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Geospatial | Integration | Solutions

The Geospatial Cambrian Explosion

Keith Fraley, President 40Geo (40geo.com)

Esri PUG

Houston, TX

May 16th, 2019

40Geo turns IoT APIs into location based intelligence



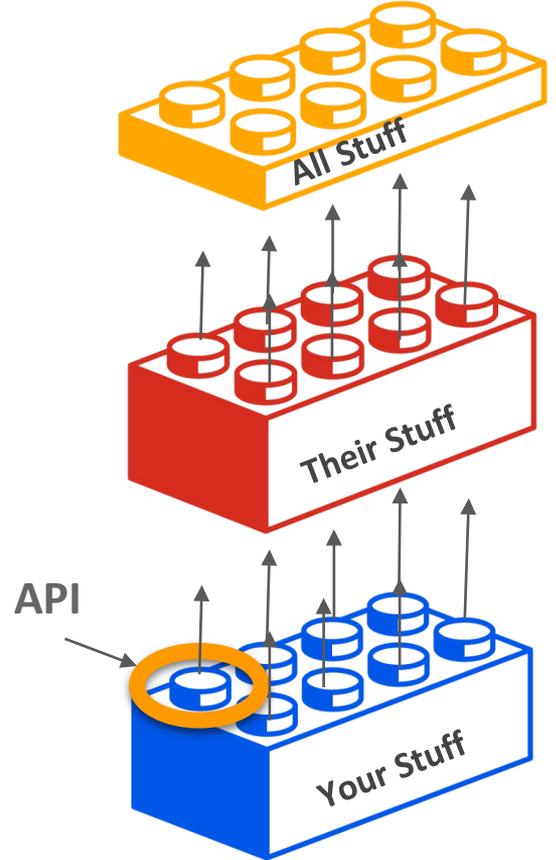
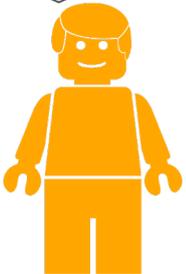
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Application Programming Interface (API):

- Rosetta Stone between disparate systems
- Connects systems through code
- Analogous to the stud or knob of a lego brick

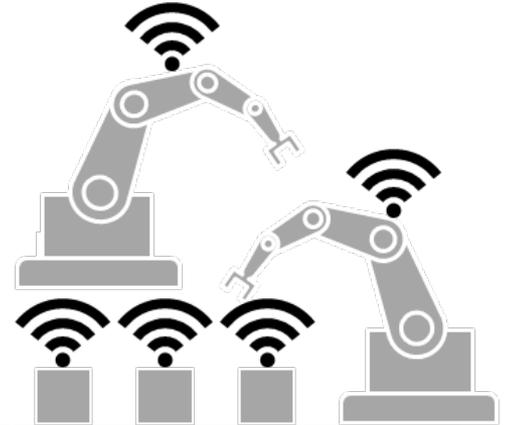
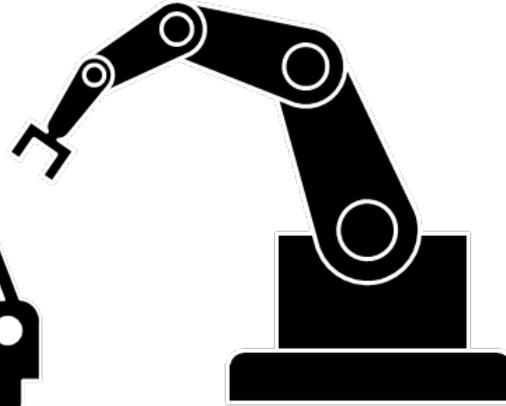
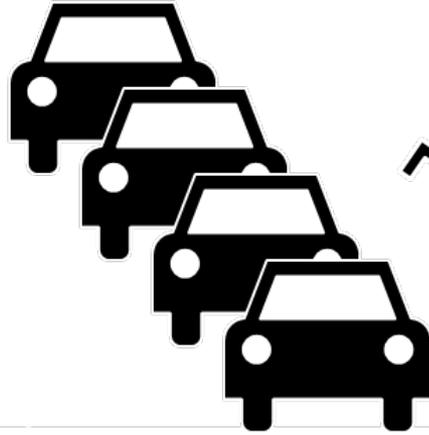
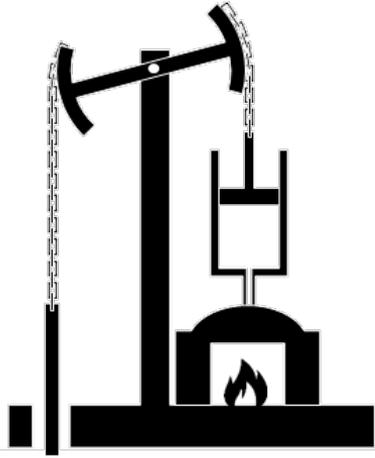
Everything is awesome...



“What makes the IoT a disruptive technology is that it dramatically increases productivity without compromising the ecological relationships that govern the planet.

Using less of the Earth’s resources more efficiently and productively are defining features of the emerging economic paradigm [Industry 4.0].”

