Delivering FAIR Land Information with Geospatial Infrastructure

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Land Administration

Geospatial Technology Powers Infrastructure for Land Administration

- Permitting
- Inspection
- Agriculture, Housing, Commercial….
- Land Use Planning

Land Use

- Mass Appraisals
- Appraisals
- Valuation
- Tax Mapping

Land Valuation

Land Planning

- Development
- Housing
- Walkability
- Utilities
- Sustainability/Resilience

- Surveying
- Cadastre
- Addressing
- Titling
- Right of way
- Conveyance
- Consolidation

Land Tenure

Land Information System

Land Management

- State Lands
- Conservation Areas
- Open Space
- Housing

Common Global Land Administration Challenges

FAIR

Findable
Accurate
Interoperable
Reusable

A geospatial infrastructure delivers
FAIR requirements…and more…..

Geospatial Technologies are Becoming Interconnected

Creating Secure Geospatial Infrastructure

Connecting and Streamlining . . .
Collaboration, Workflows and Decision Making

Findable

Not just a data catalogue and geographic search, but apps answering questions….finding answers with data

Land Administration Stakeholders

Government	Government/Private	NGO
Cadastre	Mortgage	UN Organizations
Land Registries	Insurance	Development Banks
Transportation	Developers	National Funding Agencies
Mining	Real Estate	Private Funding Organizations
Energy	Utilities	Government to Government
Agriculture	Financial Institutions	Educational Institutions
Census	Citizens	…
Water	Commerce	
Postal	Emergency Response	
Urban/Rural Planning	Judiciary	

Land Administration Consumers

- E-Commerce
- Infrastructure
- Asset Management
- Mining & Natural Resources
- Utilities
- Banking
- Rental Management
- Census
- Emergency
- Logistics
- Manufacturing
- Planning
- Real Estate
- Environment
- Urbanization
- Governance
- Forestry
- Environmental Management
- Insurance
- Taxation
- Security
- Defense
- Energy
- Water/Wastewater
- Conservation
- Mapping
- Tourism
- Public Works
- Agriculture
- Religious localities
- Tele communication
- UN Development Goals
- Humanitarian Support
- Social Services
- Health
- Postal Operations

Land
Information System

Developing Revenue Streams

Primary and secondary sustainable revenue streams

- Land Tax
- Property Tax
- Interest Tax
- Special Taxes
- ……

- Permit Fee’s
- Inspection Fee’s
- Use Payments/Rents
- ……

- Permit Fee’s
- Inspection Fee’s
- Infrastructure Payments
- ……

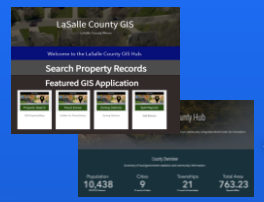
- Transaction Fee’s
- ……

- Registration
- Ownership Change
- Rights
- Property Change
- Interest Change
- Management
- Adjudication
- ……

Attorneys
Notaries
Adjudicators
Surveyors
Mortgage
Realtors
Banks
Developers
Escrows
Government
Insurances
… … .

Portals & Hubs are Changing How We Connect and Discover

New user requirements – New ways to share, collaborate and disseminate data and information



