

Esri Indonesia Petroleum User Group



Emerging Technologies in GIS for Petroleum Industry

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Solution Specialist

Agenda

- 1 Innovation in ArcGIS
 - 2 ArcGIS as an Internet of Things (IoT) Platform
 - 3 Machine Learning in ArcGIS
 - 4 Augmented Reality
-



Innovation in ArcGIS

What Is GIS Today?

A System for Managing, Analyzing,
and Applying Geographic Information

Integration

Leveraging Location . . .
. . . and Technology

Communication

. . . Maps and Visualization

Analytics

Geographic Sciences . . .
. . . and Modeling

. . . and Solving
Problems Holistically



Understanding

A Platform for Organizations . . .
. . . and Society

GIS is Advancing Rapidly

Advancing data models, workflows, and tools



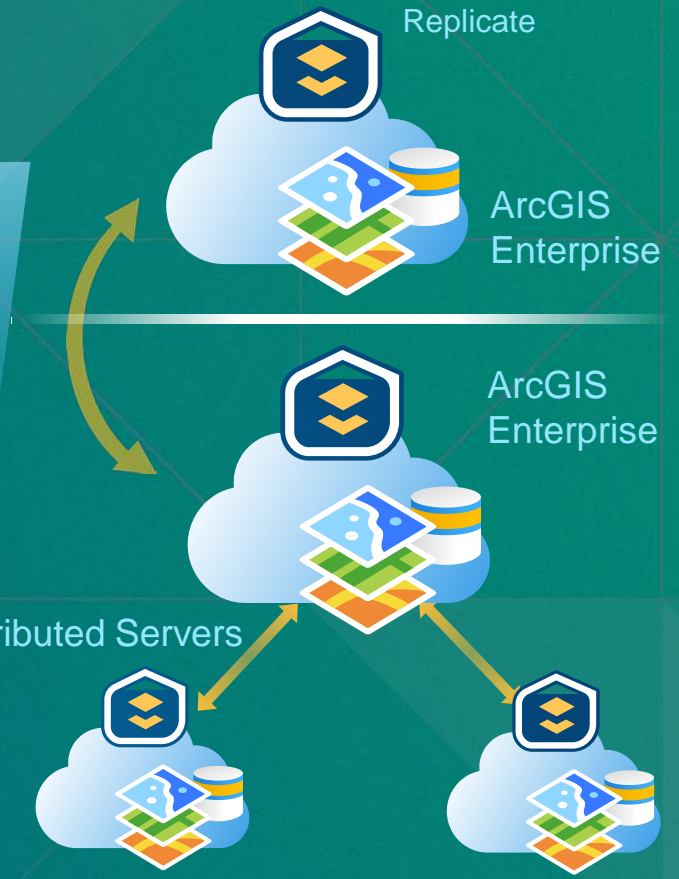
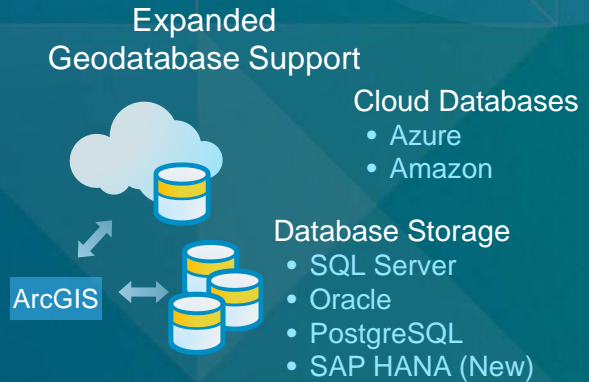
Industry Models
Utility Network PPDM
Pipeline Referencing
PODS BIM
UPDM