— jeremy rifkin



1st

2nd

3rd

4th

Mechanization,
water power, steam
power

Mass production,
assembly line,
electricity

Computer and
automation

Cyber Physical
Systems

What we do:

geospatial analytics
delivering Knowledge as a
Service



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Why we do it:

tremendous granularity at massive scale



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How we do it:

leveraging the geospatial cambrian explosion



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The Cambrian Explosion

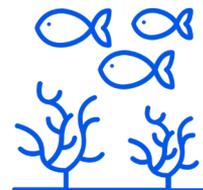




Rising
Sea Levels



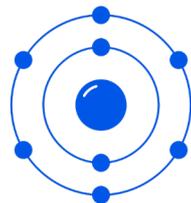
Regional
Erosion



Increased
Habitat



Food Web
Complexity



Increased
Oxygen



Genome
Patterning



Sensors



Open
Source



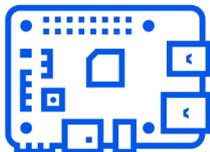
Cloud
Computing



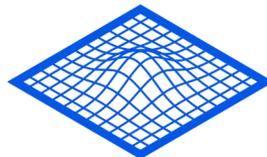
Ubiquitous
Connectivity



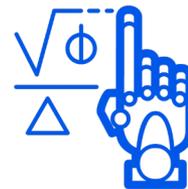
Big Data
Capabilities



Edge
Computing



Remote
Sensing



Machine
Learning

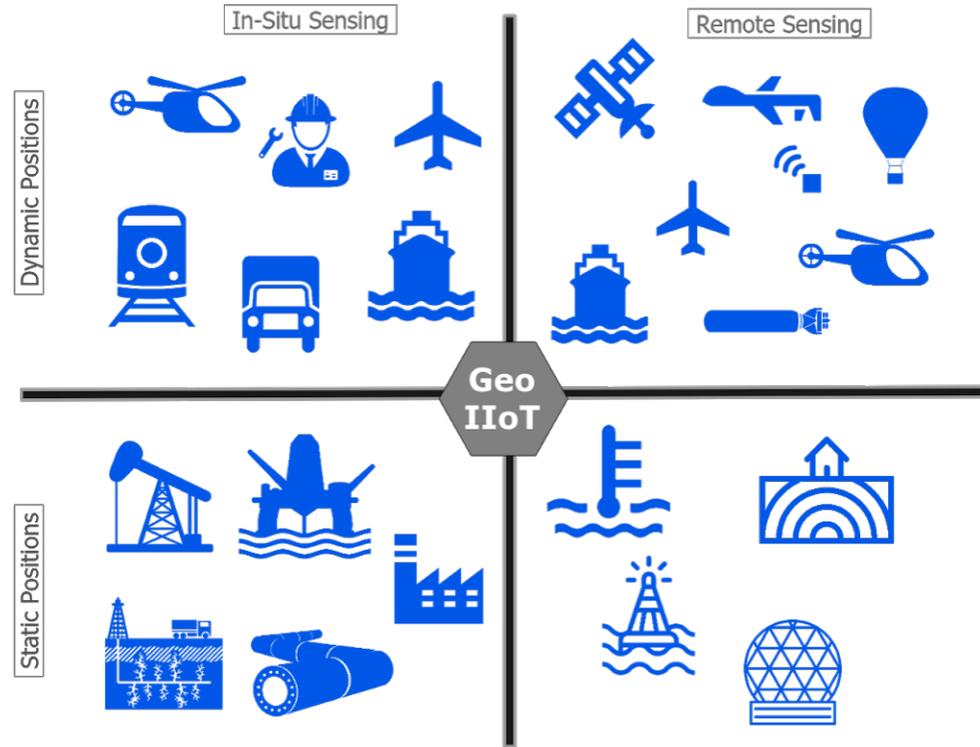
An explosion of (leads to):

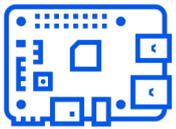
- sensors, leads to
- bandwidth, leads to
- data, leads to
- big data needs, and in turn, capabilities, leads to
- needs for elastic, scalable cloud computing, leads to
- ML/AI to make sense of the big data, leads to
- open source software to address the speed and complexity of the ecosystem evolving, leads to
- derived products addressing real world problems, leads to
- **knowledge** and ultimately a better planet for you and I :)



Sensors

A device which detects or measures a physical property and records, indicates, or otherwise responds to it.



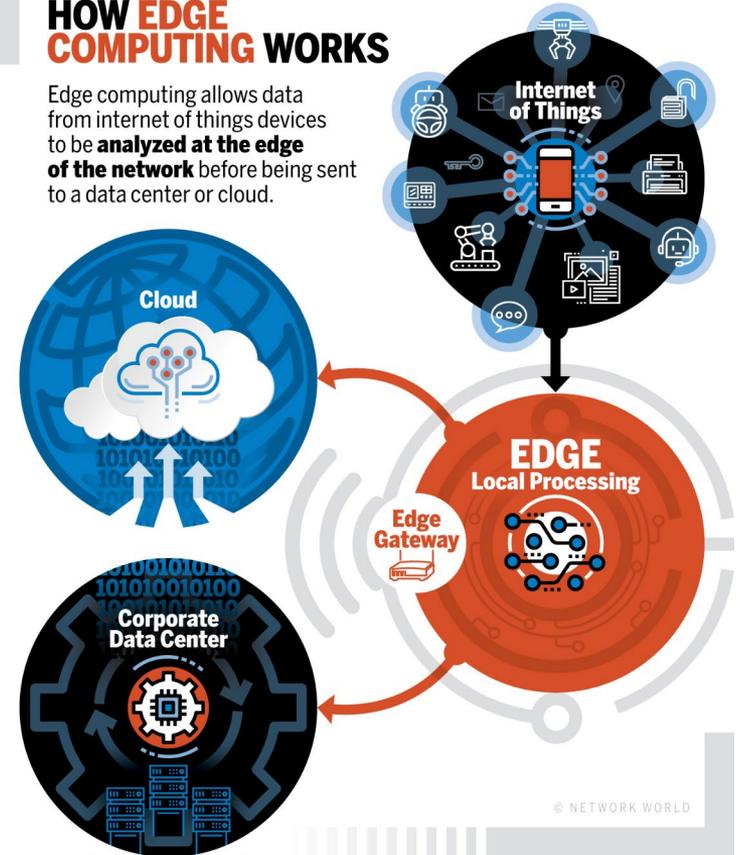


Edge Computing

Edge computing is a way to streamline the flow of traffic from IoT devices and provide real-time local data analysis

HOW EDGE COMPUTING WORKS

Edge computing allows data from internet of things devices to be **analyzed at the edge of the network** before being sent to a data center or cloud.