Open Data Portals

Portal-to-Portal Connections

Portals and Hubs

Enables Distributed and Interconnected Systems

Information Products & Services

Connecting Data Across Organizations

Sharing and Synchronization of Data, Maps and Apps

Apps, Dashboards Maps, StoryMaps

REST Services

APIs

Accurate

Positional

- Absolute
- Relative

Attribute

Topological

Feature ID

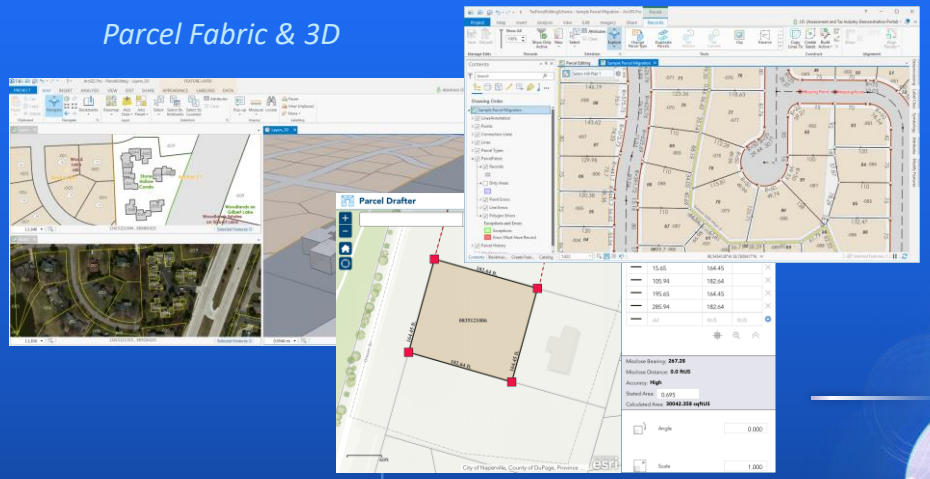
Temporal/Currency

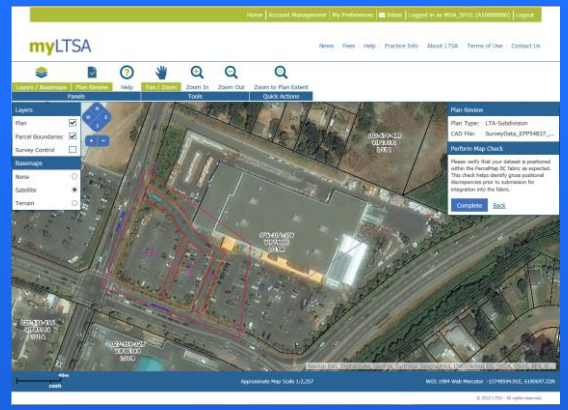
Authoritative and authenticated…..

Accuracy

Direct connect eliminates errors – services….