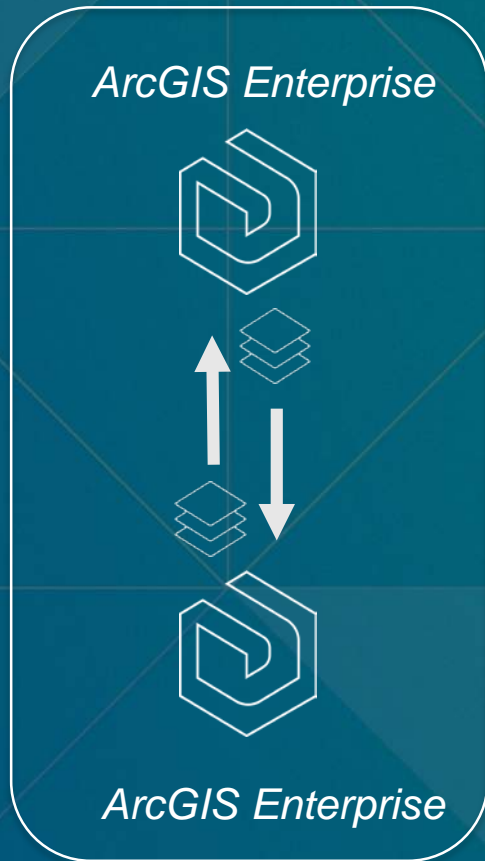
IHS Kingdom CAD
Petrel Landmark



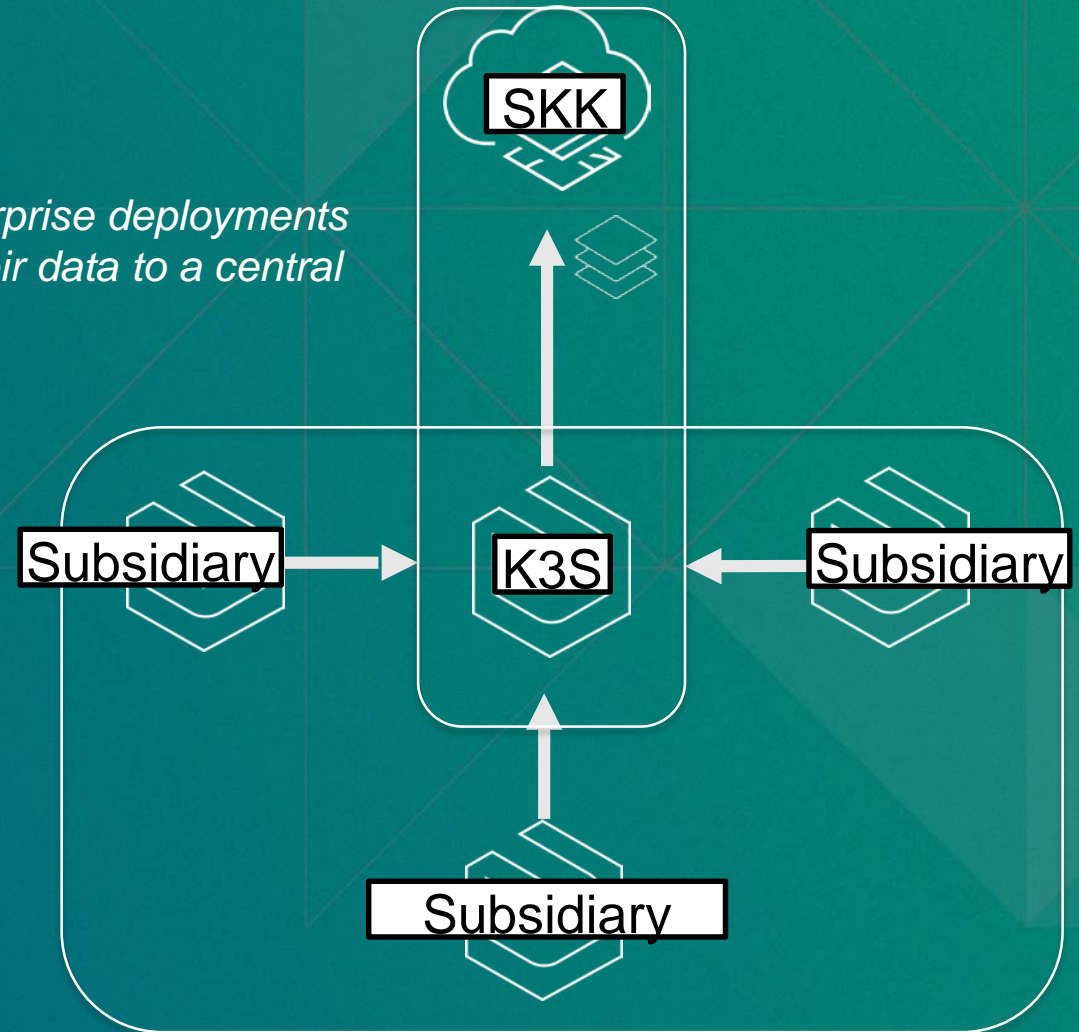
Geodatabase



Common Patterns



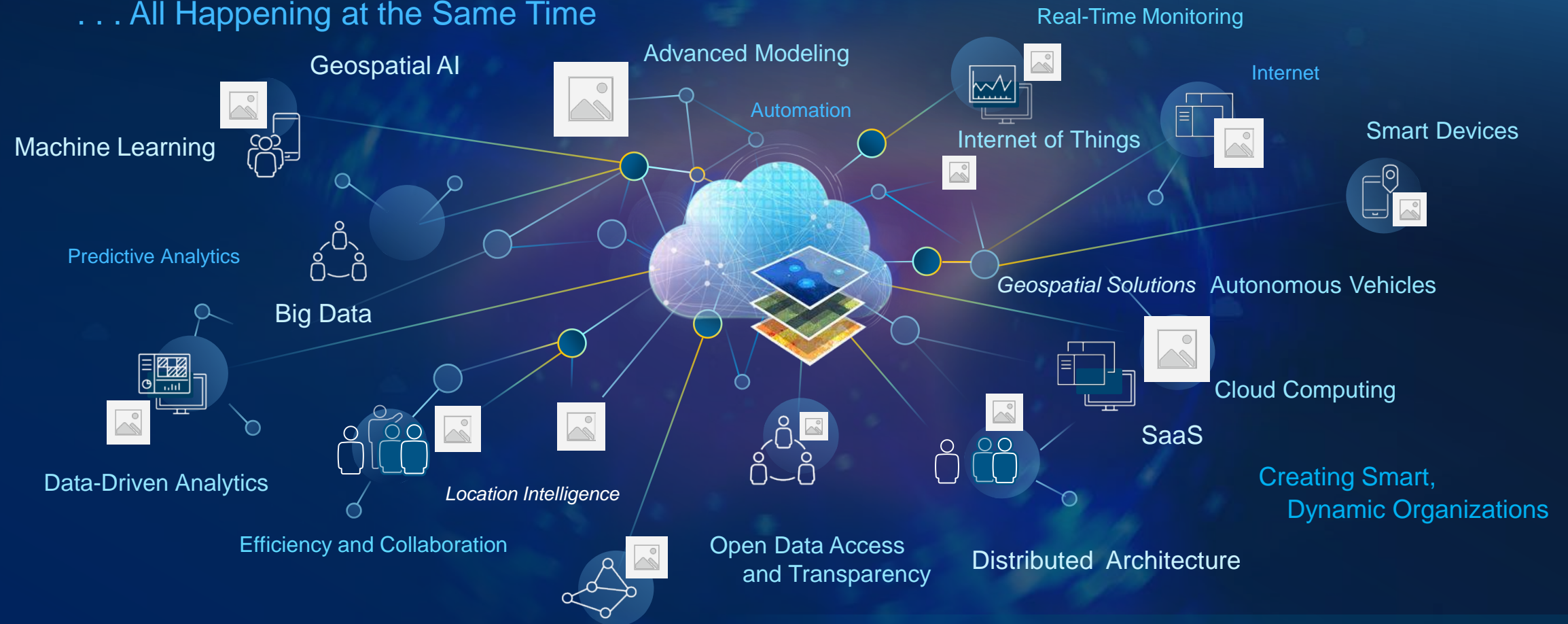
Multiple Enterprise deployments contribute their data to a central portal."



Geo-enable the 4th Industrial Revolution



Interconnected Information, Processes, and Workflows . . .
. . . All Happening at the Same Time



Using the Power of Location to Integrate Everything



ArcGIS as an Internet of Things (IoT) Platform

Internet of Things (IoT)

enabling geospatial insights with your IoT



Environment

noise co2 nitrates
gases temperature humidity
atmospheric pressure radiation
electromagnetic feedback
water level gauges
air quality

Weather

warnings earthquakes
precipitation icy conditions

pesticides
rain gauges
water quality

Airports

flight status queues
plane location runway status

Connected Cars

autonomous driving traffic conditions holes
parking meters road conditions slippery areas
network improvements

