



ArcGIS Server Image Services and the Image Extension: An Introduction

Ken Gorton & James Michel

Introduction

- Imagery and ArcGIS
- Image service—data, publishing, and access
- Image service client layer properties
- OGC WMS & WCS
- ArcGIS Server—Image Extension
- Authoring, managing, using image service definitions
- Setup and configuration of servers

- What's coming in 9.4

What do we mean by Imagery in ArcGIS?

Imagery vs. Rasters –

same data structure but potentially different processing techniques

Discrete – rasterized vectors

Soils

Landuse



Continuous - Interpolated data

Elevation

Temperature

Terms often used interchangeably

Oblique Imagery

Ortho Imagery



Multispectral Imagery

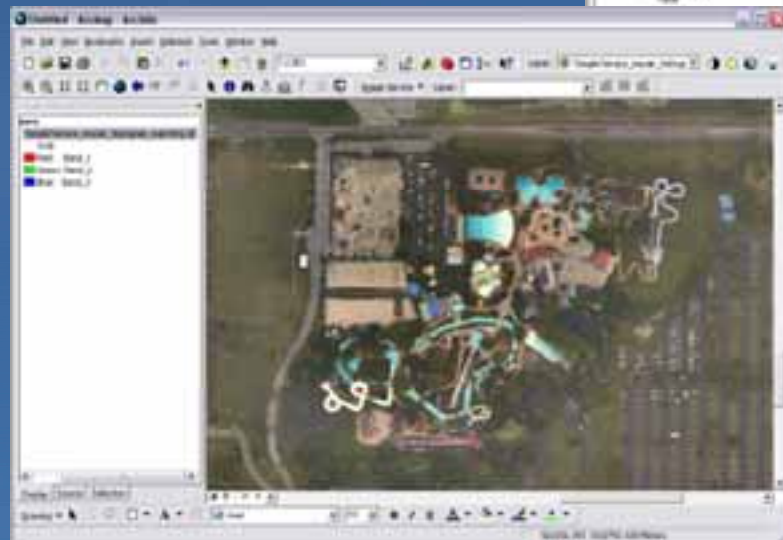
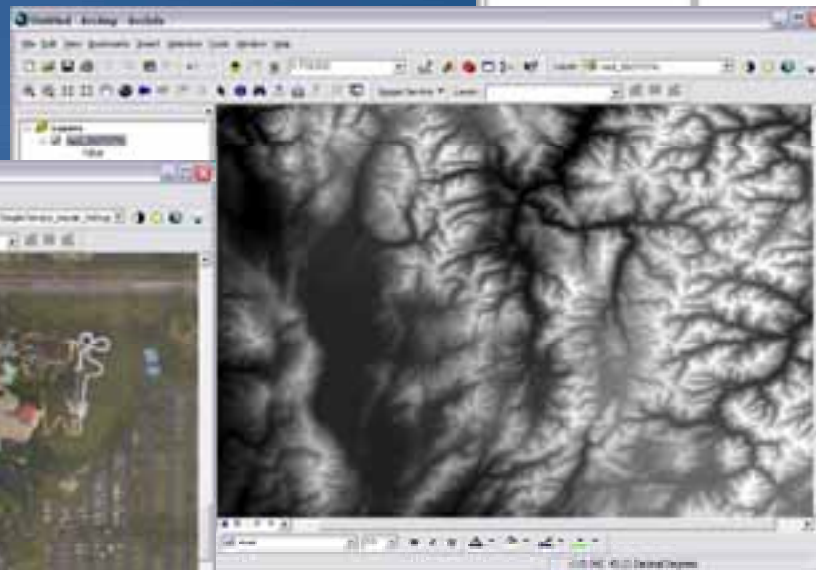
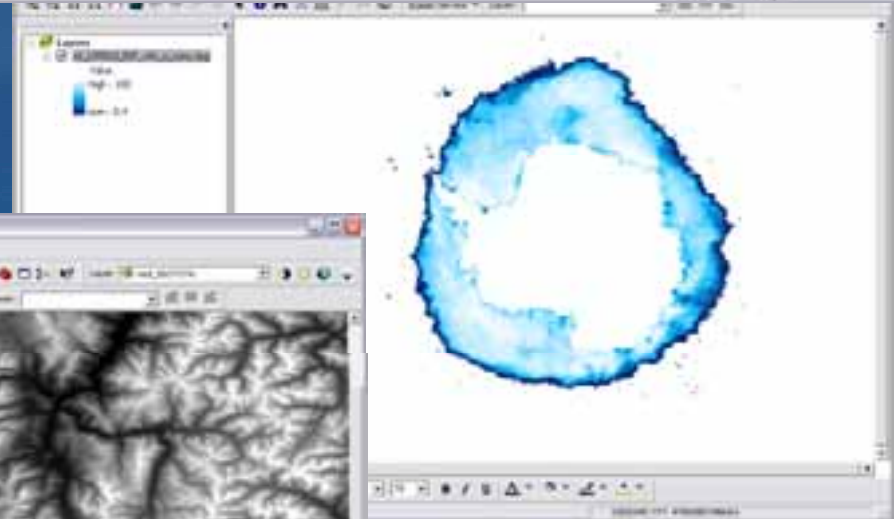
Airborne Imagery

Satellite Imagery

Image Examples

Geographic Data

- Elevation DEM
 - derived data
 - from lidar
 - from spot heights
 - from stereo imagery
- Satellite/Airborne
 - MSI (Multispectral Image)
 - RADAR