Parcel Fabric & 3D

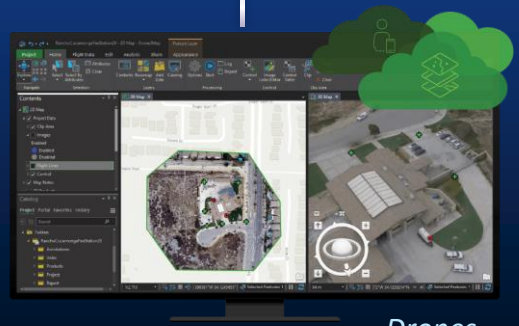




Digital Submissions

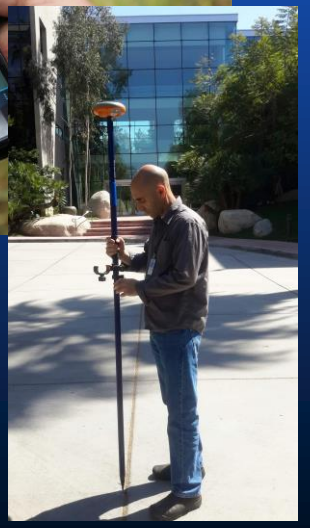
GIS & BIM

Geodetic Reference Frame & Services



Drones

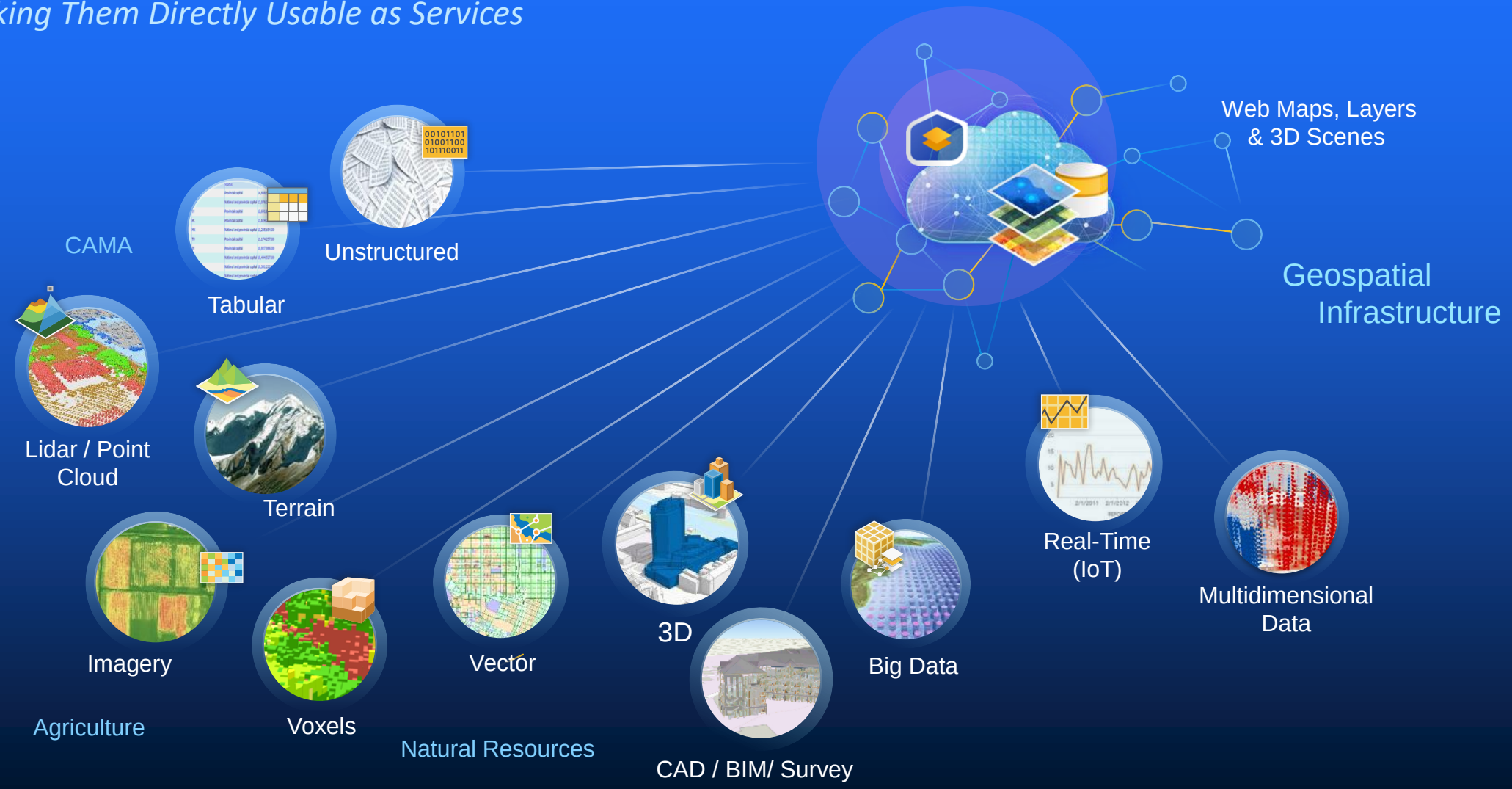
Filed Collection



High Accuracy

Integrating Data of All Types

…..Making Them Directly Usable as Services



Interoperable

(ETL doesn’t count!)

Open Platforms & Standards Enable Interoperability

Global Standards are being Widely Adopted…..

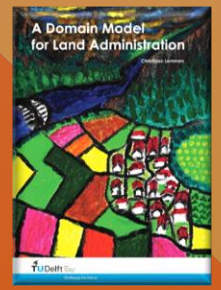
Open Standards

WMS
GML
WCS
KML
SQL
WWW
WFS
CSW
OPENDAP
SOAP
WMTS
ISO
IFC
SLD
WPS
NetCDF
GeoPackage
LAS
REST
JSON
OGC
Principal Member

Industry Formats

WaterML
Web Scene (I3S)
Imagery
OLEDB
DXF
Hadoop
CityGML
DBMSs
LERC
COLLADA
AIXM
DWG
DGN
OneGeology
INSPIRE
FileGDB
Shapefiles
Adobe Creative Cloud
Azure
MS Office
AutoCAD
AWS
SAP HANA
IBM Cognos

Open Models



Open Data
APIs
Open Architectures

Interoperability

Web Services

Changing how we work, share and communicate….

Client / Server