Transit

buses taxis rail
trains crowds

People

health monitoring
social activity

Public Safety

police fire
surveillance

Buildings

lighting hvac
occupancy counts

Energy Usage

electricity gas smart meters

City Workers

sanitation snow plows

Telecommunications

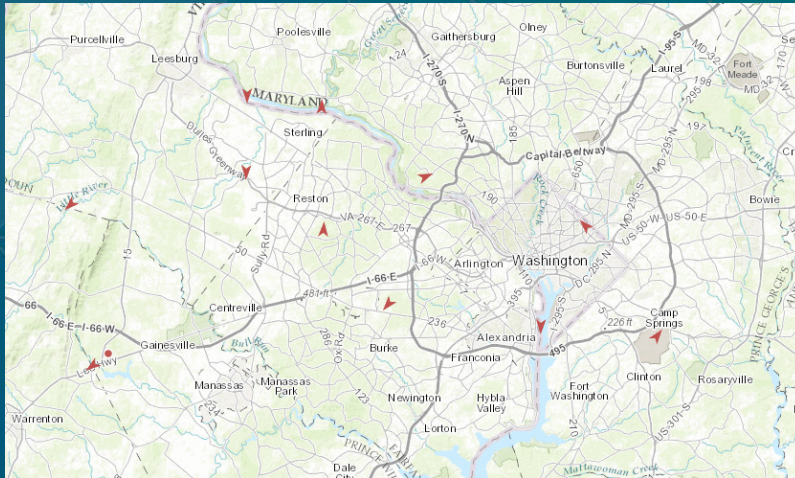
cell phone signals dropped calls



Real-Time Data in Petroleum

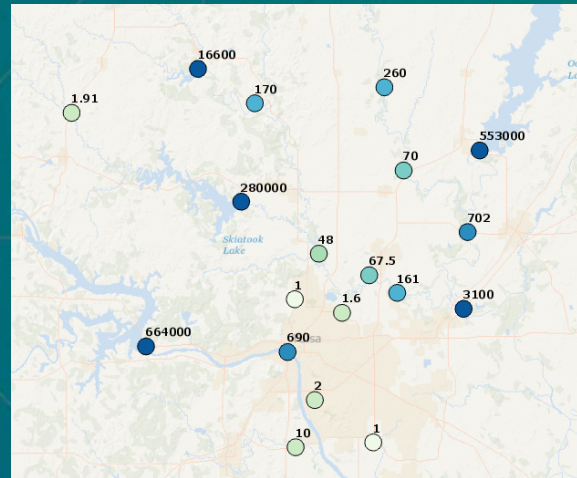
Observations whose location and attributes change over time

Things that Move



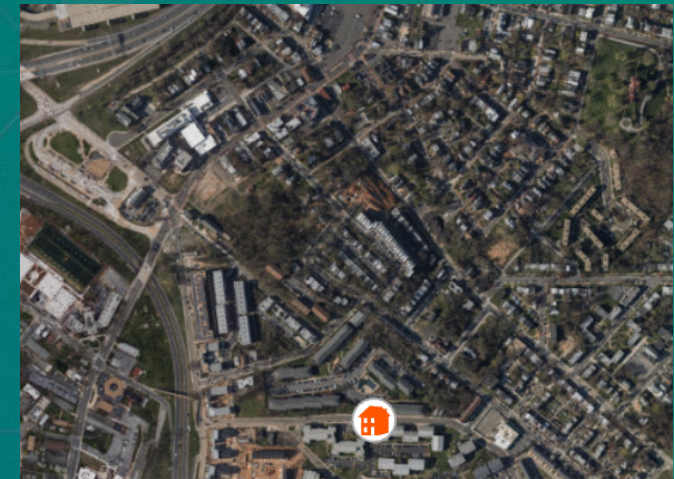
- Vessel
- Trucks
- Mobile app
- Vehicles
- Oil spill trajectory

