

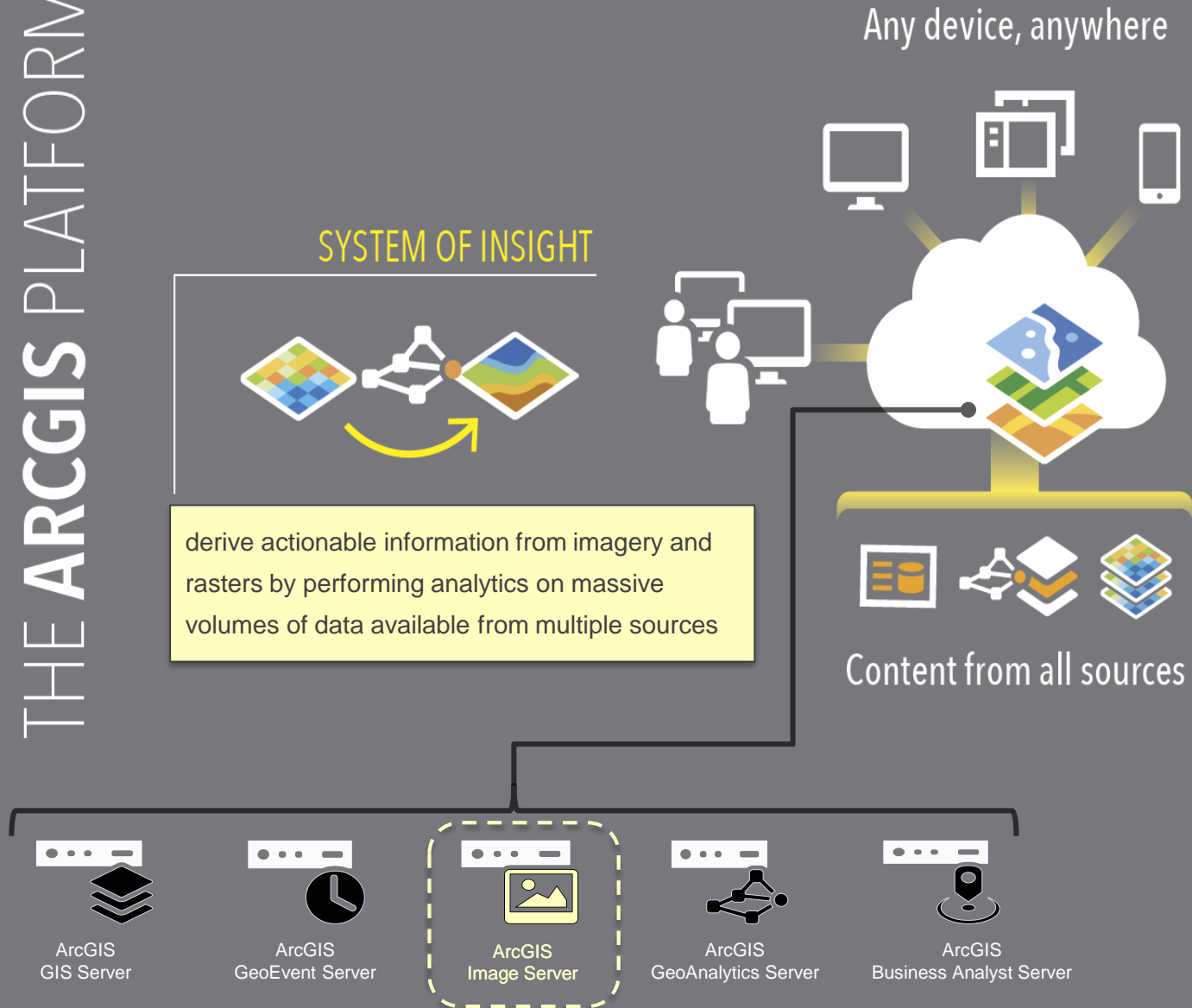
Raster Analytics in Image Server: An Introduction