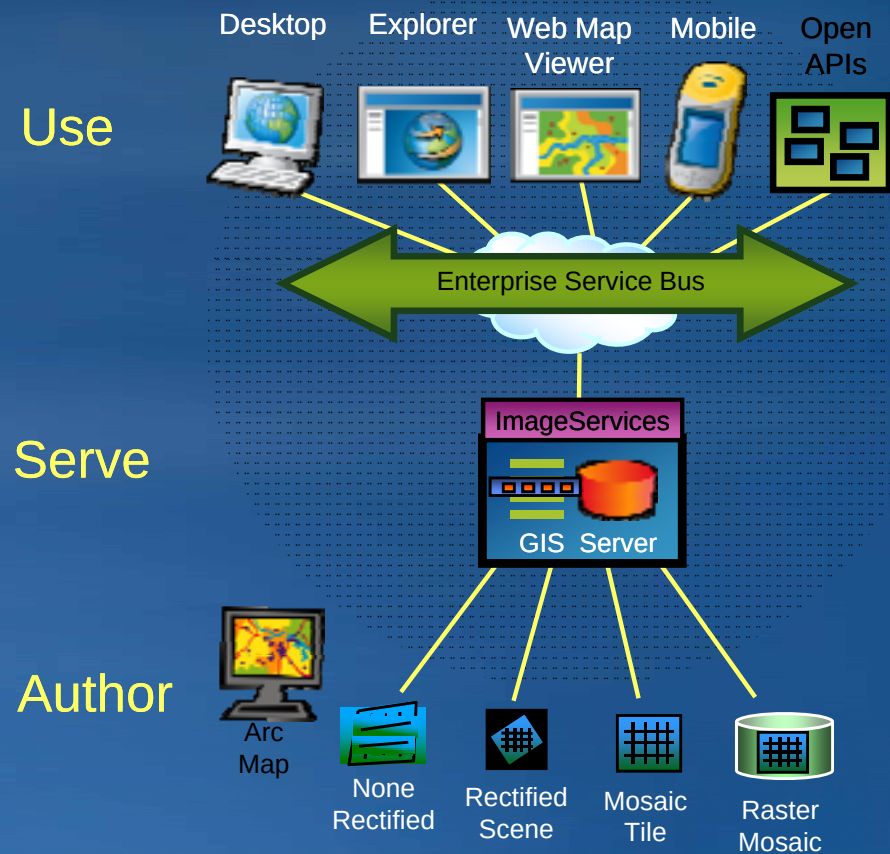
ArcGIS

Integrating imagery as an integral part of the complete Enterprise GIS

A scalable, standards based and generic, cross industry platform technology to:

- Manage
- Process
- Analyze
- Disseminate
- Visualize
- Exploit

imagery, in a wide range of applications



ArcGIS Enables Workflows

- Workflows are critical to any organization
- Different organizations have different workflow requirements
- Workflows are not always linear



Imagery and ArcGIS...

- Desktop
 - Access
 - Visualization
 - Analysis / Processing
 - Management
- Server
 - Access
 - Processing
 - Management

Image service—data, publishing, and access

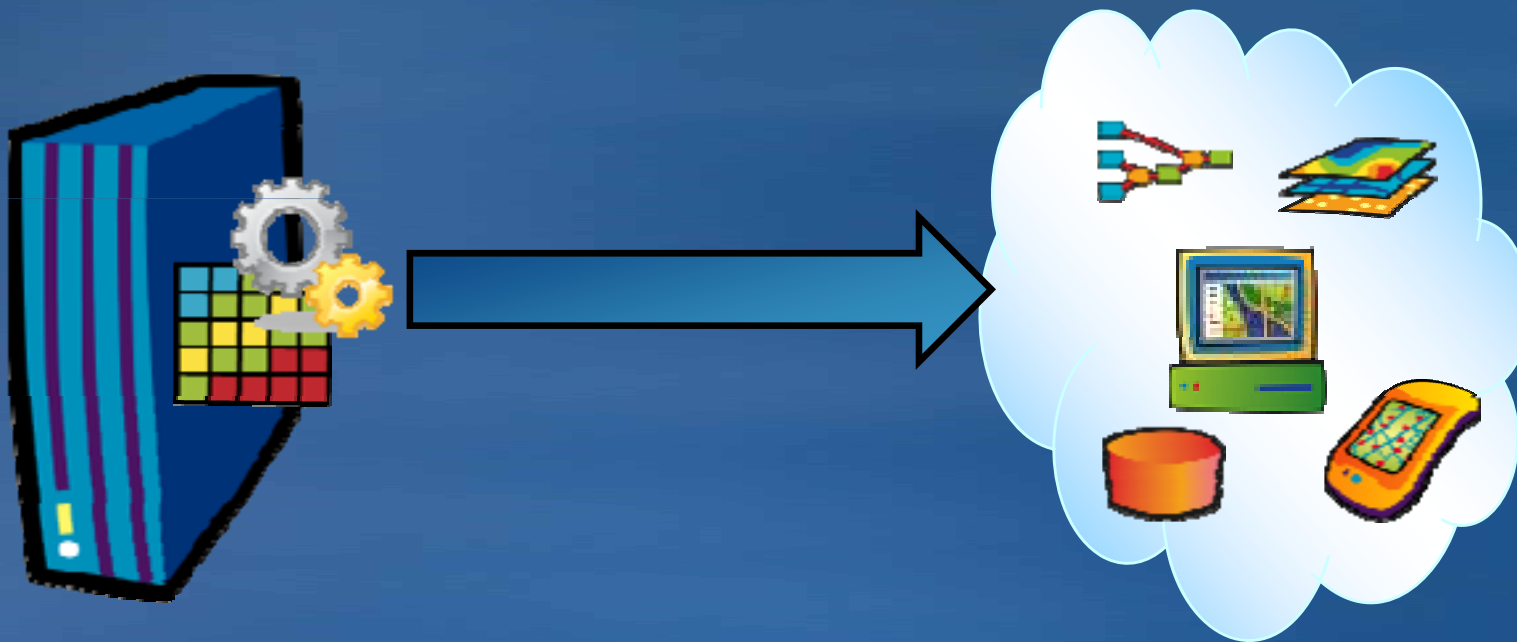
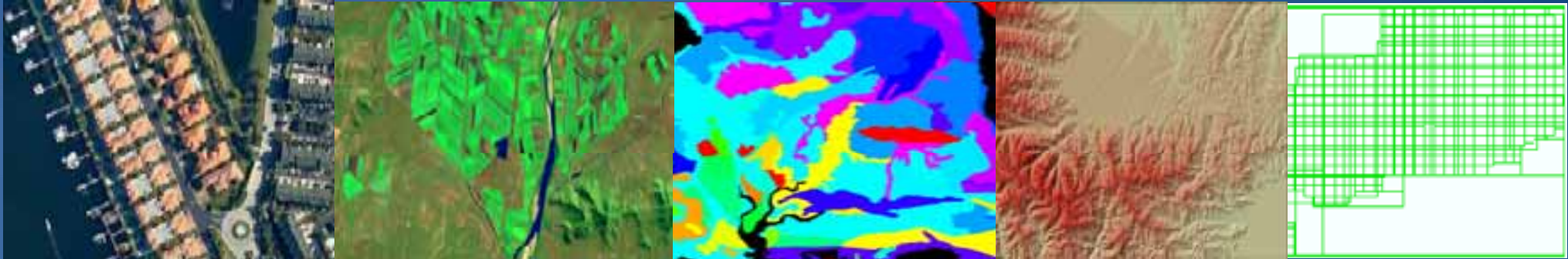


Image service—an image or raster dataset, made available by a server to a client application.