Stationary Sensors



- Well
- Valve
- Pipeline
- Weather stations

Things that Just Happen



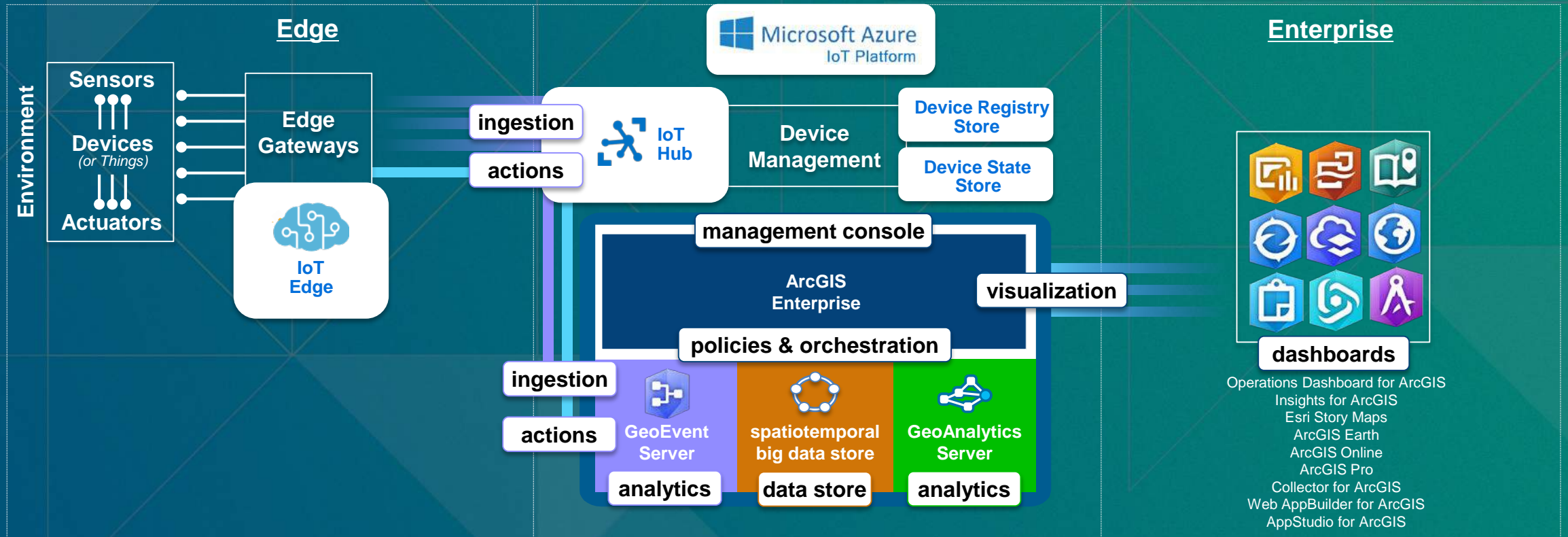
- Accidents
- Oil spill
- Pipe leak

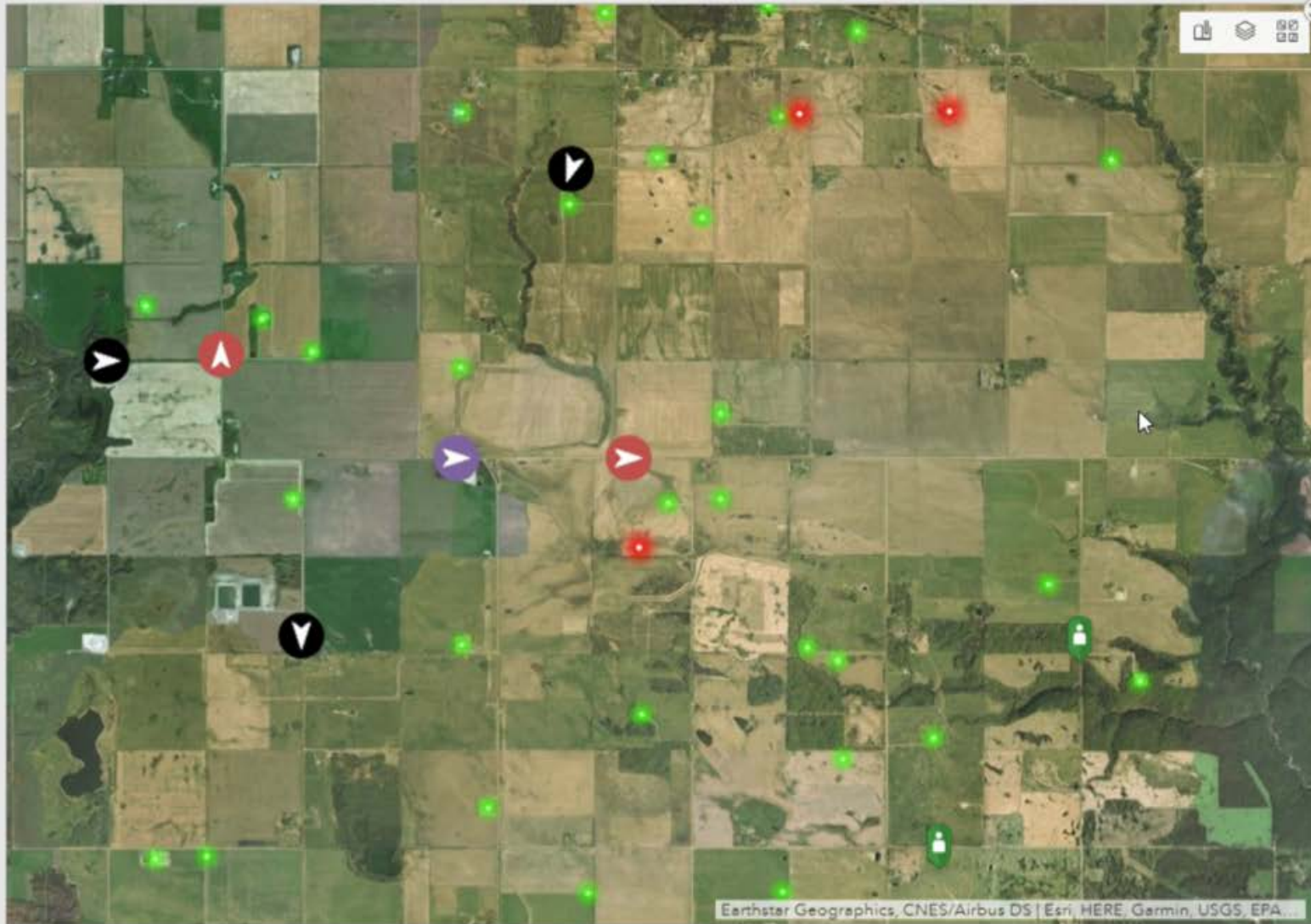
ArcGIS as an IoT Platform

enabling geospatial insights with your IoT solution



- The Edge of an IoT broadcasts into an IoT platform such as Azure IoT.
- The IoT platform integrates with ArcGIS to expand it's capabilities with spatiotemporal analytics, visualization & dashboards.





- Bruce Dooley - Pumper
- Ernest Demartino - Pipeline
- Harold Alfano - Mechanic
- Inna Beatrice - Pumper

[Workers](#) [Alarms](#) [Visits](#)

15
On Site

45
Traveling

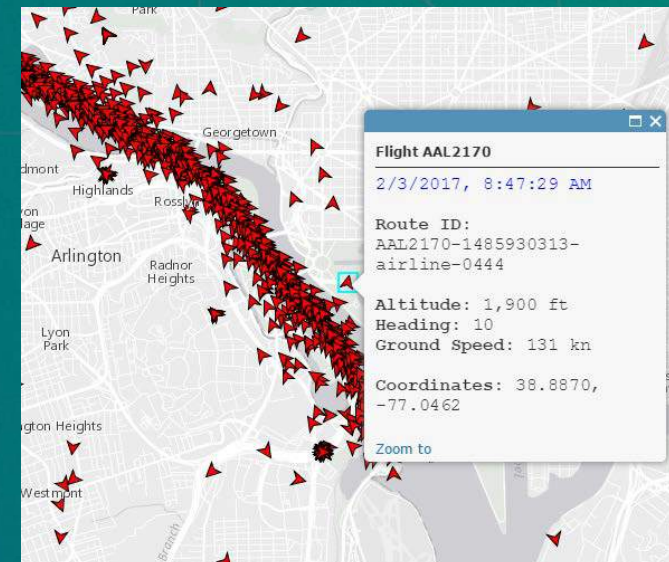
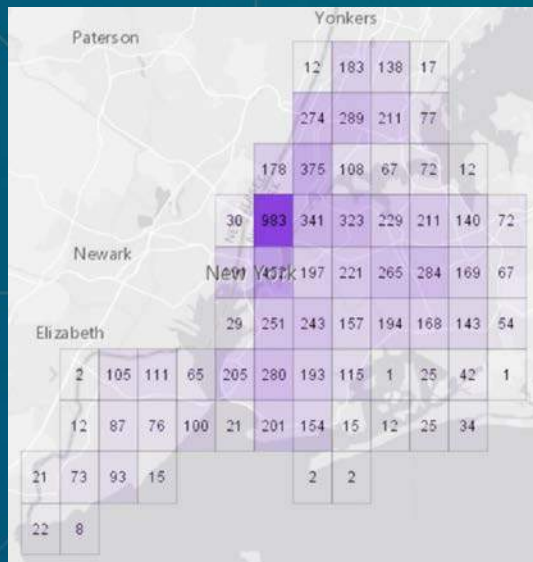
1 of 9

Driver Name Bruce Dooley
Driver Specialty Pumper
District Prairie North
Supervisor Bret Amar
Phone 541-248-2169
Speed 0
Idle yes
Last Active 5/9/2018, 11:32 AM

[Details](#) [Workforce](#)

Spatiotemporal big data store

- Visualization of observation data
- Map & Feature Services that make use data in the spatiotemporal store enable you to:
 - visualize on-the-fly aggregations of data
 - perform exploratory queries over any combination of space, time and attributes
 - switch visualization from aggregations to raw features
 - inspect feature level attributes while in aggregation or raw feature views
 - replay via a time-slider historic observations in aggregation or raw feature views



Machine Learning in GIS

What is Machine Learning?

