Applying... THE SCIENCE OF WHERE... for the Africa We Want

Dean Angelides
Corporate Director, Esri
AfricaGIS 2017
Addis Abeba, Ethiopia
OUR WORLD
Is Undergoing a Massive
Digital Transformation
THE SCIENCE OF WHERE
A Fundamental Digital Language
For Understanding and Managing Our World
THE SCIENCE OF WHERE
A Framework and Process

Transforming How We Collaborate and Act... Providing a More Integrated Approach
Applications
Addressing All Our World’s Challenges
Authoritative Mapping

UN Peacekeeper Deployment
- Central Africa Republic
- South Africa

City Map Generalization
- United Kingdom
- South Africa

Geological (Web) Visualization
- Utah Geological Survey

Topographical Map
- Jamaica
- United States Geological Survey

Travel Mapping
- France
- United Kingdom

Geospatial Management
- Global Foundation Geospatial Management (FGM)
- United States National Geospatial-Intelligence Agency (NGA)

On-Demand Services
- United States Geological Survey (USGS)

Multiscale Topo Map
- Switzerland

Topographic Mapping
- United Kingdom
- South Africa
3D Building and City Modeling

Building Asset Management
Russia
IGIT

Planned Housing
Denmark
Brøndby Kommune

Historical Viewer
Virginia
Blue Raster

New Building
New York
Bingham University

City Visualization
Sweden
Helsingborg Stad

Integration of
BIM and GIS
UK
egis

Underground
Space Planning
Singapore Land Authority

Zoning Height Analysis
California
San Francisco Planning

Power Plant
Russia
IGIT

Chernobyl Containment Structure
Ukraine
ECOMM Co
Business Analysis and Location Intelligence

- **Intermodal Freight Modeling**
  - Iceland: Samsyn
  - Wisconsin: CFIRE

- **Retail Delivery Optimization**
  - Denmark: Rapidis
  - Iceland: Samsyn

- **Optimizing Postal Routes**
  - United States: Samirillo's / Driscoll's

- **Field to Store Supply Chain Tracking**
  - United States: Samirillo's / Driscoll's

- **Optimizing Appointments**
  - Italy: MobyPlanner

- **Retail Sales**
  - Florida: Microsoft—Power BI
  - India: ML Infomap
  - Florida: BMS Re US

- **Gas Station Site Selection**
  - Brazil: Niterói City

- **New Business Location Analytics**
  - Wisconsin: CFIRE

- **Census Business Builder**
  - Washington DC: US Census Bureau

- **Insurance Analysis of Hurricane Matthew**
  - Florida: BMS Re US

- **Demographic Analysis for Banking**
  - California: RPM Consulting
Public Safety and Security

- **Bicycle Collisions**
  - North Carolina
  - BCS, Inc.

- **Marathon Tracking**
  - San Francisco
  - Nic Jay Mapping
  - Los Angeles
  - HSAC
  - Philadelphia

- **Real-Time Officer Tracking**
  - Oklahoma
  - Department of Public Safety

- **Crime Prediction (Machine Learning)**
  - London
  - Dataiku
  - Brazil
  - Rio de Janeiro

- **Fire Incidents**
  - California
  - Deccan International

- **Fire Response Times**
  - California
  - Santa Paula

- **911 Dispatch System**
  - North Carolina
  - BCS, Inc.

- **Crime and Traffic Accidents**
  - Japan
  - Aichi Prefecture

- **Online Crime Mapping**
  - San Diego
  - crimemapping.com
Preparing for and Responding to Disasters

- **Volcanic Monitoring**
  - Japan
  - JAXA

- **Tsunami Evacuation Routes**
  - Washington
  - Michael Baker International

- **Wildfire Risk**
  - France
  - Caroviz

- **Hurricane Modeling**
  - Georgia
  - Glynn County GIS

- **Disaster Preparedness**
  - Japan
  - Funabashi City
  - Kajima Corporation

- **Interactive Plume Modeling**
  - Sri Lanka
  - Geoinformatics Center

- **Liquefaction Risk**
  - Japan
  - Funabashi City

- **Flood Impacts**
  - British Columbia
  - Kerr Wood Leidal Associates Ltd.

