



Esri International Developer Summit  
Palm Springs, CA

# Workflow Automation Templates for Processing Mosaic Dataset Imagery

Cody Benkelman & Jamie Drisdelle

Tuesday, March 11, 2014 5:30 pm

**OFFERING ID: 3019**

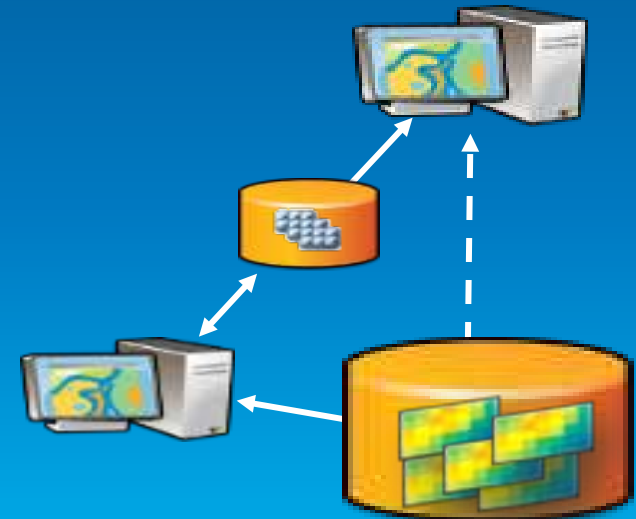
# Outline

- **Mosaic Datasets**
- **Automation with ModelBuilder & Python**
- **Mosaic Dataset Configuration Script (MDCS)**
  - **Configuration files**
  - **Source / Master / Derived design**
  - **Documentation and other resources**

# Mosaic Dataset

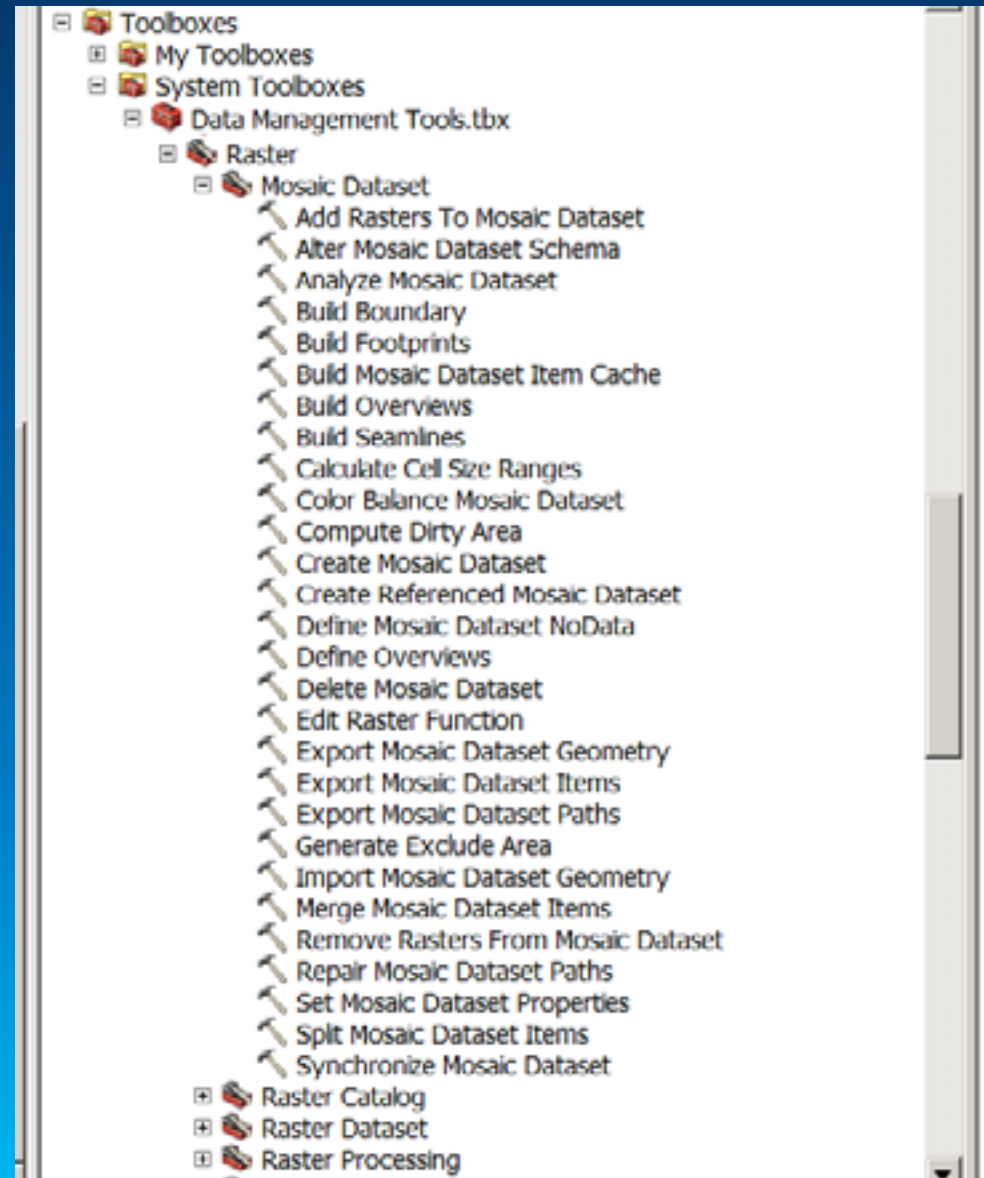
*Optimum Model for Image Data Management*

- Catalog all types of raster data
- Image data remains in original files
- Define – in Geodatabase:
  - Metadata
  - Processing to be applied
  - Default viewing rules
- Access – In all ArcGIS applications
  - As Image
    - Dynamic Mosaic, Processed on the fly
  - As Catalog
    - Footprints, Detailed metadata



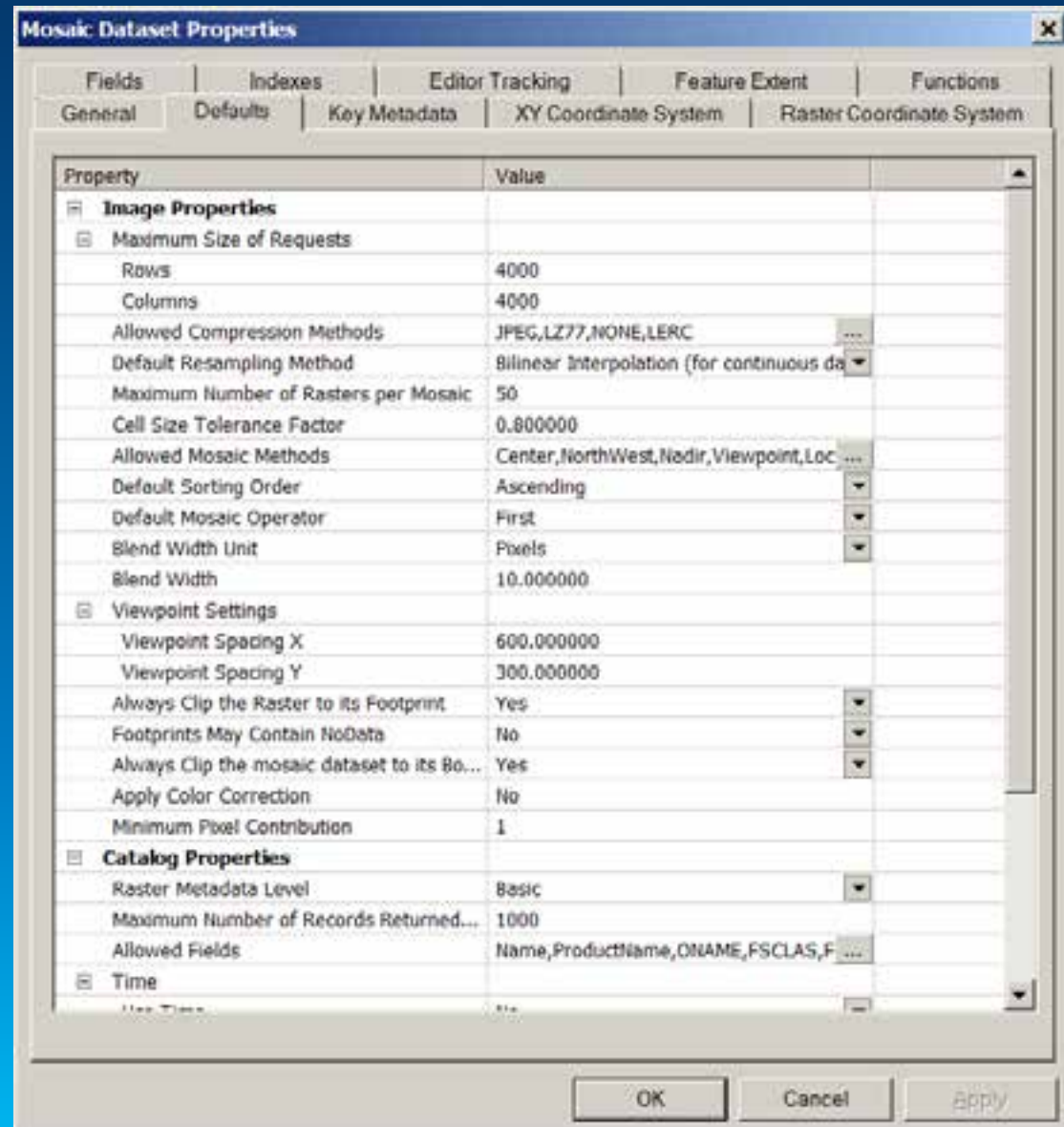
# Mosaic datasets: powerful, flexible... with many details

- GP Tools
  - Many have multiple options



# Mosaic datasets: powerful, flexible... with many details

- GP Tools
  - Many have multiple options
- MD properties
  - Configuration depends on data type and also use case