Data-driven algorithms and techniques that automate **prediction, classification** and **clustering** of data

Traditional Machine Learning

- Useful to solve a wide range of spatial problems
- Geography often acts as the 'key' for disparate data

Spatial Machine Learning

- Incorporate geography in their computation
- Shape, density, contiguity, spatial distribution, or proximity

Computationally Intensive

- Esri's continued advancements in storage and both parallel and distributed computing make solving problems at the intersection of ML and GIS increasingly possible

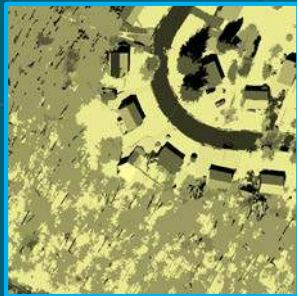


ArcGIS has Machine Learning Tools

Classification

The process of deciding to which category an object should be assigned based on a training dataset:

- Maximum Likelihood Classification
- Random Trees
- Support Vector Machine



Clustering

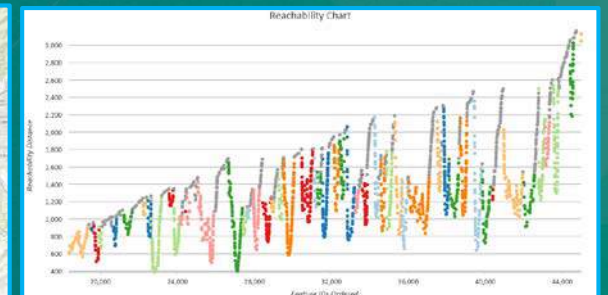
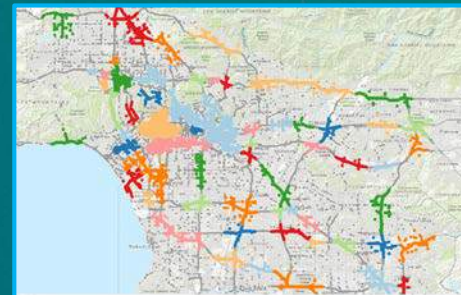
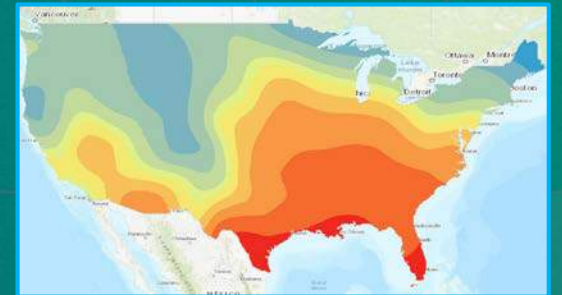
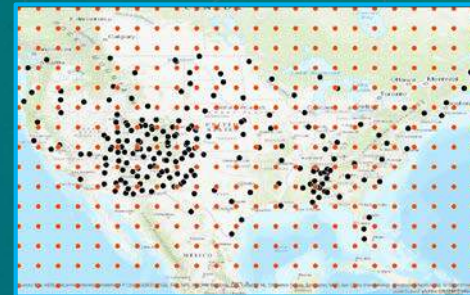
The grouping of observations based on similarities of values or locations

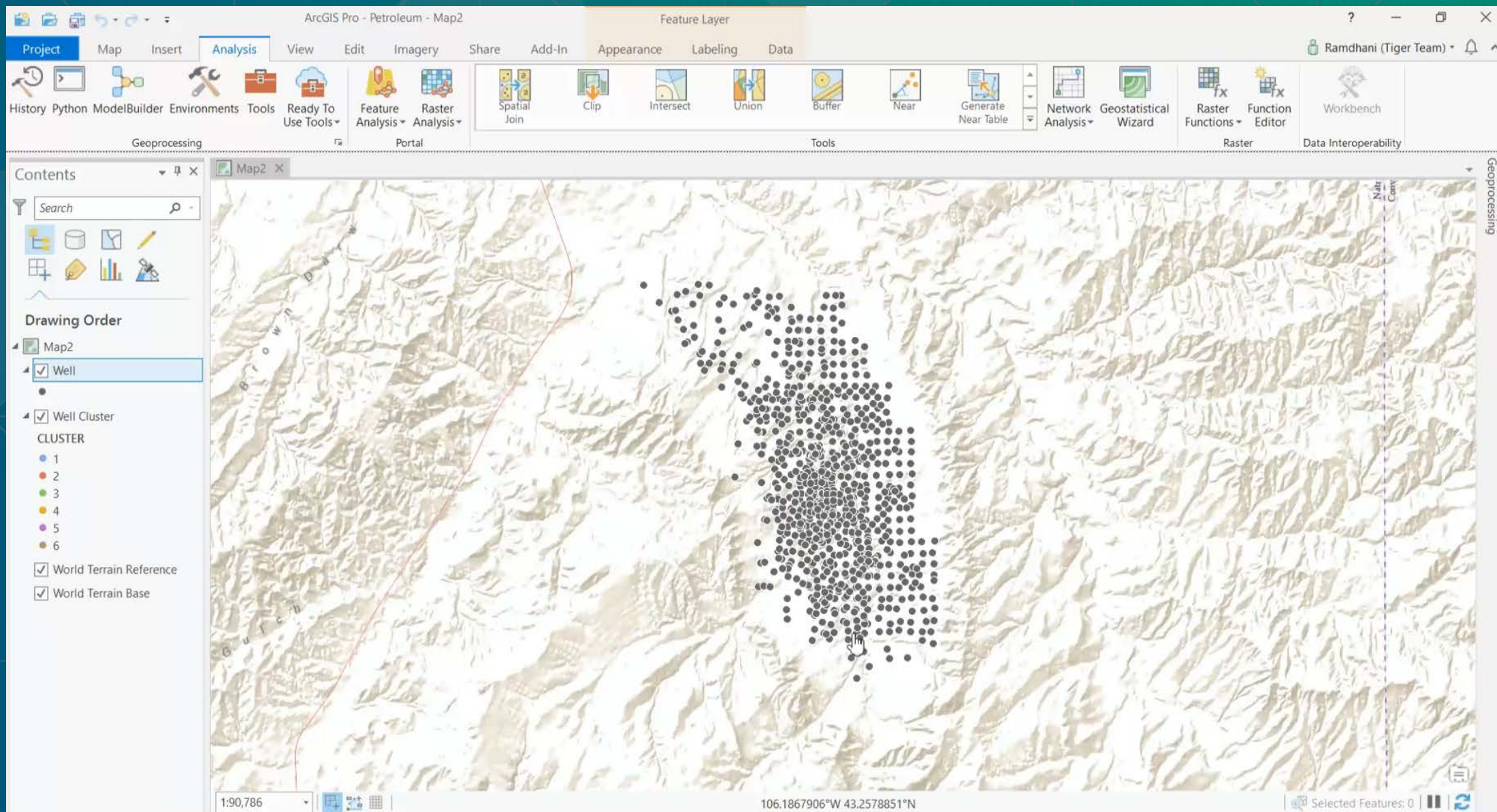
- Multivariate Clustering
- Density-based Clustering
- Image Segmentation
- Hot Spot Analysis
- Cluster and Outlier Analysis
- Space Time Pattern Mining
- Spatially Constrained Multivariate Clustering

Prediction

Using the known to estimate the unknown

- Empirical Bayesian Kriging
- Areal Interpolation
- EBK Regression Prediction
- Ordinary Least Squares Regression and Exploratory Regression
- Geographically Weighted Regression





[View media](#)

Well Optimization

Help Ramdhani

Page 1

+ ADD DATA

Map Chart Table

Well

- Shape
- SOURCE_ID
- Strokes per Minute
- Pump Fillage
- Cluster ID
- Is Seed
- Box Plot 2
- Box Plot 1
- Treemap 1

Cluster Map

Distribution of SPM by Cluster

Cluster ID	Min	Q1	Median	Q3	Max
1	7	8	8.5	9	10
2	7	8.5	9	10	11
3	2.5	4	5	6	7
4	9.5	10	10.5	11	12
5	8	9	10	11	13.5
6	1.5	4	5	6	7

