

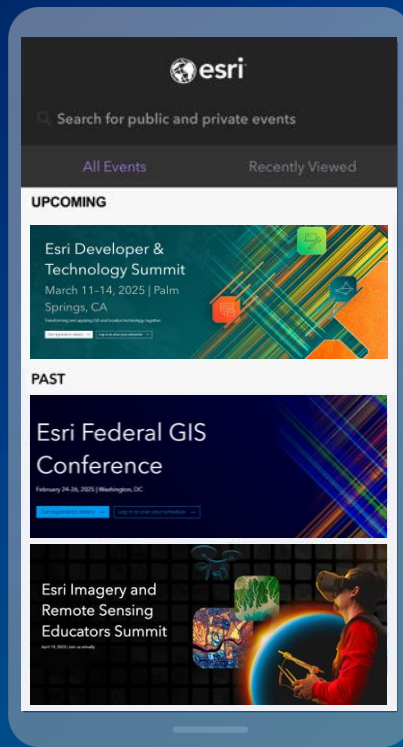
Intro to ArcGIS Knowledge Graphs & Extending with ArcGIS SDKs

Ty Fitzpatrick and Emma Tait

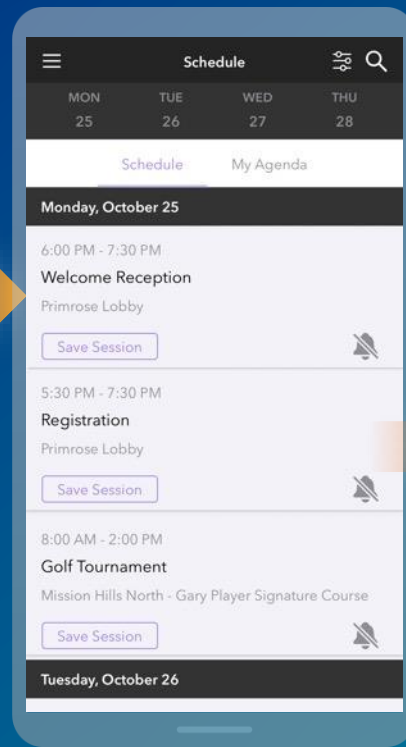


Please share your feedback in the app

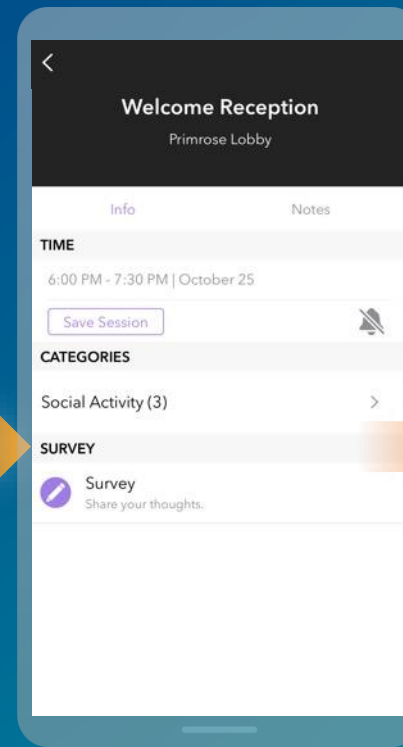
Download the Esri Events app and find your event



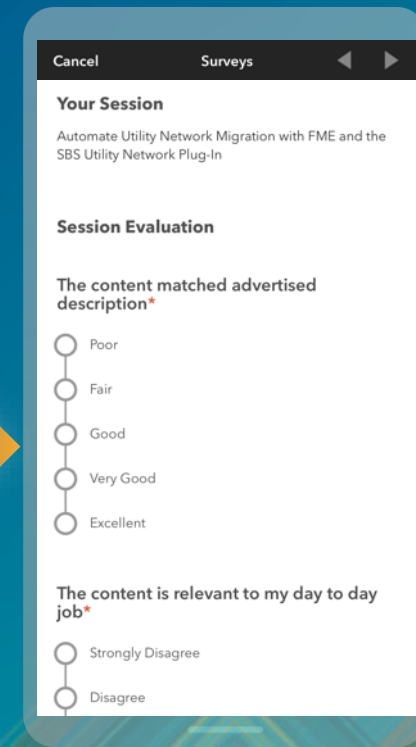
Select the session that you attended



Scroll down to "Survey"



Log in to access the survey



Agenda

Intro to ArcGIS Knowledge Graphs & Extending with ArcGIS SDKs

- Intro to ArcGIS Knowledge
- ArcGIS Pro SDK for .NET
- ArcGIS API for Python
- ArcGIS Maps SDK for Java Script
- QA



ArcGIS Knowledge

Powering enterprise knowledge
graph analytics in ArcGIS



Create and explore data in **knowledge graphs** with maps, link charts, graph and spatial analytics and fast graph queries.

Graph Data Model – Entities



Nonspatial
Point
Multi-point
Line
Polygon

Graph Data Model – Properties



Spatial Type: Point

Name: ESRI

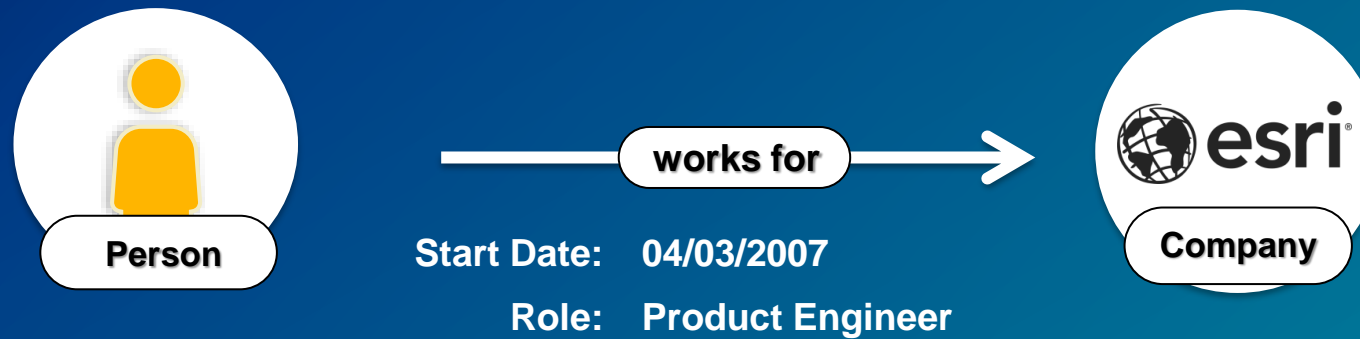
Employees: 5200

Website: esri.com

Ownership: Private

Headquarters: Redlands, CA

Graph Data Model – Relationships

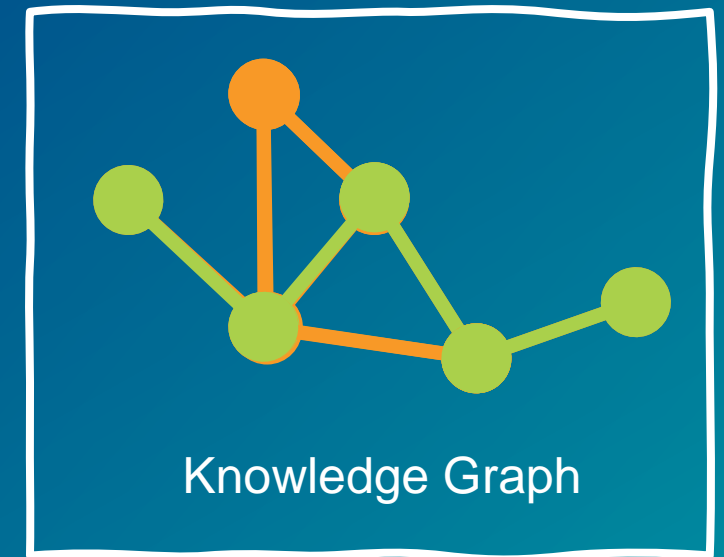


Review: Knowledge Graph Essential Vocabulary


Entity
aka
Node, Object


Relationship
aka
Edge, Link


Related Entities
aka
Triple

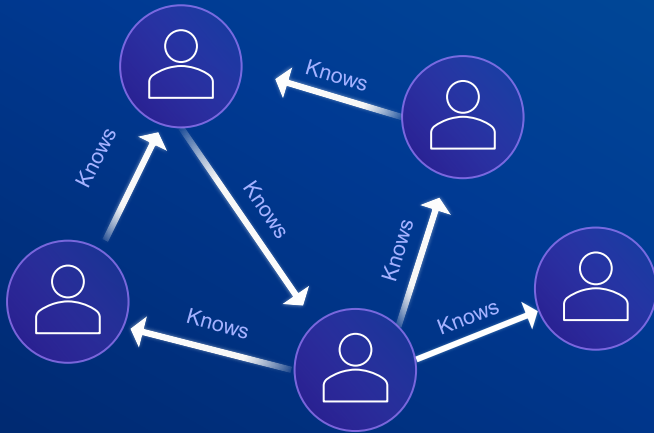


Entities, Relationships, and Properties

Graphs are everywhere!