Stand-Alone Desktop
Data Models
Static Data
Single Server
Custom Applications
Proprietary Data
2D Features
Spatial Analysis
Digital Cartography

Evolving with Enabling Technology

Web Services & Apps
Connected Desktops
Web Maps & Layers
Real-Time
Distributed Computing
Configurable Templates and Apps
Open Data & Shared Services
3D Features
Spatiotemporal & Big Data Analytics
Smart Mapping

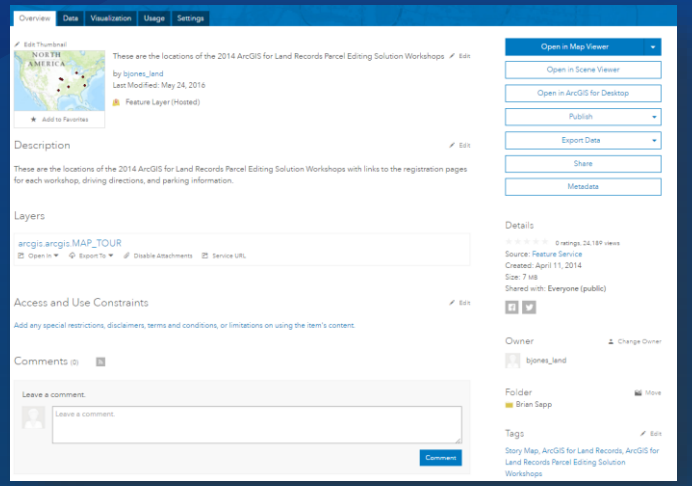
Web Services

Organizes and Securely Enables Sharing Data…..

- Secure
- Standards-based
- Scalable
- Stable
- Controlled Access via Identity
- Control Who Does What
  - View
  - Query
  - Edit
- Monitor/Track

https://

http://esriland.maps.arcgis.com/home/item.html?id=5969689b642840e39cf0491669484e0b



Reusable

Don’t forget the metadata…..

Apps

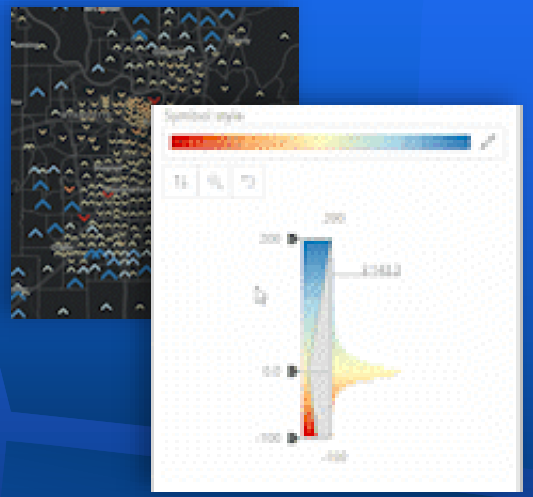
Extend the Reach of GIS to Everyone

Across Organizations and Beyond

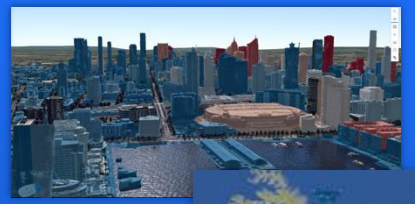
Web Maps Are Becoming Apps *Fast, Intuitive and Self-Service*