Image Service Source Data

- a raster dataset
 - from a geodatabase, ArcSDE, or file on disk
- a raster dataset layer
- a compiled image service definition
 - containing one or more raster datasets and defined processes
 - created using the Image extension



ArcGIS Supported Formats

Reading/Writing

- GRID, GRID STACK
- IMG, TIF, GEOTIF, Geodatabase Raster datasets
- ENVI (*.dat, *.img, *.envi)
- NITF and HDF
- JPG2000, JPEG, GIF, PNG

Read Only

- ERMAPPER ECW and ERS
- LizardTech MrSID
- USGS DEM
- BIL, BSQ, BIP
- ERDAS 7.5 LAN, GIS
- RAW
- Intergraph CIT COT
- IDRISI RST,
- PCI PIX, MAP,
- Xpixmap XPM

More Image/Raster Formats

Military

- DTED1
- DTED2
- ADRG
- CADRG
- NITF
- DIGEST

For Detailed list see:
webhelp.esri.com

Topic:
[Supported raster dataset file formats](#)

Publishing Image Services

- ArcGIS Server
 - raster dataset
 - raster dataset layer
- ArcGIS Server + ArcGIS Image extension
 - raster dataset
 - raster dataset layer
 - *.ISCDDef (large dynamic mosaic)

Image Service Capabilities / Formats

- Imaging - Consume in ArcGIS
- WMS (OGC web mapping service) service
- WCS (OGC web coverage service) service
 - Consume in web or 3rd Party Software Application

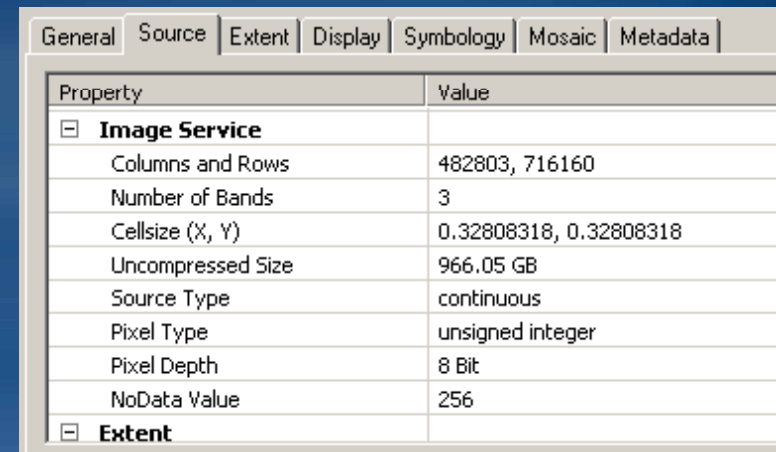
OGC: Open Geospatial Consortium

The Image Service Layer

- Similar to a raster dataset layer
- Familiar Layer Properties dialog box
- Raw pixel values are transmitted
- DEMs can be used as an ArcGlobe surface
- Image service layer can be used in a geoprocessing tool
- Can export source data, not just rendered image

Image Service Layer Properties

- Layer Properties dialog box is consistent between any type of image service and raster dataset
- 5 tabs (for all image services):
 - General
 - Source
 - Extent
 - Display
 - Symbology
- 2 additional tabs (if published from an *.iscdef):
 - Mosaic
 - Metadata
- Source tab – displays data source as ArcGIS Image Service



The screenshot shows the 'Source' tab of the Layer Properties dialog box. The 'General' tab is selected, and the 'Image Service' section is expanded. The 'Extent' section is also visible at the bottom.

Property	Value
Image Service	
Columns and Rows	482803, 716160
Number of Bands	3
Cellsize (X, Y)	0.32808318, 0.32808318
Uncompressed Size	966.05 GB
Source Type	continuous
Pixel Type	unsigned integer
Pixel Depth	8 Bit
NoData Value	256
Extent	

Layer Properties: Display Tab

- **Resampling methods**
 - Nearest neighbor
 - Bilinear
 - Cubic convolution
 - Majority
- **Transparency mask is transmitted**
 - No need to define transparent background color
 - Mask is clipped to image service boundary polygon

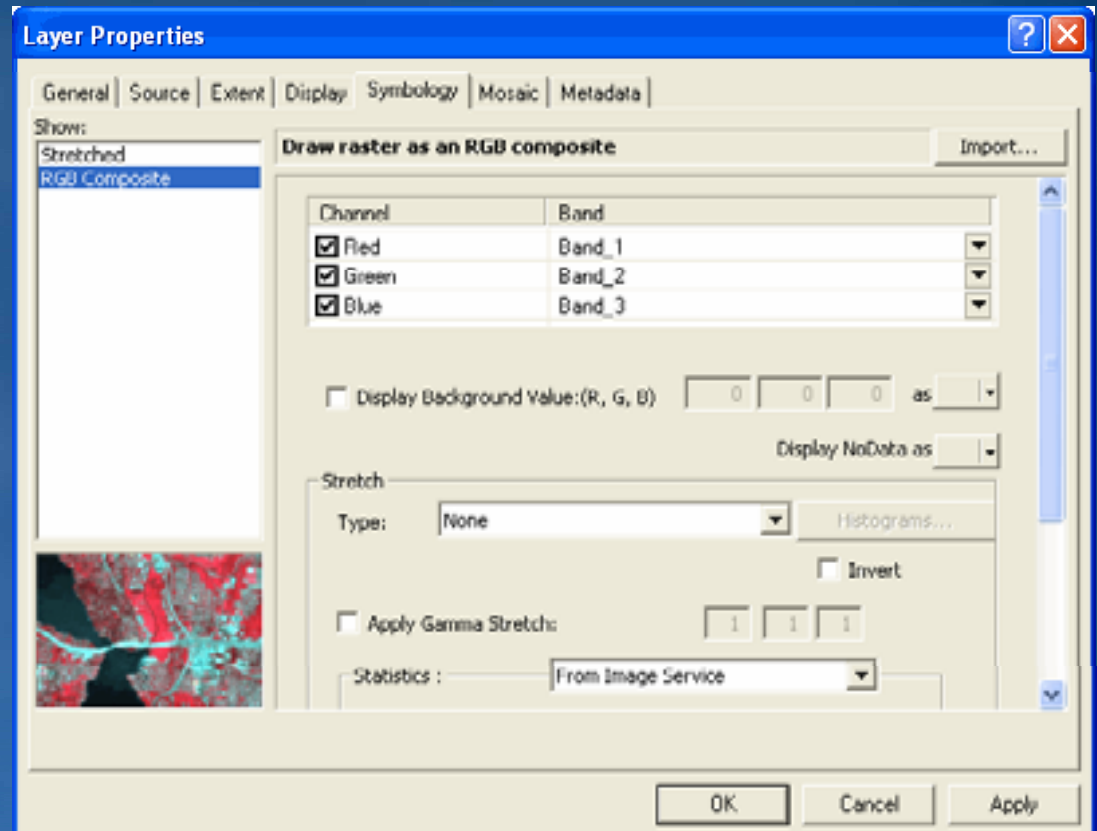
The screenshot shows the 'Layer Properties' dialog box with the 'Display' tab selected. The 'General' tab is also visible. The 'Display' tab contains the following settings:

- ☐ Allow interactive display for Effects toolbar
- Resample during display using:
 - Cubic Convolution (for continuous data)
- Contrast: 0 %
- Brightness: 0 %
- Transparency: 0 %
- Transmission Compression: JPEG
- Quality: 75 %

Layer Properties: Symbology Tab

User can change:

- **Renderer**
 - Stretched
 - RGB Composite
- **Band combinations**
- **Stretch type**
 - None
 - Standard deviations
 - Minimum-Maximum
- **Gamma stretch**



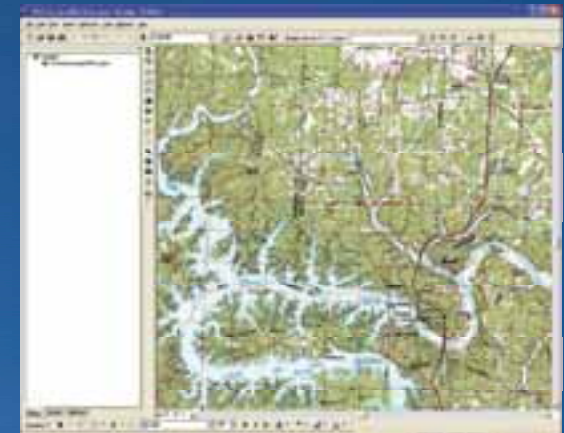
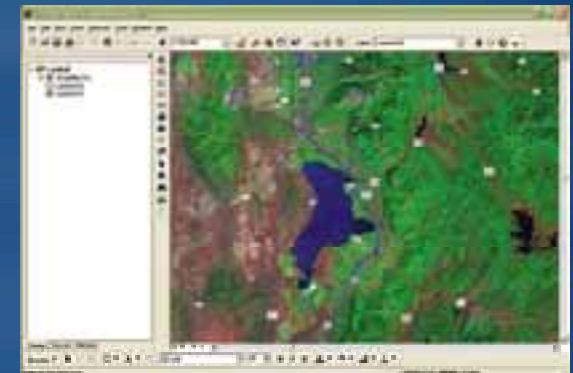
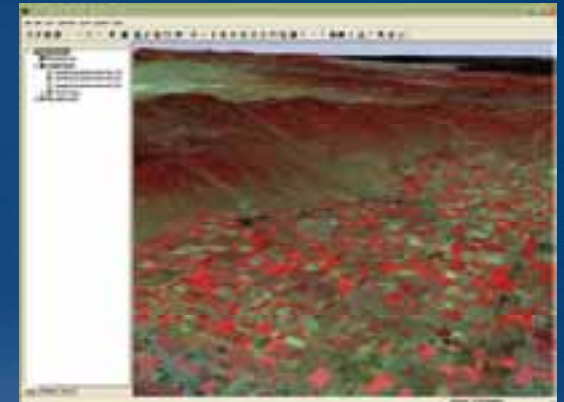
Serving Imagery with ArcGIS Server – Ken Gorton

- **Serve out Aerial Imagery**
 - Use ArcCatalog to Serve Imagery
 - Display options for service type – Arc GIS Imagery / WMS / WCS
 - Consume in ArcMap
 - Show layer properties and options
 - Consume WCS in 3rd Party Software (ITT Envi)
 - Serve Elevation Image as WMS and WCS
 - Consume in ArcMap
 - Show difference between WMS (rendered raster) and WCS (raw pixel data)
 - Run GeoProcessing Tools on WCS

Image Extension - ArcGIS Image Server

Maximizes the Value of Imagery

- Integrates directly with ArcGIS Server
- Enterprise wide image accessibility
 - Increases access and use
 - Very large image datasets
 - Within GIS, CAD, imaging, and Web applications
- Direct read of imagery in its native form
 - Simplifies data management
 - Reduces redundancy
 - Reduce delay in making imagery accessible
- On-the-fly server-based image processing
 - Serves multiple customized imagery products
 - From a single source
 - Utilizes image depth
 - Makes imagery dynamic
- End users get
 - Fast image access
 - Optimized to their requirements
 - Improved image quality
 - Important image metadata