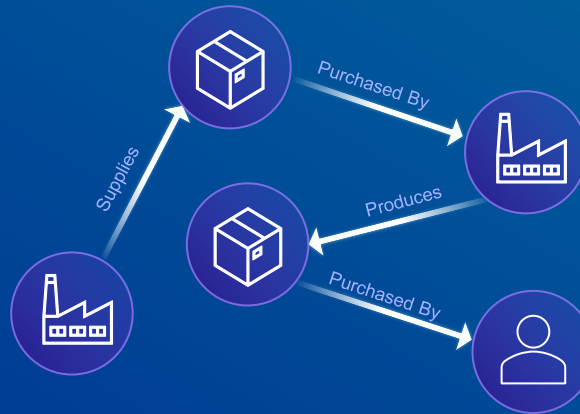
Store data like it is in the real world: intuitive, connected, dynamic

People Networks



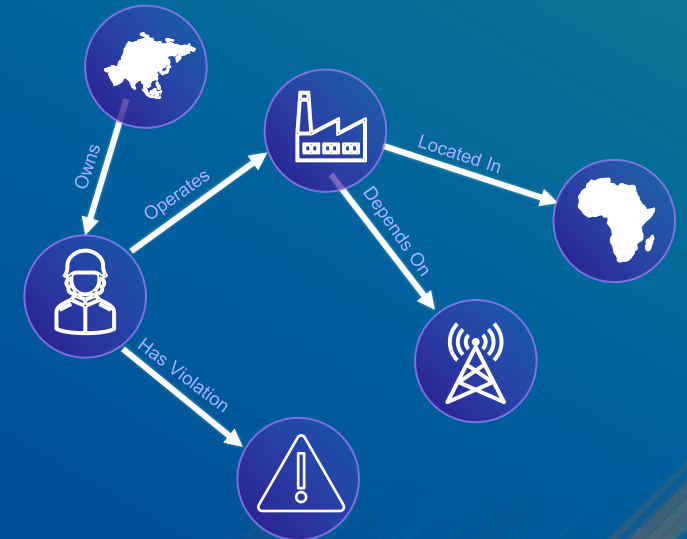
Employees, Management, Collaboration, Phone calls, Social media, Crime rings, Influencers, Contact tracing, etc.

Transaction Networks



Supply chains, Maintenance events, Financial transactions, Orders, Payments, Blockchain, Contamination

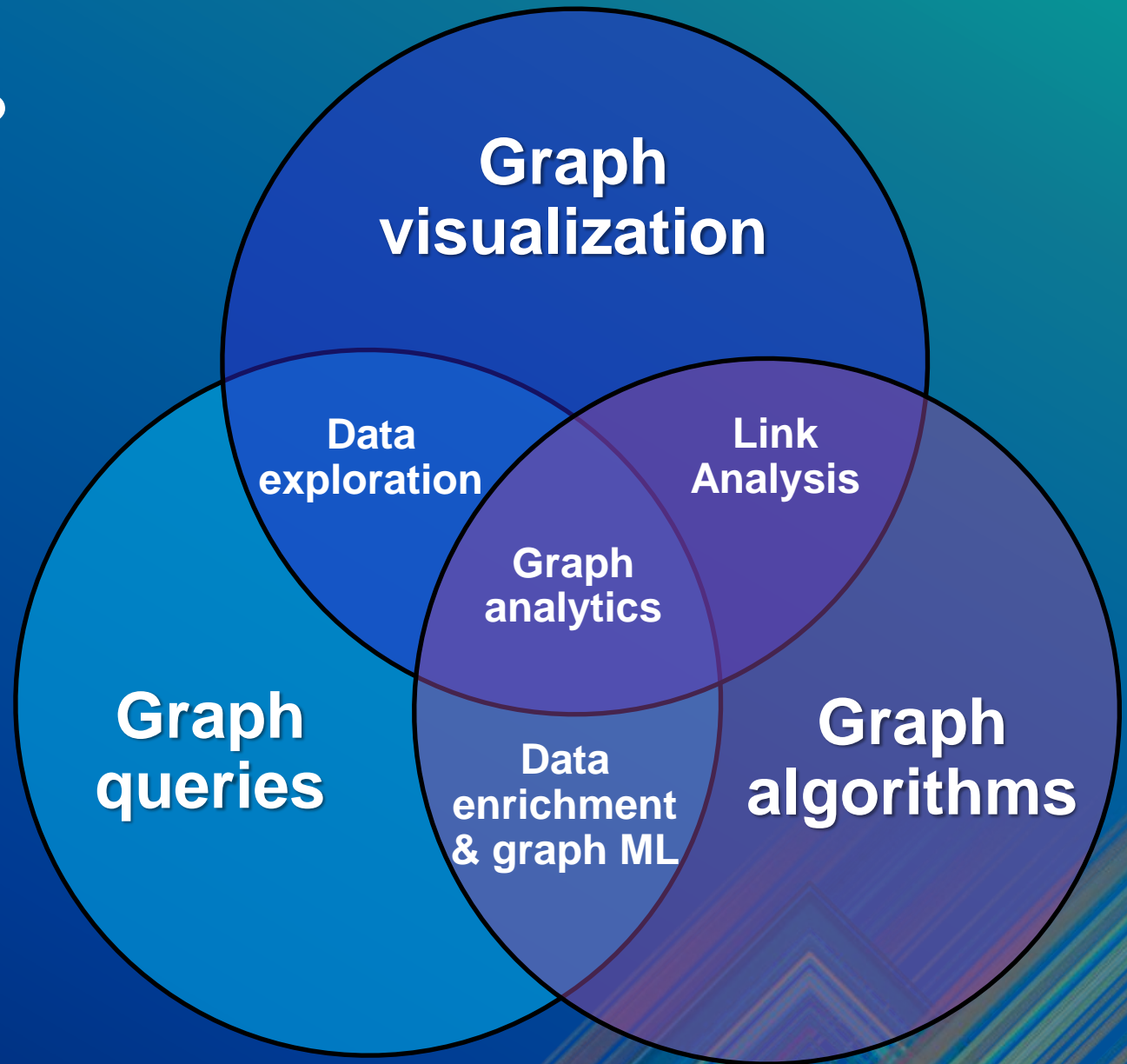
Knowledge Networks



Healthcare Network, Skills and roles, content management, domain-specific content, SOM, Order of Battle / IPB

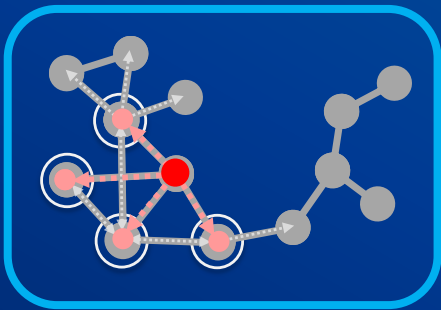
What are graph analytics?