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Introduction and Context

The ArcGIS Platform and ArcGIS Image Server

THE ARCGIS PLATFORM



SYSTEM OF ENGAGEMENT



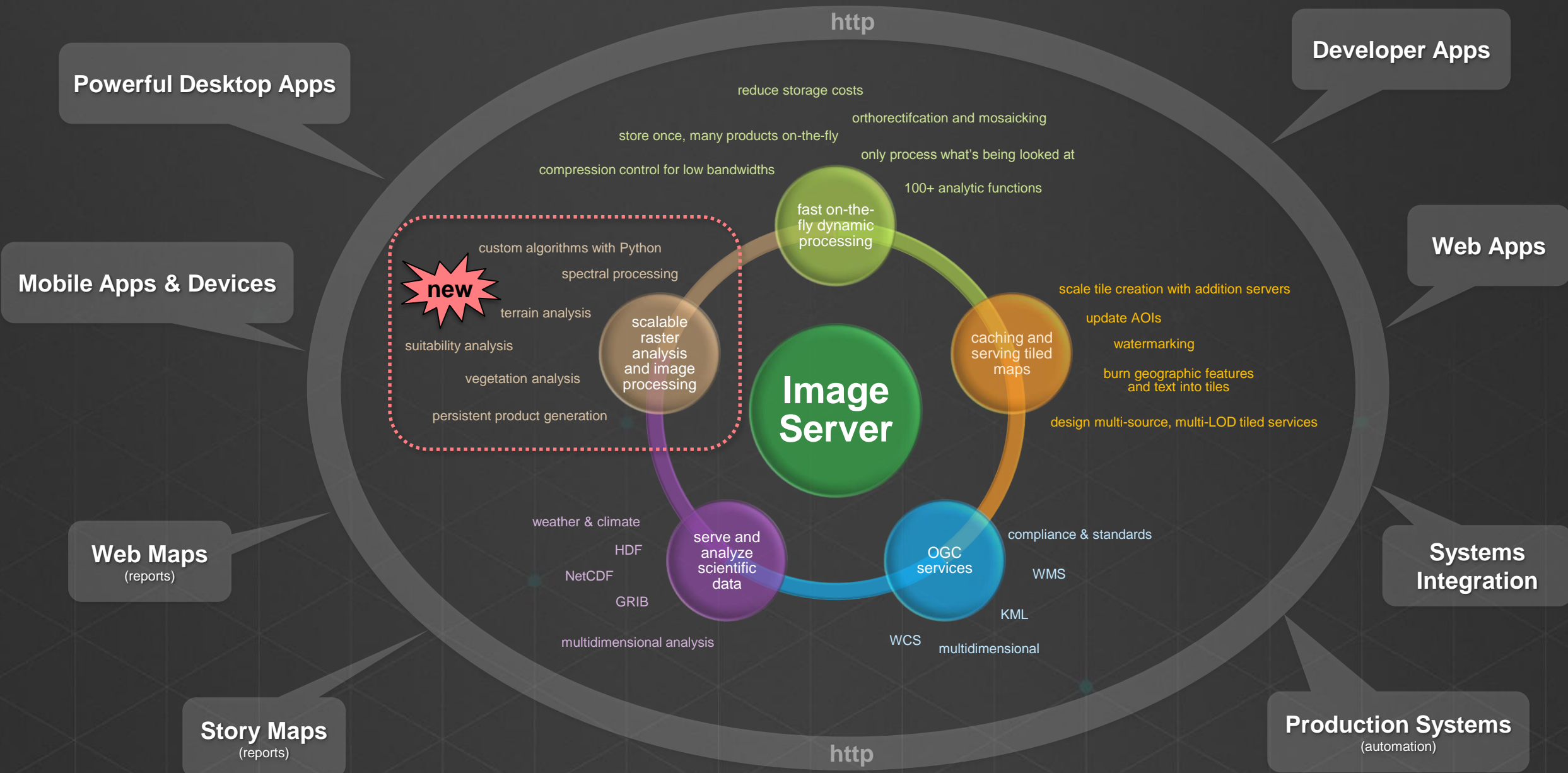
enable access to imagery and analysis through a wide range of integrated desktop, mobile, and web applications that are interactive, informative, and engaging

SYSTEM OF RECORD



manage and process imagery into authoritative data sources that are appropriately and efficiently disseminated to those that need access

ArcGIS Image Server 10.5



Raster Analytics

ArcGIS 10.5+

What is Raster Analytics?

- ***ArcGIS has a new way to create and execute spatial analysis models and image processing chains which leverage distributed storage and analytics***
 - **Raster Analytics works with your existing GIS data and imagery**
 - register your data and go, importing existing data to distributed storage is not mandatory
 - **Raster Analytics can optimize your data for distributed analytics**
 - import your data into ArcGIS distributed storage which further improves the scalability of distributed analytics
 - **Raster Analytics is designed to scale with your organization's demands**
 - scale up to get the job done, scale down when resources are no longer needed

Raster Analytics Foundational Concepts

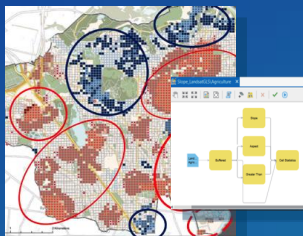
- Raster Analytics adds to existing ArcGIS foundational concepts