- **Damage Assessment**
  - Europe
  - Eurocommand

- **Disaster Preparedness**
  - Germany
  - Emergency Management Center

- **Hailstorm Tracking**
  - Texas
  - CoreLogic
Story Maps

Transit Corridors
- Finland

Archaeology
- Ecuador

Climate Change
- Africa
- Tesla Government
- Global

Social Conflict Events
- Switzerland

Memorial Forest Locations
- New Zealand (Thames-Coromandel District Council)

Geological Sites
- Utah Geological Survey

Snow Avalanches
- Japan

Postcard Collection
- California (Los Angeles World Airports)

Butterfly Zone
- Italy (Comune di Milano)

Rail Stations
- Virginia

Inequality
- Utah Geological Survey

Climate Change
- Global
Open Portals for Citizen Engagement, Open Data, and Collaboration

Transport Data

Moreton Bay

Logan City Council

VicRoads

Open Data Global Forest Watch

Democratic Republic of Congo

Cameroon

Global Sustainability

Clean Water Living Atlas

Education

Gender Equality

UK Office for National Statistics

US Department of Housing & Urban Development

NOAA

Ordnance Survey Ireland

Clean Water Living Atlas

UN

Clean Water Living Atlas

The Global Goals on sustainable development data
GIS Provides a Platform
For Managing, Analyzing, and Applying Geographic Knowledge

Integrating People, Processes, Things, and Data About Them
Web GIS Is the Modern GIS Architecture

Helping Everyone Do Their Work Better

Growing Exponentially

Leveraging Web Services

Sharing Knowledge

Collaboration

Improving Productivity and Efficiency
Web GIS Simplifies Working With All Types of Data
Using Web Maps, Scenes, and Layers

Creating A Common Language

Apps

Distributed

Map
Tabular
Imagery
3D
Real-Time (IoT)
Big Data
Lidar

Portal
Apps Make the System Come Alive
Leveraging Open Data and Services
Integrating Real-Time Information
Leverages Dynamic Data About Everything
Web GIS Is Making Spatial Analysis More Accessible
Advancing Analytics and Geo-Enabling Data Science

Exploratory Data Analysis

Opening Access

Analytic Services

Python API

Integration

Spatial Analysis & Geoprocessing

Big Data Geoanalytics

Data Science
Smart Mapping and Exploratory Data Analysis
Simplifies the Use of Analytics and Creates Beautiful Maps
Web GIS Is Revolutionizing How We Plan and Design

Integrating Science Into the Design Process

Rapidly Creating and Evaluating Scenarios

Analyzing

Designing

Evaluating

Visualizing

Disseminating

Economic Development

Urban Design

City Planning

Green Infrastructure

Transportation

Rapidly Creating and Evaluating Scenarios
Web GIS Is Connecting Everyone
Using Web Maps and Apps to Share and Collaborate

Supporting Communication and Real-Time Awareness

Creating a System of Engagement
GIS Is Implemented in Multiple Patterns

Web Services Are Interconnecting Everything
Web GIS Organizes Distributed Content Using a Portal
Introducing GeoHive
Buying Property in Ireland

Infobox
This map shows the Planning & Zoning Information provided by the Dept of Environment, including:

- LPT Waiver Areas
- Residential Land Availability
- Residential Zoning
- Unfinished Housing Estates

You can click on the areas to view a popup with further information.

To view more information like this, go to the main GeoHive application here.
GIS Portals Are Evolving How We Think of SDI
Enabling Dynamic Integration of Distributed Services
Web GIS Enables Community Engagement

Organizing and Managing Community Interactions

Providing Citizens Information . . .
. . . And Leaders Input

Community GIS Hub

Citizen Communication
Citizen Surveys (Crowdsourcing)
Status Reporting
Open Data
Storytelling
Demographic Information

Policy Initiative Based
City of Los Angeles

- **40+** departments running on an array of disconnected technology platforms
- **500+** datasets—and growing—into a centralized business intelligence system
- **202** Los Angeles-based startups generating more than $3 billion in yearly capital
- **3.8M** People and counting in the Greater Los Angeles area

Vision Zero
Open Data

Urban Planning
Demographic Reporting

Easily Configured and Used
Clean Streets

22,000 miles of public streets and alleys assigned a cleanliness score. Residents can explore the cleanliness of streets near them while city staff use this data to prioritize clean-up efforts, prevent illegal dumping, and deploy 5,000 trash bins in the right locations.
Livable Streets

The city’s annual campaign to repave 2,400 miles of roads delivers more reliable and safer transportation options for all citizens. The app helps citizens keep tabs on the city’s progress and shows how staff are meeting their current goal—ahead of schedule and under budget.
Enhance livability by easing traffic, the city pooled its open data via GeoHub to create Street Wize, an interactive web-based application that maps street construction and permit activities.
Los Angeles Vision Zero

Vision Zero is a global initiative whose goal is to reduce severe injuries and deaths in roadway collisions. Through the LA GeoHub you can explore, visualize, and download Vision Zero’s location-based Open Data, as well as use and develop web and mobile applications that support this initiative.
GIS Now Provides the Means . . .