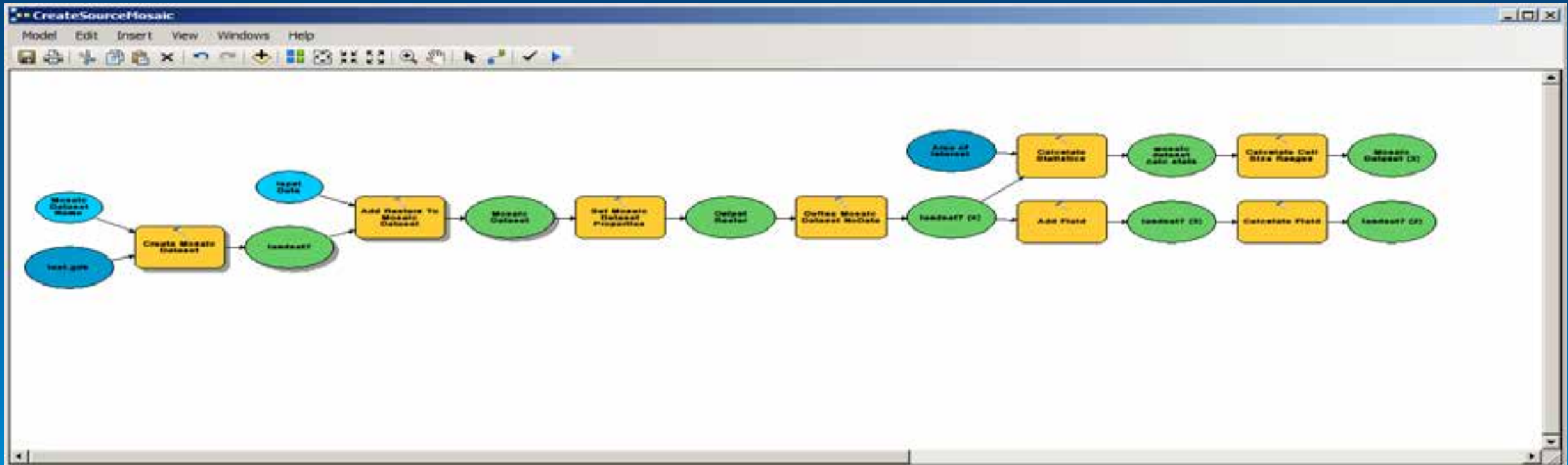
# Automation Requirements

- **Simplicity**
- **Productivity**
  - **Repeatability, Scalability, Maintainability**
  - **Documentation à Facilitate QA & QC, Design Review**
- **Training/Examples**
  - **Encapsulate best practices**
  - **Reusable templates**

## Options for building Mosaic Datasets

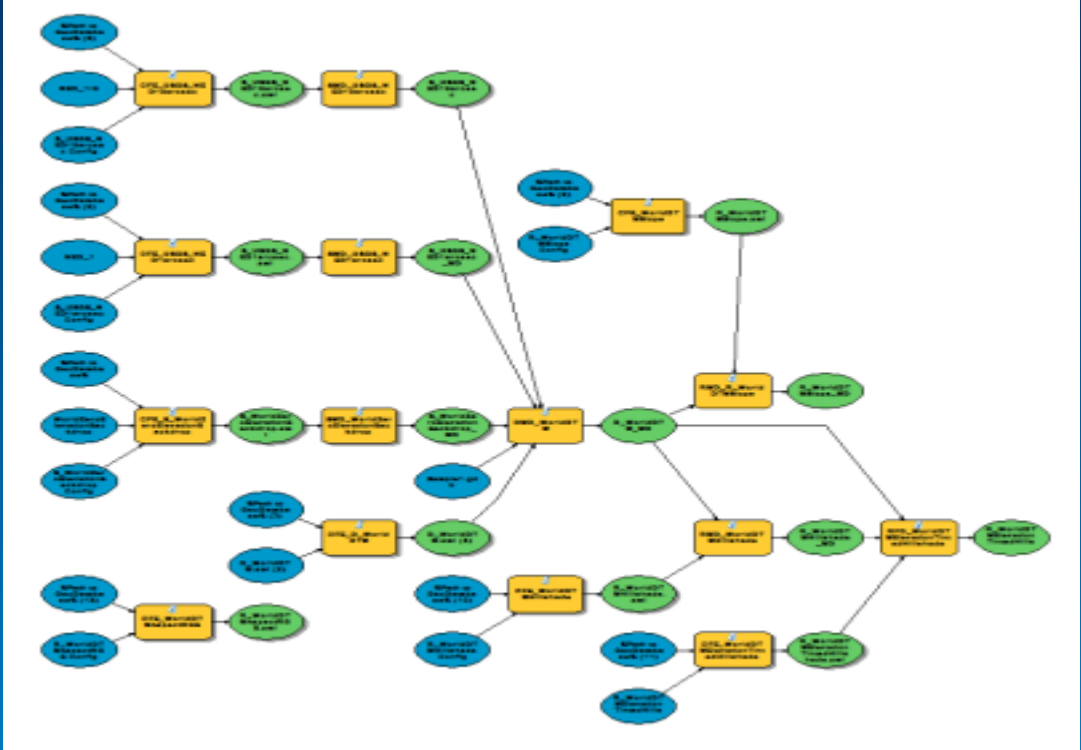
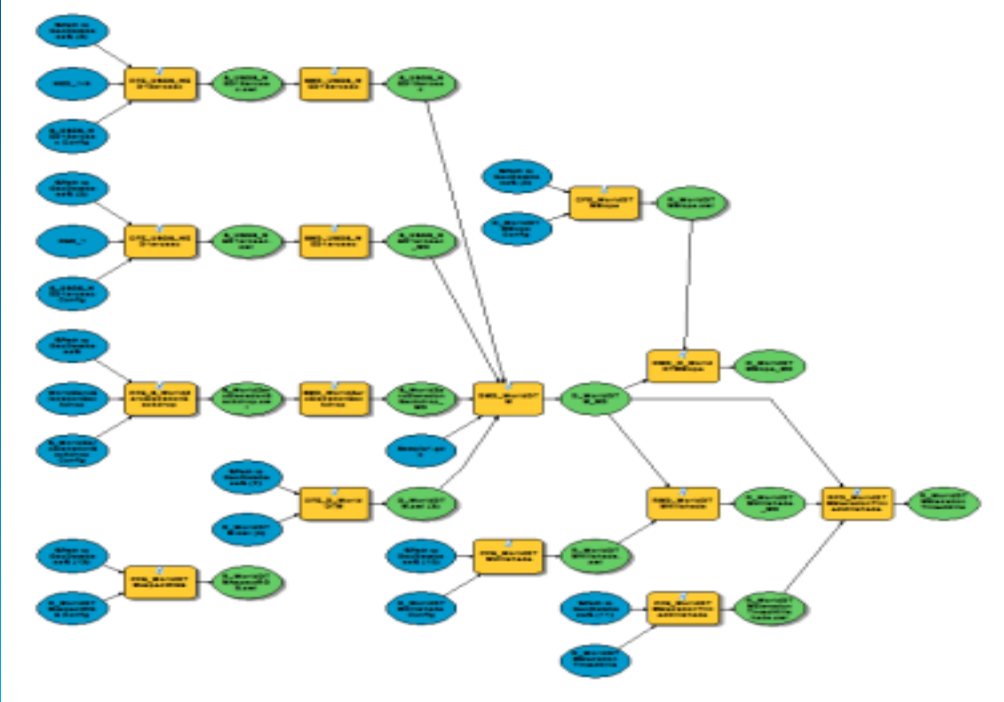
- Discrete GP tools (manual)
- ModelBuilder
- Python (added at 10.1)

# Create Simple Mosaic Dataset - ModelBuilder





# Comparing Models



# Python in the GP Framework

- Calling Geoprocessing tools in Python:
  - *Import arcpy*
  - *arcpy.CreateMosaicDataset\_management("C:\\temp\\test.gdb", "abc"...*
  - HELP LINK [Using tools in Python](#)
  - HELP LINK [Create Mosaic Dataset](#)

## Python Example - *Mosaic Dataset Configuration Script (MDCS)*

- Calling standard Geoprocessing tools from a single script
- Input configuration file contains complete information to:
  - Create,
  - Populate, and
  - Configure one mosaic dataset



- Also generates detailed log files

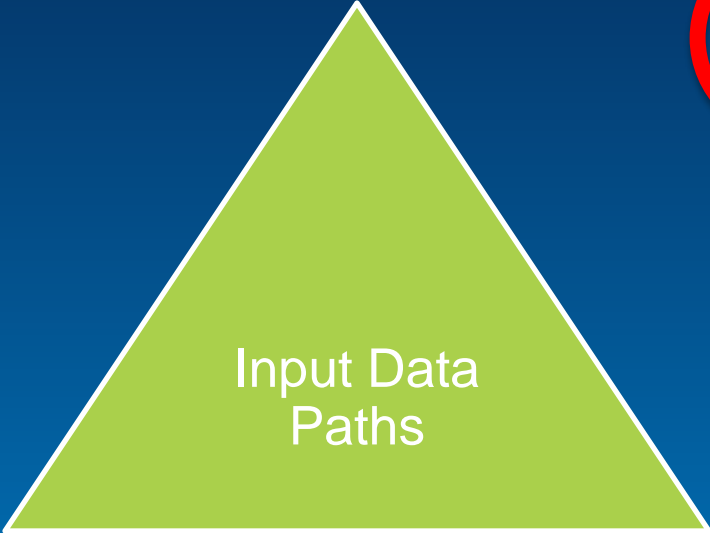
## Advantages of MDCS

- **Configuration file encapsulates “Best practices” (mosaic dataset properties) based on image type**
- **“Self Documenting” –**
  - **Template is reusable for different image types, or multiple mosaic datasets within a more complex system**
  - **Compare versions (difficult with ModelBuilder)**
- **Automated Log files – Simple Review**
- **Standard Geoprocessing tools have been enhanced/improved**
- **Compatibility with upcoming ArcGIS Pro App**

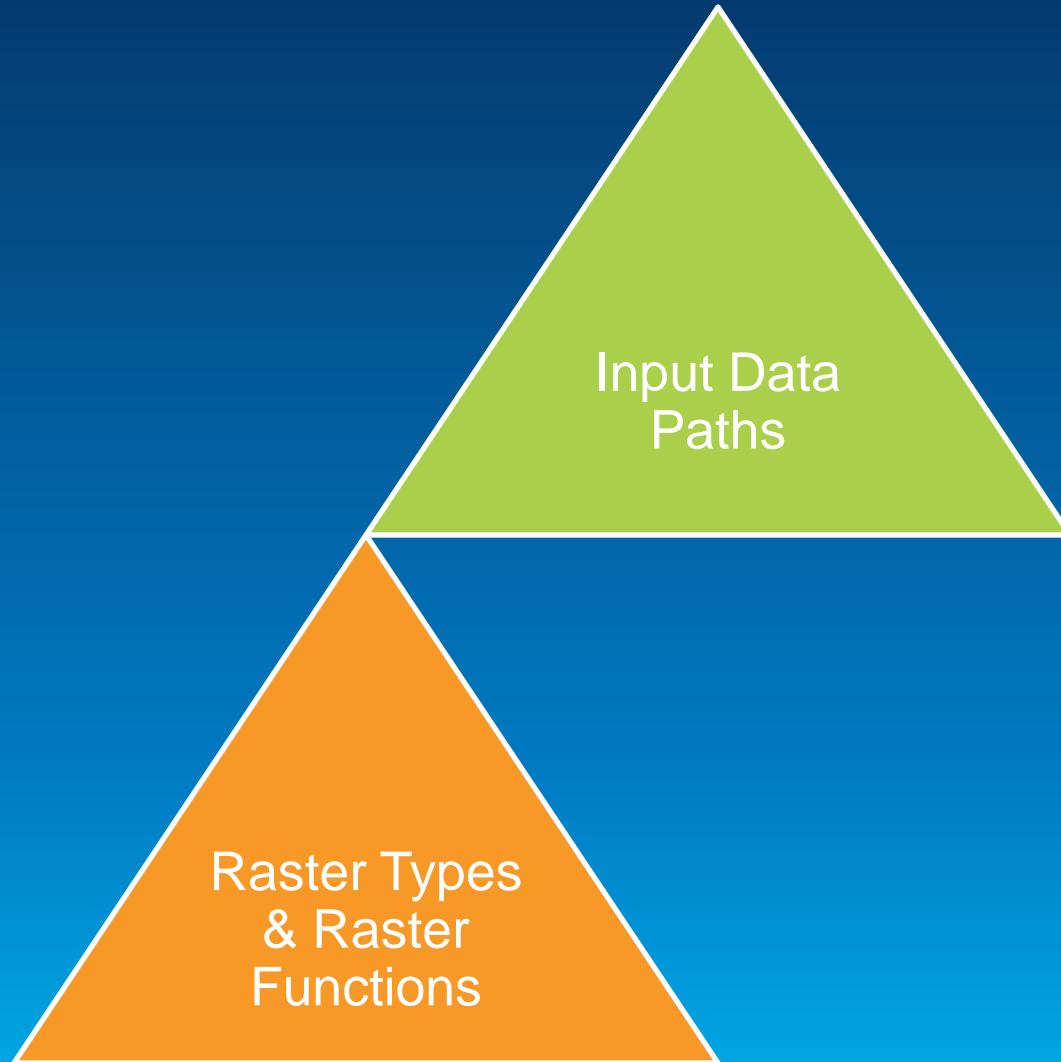
## Other features to note within MDCS

- Can run subsets of full configuration via command line options
- Built in version compatibility checks
- Extensible: additional commands can be added