Dynamic Raster Models



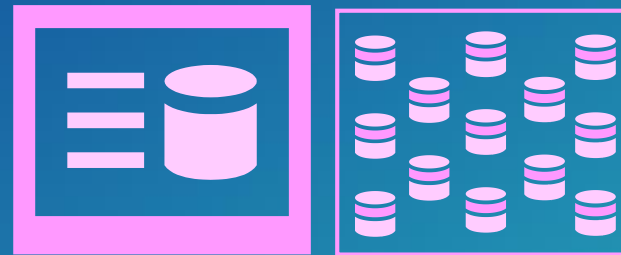
on-the-fly processing

Geoprocessing Models



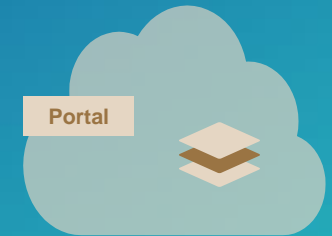
powerful analytics

Server-based Distributed Raster Analytics with Distributed Raster Data Storage



(persistent) distributed analytics with optional distributed storage for even greater scalability

Web GIS Layers



rich geoinformation model

more

more

new

extends

Solve New Problems with Raster Analytics

- **run models against data that is too big for single desktop**
 - small and medium scale global rasters (big geography)
 - large scale local or regional rasters (high resolution)
- **run models against massive collections and scale it**
- **run models and meet time constraints**



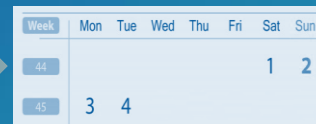
January	February	March	April
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September	October	November	December
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months

November

Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
43						1	2
44	3	4	5	6	7	8	9
45	10	11	12	13	14	15	16
46	17	18	19	20	21	22	23
47	24	25	26	27	28	29	30

weeks



Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
44						1	2
45	3	4					

days



hours



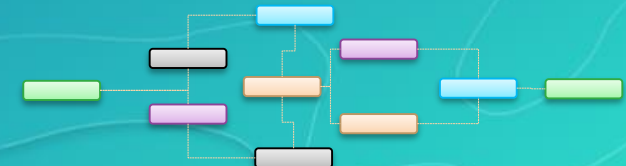
minutes

Raster Analytics is Powerful

- run a model based on a single function

Math	Square Square Root Times Bitwise And Bitwise Left Shift Bitwise Not Bitwise Or Bitwise Right Shift Bitwise Xor Boolean And Boolean Not Boolean Or Boolean Xor Equal To Greater Than Greater Than Equal Is Null Less Than Less Than Equal	Not Equal ArgStatistics Cell Statistics Statistics ACos ACosH ASin ASinH ATan ATan2 ATanH Cos CosH Sin SinH Tan TanH	Correction Apparent Reflectance Geometric Correction Speckle Filtering (Lee,Frost,Kuan)	Visualization & Appearance Contrast and Brightness Convolution Pansharpener Resample Statistics and Histogram Stretch	Analysis: Density Kernel Density	Analysis: Band Math & Indices NDVI / NDVI Colorized SAVI / MSAVI / TSAVI GEMI GVI (Landsat TM) PVI Tasseled Cap (Kauth-Thomas) Binary Thresholding	Python Custom Algorithms
Abs Arithmetic Band Arithmetic Calculator Divide Exp Exp10 Exp2 Float Int Ln Log10 Log2 Minus Mod Negate Plus Power Round Down Round Up				Analysis: Overlay Weighted Sum Weighted Overlay			
				Analysis: Zonal Zonal Statistics			
			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	Interpolation Natural Neighbor Nearest Neighbor Inverse Distance Weighted Empirical Bayesian Kriging Swath	Analysis: Image Segmentation & Classification Segmentation (Mean Shift) Training (ISO, ML, Support Vector Machine,Random Trees) Classification		
Conditionals Con Set Null				Surface Generation & Analysis Aspect Curvature Elevation Void Fill Hillshade Shaded Relief Slope Viewshed			

- run a model by combining many functions



Raster Analytics is Easy

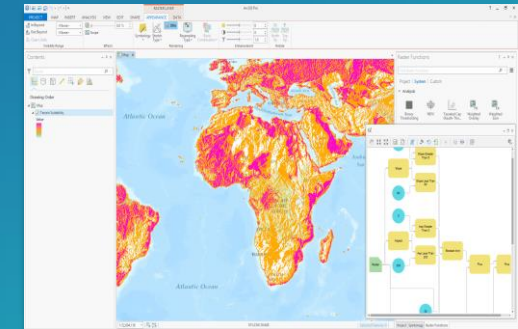
- easy to get started, it is **“out of the box analytics”**