Traditional Imagery Process Flow

Issues: Volumes & Latency

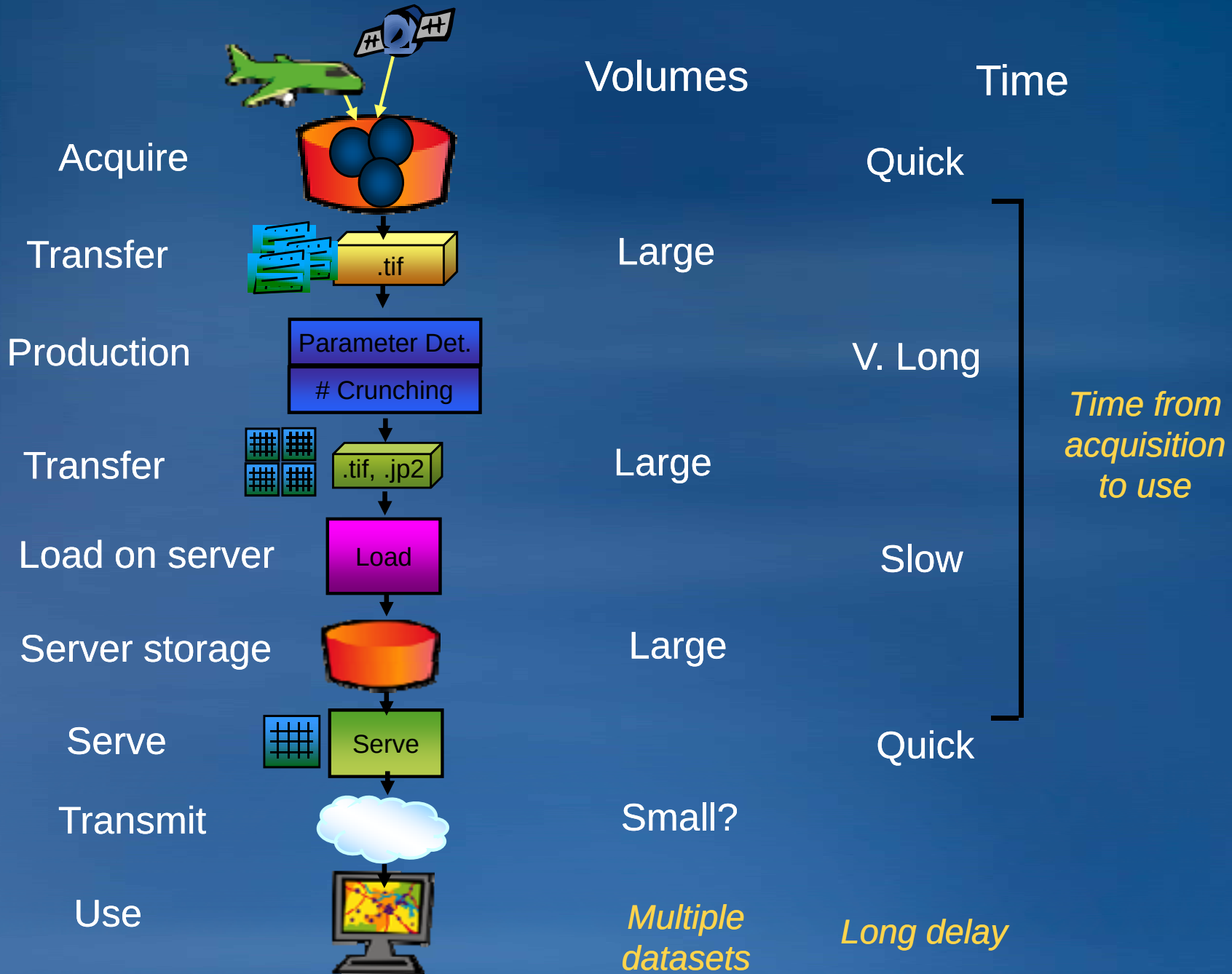
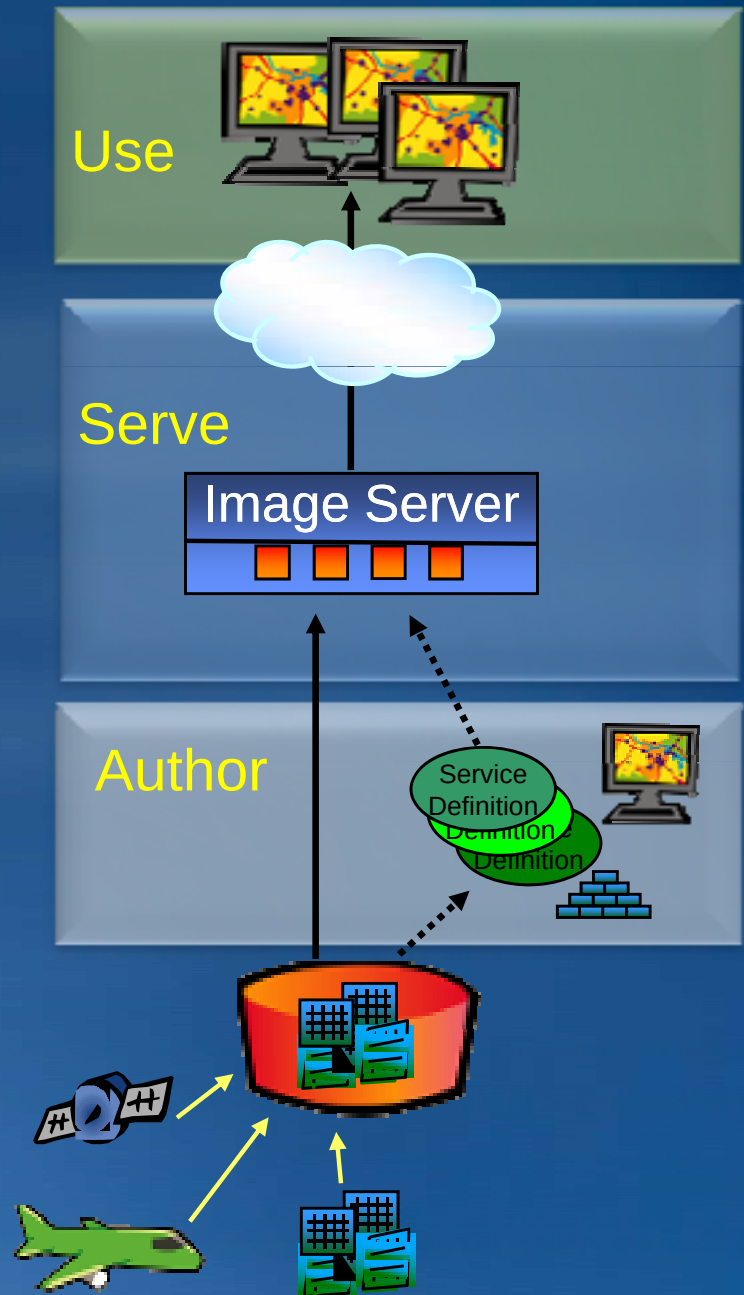


Image Extension Paradigm

Combine Processing with Serving

- Keep imagery in native form
- Author image service definition (catalog)
 - Properties of images
 - Processing to be applied
 - Properties of the service
 - Generate service overviews (optional)
- Publish image service
- Client accesses service
 - Client defines area of interest
 - Server accesses and processes imagery
 - Required image transmitted to client
 - Client displays image



