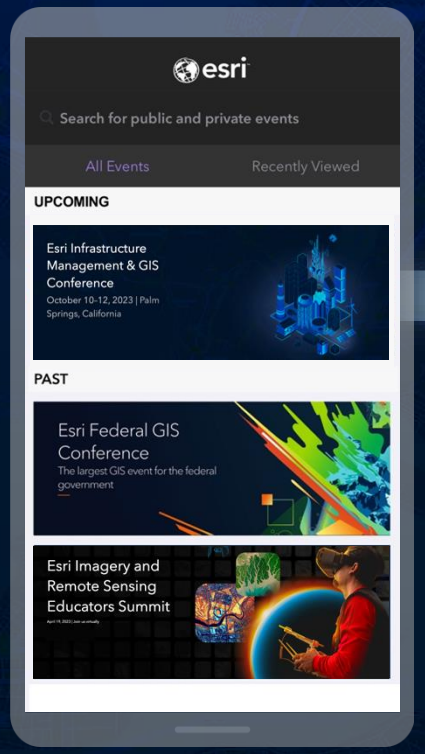
Getting Started as a Developer with ArcGIS

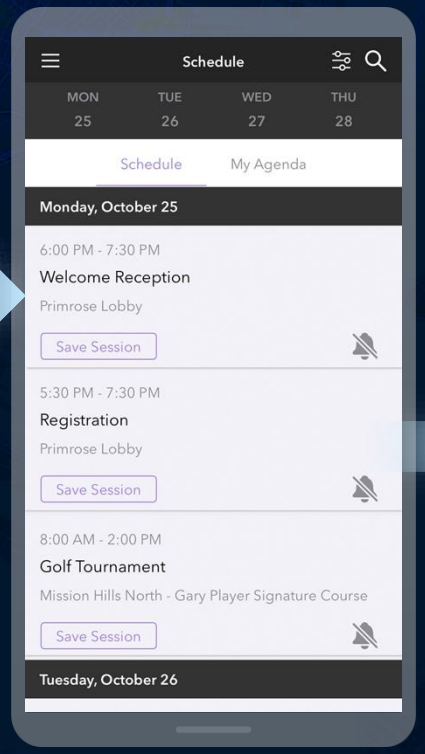
Jim Barry

Please Share Your Feedback in the App

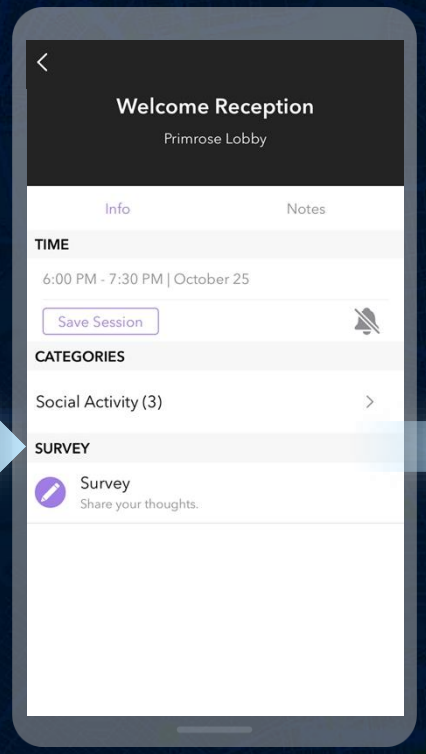
Download the Esri Events app and find your event



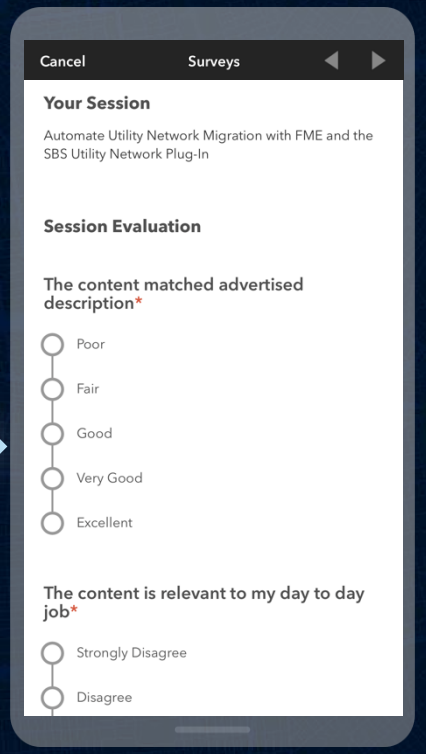
Select the session you attended



Scroll down to "Survey"



Log in to access the survey



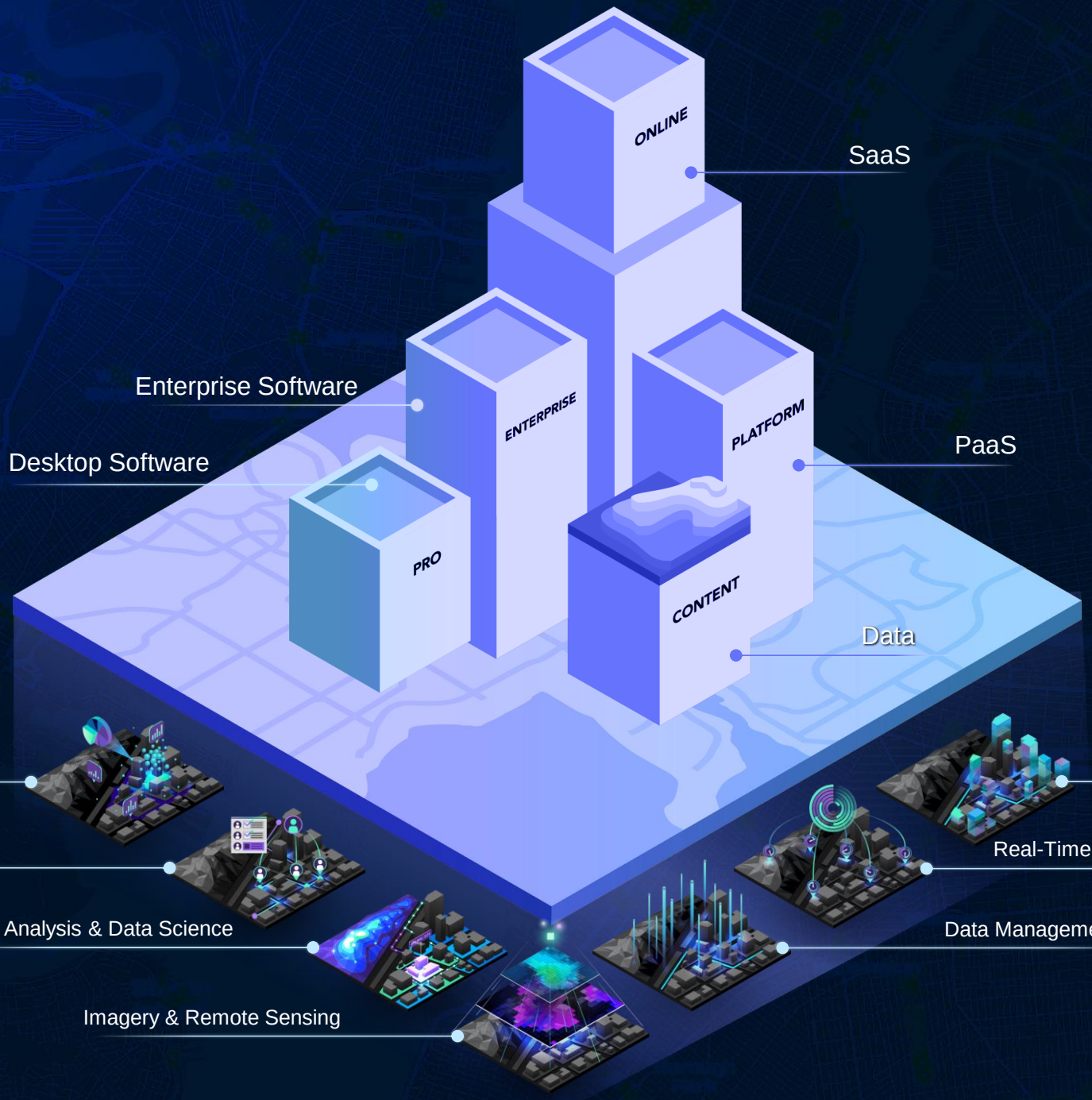
Getting Started as a Developer with ArcGIS

- ArcGIS through a developer lens
- ArcGIS Platform (PaaS)
- Building Apps: web, native, game engines
- Extending the ArcGIS system
- Automating and Scripting
- Resources for your success

The Comprehensive

ArcGIS SYSTEM

Capabilities of a
COMPLETE GIS
& MAPPING SYSTEM



DEVELOPER EXPERIENCES

No-Code & Low-Code Builders

StoryMaps
Dashboards
Instant Apps

Experience Builder
Web AppBuilder
AppStudio

Client APIs

Web
Mobile
Desktop

Open-Source
Game Engines
REST

Extending SDKs

Enterprise SDK
Pro SDK

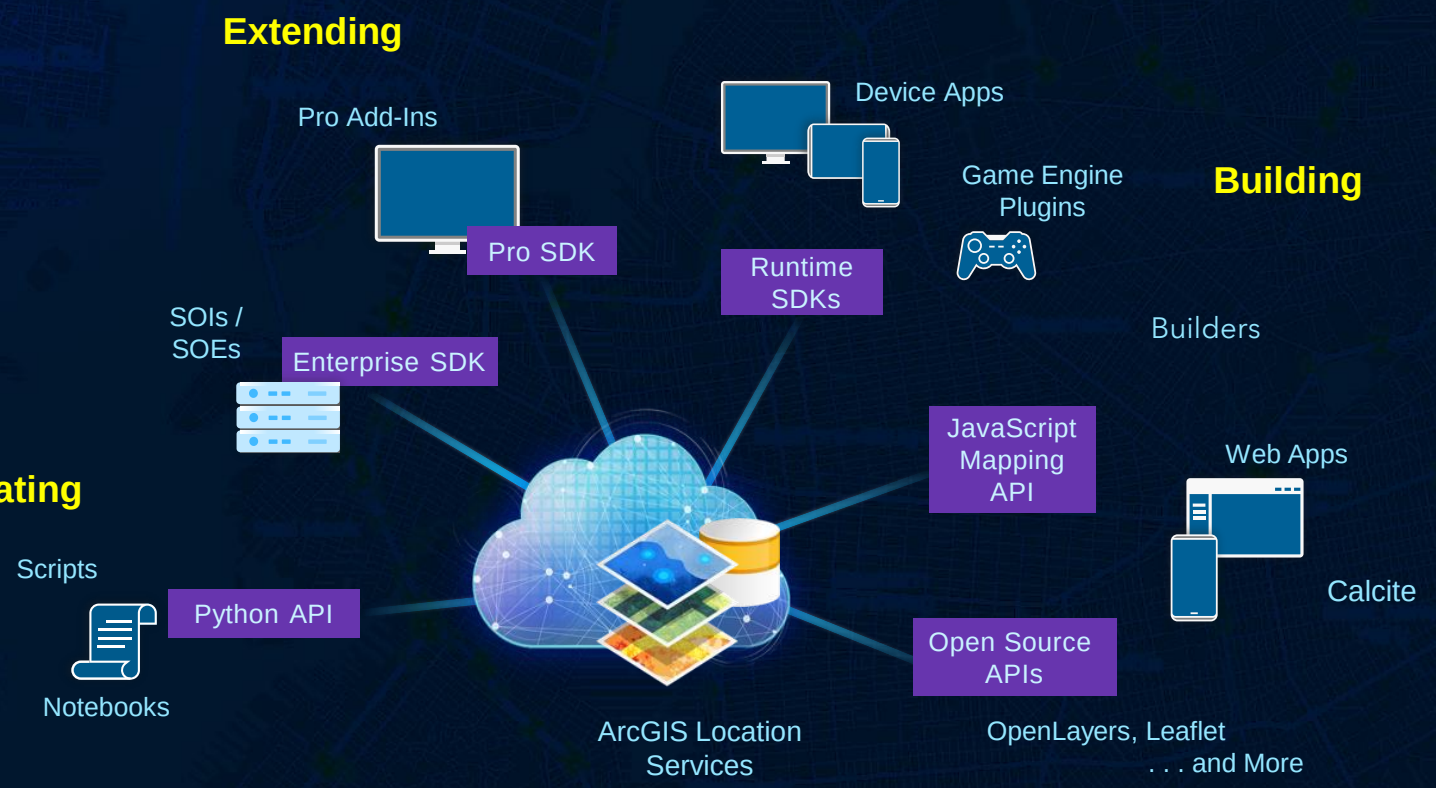
Automation APIs

Python API *("arcgis" package)*
ArcPy *("arcpy" package)*

ArcGIS Developer

APIs & SDKs for Building Apps, Extending ArcGIS . . . and Automating Workflows

- Performance
- Visualization and Analytics
- Data Hosting
- Developer Experience
- Low Code/No Code Builders



Reduce Development Time

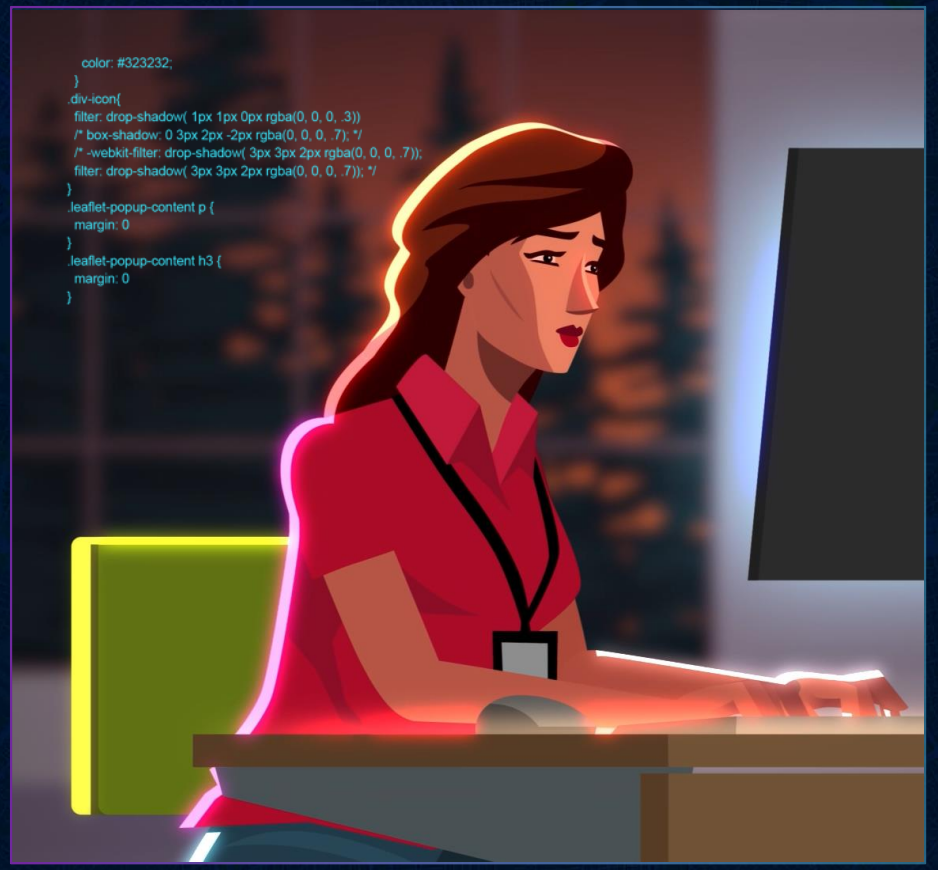
Helping You Get to Market Faster

Widgets and Components

Familiar Developer Tooling

Documentation

Content



Variety of Development Choices

Use the Right Tools for Your Skills and Requirements

Client APIs

JavaScript
iOS
Python
Android
Java
.NET
REST
Qt
Unreal Engine
Unity

Open-Source APIs

Leaflet
REST JS
CesiumJS
OpenLayers
MapLibre GL JS

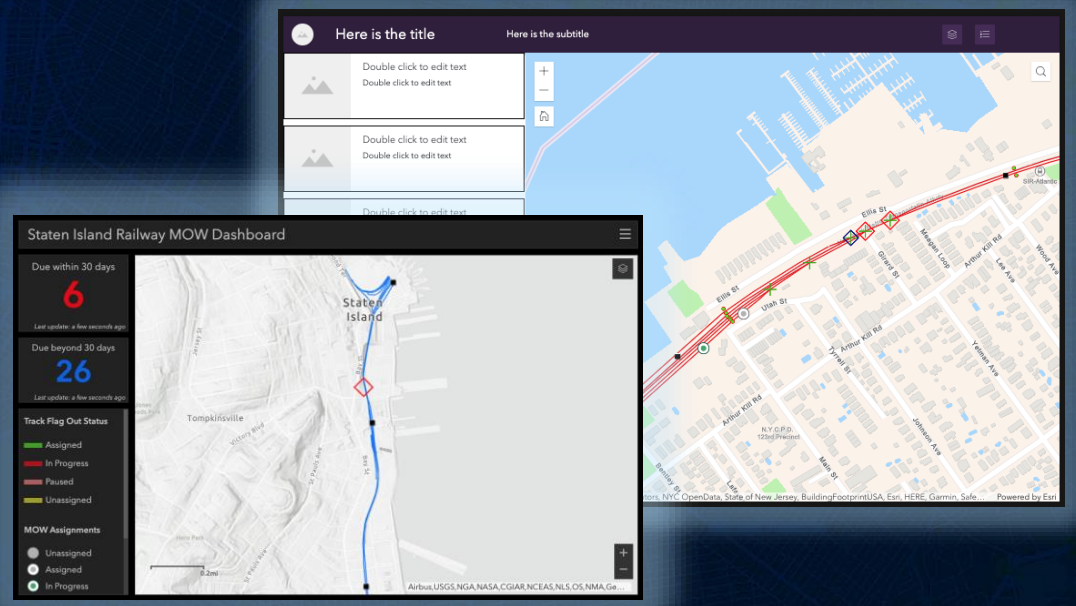
Low-code & No-code Builders

Experience Builder
AppStudio
Web AppBuilder
Instant Apps
StoryMaps
Dashboards

Custom Tools vs COTS

Developer Tools are more than just APIs

- Configure then customize
  - UI configuration and builders first
  - APIs second



Apps *UI Configure* *Solutions* *Templates* *Builders* *Widgets* *SDKs* **APIs**

Developer Tools

NEW NAME	OLD NAME
• ArcGIS Maps SDK for JavaScript	• ArcGIS API for JavaScript
• ArcGIS Maps SDK for Swift	• ArcGIS Runtime SDK for iOS
• ArcGIS Maps SDK for Kotlin	• ArcGIS Runtime SDK for Android
• ArcGIS Maps SDK for .NET	• ArcGIS Runtime SDK for .NET
• ArcGIS Maps SDK for Java	• ArcGIS Runtime SDK for Java
• ArcGIS Maps SDK for Qt	• ArcGIS Runtime SDK for Qt
• ArcGIS Maps SDK for Unity	• ArcGIS Maps SDK for Unity
• ArcGIS Maps SDK for Unreal Engine	• ArcGIS Maps SDK for Unreal Engine

SOFTWARE DEVELOPMENT KIT

SDK

Tools and resources for application development

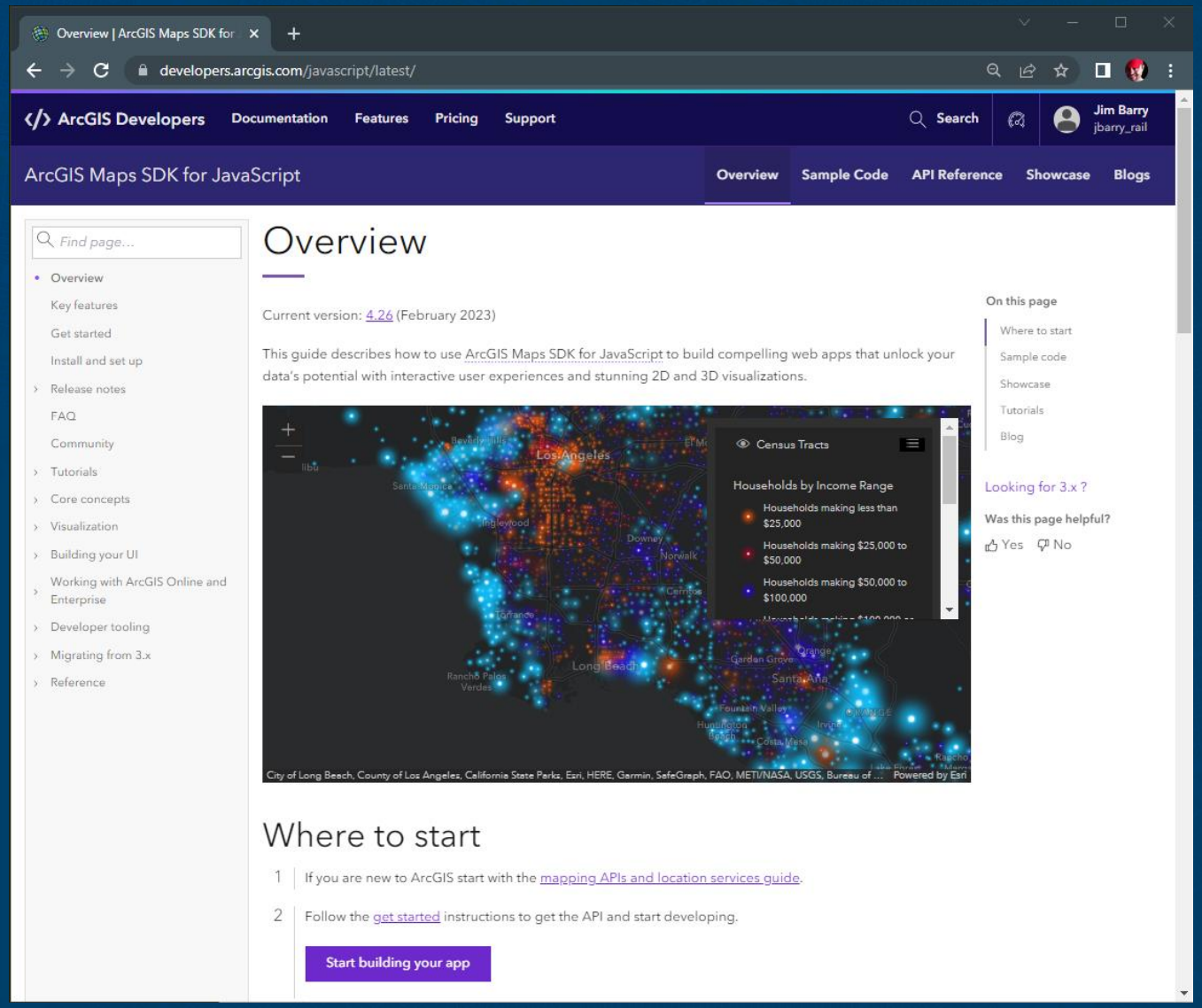
Libraries, Doc, Samples

API

Rules
Methods
Protocols

Classes
Functions
Procedures

APPLICATION PROGRAMMING INTERFACE



ArcGIS Platform

(ArcGIS PaaS)

ArcGIS Platform | Location Platform-as-a-Service

Location Services

Content &
Capabilities

Developer Experience

Mapping APIs
Open-Source Mapping Libraries
Developer Resources

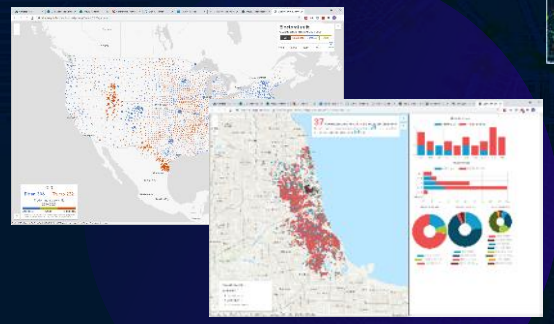
Business Model

Consumption-Based
Service usage
Deployment instances

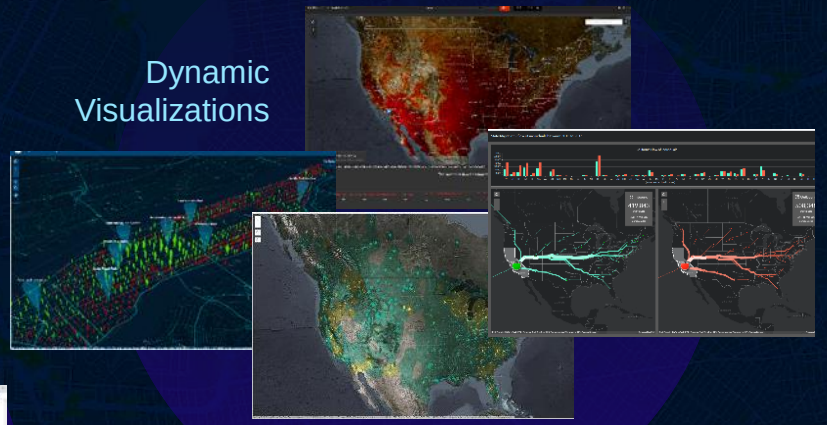
An intuitive developer experience
for accessing and using ArcGIS Platform