Graph analytics, or link analysis, techniques use network theory to quantify and evaluate the relationships or connections within a network of data.

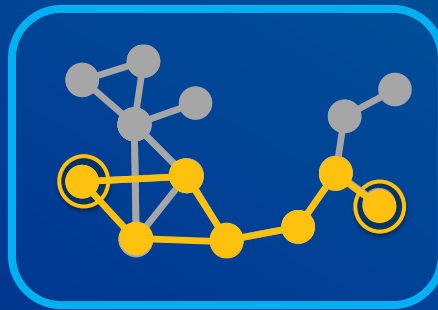


Graph analytics provide new insights

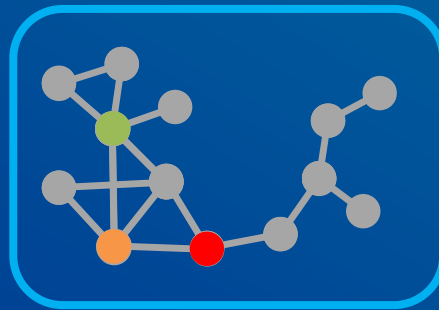
Ask real world questions of your connected data and get answers fast.



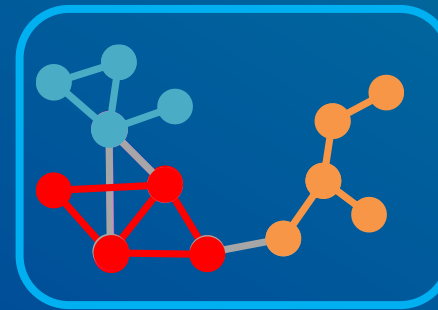
***Neighborhood
Analysis***



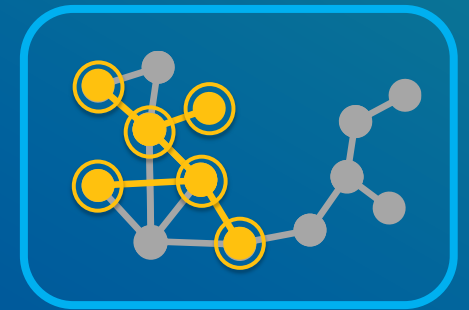
Path Finding



Centrality



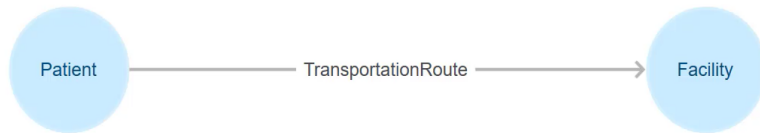
***Community
Detection***



***Pattern
Matching***

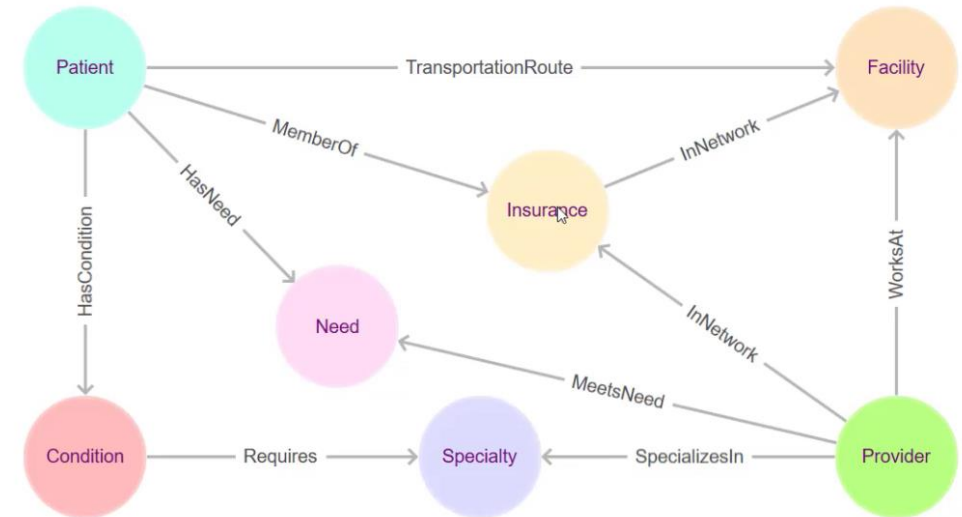
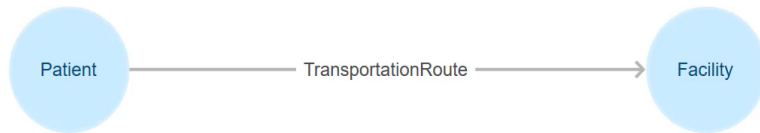
Healthcare Network

Find routes to facilities.



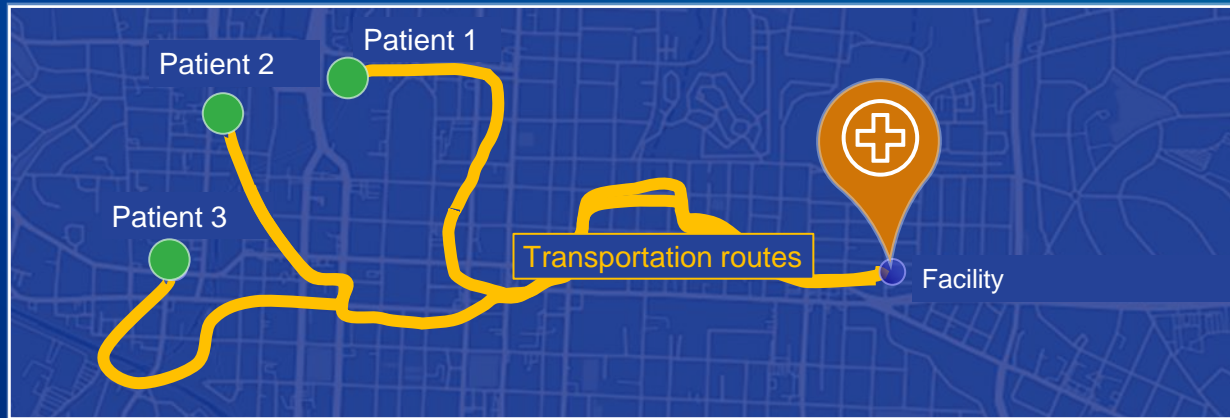
Healthcare Network

Find routes to facilities that have service for a condition.