The Advantage of Combining Processing and Serving

Traditional

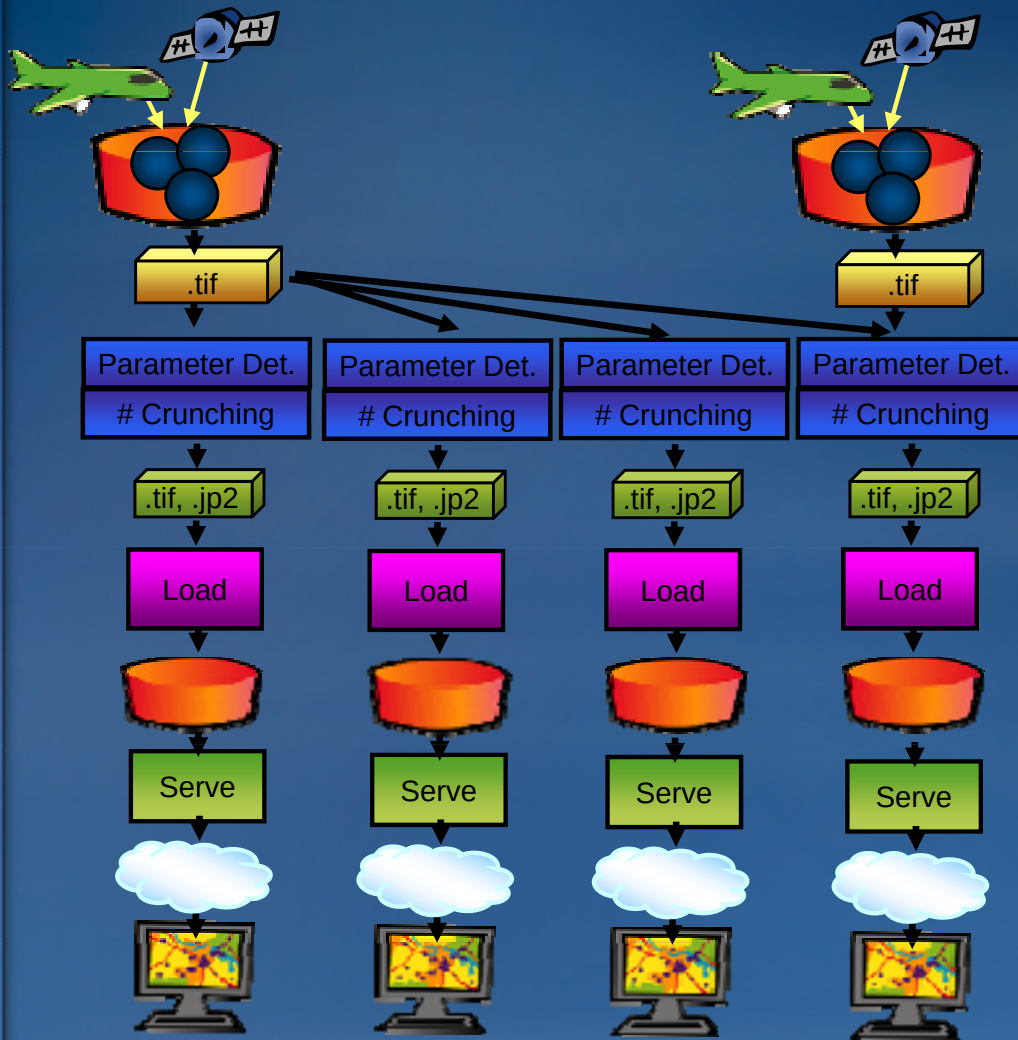
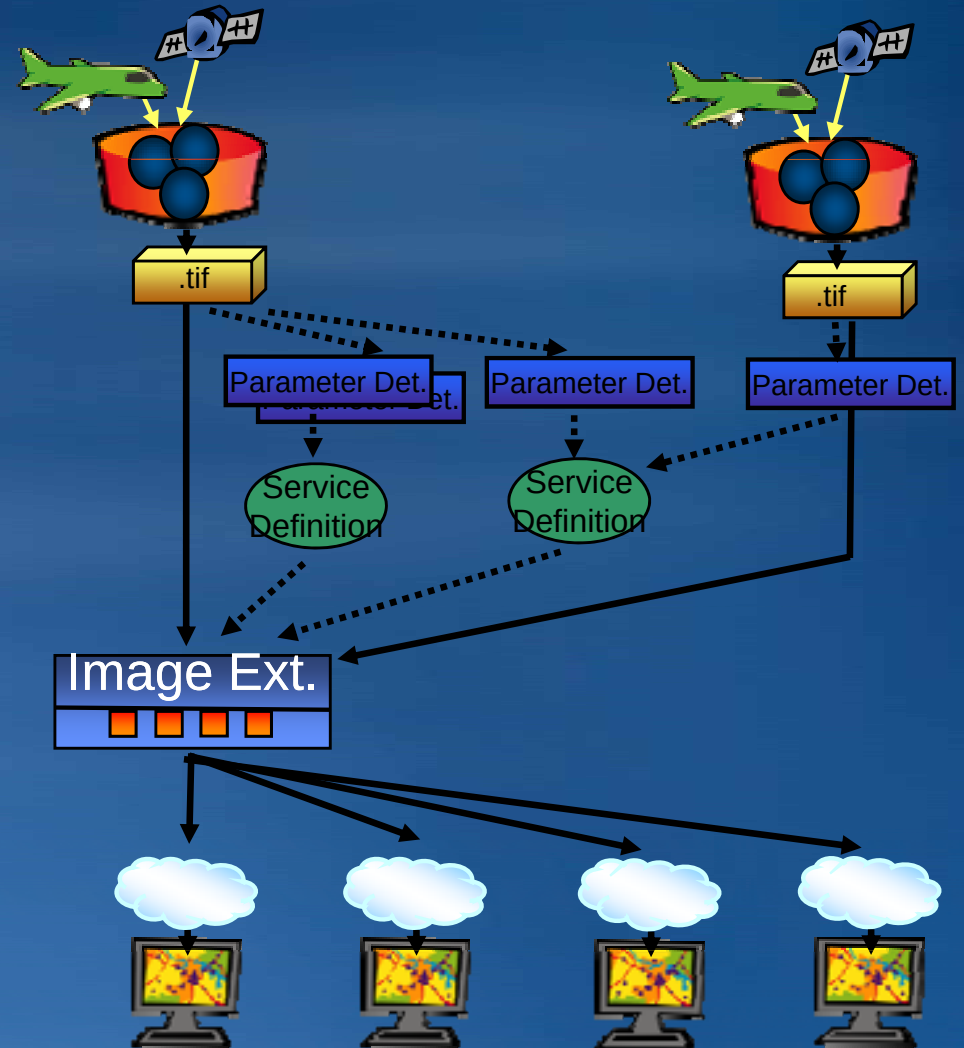
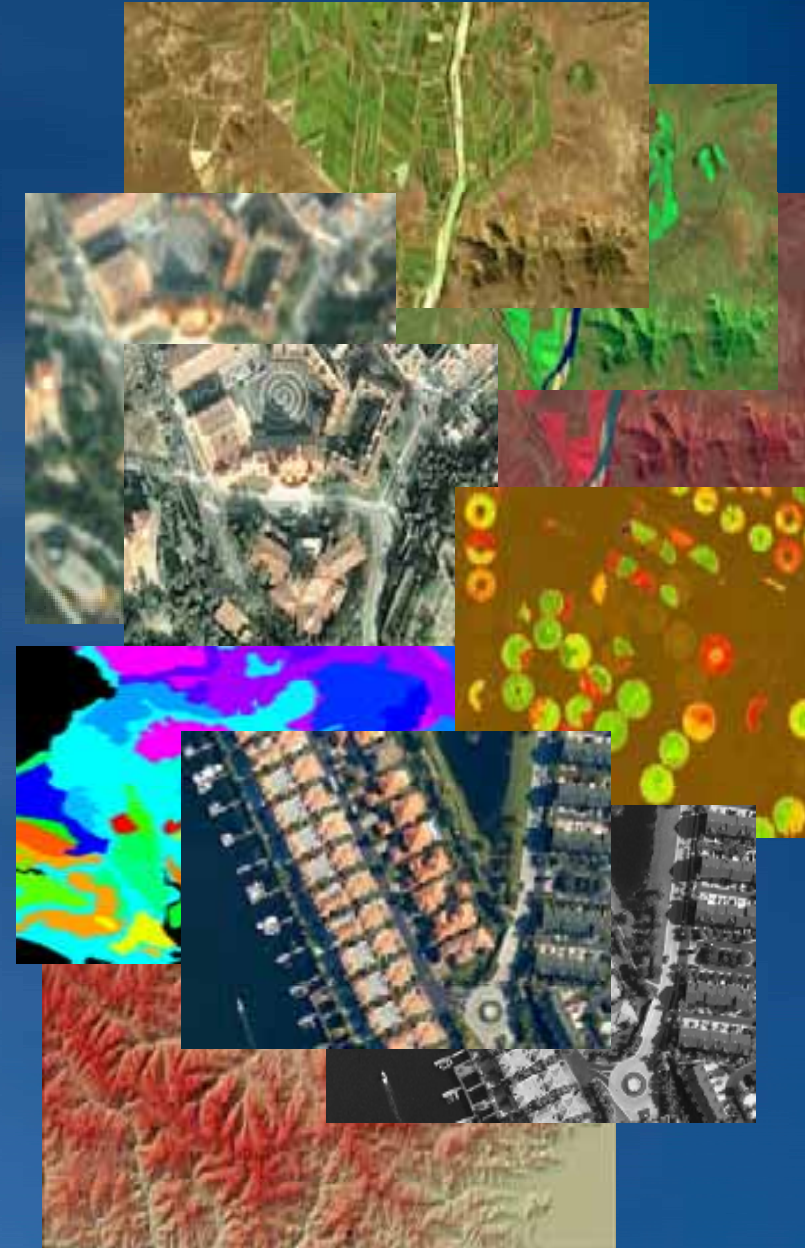