ArcGIS Platform | Build Solutions with Location Services

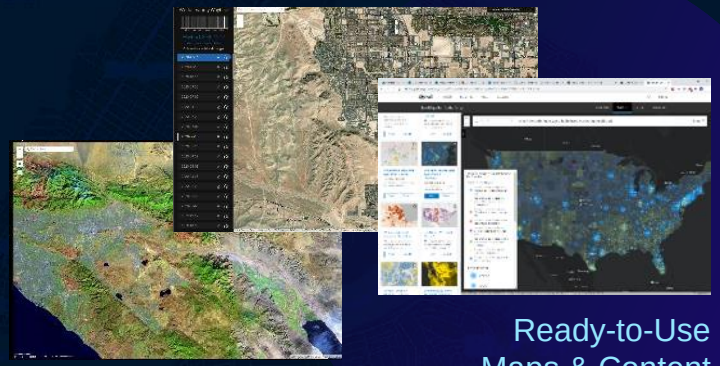
Engaging Maps
& Solutions



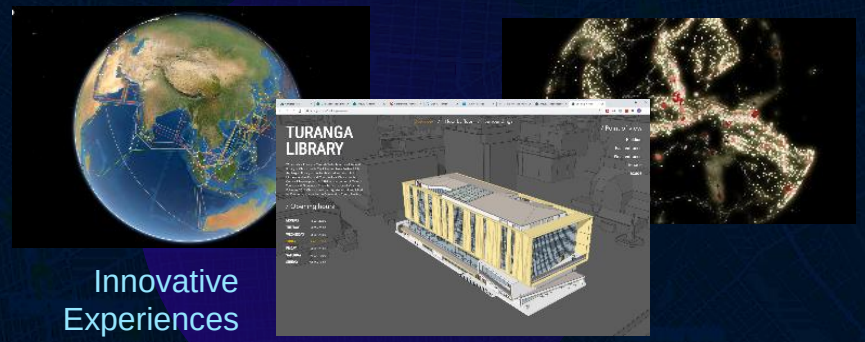
Hosted Data



Dynamic
Visualizations



Ready-to-Use
Maps & Content



Innovative
Experiences

Location Services

On-Demand Access to Extensive Content and Powerful Capabilities

Content

Basemaps

Demographics

Ready-to-Use Content

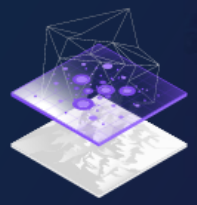
Data Hosting

Capabilities

Visualization

Geocoding & Search

Routing & Directions



Spatial Analytics

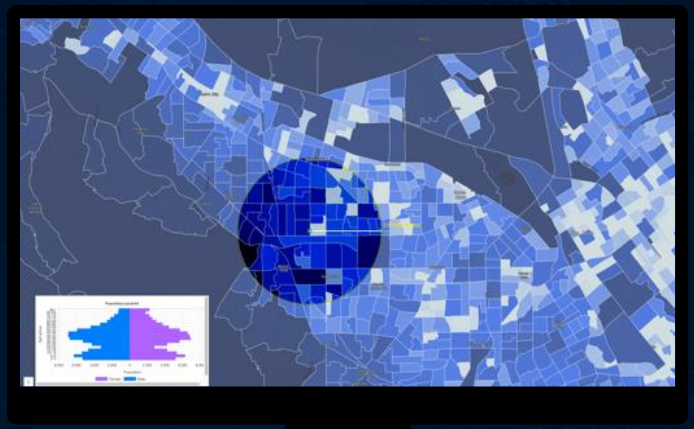
Deployment Options

Ready-to-Use Content

Choose From a Library of Hundreds of Data Sources

Basemaps

Library of
Pre-Styled Maps



Apply Your Own
Custom Style

Demographics

- Data Enrichment
- Reports and Infographics

Access
Thousands of
Variables

Data

- Imagery
- Weather
- Traffic
- Boundaries

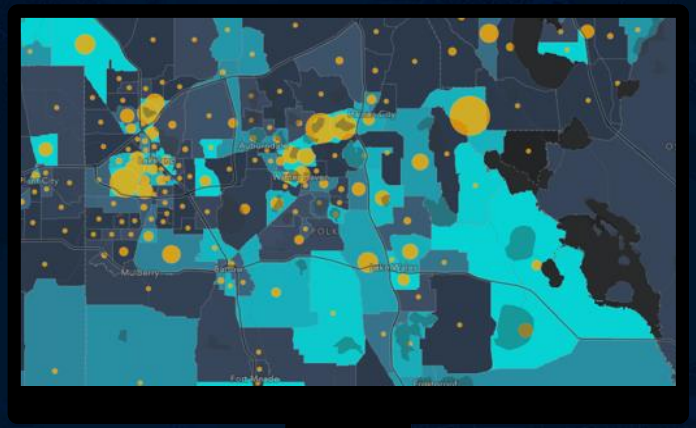
Authoritative,
Comprehensive & Global

Powerful Capabilities

On-Demand Location Services for Your Apps

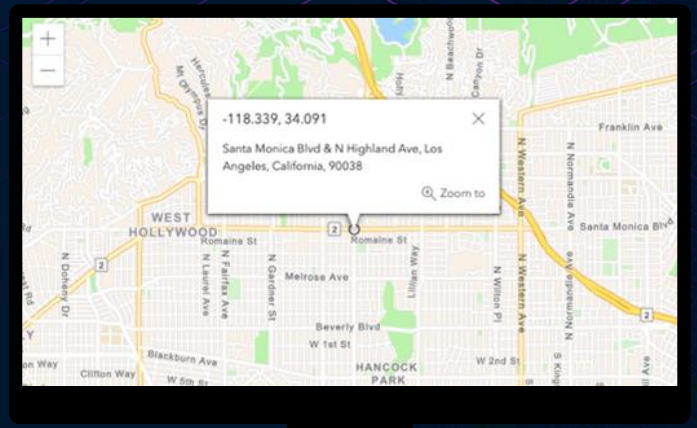
Visualization

- Interactive Data-Driven Styling
- 2D and 3D
- Smart Mapping



Geocoding & Search

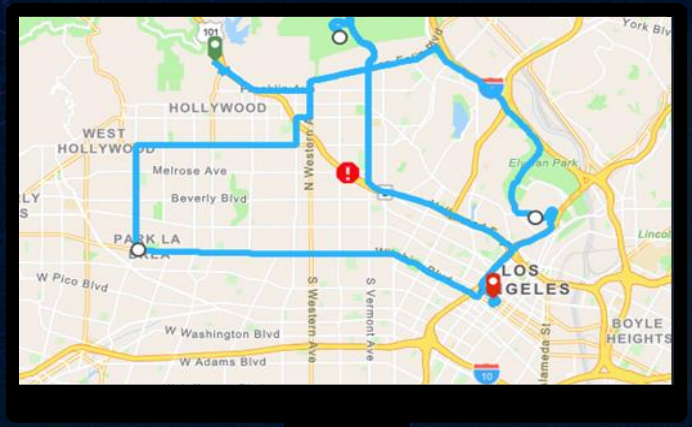
- Multiple Authoritative Sources
- Support for Local Languages and Address Formats



Global Coverage

Routing & Directions

- Point-to-Point
- Multiple Vehicles
- Optimized Routes



Drive-Time Areas (Isochrones)

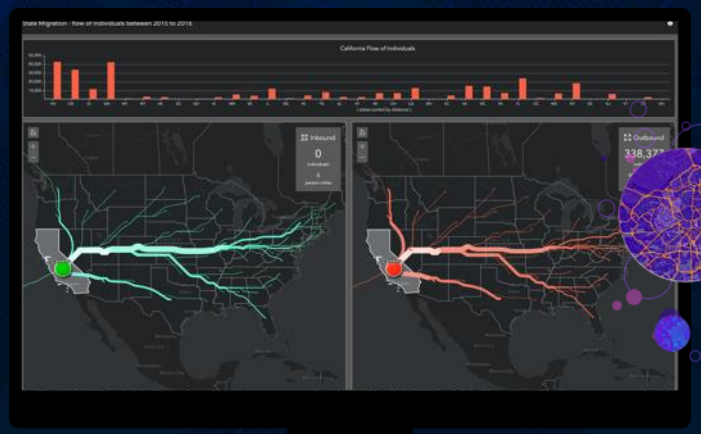
Closest Facility

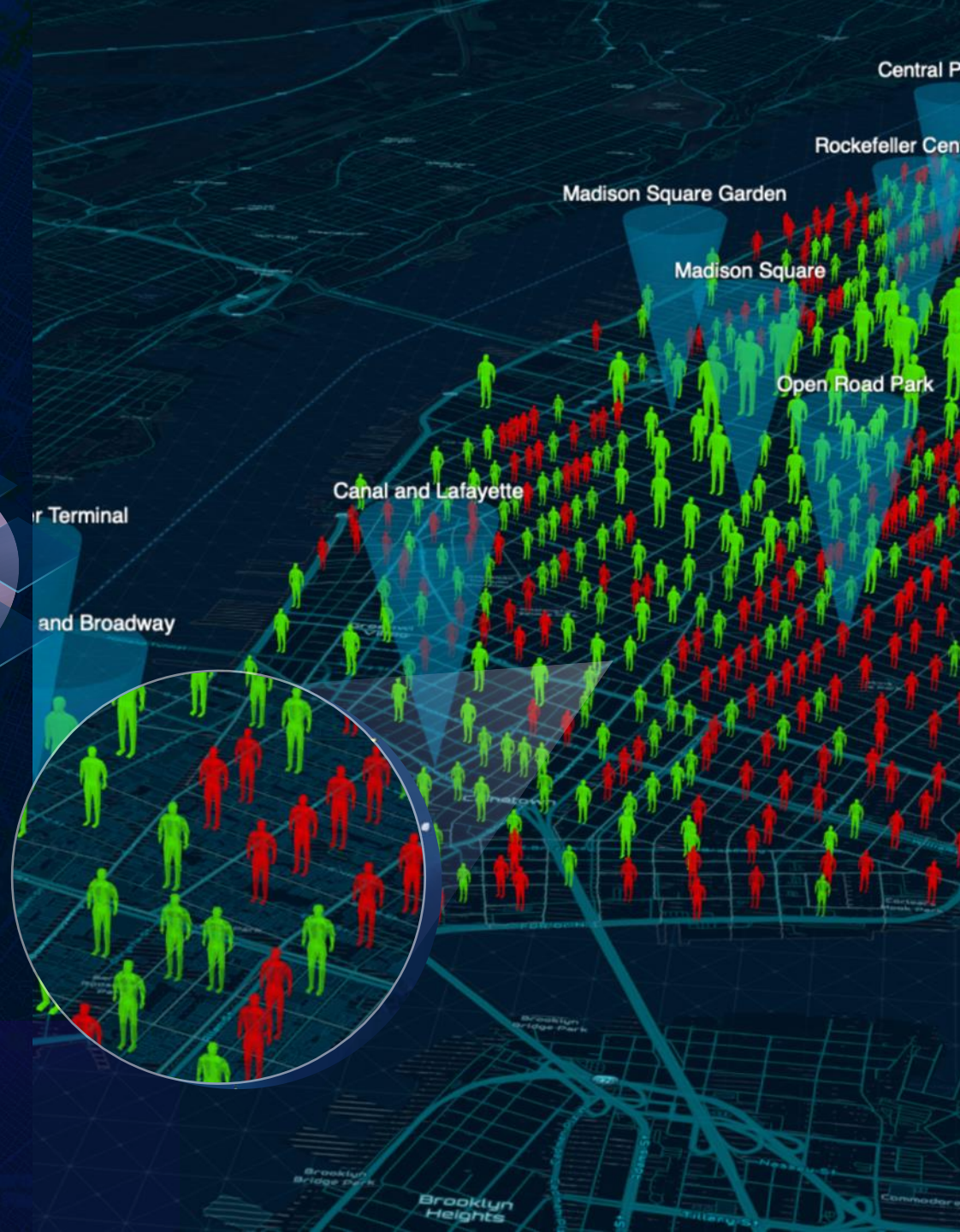
Origin-Destination Matrices

Data Hosting

Create Services From Your Data

- Visualize, Edit & Analyze
- Secure, Scalable, Performant
- Maintain Data Ownership

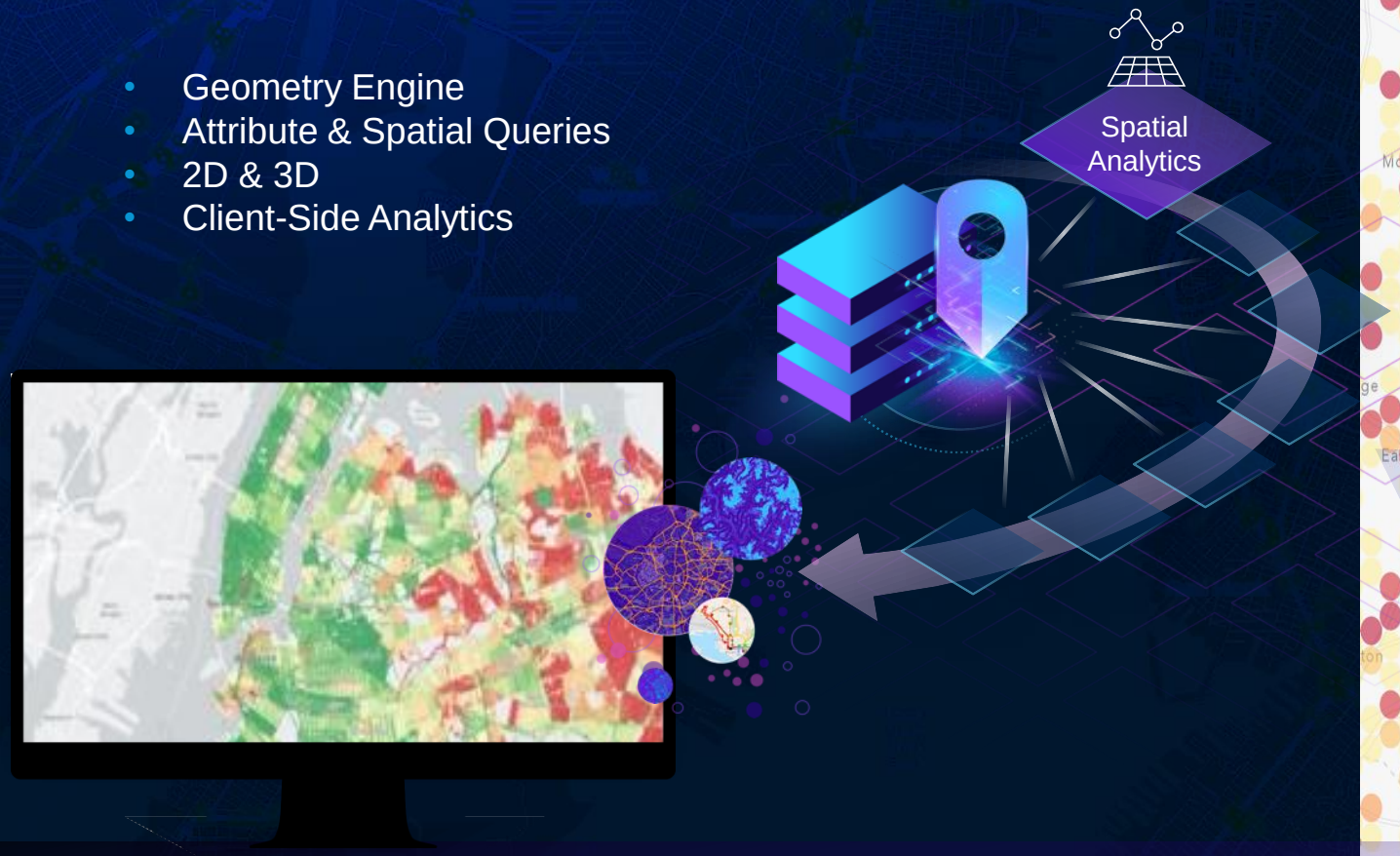


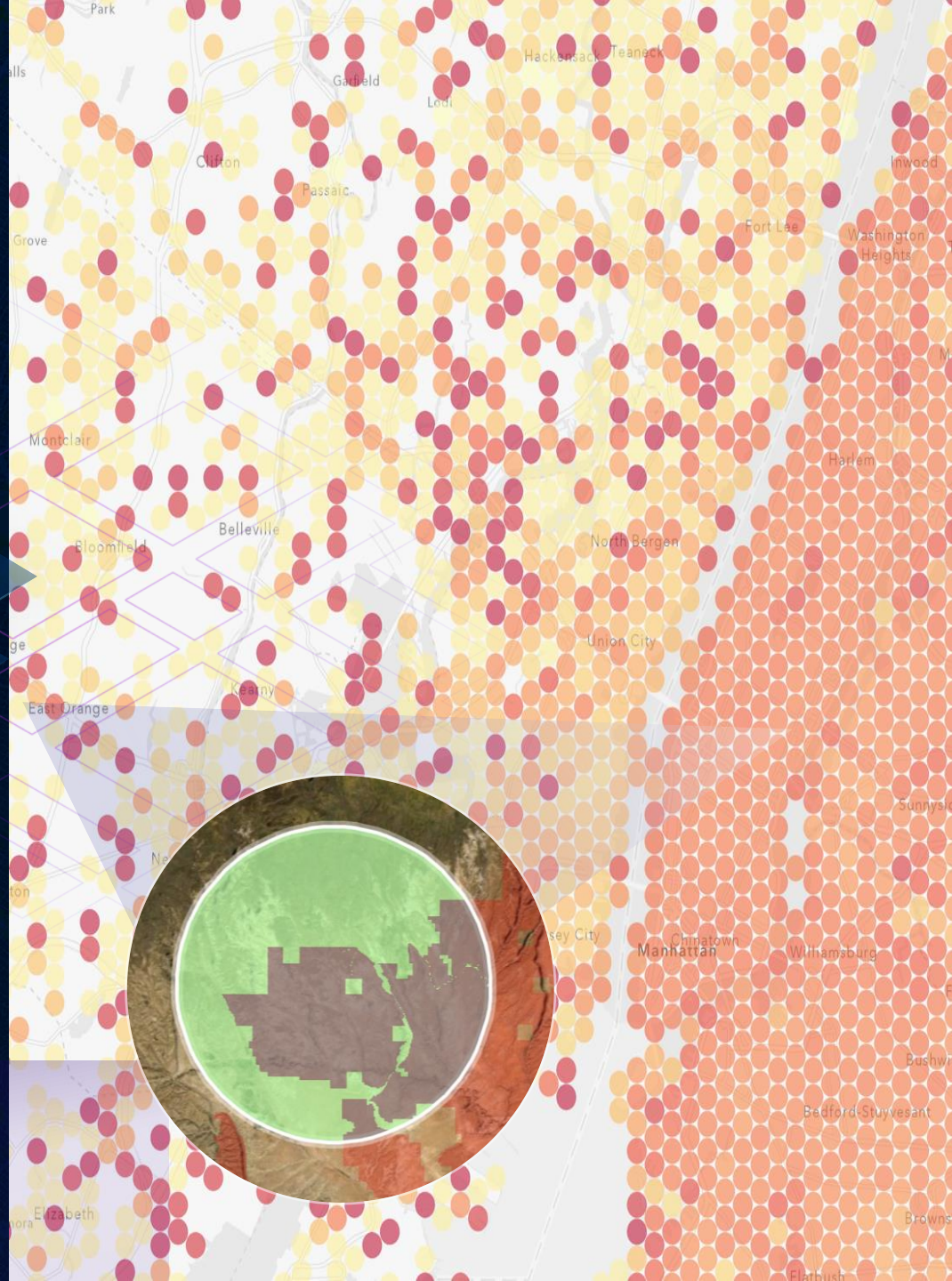


Spatial Analytics

Create Understanding From Data

- Geometry Engine
- Attribute & Spatial Queries
- 2D & 3D
- Client-Side Analytics





Build on Your Investment in ArcGIS

Apply Developer Tools Available to All ArcGIS Customers

Building
Apps On Your ArcGIS

Extending
the ArcGIS System

Automating
& Integrating GIS Workflows

Build Apps On Your ArcGIS

- Use ArcGIS Identity, or anonymous access
- Leverage shared content and items
- Provide custom workflows
- Build custom apps that are tightly integrated with ArcGIS Online/Enterprise

Web Apps

Web Apps

- ArcGIS Maps SDK for JavaScript

…but also:

- Configurable Apps
- Embeddable Apps
- Instant Apps
- Builders
- ArcGIS support for 3rd-party web development tools
  - Maplibre GL JS, CesiumJS, OpenLayers, Leaflet
  - ArcGIS REST JS and API Keys

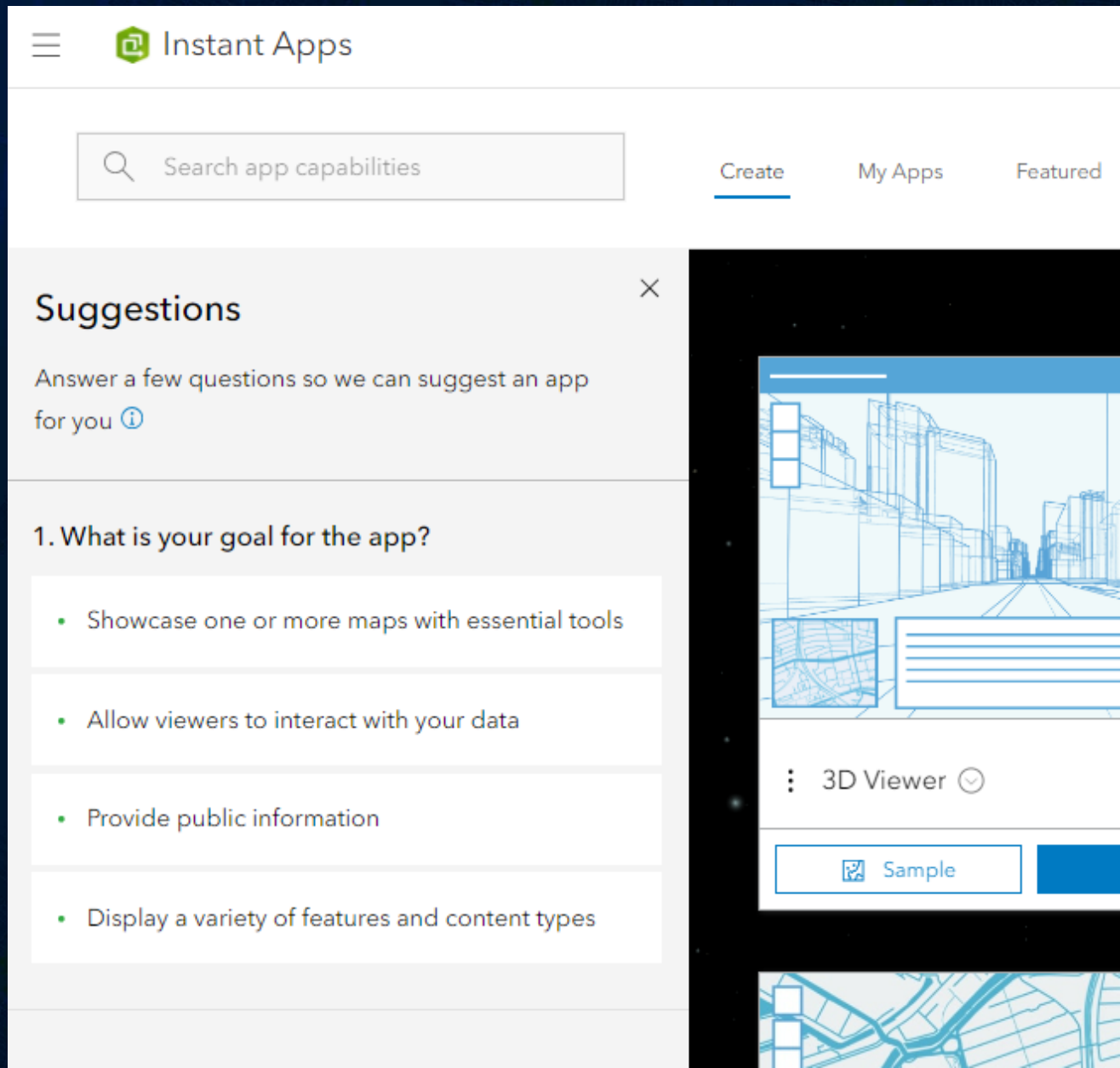
Instant Apps

no-code

Choose from a list of templates

or…

Answer some questions and let it guide you to the right emplate

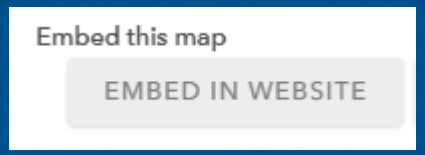


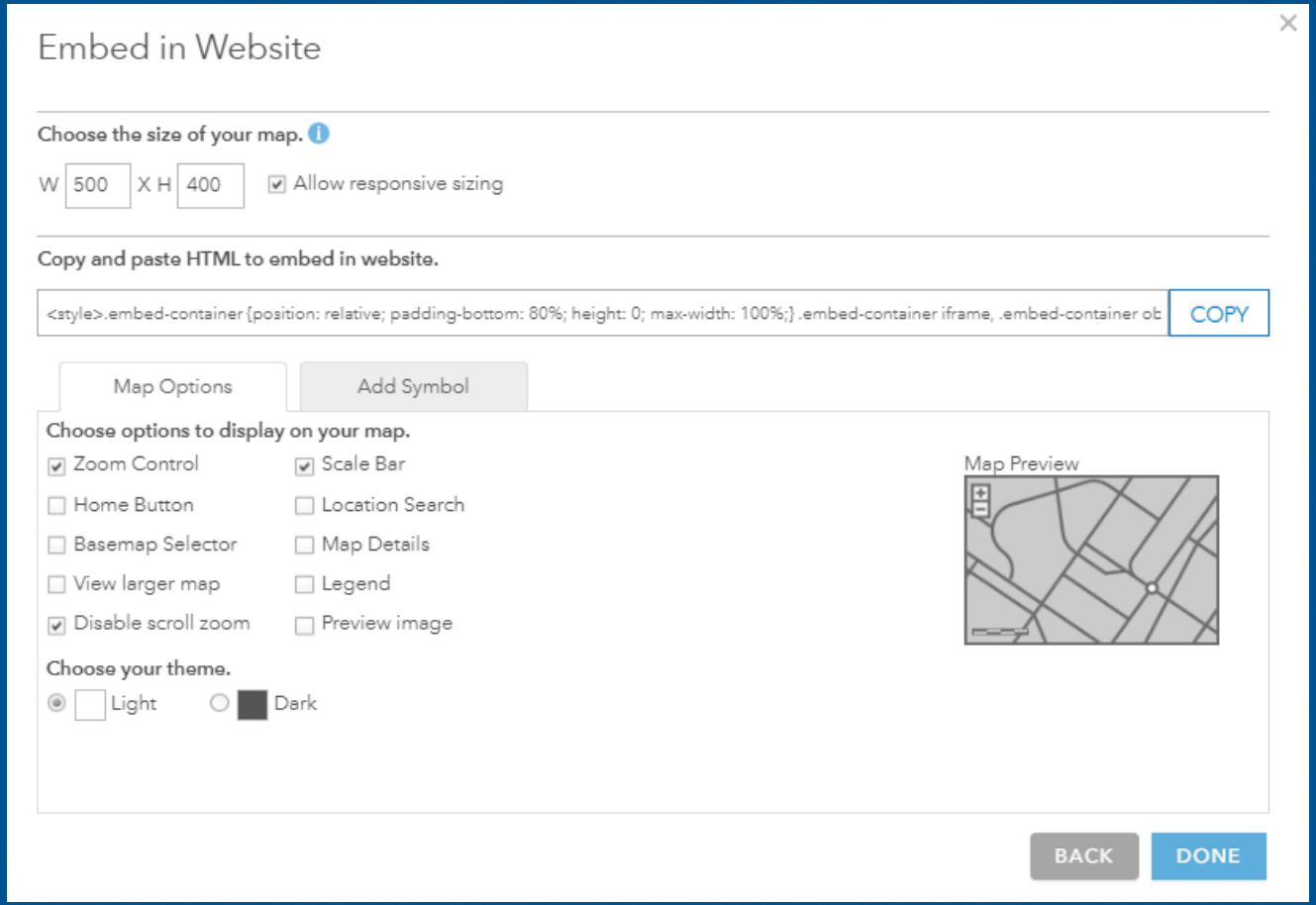
Embeddable App

no-code

Configure your tools, then grab the HTML/CSS and use in your page.