- install on nodes -> start Raster Analytic services -> go



- **ArcGIS Pro user experience**

- just works with layers
- visual modeler to design simple and complex models



- **results are immediately available as services**

- no publishing workflow required



Raster Analytics and Your Data



- **using your own registered data**

- registered data can be used as input but not output
- models running against single rasters can be parallelized by block (*as long as the model allows it)
- models running against a collection of rasters will be parallelized per raster in the collection
- performance can be susceptible to underlying image format (TIFF vs. JP2)

- **using ArcGIS distributed storage**

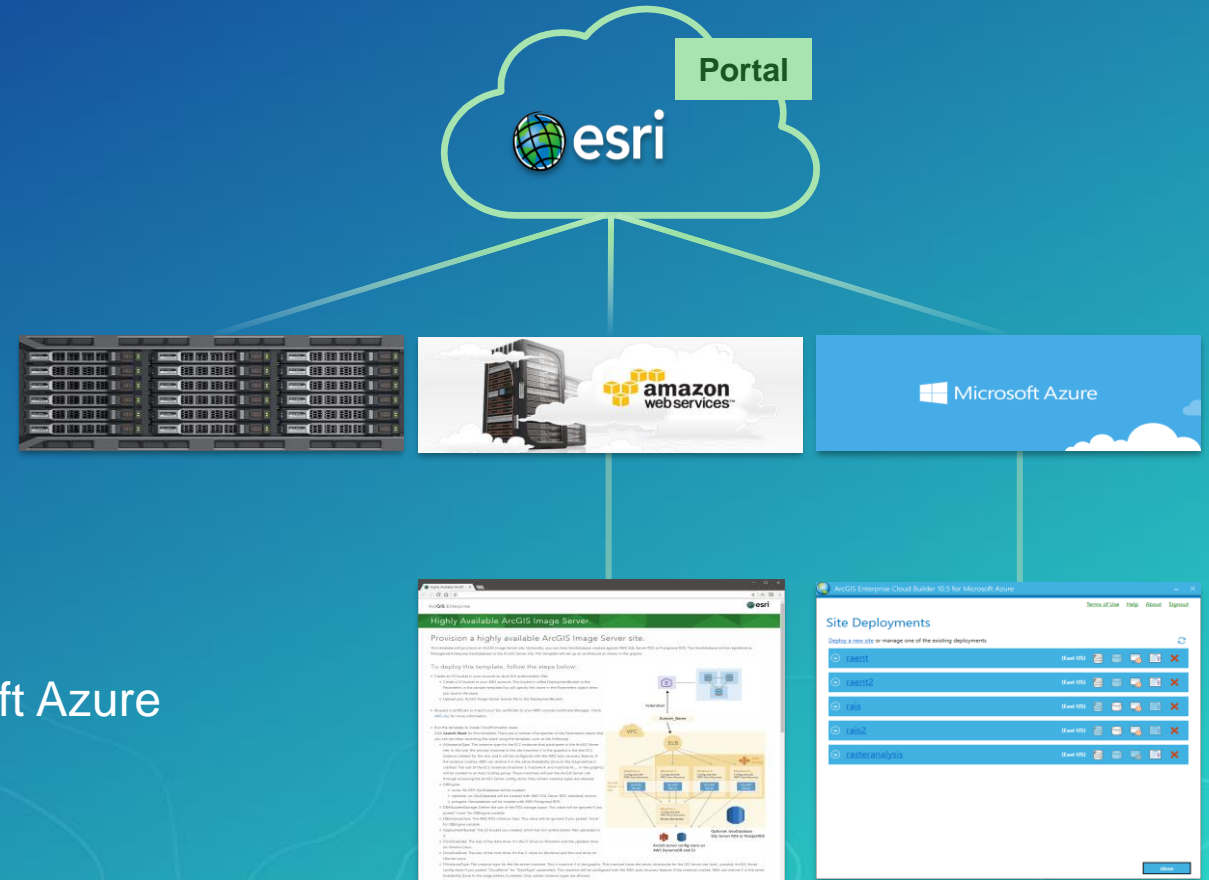
- easy to use import tool gets your data into Raster Analytics optimized storage
- CRF (Cloud Raster Format)
 - multi-band, block based, multiple readers, multiple writers, fast
- CRF is a format optimized for Raster Analytics computations

- **all outputs of Raster Analytics are written in parallel to ArcGIS distributed storage**