Distribution of Pump Fillage by Cluster

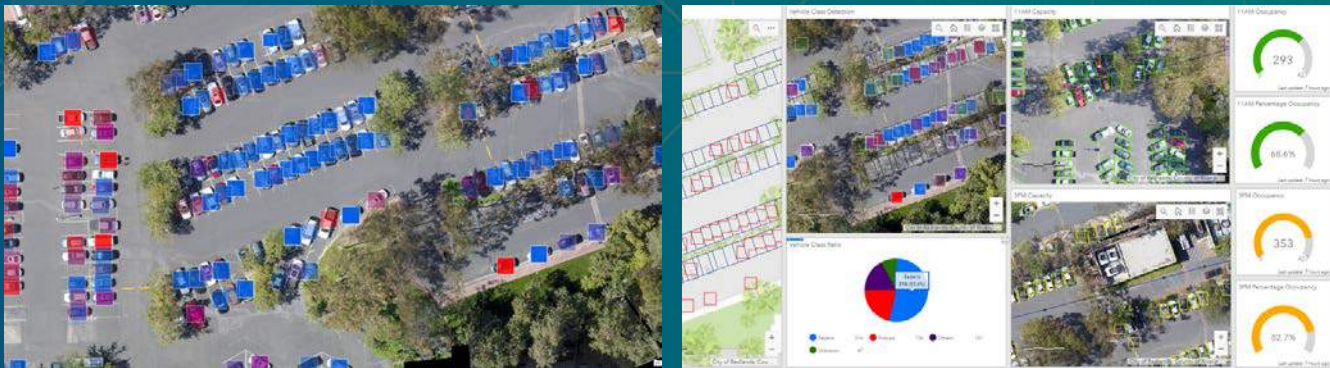
Cluster ID	Min	Q1	Median	Q3	Max
1	5	20	30	35	45
2	45	55	65	70	85
3	60	70	90	98	100
4	0	20	30	38	65
5	65	85	95	100	100
6	2	20	35	40	60

Cluster Distribution

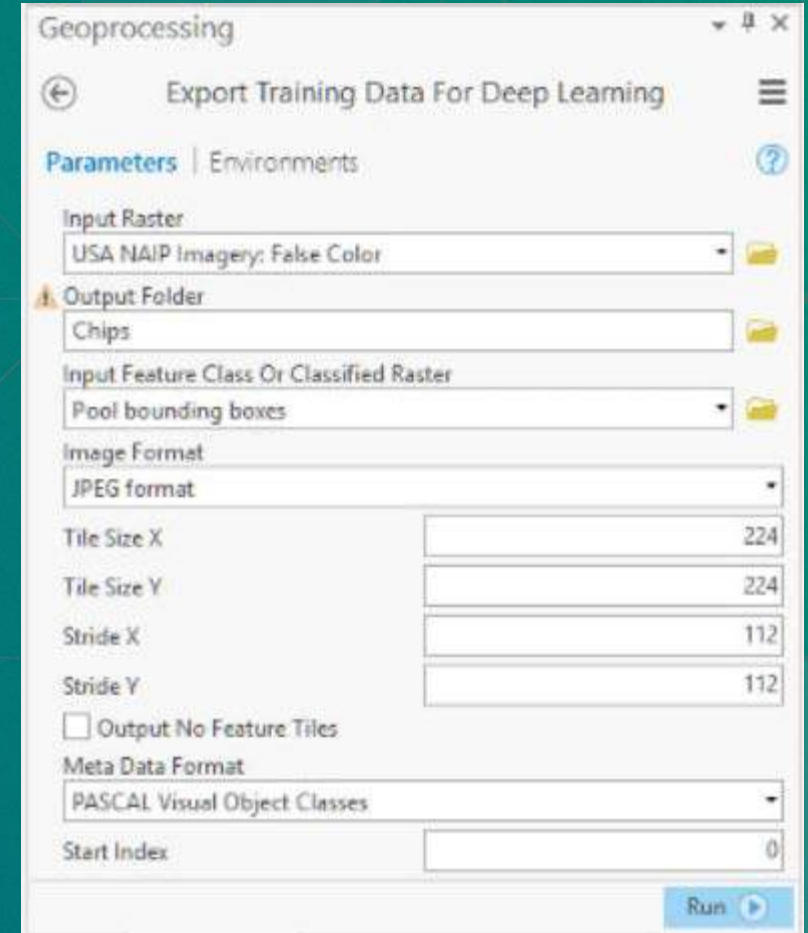
Cluster ID	Count
1	4
2	2
3	1
4	1
5	1
6	1

