DIGITAL MAPPING TECHNIQUES 2014

The following was presented at DMT'14
(June 1-4, 2014 - Delaware Geological Survey,
Newark, DE)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2014)

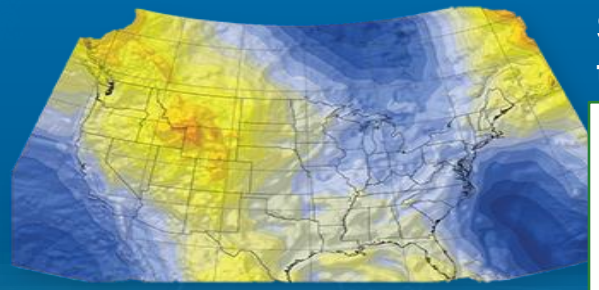
http://ngmdb.usgs.gov/info/dmt/

ArcGIS:
A Platform for Point Cloud Processing

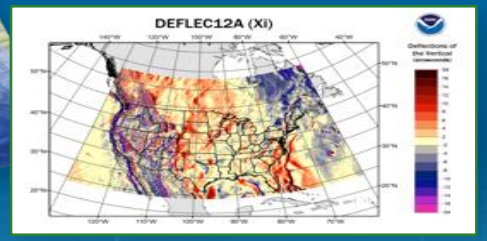
Larry Batten – Account Manager (BLM, USGS)

Your Mission is Our Mission

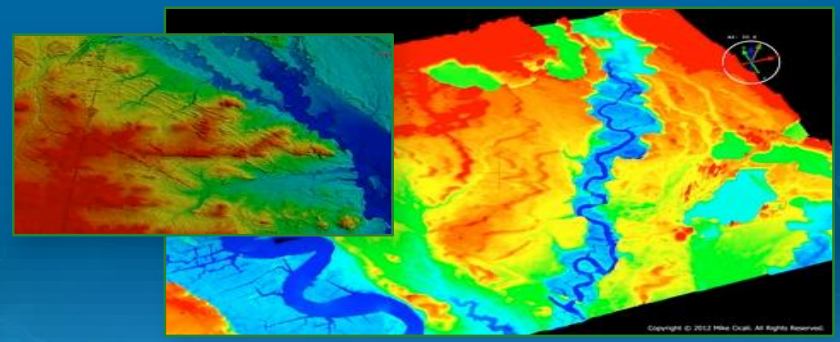
Support for Deepening Analytic Expertise



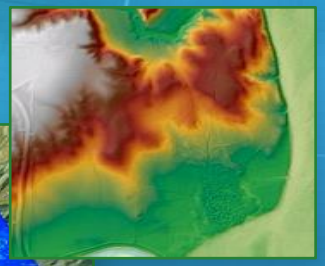
Studying the Earth's Shape



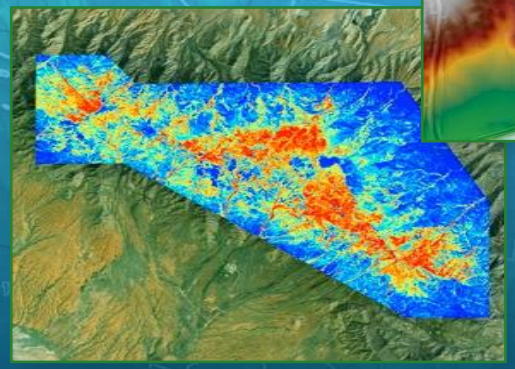
Geomorphic Analysis



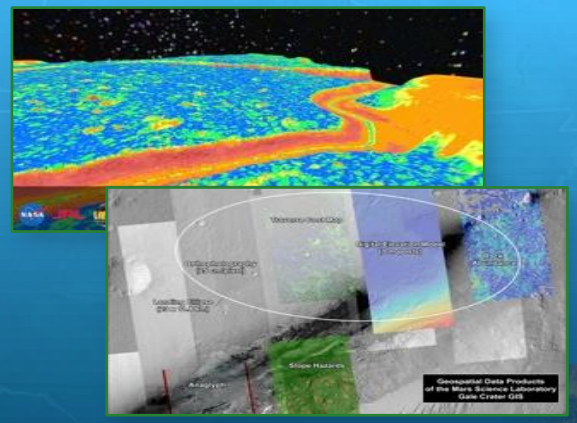
Finding Historic Features



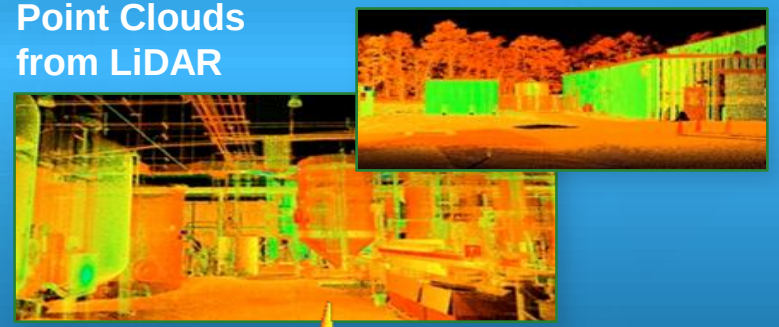
Calculating Tree Canopy



Exploratory



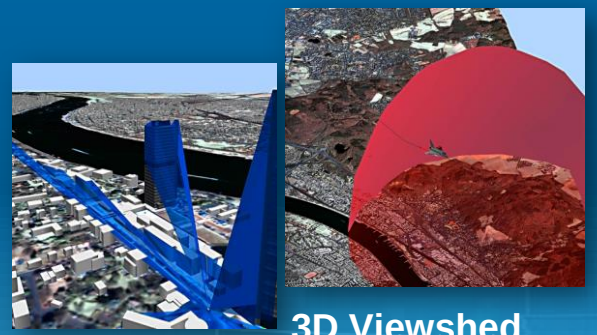
Point Clouds from LiDAR



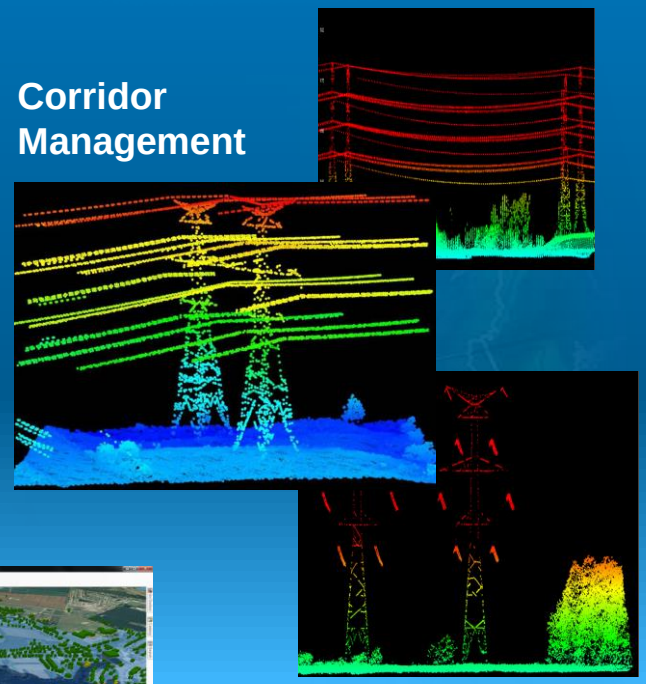
Your Mission is Our Mission

Support for Management and Preparedness

Threat Assessment

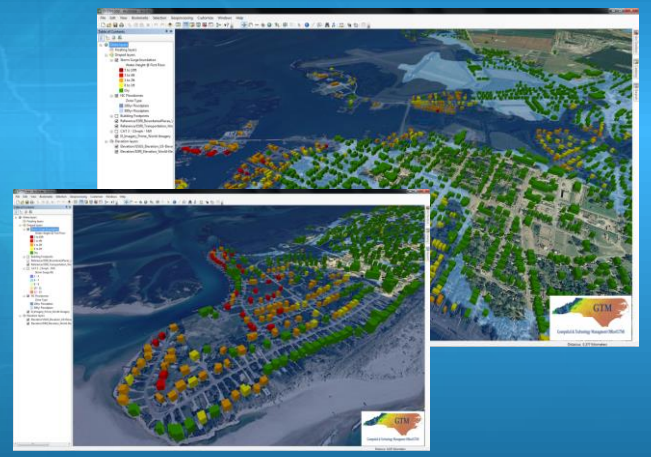


Corridor Management

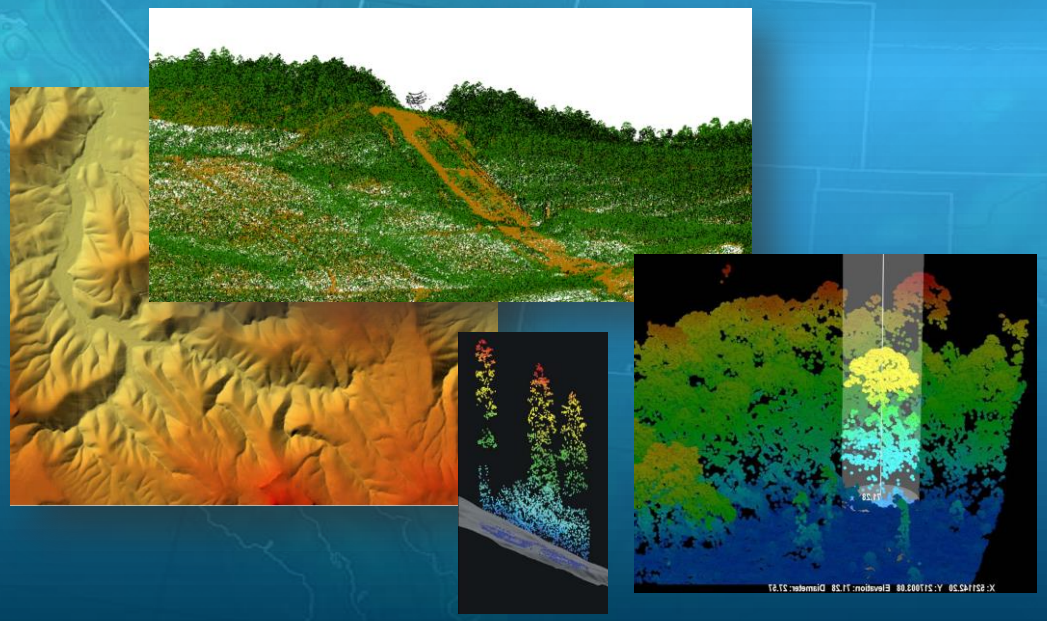


3D Viewshed

Inundation Analysis



Forestry Analysis



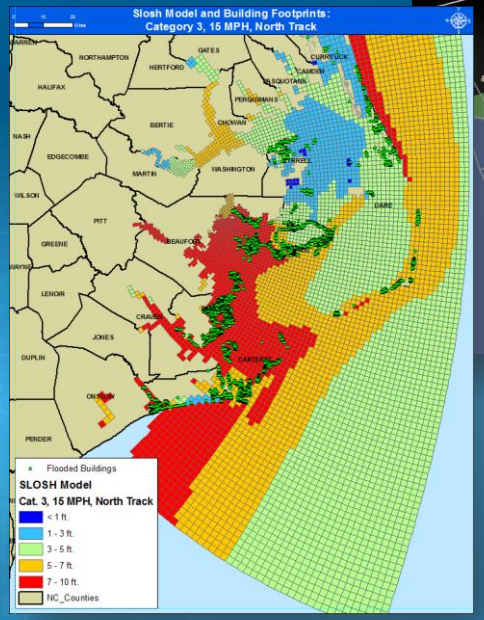
Your Mission is Our Mission

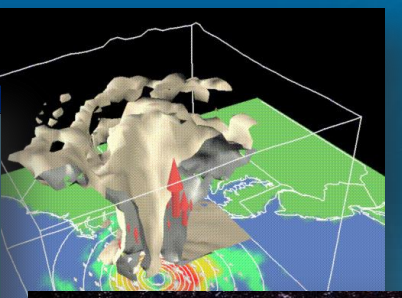
Support for Disaster Mitigation

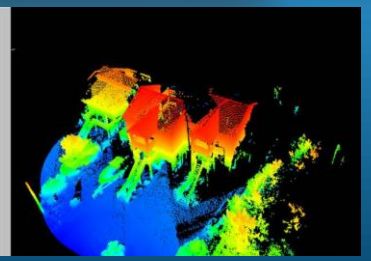
Potential tsunami inundation: Bandon, Oregon

Data courtesy of DOGAMI

Hurricane Preparations







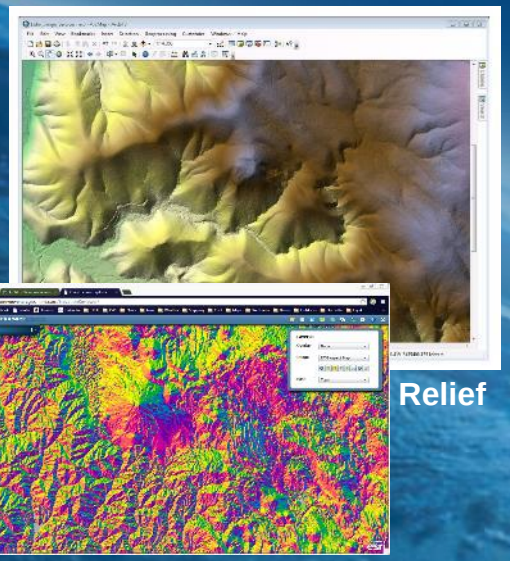
GTM

Geospatial & Technology Managment Office(GTM)