- running models on new Web GIS layers is inherently optimized

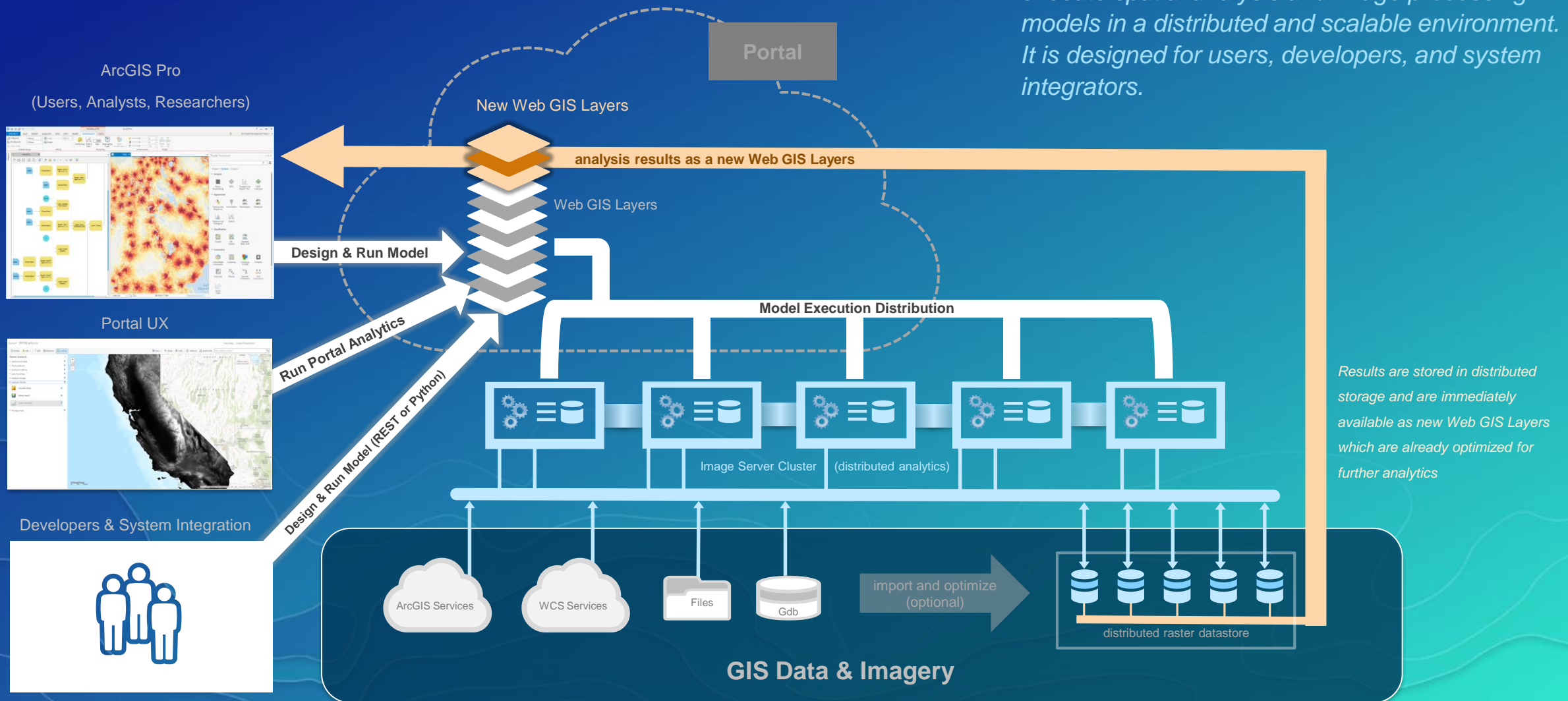
Raster Analytics in Your Infrastructure

- deployed as Enterprise GIS on-premise
- your infrastructure can be...
 - your hardware
 - your Amazon
 - your Azure
- deployment tools
 - Amazon CloudFormation Templates
 - ArcGIS Enterprise Cloud Builder for Microsoft Azure



Raster Analytics Conceptual Overview

Raster Analytics can power systems that need to execute spatial analysis and image processing models in a distributed and scalable environment. It is designed for users, developers, and system integrators.