Only with “*Classic*” Map Viewer





Just copy/paste this HTML/CSS code into your web page.

<style>

<a>

<iframe>

Title

An article for testing my embedded map

```
<p> Here is a blog article for testing an embedded map with configured tools.  Here it is below.</p><p><br /></p>

<br />

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    height: 0;
    max-width: 100%;
  }
  .embed-container iframe,
  .embed-container object,
  .embed-container

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    top: 0;
    left: 0;
    width: 100%;
    height: 100%;
  }
  small{
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    z-index: 40;
    bottom: 0;
    margin-bottom: -15px;
  }
</style>

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details=true&legend=true&active_panel=details&basemap_gallery=true&disable_scroll=true&theme=dark" style="color:#0000FF;text-align:left"
target="_blank">View larger map</a>
  </small><br>

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src="//esrirail.maps.arcgis.com/apps/Embed/index.html?
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&searchextent=true&details=true&legend=true&active_panel=details&basemap_gallery=true&disable_scroll=true&theme=dark">  </iframe>
</div>

<br />

<p>Above is a test of my embedded mapping app.</p>
```

An article for testing my embedded map

October 09, 2023

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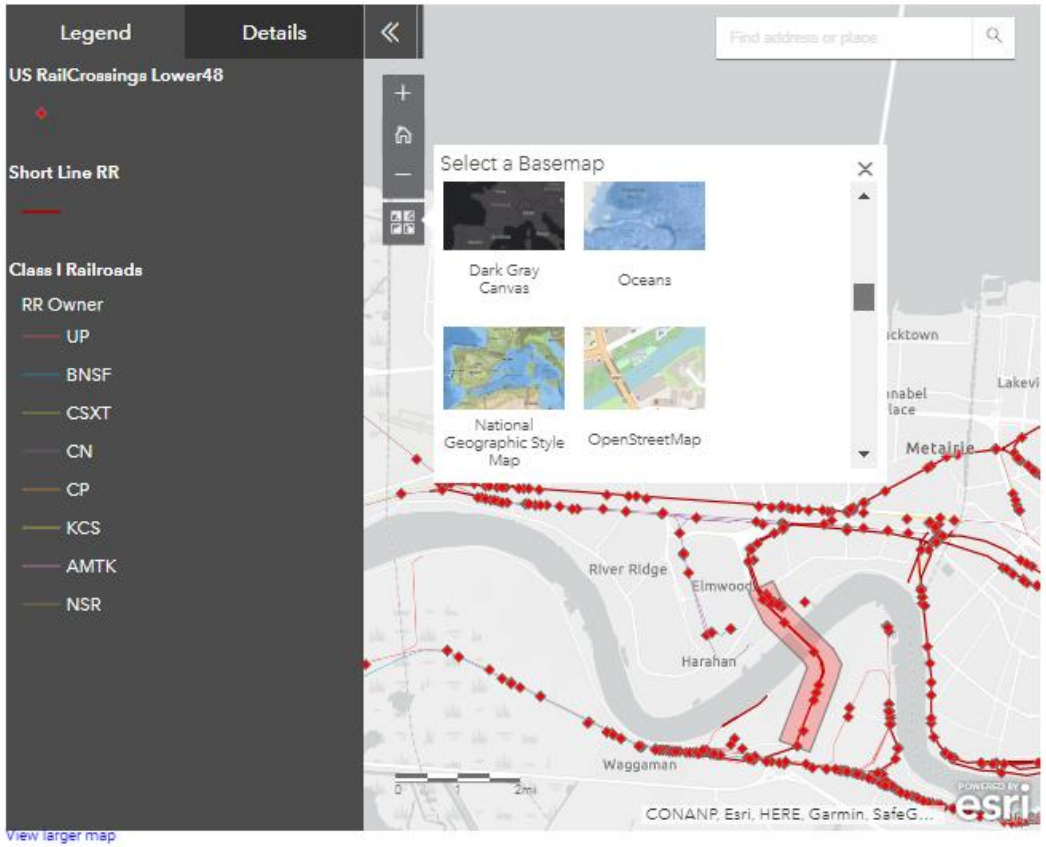
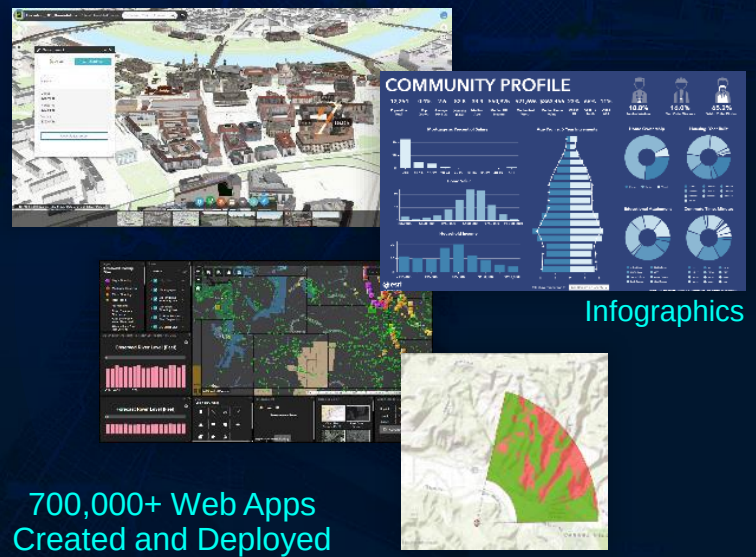


View larger map

Above is a test of my embedded mapping app.

Low Code Builders for Web Apps

Web AppBuilder

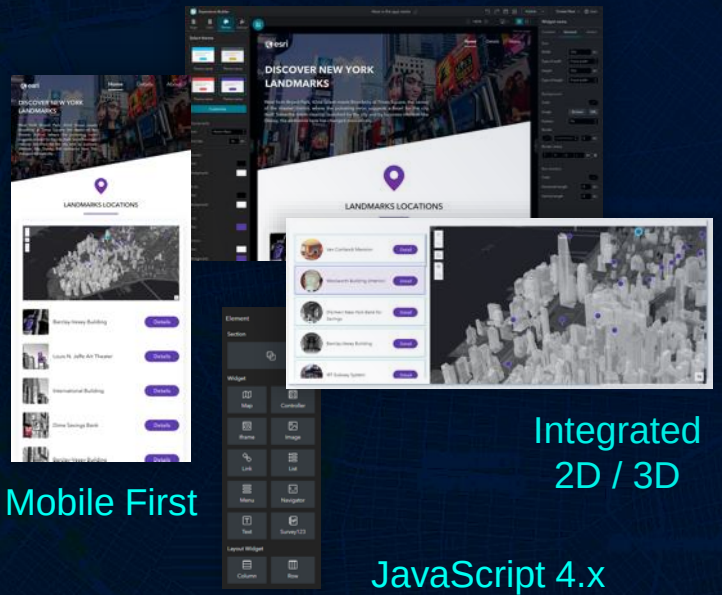


Infographics

700,000+ Web Apps
Created and Deployed

Visibility

Experience Builder



Mobile First

Integrated
2D / 3D

JavaScript 4.x

- *Builders are included with ArcGIS Online (SaaS), ArcGIS Enterprise (on-premises)*
- *Also a locally installable "Developer Edition" for building custom widgets, themes, and app templates*

Low Code Builders for Web Apps

Web AppBuilder

Infographics

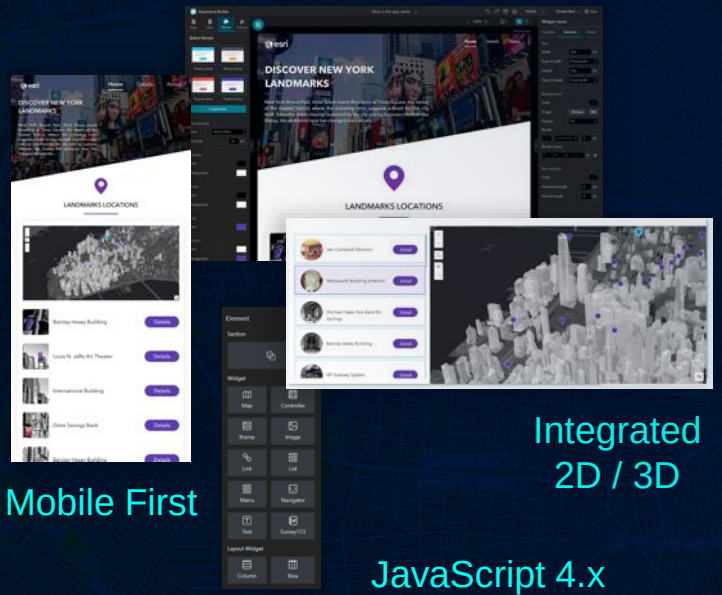
700,000+ Web Apps
Created and Deployed

Visibility

Product retirement:

- *Developer edition: July 2024*
- *Enterprise edition: Q2 2025*
- *Online edition: Q4 2025*

Experience Builder



Mobile First

Integrated
2D / 3D

JavaScript 4.x

Low Code Builders for Web Apps

Web AppBuilder

Infographics

700,000+ Web Apps
Created and Deployed

Visibility

Product retirement:

- *Developer edition: July 2024*
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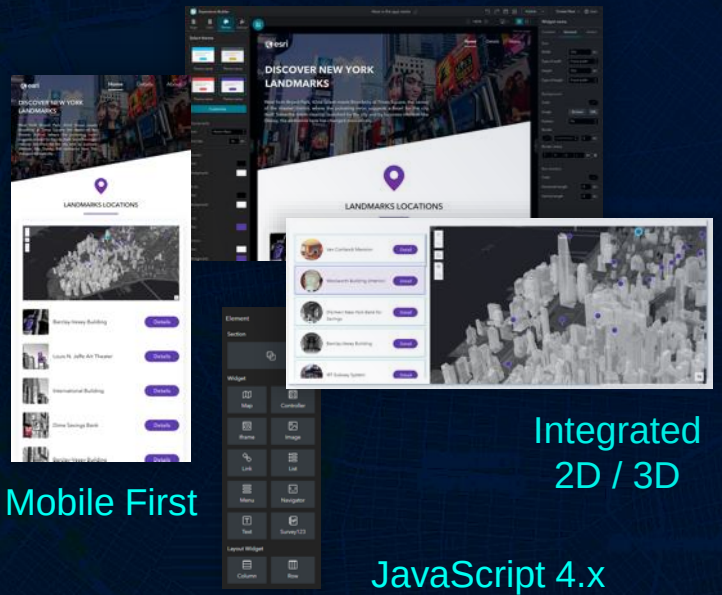
- *Online edition: Q4 2025*

Experience Builder



Mobile First

Integrated
2D / 3D

JavaScript 4.x

GALLERY

ArcGIS Maps SDK for JavaScript

Web Application Development

Enabling Powerful and High-Performance Web Apps

Fast Performance

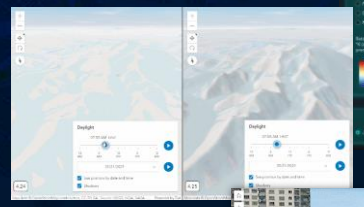
Previous Current

Fast Loading

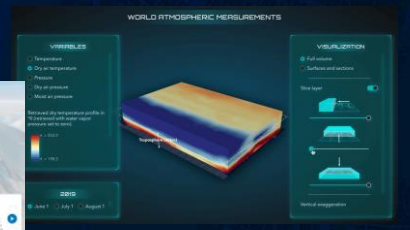
Animations

3D Apps

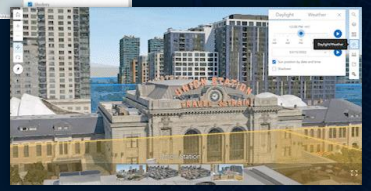
Previous Current



Better Terrain

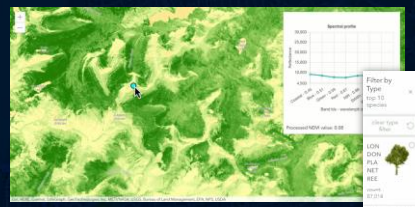


Voxels



Realistic Weather

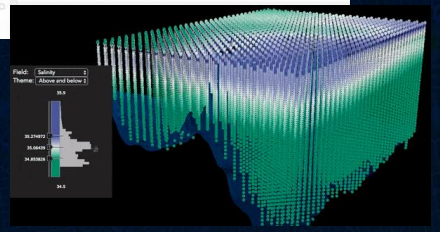
Client-Side Analysis



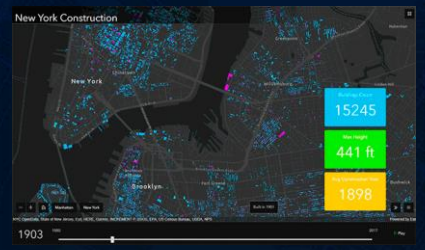
Raster Functions

2D & 3D Analytics

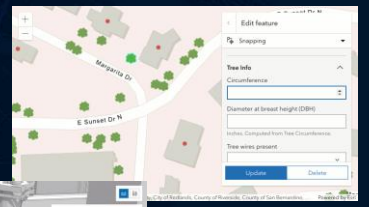
Time-Based



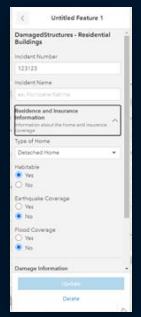
Widgets and Workflows



2D & 3D Editing



Smart Forms



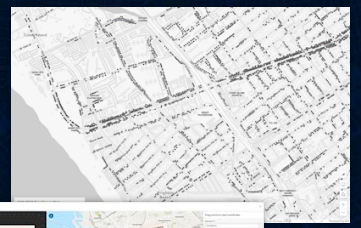
Snapping

50+ Widgets

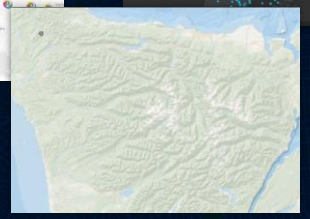
Data-Driven Visualization

Binning

2D & 3D Heat Map



Pie Charts



Vector Symbology

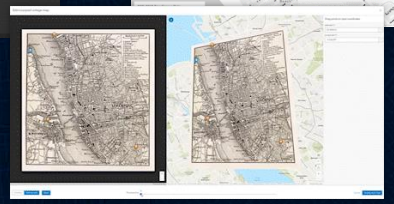


Image & Video Overlays

ArcGIS Maps SDK for JavaScript

Web Application Development

DEMO

Enabling Powerful and High-Performance Web Apps

Fast Performance

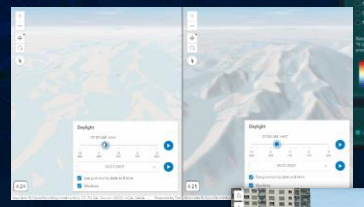
Previous Current

Fast Loading

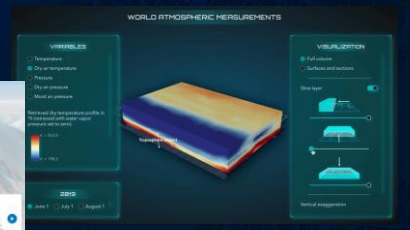
Animations

3D Apps

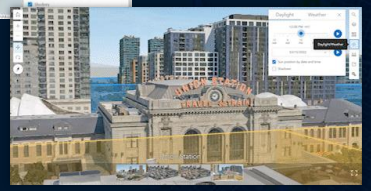
Previous Current



Better Terrain

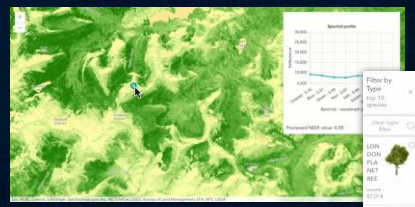


Voxels



Realistic Weather

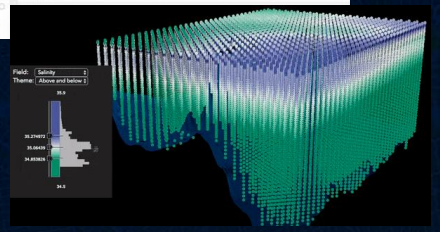
Client-Side Analysis



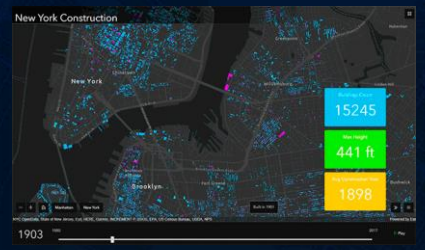
Raster Functions

2D & 3D Analytics

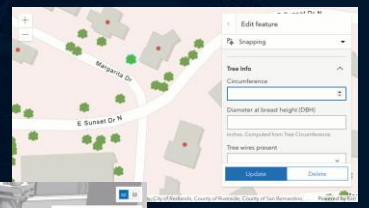
Time-Based



Widgets and Workflows



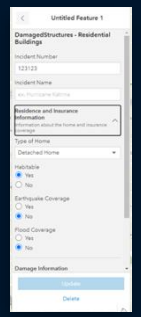
2D & 3D Editing



Snapping

50+ Widgets

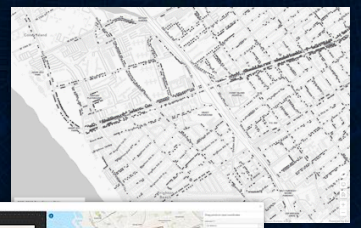
Smart Forms



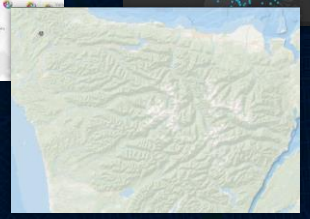
Data-Driven Visualization

Binning

2D & 3D Heat Map



Pie Charts



Vector Symbology

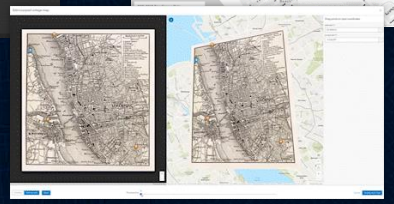


Image & Video Overlays

ArcGIS Maps SDK for JavaScript: ×

codepen.io/JimBarry/pen/ExGrBYN?editors=1000

ArcGIS Maps SDK for JavaScript: Display a map

Jim Barry

Run | Save | Settings

HTML

```html
<style> html, body, #viewDiv {padding: 0; margin: 0; height: 100%; width: 100%;} </style>

<link rel="stylesheet" href="https://js.arcgis.com/4.27/esri/themes/light/main.css">
<script src="https://js.arcgis.com/4.27/"></script>

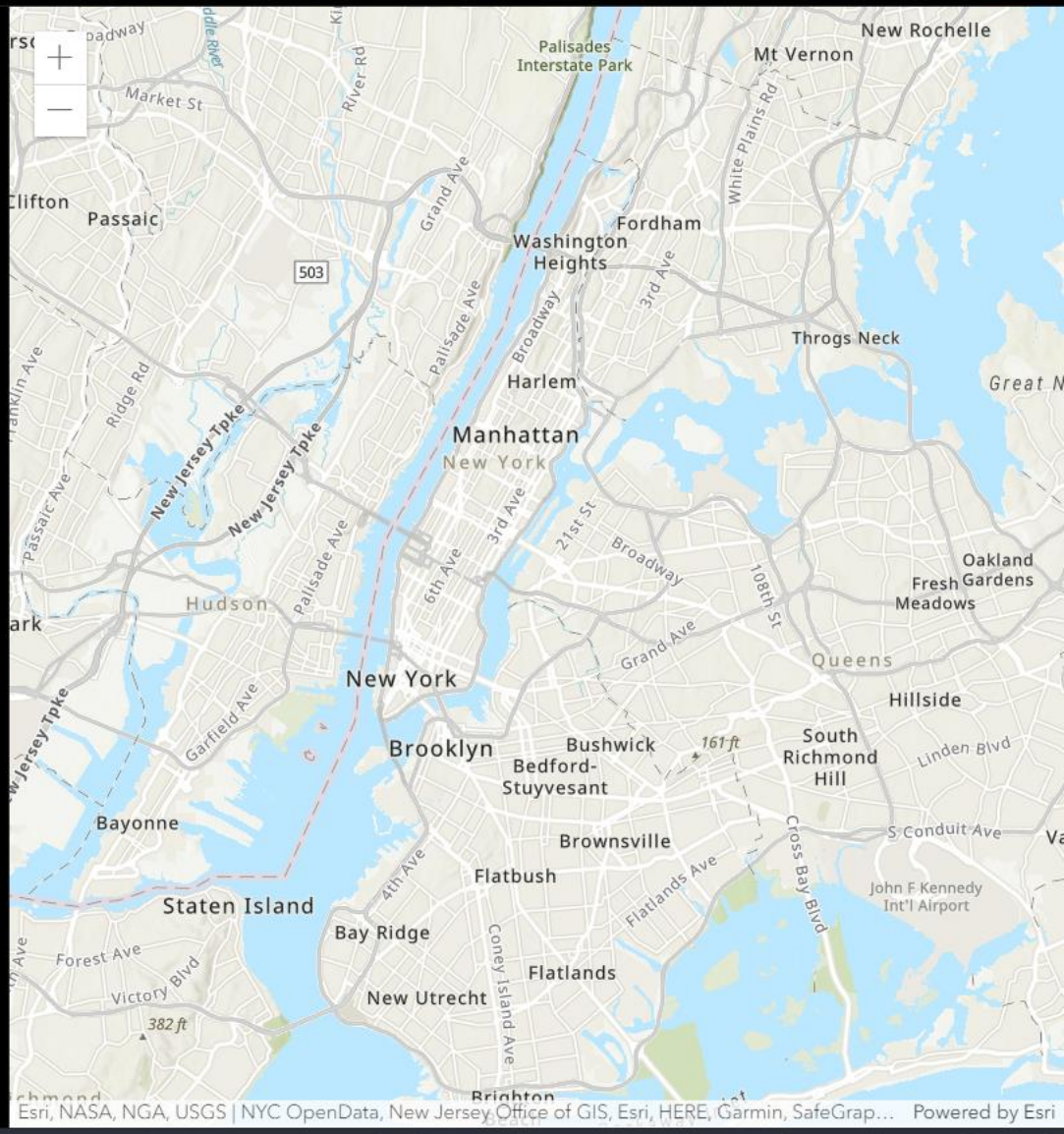
<script>
 require(["esri/config", "esri/Map", "esri/views/MapView"], function(esriConfig, Map, MapView) {
 const key = "AAPK3dbcd91d41ea44278c784dafaf7f77f4aRIhgE9q9TMkJq6EiOxx-QN8-q3X0OBh44FGQMvpHk";
 esriConfig.apiKey = key;

  const map = new Map({
    basemap: "arcgis-topographic" // Basemap layer service
  });

  const view = new MapView({
    map: map,
    center: [-73.95, 40.75], // Longitude, latitude
    zoom: 11, // Zoom level
    container: "viewDiv" // Div element
  });
});
</script>
</head>
<body>
<div id="viewDiv"></div>
</body>
</html>
```