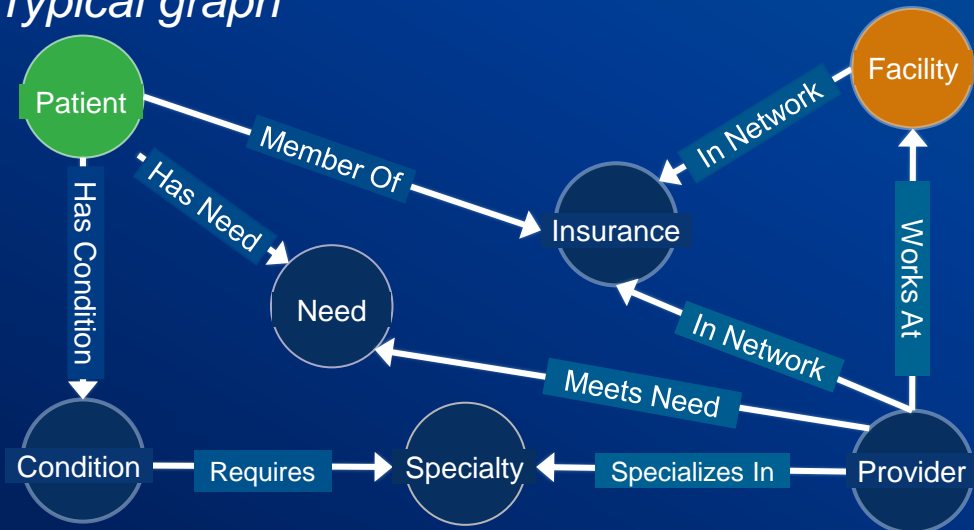


Why blend knowledge graphs with spatial analysis

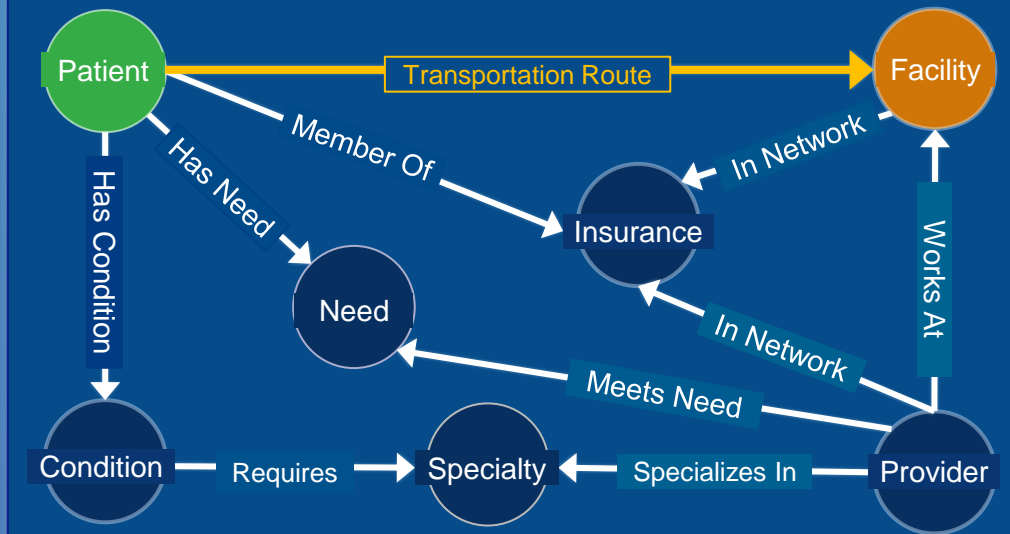
Typical map

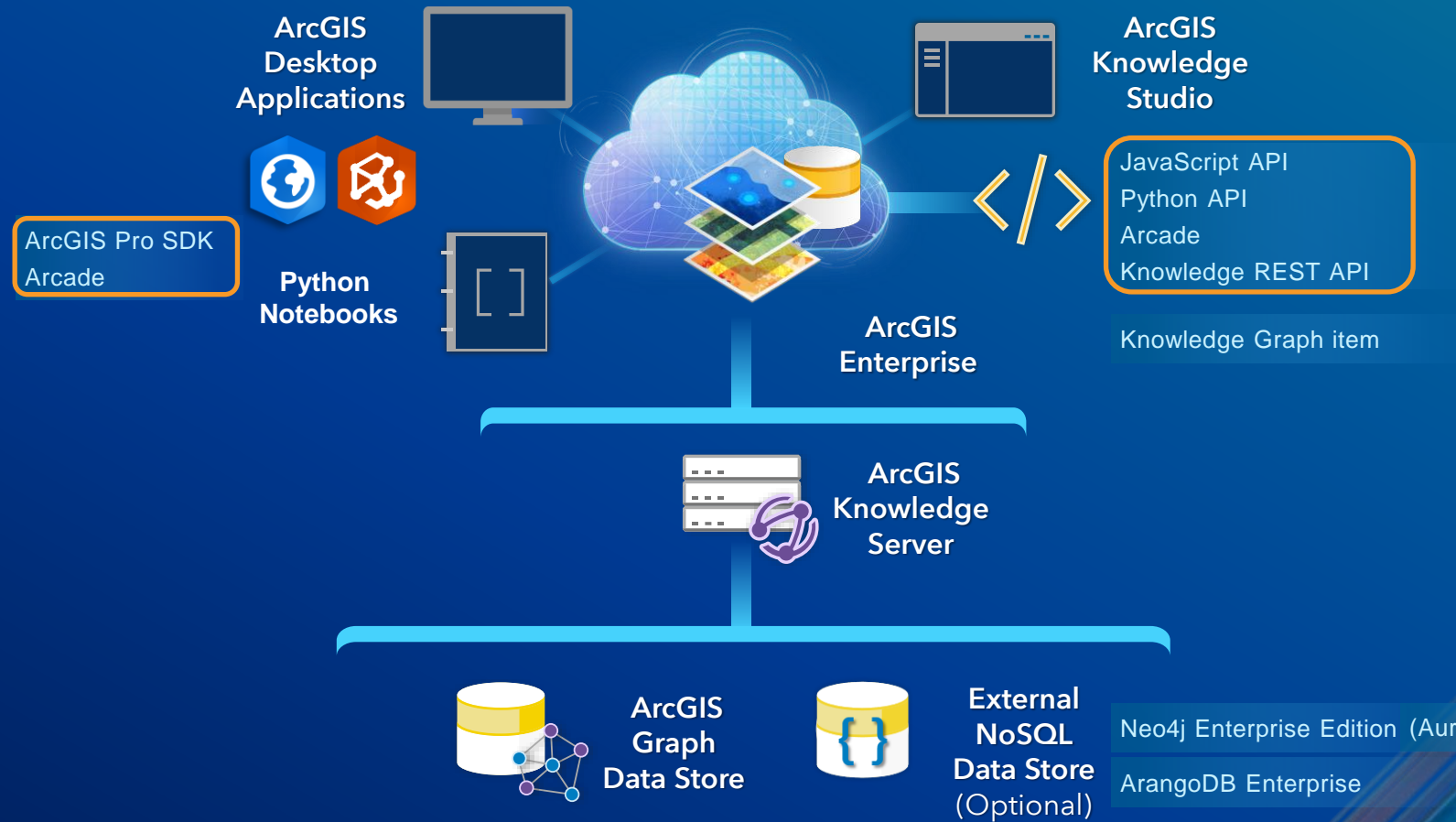


Typical graph



Spatially-enriched graph





Knowledge in the ArcGIS Pro SDK for Microsoft .NET

Ty Fitzpatrick

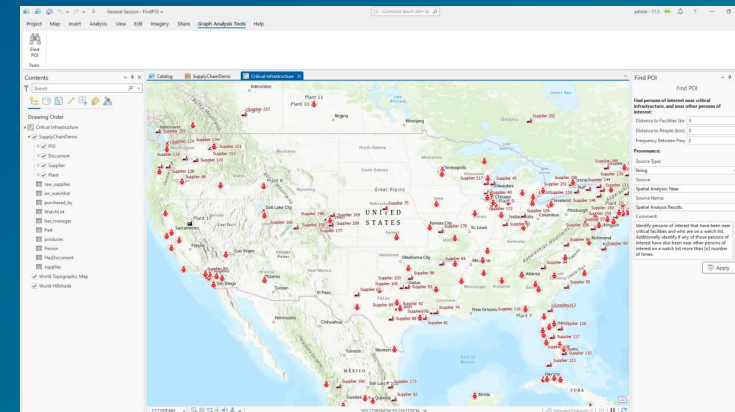


ArcGIS Pro SDK for Microsoft .NET

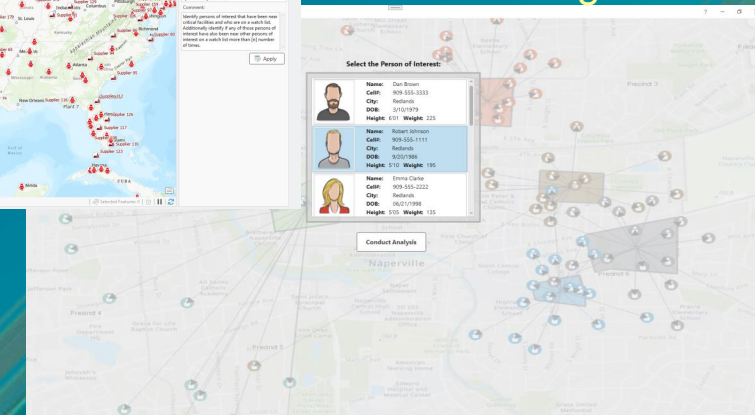
Microsoft
.NET

- Templates and tools for extending ArcGIS Pro
 - Microsoft .NET Desktop Development – Visual Studio 2022, .NET 8
 - Use ArcGIS Pro APIs
 - Updates are in sync with Pro's releases