Image Extension



When to Use the Image Extension?

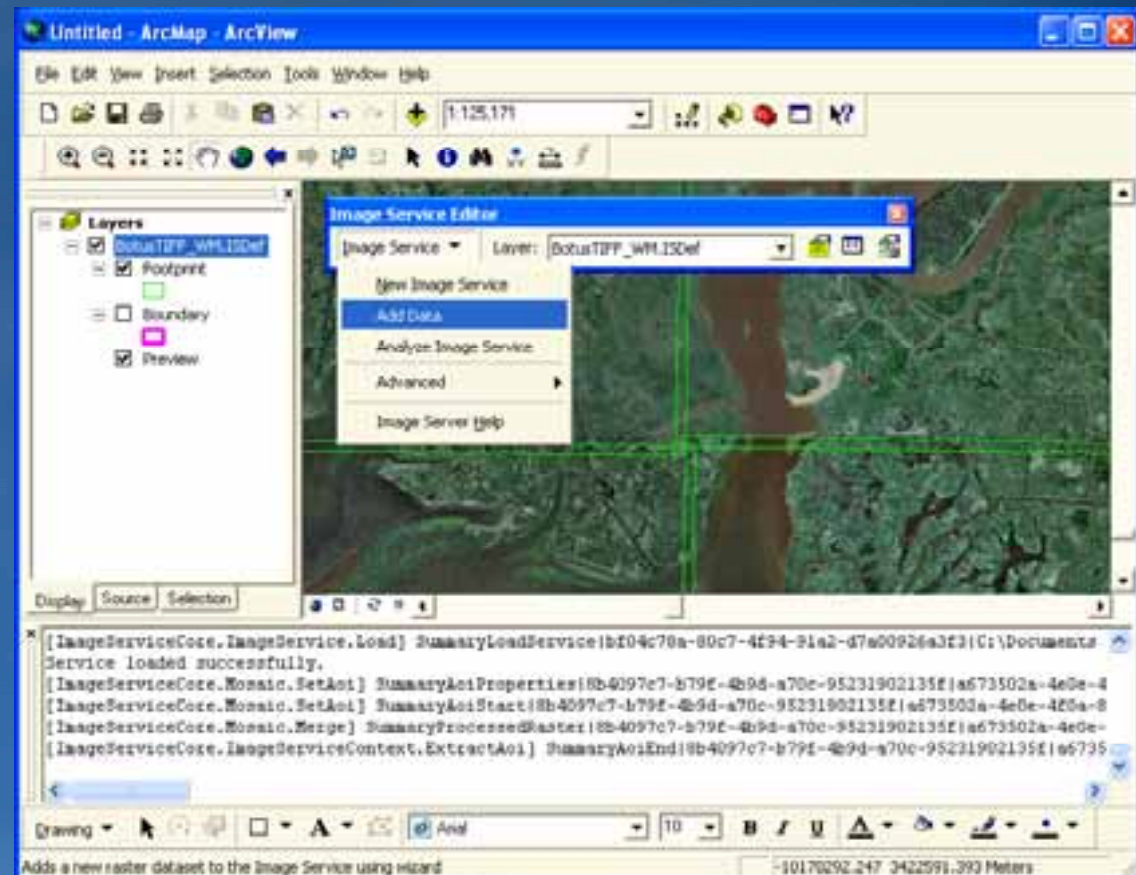
- When you:
 - Have multiple images
 - Do not wish to pre-mosaic
 - Need different image products
 - Exploit overlap (i.e. temporal)
 - Want image specific metadata
 - Fast authoring and updates



How to Author an Image Service Definition

- **Toolbar in ArcMap**
 - Define image service definition & properties
 - Add imagery or raster datasets
 - Derives footprints
 - Extracts metadata
 - Define processing
 - Optimize
 - Compile

An image service definition can contain raster datasets in various types, formats, geometry, or projections.