. . . For Creating Federated Systems
THE GLOBAL GOALS
For Sustainable Development.

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace and Justice, Strong Institutions
17. Partnerships for the Goals
GIS Capabilities Are Advancing

Many Innovations

- Field Mobility
- Real-Time
- Visualization
- Mapping
- Imagery
- Apps
- 3D
- Content
- Open
- Data Exploration
- Data Management
- Big Data
- Spatial Analysis
- Community Engagement
Content | A Fundamental Part of the Platform

Millions of Maps and Layers
Shared by Users

Soils
Vegetation
Traffic
Landsat
Land Cover
Population
Elevation
Demographics
Boundaries
Floodplains
Hazardous
Protected Areas
Basemaps
Topo Maps
Addressing
Traffic
Roads
Imagery
Vegetation
Scientific
Landsat
Elevation
Water
Demographics
Hazard
Weather
Population
Sea Temperature
Millions of Maps and Layers
and Datasets from Esri

The Foremost Collection of Global Geographic Information . . .
. . . A Living Atlas for the Planet
Data Management and Compilation | Advancing Data Models, Workflows, and Tools

New Utility Network

CAD Integration

Improved Editing

Improved Geocoding & Location Finding

- Annotation Editing
- Automatic Image Registration
- Stereo & Feature Extraction
- 3D Editing
- Smart Conflation
- USNG/MGRS
- Performance

- CAD Toolbar
- Georeferencing Drawings
- Autodesk Integration
- 3D CAD/BIM
- Improved Geocoding & Location Finding
Field GIS | Taking ArcGIS Beyond the Office

- Collecting Data
- Coordinating Work
- Advanced Navigation
- Mapping and Markup

Connecting the Field with the Enterprise
Mapping and Cartography | Advancing Tools and Methods

Smart Mapping

Pro Improvements

SVG Import
Dynamic Charts in Layouts
Measured Grids
Multiscale Drawing
Vector Tiles

Production Charting and Mapping

Adobe Creative Cloud

Very Fast Display
2D
3D
Projections
Aeronautical
Nautical
Topographic
Improving Capabilities Across the Platform

Visualization
- 3D Symbols
- Landscape

Urban Planning and Geodesign
- Urban Design
- Shadows
- Indoor GIS

Innovation
- Augmented Reality
- Virtual Reality
- Animations

New Data Types
- WMTS
- Lidar
- Massive Point Clouds

Apps
- Earth
- Pro Navigation
- Scene Viewer
- KML & Sketching
- Pro

3D Symbols
- Urban
- Landscape
Aerial Photos
High-Resolution Satellites
Small Sats
Supporting Advanced Processing, Analysis, and Management
GIS | A Complete Imagery Platform
Dynamic Image Processing
Desktop and Web
Full-Motion Video
Mensuration
Image Space
Pro Imagery Tab
NDVI
Classification
Change Analysis
Powerful Analytics
Aerial Photos
High-Resolution Satellites
Small Sats
Drones
Weather
Landsat
All Major Sensors
Radar
Dynamic Image Processing
NDVI
Classification
Change Analysis
Powerful Analytics
Spatial Analysis | Expanding and Improving Tools

Web-Based Analysis
- Join Features
- Hot Spot Outliers
- Aggregation
- Science Integration
- Charting

Spatial Statistics
- Vector Analysis In Space-Time Cubes
- Space-Time Pattern Mining
- Enhanced Cube Explorer
- Geostatistical Wizard

Spatial Analysis
- Improved R Integration
- Machine Learning Tools

Other Enhancements
- Dynamic Aggregation
- Model Builder
- Areal Interpolation
- Optimum Site Selection
- Optimized VRP Clustering

Raster and Lidar
- New Raster Functions
- Improved Slope/Aspect
- LAS Classification

Improved Processing
- Parallel Processing
- Models as a Service
Insights | A New Experience for Spatial Analytics

- Visual, Intuitive, Responsive
- Exploratory Data Analysis and Visualization

Spatial / BI

New Charts

Linked and Responsive Charts and Maps

On-the-Fly Visual Models

Integrated Spatial and Tabular Analysis

Local
- Excel
- CSV

DBMSs
- SQL Server
- Oracle
- SAP HANA
- Teradata

GIS

Coming Soon In ArcGIS Online

For Analysts and Data Scientists
Big Data Spatial Analytics | Faster and Massively Scalable