CSS

JS



Console | Assets | Comments | Shortcuts

Last saved OCTOBER 10, 2023 – 1:56:32 PM | Delete | Add to Collection | Fork | Embed | Export | Share

Line of sight widget

codepen.io/pen?editors=1000

Line of sight widget

Captain Anonymous

Save | Settings | Sign Up | Log In

HTML

```
      const lineOfSight = new LineOfSight({
        view: view,
        container: "losWidget"
      });

      /***********************************
       * Add symbols to mark the intersections
       * for the line of sight
       ***********************************/

      const viewModel = lineOfSight.viewModel;

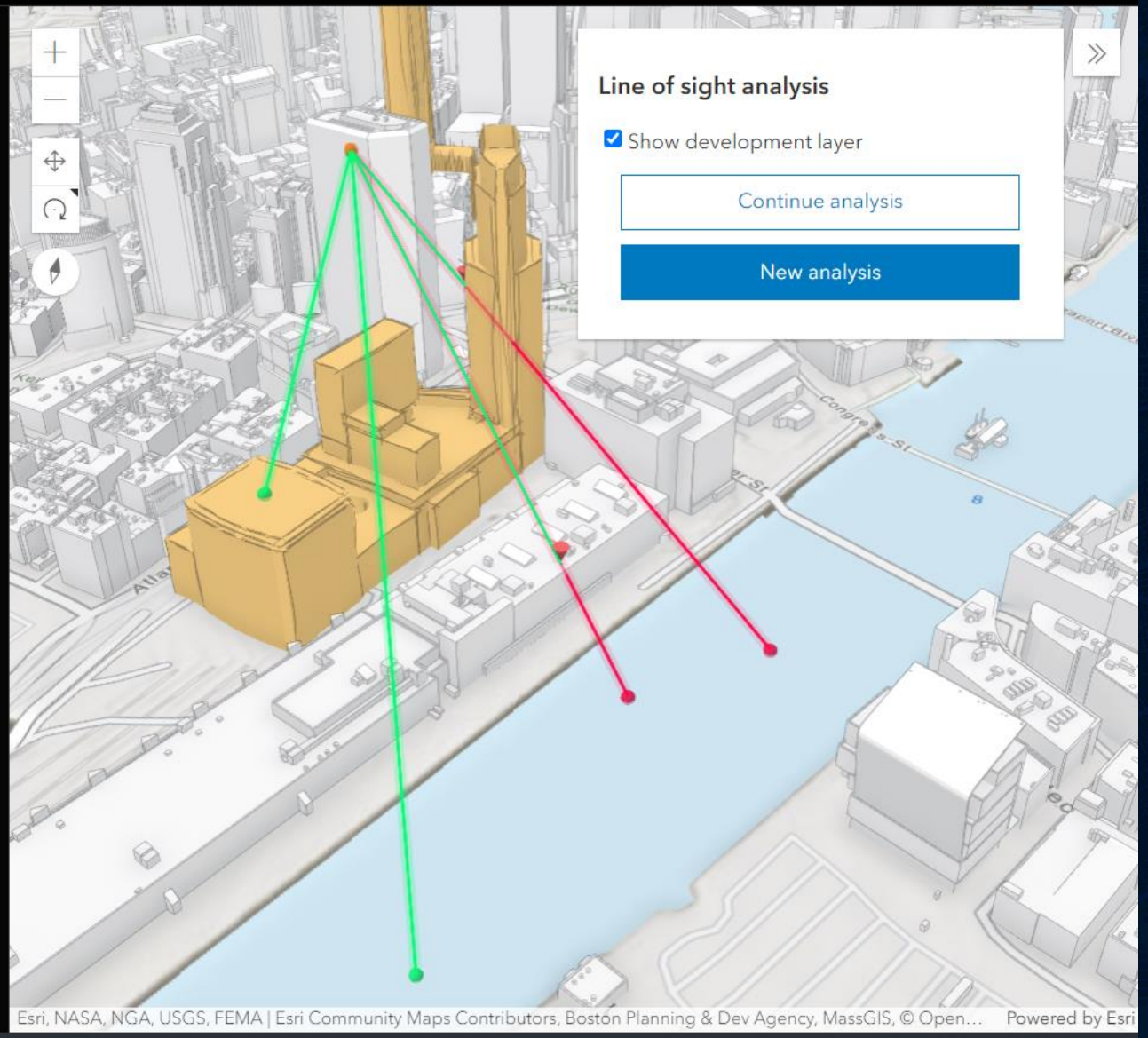
      // watch when observer location changes
      viewModel.watch("observer", (value) => {
          setIntersectionMarkers();
      });

      // watch when a new target is added or removed
      viewModel.targets.on("change", (event) => {
        event.added.forEach((target) => {
          setIntersectionMarkers();
          // for each target watch when the intersection changes
          target.watch("intersectedLocation", setIntersectionMarkers);
        });
        event.removed.forEach(() => {
          // remove intersection markers for removed targets (remove with right
click on target)
```

CSS

JS

Console | Assets | Shortcuts



arcgis-rest-js Public

compact, modular JavaScript wrappers for the ArcGIS REST API

TypeScript 313 Apache-2.0 103 67
(6 issues need help) 22 Updated 4 days ago

Not using the ArcGIS Maps SDK for JavaScript?

ArcGIS Developers | Documentation | Features | Pricing | Support | Search

ArcGIS REST JS | Home

Find page...

- Overview
- Key features
- Get started
- Install and set up
- Tutorials
- Release notes
- Authentication

ArcGIS REST JS

ArcGIS REST JS is a light-weight collection of JavaScript modules for accessing ArcGIS services and building mapping and spatial analysis applications. The library makes it easy to perform authentication with API keys and OAuth 2.0 and to make requests to ArcGIS location services and ArcGIS Enterprise services. For example, you can make requests to perform data queries, geocoding, routing, demographic queries, content management, and administration tasks. The library is available as ES, CommonJS, and UMD modules for client and server-side use.

Learn more about the capabilities in Key features.

Find a route and directions

Routing is the process of finding the path from an origin to a destination in a street network. You can use the route service to find routes, get driving directions, calculate drive times, and solve complicated, multiple vehicle routing problems. To create a route, you typically define a set of stops (origin and one or more destinations) and use the service to find a route with directions. You can also use a number of additional parameters such as barriers and mode of travel to refine the results.

In this tutorial, you find a route and directions for an origin and destination by accessing the route service.

Note

To learn more about the routing and the route serivce, visit Routing in the *Mapping APIs and location services* guide.

Prerequisites

You need an ArcGIS Developer or ArcGIS Online account to access the developer dashboard and create an API key.

On this page

- Prerequisites
- Steps
  - Create a new pen
  - Get an API Key
  - Make the request
- Result
- What's next?

Solution

View in CodePen

Estimated time

10 minutes

Was this page helpful?

Yes No

Using a different web front end developer toolset?

- Leaflet
- OpenLayers
- CesiumJS
- **Maplibre GL JS**

What the REST JS can do:

plus:
- Geoenrichment Service
- Portal Management: users, groups, content
- Root Functions: request/response, authentication helpers, error handling

- @esri/arcgis-rest-demographics
- @esri/arcgis-rest-feature-service
- @esri/arcgis-rest-geocoding
- @esri/arcgis-rest-places
- @esri/arcgis-rest-portal
- @esri/arcgis-rest-request
- @esri/arcgis-rest-routing

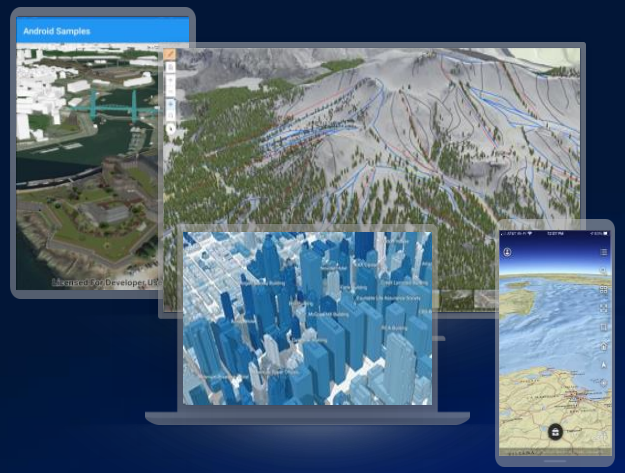
- Big Data Catalog Service
- Data Reviewer Server
- Feature Service
- Feature Service (Sync)
- Feature Service (Admin)
- GeoAnalytics (Get Started)
- GeoAnalytics (Tasks)
- GeoAnalytics (Task Concepts)
- GeoAnalytics (Context)
- Geocode Service
- Geocoding Tools
- Geodata Service

- Geometry Service
- Geoprocessing Service (General)
- Geoprocessing Service (Async)
- Geoprocessing Service (Sync)
- Globe Service
- Image Service
- Info
- Knowledge Graph Service
- Knowledge Graph Service (Admin)
- Linear Referencing Service
- Map Service
- Mobile Service

- Network Diagram Service
- Ortho Mapping Service
- Parcel Fabric Services
- Raster Analytics (Get Started)
- Raster Analytics (Tasks)
- Raster Analytics (Context)
- Raster Utilities
- Relational Catalog Service
- Routing Services
- Scene Service
- Schematic Service
- Spatial Analysis (Overview)

- Spatial Analysis (Tasks)
- Spatial Analysis (Reference)
- Stream Service
- Symbol Service
- System
- Topographic Production Service
- Trace Network Service
- Uploads
- Utilities
- Utility Network Service
- Validation Service
- Vector Tile Service
- Version Management Service

Native Apps



Native Apps

Introduction

- Use the term ‘native’ to differentiate from web and web/hybrid apps
- Apps built with native device/platform APIs
- Access device capabilities e.g. Bluetooth, GPS, notifications
- Deliver highest performance
- Enable offline workflows
- UI / UX consistent with device environment
- App stores provide trusted source

Native apps

Powered by ArcGIS Maps SDKs for Native Apps

ArcGIS QuickCapture

ArcGIS Earth

ArcGIS Survey123

ArcGIS Navigator

Site Scan for ArcGIS

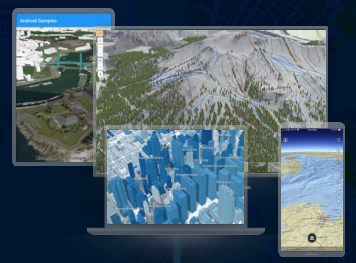
ArcGIS Indoors

ArcGIS Mission Responder

ArcGIS Workforce

ArcGIS Field Maps

Your apps



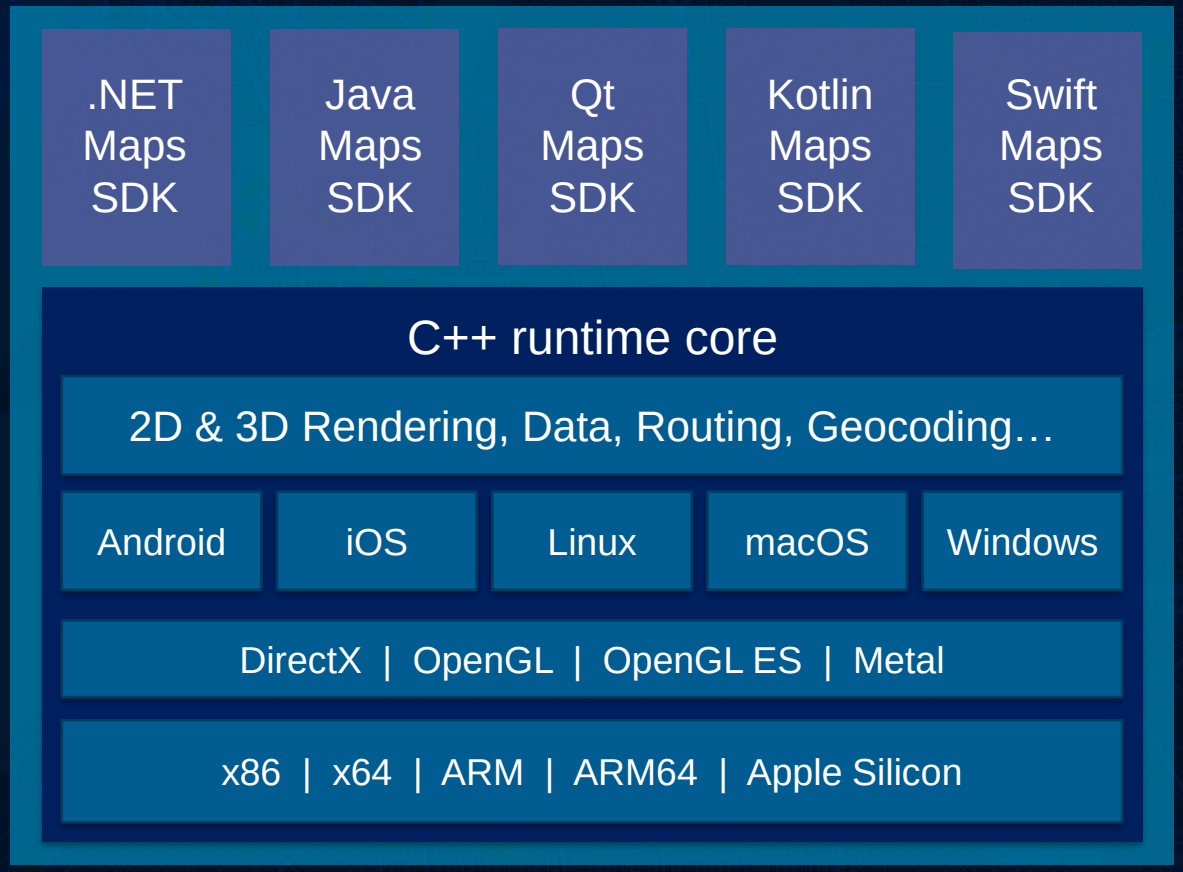
Partner apps

ArcGIS Maps SDKs for Native Apps

Native Maps SDKs

Architecture

- 5 SDKs
- Built on common runtime
  - Continuation of Runtime SDKs 100.x
- 5 Platforms
  - Platform-specific & cross-platform options
- All the capabilities of 100.0 – 100.15
- Plus new capabilities in 200.0 – 200.2



Native Maps SDKs

2022 DECEMBER APRIL AUGUST 2023

200.0

Native Maps SDKs

New features

- Offline Utility Networks

API advancements

- .NET MAUI
- Qt 6
- JavaFX 17

200.1

Native Maps SDKs

New Features

- Real-time
- Offline Utility Networks
- GeometryEditor

API advancements

- Kotlin
- Swift

200.2

Native Maps SDKs

Real-time

Feature Reduction

Utility Network

GeometryEditor

Feature Forms

3D Basemaps

Offline Utility Networks

200.0 – December 2022

- 200.0 (Dec 2022) first support offline tracing in the Native Maps SDKs
- Utility Networks in mobile geodatabases on the device
  - Includes data, network topology, and indexes
- Sideload / download standalone mobile geodatabase to device
- Load Utility Network and layers
- Builds on existing capabilities for locations, barriers, tracing
  - Connected, downstream, upstream, and subnetwork traces

Utility Networks and offline

200.1 – April 2023

- Enhanced offline tracing
- Offline support for gas and water utilities with isolation trace and hierarchical networks
- Geometry results

200.1 + ArcGIS Enterprise 11.1 Patch (2)

- Supporting utility network tracing in offline map workflows
  - New sync option on the *createReplica* REST endpoint allows downloading utility network topology
  - OfflineMapTask & GeodatabaseSyncTask account for this new property
  - Read-only for the first release

Utility Networks and offline

200.2 – August 2023

- Utility Network Offline Enhancements
- Nearest neighbor tracing
- Loop tracing
- Improved performance of offline tracing

Content - My Content | NapervilleElectric - Overview

https://rt-server111.esri.com/portal/home/item.html?id=54a4d3e2fc884dbdb6fdd6de86f68f6e#overview

ESRI | MS | Bing | Google | Database | UN | ParcelFabric | Research | ToDo | ToRead | Python | R | RUSD | Active | MAUI | Holistic | Testing | How to create a te... | SmartForms | Scrum | Other favorites

Home | Gallery | Map | Scene | Groups | Content | Organization

Utility Network Admin...
unadmin

NapervilleElectric

Overview | Settings

Edit thumbnail

Add to Favorites

NapervilleElectric

Edit

Web Map by unadmin

Item created: May 9, 2023 Item updated: May 12, 2023 View count: 23

Open in Map Viewer Classic

Open in ArcGIS Desktop

Open in Field Maps

Create Web App

Share

Description

Edit

Add an in-depth description of the item.

Layers

- Electric Device
  Feature Layer
- Electric Assembly
  Feature Layer
- Electric Junction
  Feature Layer
- Electric Line
  Feature Layer
- Electric Subnet Line
  Feature Layer
- Structure Junction
  Feature Layer
- Structure Line

Item Information

Learn more

Low High

Top Improvement: Add a longer summary

Details

Size: 195.465 KB

Share

Edit

Owner

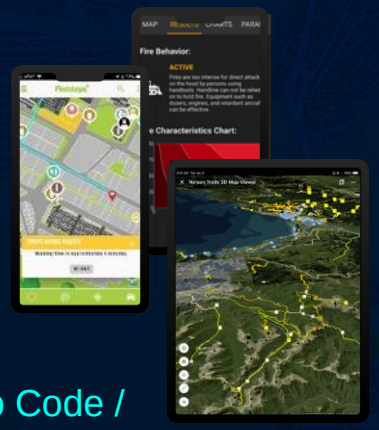
UN unadmin

Folder

Move

Low Code Builder for Native Apps

AppStudio



Build
Cross-Platform
Native Apps

No Code /
Low Code

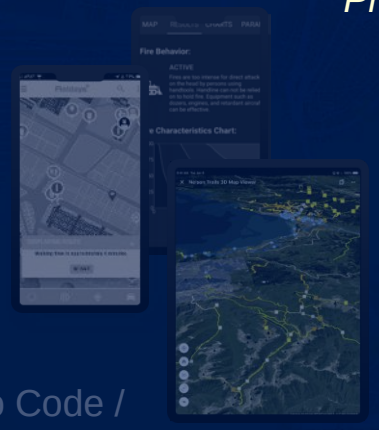
Common App Player

Low Code Builder for Native Apps

AppStudio

Product retirement:
February 2025

BLOG ARTICLE

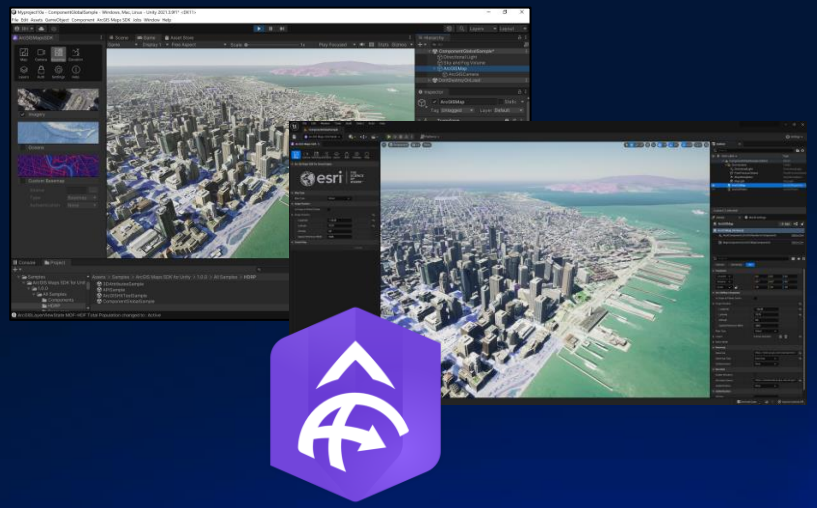


Build
Cross-Platform
Native Apps

No Code /
Low Code

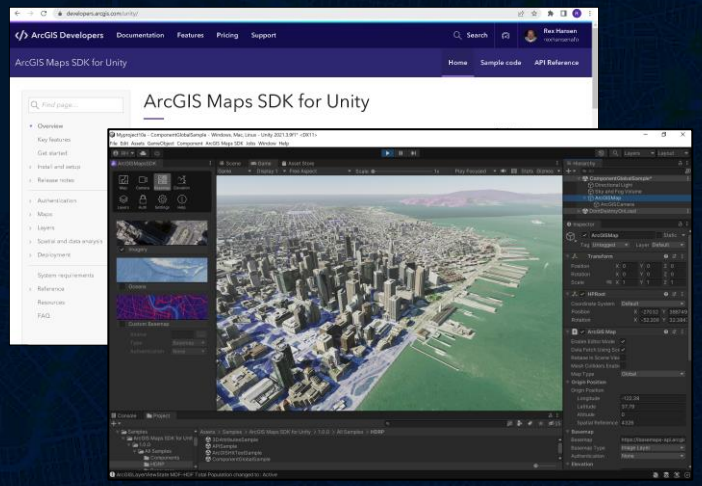
Common App Player

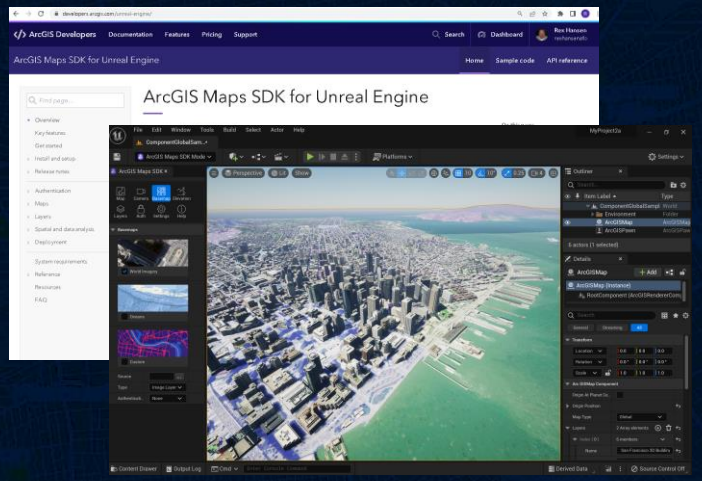
ArcGIS Maps SDKs for Game Engines



ArcGIS Maps SDKs for Game Engines

- Bring geospatial data to life in game engines
  - Unity
  - Unreal Engine
- Build immersive 3D geospatial experiences
- Free to download and develop
- Work with high precision in real-world coordinate space
- Integrate with the ArcGIS system





Immersive apps

- User feels fully immersed in the application experience
- Digital replica of the physical world
- High-fidelity photorealistic geospatial content
- Authoritative geo-specific content
- Lifelike behavior
- Real-time connectivity
- Next generation of 3D geospatial applications

XR – Extended Reality

Extended Reality XR

Physical Reality

The real world around us

Augmented Reality AR

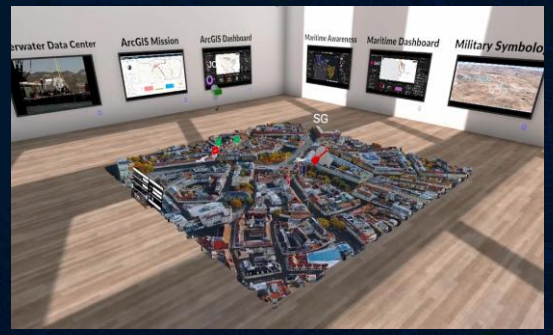
Overlay of information onto the real world