Ubiquitous
Connectivity



T-Mobile



tampnet

Telit



AT&T

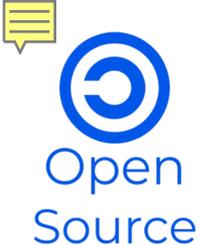
ORBCOMM™

verizon✓

Sprint



twilio



- Permission-less Innovation
- Innovation through Integration
- Far higher levels of experimentation

The screenshot shows the npm website for the `grib2json` package. At the top, there's a navigation bar with 'Nameless Package Manager' and links for 'npm Enterprise', 'Products', 'Solutions', 'Resources', 'Docs', and 'Support'. Below that is a search bar and a 'Join' button. A banner at the top right says 'Ready to take your JavaScript development to the next level? Meet npm Enterprise - the ultimate in enterprise JavaScript. Learn more >'. The main content area for `grib2json` includes: a 'Readme' tab, statistics for '1 Dependencies', '2 Dependents', and '2 Versions', a description 'A simple wrapper around the grib2json command line tool. Allows you to call the grib2 converter directly from your nodejs code.', an 'Installation' section with the command `npm i --save grib2json`, and a sidebar with various metrics: '10 weekly downloads', 'version 1.0.2', 'license MIT', '0 open issues', '0 pull requests', 'homepage github.com', and 'repository github.com'.





Open Source



CouchDB
relax



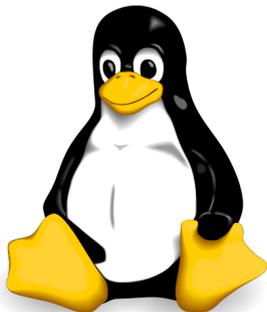
python™



TensorFlow



kubernetes



kafka



elastic



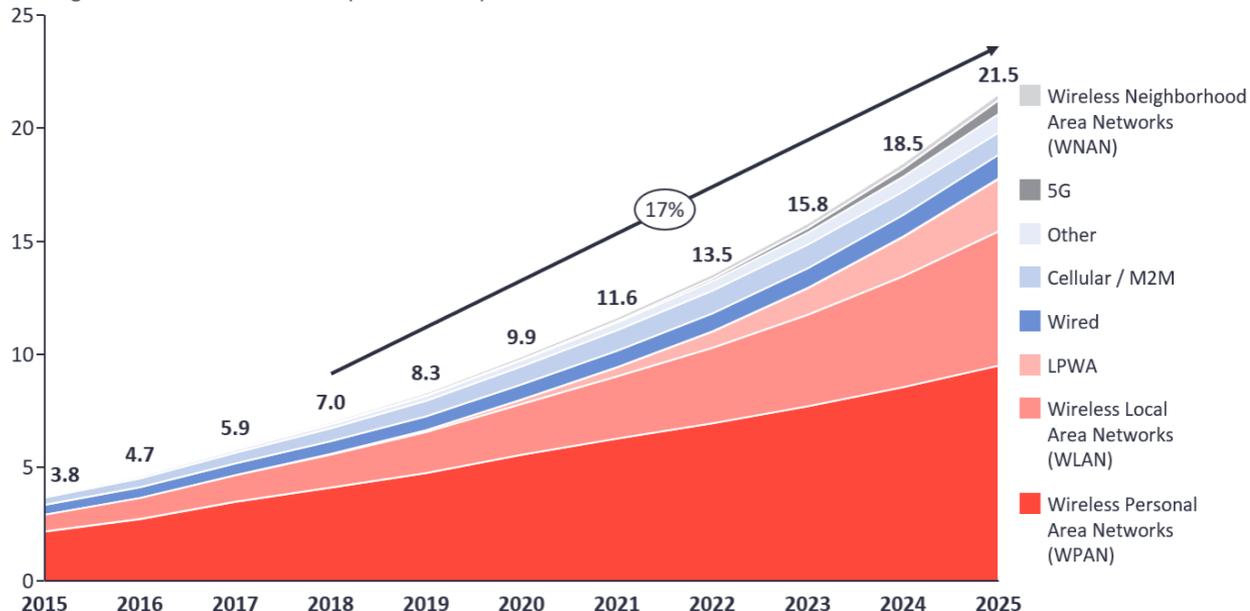
mongoDB®



Big Data Capabilities

Global Number of Connected IoT Devices

Number of global active IoT Connections (installed base) in Bn

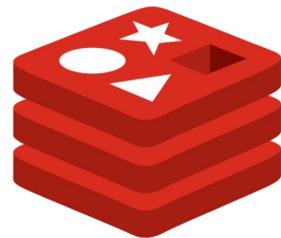


Note: IoT Connections do not include any computers, laptops, fixed phones, cellphones or tablets. Counted are active nodes/devices or gateways that concentrate the end-sensors, not every sensor/actuator. Simple one-directional communications technology not considered (e.g., RFID, NFC). Wired includes Ethernet and Fieldbuses (e.g., connected industrial PLCs or I/O modules); Cellular includes 2G, 3G, 4G; LPWAN includes unlicensed and licensed low-power networks; WPAN includes Bluetooth, Zigbee, Z-Wave or similar; WLAN includes Wi-fi and related protocols; WNAN includes non-short range mesh; Other includes satellite and unclassified