Laser Scanning is Opening a World of Applications

Point Clouds require a new generation of capabilities to maximize their use

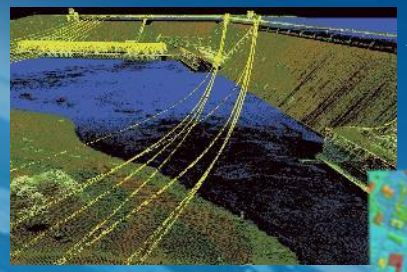
Elevation:



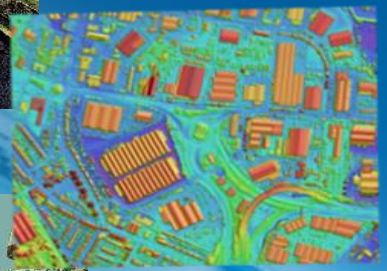
Relief

Aspect

Facilities:



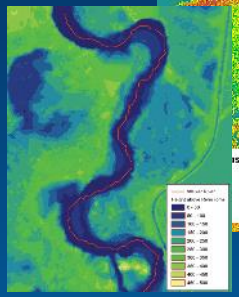
Asset Management

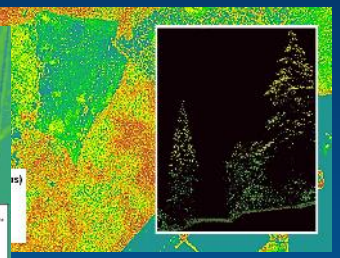


Property Records

Infrastructure

Environment:

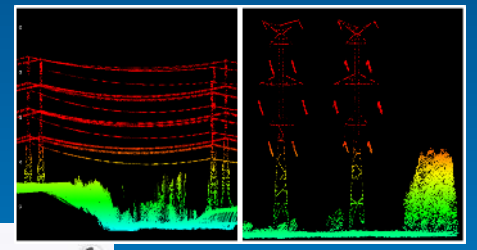




Biomass

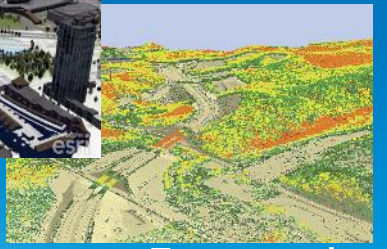
Hydrography

3D Features:



Utilities

Urban Planning



Transportation

Point Clouds are a transformation

Enhanced Elevation Data Has Direct Cost Benefits

Conservative Estimate of total annual cost benefit of $1.2 Billion

Rank	Functional Area	Benefit
1	Flood Risk Management	$294,706,000
2	Infrastructure and Construction Management	$206,212,000
3	Natural Resources Conservation	$159,225,000
4	Agriculture and Precision Farming	$122,330,000
5	Water Supply and Quality	$85,288,000
6	Wildfire Management-Planning and Response	$75,700,000
7	Geologic Resource Assessment and Hazard Mitigation	$51,750,000
8	Forest Resources Management	$43,949,000
9	River and Stream Resource Management	$38,422,000
10	Aviation Navigation and Safety	$35,000,000

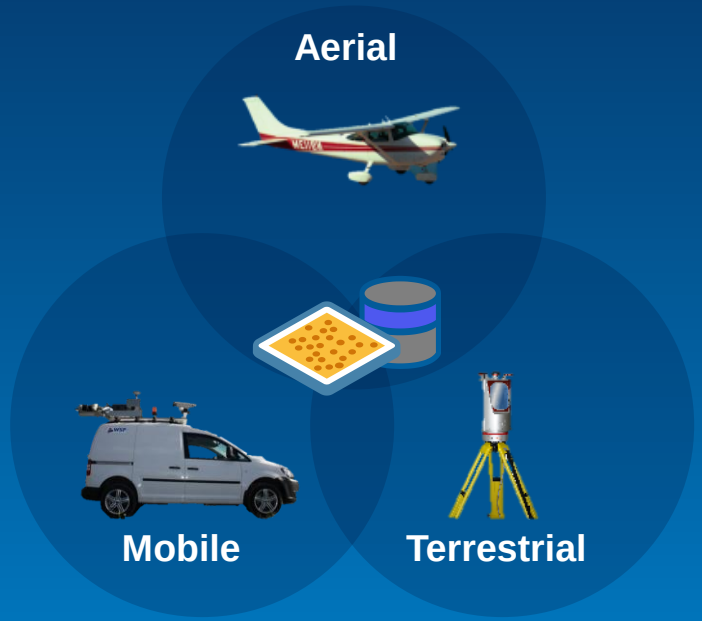
Source: USGS & Dewberry (2012), 'National Enhanced Elevation Assessment'

Total Potential Benefit of over $13 billion/year

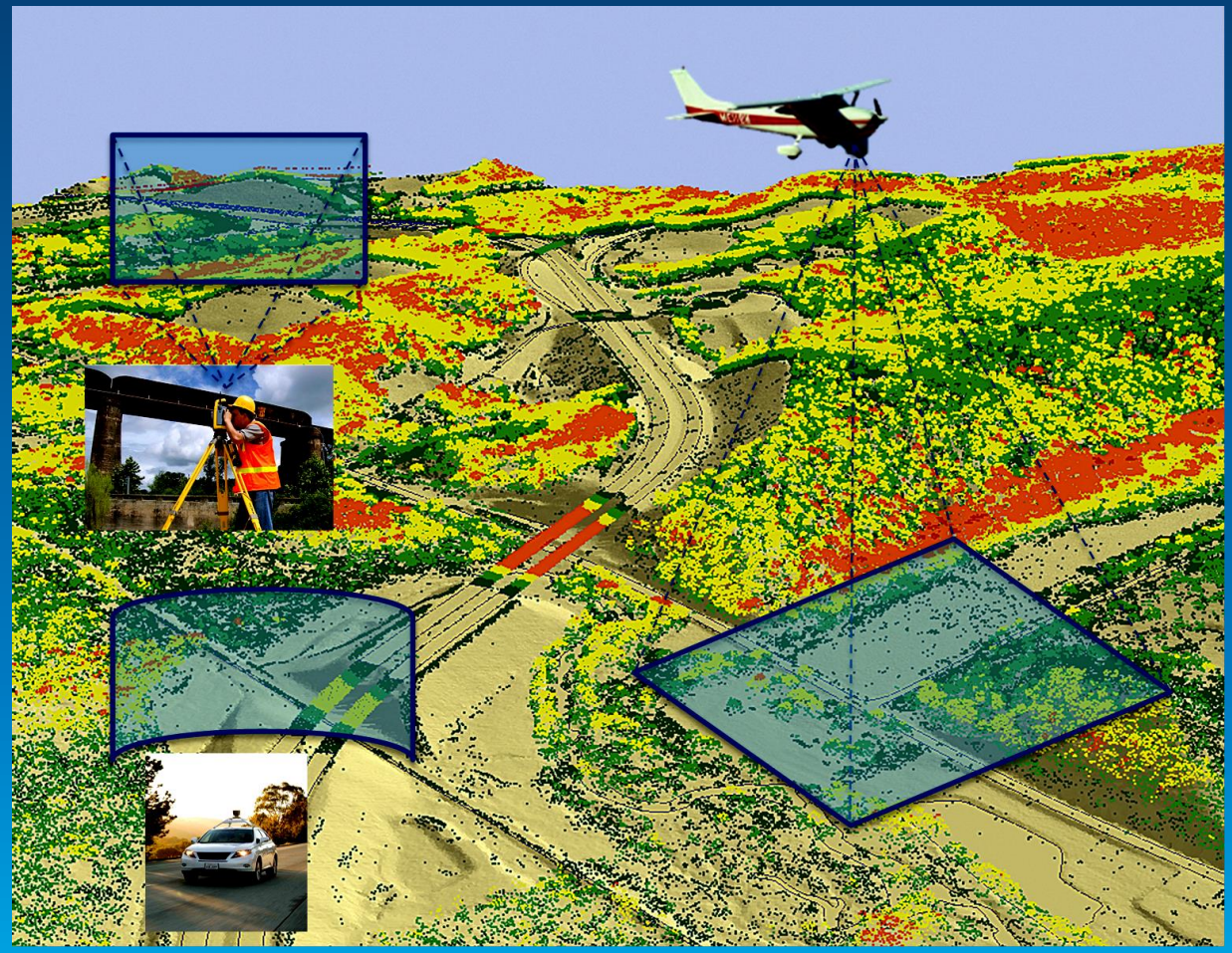
USGS: 3D Elevation Program (3DEP)

Encompassing Multiple Collection Strategies

Integrated data management is as fundamental as analysis tools



- Wide variety of collection parameters
- Over, on, and under – 360 Degree Field of View
- High resolution, high density data collection
- Combined with other sensors, especially imagery

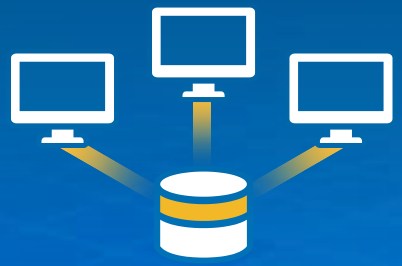


A versatile , economical, and accurate remote sensing resource

ArcGIS Supports Multiple Implementation Patterns

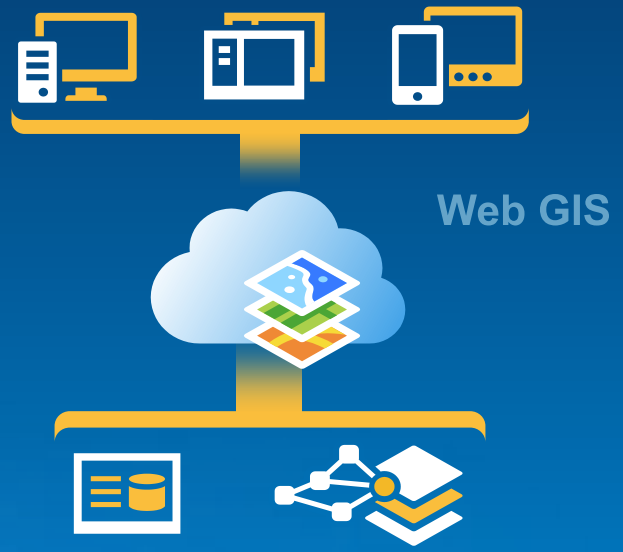
Leveraging Common Computing Architecture

File Based



Database Centric

Server Centric



Web Centric

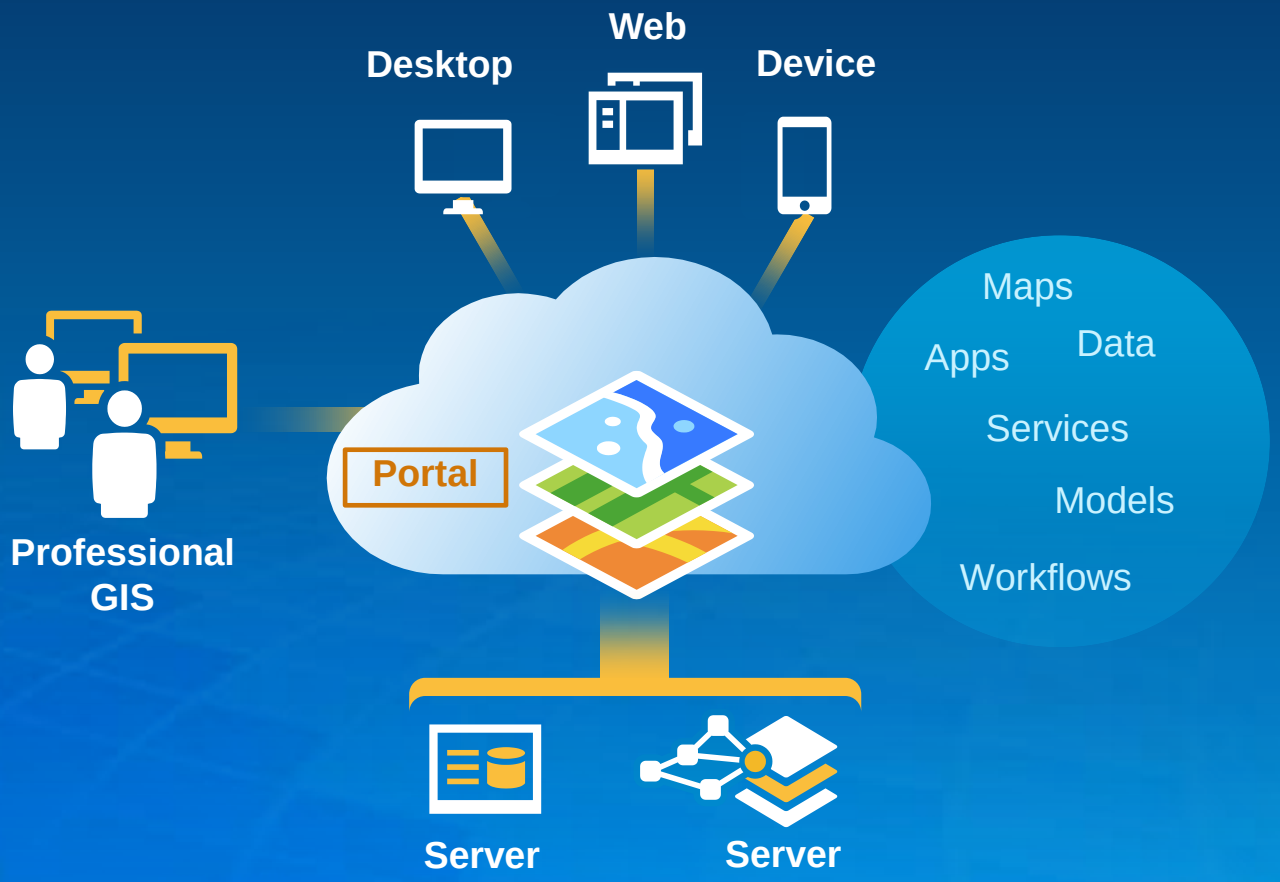
Point Cloud processing has been enabled throughout this evolution