Add-ins



Configurations

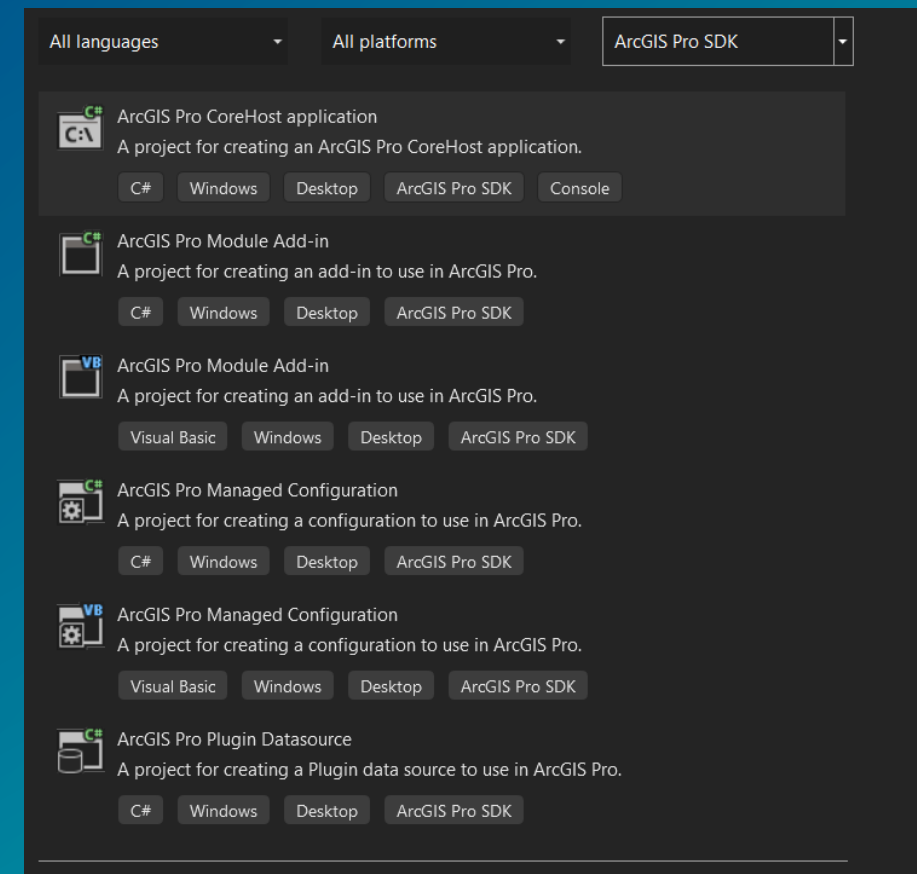


ArcGIS Pro SDK Extensibility Patterns

Extending ArcGIS Pro via the .NET SDK

- Add-ins
 - Primary pattern for developing new tools and workflows to extend ArcGIS Pro and/or ArcGIS AllSource
- Configurations
 - All the capabilities of add-ins “+” deeper customization of the Pro UI/UX
- Plug-in datasources
 - Integrate custom data sources into Pro
- Corehost
 - Headless api for stand-alone apps and batch programs

Visual Studio Project Templates

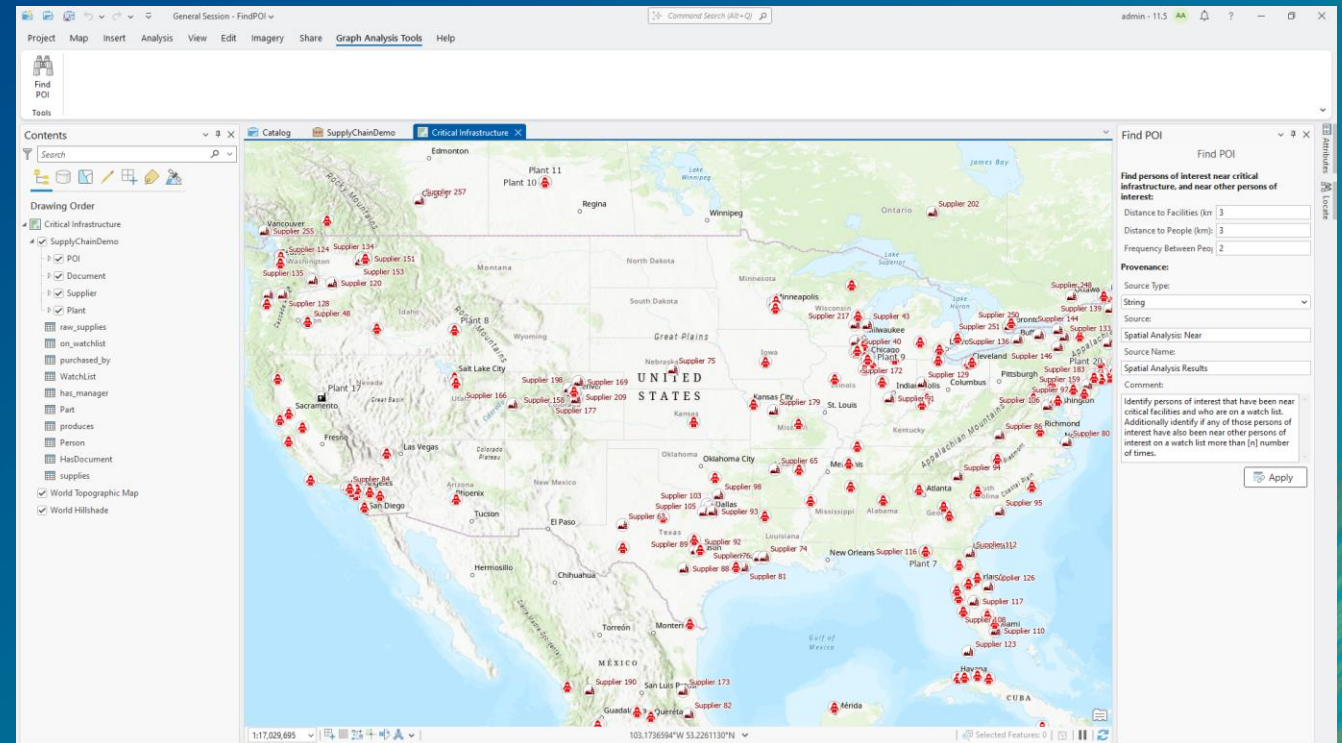


Add-in for Knowledge Graphs

Develop add-ins to streamline your workflows

- Connect to knowledge graph
 - Data model query and edit
 - Entity types, relationship types, properties
- Graph query
- Search
- Apply edits
 - Create, update, and delete entities and relationships
 - Update property values
- Domains
- Provenance query & edit
- Add and append to link charts and maps