Mixed Reality MR

Merging of information and real world

Virtual Reality VR

Immersing in a digital world



Game Engine Maps SDKs

2022 DECEMBER APRIL AUGUST 2023

1.1

Game Engine Maps SDKs

Vector tile layers

Scene layer rendering

SDK improvements

1.2

Game Engine Maps SDKs

Building scene layers

Multiple elevation layers

1.3

Game Engine Maps SDKs

3D Scene Layer Spatial Filtering

Terrain and Integrated Mesh filtering

Tabletop Augmented Reality

ArcGIS REST API

Web

ArcGIS Maps SDK for JavaScript ›

Native

ArcGIS Maps SDK for .NET ›
ArcGIS Maps SDK for Kotlin ›
ArcGIS Maps SDK for Swift ›
ArcGIS Maps SDK for Java ›
ArcGIS Maps SDK for Qt ›

Game engines

ArcGIS Maps SDK for Unity ›
ArcGIS Maps SDK for Unreal Engine ›

Scripting and services

ArcGIS API for Python ›
ArcGIS REST JS ›
ArcGIS REST APIs ›

Open source

Esri Leaflet ›
MapLibre GL JS ›
OpenLayers ›

Calcite design system

Overview ›
Components ›
Colors ›
Icons ›

App builders and templates

ArcGIS AppStudio ›
ArcGIS Experience Builder ›
ArcGIS Survey123 ›
ArcGIS Web AppBuilder ›

ArcGIS Pro

ArcGIS Pro SDK for Microsoft .NET
ArcPy

ArcGIS Enterprise

ArcGIS Enterprise SDK ›
ArcGIS Workflow Manager ›
Chef for ArcGIS Enterprise
GeoEvent Server SDK

Reference topics

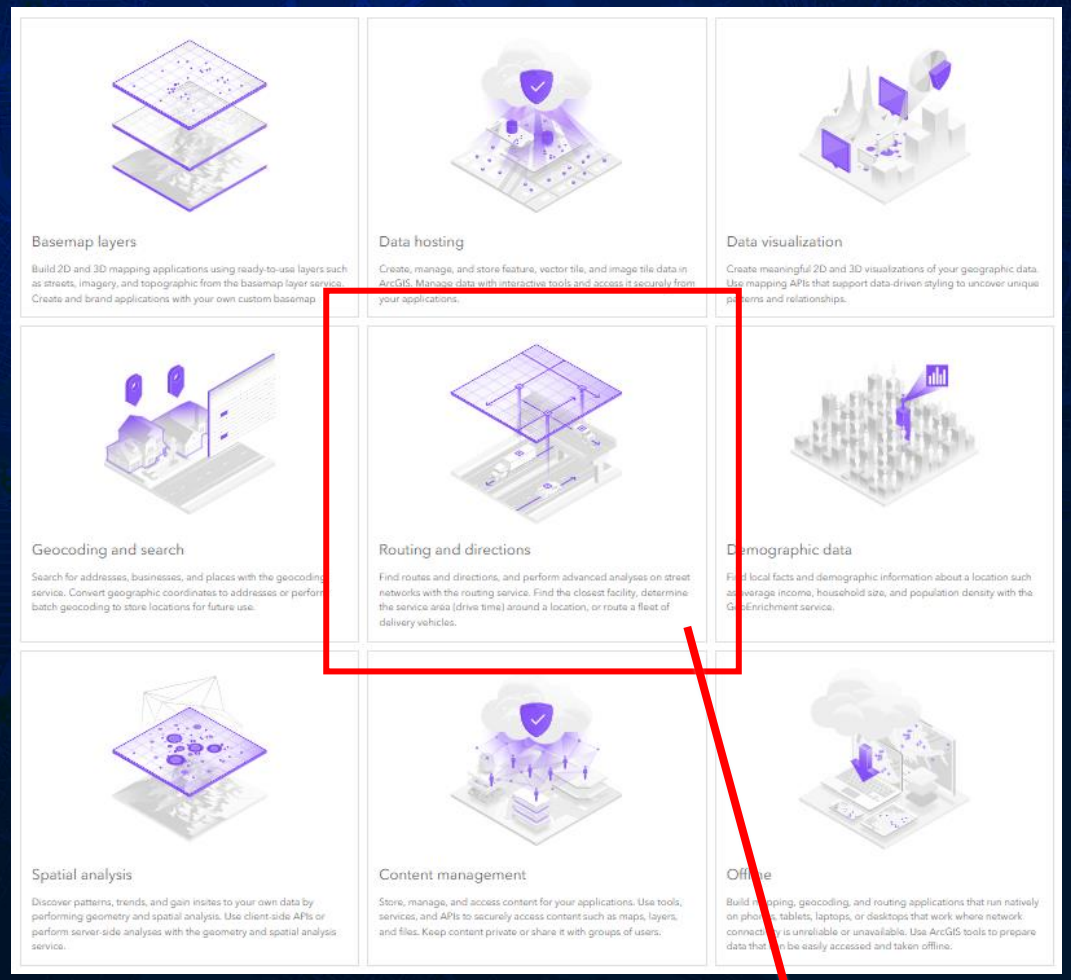
Arcade ›
Cartographic Information Model Specification
Common data types ›
Developer glossary ›
Indexed 3D Scene Layers
Spatial references ›
Tile package specification
Web Map Specification ›
Web Scene Specification ›

ArcObjects

ArcObjects SDK for C++
ArcObjects SDK for Java
ArcObjects SDK for .NET

Other documentation

ArcGIS API for JavaScript (legacy 3.x) ›
ArcGIS Developer release notes ›
ArcGIS Earth Automation API ›
ArcGIS GeoAnalytics Engine ›
ArcGIS Urban API ›
ArcGIS CityEngine SDK ›
ArcGIS Velocity gRPC Feeds (Beta) ›
Frequently asked questions (FAQ) ›
Vector Tile Style Editor



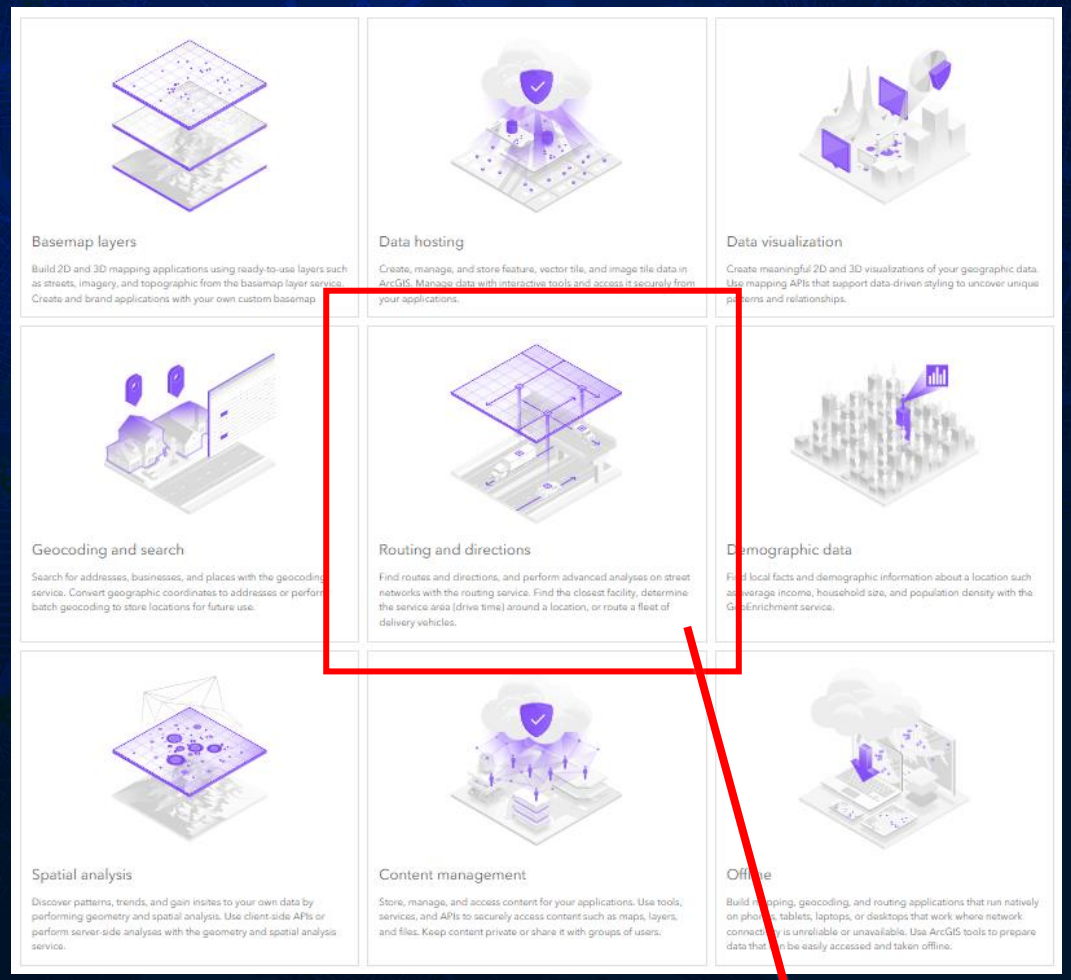
What is the REST API?

Collection of methods, accessible as HTTPS requests, that return results.

Supports GET and POST

Return data is often JSON, but could also be images or other kinds of data.

https://route.arcgis.com/arcgis/rest/services/World/Route/NAServer/Route_World/solve
?stops=-74.068398,40.418693;-74.067576,40.417070&token=*[your_token]***&f=pjson**



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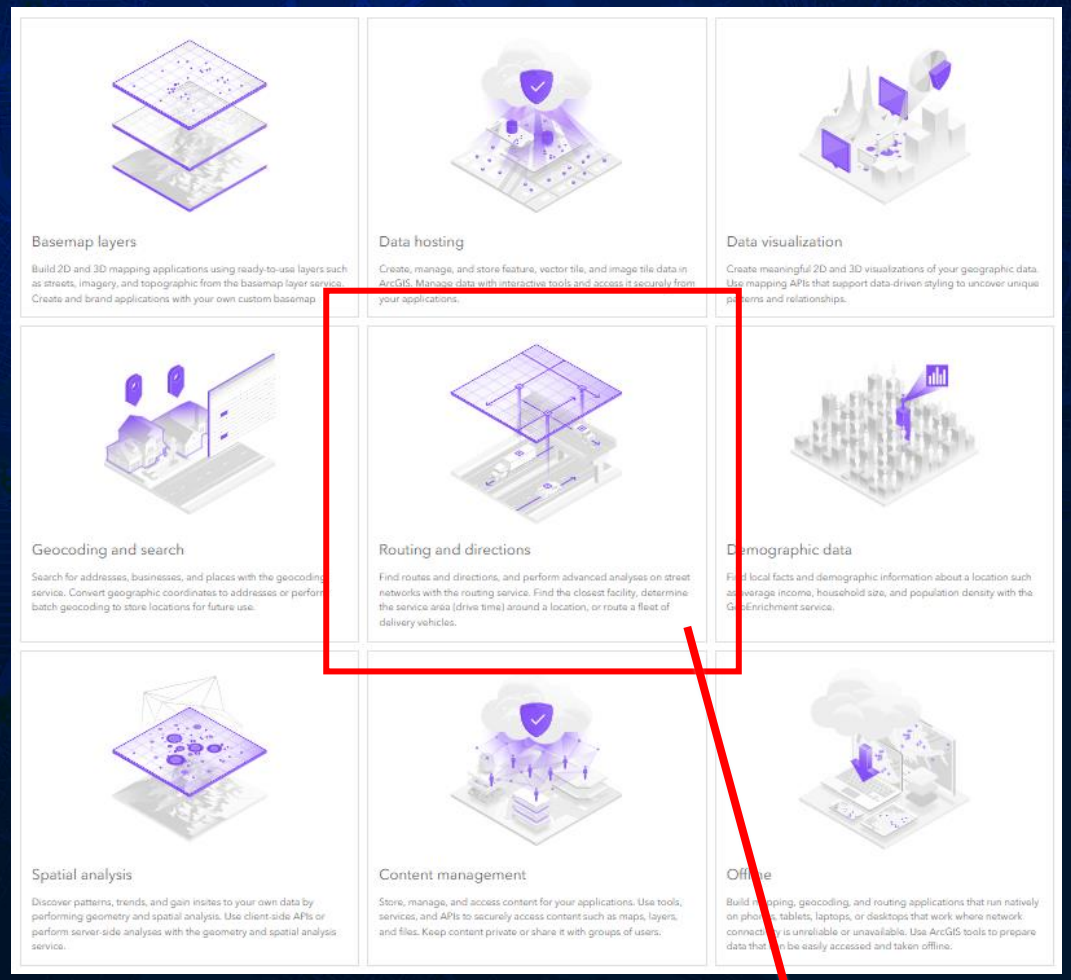
?stops=-74.068398,40.418693;-74.067576,40.417070&token=[your_token]&f=pjson
```



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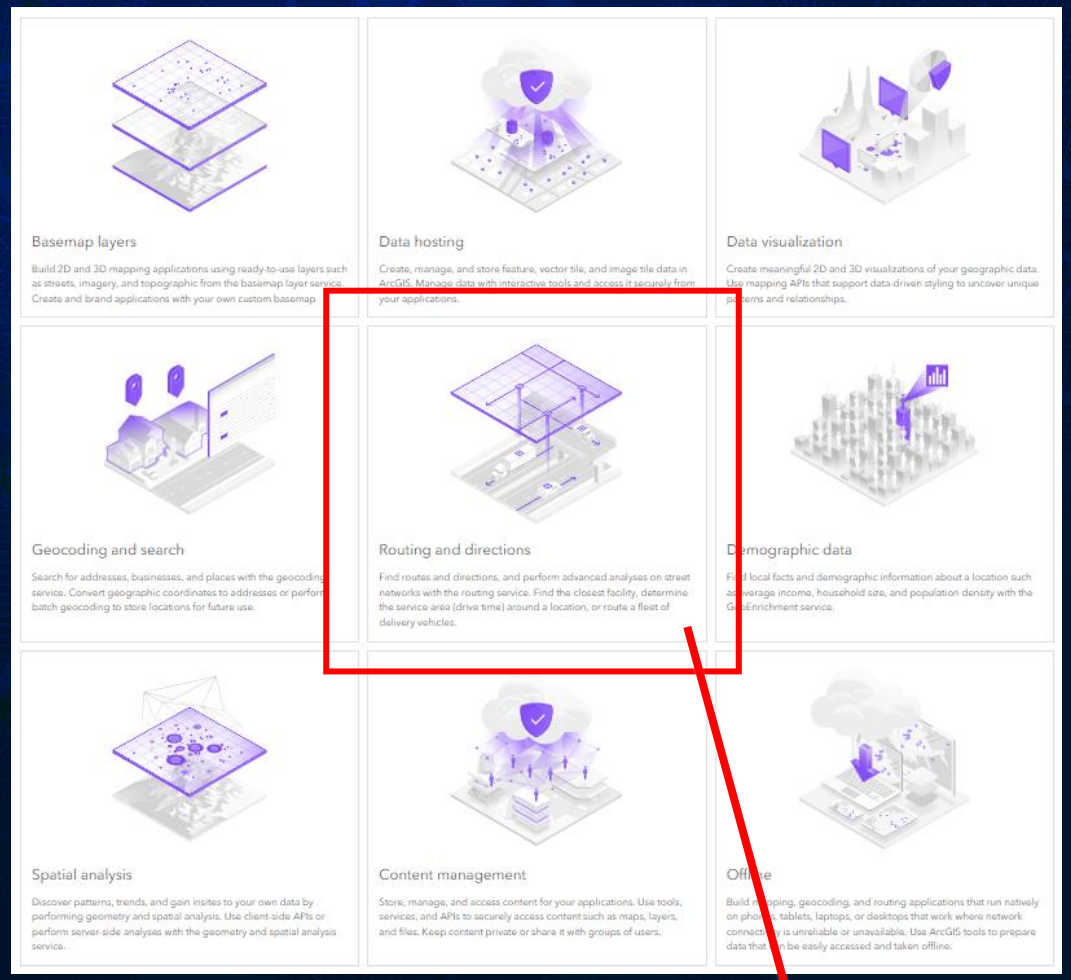

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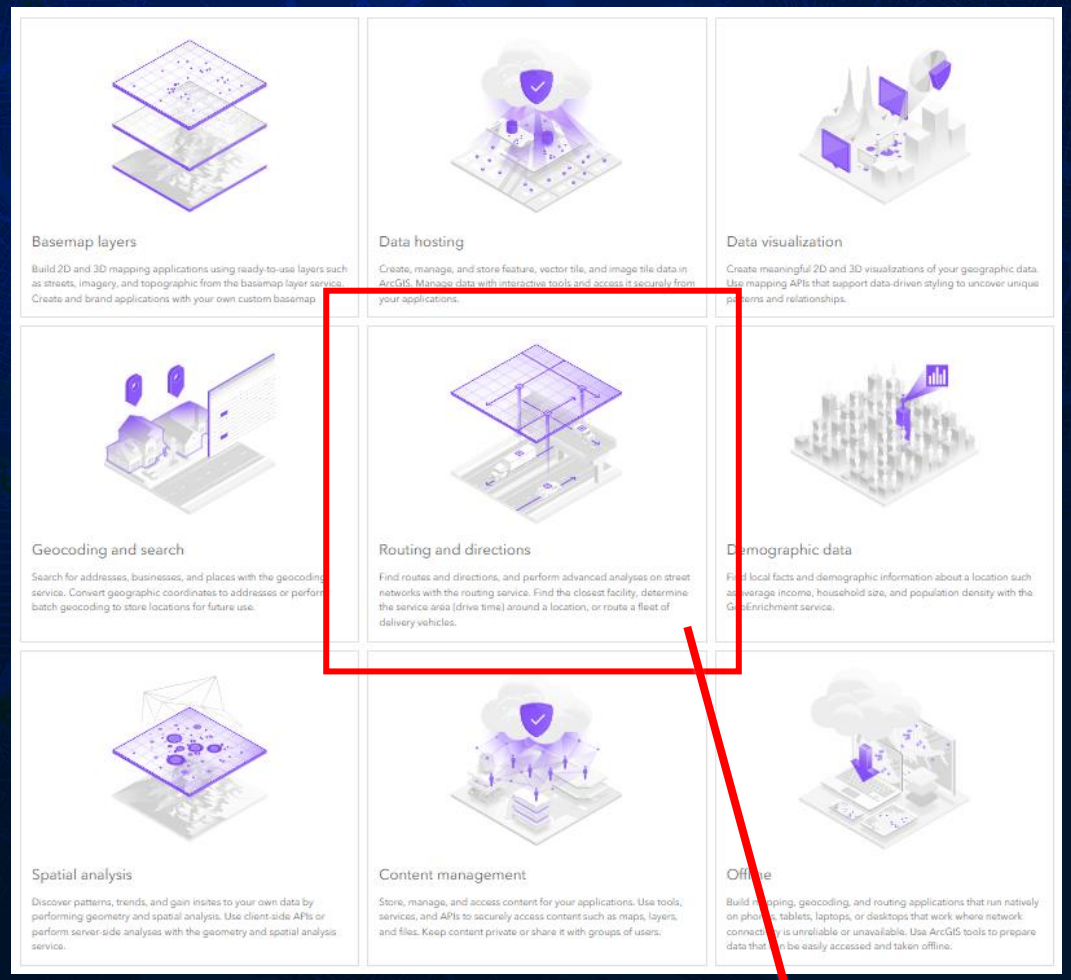

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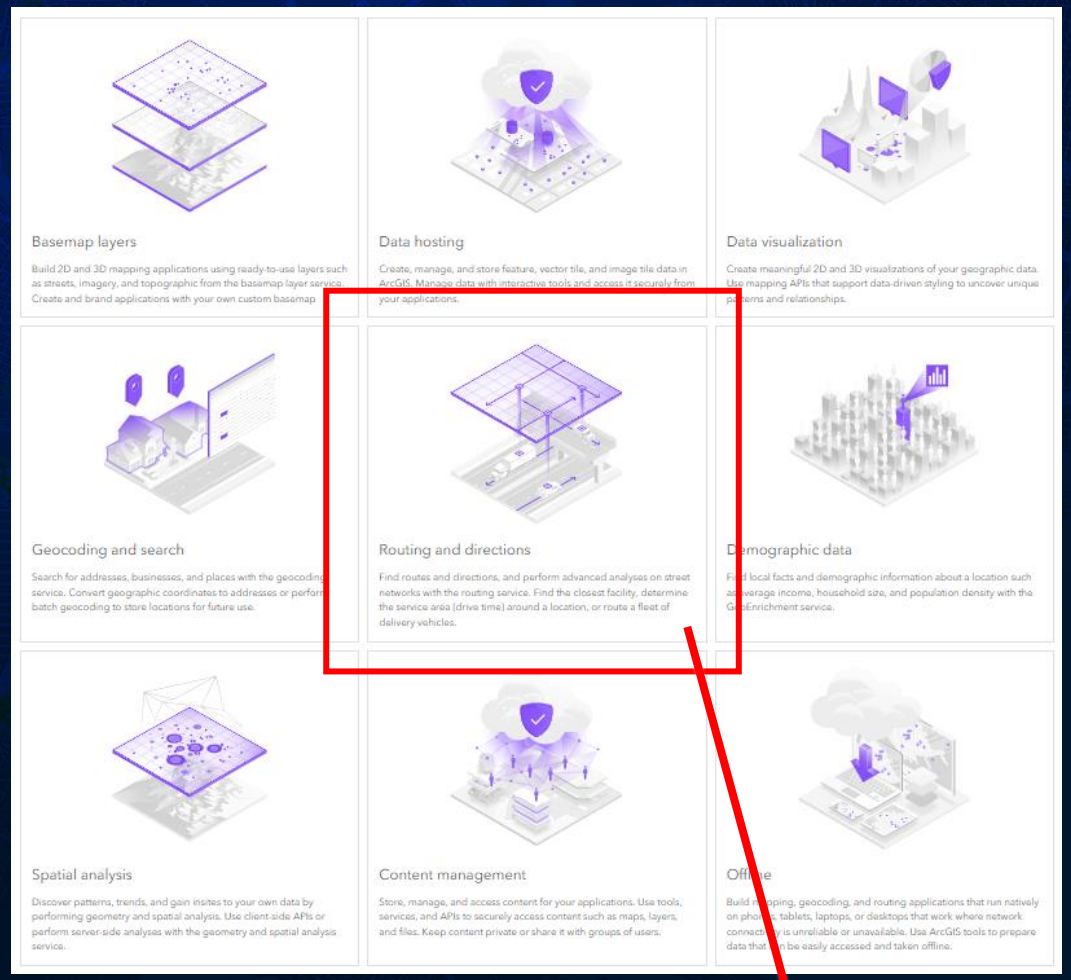

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?stops=-74.068398,40.418693;-74.067576,40.417070&token=*[your_token]***&f=pjson**

Home Workspaces API Network Explore Search Postman Upgrade

[CONFLICT] GET route_with POST createRe GET https://s POST genera GET NS_route_ GET FindAdc GET SolveRo login_stuff

Routing / **SolveRoute_wToken** Save

GET https://route.arcgis.com/arcgis/rest/services/World/Route/NAServer/Route_World/solve?stops=-74.068398, 40.418693;-74.067576, 40.417... Send

Params

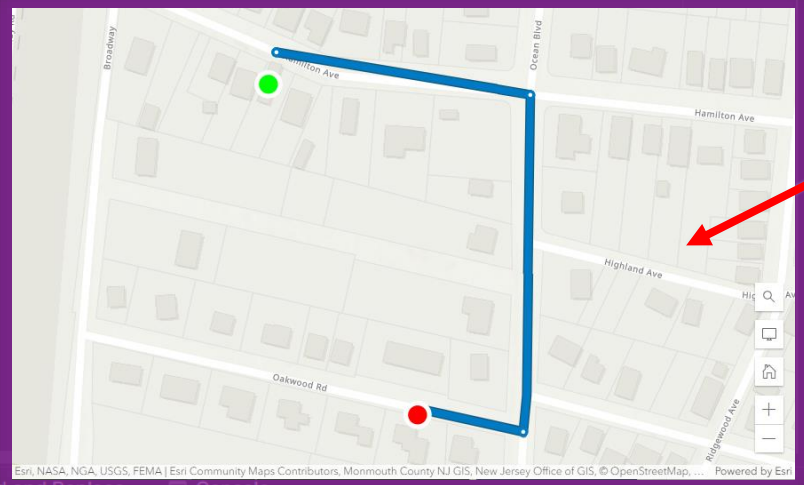
Query Params

KEY	VALUE	DESCRIPTION
stops	-74.068398, 40.418693;-74....	
token	AAPKbd4e54318a1a4070be...	
f	json	
Key	Value	Description

Body 200 OK 748 ms 1.64 KB Save Response

Pretty Raw Preview Visualize JSON