Source: IoT Analytics Research 2018



Big Data
Capabilities



redis



elastic



mongoDB®



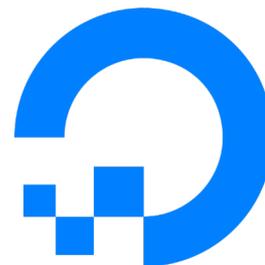
Cloud
Computing



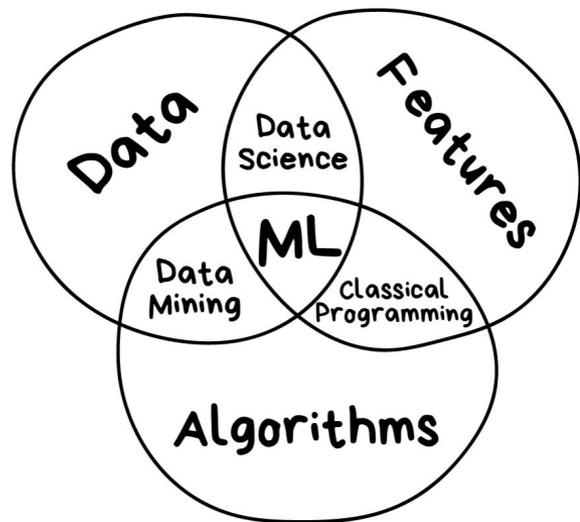
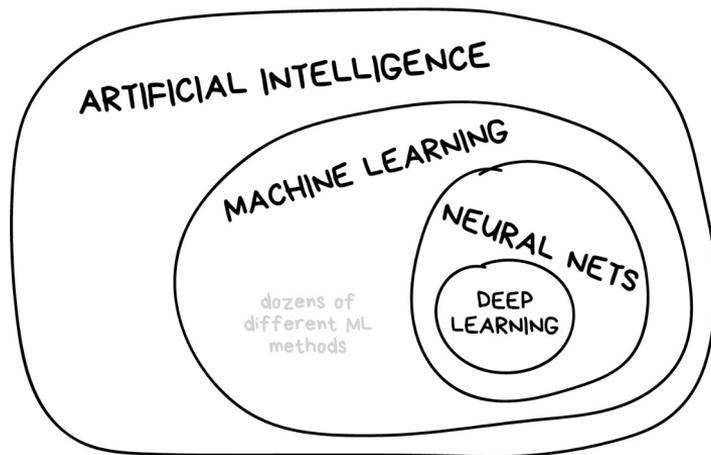
IBM Cloud



Google Cloud



DigitalOcean



Machine can	Machine cannot
Forecast	Create something new
Memorize	Get smart really fast
Reproduce	Go beyond their task
Choose best item	Kill all humans

VISIT SPIRE MARITIME

FUTURE

2017-05-31 14:44:36
37.740175, -122.911906
CONFIDENCE: 95%

2017-05-31 14:39:41
37.739564, -122.911455
CONFIDENCE: 96%

2017-05-31 14:33:12
37.739063, -122.911026
CONFIDENCE: 97%

2017-05-31 14:28:28
37.738605, -122.910382
CONFIDENCE: 98%

2017-05-31 14:22:10
37.738605, -122.909127
CONFIDENCE: 99%

CURRENT

2017-05-31 14:12:10
37.738595, -122.908915
SOURCE: S-AIS

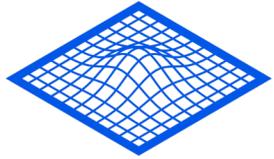
2017-05-31 14:10:23
37.738595, -122.908915
SOURCE: T-AIS