Data-Driven
Exploratory Mapping

Smart Mapping:
Color, Size and Shape



3D

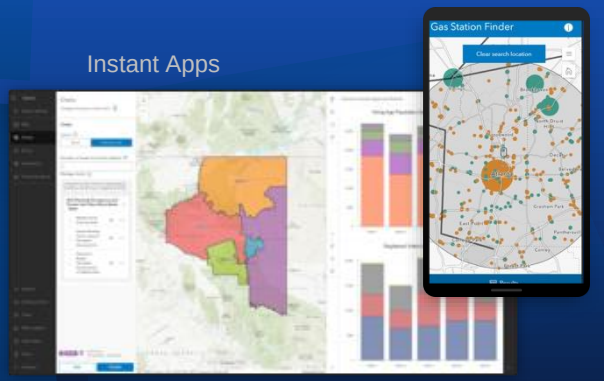


Imagery

Smart Data
Visualization

Sketching – Markup and Annotation

Instant Apps



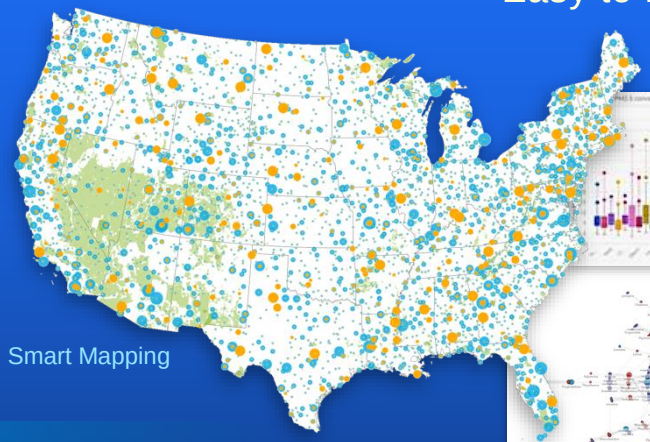
Easily Creates Apps

Transforming Mapping with Data Exploration

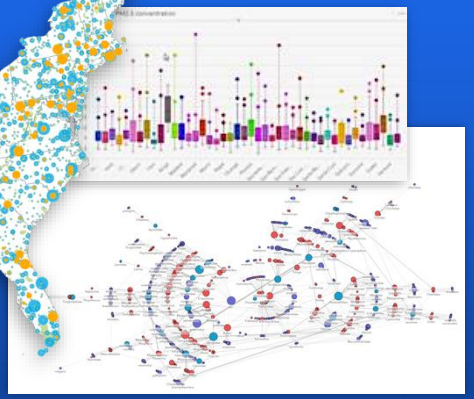
Interactive Visual Analytics Intuitive Spatial Data Exploration

Insights

Easy to Learn and Use

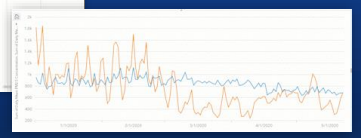


Smart Mapping



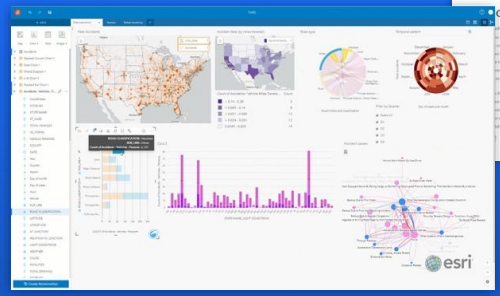
Statistics

Link Analysis

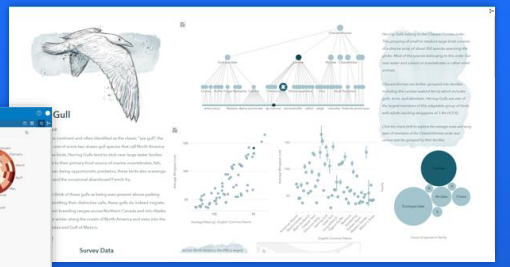


Dynamic Charts

- Cloud Data Warehouse Access
- Custom Data Connections
- Temporal Analysis & Forecasting
- Analysis Scheduling
- Data Export
- Charting
- StoryMap Integration