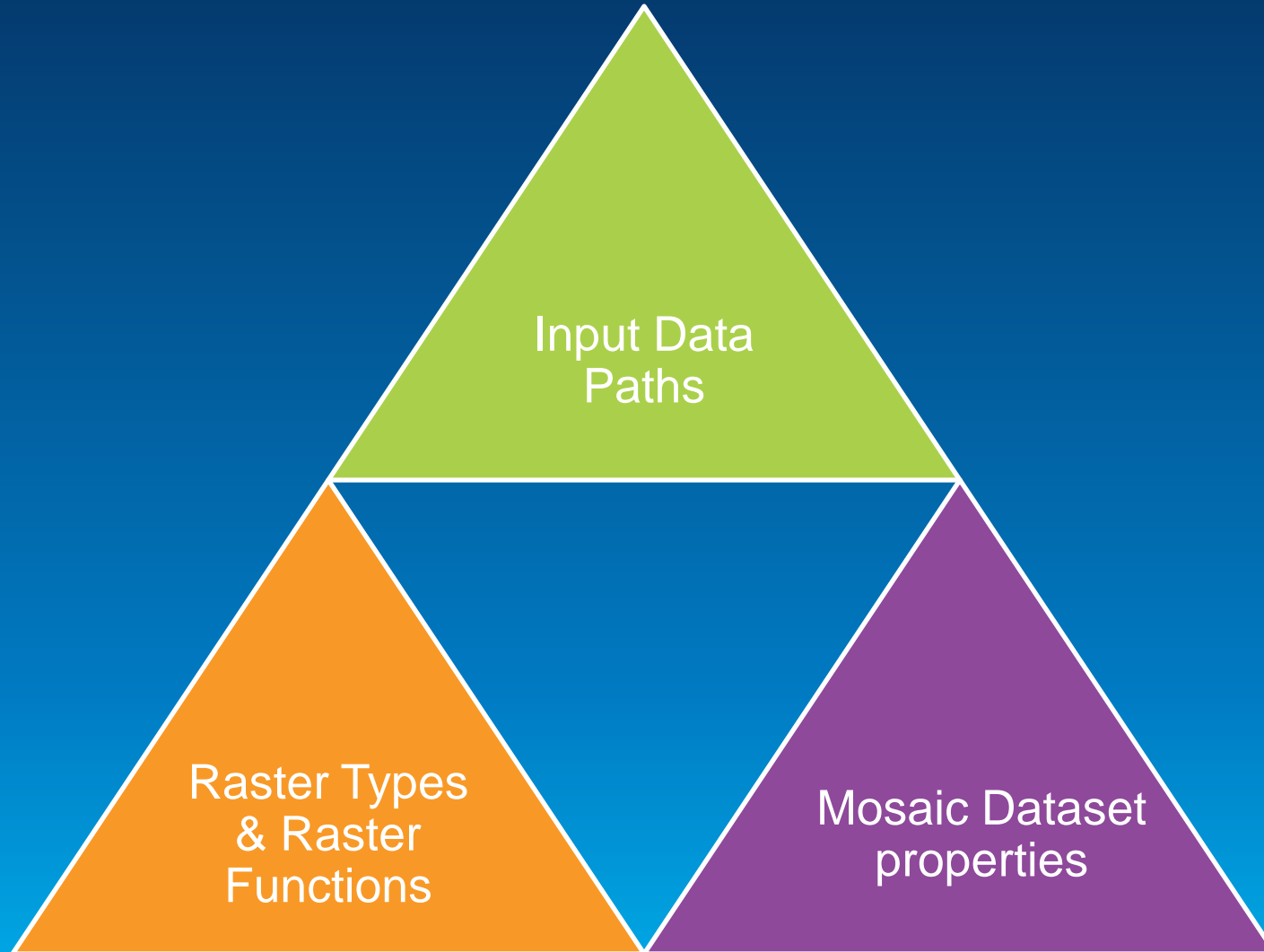
# Configuration file contents



# Configuration file contents

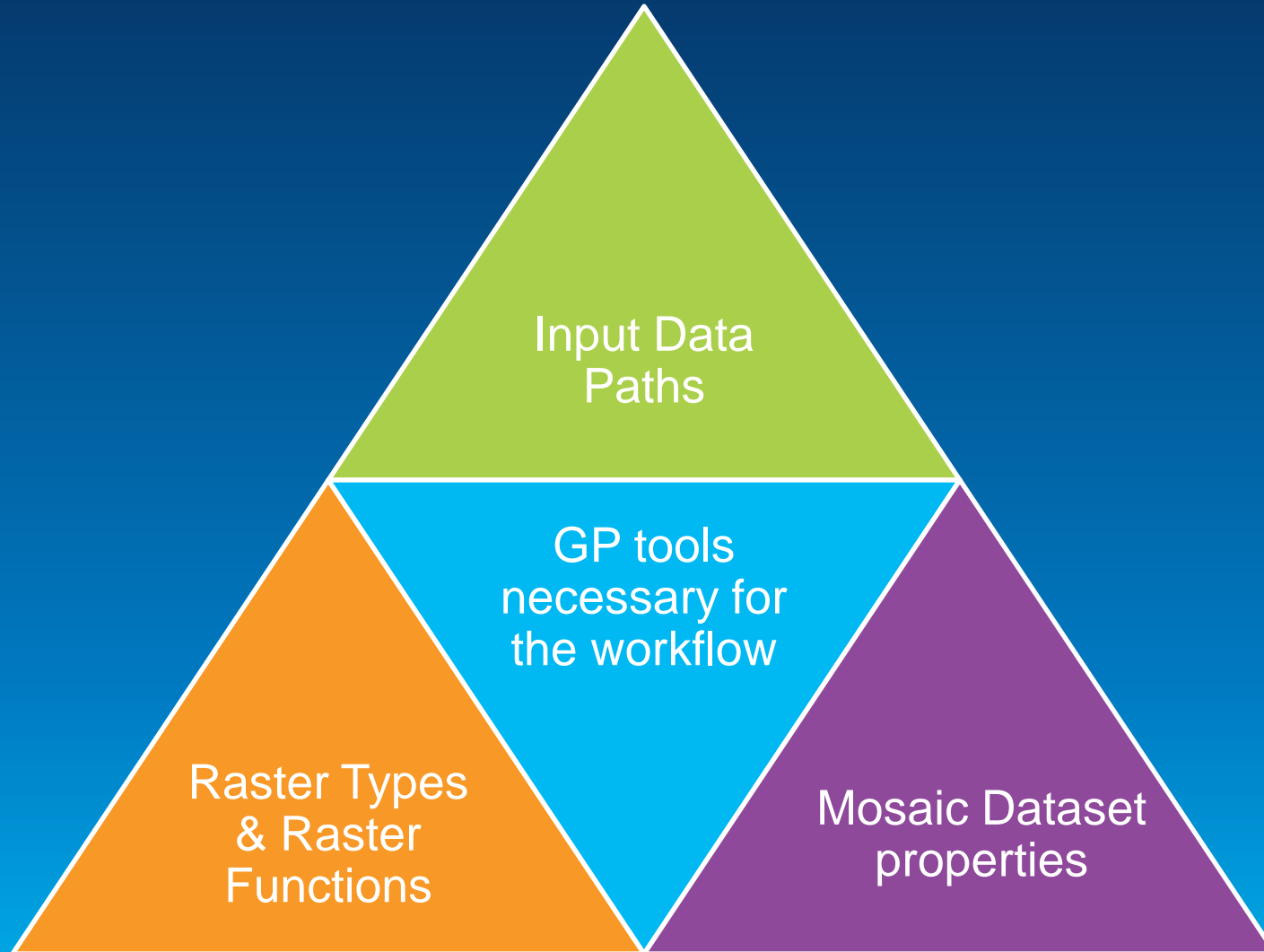


# Configuration file contents

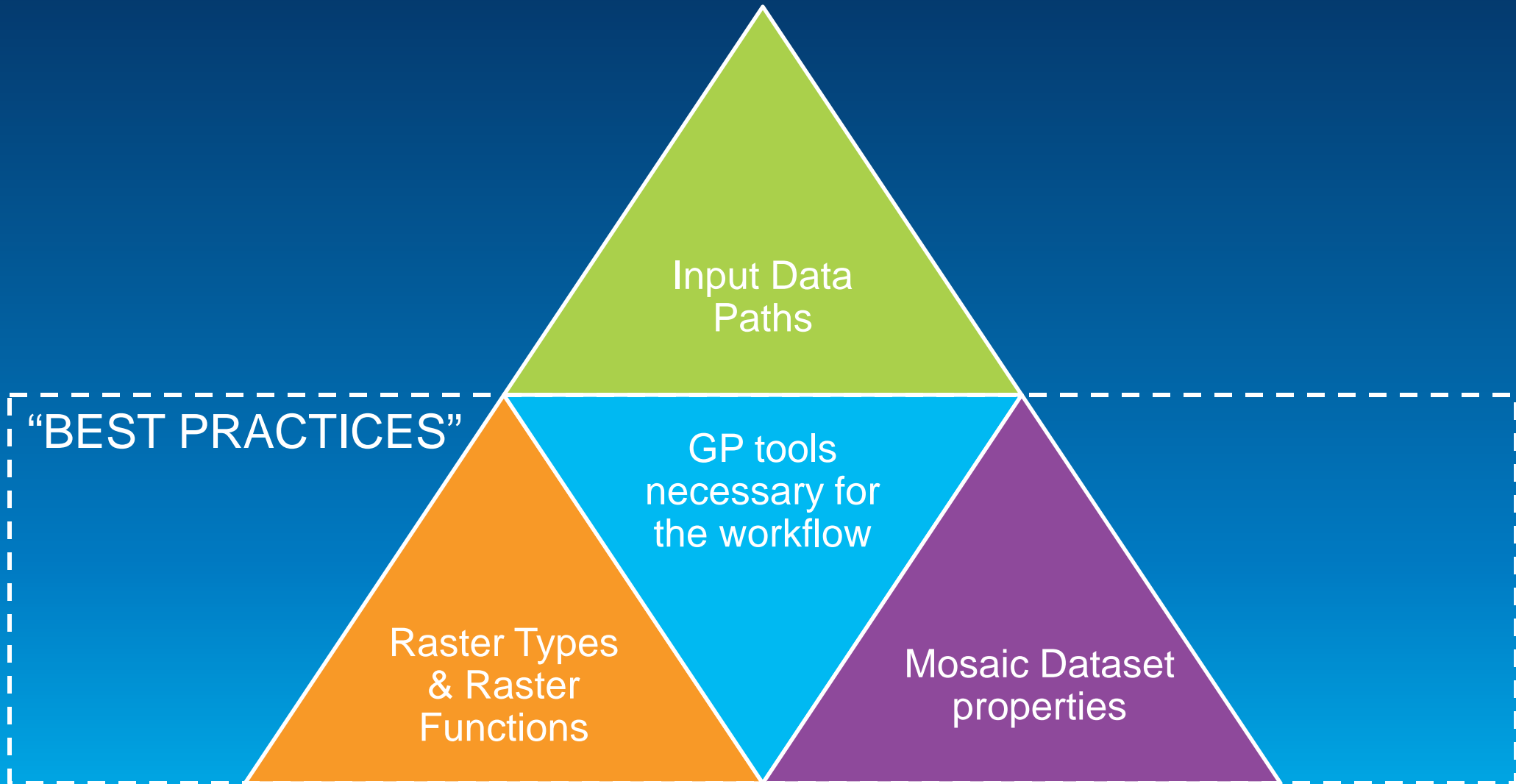




# Configuration file contents



# Configuration file contents



# Configuration XML

```
<AddRasters>
- <DefaultProperties>
  <RasterPerMosaic>50</RasterPerMosaic>
  <MaxRequestSizeX>4000</MaxRequestSizeX>
  <MaxRequestSizeY>4000</MaxRequestSizeY>
  <allowed_compressions>LZ77;NONE;LERC</allowed_compressions>
  <default_compression_type>LERC</default_compression_type>
  <CompressionQuality>75</CompressionQuality>
  <resampling_type>BILINEAR</resampling_type>
  <LERC_Tolerance>0.01</LERC_Tolerance>
  <clip_to_footprints>CLIP</clip_to_footprints>
  <clip_to_boundary>CLIP</clip_to_boundary>
  <color_correction>NOT_APPLY</color_correction>
  <footprints_may_contain_nodata>FOOTPRINTS_MAY_CONTAIN_NODATA</footprints_may_contain_nodata>
  <allowed_mensuration_capabilities>BASIC</allowed_mensuration_capabilities>
  <default_mensuration_capabilities>BASIC</default_mensuration_capabilities>
  <allowed_mosaic_methods>LockRaster;ByAttribute;Seamline;None</allowed_mosaic_methods>
  <default_mosaic_method>ByAttribute</default_mosaic_method>
  <Order_field>BEST</Order_field>
  <order_base>0</order_base>
  <sorting_order>Ascending</sorting_order>
  <mosaic_operator>FIRST</mosaic_operator>
  <blend_width>10</blend_width>
  <view_point_x>300</view_point_x>
  <view_point_y>300</view_point_y>
  <max_num_per_mosaic>50</max_num_per_mosaic>
  <cell_size_tolerance>999</cell_size_tolerance>
  <cell_size>#</cell_size>
  <metadata_level>BASIC</metadata_level>
  <transmission_fields>Name;MinPS;MaxPS;LowPS;HighPS;ProductName;BEST;Source;LE90;CE90;D
  <use_time>DISABLED</use_time>
```

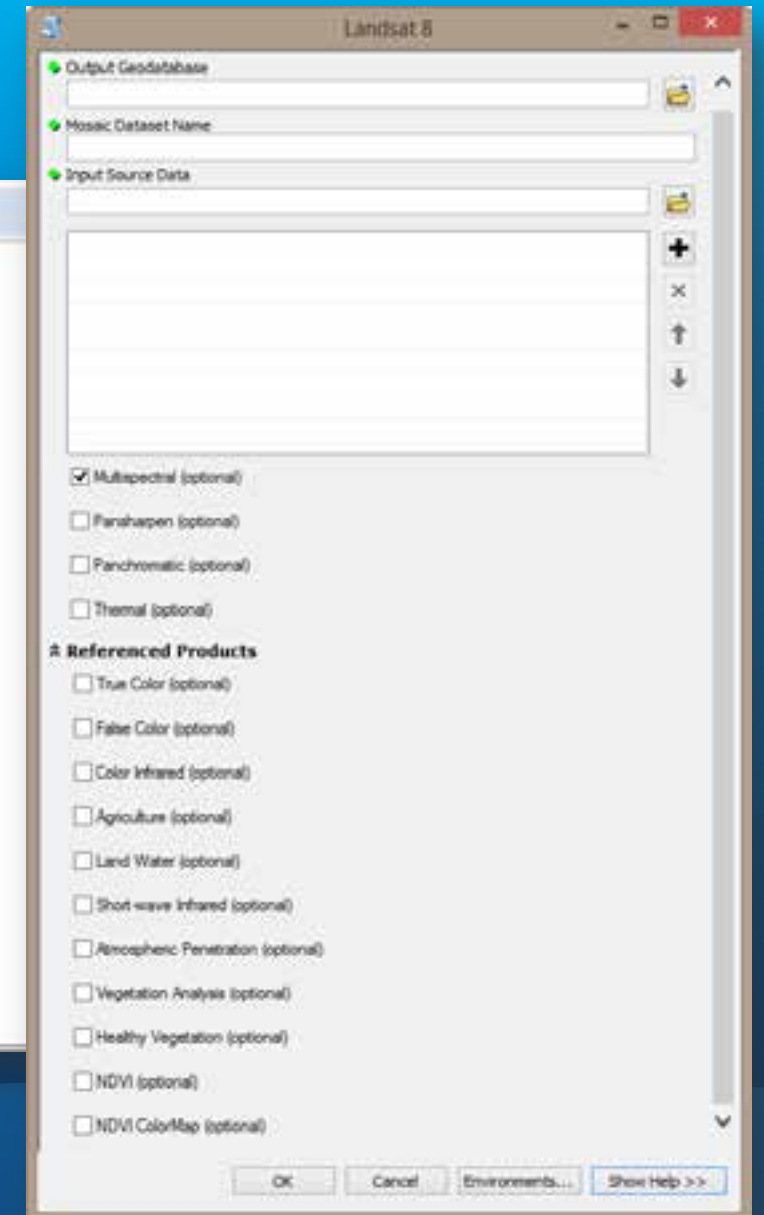
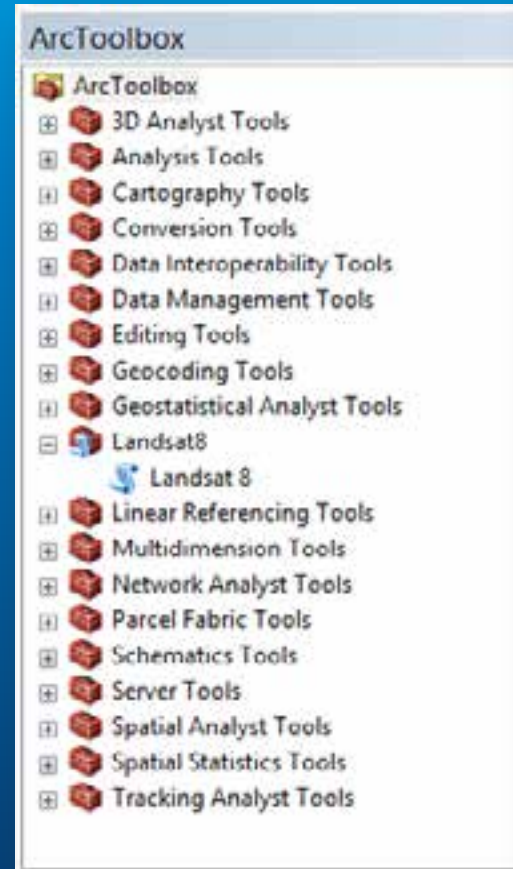
# Correlating XML to MD Properties

```
<Filter>*</Filter>
</AddRaster>
AddRasters>
defaultProperties>
<RasterPerMosaic>50</RasterPerMosaic>
<MaxRequestSizeX>4000</MaxRequestSizeX>
<MaxRequestSizeY>4000</MaxRequestSizeY>
<allowed_compressions>LZ77;NONE;LERC</allowed_co
<default_compression_type>LERC</default_compress
<CompressionQuality>75</CompressionQuality>
<resampling_type>BILINEAR</resampling_type>