2017-05-31 14:08:51
37.738561, -122.908121
SOURCE: S-AIS

HISTORICAL

2017-05-31 14:05:21
37.738663, -122.906705
SOURCE: T-AIS

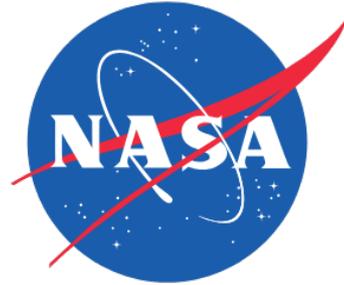




Remote
Sensing

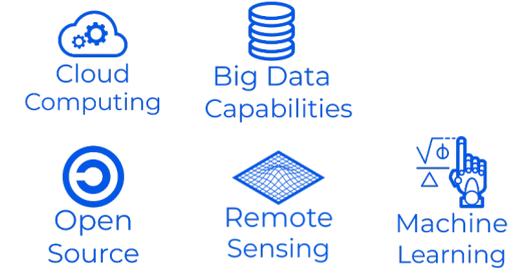
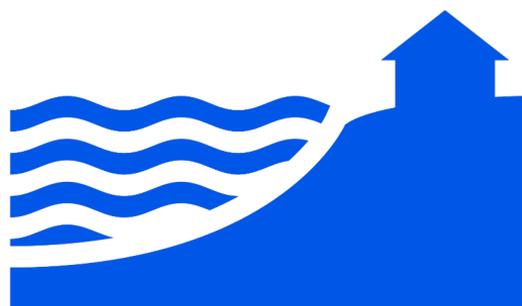
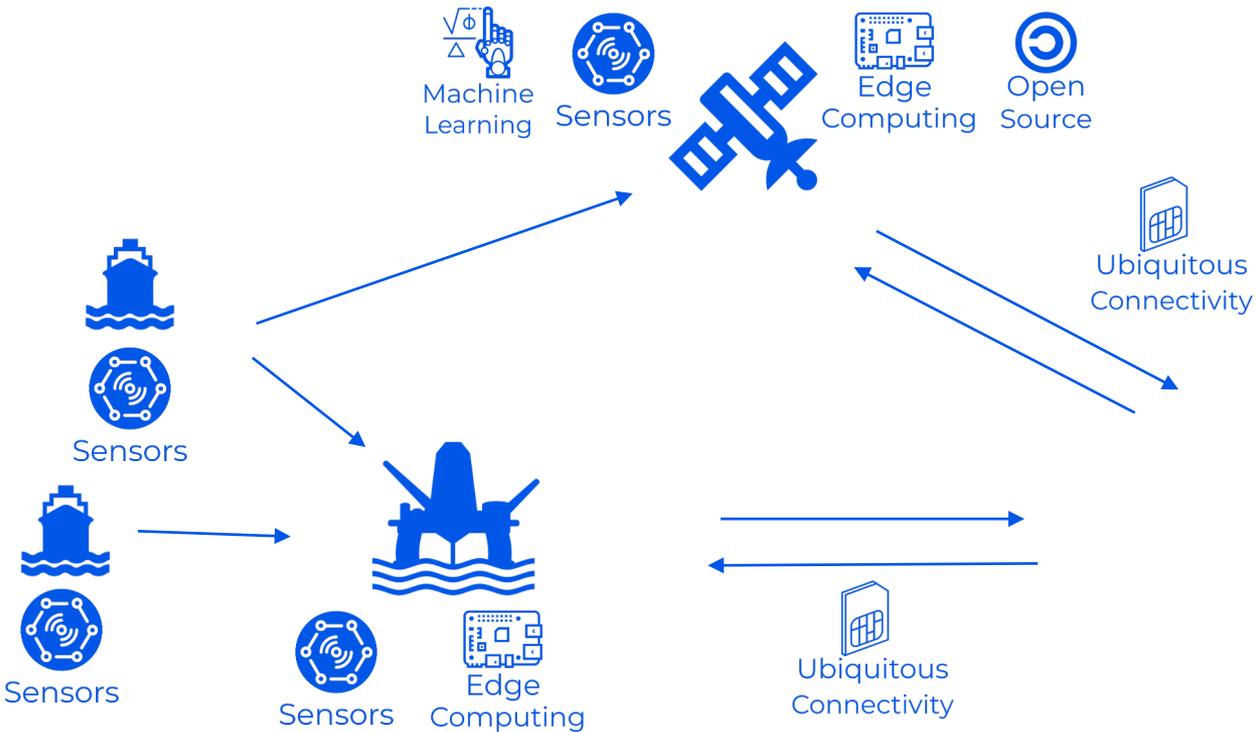


sentinel-1



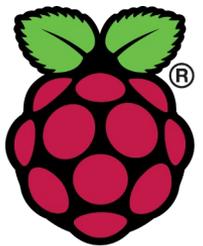
Geospatial IoT Case Study: AIS

- Automatic Identification System (AIS)
- Designed to be a collision avoidance system for large vessels
- Sensor and attribute about the vessel data is broadcast over unencrypted VHF radio waves
 - GPS
 - Gyrocompass
 - (name, callsign, unique id, length, width, draught, flag, type)
- Although originally designed for safety, AIS has fueled a connected shipping industry that is now worth over \$7 Billion annually



AIS

Actors



Ubiquitous Connectivity Machine Learning Sensors Edge Computing Open Source



Sensors Machine Learning Edge Computing Ubiquitous Connectivity Open Source

Sensors

Sensors

Sensors

Common Operating Picture

3/27/2019, 10:17 PM The Cargo, STAR ISFJORD has left the Galveston 9 mile buffer

3/27/2019, 10:17 PM The Passenger, VISION OF THE SEAS has entered the Galveston 3 mile buffer The Passenger, VISION OF THE SEAS has left the Galveston 1000 meter buffer

3/27/2019, 10:17 PM The Passenger, EXCALIBUR has entered the Galveston 6 mile buffer The Passenger, FXCAI IRIIR has left the

Last update: a few seconds ago

Vessels within View

M/V VICTORIA, Other
4/2/2019, 4:26 PM
Status: under way using engine

JANICE ROBERTS, Tug
4/2/2019, 4:26 PM
Status: under way using engine

BAFFIN BAY, Local Vessel
4/2/2019, 4:26 PM
Status: under way using engine

SAVAGE MENTOR, Tug
4/2/2019, 4:26 PM
Status: under way using engine

Last update: a few seconds ago

Aircraft within View

Callsign: N881BA
ICAO: AC21A6
Altitude: 700 ft
Speed: 137
4/2/2019, 4:25 PM

Callsign: FE72
ICAO: 491PH
Altitude: -1 ft
Speed: 0
4/2/2019, 4:25 PM

Last update: a few seconds ago

Vessels within 1000 meters of the Port of Galveston

AET EXCELLENCE

AET PARTNERSHIP

ALPINE
MAGNOLIA

Last update: a few seconds ago

raptor_vessels: DOUGLAS MURP...

The Local Vessel DOUGLAS MURPHY latest position update was at 4/2/2019, 4:25 PM. It's location was Lat:29.31, Lon:-94.81 with a heading of 202, a speed of 0 kts and a status of under way using engine and a destination of GALVESTON HARBOR.

Current Active Global Storms

No Data

Last update: 3 minutes ago

Gulf Platforms within View

- Name: C
Company: Exxon Mobil
Corporation
Heliport: Y
24 hour: Y
- Name: C
Company: Exxon Mobil
Corporation
Heliport: Y
24 hour: Y