```
126            {
127                "attributes": {
128                    "length": 0.1067529323196411,
129                    "time": 0.4986114501953125,
130                    "text": "Turn right on Ocean Blvd",
131                    "ETA": -2209161600000,
132                    "arriveTimeUTC": -2209161600000,
133                    "maneuverType": "esriDMTTurnRight"
134                },
135                "compressedGeometry": "+rkq95-1vvvuqk
                       +12tj4v5-92-j83-92-jq8-i4-4q1",
136                "strings": [
                       {
                           "string": "Ocean Blvd",
                           "stringType": "esriDSTStreetName"
                       }
                   ]
               },
               {
                   "attributes": {
                       "length": 0.0355059163350444,
                       "time": 0.29912211675002376,
                       "text": "Turn right on Oakwood Rd",
                       "ETA": -2209161600000,
                       "arriveTimeUTC": -2209161600000,
                       "maneuverType": "esriDMTTurnRight"
```

Online Find and Replace Console Cookies Capture requests Runner Trash

ArcGIS | A Collection of Location Services

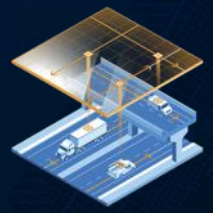
Extensive Content and Powerful Capabilities Available On-Demand

Basemaps

Data Hosting

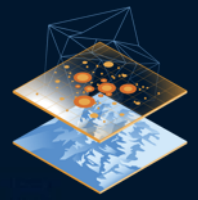
Data Visualization

Geocoding & Search

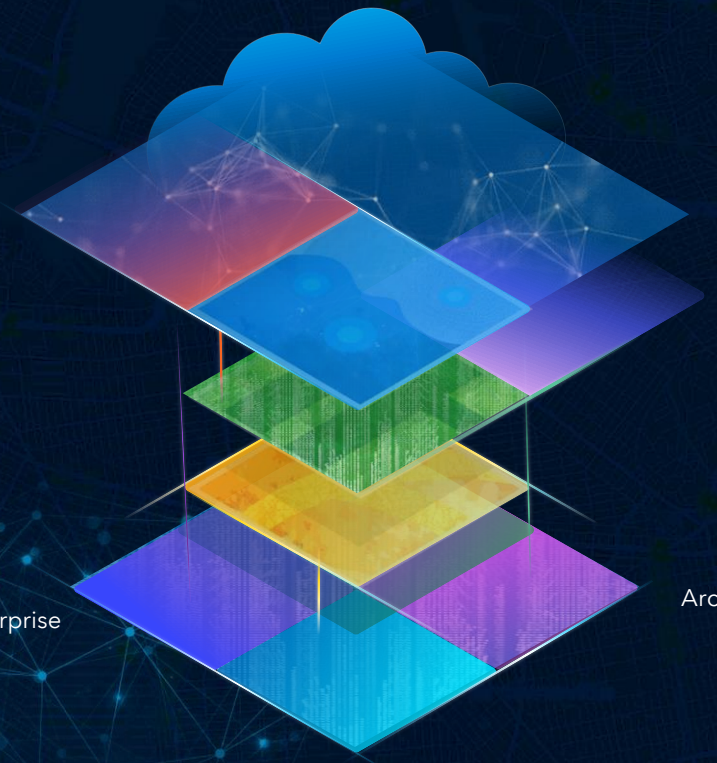


Routing & Directions

Maps & Data



Spatial Analytics



Software
ArcGIS Pro
ArcGIS Enterprise

SaaS
ArcGIS Online

PaaS
ArcGIS Platform

REST API isn’t just for Location Services

- Big Data Catalog Service
- Data Reviewer Server
- Feature Service
- Feature Service (Sync)
- Feature Service (Admin)
- GeoAnalytics (Get Started)
- GeoAnalytics (Tasks)
- GeoAnalytics (Task Concepts)
- GeoAnalytics (Context)
- Geocode Service
- Geocoding Tools
- Geodata Service

- Geometry Service
- Geoprocessing Service (General)
- Geoprocessing Service (Async)
- Geoprocessing Service (Sync)
- Globe Service
- Image Service
- Info
- Knowledge Graph Service
- Knowledge Graph Service (Admin)
- Linear Referencing Service
- Map Service
- Mobile Service

- Network Diagram Service
- Ortho Mapping Service
- Parcel Fabric Services
- Raster Analytics (Get Started)
- Raster Analytics (Tasks)
- Raster Analytics (Context)
- Raster Utilities
- Relational Catalog Service
- Routing Services
- Scene Service
- Schematic Service
- Spatial Analysis (Overview)

- Spatial Analysis (Tasks)
- Spatial Analysis (Reference)
- Stream Service
- Symbol Service
- System
- Topographic Production Service
- Trace Network Service
- Uploads
- Utilities
- Utility Network Service
- Validation Service
- Vector Tile Service
- Version Management Service

REST API covers all web-accessible ArcGIS Services

When to use…

- Use the ArcGIS Maps SDKs
  - You're building an app that needs to be robust and capable
    - The API covers most of Web GIS
    - Coarse-grained widgets
    - Fine-grained functionality
    - Familiar tooling for your platform of choice

- Maybe consider using the ArcGIS REST API
  - Your app just needs a simple function or two
  - You don't mind doing yourself…
    - Constructing the REST URL and parameters
    - Authentication
    - Parsing and processing the results
    - Error handling

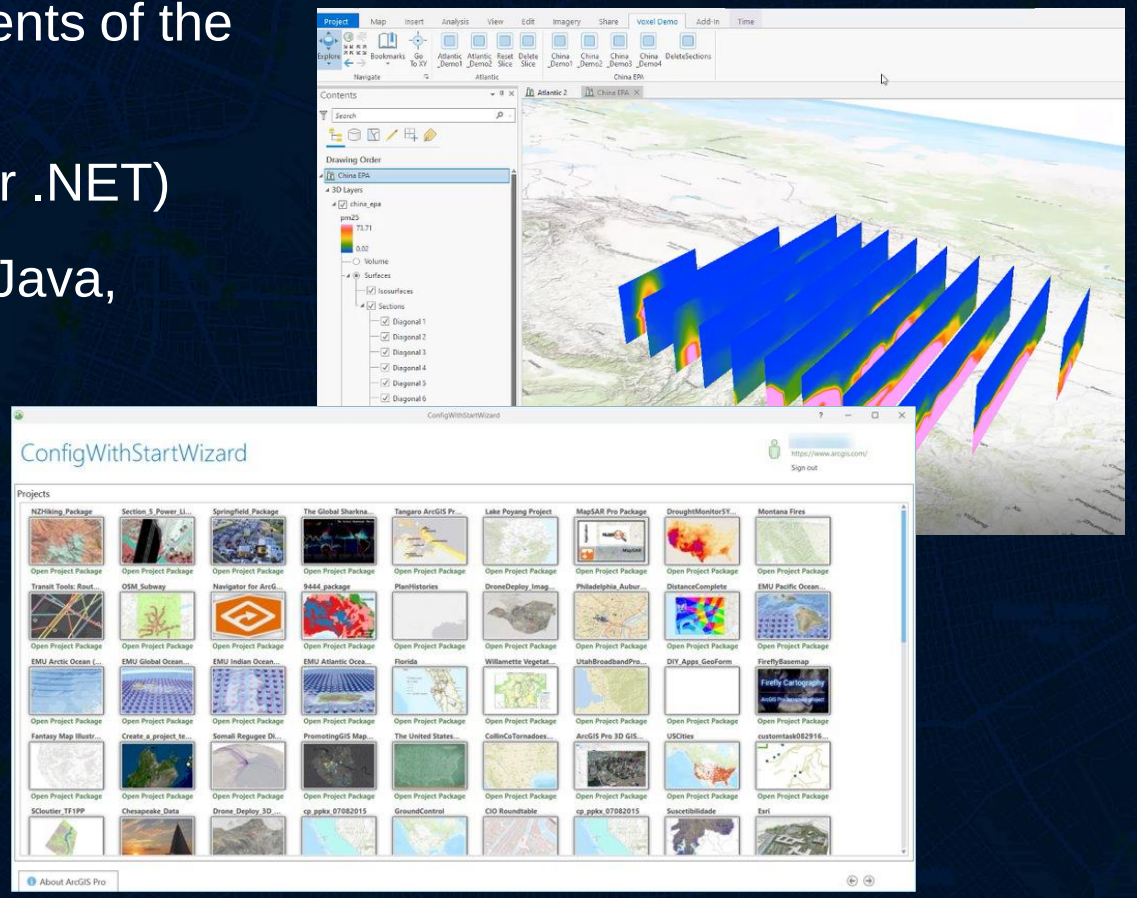
VS.

App Deployment and Licensing

- ArcGIS Identity
  - Users have all capabilities *in your app* that they have across the rest of the ArcGIS system
- Anonymous access
  - Native: deployment packs per instance, flexible cost based on capability levels
- Dev subscription “Builder” level and above
  - Unlimited commercial distribution of “Lite” level apps
- Pay-as-you-go pricing for Esri Location Services

Extend the ArcGIS System

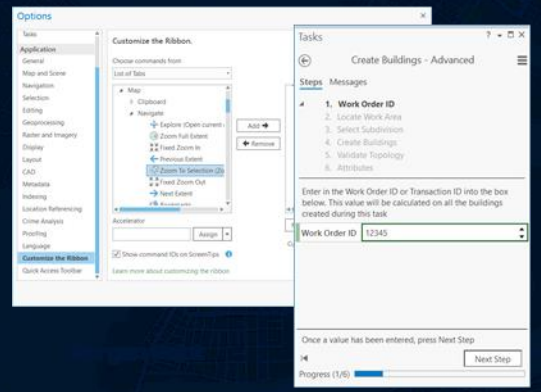
- Customize components of the ArcGIS System
- ArcGIS Pro (SDK for .NET)
- ArcGIS Enterprise (Java, .NET)

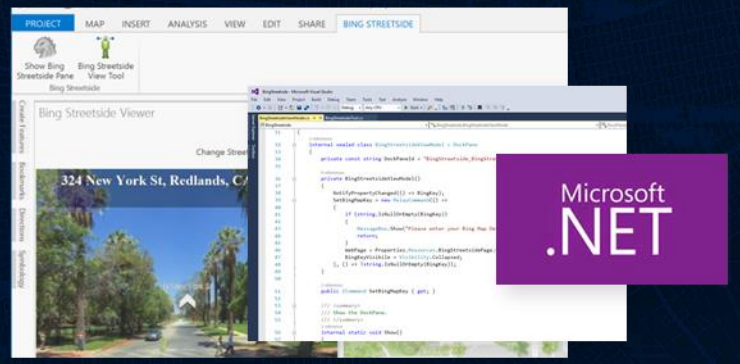


Extending ArcGIS Pro

Options:

- Configure UI through settings, and workflows through Tasks
- Automate using geoprocessing and Python
- Extend with your own custom tools and solutions using the ArcGIS Pro SDK for .NET

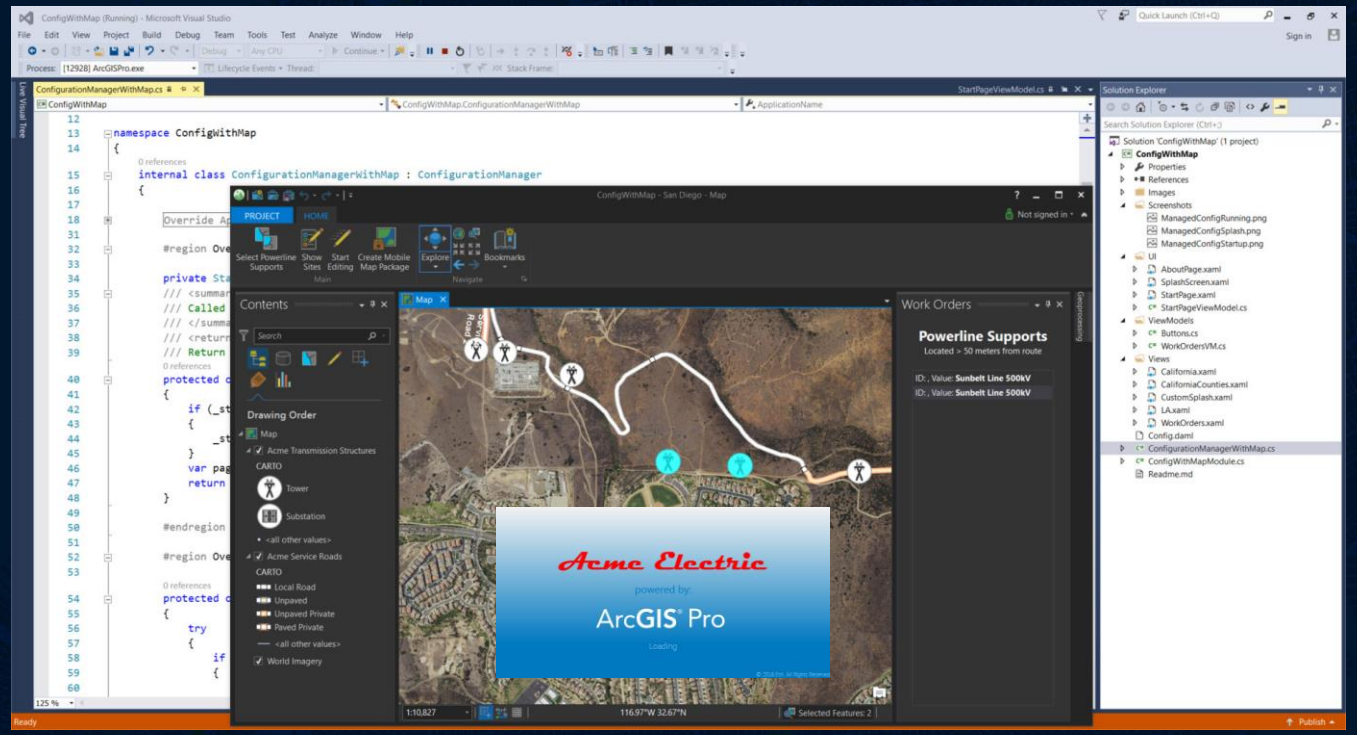




Configurations

- Custom start-up UX – splash screen, start page
- Vary UI / UX based on user role

- Documentation
  - ProConcepts – Configurations concepts
  - ProGuide – Configurations walk-through
  - Samples –
    - ConfigWithMap
    - ConfigWithStartWizard



ArcGIS Pro SDK for Microsoft .NET

- Extensibility API for customizing and extending the ArcGIS Pro application
  - SDK is designed and built specifically for this purpose

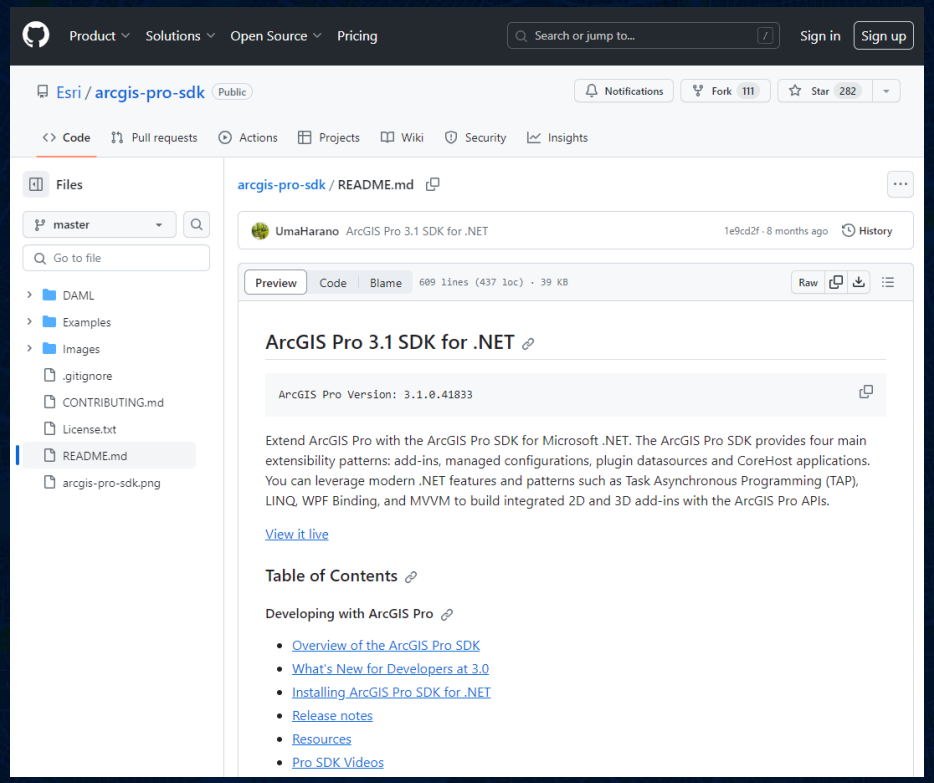
- Microsoft Visual Studio
  - C# and VB
  - 4 different extensibility patterns to choose from
    - Add-ins, Configurations, Plug-in Datasources, Corehost

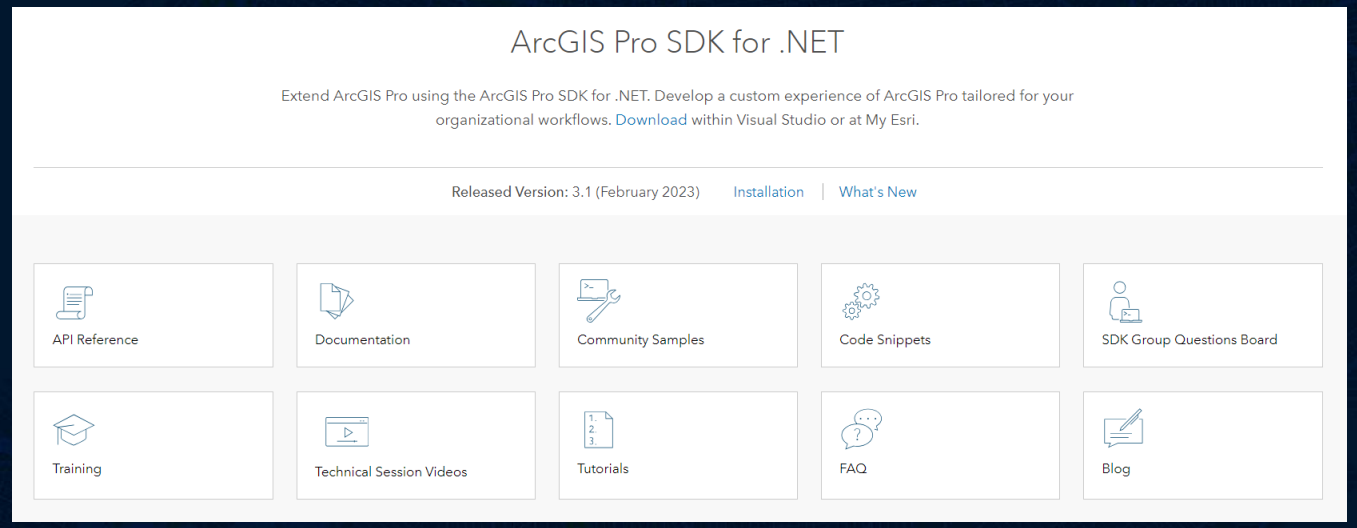
- Currently at release v3.1
  - Almost 30,000 classes and methods available in the public API

ArcGIS Pro SDK Resources for You

- Complete API Reference
  - each assembly, class and method
- Over 200 Community samples
- 1000's of code snippets
  - copy/paste ready
- Concept Documents
- Step by Step Tutorials and Guides
- Videos

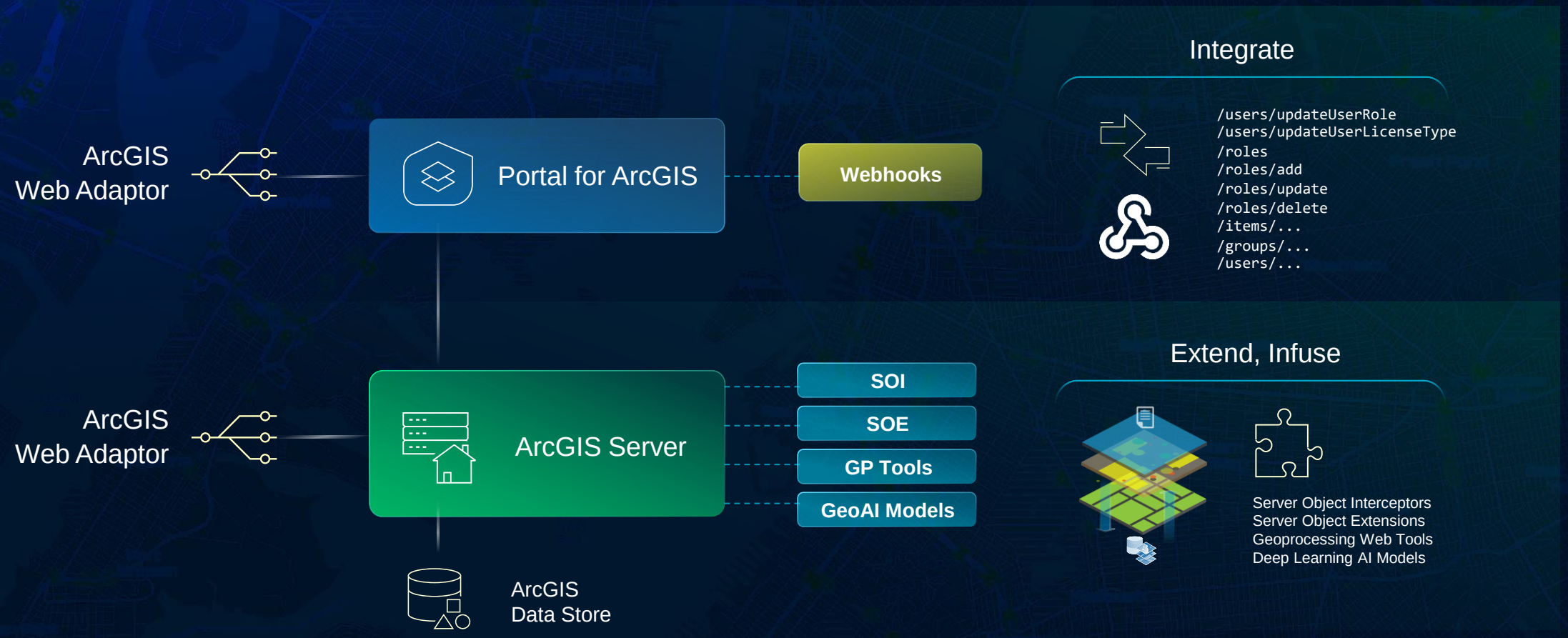
https://pro.arcgis.com/en/pro-app/latest/sdk/



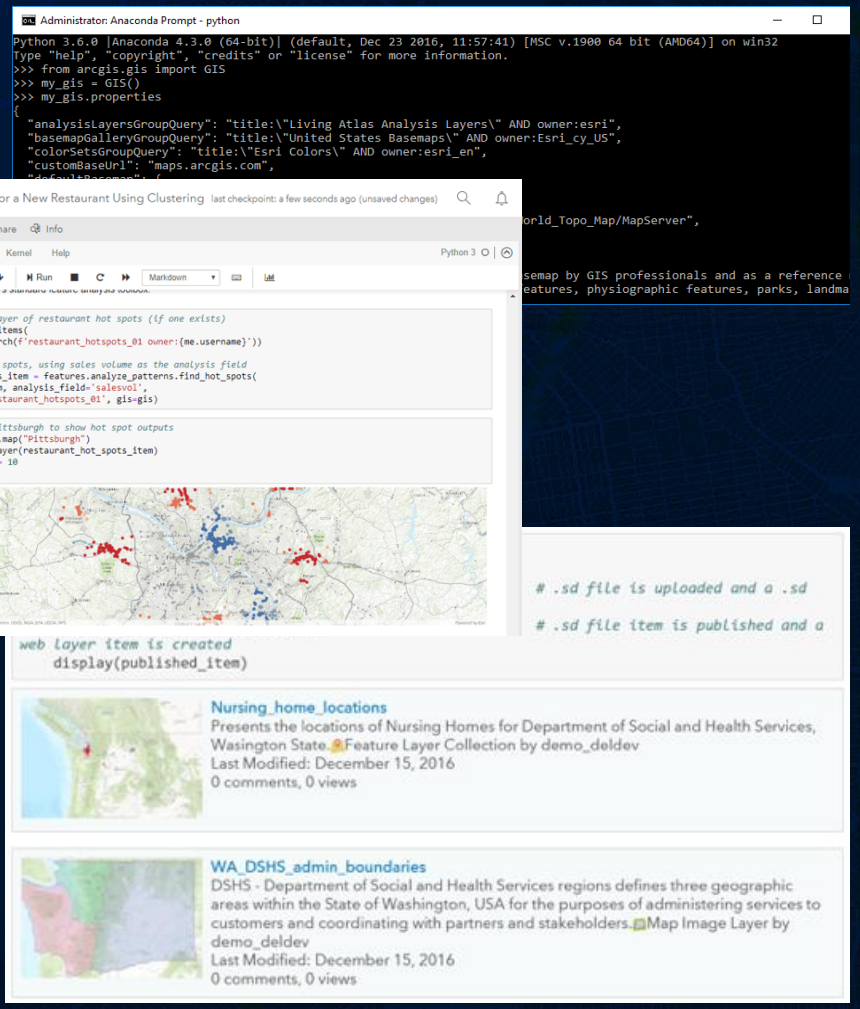


Integrate, Extend, Infuse

ArcGIS Enterprise



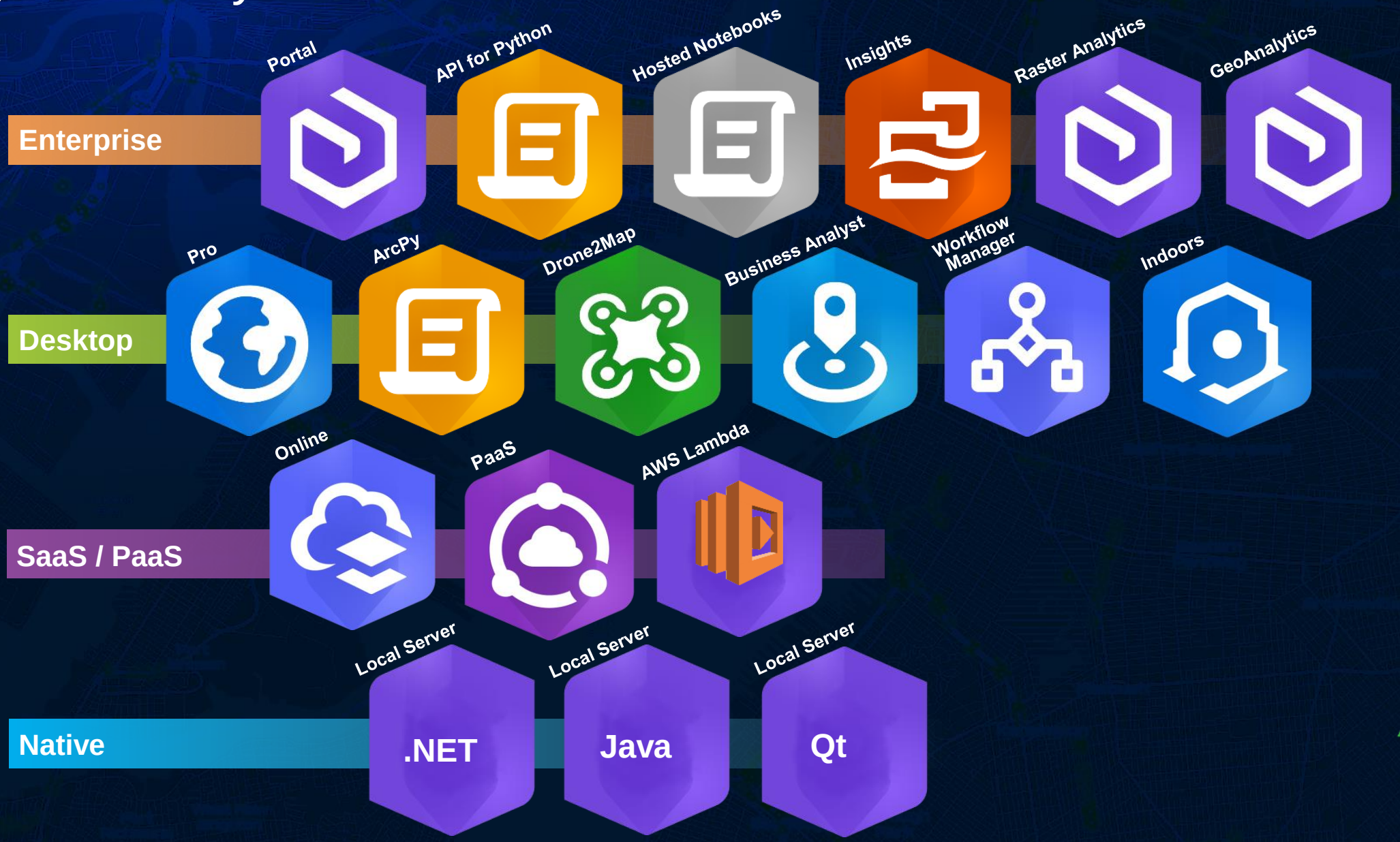
Automate & Integrate GIS Workflows



ArcGIS Pro and Python

- Geoprocessing tools (2000+) of them
  - Modelbuilder visual programming interface
- ArcGIS Python Libraries in Pro
  - ArcPy – "**`arcpy`**" package
    - access to geoprocessing tools and functions for automation
  - ArcGIS API For Python – "**`arcgis`**" package
    - analyzing spatial data, managing your Web GIS, and performing spatial data science
- Python command line
  - exploratory coding and running short snippets
- Script tools
  - Python and R scripts you have written as the source for your own geoprocessing tools
- Notebooks
  - Powerful tool for spatial data science, visualization and sharing

Python Everywhere



ANACONDA

Workflow

Automation

Tools, APIs and capabilities . . .
to support scripting
and automating your tasks

ArcGIS API for Python

AI model training / retraining, QA and deployment

AI / ML Engineer

Data science, content management, administration and user tasks

Decision Maker

Analyst

Author and update Dashboard apps, StoryMaps and more

Data Scientist

Bulk publishing and data management tasks

Content Manager

Schedule, callback and execute notebooks as scripted tasks

Organization Administrator

System Administrator

. . . and a lot more

example
example2

Sample Notebooks

100+

- Valuable to run as-is, or modify to fit

Information extraction from Madison city crime reports using Deep Learning

Temperature forecast using time series data

Vehicle detection and tracking

Shipwrecks detection using bathymetric data

Increase Image Resolution using SuperResolution

SAR to RGB image translation using CycleGAN

Identifying country names from incomplete house addresses using Deep Learning

Classification of Raw Point Clouds using Deep Learning & generating 3D Building Models

Automatic road extraction using deep learning

Prediction of energy generation from Solar Photovoltaic Power Plants using weather variables

Detection of electric utility features and vegetation encroachments from satellite images using deep learning

Forecast monthly rainfall using TimeSeriesModel

Land cover classification using hyperspectral imagery and deep learning

Streams Extraction using Multi TaskRoadExtractor

Change Detection of Buildings from Satellite Imagery

Land Parcel Extraction using Edge Detection model

Generating RGB Imagery using Pix2Pix

Address Standardization and Correction with SequenceTo Sequence

Model explainability for ML Models

Detecting Mussel Farms using Deep Learning

Forecasting Air Temperature in California using ResCNN model

Count cars in aerial imagery using deep learning

Classify land cover to measure shrinking lakes

Lunar Craters Detection using Deep Learning

Training a wind turbine detection model using large volumes of training data

Landsat 8 to Sentinel-2 using Pix2Pix

Image scene classification using FeatureClassifier

Image Captioning Using Deep Learning

Covid case forecasting Using TimeSeriesModel from arcgis.learn

Chennai Floods 2015 - A Geographic Analysis

Analyzing violent crime

Finding hospitals closest to an incident

Which college district has the fewest low-income families?

Designate Bike Routes for Commuting Professionals

Locating a new retirement community

Finding grazing allotments

Analyzing growth factors of rental properties in New York City

How green is New Delhi?

Safe Streets to Schools

Which areas are good cougar habitats?

Data Visualization - Construction permits near Washington DC, part 1/2

Data Summarization - Construction permits near Washington DC, part 2/2

Analyzing United States tornadoes

Finding a New Home

Mapping the 2019 Novel Coronavirus Pandemic

Time Series Analysis of the 2019 Novel Coronavirus Pandemic

Predictive Analysis of the 2019 Novel Coronavirus Pandemic

Identifying facilities at risk of forest fires using spatial overlay analysis

Predict Floods with Unit Hydrographs

River Turbidity Estimation using Sentinel-2 data

Finding suitable spots for AED devices using Raster Analytics

California wildfires 2017 - Thomas Fire analysis

Counting features in satellite images using scikit-image

Creating raster information product using Raster Analytics

Historical wildfire analysis

Predicting El Niño Oscillations

Snow avalanche hazard mapping

Raster Analytics - Calculate wildfire landslide risk

Creating hurricane tracks using GeoAnalytics

Analyze New York city taxi data

Forecasting PM 2.5 concentration using big data analysis techniques

Crime analysis and clustering using geoanalytics and pyspark.ml

Spatial and temporal distribution of service calls using big data tools

Data Preparation - Global hurricane analysis, part 1/3

Exploratory Statistics - Global hurricane analysis, part 2/3

Correlation - Global hurricane analysis, part 3/3

Calculating cost surfaces using weighted overlay analysis

Identifying suitable sites for new ALS clinics using location allocation analysis

Analyzing and predicting Service Request types in DC

Constructing drive time based service areas

Drive time analysis for opioid epidemic

Finding routes for appliance delivery

Calculating origin destinations matrix

Pawnee Fire analysis

Calculate Impervious Surfaces from Spectral Imagery

Visualize monthly changes in Hirakund reservoir using video

Mapping infrastructural damage due to Beirut blast

Coastline extraction using Landsat-8 multispectral imagery and band ratio technique

Coastline classification using Feature Classifier

Determining site suitability for oil palm plantation

Detecting swimming pools using deep learning

Plant species identification using a TensorFlow Lite model within mobile devices

Land Cover Classification using Satellite Imagery and Deep Learning

Land cover classification using sparse training data

Extracting building footprints from drone data

Detecting super blooms using image classification

Feature Categorization using Satellite Imagery and Deep Learning

Automate Road Surface Investigation Using Deep Learning

Detecting and Categorizing Brick Kilns from Satellite Imagery

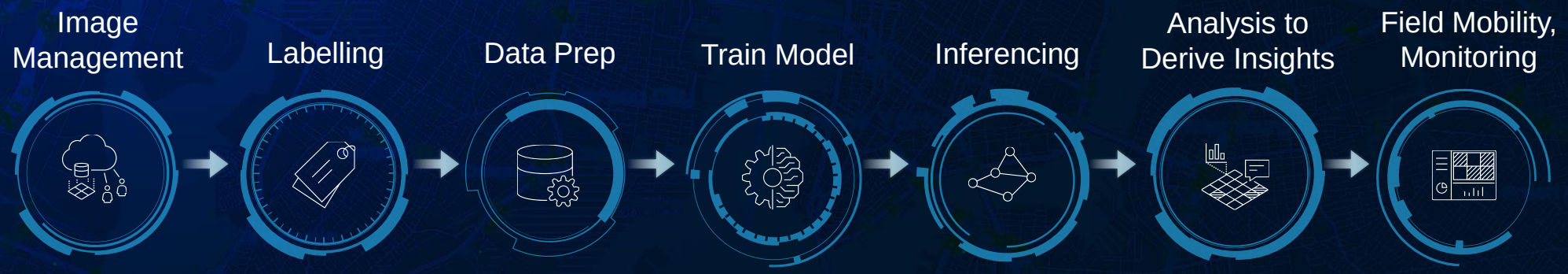
Extracting Slums from Satellite Imagery

Automate building footprints extraction using instance segmentation

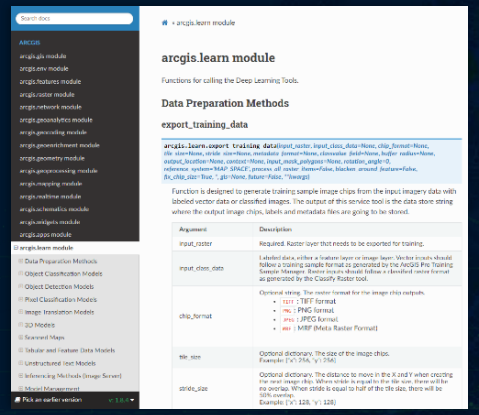
Reconstructing 3D buildings

Detecting settlements using supervised classification

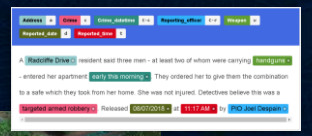
Deep Learning in ArcGIS



- Dozens of models for various geospatial workflows
- Models for imagery, video, 3D, tabular, timeseries and text (NLP)
- Integration with popular deep learning libraries



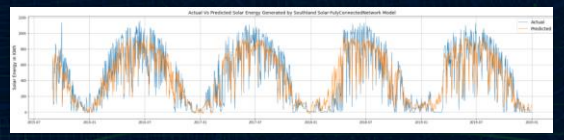
Text



Optical imagery

Point cloud

Motion imagery



Tabular & Time Series

Grade Crossing

also: "crossing at grade", "level crossing"

Fouled

Not-Fouled

Fouled *or* Not-Fouled

Your Choice

bc18-134.jpg

bc18-135.jpg

bc18-136.jpg

bc18-137.jpg

bc18-138.jpg

bc18-139.jpg

bc18-140.jpg

bc18-1.jpg

bc18-2.jpg

bc18-3.jpg

bc18-4.jpg

bc18-5.jpg

bc18-6.jpg

bc18-7.jpg

bc18-8.jpg

bc17-1.jpeg

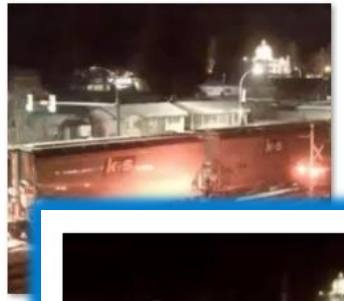
bc17-2.jpeg

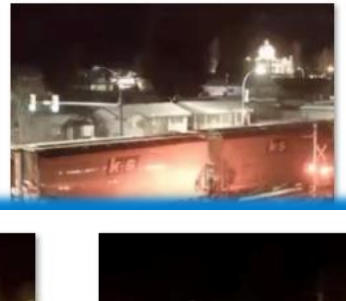
bc17-3.jpeg

bc17-4.jpeg

bc17-5.jpeg

bc17-6.jpeg





bc17-81.jpeg

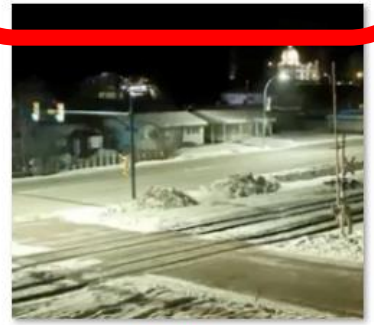
bc17-82.jpeg

bc17-83.jpeg

bc17-84.jpeg

bc17-85.jpeg

bc17-86.jpeg


bc17-87.jpeg

bc17-88.jpeg

jupyter Train_the_Deep_Learning_Model Last Checkpoint: 02/21/2021 (autosaved)

File Edit View Insert Cell Kernel Widgets Help

Trusted | Python 3

In [1]:
```
from arcgis.learn import FeatureClassifier, prepare_data
```