<LERC Tolerance>0.01</LERC Tolerance>
<clip to footprints>CLIP</clip to footprints>
<clip to boundary>CLIP</clip to boundary>
<color_correction>NOT_APPLY</color_correction>
```

| Property                                   | Value  |
|--|--|
| <b>Image Properties</b>                    |  |
| Maximum Size of Requests                   |  |
| Rows                                       | 4000   |
| Columns                                    | 4000   |
| Allowed Compression Methods                | None,LZ77,LERC                               |
| Default Resampling Method                  | Bilinear Interpolation (for continuous d...) |
| Maximum Number of Rasters per Mosaic       | 50   |
| Cell Size Tolerance Factor                 | 0.800000                                     |
| Allowed Mosaic Methods                     | Center,NorthWest,LockRaster,ByAttri ...      |
| Default Sorting Order                      | Ascending                                    |
| Default Mosaic Operator                    | First  |
| Blend Width Unit                           | Pixels                                       |
| Blend Width                                | 10.000000                                    |
| <b>Viewpoint Settings</b>                  |  |
| Viewpoint Spacing X                        | 600.000000                                   |
| Viewpoint Spacing Y                        | 300.000000                                   |
| Always Clip the Raster to its Footprint    | Yes  |
| Footprints May Contain NoData              | Yes  |
| Always Clip the mosaic dataset to its B... | Yes  |
| Apply Color Correction                     | No   |
| Minimum Pixel Contribution                 | 1  |
| <b>Catalog Properties</b>                  |  |
| Raster Metadata Level                      | Full   |
| Maximum Number of Records Returned...      | 1000   |
| Allowed Fields                             | Name,MinPS,MaxPS,LowPS,HighPS,Ta             |

# MDCS GP Tools

- Geoprocessing tool interface for end users.
- Allows users to define output GDB, mosaic dataset name and input directory.
- Checkboxes are used to trigger elements of MDCS that create products.
- Allows users to output mosaic dataset product as well as referenced mosaic dataset products.
- Customizable