Interactive Visualization



Integrated Reporting

Advanced Analysis

Interactive Reports

Exploratory Visual Analytics

Data Access & Engineering

Web and Desktop

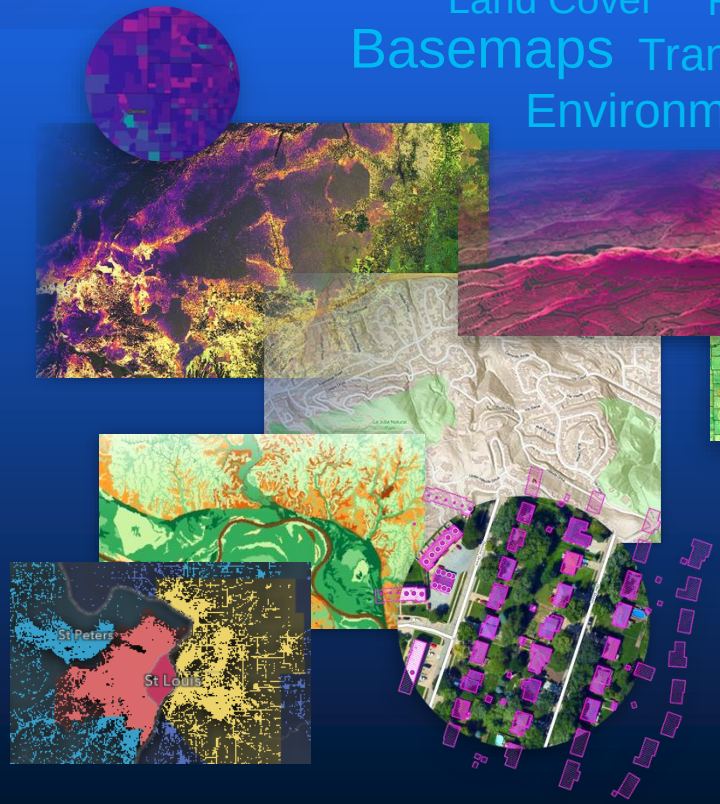
Empowering Spatial and Business Analysts

Online Ready-to-Use Content

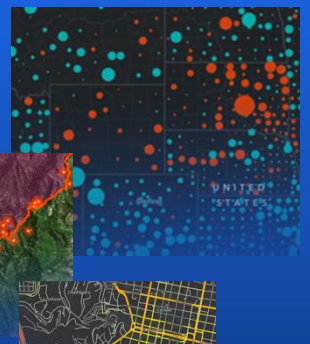
Petabytes of Basemaps, Imagery, Open and Crowd-sourced Data . . .

ArcGIS
Living Atlas

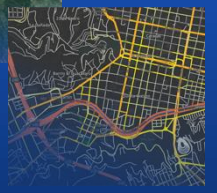
Land Cover
Habitats
Biodiversity
Basemaps
Transportation
Landscape
Environment
Movement
Infrastructure
Hydro
Traffic
Business
Elevation
Boundaries
Demographics
Imagery
POI
Oceans
Hazards
Weather
Soils
Authoritative
Community Content



Monthly Unemployment Statistics (BLS)



Real-Time Observations



OpenStreetMap Layers

Shared Maps & Data

Global & Local Geographic Content . . .
About Everything

Geospatial Infrastructure Leverages Technology Advancements

Integrating and Leveraging Many Innovations

Expanding into nearly all areas of society…..

Geospatial Infrastructure Enabling FAIR Data and Systems

Enabling a New Land Administration Paradigm

Geospatial Infrastructure Enabling Land Administration Systems Worldwide

Technology Megatrends and Land Administration Systems

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Technology Responds to Challenges and Opportunities

How Technology Decisions are Made

Decision-making processes evolving with evolving challenges and technology

Standardizing Data

Standardize data for use in other systems and interoperability.

- ISO Standards
- Metadata
- Land Administration Domain Model (LADM)

Understand Stakeholder Needs

Understand customers, users, stakeholders needs i

- New devices
- Data services
- Maps and Apps

Agile

Modernize technology infrastructure to support:

- Continuous delivery
- Strong stakeholder interaction
- Respond to change
- Customer collaboration

How Technology Decisions are Made

Decision-making process evolving with challenges and technology

Build It Right

Build it right the first time.

- High availability
- Backup
- Recovery
- System monitoring
- Consistent environments
- Support