```
C:\Users\jimba\Anaconda3\envs\polb37\lib\site-packages\arcgis\features\_data\geodataset\utils.py:15: FutureWarning: The pandas.
datetime class is deprecated and will be removed from pandas in a future version. Import from datetime module instead.
  pd.datetime,
```

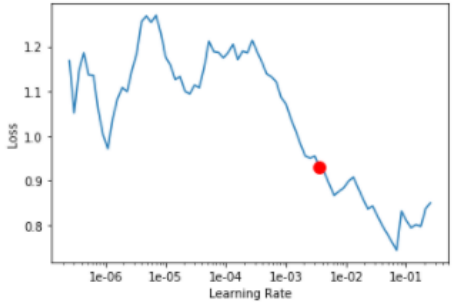
In [2]:
```
# contains two subfolders: images and labels
#data_path = r'C:\Users\jimba\Desktop\grade-crossing\bc-day\data'
data_path = r'C:\Users\jimba\Desktop\grade-crossing\bc-nite\data'
```

In [3]:
```
data = prepare_data(data_path, dataset_type='Imagenet', transforms=False, chip_size=300, batch_size=2)
```

In [4]:
```
data.show_batch()
```

In [5]:
```
model = FeatureClassifier(data)
```

In [6]:
```
model.lr_find()
```



In [7]:
```
model.fit(epochs=5)
```

epoch	train_loss	valid_loss	accuracy	time
0	0.461639	0.091461	0.996599	02:06
1	0.565809	0.103746	0.993197	02:09
2	0.405168	0.109784	0.996599	02:07
3	0.391308	0.106105	0.989796	02:06
4	0.462020	0.072809	0.993197	02:07

In [8]:
```
model.show_results(rows=4)
```

In [9]:
```
# model.save("C:\\Users\\jimba\\Desktop\\grade-crossing\\test\\models\\bc-day-model")
model.save(r'C:\Users\jimba\Desktop\grade-crossing\test\models\bc-nite-model99')
```

Out[9]:
```
WindowsPath('C:/Users/jimba/Desktop/grade-crossing/test/models/bc-nite-model99')
```

jupyter predict-grade-crossing-blockages-3 Last Checkpoint: 02/23/2021 (autosaved)

Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

In [1]:
```
from arcgis.learn import FeatureClassifier
import pathlib
import datetime
from arcgis.gis import GIS
from IPython.display import display
from getpass import getpass
```

```
C:\Users\jimba\Anaconda3\envs\polb37\lib\site-packages\arcgis\features\_data\geodataset\utils.py:15
datetime class is deprecated and will be removed from pandas in a future version. Import from datet
  pd.datetime,
```

In [2]:
```
### get inputs from user
# ptl = input('enter arcgis online org name: ')
# unm = input('enter username: ')
pwd = getpass('enter password: ')
# srt = input('enter feature layer search term: ')
```

```
enter password: ·····
```

In [3]:
```
# connect to org
#gis = GIS("https://" + ptl + ".maps.arcgis.com", username=unm, password=pwd)
gis = GIS("https://esrirail.maps.arcgis.com", "jbarry_rail", pwd)
```

In [4]:
```
# search items by keyword, show basic results
my_content = gis.content.search("revelstoke", item_type="Feature Layer")
my_content
```

Out[4]:
```
[<Item title:"revelstoke_cams_gdb" type:Feature Layer Collection owner:jbarry_rail>]
```

In [5]:
```
# show full results
for item in my_content:
    display(item)
```

revelstoke_cams_gdb

Feature Layer Collection by jbarry_rail
Last Modified: February 24, 2021
0 comments, 12 views

In [6]:
```
model = FeatureClassifier.from_model(r'C:\Users\jimba\Desktop\grade-crossing\test\models\bc-nite-mo
```

In [7]:
```
for i in range(1, 101):

    fname = pathlib.Path("C:\\Users\\jimba\\Desktop\\grade-crossing\\test\\images\\test-bc-nite-2\\" + str(i) + ".jpeg")

    if fname.exists():
        a = model.predict(fname)
        print('Image ' + str(i) + ": " + a[0].obj)
    else:
        print('DONE')
        break
```