# Python toolbox code

- Controls toolbox/tool labelling
- Validates parameters
- Formats parameters
- Verifies license level
- Passes parameters into MDCS

```
class Toolbox(object):
    def __init__(self):
        """Define the toolbox (the name of the toolbox is the name of the
        .pyt file)."""
        self.label = "Landsat8"
        self.alias = ""
```

```
args= []
args = [pythonPath, os.path.join(solutionLib_path, 'MDCS.py'), '#gprun']
if (parameters[i].category == 'Referenced Products'):
    configName = "GP_R_" + parameters[i].name + '.xml'
    mdName = parameters[1].valueAsText + str(master) + '_' + parameters[i].name
```

```
def getParameterInfo(self):

    ref = 'Referenced Products'

    """Define parameter definitions"""
    in_worksapce = arcpy.Parameter(
        displayName="Output Geodatabase",
        name="in_worksapce",
        datatype="DEType",
        parameterType="Required",
        direction="Input")

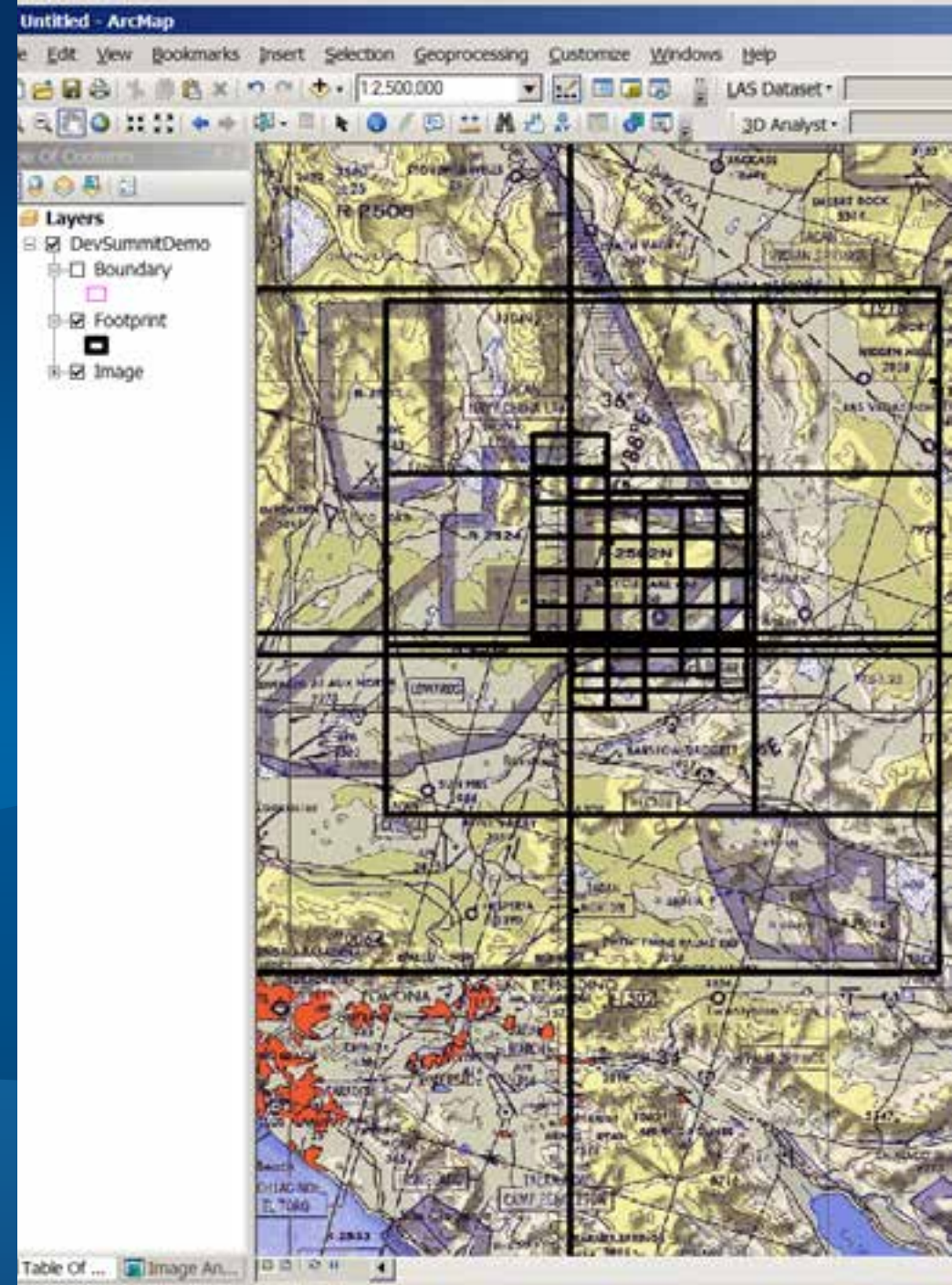
    in_mosaicdataset_name = arcpy.Parameter(
        displayName="Mosaic Dataset Name",
        name="in_mosaicdataset_name",
        datatype="GPString",
        parameterType="Required",
        direction="Input")

    input_path = arcpy.Parameter(
        displayName="Input Source Data",
        name="input_path",
        datatype= 'DEType',
        parameterType="Required",
        direction="Input",
        multiValue=True)

    ms = arcpy.Parameter(
        displayName="Multispectral",
        name="MS",
        datatype="GPBoolean",
        parameterType="Optional",
        direction="Input")
    ms.value = True
```

# Demo - MDCS

Multi-resolution scanned maps



# Advanced Image Data Management Objectives/Tasks

- **Multiresolution, Multi-date image collections**
- **Updating existing Mosaic Datasets**



# Managing large image collections

- Best practices implicit in the design of MDCS
- Key field in configuration file “MD Type”, with allowable values:
  - *Source*
  - *Derived*
  - *Referenced*

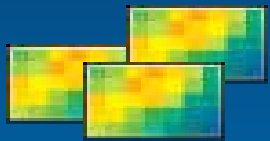
```
<?xml version="1.0"?>
- <Application>
  <Name>Elevation_Project</Name>
  <Command>CM+AF+AR+CC+CV+BB+SP+SS</Command>
  - <Workspace>
    <WorkspacePath>MD</WorkspacePath>
    <Geodatabase>Sample2.gdb</Geodatabase>
  - <MosaicDataset>
    <MosaicDatasetType>Source</MosaicDatasetType>
    <Name>S_SRTM</Name>
```

- For simple systems, use “Source” and stop here!...