ArcGIS Provides a Platform

A comprehensive environment for point cloud solutions

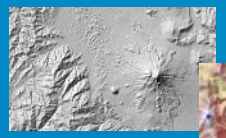
Enabling:

- Content Management
- Access
- Sharing
- Collaboration
- Apps



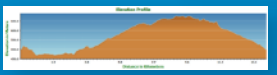
Analytics:

Elevation



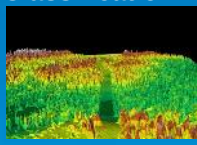
Viewshed

Profile



Extraction

Classification

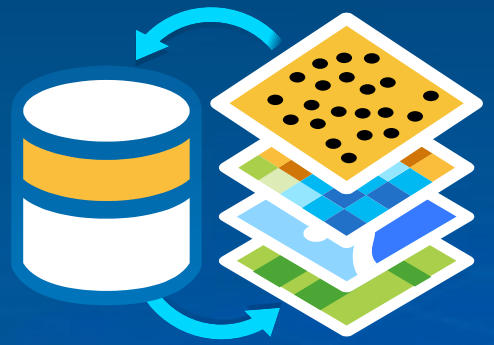


Extends point cloud applications to any device at any location

The Advantage of ArcGIS

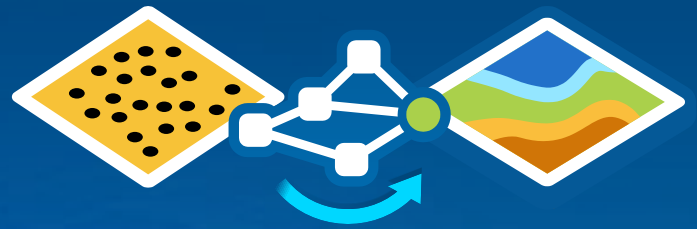
Enabling technologies maximize Point Cloud processing

Content Management



- Shared Data Model
- Data Discovery
- Rapid Access
- Services

Analytics



- Integration with GIS
- Dynamic Processing
- Workflow Manager
- Partner Technology