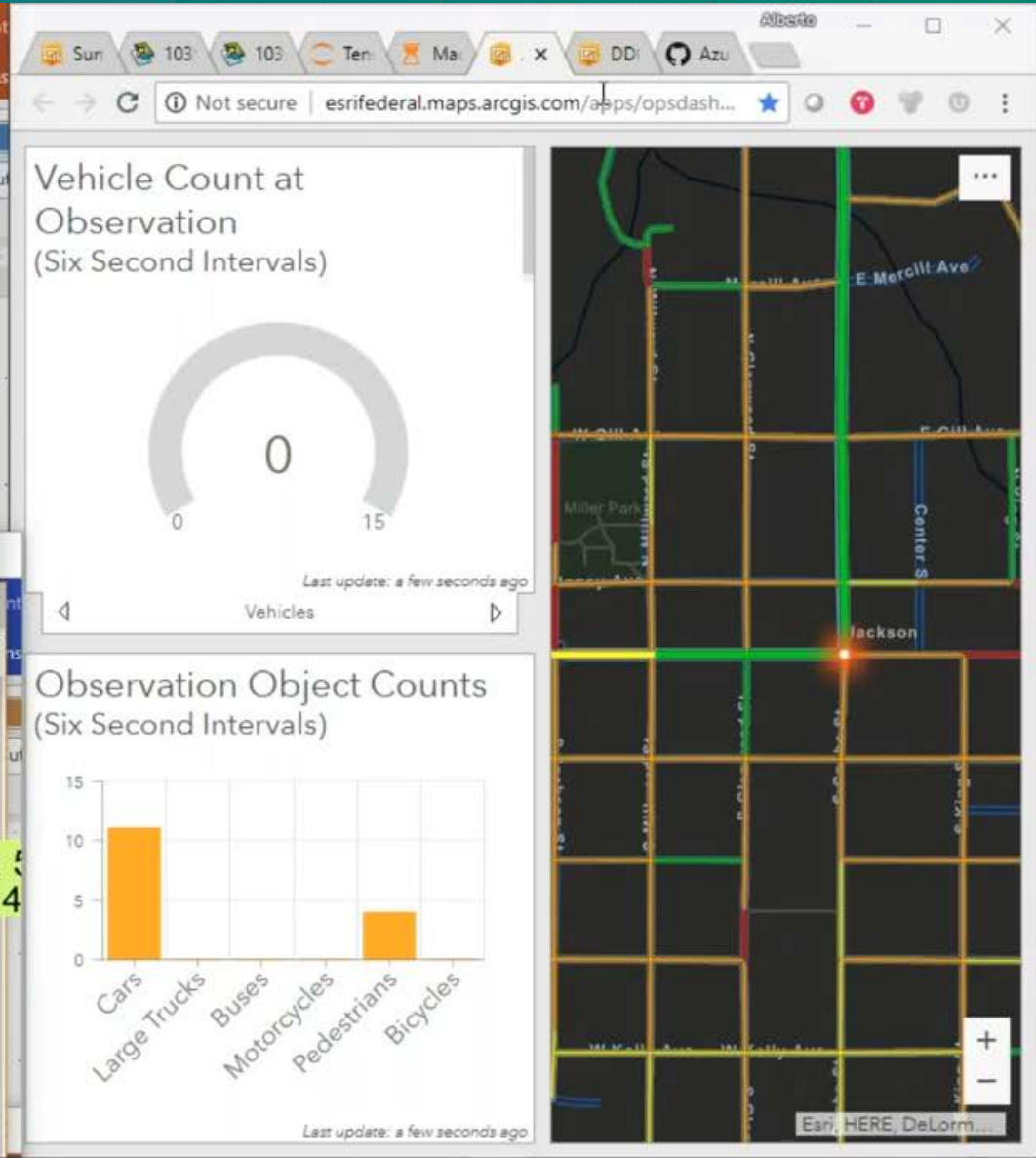
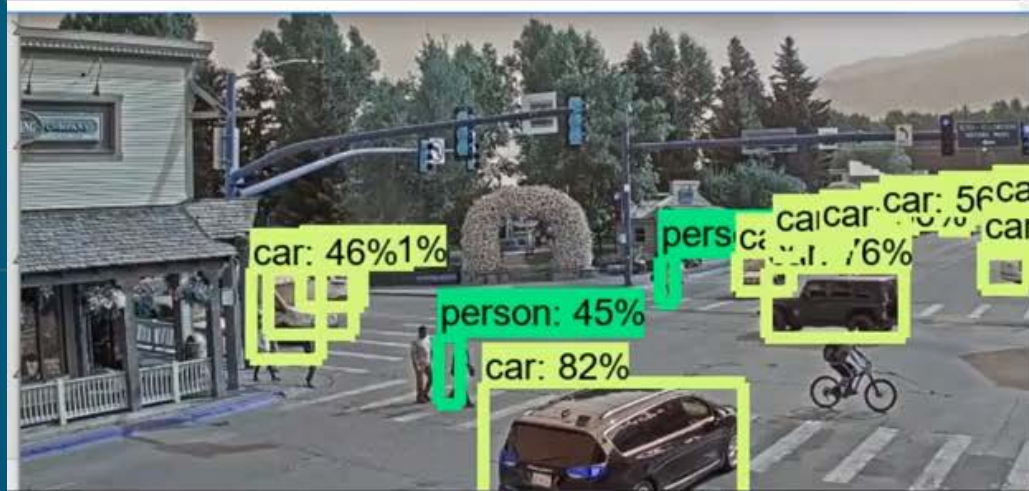
CREATE Relationships

Integrating Deep Learning with ArcGIS



Object Detection Using Drone Imagery





[View media](#)

Augmented Reality

Minimizing Disruptions

FEBRUARY 19, 2016 | 07:00 AM

Worker dies in pipeline accident, PUC steps up calls for reform

Susan Phillips ⊕

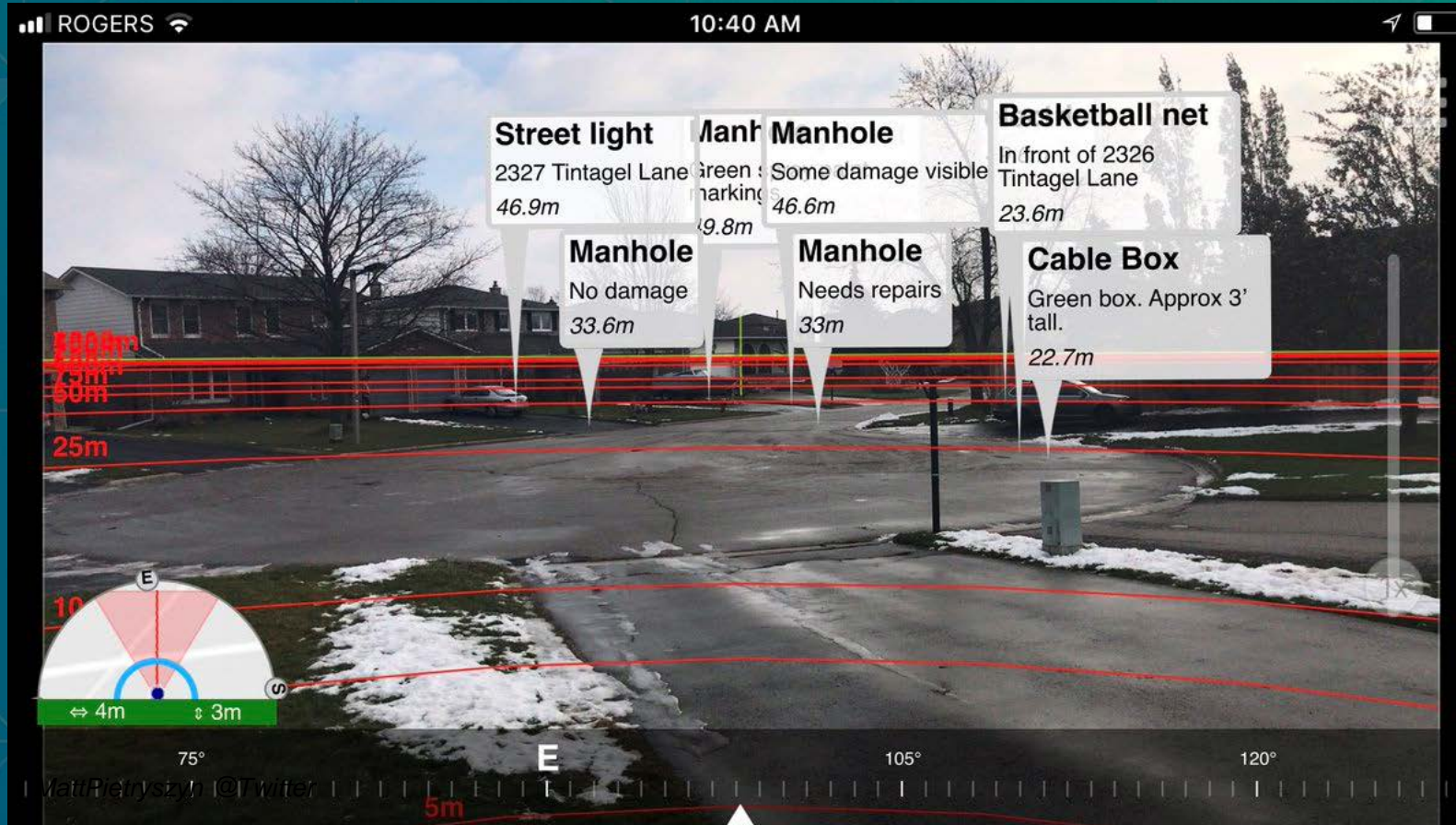


Keith Srakocic / APPhoto

In this April 17, 2014 photo, workers build a gas pipeline in Harmony, Pa.



