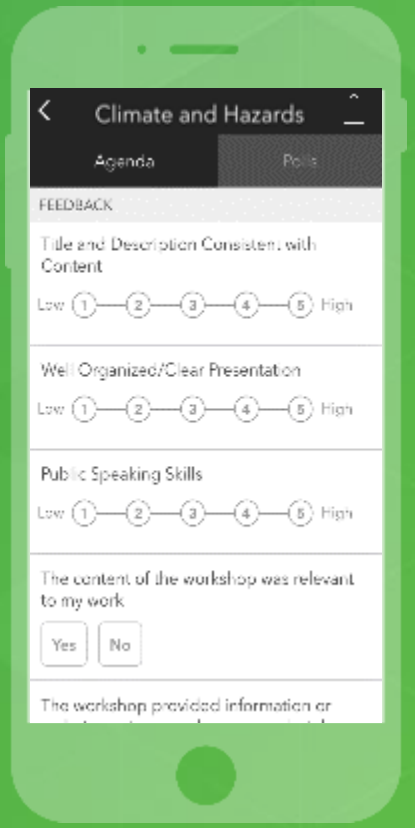


Scroll down to find the survey



Complete Answers and Select "Submit"



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