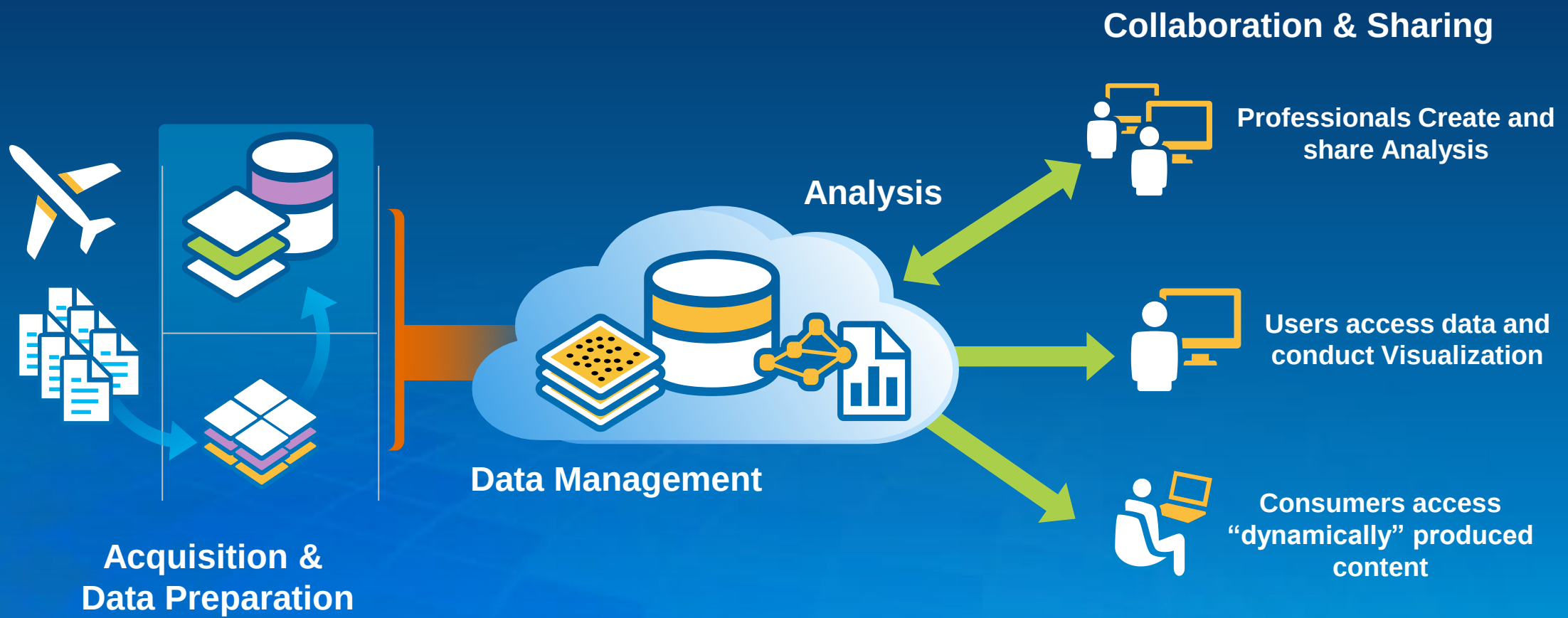
Sharing & Collaboration

- Web & Cloud
- Maps & Apps
- User Mashups

Interconnected capabilities

An End-to-End Workflow for Point Clouds

Tightly integrated functional segments facilitate multiple processing chains

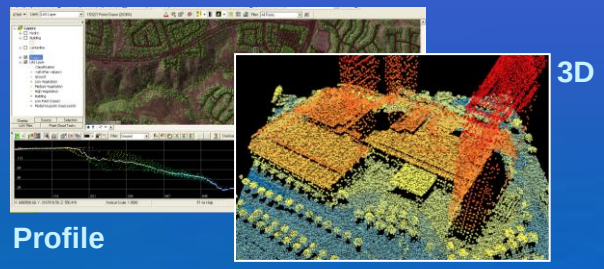


Laser scanned data easily flows from sensor to web services

Visualization & Analytics

Four categories of analysis tools result in thousands of derived products

Visualize



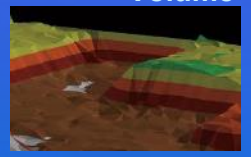
3D

Profile

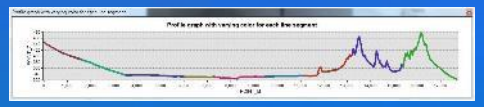
Advanced Mensuration

Area

Volume

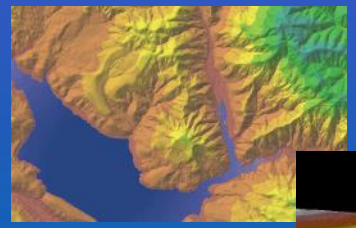


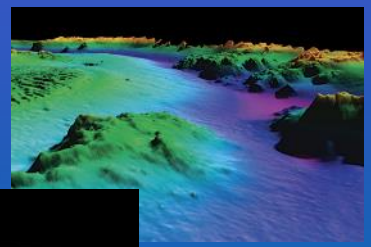
Heights



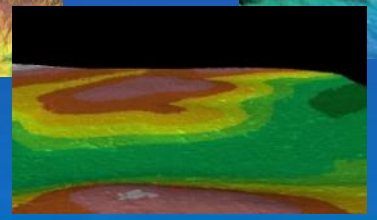
Elevation Extraction

Terrain



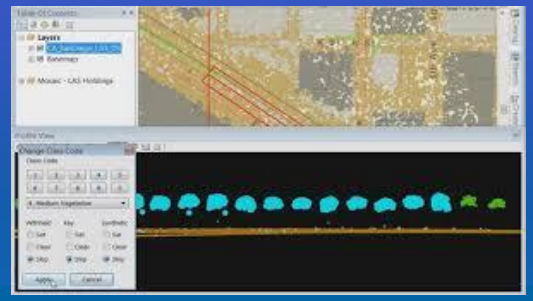


Bathymetry



Bare Earth

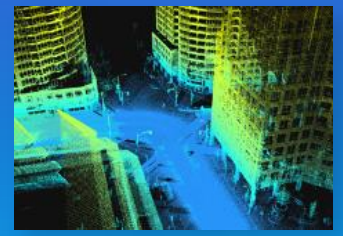