GeoAnalytics Server
Large Observation Collections

Image Server
Large Imagery Collection

Features / Vectors
Space-Time Analytics
Hot Spots
Density
Buffer
Summarize
Aggregation
Construct Tracks
Find Similar
Spatial Join

Image
Image Processing
Classification
Change Detection
Topo
Suitability
Density
Corridors
Distance
Proximities
Interpolation

Leveraging Distributed Computing and Parallel Processing

... Accessible from ArcGIS Pro and Python API
Real-Time Analytics | Integrating Sensor Networks and the IoT

- High-Velocity Data Streams
- Monitoring and Alerting

Improvements
- Scalability
- Availability
- Cloud IoT Connectors

Supporting Real-Time GIS Applications...
Major Advancements
- JavaScript
- Runtime
- Python Web Scripting
- Pro Customizations

For Devices, Web, and Desktop

Supporting Enterprise Developers . . .
and the Creative “Maker” Community
ArcGIS API for Python | Enables Scripting and Automation

A Whole New Way to Experience and Leverage ArcGIS

- Automation
- Analysis
- System Administration

Programmatic Access to ArcGIS

Empowering GIS Users
. . . And Opening ArcGIS to Data Scientists
ArcGIS — An Open, Interoperable, and Standards-Compliant Platform

Open Standards and Formats
- WMS
- GML
- IFC
- OPeNDAP
- LERC
- REST
- NetCDF

ISO
- OneGeology
- CityGML

WWW
- KML
- WFS
- WFS
- WCS
- SQL
- SOAP
- LAS
- CSW
- WMTS
- WPS
- Shapefiles
- GeoPackage

Open Software
- Adobe Creative Cloud
- AWS
- IBM Cognos
- SharePoint
- AutoCAD
- Azure
- Netezza
- SAP HANA
- Teradata
- Oracle

Open Data Access
- Open APIs & SDKs
- Extensible Architecture
- Embeddable Components
- Open-Source Contributions (500+)
- Open-Source Integration

Any System

...Successfully Integrated into Thousands of Systems
**ArcGIS Online** | ArcGIS Delivered as SaaS

**New and Improved**
- Smart Mapping (2D / 3D)
- Vector Tiles
- Analytics
- Enhanced User Experience
- Automatic Tile Generation
- Standards/OGC (WMS, WMTS, WFS, KML)
- Administration
- New Viewer Role

**Coming**
- Improved Search and Metadata
- Collaboration
- Charting
- Clustering

<table>
<thead>
<tr>
<th>Metric</th>
<th>Increase</th>
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</thead>
<tbody>
<tr>
<td>4.4 MILLION Users</td>
<td>+30%</td>
</tr>
<tr>
<td>3 BILLION Tiles Served / Day</td>
<td>+95%</td>
</tr>
<tr>
<td>11 MILLION Items</td>
<td>+77%</td>
</tr>
<tr>
<td>40+ MILLION Open Data Downloads</td>
<td>+200%</td>
</tr>
</tbody>
</table>

Web Mapping, Analysis, Content, and Apps

A Global Community . . . . . . Finding, Exploring, Mapping, and Sharing
Esri  Serving Our Users

Advancing GIS and The Science of Where

Strong and Growing Engineering and Science Focus

Promoting Spatial Literacy

Supporting Employees Working to Make a Difference
Professional Development
Lifelong Learning

E-Learning
Supporting Universities
Personal Use License
Training
Certification Program
Student License
DevSummit
GeoNet Community
Esri Press
ArcUser
User Conference
ArcNews
Young Professionals Network
MOOCs

Esri Press
Training
Professional Development
Lifelong Learning
Supporting Universities
E-Learning
Student License
Certification Program
DevSummit
GeoNet Community
Esri Press
ArcUser
User Conference
ArcNews
Young Professionals Network
MOOCs
Education
Building the Next Generation

School Program
Advancing Geoliteracy
Higher Ed Program
Books
Curriculum
Project-Based Learning
STEM

GIS Day
November 15

GeoMentors
Humans Are More Capable Than Ever

. . . of Sharing and Applying Geographic Knowledge

. . . of Understanding and Acting
Technology Is Not Enough. . .

- Tech-Savvy Leadership
- Understanding What's Needed
- Data-Driven Culture
- Collaboration Across Departments
- Real-Time Awareness
- Citizen and Private Sector Engagement

…Good People / Good Attitude / Good Relationships
It’s up to YOU

A Global Community of Geospatial Professionals
Knowing is not enough . . .
... we must apply.

Being willing is not enough . . .
... we must do.

— Leonardo da Vinci