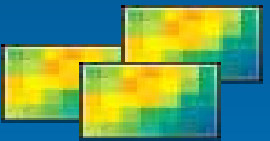
# Source Mosaic Datasets

Source Imagery

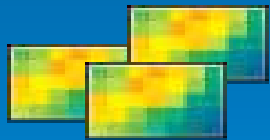
Source Mosaic Datasets



2004



2007

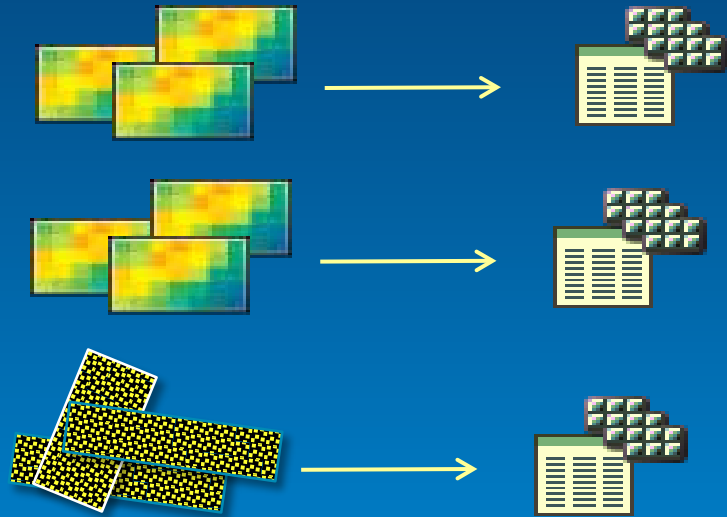


2010

# Source Mosaic Datasets

Source Imagery

Source Mosaic Datasets

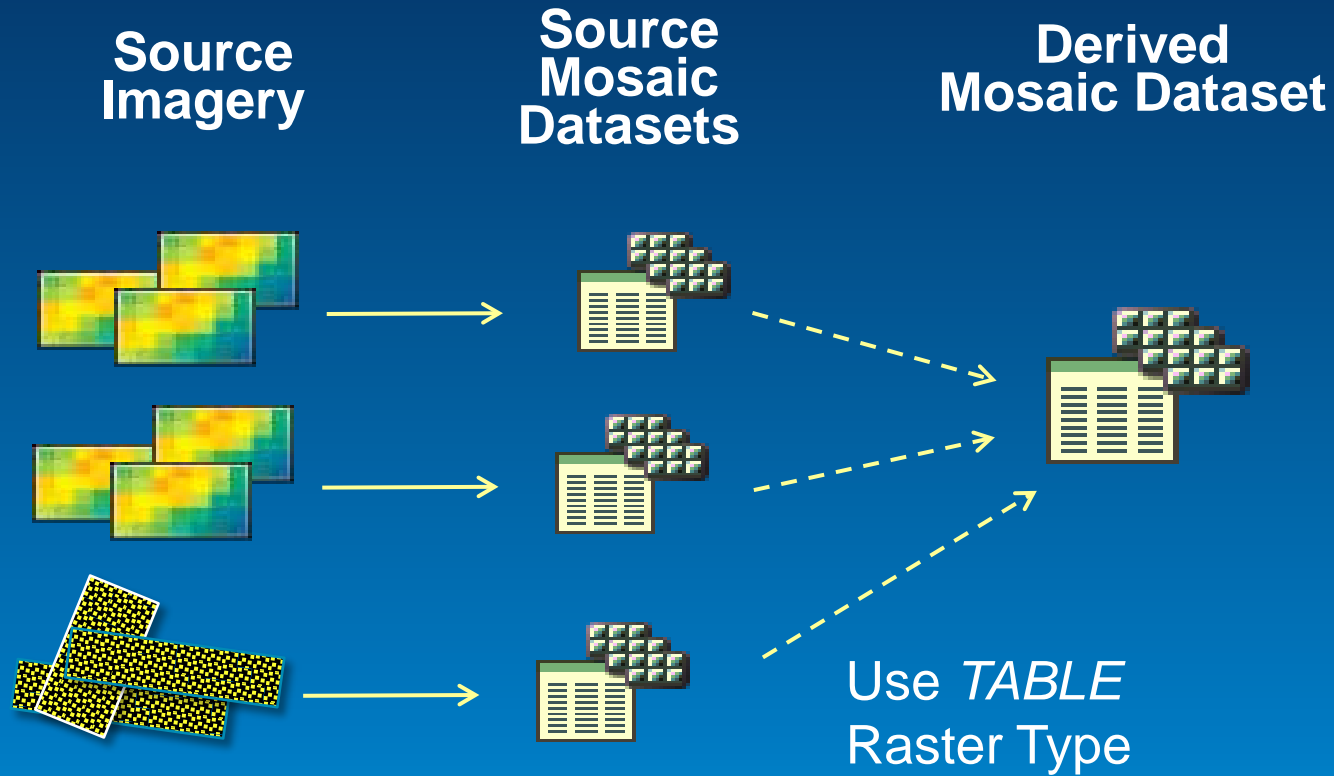


SRTM

NED 1/3 arcsec

LiDAR Project #N

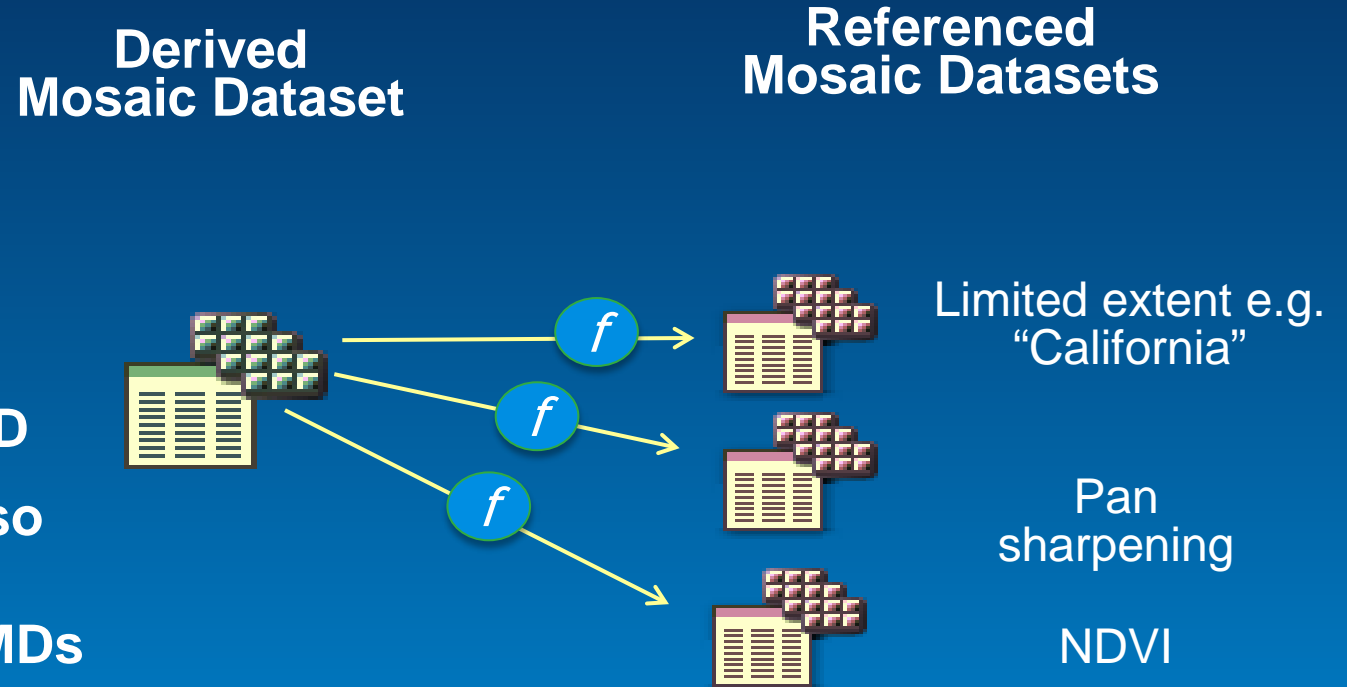
# Combine into Derived Mosaic Dataset



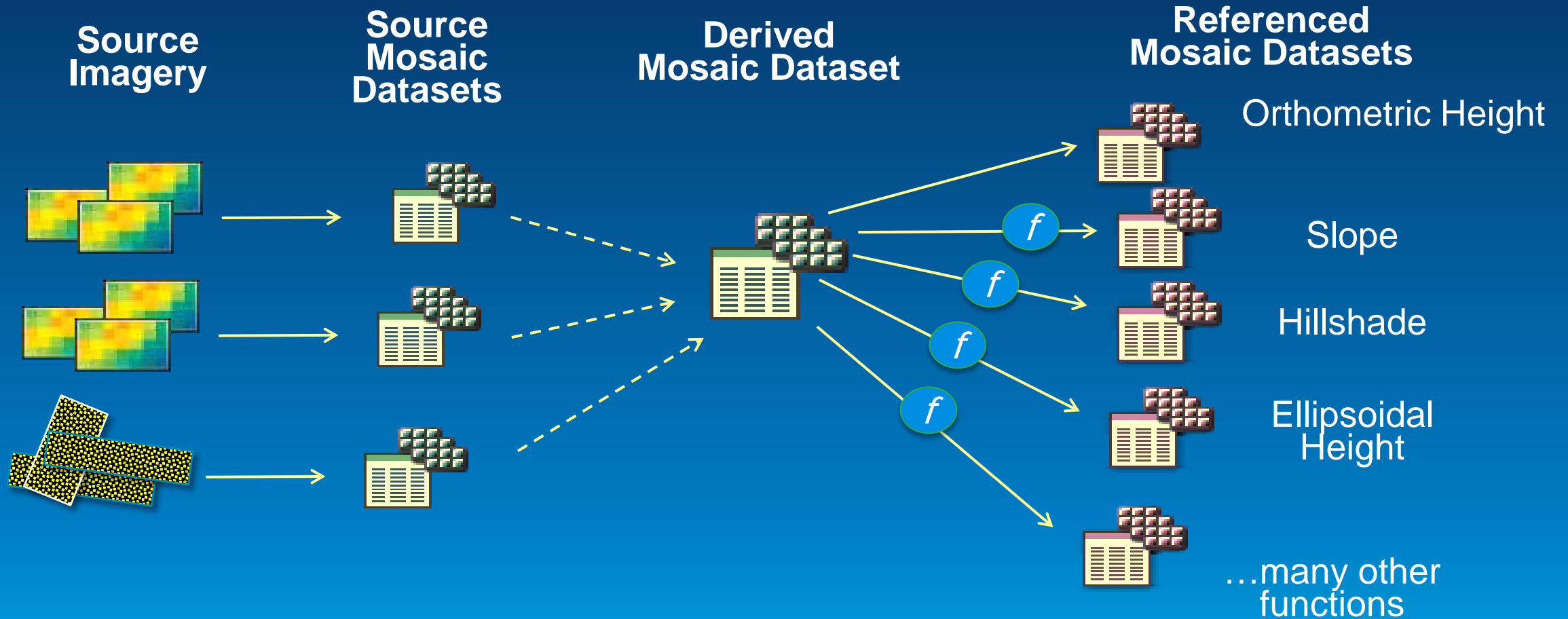
Advantage: All image data available in a single location

# Referenced Mosaic Datasets

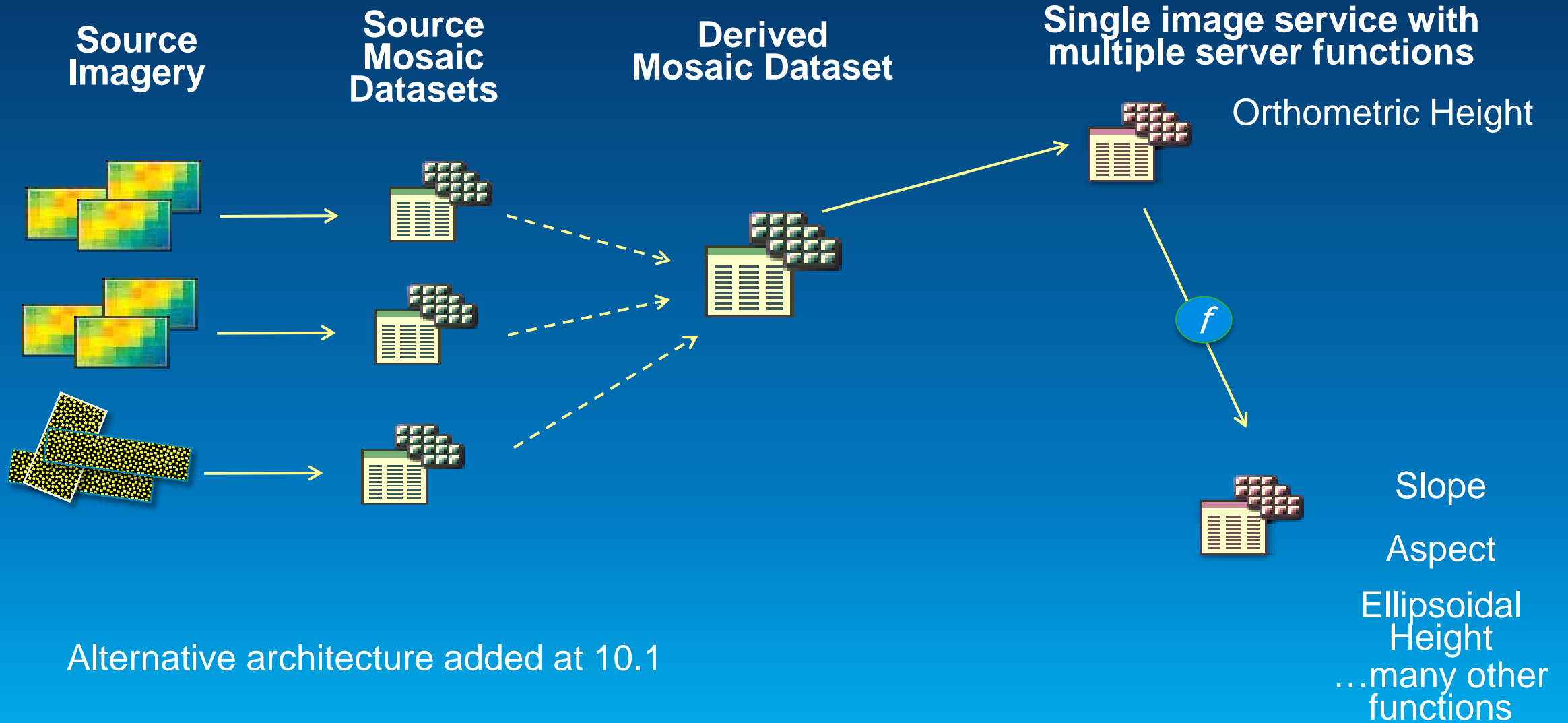
- Read-only copies of the parent MD
- Referenced MDs are live copies, so any changes in the parent are immediately available in the Ref MDs
- Functions applied on-the-fly; no need to write new raster to disk