Classification



3D Object Extraction

Natural

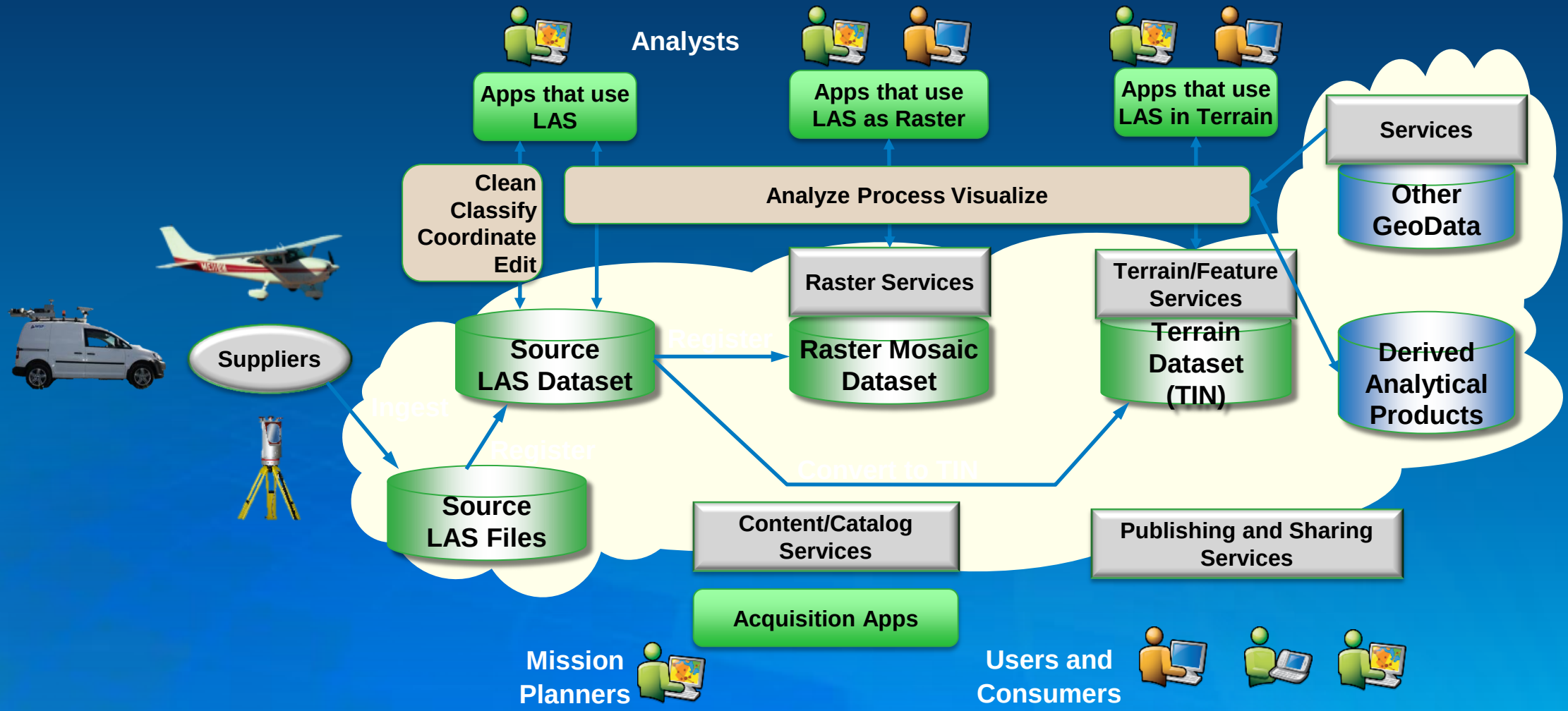
Man-Made



From Sensor to Web Services

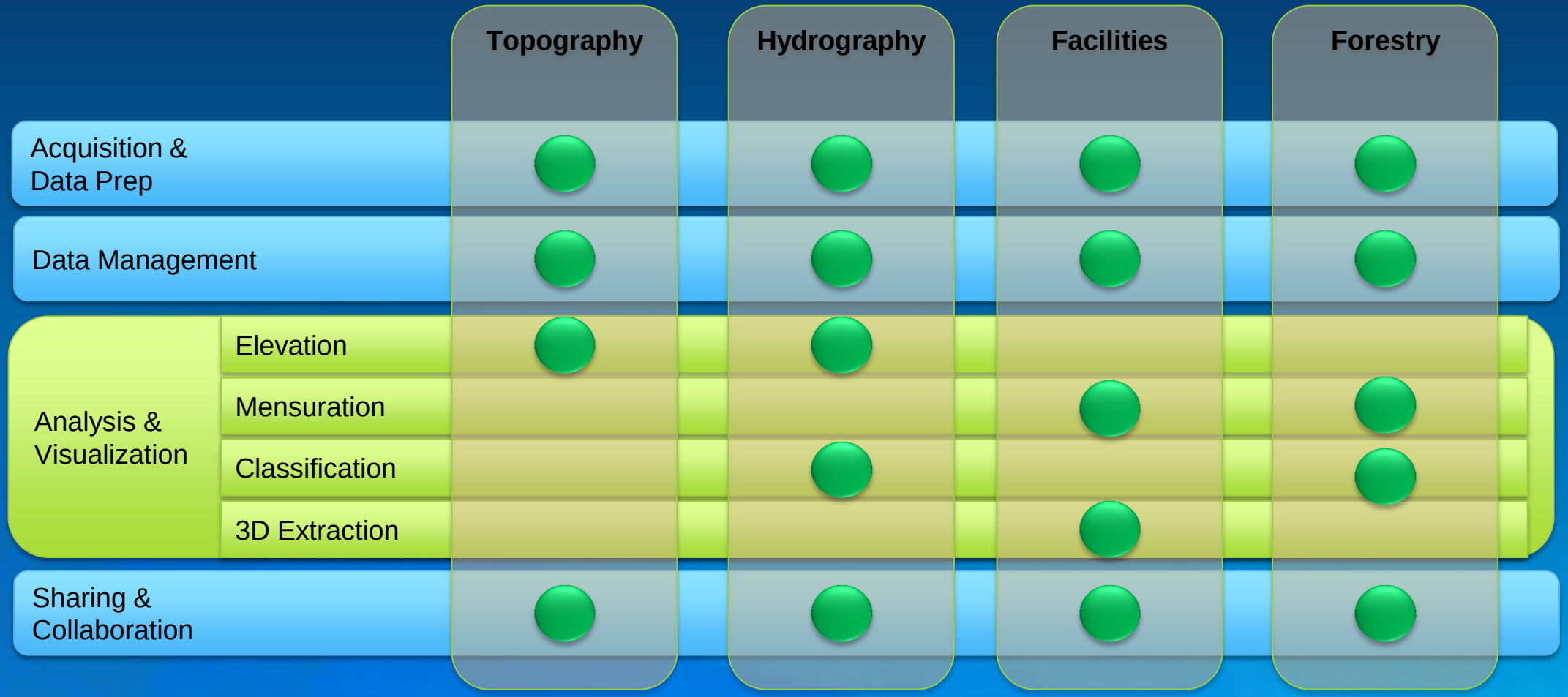
Extending Beyond the Enterprise

Proven Architectures Support Inter-Agency Implementations



Cross Cutting Technical Capabilities

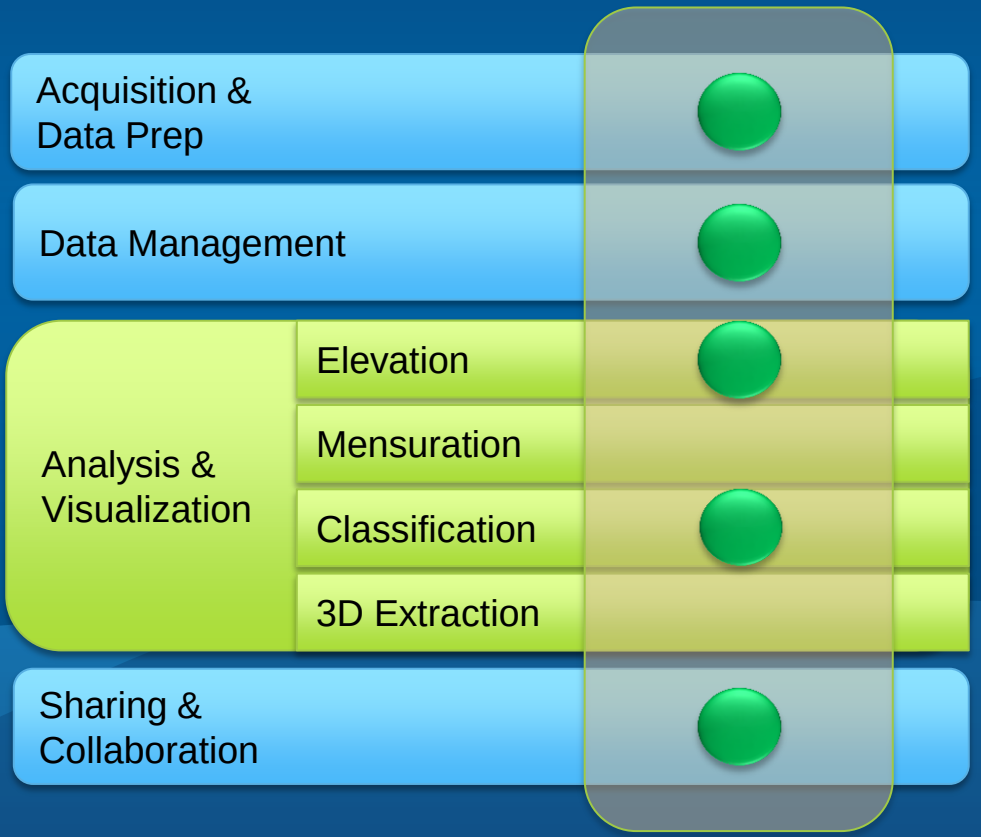
Data Prep, Management, and Sharing remain consistent while Analysis varies based on solution requirements

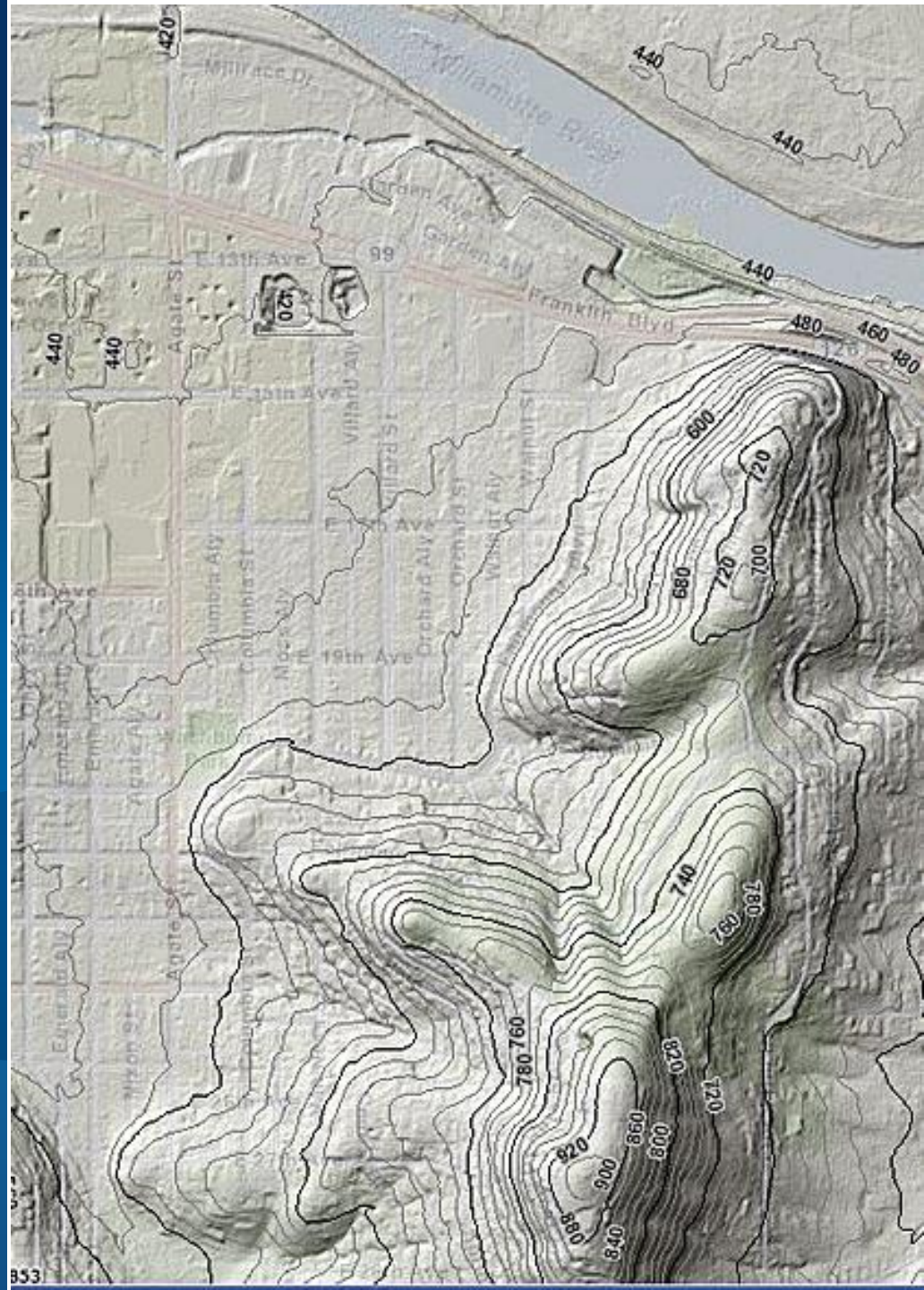


From Sensor to Web Services

Example

Elevation to Support Hydrography

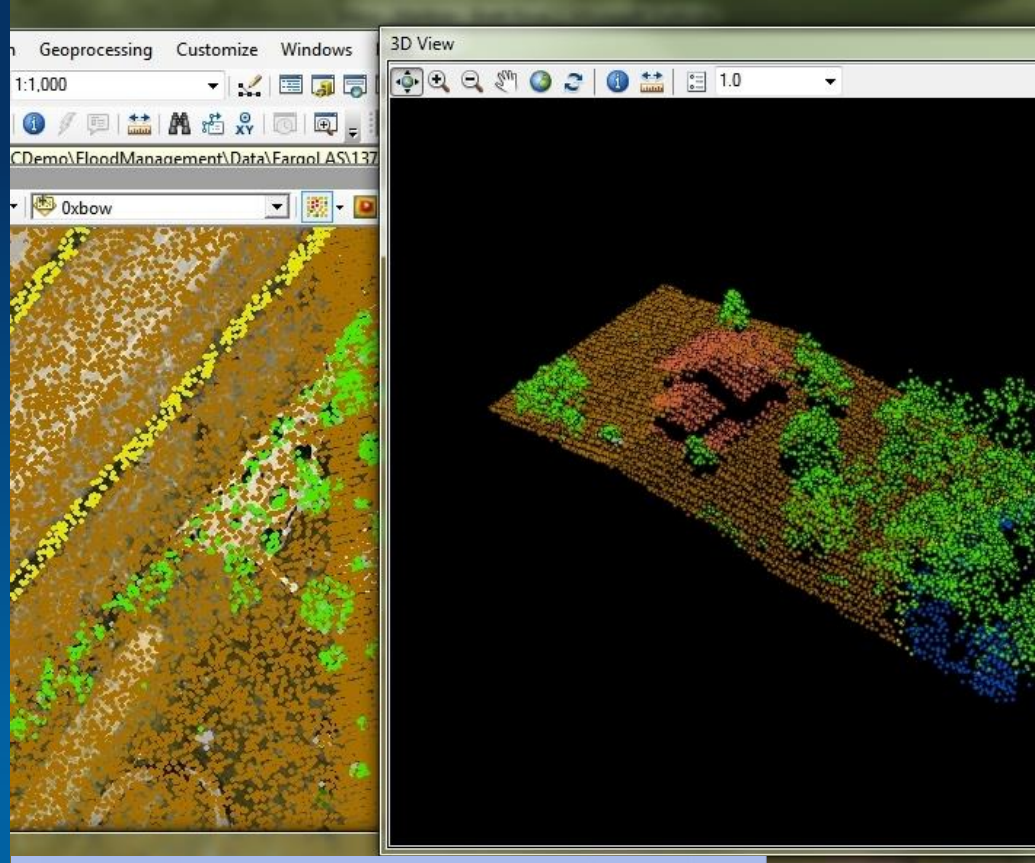


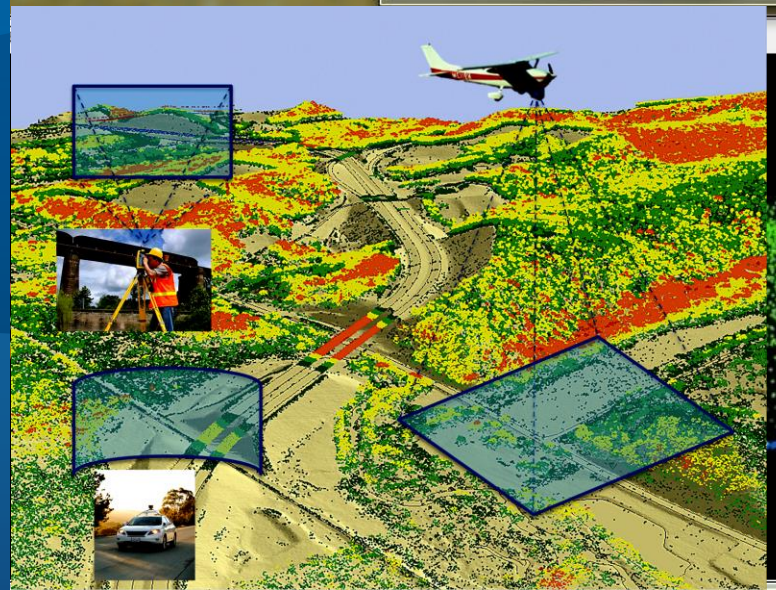


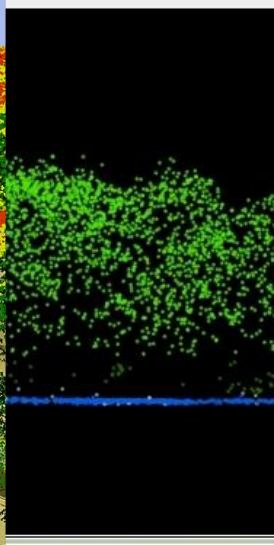
Step 1

Acquisition & Data Preparation

- Acquisition & Data Prep
- Data Management
- Analysis & Visualization
  - Elevation
  - Mensuration
  - Classification
  - 3D Extraction
- Sharing & Collaboration