Find Persons of Interest Near Critical Facilities

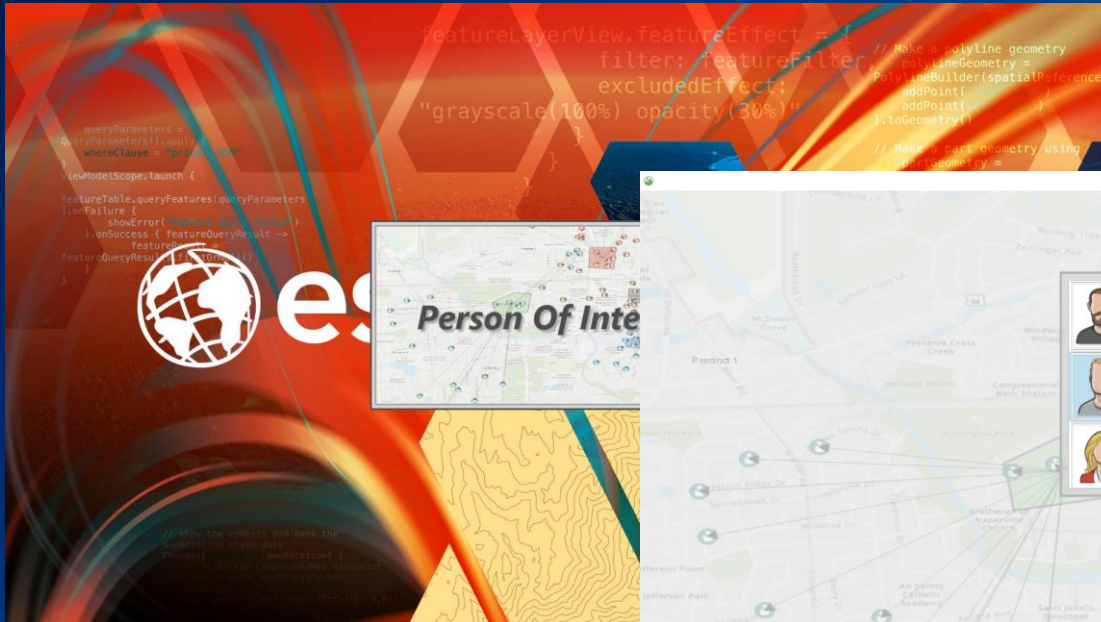


Demo Add-in

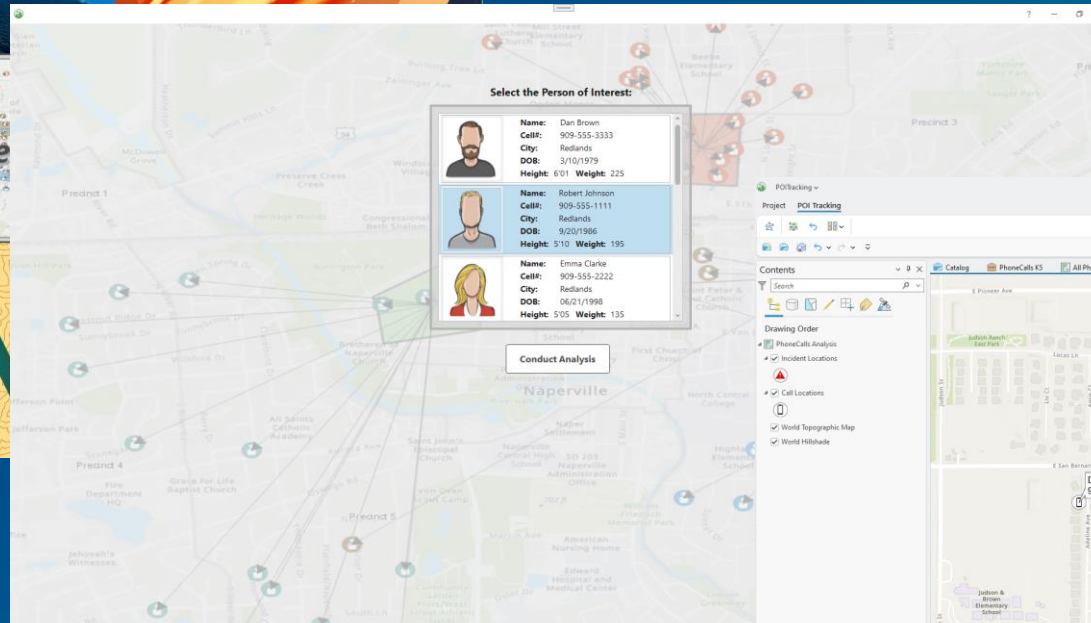


Managed Configuration for Knowledge Graphs

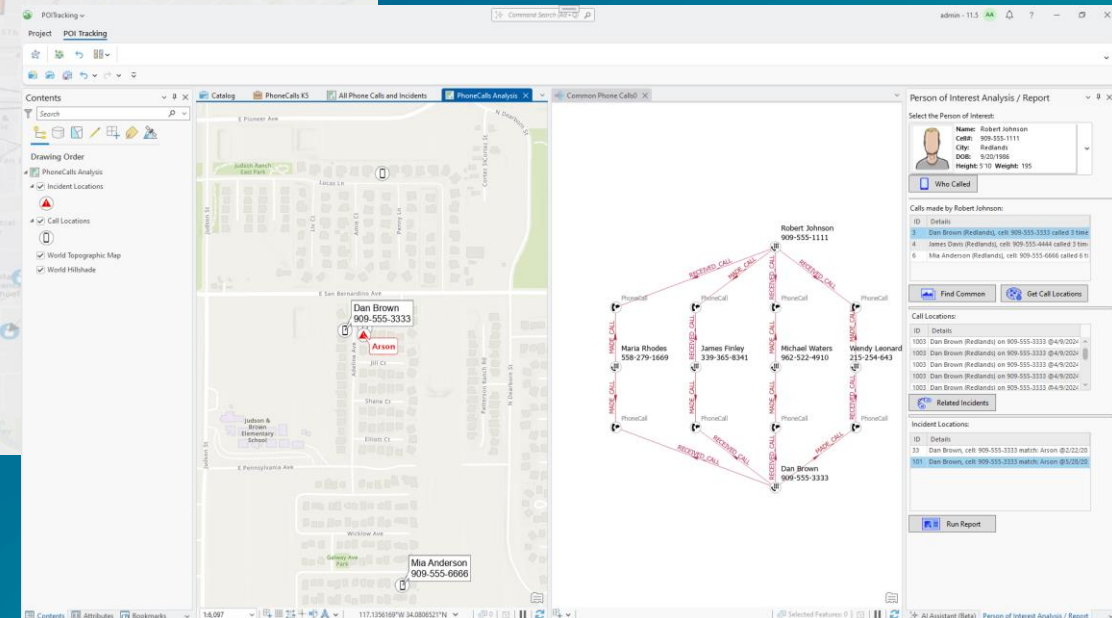
Develop new configurations to streamline ArcGIS Pro



Custom Splash Screen



Custom Start Page



Application

ArcGIS Pro SDK Resources

Knowledge in the ArcGIS Pro SDK for .NET

- Landing Page –

- <https://pro.arcgis.com/en/pro-app/sdk/>

- Links to all the Resources

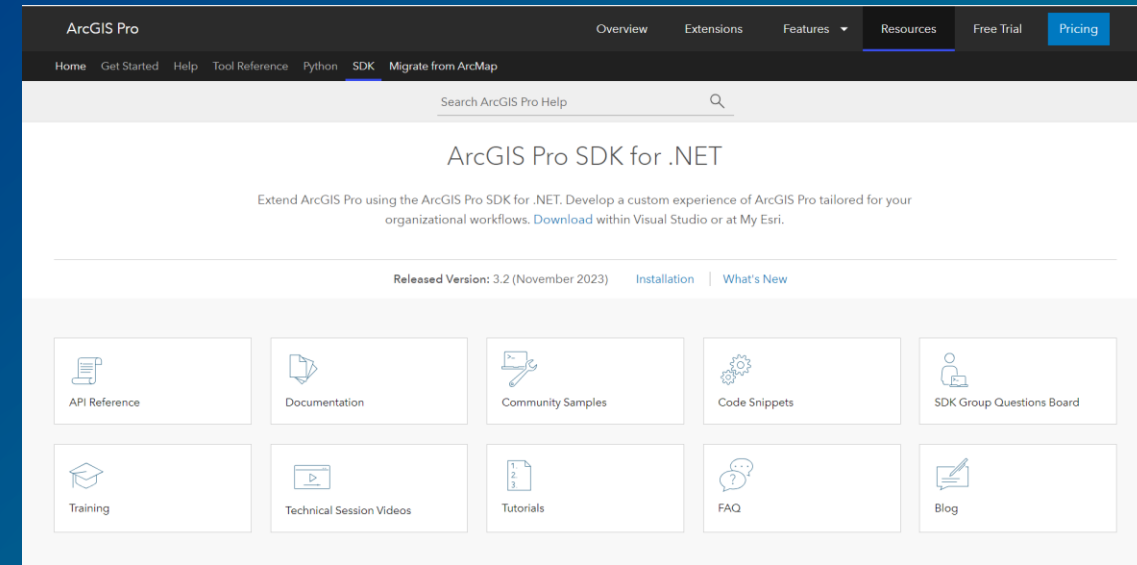
- [API Reference](#), [Samples](#), [Snippets](#), [Documentation](#), and [Resources](#)