```
Image 1: not-fouled
Image 2: not-fouled
Image 3: not-fouled
Image 4: not-fouled
Image 5: not-fouled
Image 6: not-fouled
Image 7: not-fouled
Image 8: not-fouled
Image 9: not-fouled
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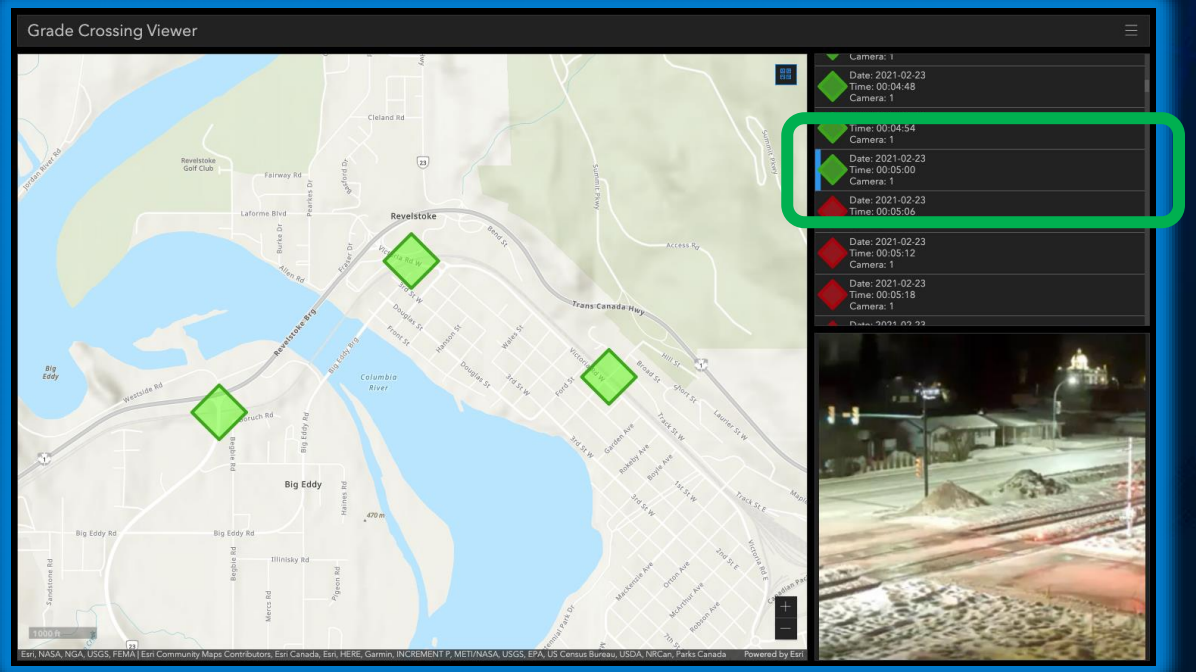
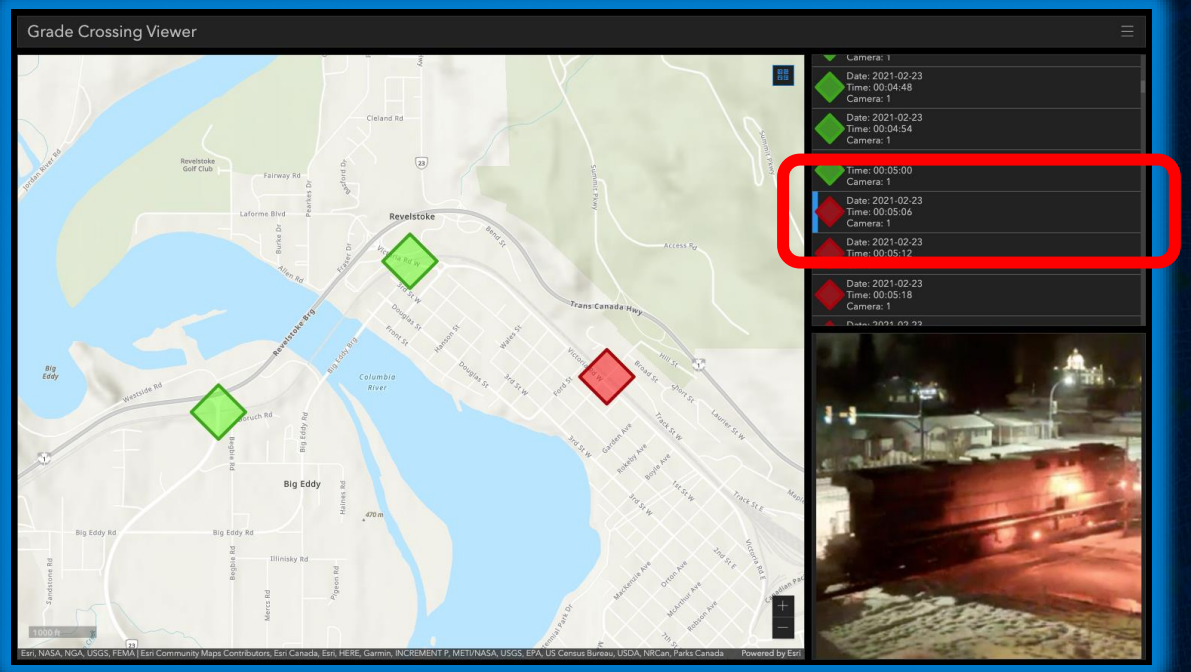
Image 65: fouled
Image 66: fouled
Image 67: fouled
Image 68: fouled
Image 69: fouled
```

Not-Fouled



Fouled



- email or SMS notifications
- report to local authorities
- change dynamic signage

- visualize
- analyze
- find patterns and correlations

ArcGIS Living Atlas of the World

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dlpk

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All content types | All time | All regions | Esri-only content | Authoritative-only content | Sort by: Relevance

20 Results

Building Footprint Extraction - USA
Deep Learning Package By esri_analytics
Deep learning model to extract building footprints from high-resolution aerial and satellite imagery.

Tree Point Classification
Deep Learning Package By esri_analytics
Deep learning model to classify point cloud into trees or background.

Land Cover Classification (Sentinel-2)
Deep Learning Package By esri_analytics
Deep learning model to perform land cover classification on Sentinel-2 imagery.

Land Cover Classification (Landsat 8)
Deep Learning Package By esri_analytics
Deep learning model to perform land cover classification on Landsat 8 imagery.

Car Detection - USA
Deep Learning Package By esri_analytics
Deep learning model to detect cars in high resolution imagery.

Windows and Doors Extraction
Deep Learning Package By esri_analytics
Deep learning model to extract windows and doors in building data displayed in 3D views. This model was trained using the Open Images Dataset.

Object Tracking
Deep Learning Package By esri_analytics
Deep learning model to track objects in motion imagery.

Face Blurring
Deep Learning Package By esri_analytics
Deep learning model for blurring human faces in street-level imagery.

Power Line Classification
Deep Learning Package By esri_analytics
Deep learning model to classify point clouds into distribution wires, poles, or background.

Road Extraction - North America
Deep Learning Package By esri_analytics
Deep learning model to extract roads from high resolution satellite imagery.

Human Settlements Classification (Sentinel-2)
Deep Learning Package By esri_analytics
Deep learning model to perform human settlements classification on Sentinel-

License Plate Blurring
Deep Learning Package By esri_analytics
Deep learning model for blurring license plates of vehicles in street-level

Resources for your success

training.esri.com – *learn your way*

- Documents
- E-Learning
- Instructor-Led
- Learning Plans
- MOOCs
- Story Maps
- Teacher Resources
- Training Seminars
- Tutorials
- Videos
- Web Courses

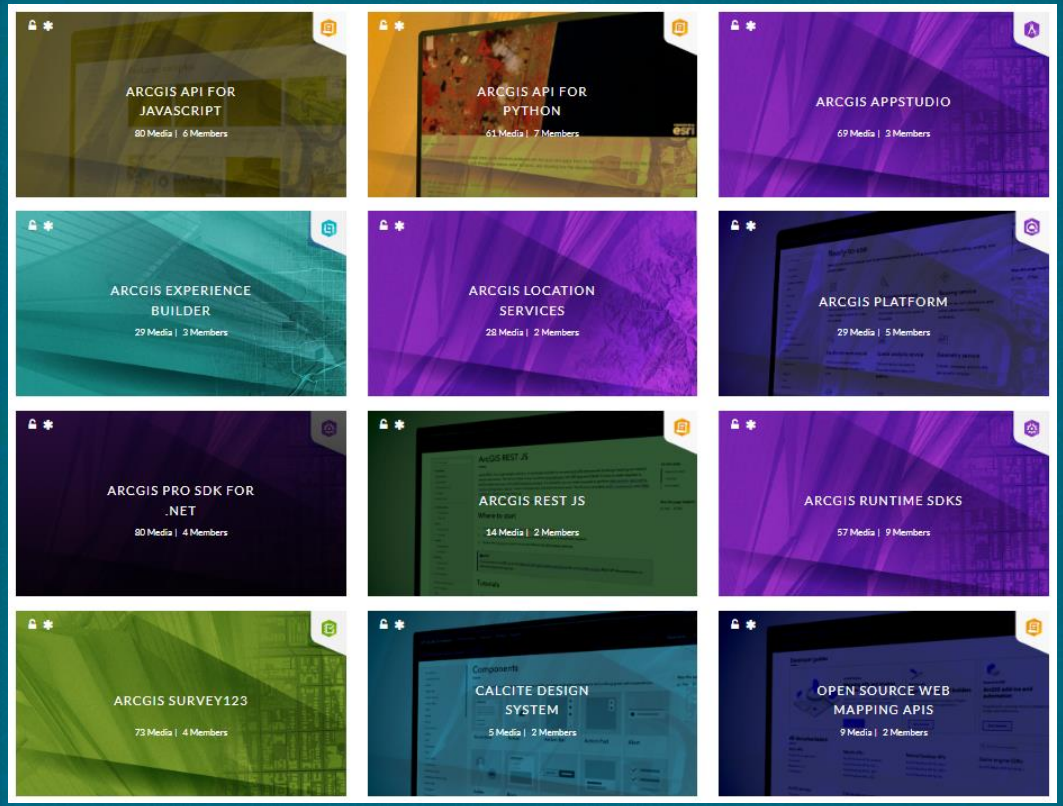
Select a Focus Area

Get Started	Build Desktop Apps	Build Mobile Apps	Build Web Apps	Script and Automate

WEB COURSE Basics of JavaScript Web Apps	1 Hour, 15 Minutes Free	(4421)	
LEARNING PLAN ArcGIS API for JavaScript Fundamentals Added by Esri on May 5, 2020	3 Courses	(27)	
VIDEO ArcGIS API for JavaScript: An Introduction	59 Minutes Free	(625)	
LEARNING PLAN Esri ArcGIS API for JavaScript Certification 19-001 Added by Esri Technical Certification on June 18, 2019	4 Courses	(10)	
VIDEO ArcGIS API for JavaScript: Programming Patterns and API Fundamentals	61 Minutes Free	(577)	
LEARNING PLAN Esri Partner Enablement: Extend ArcGIS - Web Applications Added by Esri Partner Onboarding on May 5, 2020	14 Courses	(3)	
VIDEO ArcGIS Experience Builder: Customizing and Extending	61 Minutes Requires Maintenance	(438)	

Videos – *several hundred of them*

- **mediaspace.esri.com**/category/ArcGIS+Developers/244548402
- **youtube.com/EsriTV** *(deprecated)*

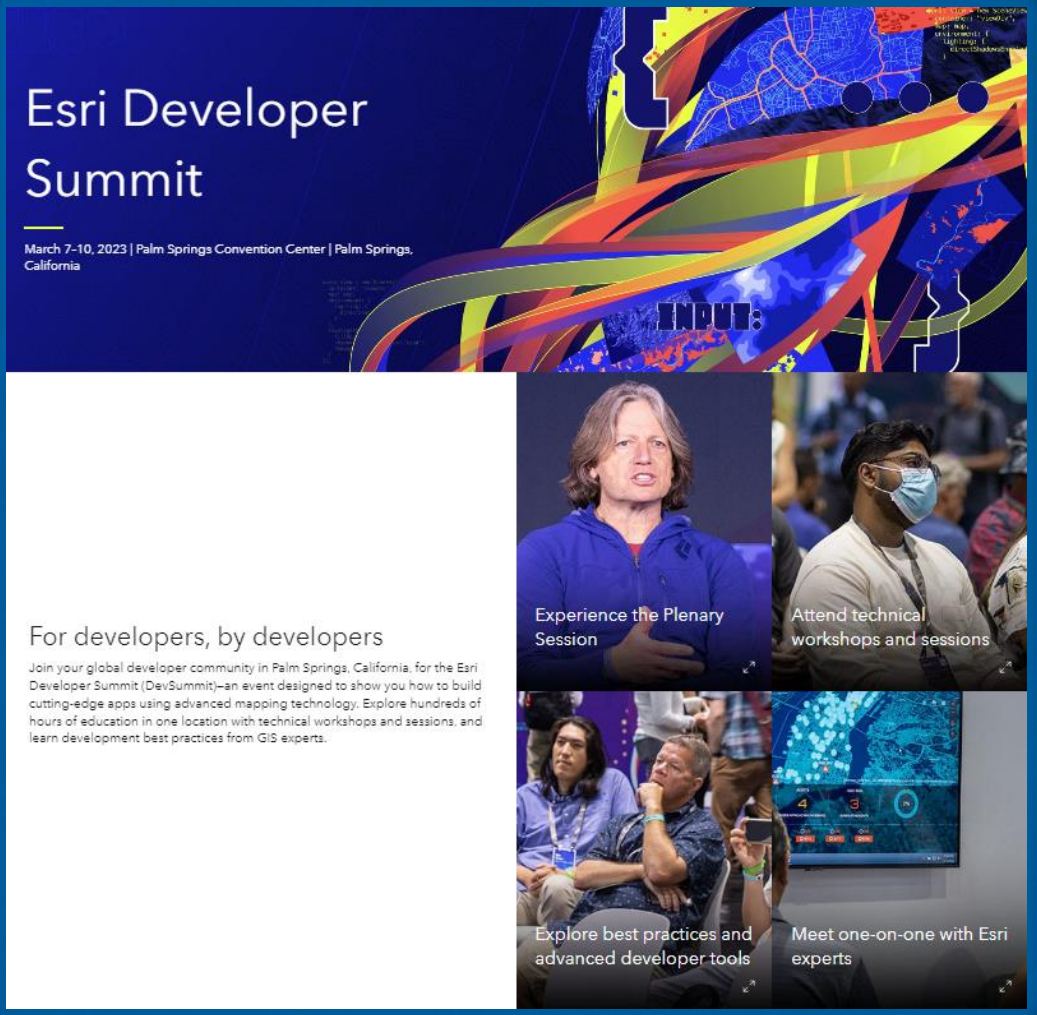


DevSummit

For Developers, By Developers

- Berlin *14-16 November 2023*

- Palm Springs *12-15 March 2024*
  - *tech sessions, demo theaters*
  - *hundreds recorded*
  - *dozens live-streamed*



The largest conference for geospatial developers in the world

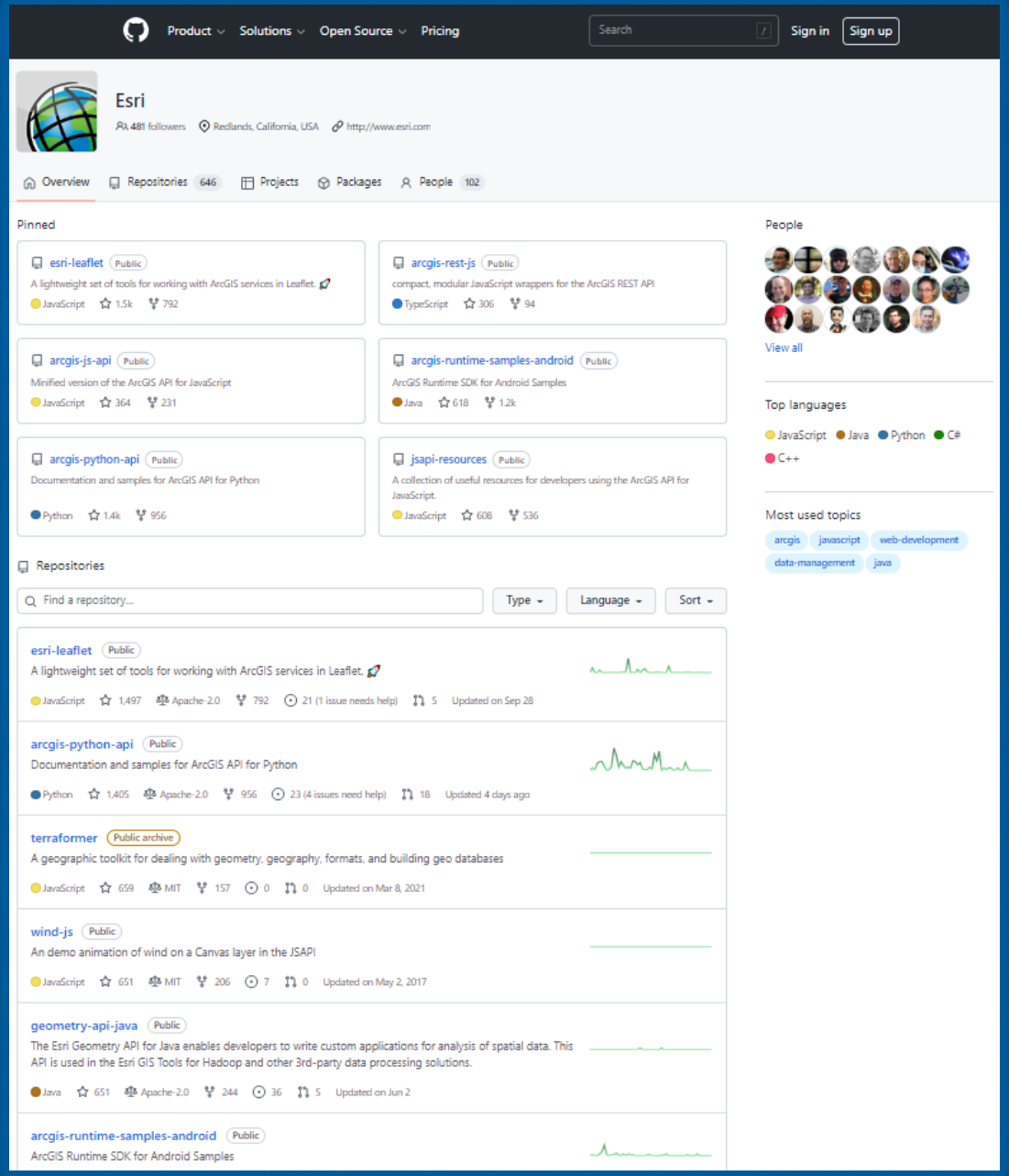
Developer Day at Esri UC

- Overview session
  - What's new, what's next
- Breakout tech sessions
- Pool social

Github.com/Esri

600+ repos

- Apps
- Libraries
- Widgets
- Extensions
- Documents
- …and more



Hackathon Kickstarter

30-minute video

- *Data > Design > Develop*

- Free developer subscription
- Make and share maps
- Make custom apps without code
- Get started with your API
- Scripting

Hackathon Kickstarter Video: ArcGIS Platform for Developers

1253 0 03-22-2021 09:21 AM

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About the Author

http://twitter.com/jimbarry

When you're at a hackathon, you tend to use the tools that you know. That way you can put all of your effort and time into the app you're trying to build, and not into having to learn a new tool that might set you back.

But what if you want to use ArcGIS but don't have much experience with it?

Well, here's a video that in just 30 minutes will give you everything you need to get going and get productive with ArcGIS Platform and ArcGIS Online for hosting data, making maps, using location services, and making apps. Even during a fast-paced hackathon you may find that spinning up on a few key skills could be a great investment when you see what kinds of capabilities you can bring to your project.

In this video, we cover all 10 of these topics:

1. Who is Esri and What is ArcGIS?
2. Sign up for a free ArcGIS Online for Developers account
3. Search, find, import, create, and host map data on the cloud
4. Make, style, and share a web map
5. Use API Keys for activating content, location services, and interactive data analysis tools
6. Create custom web mapping apps without code: *StoryMaps, Dashboards, app builders and templates*
7. Create custom web mapping apps with code: *REST API, JavaScript API, Runtime SDKs*
8. Use ArcGIS along with other commercial and open source mapping tools
9. Data science with ArcGIS: *ArcGIS Python packages*
10. Community tools and resources: *online forums, open source projects*

Here is a link to the video: https://tiny.cc/ArcGISHacksVideo_v2

https://tiny.cc/arcgis-hackathon

Hackathon Kickstarter Cheat Sheet

tiny.cc/ArcGISHacksCheatSheet

Welcome to Esri and ArcGIS

ArcGIS from Esri provides powerful software and useful content for mapping and GIS (geographic information systems). This is software you can download, install, and run on your own machine, or you can use ArcGIS Online to work with these apps and tools on the cloud through a browser.

Sign-up

A great way to get started is to sign-up for a free Developer subscription of ArcGIS Online: https://developers.arcgis.com/

This is not a free trial, but a perpetually free subscription that gives you a base level of cloud storage and processing for hosting data, making maps, and sharing those maps and data visualizations with others, either by themselves, or wrapped inside highly customized web applications, with or without any coding on your part.

What can ArcGIS do?

On the ArcGIS for Developers front page, scroll down a bit to the section "*Explore the capabilities of ArcGIS*", and click through the list of capabilities and see if you can make use of those.

Getting started

When you're ready to get hands-on, here are the first 4 self-paced tutorials (10-15-min each) we recommend you use for getting started:

Import data: https://developers.arcgis.com/documentation/mapping-apis-and-location-services/data/tutorials/tools/import-data-as-a-feature-layer/

Create a web map: https://developers.arcgis.com/documentation/mapping-apis-and-location-services/maps/tutorials/tools/create-a-web-map/

Style feature layers: https://developers.arcgis.com/documentation/mapping-apis-and-location-services/visualization/tutorials/tools/style-layers-web-map/

Create a new dataset: https://developers.arcgis.com/documentation/mapping-apis-and-location-services/data/tutorials/tools/create-a-new-feature-layer/

For developers

If you are a web developer, or have some experience with JavaScript, try these:

Create a starter app: https://developers.arcgis.com/labs/javascript/create-a-starter-app/
Select a basemap: https://developers.arcgis.com/labs/javascript/select-a-basemap/
Search for an address: https://developers.arcgis.com/labs/javascript/search-for-an-address/

There are hundreds more short tutorials, most under 15 minutes each:
https://developers.arcgis.com/documentation/mapping-apis-and-location-services/tutorials/

For data scientists

You can use the ArcGIS API for Python to bring ArcGIS into your analytical workflows, perhaps with Jupyter Notebooks.
ArcGIS Pro has an ArcPy module as a Python interface to desktop workstation GIS capabilities.

Map content you can use

You can mix and overlay your map data with any number of thousands of other map layers of useful data made available through the Living Atlas of the World:
https://livingatlas.arcgis.com/en/

Building web apps for your maps

When you want to share your map inside of a custom web app, with tools your end-users can use, a great place to start is the ArcGIS Web AppBuilder:
https://doc.arcgis.com/en/web-appbuilder/

If you're familiar with the Johns Hopkins COVID-19 dashboard, well, you can make dashboards too, by clicking and dragging:
https://doc.arcgis.com/en/operations-dashboard/

Another great way to share maps, charts, images, and multimedia is by telling a story. Try ArcGIS Story Maps:
https://storymaps.arcgis.com/

X *(previously Twitter)*

@EsriDevs

- products, news, techniques
- *…and more*

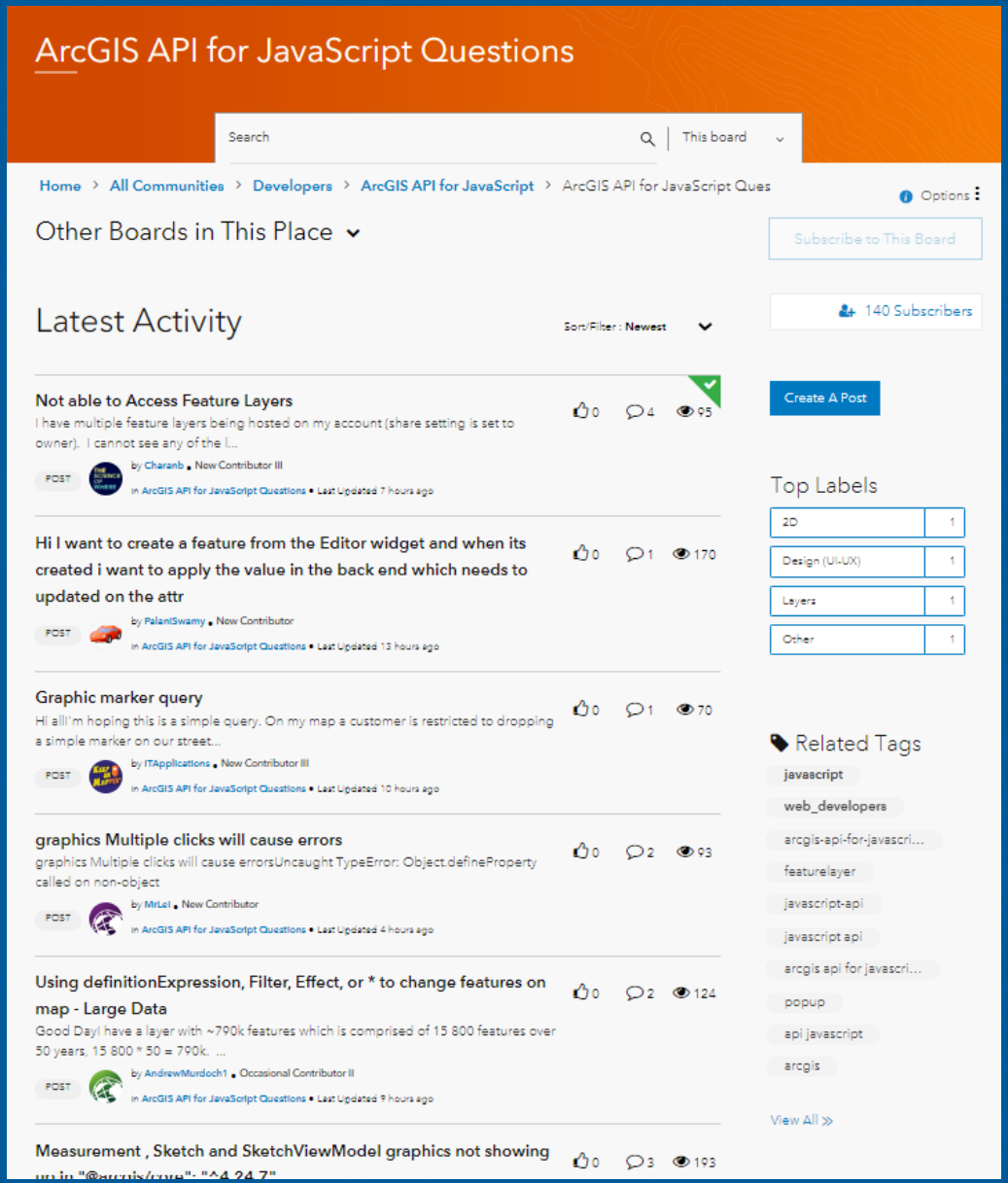
@EsriDevEvents

- conferences, live streams, meetups
- *…and more*

community.esri.com

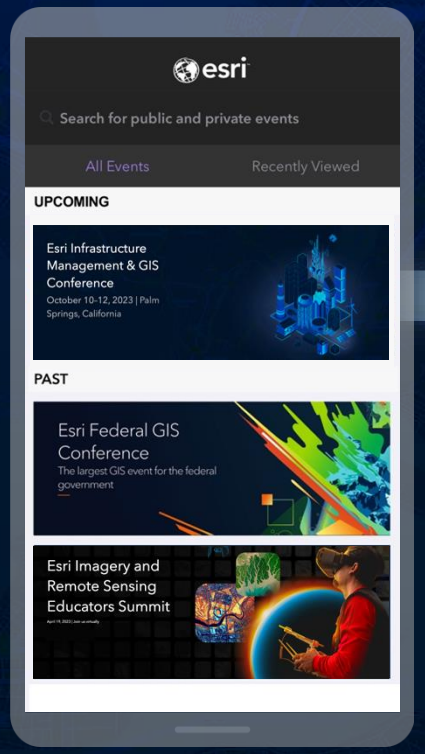
(formerly "GeoNet")

- Q&A Forums
- Blog articles
- Videos
- Code samples
- …and more

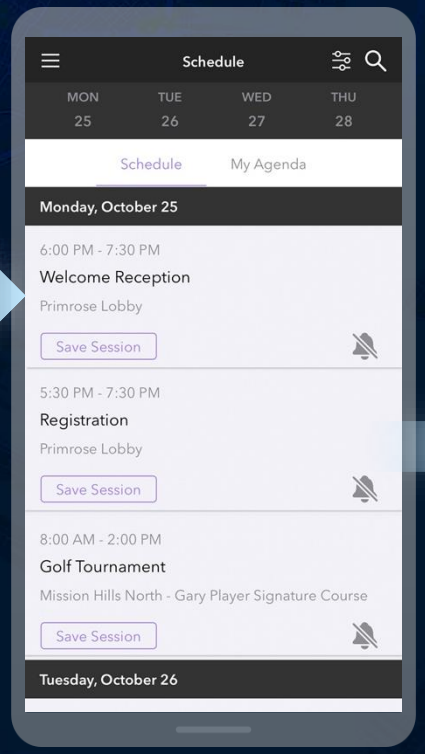


Please Share Your Feedback in the App

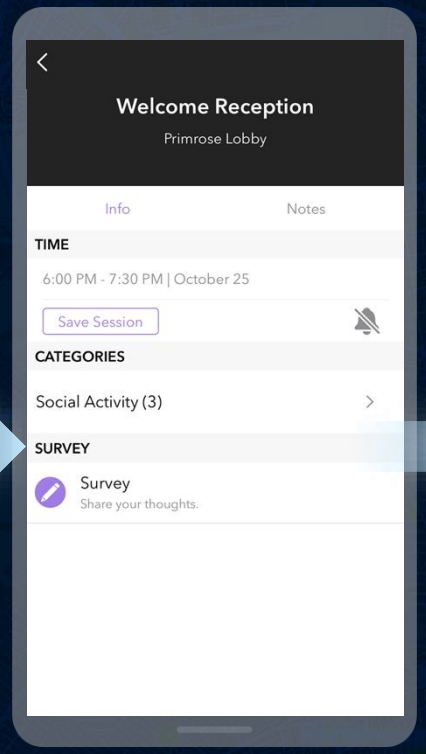
Download the Esri Events app and find your event



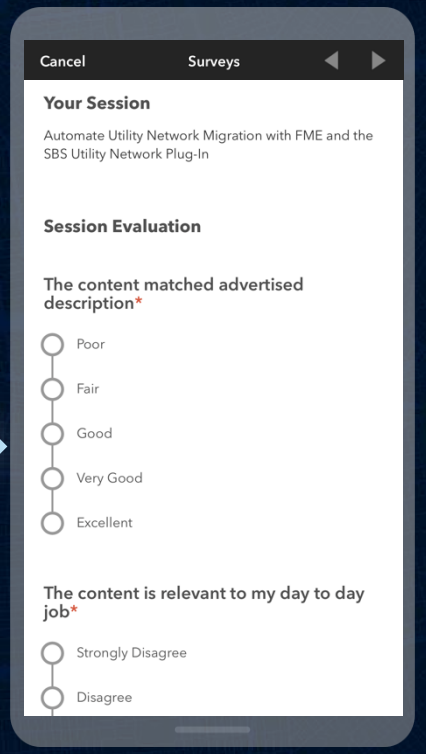
Select the session you attended



Scroll down to "Survey"



Log in to access the survey



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