Raster Analytics Test Cases

Benefits of a Distributed Processing System

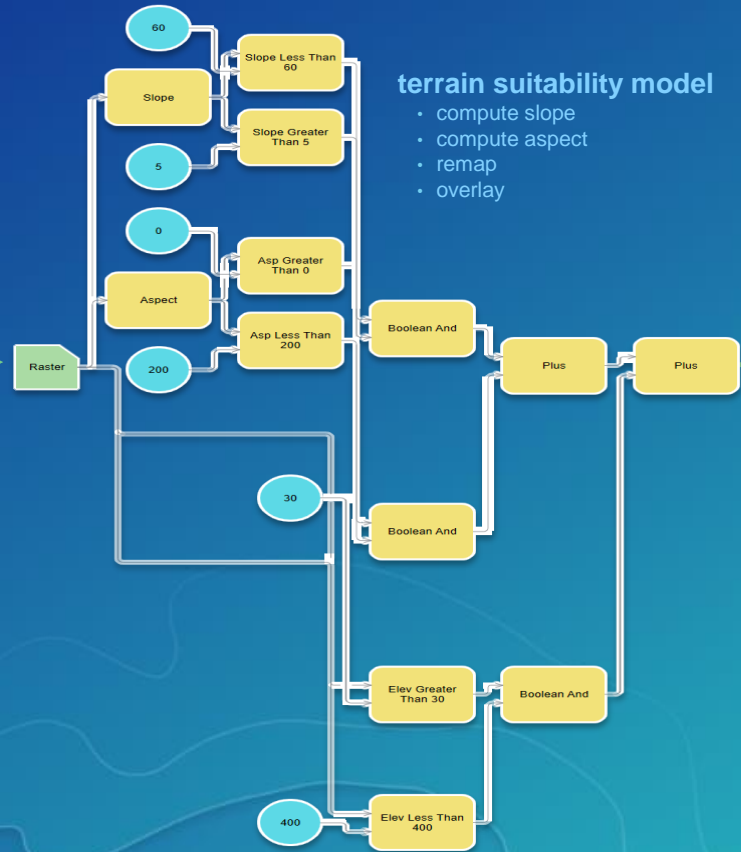
Raster Analytics Test Case: Terrain Suitability

esri virtual machine

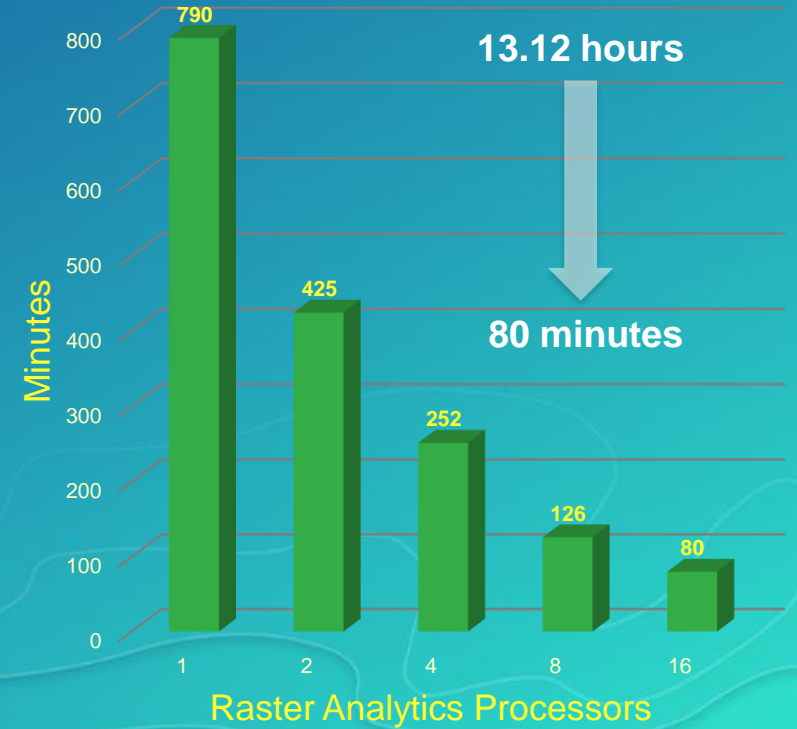
- 16GB RAM, 8 cores, NAS storage



Global SRTM 90m



global terrain suitability raster



Raster Analytics Test Case: Solar Power Plant Suitability

Enterprise GIS (Image Server cluster) on Amazon

- 8 c3.2xlarge instances (8 vCPUs, 16GB RAM)



Raster Analytics Test Case: Landsat Processing

Infrastructure



ArcGIS Enterprise GIS on AWS



Distributed Raster Analytics (Image Server) Cluster

- single node
- AWS c3.8xlarge
- 60GB RAM, 32 cores, 500GB SSD
- 200 Raster Analytics Processors