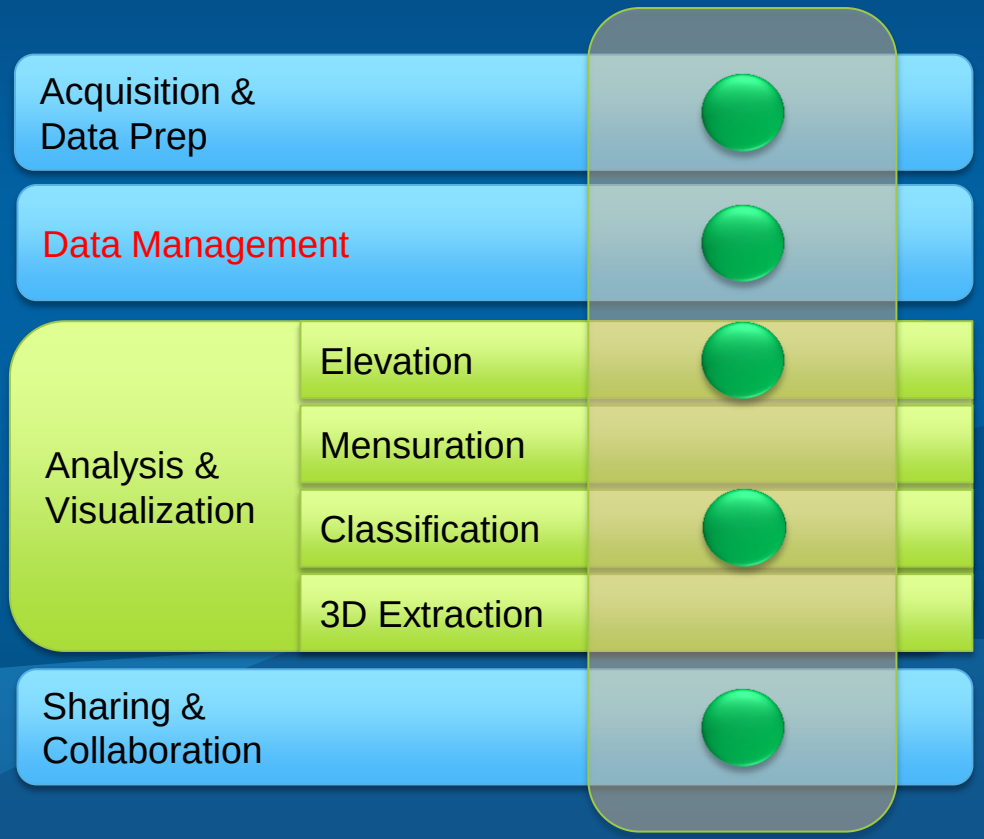


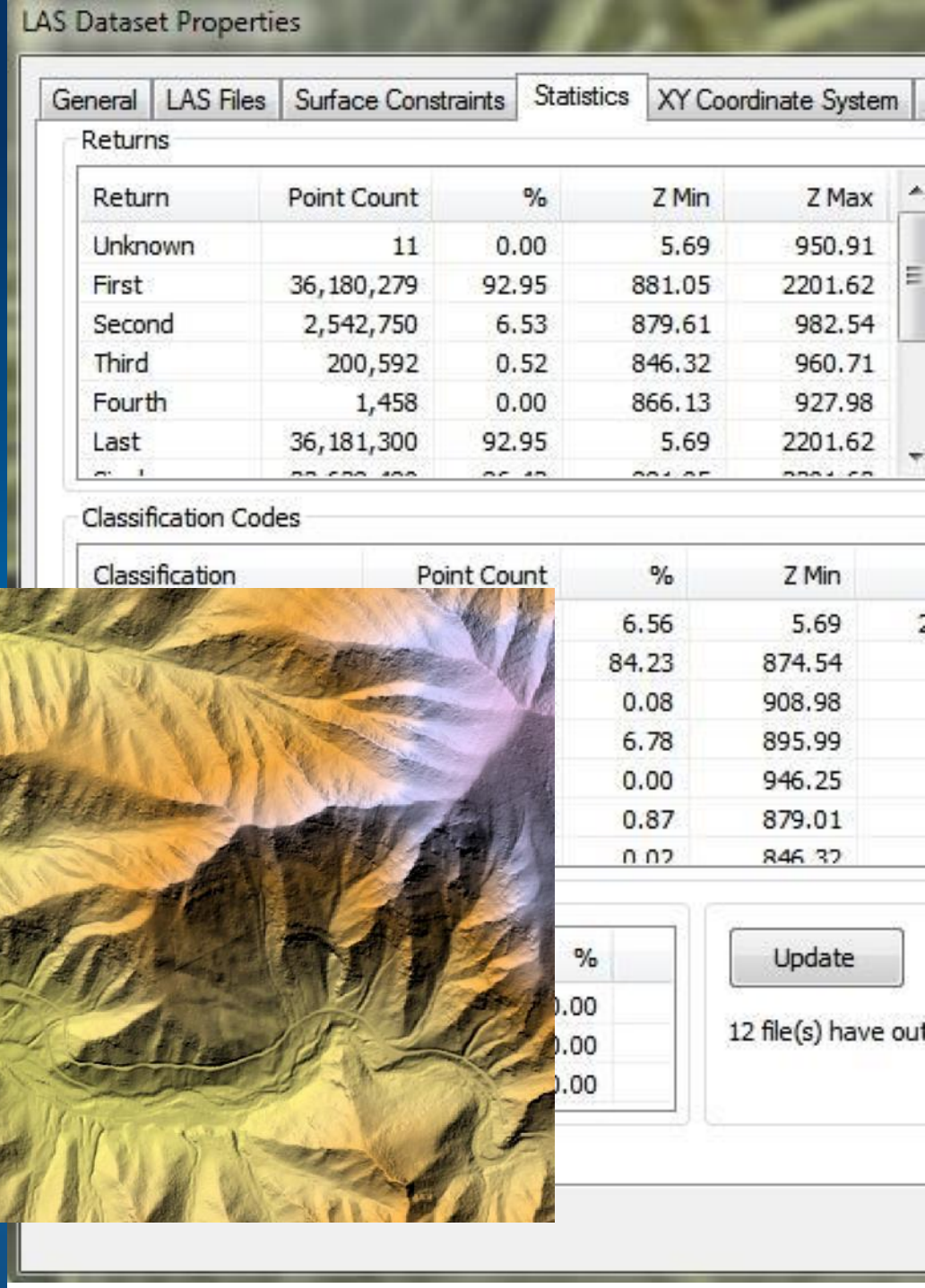




Step 2

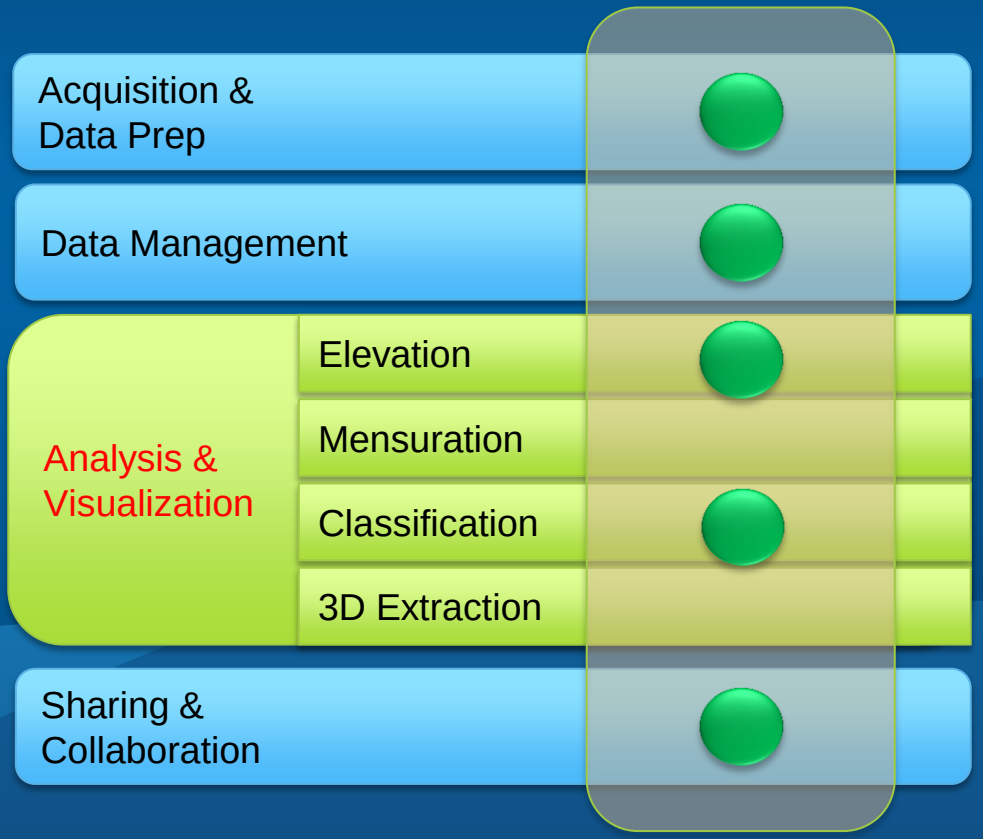
Data Management

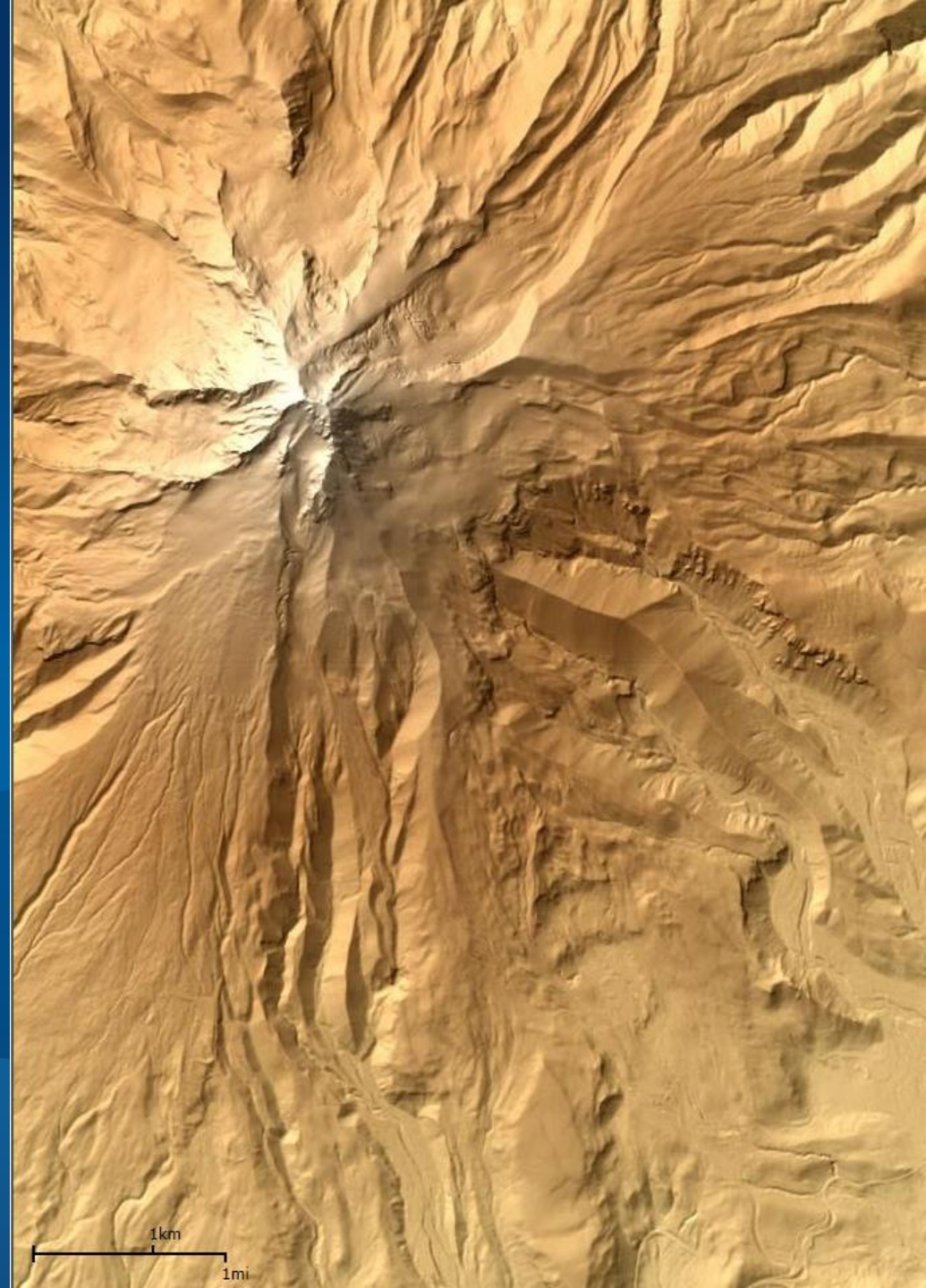




Step 3

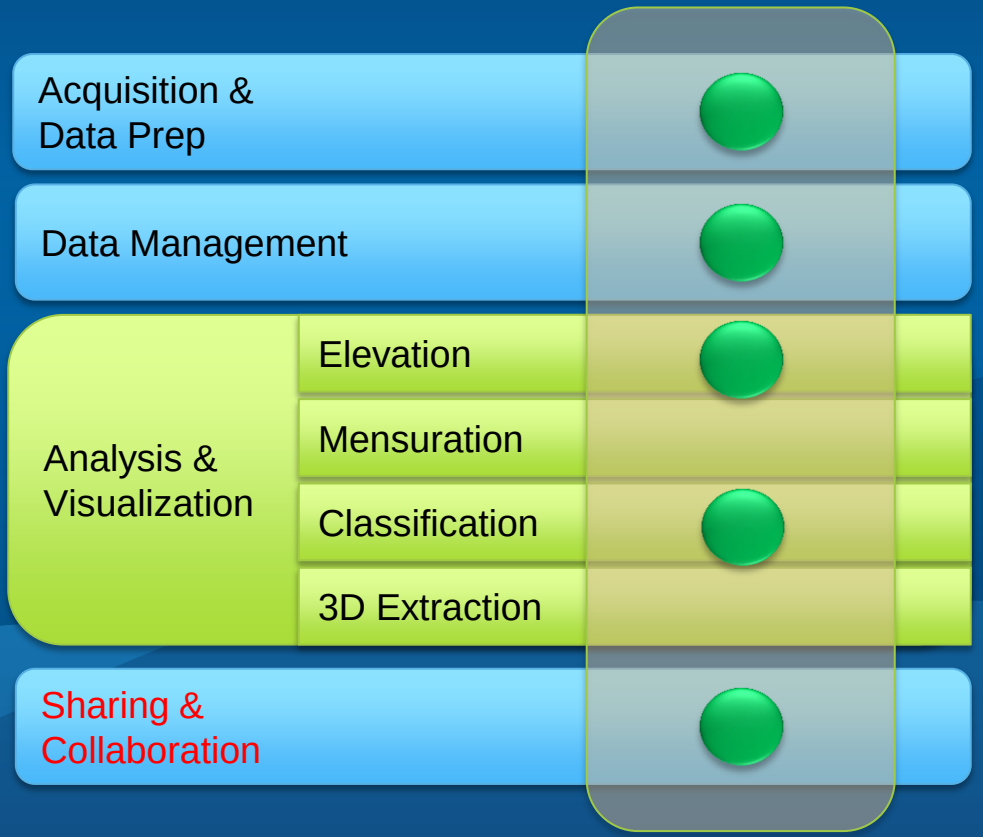
Analysis & Visualization





Step 4

Sharing & Collaboration



Elevation Reviewer - example web application (Silverlight)

Example web application for exploring the World Elevation services, including tools (e.g. profile) and example controls of server-side functionality. Requires Microsoft Silverlight plugin to be installed on user's web browser

Open ▾ Details

Web Mapping Application by esri

Last Modified: June 17, 2013

☆☆☆☆☆ (0 ratings, 0 comments, 1,461 views)

World Digital Terrain Model (DTM)

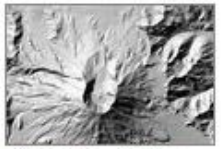
Digital terrain model (DTM) of ground surface heights. The ground heights are based on multiple sources. Heights are orthometric (sea level = 0), and water bodies are approximated to nominal water heights.

Open ▾ Details

Imagery by esri

Last Modified: April 22, 2012

☆☆☆☆☆ (0 ratings, 0 comments, 1,173 views)



World Elevation DTM Hillshade

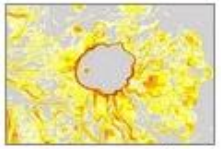
Hillshaded surface image created from the World Digital Terrain Model (DTM) of ground surface heights.

Open ▾ Details

Imagery by esri

Last Modified: March 23, 2012

☆☆☆☆☆ (0 ratings, 0 comments, 562 views)



World Elevation Slope Map

Surface slope created from the World Digital Terrain Model (DTM) and rendered with color to indicate the relative steepness, and flat terrain shown in gray.

Open ▾ Details

Imagery by esri

Last Modified: August 1, 2013

★★★★☆ (1 rating, 0 comments, 533 views)

World Aspect Map

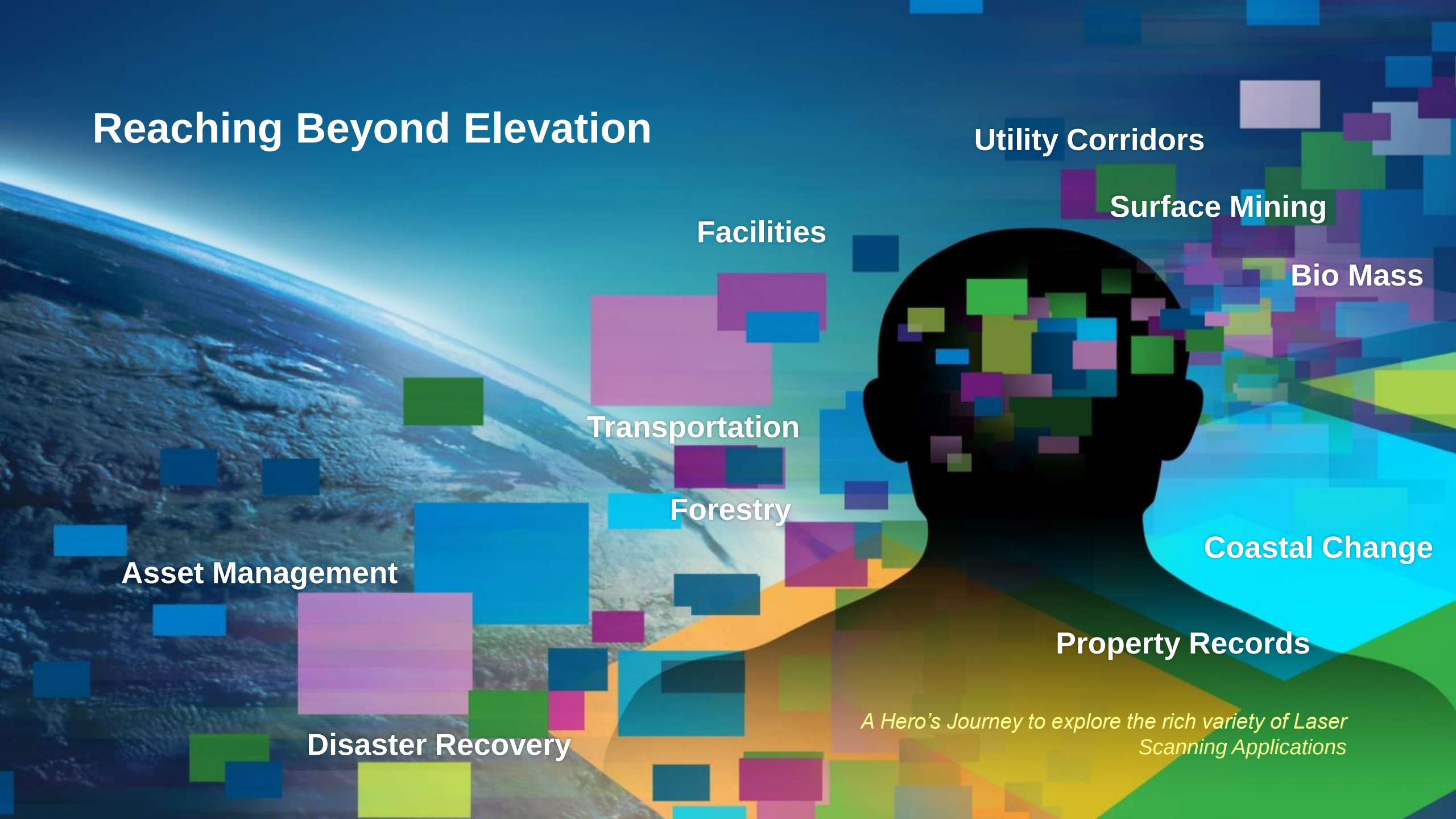
Surface aspect created from the World Digital Terrain Model (DTM) and rendered with color to indicate the orientation of the slope—North/East/South/West.