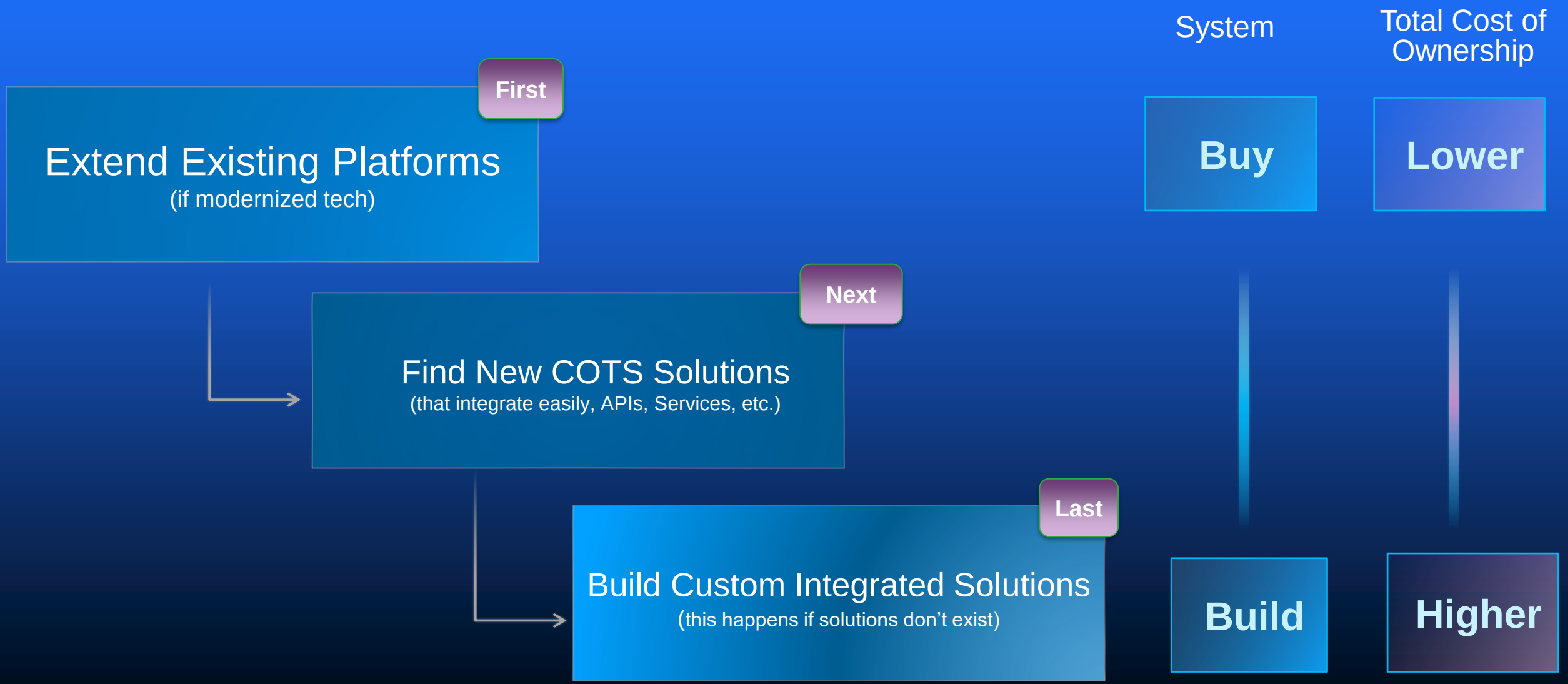
Security

Adhere to current and evolving security standards.

- Role-based control
- Single sign-on
- Encryption when called for

CIO/GIO Decision Making Framework

Extend and configure first, build last….analyse total cost of ownership/lifespan



Why This Decision-Making Process

Decision-making process evolving with challenges and technology

- Training
- Sustainability
- Scalability
- Support
- Extendibility
- Needed Flexibility
- Can’t Keep Pace
- Need to be Nimble

“Public sector not well positioned to develop and maintain software over the long term…”

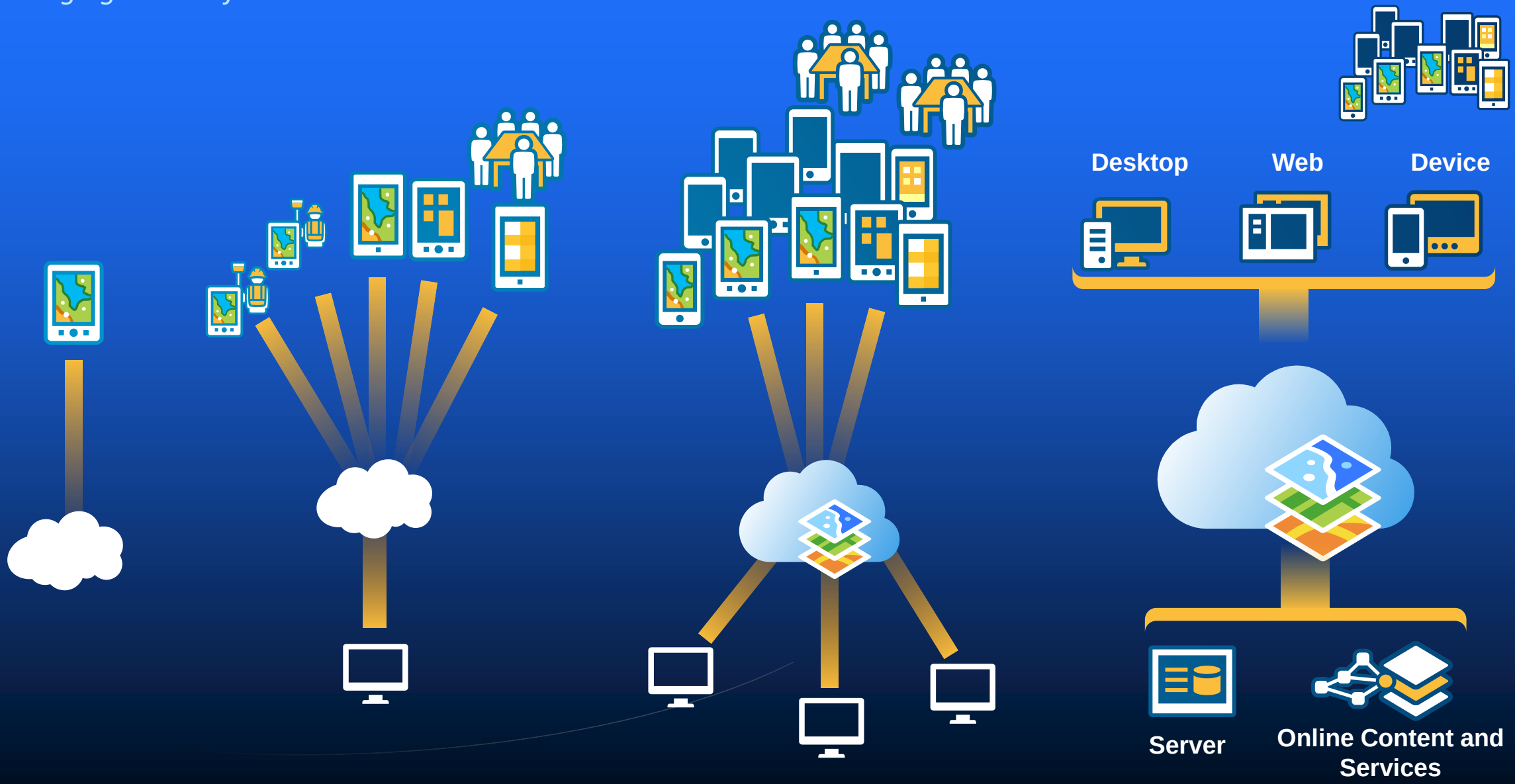
- Core mandate, rapid tech advances, IT staff retention, slow procurement, growing mandates, budgets, ….