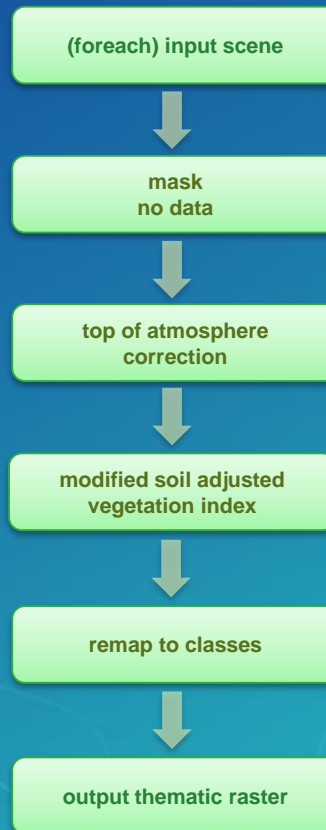
Input Collection



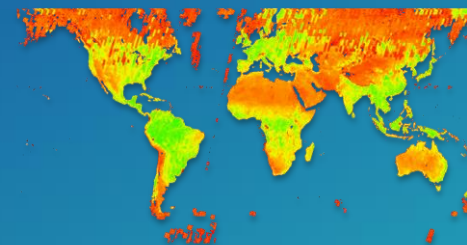
Landsat GLS 1990

- 7422 Multispectral Scenes
- S3 storage

Processing



Output



Thematic Rasters

- 7422 Thematic Rasters
- Distributed Raster Datastore

2 hours 48 minutes

44 scenes per minute

$\frac{3}{4}$ scene per second

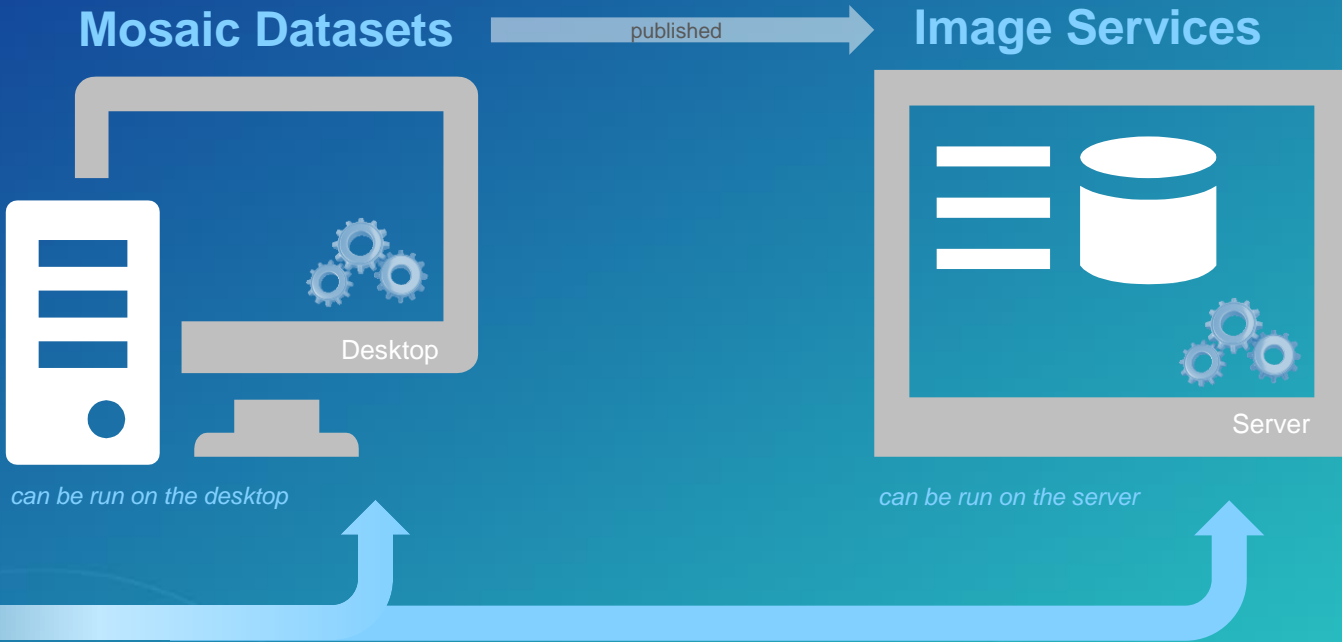
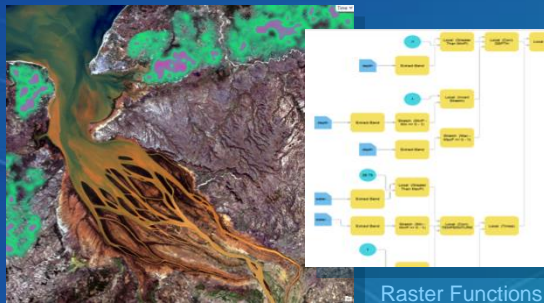
Comparing Previous Versions