Open ▾ Details

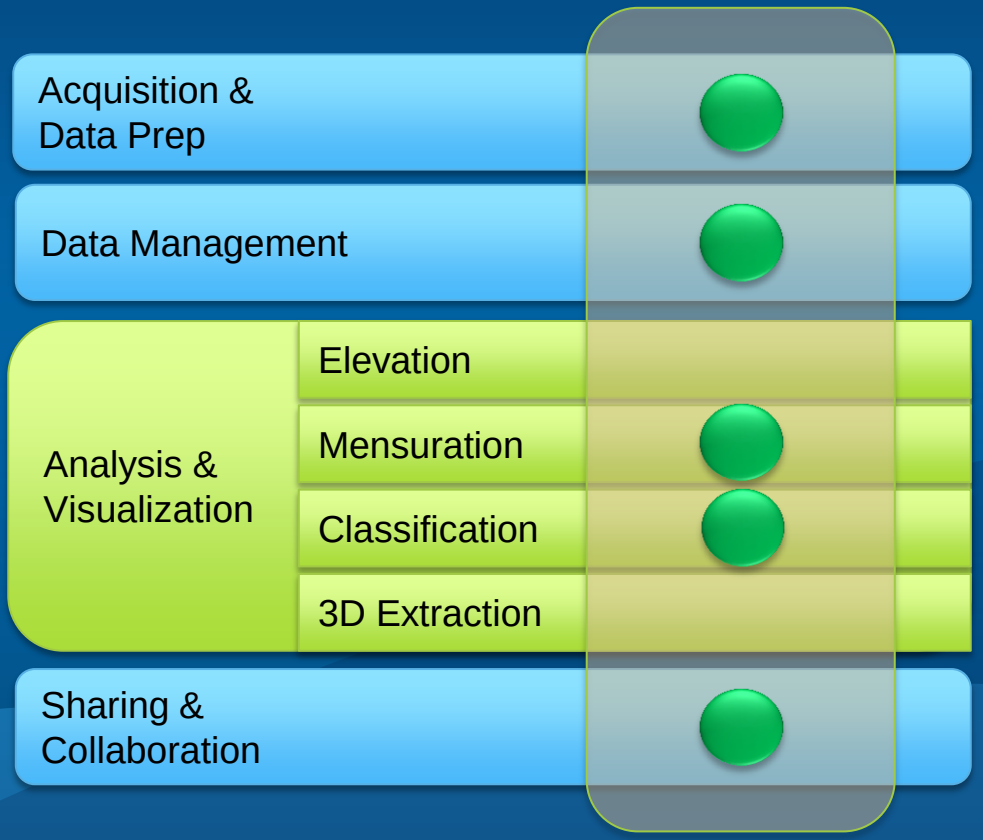
Imagery by esri

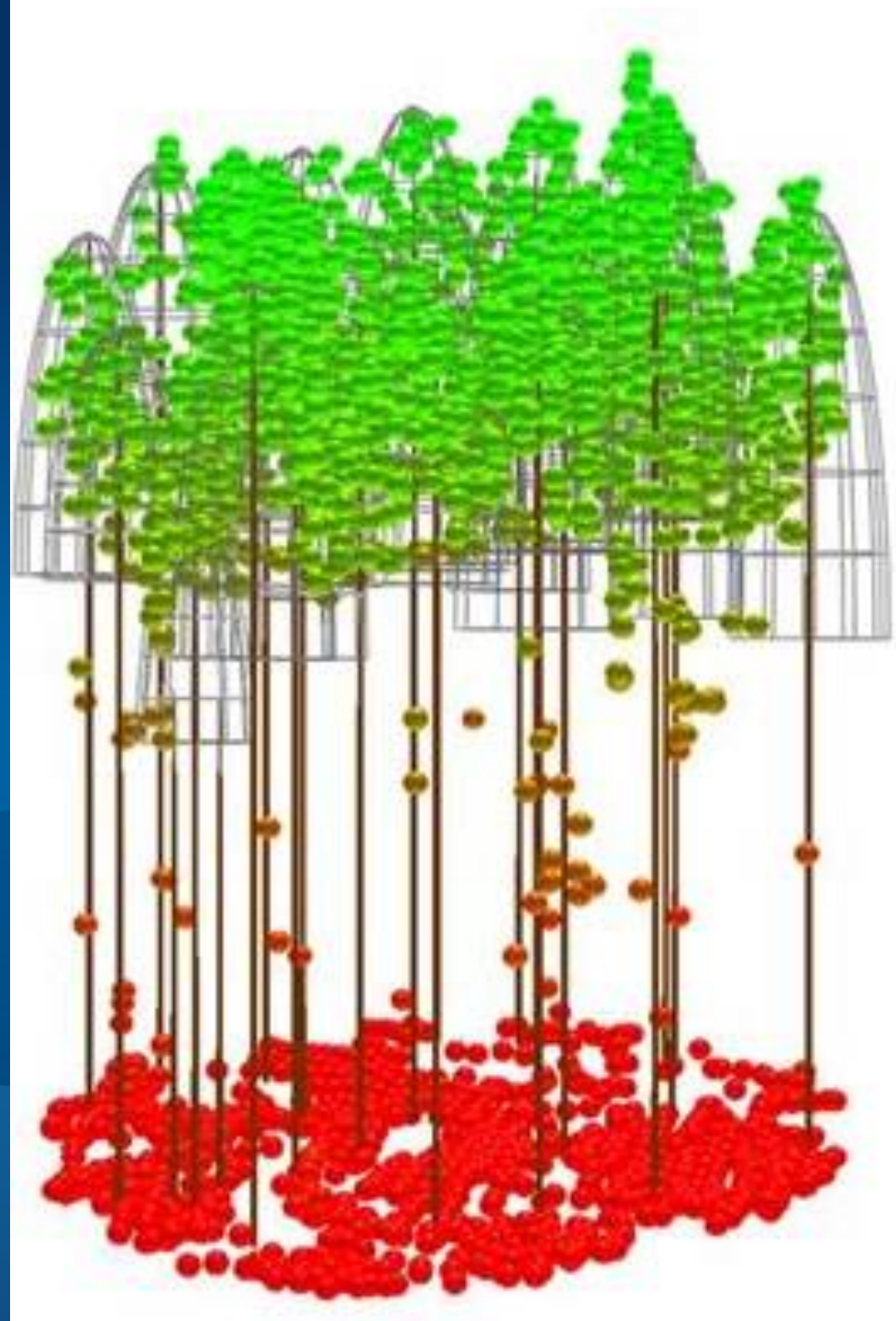
Last Modified: June 30, 2012

☆☆☆☆☆ (0 ratings, 0 comments, 527 views)

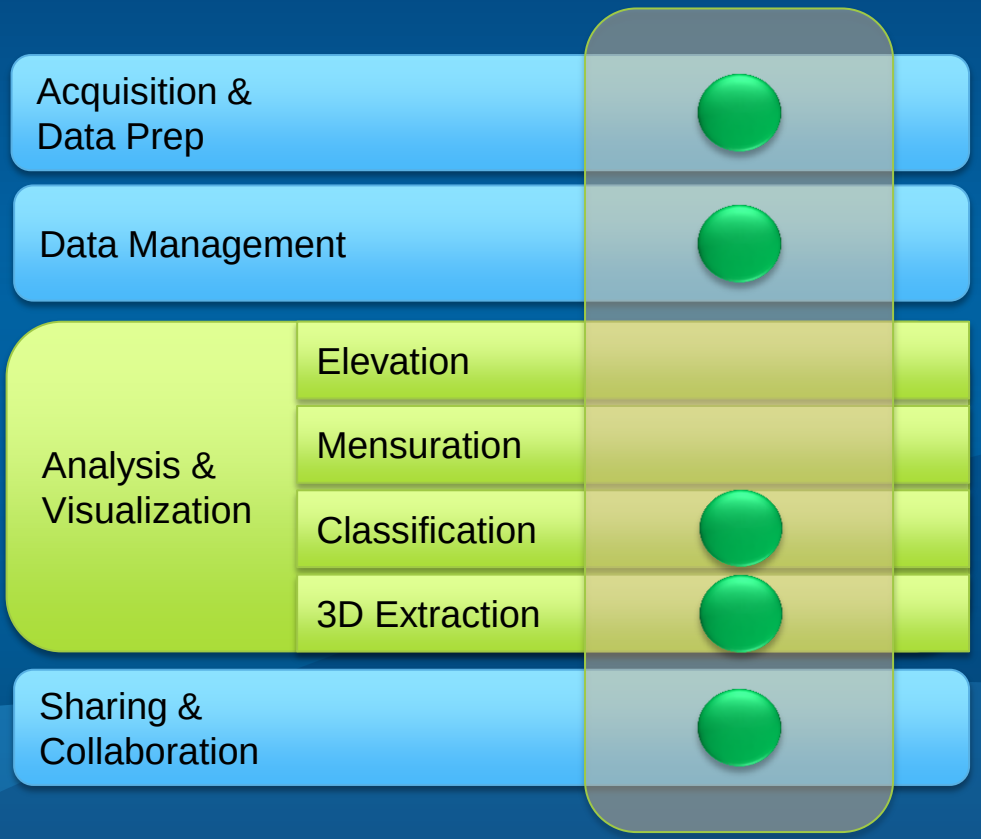

Reaching Beyond Elevation
Utility Corridors
Surface Mining
Facilities
Bio Mass
Transportation
Forestry
Coastal Change
Asset Management
Property Records
Disaster Recovery
A Hero's Journey to explore the rich variety of Laser Scanning Applications

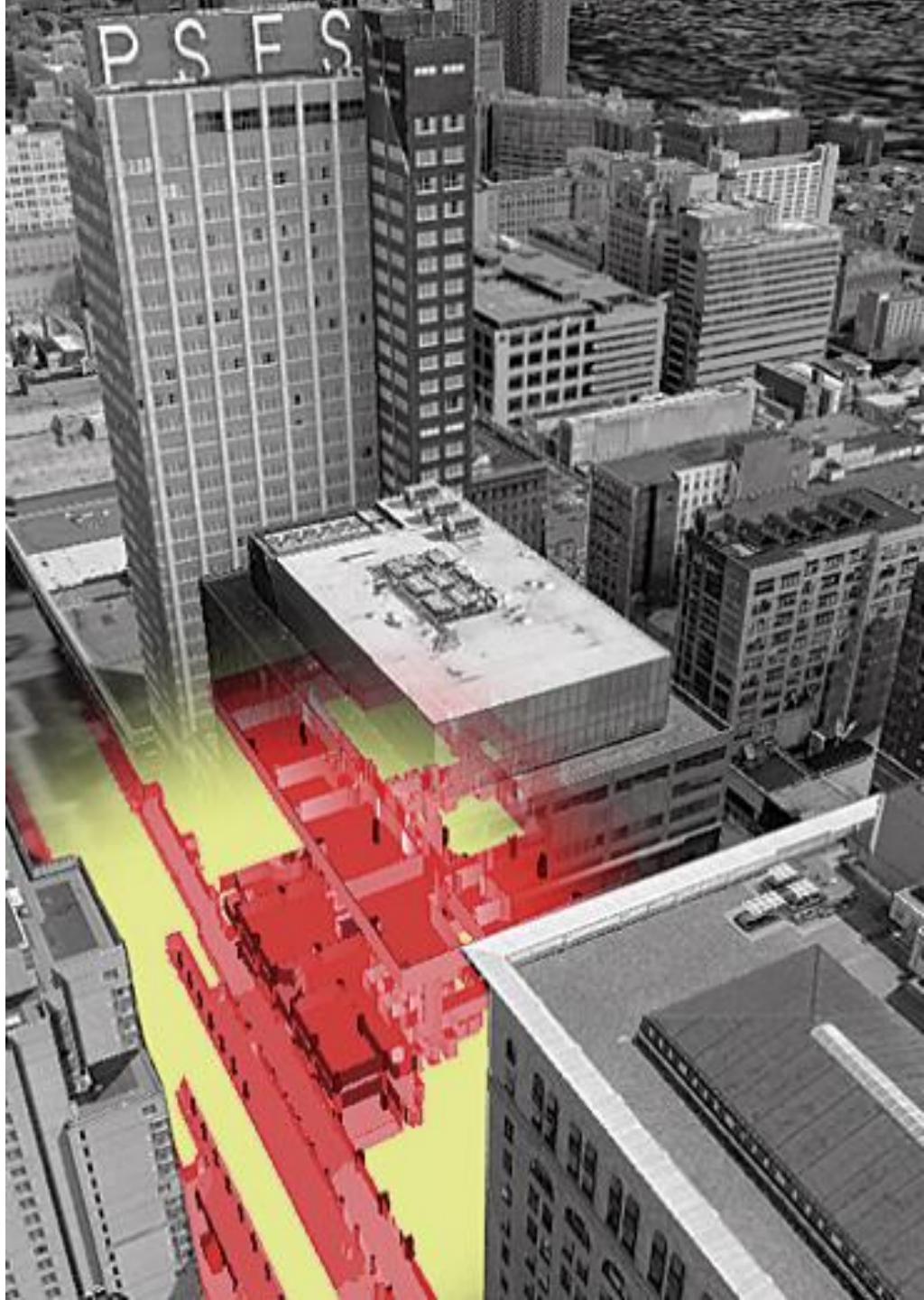
Forestry


Acquisition &
Data Prep
Data Management
Analysis &
Visualization
Elevation
Mensuration
Classification
3D Extraction
Sharing &
Collaboration

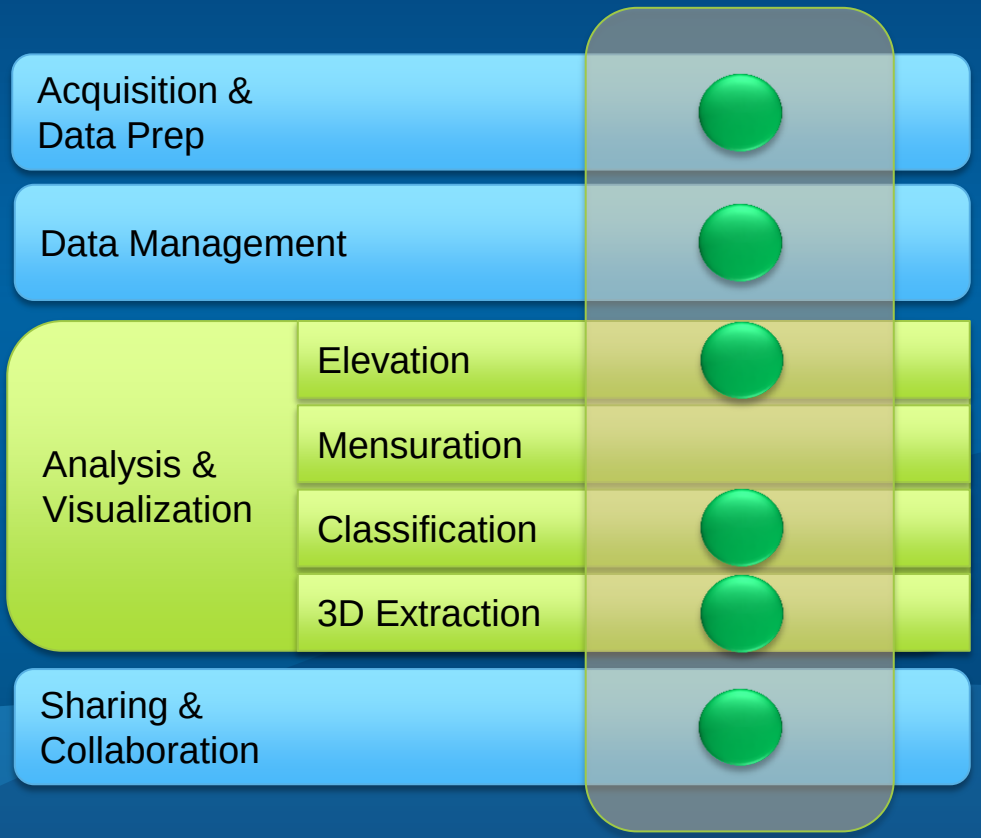


Facilities


Acquisition &
Data Prep
Data Management
Analysis &
Visualization
Elevation
Mensuration
Classification
3D Extraction
Sharing &
Collaboration