Bycatch and Exhaust Data

Supporting Multiple Uses

Scalable and Fit-for-Purpose Systems

Leveraging COTS software and data



….As A Service

SaaS

PaaS

IaaS

*aaS

GIS 3D Capabilities Are Rapidly Advancing

- BIM Integration
- Reality Capture
- I3S Standard
- Performance
- Game Engine Integration
- Interactive Analysis
- Editing on the Web

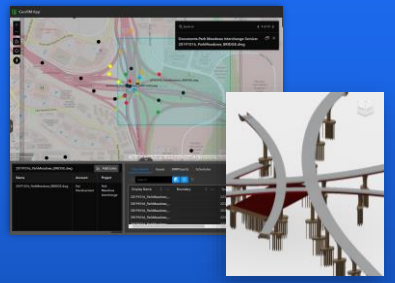
Immersive Experiences

Game Engine Integration

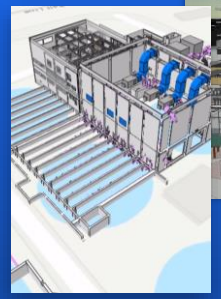
Water Effects on the Web

BIM Integration

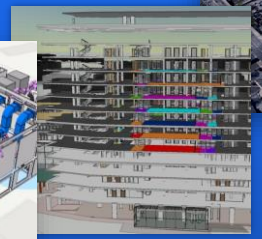
GeoBIM



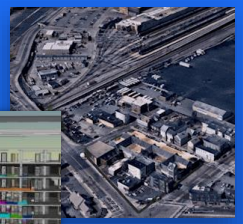
Open BIM



IFC Integration

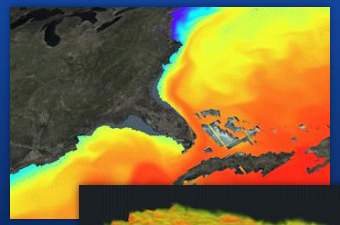


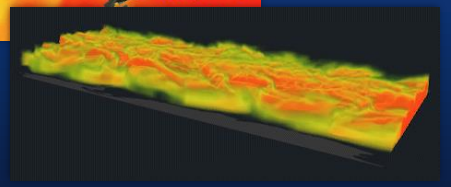
3D Feature Updating



Voxels

Voxel Sections

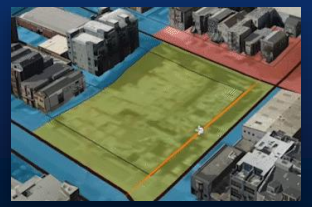




Voxel Animation

3D Web Editing

3D Symbols

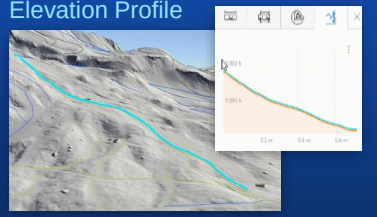


Polygons

Interactive Analysis

Viewshed

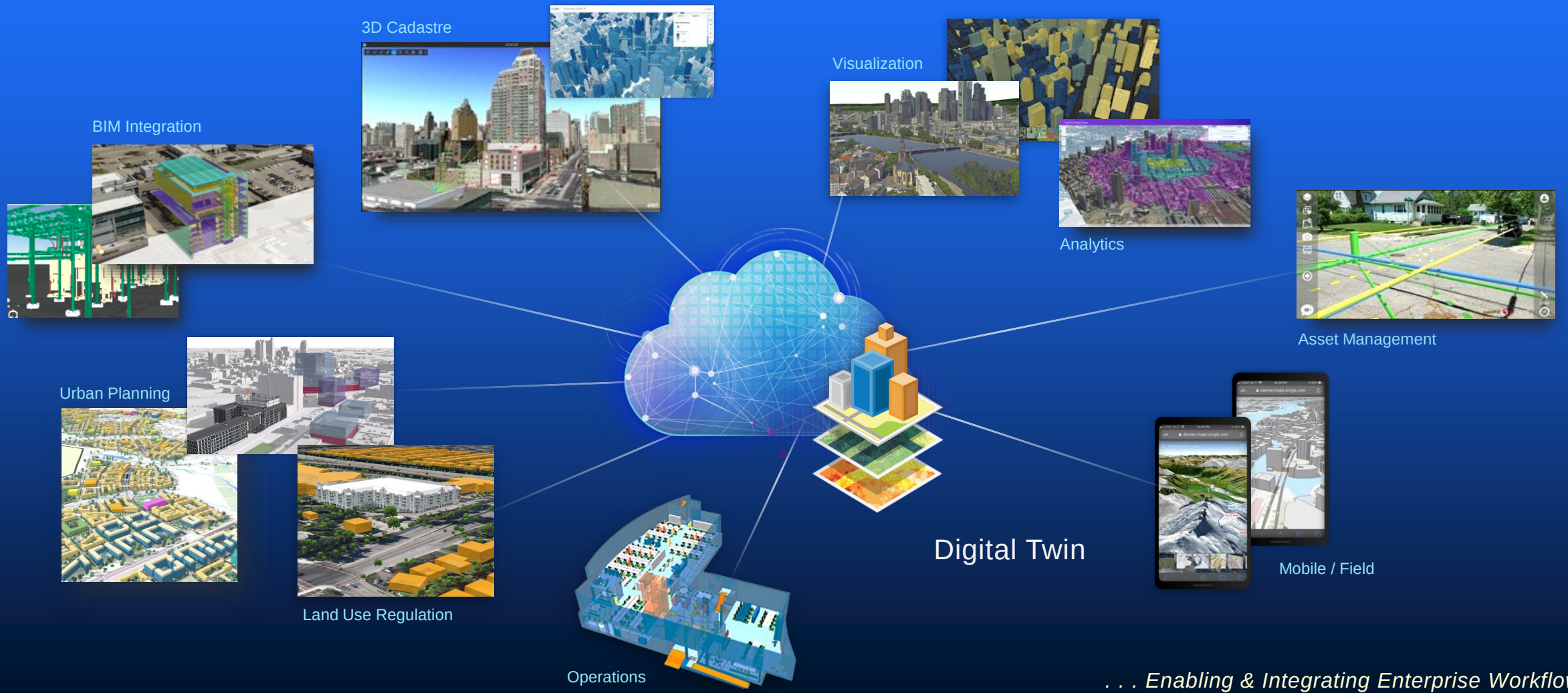
Elevation Profile



Slice

Integrated 3D Systems of Record Enabled by GIS

Supporting Multiple Applications

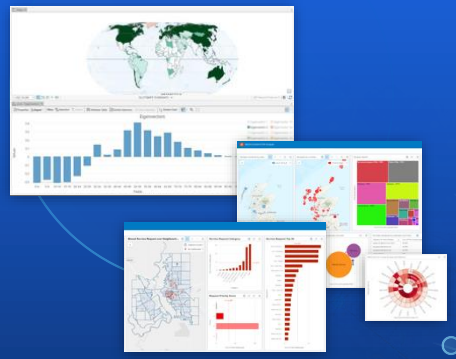


. . . Enabling & Integrating Enterprise Workflows

New Spatial Analytics

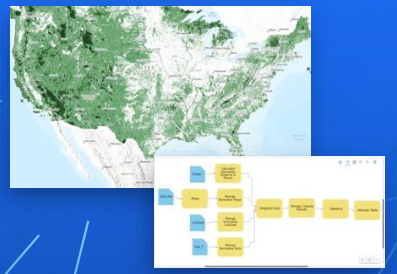
Creating New Insights and Understanding

Interactive
Visual Analytics

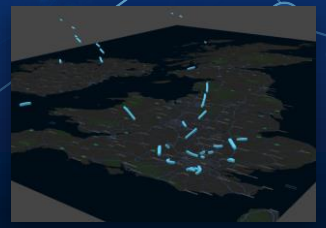


GeoAI & ML

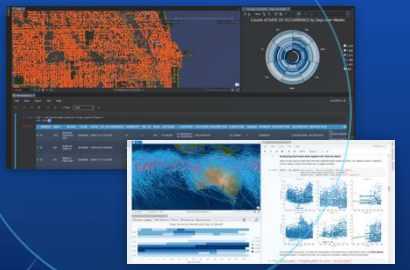
Raster Analytics
& Modeling
(In the Cloud)



Real-Time



Big Data



Leveraging Many Technical and Scientific Innovations