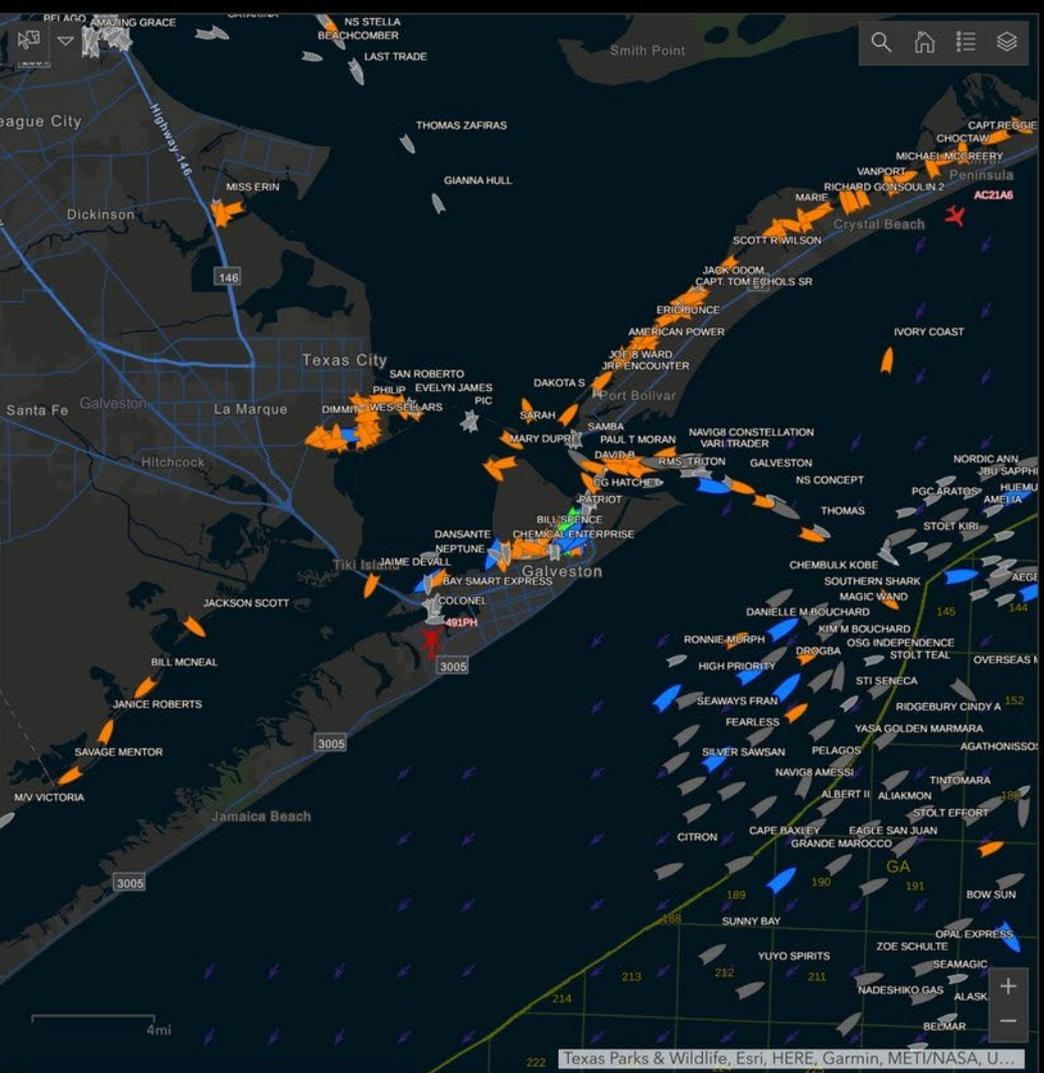
Last update: a few seconds ago

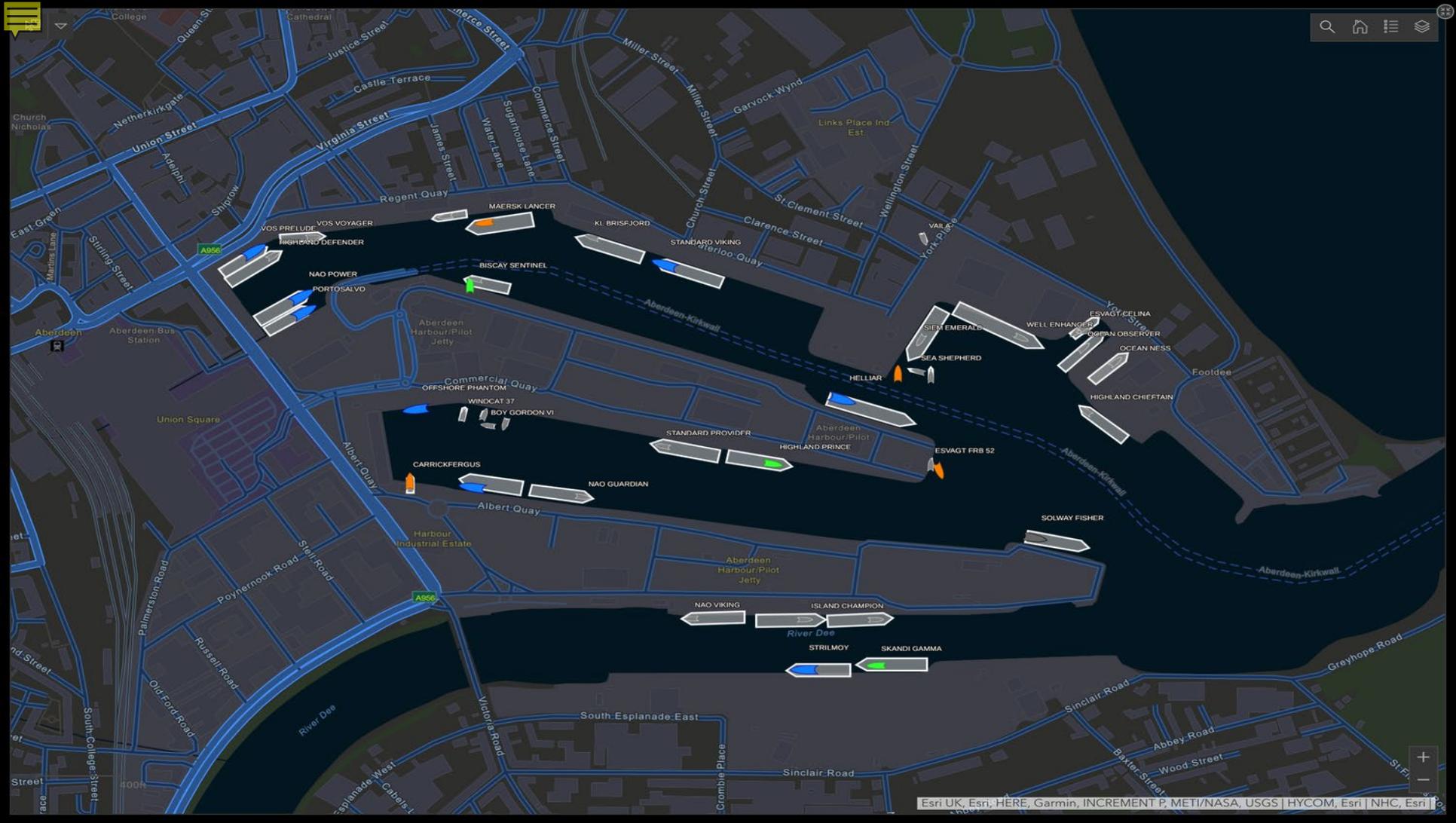


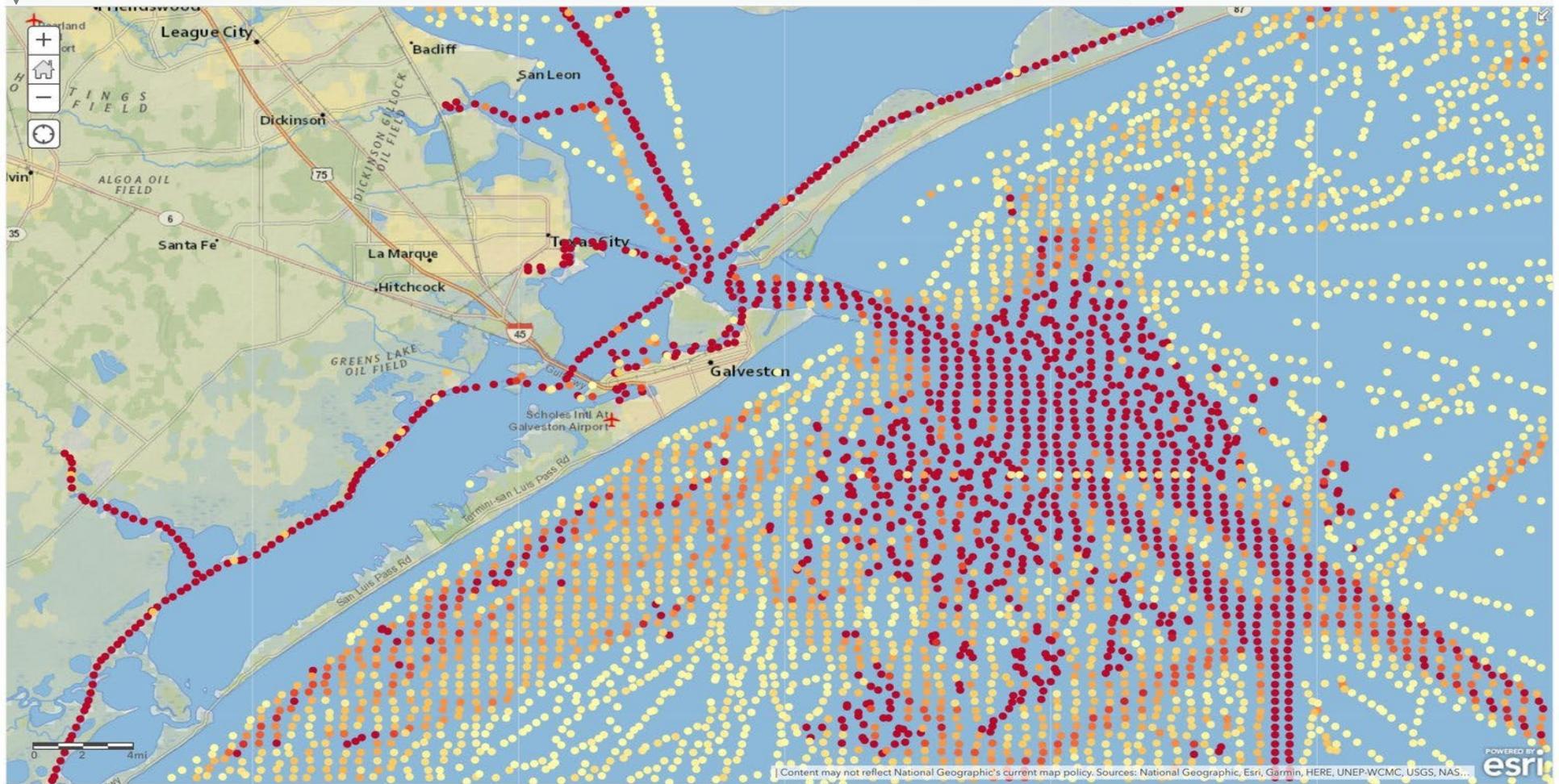
Name: DOUGLAS MURPHY
Callsign: WDG2017
MMSI: 367,511,270
IMO: 0

AIS Classification: Local Vessel
Type: Local Vessel
Length: 21 m
Width: 10 m
Draught: 3.00
Gross Tonnage: 0