- [ArcGIS Tutorials](#)

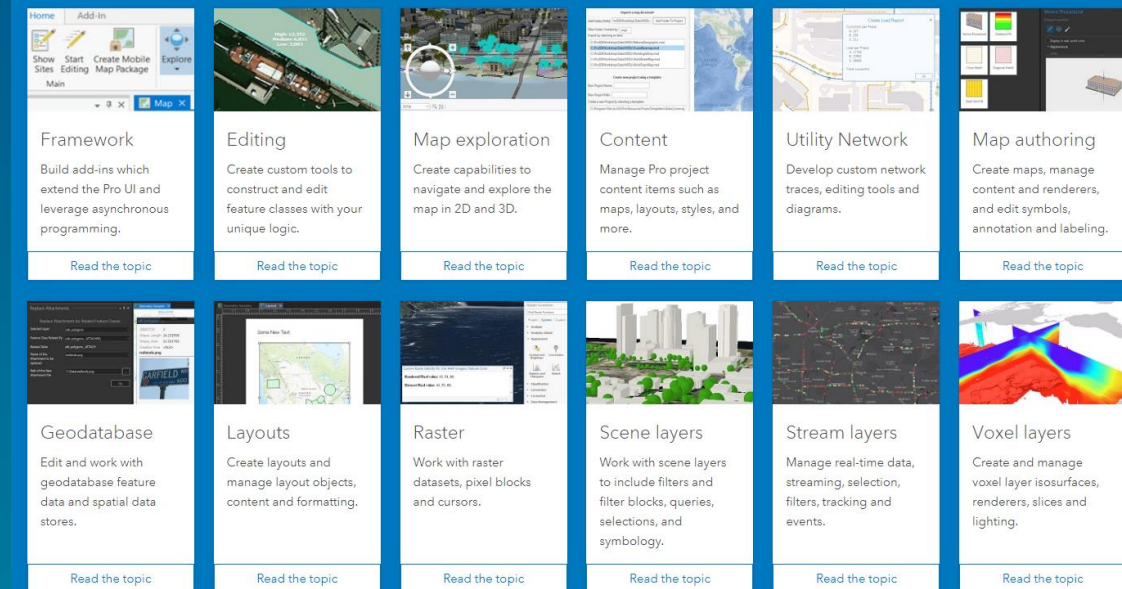
- [Pro SDK Group on Esri Community](#)

- Tech session video recordings

- ArcGIS Blog posts



Learn key concepts



ArcGIS Pro SDK for Knowledge Graphs Road Map

Near 3.5

- Investigations: create, open
- Data model view open

Mid 3.6+

- Centrality
- Filtered find paths
- Expand, Filtered expand
- Connect
- Find, select between
- Find, select neighbors
- Trim
- Remove
- Investigations: set data source, saved queries, load data configurations, filtered find path configurations

Long

- Community detection
- Data model view open, edit drafts, save drafts

Knowledge in the ArcGIS API for Python

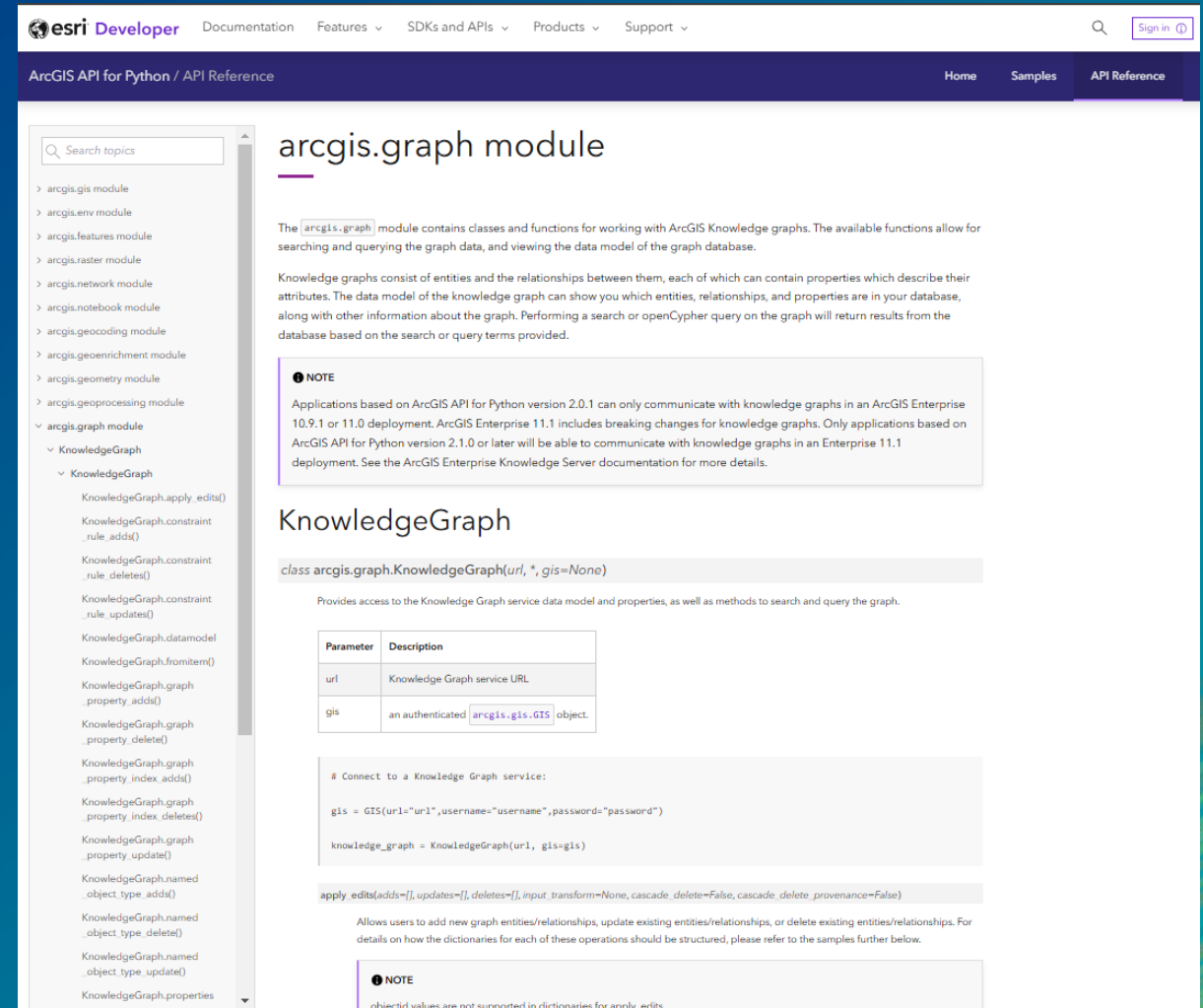
Emma Tait



Knowledge in the ArcGIS API for Python

Current capabilities

- Query and Streaming Query
- Search
- Data Editing
- Data Model Editing
- Provenance
- Relationship Constraint Rules
- Property index
- Search Index
- Synchronize user managed data model



The screenshot shows the ArcGIS Developer API Reference page for the `arcgis.graph` module. The page has a dark blue header with the Esri Developer logo and navigation links. A sidebar on the left lists various modules, with `arcgis.graph` expanded to show a list of methods under the `KnowledgeGraph` class. The main content area is titled `arcgis.graph module` and contains an introduction to the module, a note about version compatibility, and a detailed section for the `KnowledgeGraph` class. This section includes the class signature, a description of its purpose, a table of parameters, example code for connecting to a service and performing edits, and another note about object IDs.