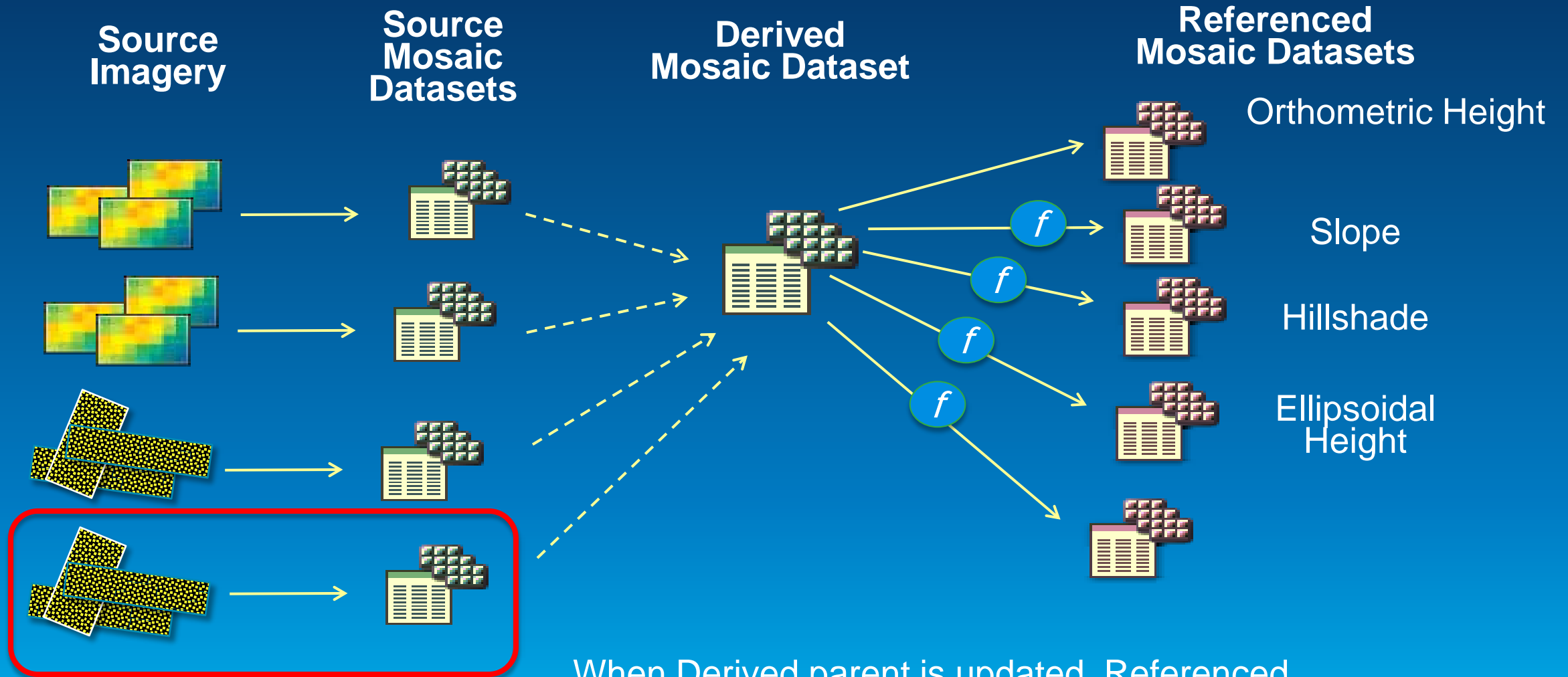
# Example – ArcGIS World Elevation



# Example – ArcGIS World Elevation – Server Raster Functions



# Example – ArcGIS World Elevation



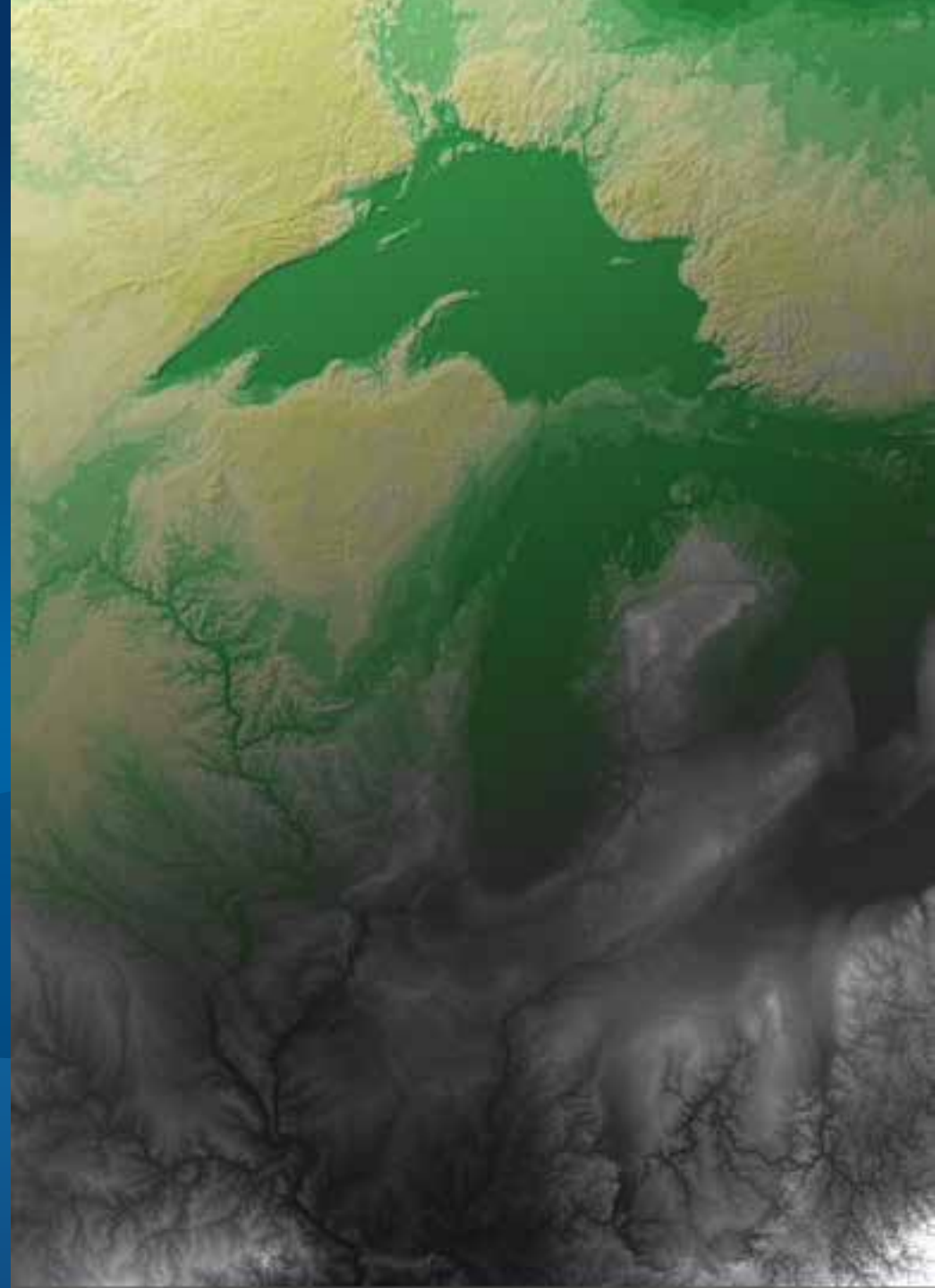
When Derived parent is updated, Referenced Mosaic Datasets synch automatically



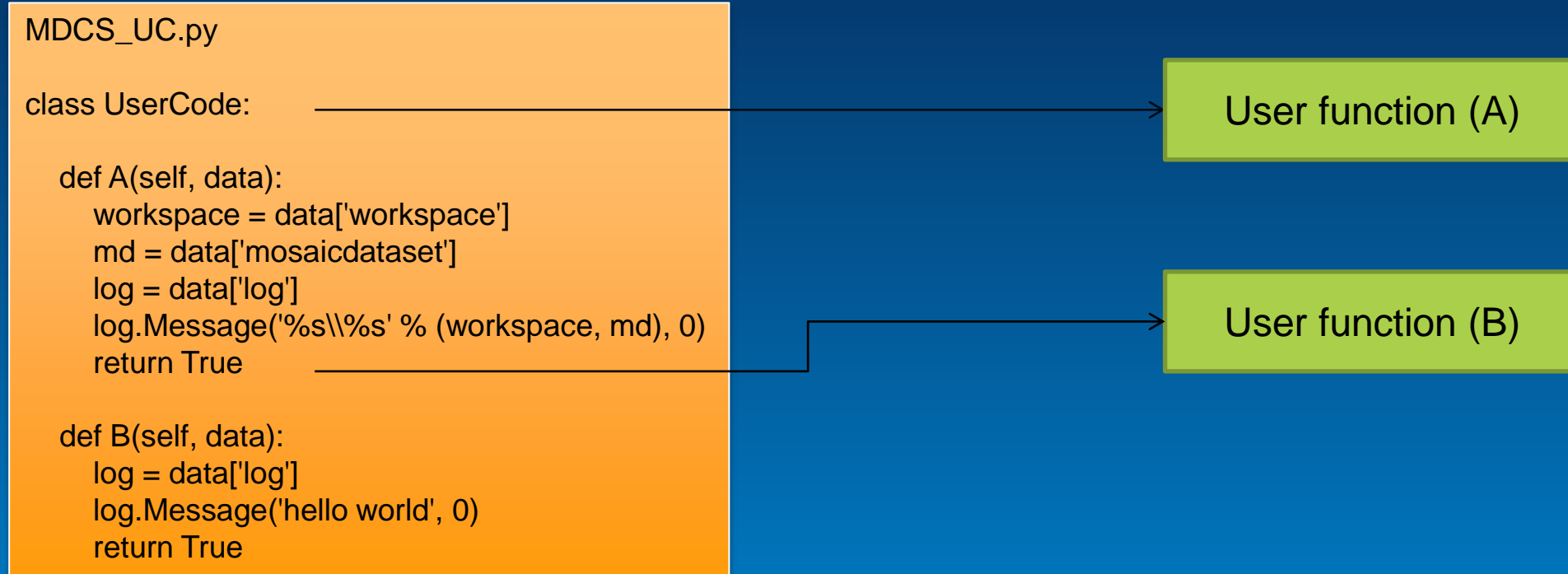
# Demo - MDCS

Worldwide elevation data, with  
on-the-fly derived products

Adding Lidar



# MDCS extensibility: User Code module



```
C:\> python.exe MDCS.py -c:CM+A+B+AR
```

# Finding MDCS and related resources

- Landing page on Resource Center

ArcGIS Resources ArcGIS Online Sign in English 

[Home](#) [Communities](#) [Help](#) [Blog](#) [Forums](#) [Videos](#)

## Image Management Workflows

Communities / Imagery

Manage collections of imagery in ArcGIS using a mosaic dataset.

Share your collections online as image services.

ArcGIS enables you to work with a wide variety of imagery acquired from different sources. These image management workflows provide best practices for managing large collections of imagery to make the imagery quickly and efficiently accessible. The image management workflows are described in the [Image Management Guidebook](#) which begins with a general overview of all aspects related to image management workflows listed below.

The following additional components unique to each workflow are referenced below:

- Scripts and associated documentation for the automation of workflows.
- Sample data to be used with the scripts to create sample mosaic datasets and image services.
  - See [this Group on ArcGIS Online](#) for workflow-specific example scripts and data, as well as the underlying [Mosaic Dataset Configuration Script \(MDCS\)](#) which is used for all workflows.
- Links to live example services on ArcGIS Online.
- Links to other resources such as Forums, Blogs, and Help system.