Authoring image service definitions

ServiceName.ISDef



Properties



Boundary



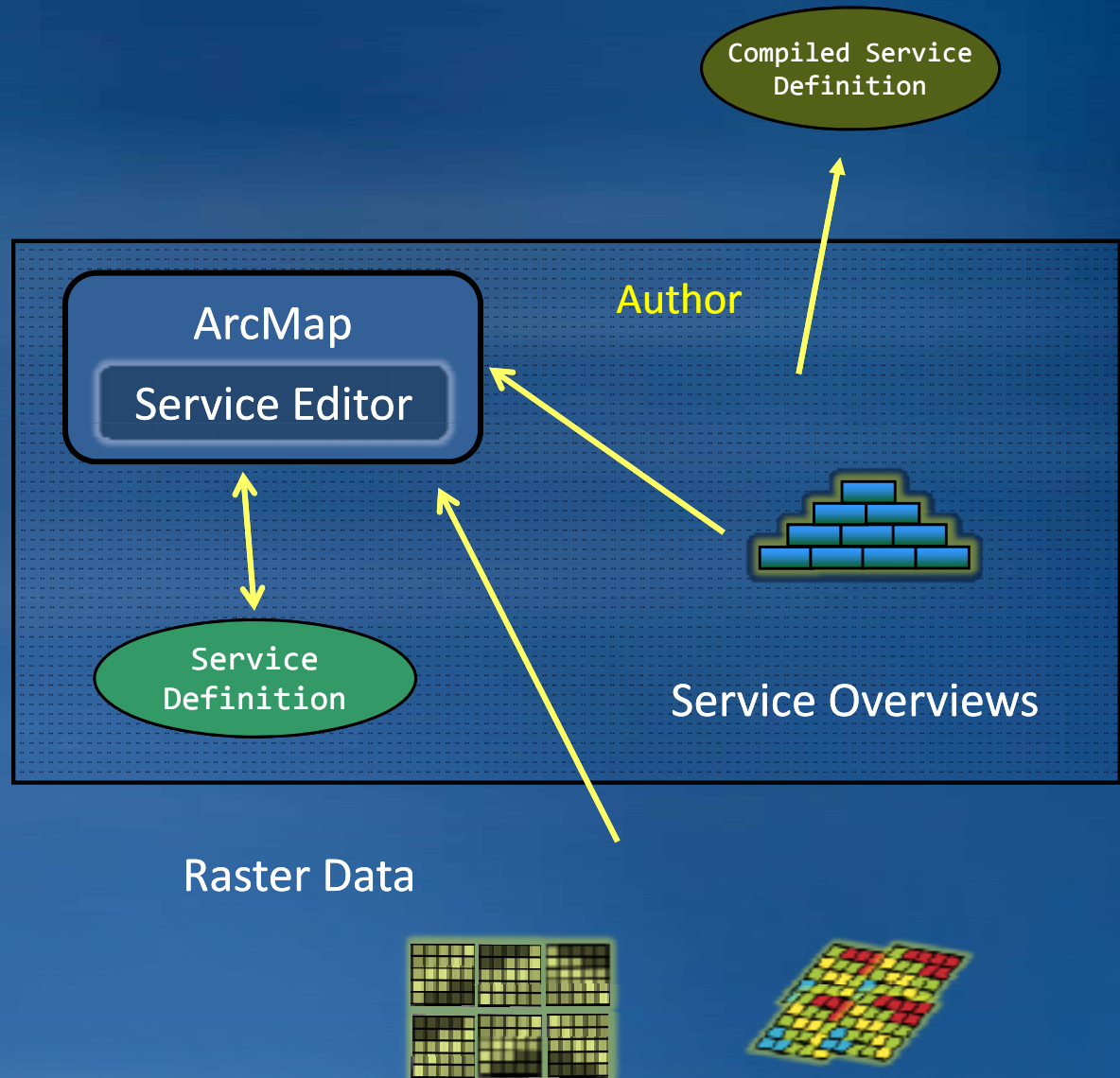
Footprint



Seamline



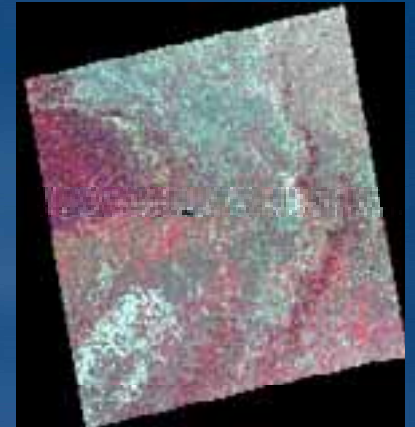
Process Definitions



Footprint & Service Table

- **Footprint**

- Polygon representing the extent of the valid pixel data in each image
- Used to
 - Select rasters that intersect with client AOI
 - Clip pixels
- Clipping using footprints more efficient than using transparency.



- **Service Table**

- contains the attributes for each footprint, including:
 - Source raster
 - Low and high pixel sizes
 - Minimum and maximum pixel sizes
 - Display order
- Used to filter raster datasets to be processed depending on scale prior to mosaic

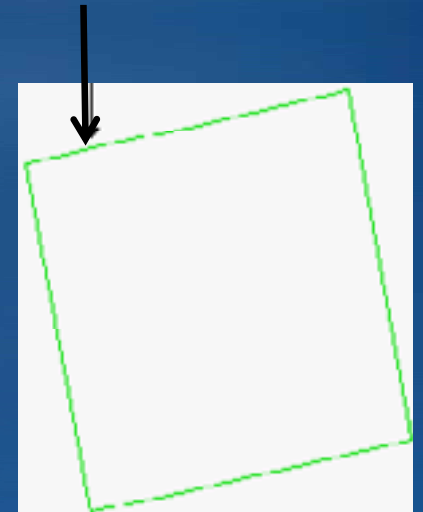
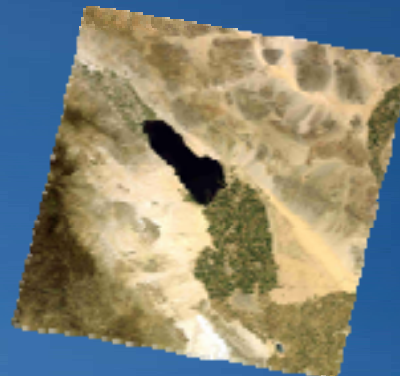
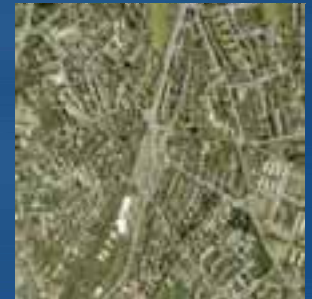


Image Service Editing: Footprint

Improved options to recompute footprints

- By Geometry^{*New at 9.3}
 - useful for orthorectified raster datasets
- By Radiometry^{*New at 9.3}
 - useful for data requiring a transparent boundary
- By Clipping to Boundary^{*New at 9.3}
- By Shrinking
- By Related Geometry^{*New at 9.3}
 - Useful for using footprints\polygons from elsewhere



Processes



- **Enhancing image appearance**
 - Stretching
 - Pan-sharpen
 - Convolution Filter
 - Trend
- **Band organization**
 - Extract Bands
 - Stack Bands
- **Displaying elevation**
 - Visualize Elevation
- **Geometric processing**
 - Affine, Warp Grid, etc.
 - Orthorectification
- **Applying algebra and extraction**
 - Classify pixel
 - Image Algebra
 - NDVI
 - Convert Pixel Type
 - Histogram
- **Changing output color**
 - Grayscale
 - Color Map
 - Spectral Matrix
 - Trend

Mosaicking methods

Reorder overlapping imagery

- Closest to Center
- Closest to Nadir
- Closest to Viewpoint
- By Attribute
- Most Northwest
- Seamline
- Lock Raster



Image Service Editing: Seamlines

- Options to generate seamlines:
 - By Radiometry^{*New at 9.3}
 - Examines overlapping raster datasets and intelligently creates a seamline to follow natural patterns between the overlap
 - By Exporting Footprints
- Do not appear as overlapping polygons
 - Makes it easier to distinguish and edit them

Demos:

**Authoring an image service definition and
recomputing the footprints**