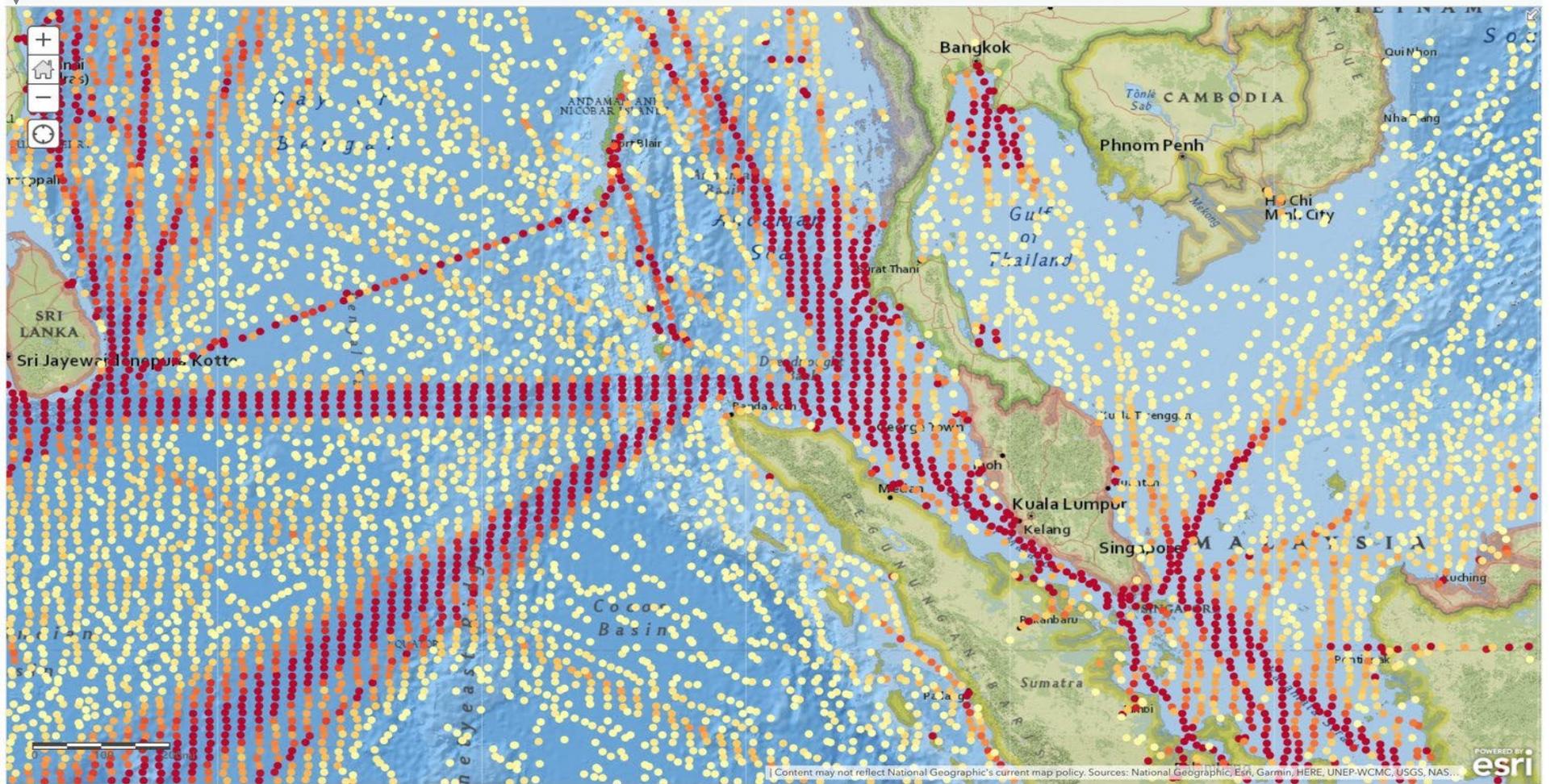
Last update: a few seconds ago



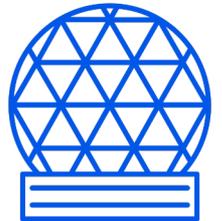
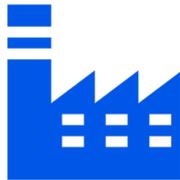
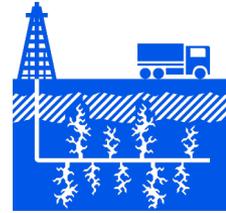
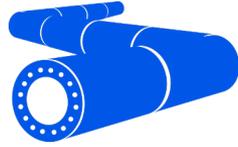




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Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, Esri





Common Operating Picture



Remote Monitoring





Remote Monitoring





Supply Chain Optimization





Supply Chain Optimization

Competitive Intelligence

An aerial photograph of a large industrial or warehouse complex. The main building is a long, dark structure with a series of white, curved awnings along its length. In front of the building is a large, paved parking lot with white parking lines. Several white semi-trailers are parked in the lot, along with a few cars. To the left of the main building, there is a smaller, lighter-colored building and a grassy area. In the bottom left corner, there is a fenced-in parking area with several cars parked in rows. The overall scene depicts a busy industrial or distribution center.



Exception Based Surveillance



So, how best to get started?

First step, *say out loud* “The technology is the easy part” Then use the following guide :)

- State the challenge and work backwards
- Data Access > Data Ownership (there’s an API for that)
- The second mouse gets the cheese
- Presentation matters
- Ignore the shiny toy in the box
- Simplicity is the ultimate sophistication
- Perfection is the enemy of progress

“If you can't explain it simply, you don't understand it well enough.”

-Albert Einstein

Questions?



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40Geo is a products and consulting company focused on the integration of geospatial technologies into enterprise wide systems. Our leadership has been designing, developing and delivering world class geospatial solutions for 20 years in a wide variety of industries.

Better. Faster. Simpler.

What if it all just worked? Our ethos can be summed up in three words: better, faster, simpler. Industries are not immune to the fundamental digital transformation our world is currently going through. Our goal is to make that journey as seamless as possible for our clients and to help them reach their full digital potential.



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