PSFS

Utilities


Acquisition &
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Mensuration
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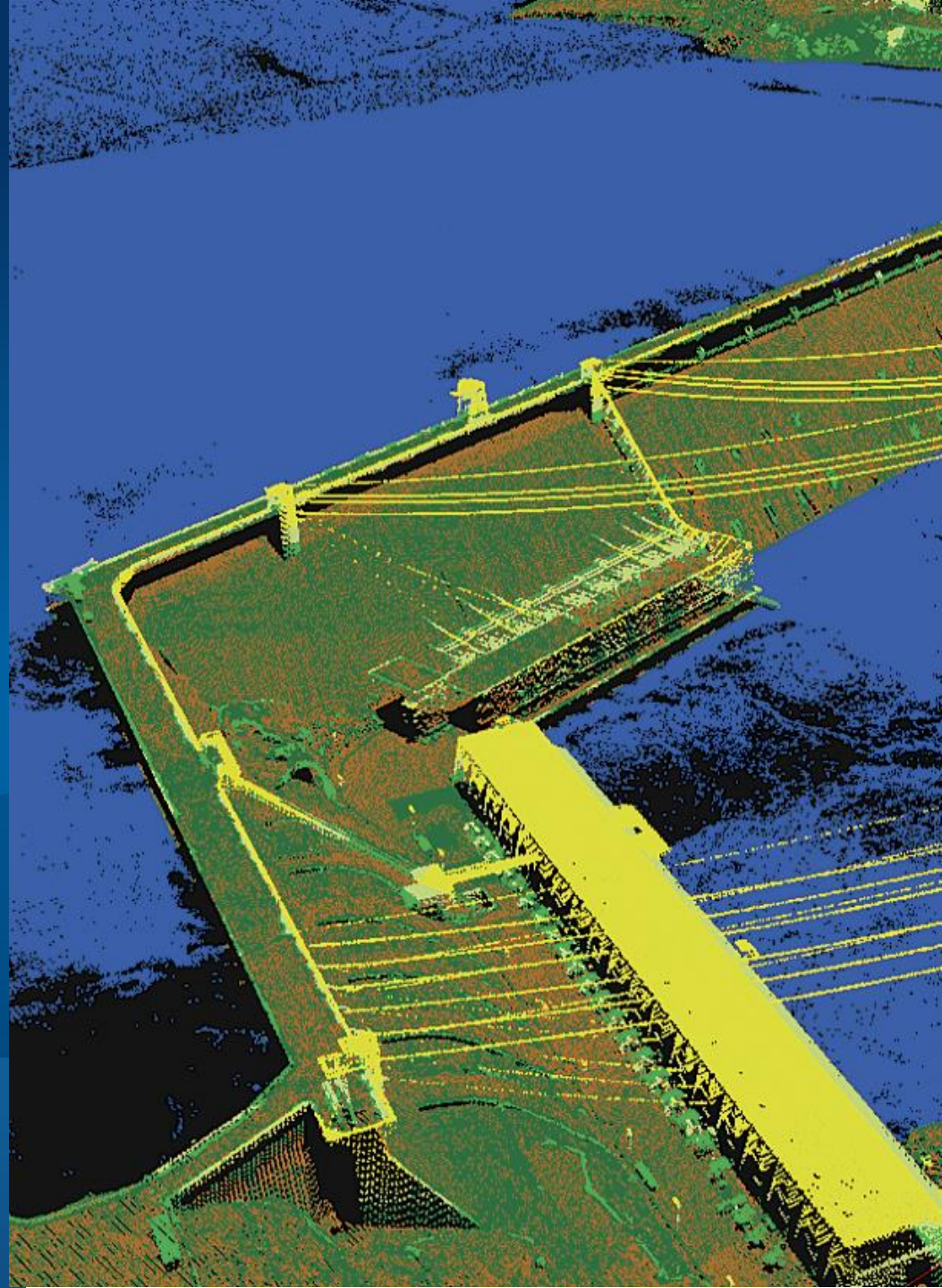
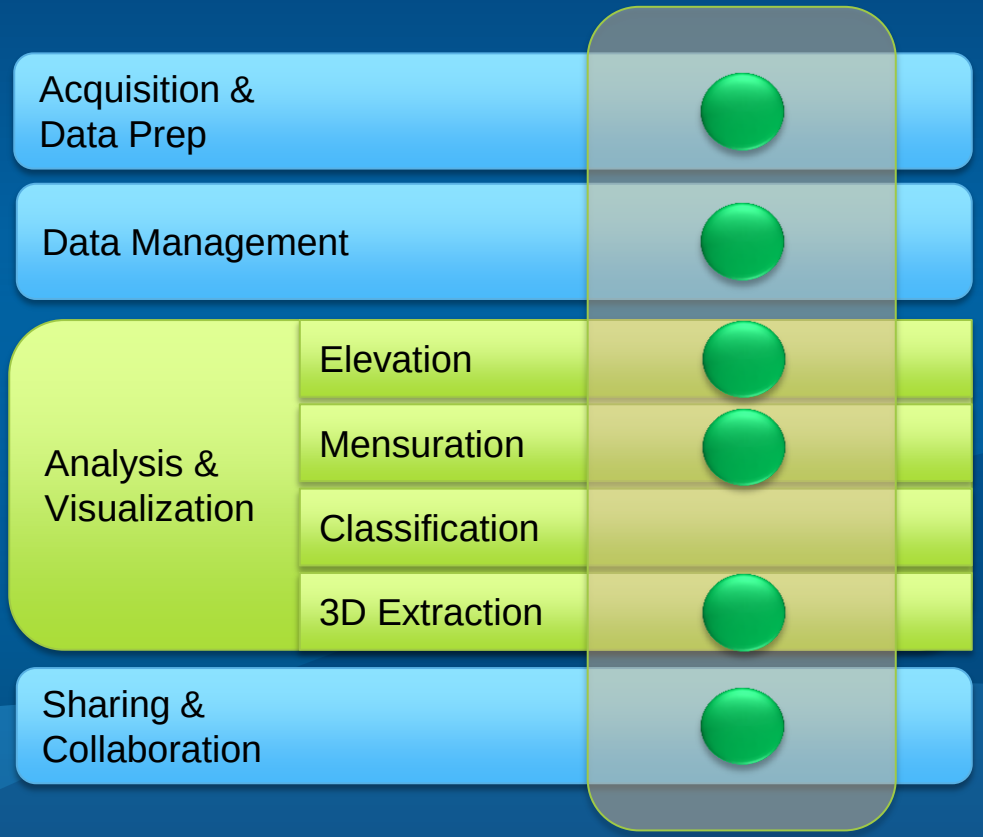
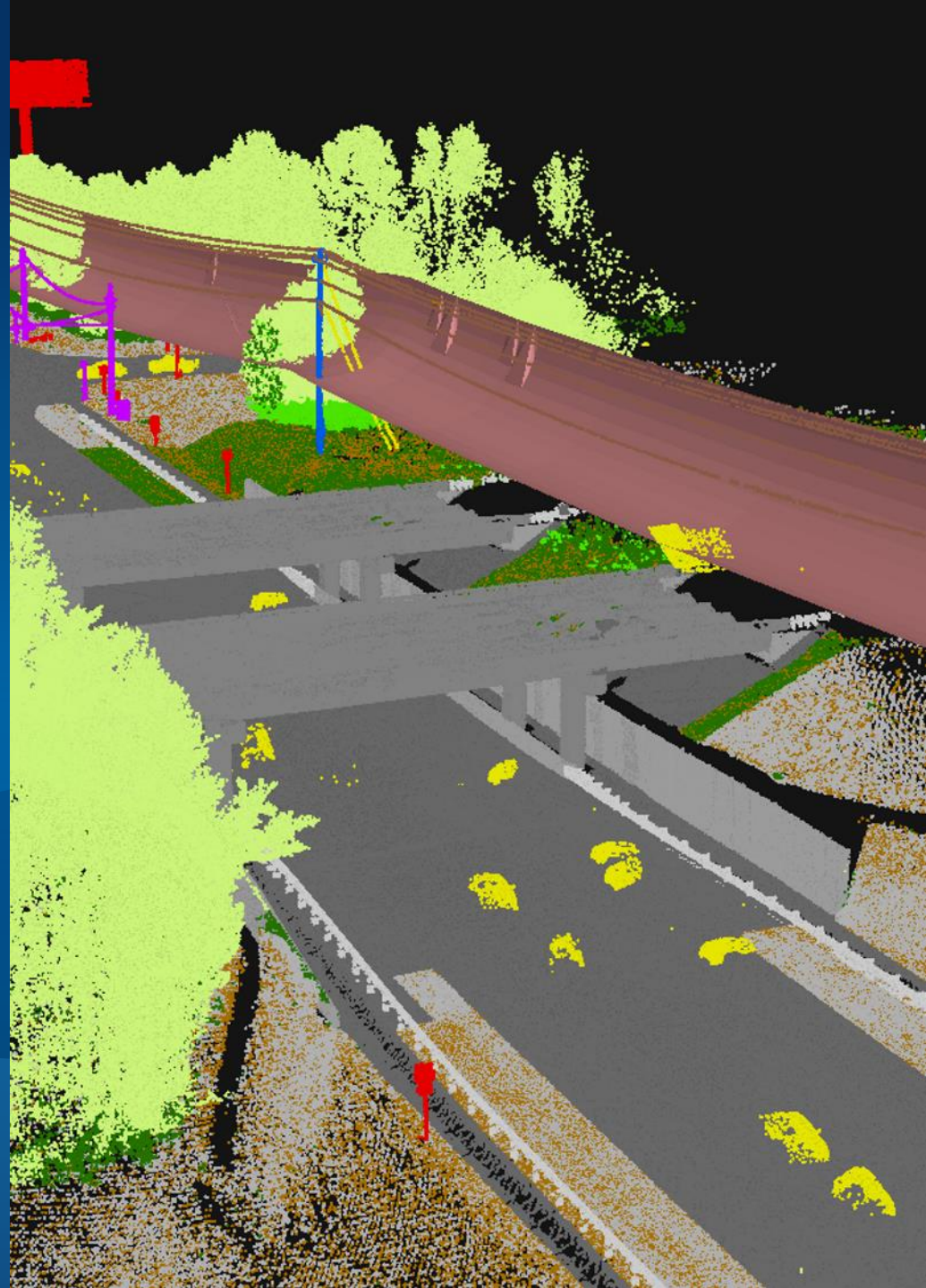
Collaboration



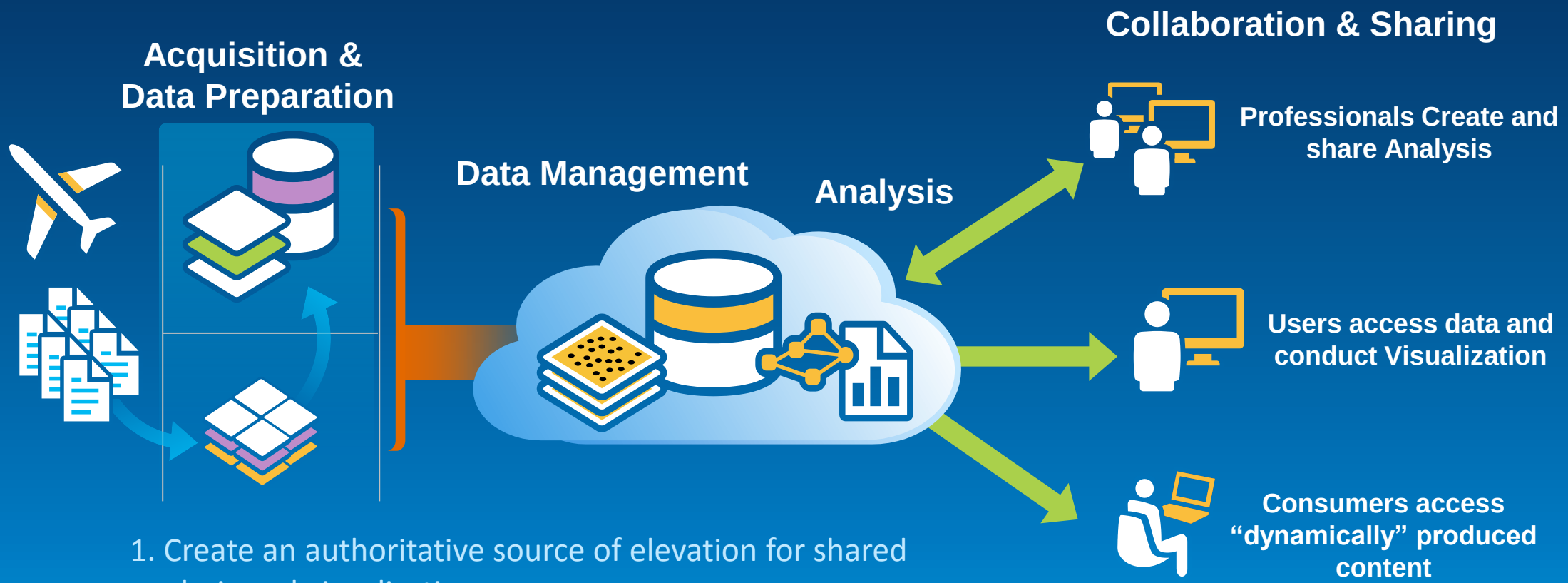
Transportation





Summary: ArcGIS Is An End-to-End Solution for Point Clouds

Tightly integrated functional segments facilitate multiple processing chains



1. Create an authoritative source of elevation for shared analysis and visualization
2. Manage, analysis and share to maximize the value
3. Foster collaboration

Understanding our world.