<= ArcGIS 10.4

ArcGIS 10.4 Raster Analytics and Image Processing

- ArcGIS 10.4 has scalable high performance analysis of **big rasters** and **imagery for visual analytics**
- on-the-fly processing of massive images and massive image collections
- desktop and server
- visual results can be exported

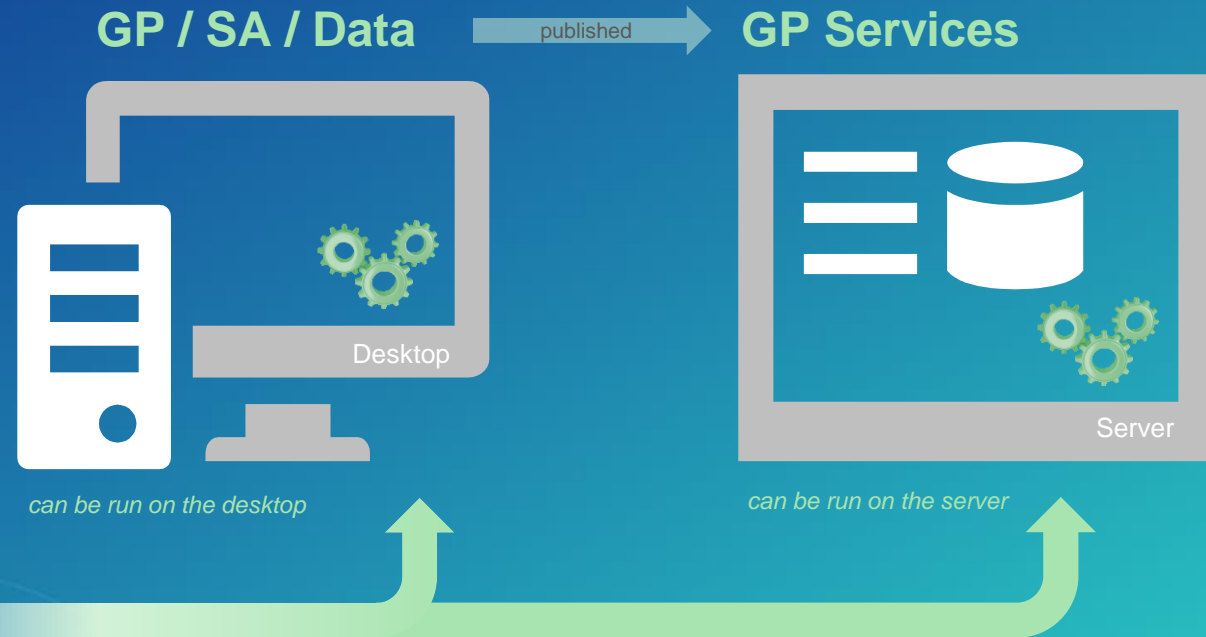
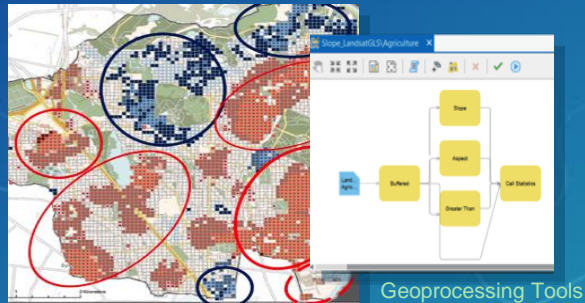
Dynamic Raster Models



ArcGIS 10.4 Raster Analytics and Image Processing

- ArcGIS 10.4 has scalable high performance analysis of **standard rasters and imagery for persistent analytics**
- processing of single images or spatial subsets of massive images or mosaicks
- desktop and server
- persistent results

Geoprocessing Models



What differentiates Raster Analytics from ArcGIS 10.4?

- **Raster Analytics are “out of the box” and “ready to use” within your ArcGIS system**
 - today you have to explicitly author and publish the specific analytics you need
 - faster prototyping and R&D
- **Raster Analytics gives you tools and operations that work against existing layers and future layers within your ArcGIS system – built for Enterprise GIS**
- **Raster Analytics helps you get “big jobs” done faster**
 - you don’t have to partition the job yourself – built for big jobs, big data
 - elasticity and scalability that doesn’t come with desktop workflows
- **Raster Analytics is for massive collection processing with persistent results**
 - product generation, automated production systems (TCPED)
 - for systems that can’t rely on visual analytics and on-the-fly product generation

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