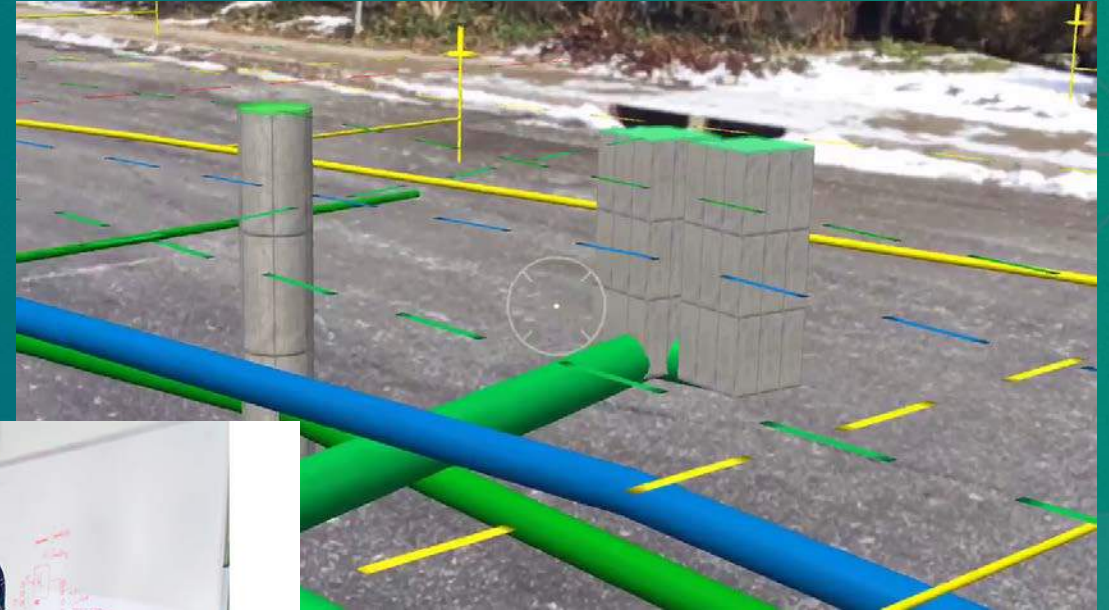
“See” your asset where you cannot see



Underground assets: pipes, valves, holes ...

Inspect your asset better

Increase Safety, Easy Maintenance

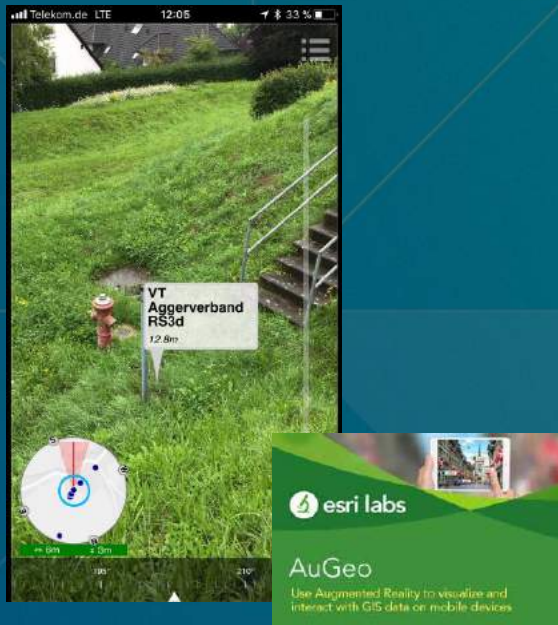


Augmented Reality / Virtual Reality Solution

Ready-to-Use Apps

AuGeo

- Augmented reality
- Compatible with point data only (currently)



ArcGIS 360 VR

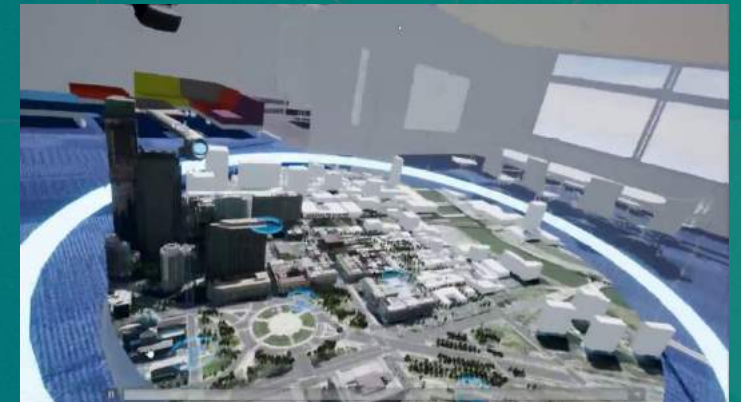
- Virtual reality
- Data generated with CityEngine
- Samsung Gear (Oculus App)



Developer Sources

ArcGIS Runtime SDK (beta)

- VR/AR
- iOS, Android, .NET
- Point, line, polygon



3rd party apps, game engines ...

AuGeo Test Esri Campus

ismael.maps.arcgis.com/home/Item.html?id=e5ba846c7a4b482da079e747133b4e94#visualize

Home Gallery Map Scene Groups My Content My Organization

ArcGIS

Overview Data Visualization Usage Settings

Save as new layer

Change the layer's default style, filter, pop-ups and labels.

Esri Campus AuGeo

RECORDED WITH SCREENCAST MATIC

City of Redlands, County of Riverside, Bureau of Land Management, Esri, HERE, Garmin, INCREME... esri

The screenshot shows the ArcGIS web interface. At the top, there's a browser window with the URL 'ismael.maps.arcgis.com/home/Item.html?id=e5ba846c7a4b482da079e747133b4e94#visualize'. Below the browser, the ArcGIS logo is prominent. The main content area features a map of Esri Campus with several buildings labeled, such as 'Esri Labs', 'Esri Field Office', and various 'Esri' buildings (A through O). A semi-transparent overlay is present on the map, containing icons for 'Visualize', 'BETA', and 'Usage'. In the top right corner of the map area, the 'Save as new layer' button is highlighted with a mouse cursor. On the left side, there's a panel for layer management with the title 'Change the layer's default style, filter, pop-ups and labels.' and a list containing 'Esri Campus AuGeo'. At the bottom left, there's a 'RECORDED WITH SCREENCAST MATIC' watermark. At the bottom right, there's a scale bar and the Esri logo.

[View media](#)