Following are the workflows that are currently being documented. If you have questions, please do check out the corresponding FAQs and post questions (and answers) to Forums, and alternatively let our team know by sending email to [ImageManagementWorkflows@esri.com](mailto:ImageManagementWorkflows@esri.com).

### Multispectral Satellite Imagery

This workflow addresses management of imagery from medium (5-30m) and low resolution (>30m) satellites, such as RapidEye, SPOT, Landsat & ASTER. This imagery is commonly used for regional or country-wide assessment and monitoring. Typical applications include agricultural or environmental monitoring. A significant value of images from these satellites are multispectral that support a wide range of applications, which rely on analysis utilizing the different spectral bands. Aspects such as atmospheric correction are of higher importance. By



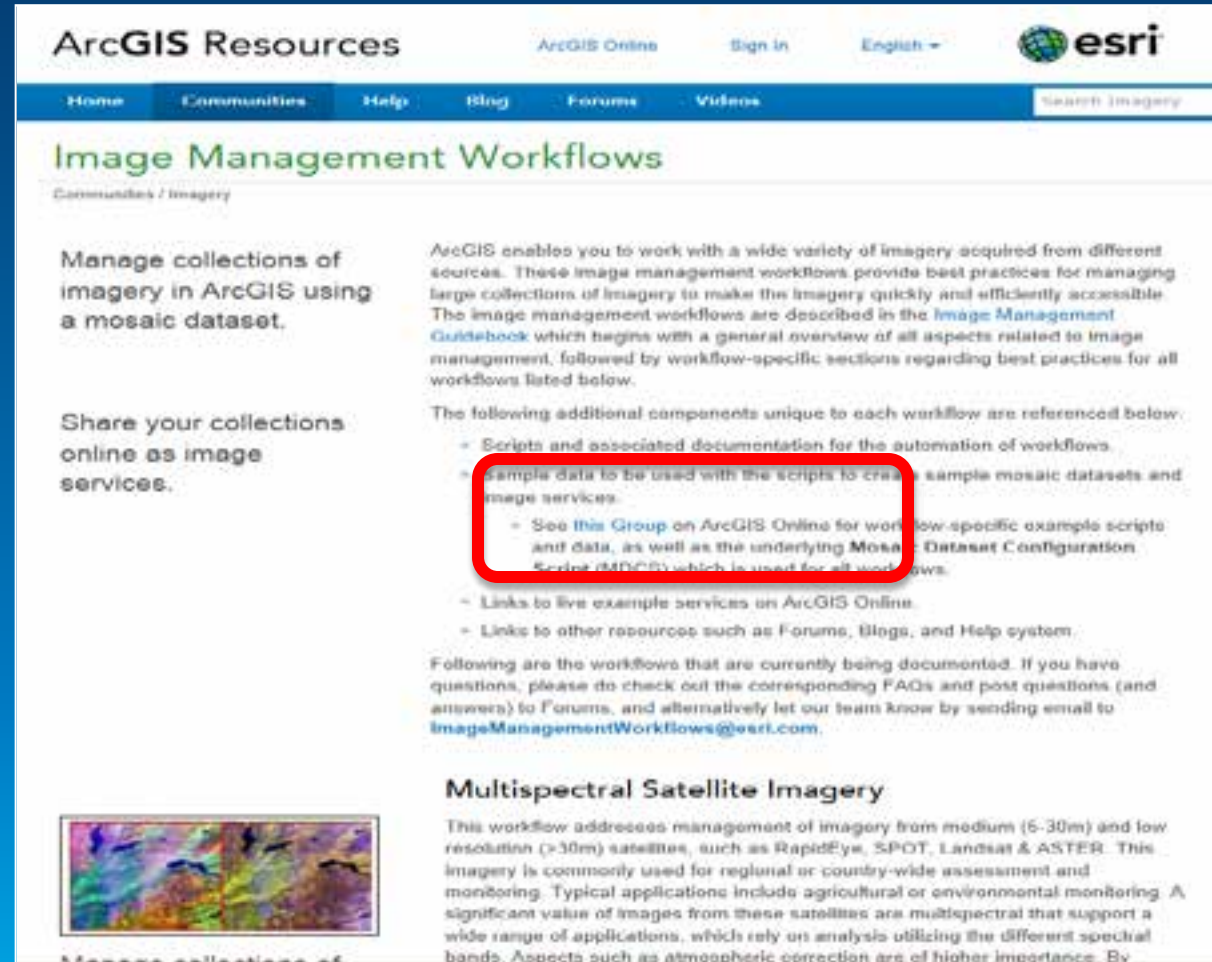
# Finding MDCS and related resources

- Image Management Guidebook in ArcGIS Help System

The screenshot displays the ArcGIS Resources website. At the top, the header includes 'ArcGIS Resources' on the left, and 'ArcGIS Online', 'Sign In', and 'English' on the right, along with the Esri logo. A navigation bar below the header contains links for 'Home', 'Communities', 'Help', 'Blog', 'Forums', and 'Videos'. A search bar on the right of the navigation bar is labeled 'Search Imagery'. The main content area is titled 'Image Management' in green text, with 'Help' written below it. On the right side of the main title, there are links for 'FEEDBACK | PRINT | EMAIL'. A left-hand navigation pane lists various topics under 'Image Management', including 'Standard Workflow', 'Overview', 'Data sources and formats', 'Data structure', 'Metadata', 'Preprocessing', 'Mosaic dataset design', 'Source mosaic datasets', 'Derived mosaic datasets', 'Referenced mosaic datasets', 'Publishing', 'Caching', 'Optimization', 'Maintenance', 'Elevation data', and 'Browse Imagery'. The main content area features a heading 'Image Management' with navigation arrows, followed by three paragraphs of introductory text. The first paragraph states the guidebook's purpose for supporting data managers. The second paragraph describes the scope of the guide, covering various data types and the full lifecycle from cataloging to serving. The third paragraph notes the target audience and the guide's role as a supplement to other help documentation. At the bottom of the page, there is a copyright notice: 'Copyright © 1995-2013 Esri. All rights reserved.' and the date '10/28/2013'.

# ArcGIS Online (AGOL) group

- Downloadable examples
- More workflows/templates to be added over time



The screenshot shows the ArcGIS Resources website page for "Image Management Workflows". The page header includes "ArcGIS Resources", "ArcGIS Online", "Sign In", "English", and the Esri logo. A navigation bar contains "Home", "Communities", "Help", "Blog", "Forums", and "Videos", along with a "Search Imagery" box. The main heading is "Image Management Workflows" with a sub-heading "Communities / Imagery".

**Manage collections of imagery in ArcGIS using a mosaic dataset.**

**Share your collections online as image services.**

ArcGIS enables you to work with a wide variety of imagery acquired from different sources. These image management workflows provide best practices for managing large collections of imagery to make the imagery quickly and efficiently accessible. The image management workflows are described in the [Image Management Guidebook](#) which begins with a general overview of all aspects related to image management, followed by workflow-specific sections regarding best practices for all workflows listed below.


The following additional components unique to each workflow are referenced below:

- Scripts and associated documentation for the automation of workflows.
- Sample data to be used with the scripts to create sample mosaic datasets and image services.
  - See [this Group](#) on ArcGIS Online for workflow-specific example scripts and data, as well as the underlying [Mosaic Dataset Configuration Script \(MDCS\)](#) which is used for all workflows.
- Links to live example services on ArcGIS Online.
- Links to other resources such as Forums, Blogs, and Help system.

Following are the workflows that are currently being documented. If you have questions, please do check out the corresponding FAQs and post questions (and answers) to Forums, and alternatively let our team know by sending email to [ImageManagementWorkflows@esri.com](mailto:ImageManagementWorkflows@esri.com).

### Multispectral Satellite Imagery

This workflow addresses management of imagery from medium (5-30m) and low resolution (>30m) satellites, such as RapidEye, SPOT, Landsat & ASTER. This imagery is commonly used for regional or country-wide assessment and monitoring. Typical applications include agricultural or environmental monitoring. A significant value of images from these satellites are multispectral that support a wide range of applications, which rely on analysis utilizing the different spectral bands. Aspects such as atmospheric correction are of higher importance. By





# ArcGIS Online (AGOL) group

- Downloadable examples
- More workflows/templates to be added over time



The screenshot shows the ArcGIS Image Management Workflows group page. At the top, there is a blue header with the ArcGIS logo and the group name. Below the header, there are buttons for "LEAVE THIS GROUP" and "SHARE". A description of the group is provided, followed by a table of resources. The table has columns for Title, Owner, Rating, Views, and Date. Three resources are listed: "Raster Tile Cache Tools", "ElevationScripts", and "Elevation Sample Data Download". Each resource includes a thumbnail, a description, the owner, the last modified date, and a rating.

## ArcGIS Image Management Workflows

[LEAVE THIS GROUP](#) [SHARE](#)

This group includes resources associated with Esri's "best practices" for managing & serving large collections of imagery. Resources include sample data and Python scripts, links to documentation, and example image services and web applications. ↕

| Title   | Owner                | Rating | Views | Date             |
|---|----------------------|--------|-------|------------------|
|  Raster Tile Cache Tools<br>Python scripts for creating, packaging, and sharing raster tile cache of imagery, including metadata support.<br>Geoprocessing Sample by ImageryWorkflowsTeam<br>Last Modified: January 28, 2014<br>(0 ratings, 0 comments, 0 downloads)   | ImageryWorkflowsTeam |        |       | January 28, 2014 |
|  ElevationScripts<br>A ZIP archive containing Python scripts & ModelBuilder examples for building a multisource, multiresolution elevation mosaic dataset and multiple ancillary products (Hillshade, Slope, and others).<br>Code Sample by ImageryWorkflowsTeam<br>Last Modified: January 6, 2014<br>(0 ratings, 0 comments, 1 download)     | ImageryWorkflowsTeam |        |       | January 6, 2014  |
|  Elevation Sample Data Download<br>This is a ZIP archive containing public domain elevation data. This data is used by the sample scripts in this group for building a multi-source & multi-resolution mosaic dataset and numerous ancillary products (e.g. hillshade, slope, aspect, more).<br>Geoprocessing Sample by ImageryWorkflowsTeam | ImageryWorkflowsTeam |        |       |                  |

## Resources: “Imagery Management Workflows”

- Imagery Resource Center : <http://esriurl.com/6005>
- Image Management Workflows: <http://esriurl.com/6550>
- Guidebook in ArcGIS Help: <http://esriurl.com/6007>
- ArcGIS Online Group: <http://esriurl.com/6539>
- Available soon on Github



- Cody Benkelman [cbenkelman@esri.com](mailto:cbenkelman@esri.com)
- Jamie Drisdelle [jdrisdelle@esri.com](mailto:jdrisdelle@esri.com)

PLEASE fill out a SURVEY! Offering ID: 3019 <http://esriurl.com/survey>



Understanding our world.