esri Developer Documentation Features SDKs and APIs Products Support

ArcGIS API for Python / API Reference Home Samples API Reference

Search topics

- > arcgis.gis module
- > arcgis.env module
- > arcgis.features module
- > arcgis.raster module
- > arcgis.network module
- > arcgis.notebook module
- > arcgis.geocoding module
- > arcgis.geoenrichment module
- > arcgis.geometry module
- > arcgis.geoprocessing module
- > arcgis.graph module
 - KnowledgeGraph
 - KnowledgeGraph.apply_edits()
 - KnowledgeGraph.constraint_rule_adds()
 - KnowledgeGraph.constraint_rule_deletes()
 - KnowledgeGraph.constraint_rule_updates()
 - KnowledgeGraph.datamodel
 - KnowledgeGraph.fromitem()
 - KnowledgeGraph.graph_property_adds()
 - KnowledgeGraph.graph_property_delete()
 - KnowledgeGraph.graph_property_index_adds()
 - KnowledgeGraph.graph_property_index_deletes()
 - KnowledgeGraph.graph_property_index_updates()
 - KnowledgeGraph.graph_property_update()
 - KnowledgeGraph.named_object_type_adds()
 - KnowledgeGraph.named_object_type_delete()
 - KnowledgeGraph.named_object_type_update()
 - KnowledgeGraph.properties

arcgis.graph module

The `arcgis.graph` module contains classes and functions for working with ArcGIS Knowledge graphs. The available functions allow for searching and querying the graph data, and viewing the data model of the graph database.

Knowledge graphs consist of entities and the relationships between them, each of which can contain properties which describe their attributes. The data model of the knowledge graph can show you which entities, relationships, and properties are in your database, along with other information about the graph. Performing a search or openCypher query on the graph will return results from the database based on the search or query terms provided.

NOTE

Applications based on ArcGIS API for Python version 2.0.1 can only communicate with knowledge graphs in an ArcGIS Enterprise 10.9.1 or 11.0 deployment. ArcGIS Enterprise 11.1 includes breaking changes for knowledge graphs. Only applications based on ArcGIS API for Python version 2.1.0 or later will be able to communicate with knowledge graphs in an Enterprise 11.1 deployment. See the ArcGIS Enterprise Knowledge Server documentation for more details.

KnowledgeGraph

```
class arcgis.graph.KnowledgeGraph(url, *, gis=None)
```

Provides access to the Knowledge Graph service data model and properties, as well as methods to search and query the graph.

Parameter	Description
url	Knowledge Graph service URL
gis	an authenticated <code>arcgis.gis.GIS</code> object.

```
# Connect to a Knowledge Graph service:
gis = GIS(url="url", username="username", password="password")
knowledge_graph = KnowledgeGraph(url, gis=gis)

apply_edits(adds=[], updates=[], deletes=[], input_transform=None, cascade_delete=False, cascade_delete_provenance=False)
```

Allows users to add new graph entities/relationships, update existing entities/relationships, or delete existing entities/relationships. For details on how the dictionaries for each of these operations should be structured, please refer to the samples further below.

NOTE

objectId values are not supported in dictionaries for apply_edits

Demo



Resources

Knowledge in the ArcGIS API for Python

- Documentation
 - [arcgis.graph module](#)
- Guides
 - [Part 1 – Introduction](#)
 - [Part 2 – Search and Query](#)
 - [Part 3 – Data and Data Model Editing](#)
- Samples
 - [Create and load backups of knowledge graphs](#)

Knowledge in the ArcGIS Maps SDK for JavaScript

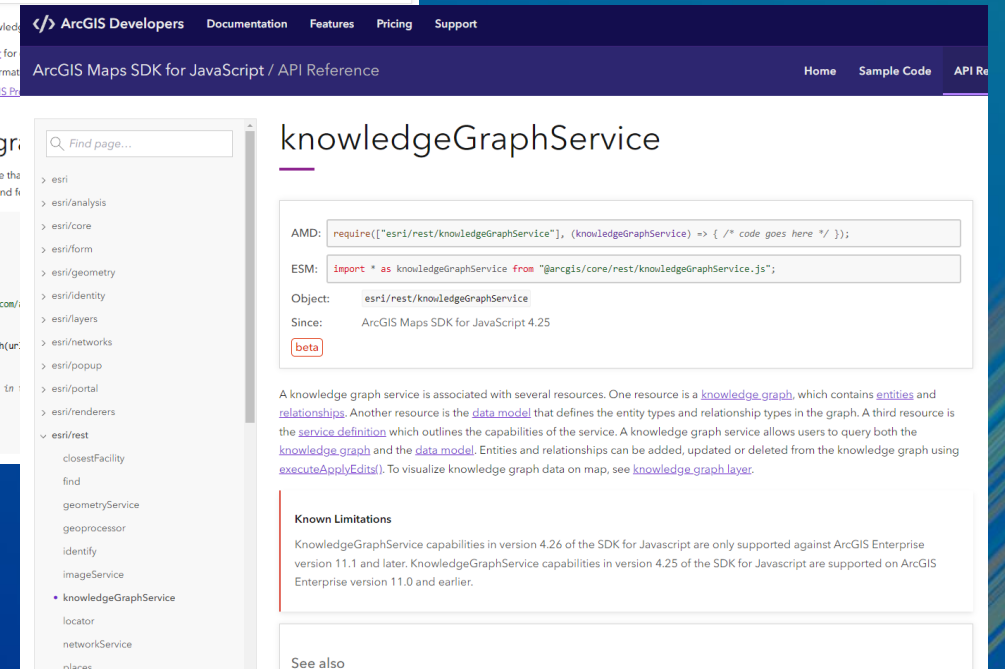
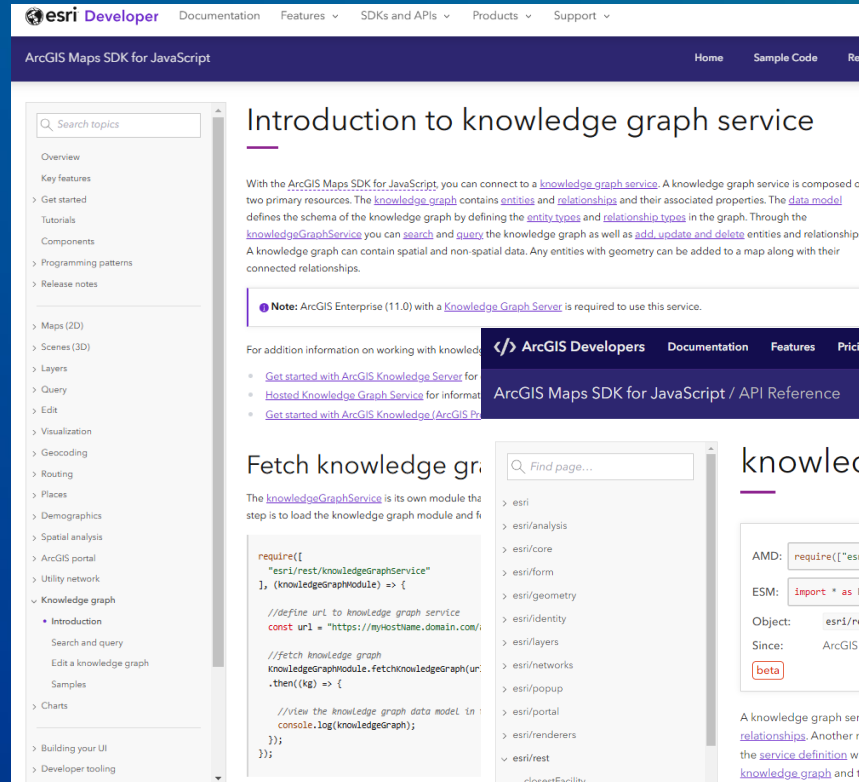
Emma Tait



Knowledge in the ArcGIS Maps SDK for JavaScript

Current Capabilities

- Web Link Charts **NEW!**
- Link Analysis Tools **NEW!**
- Knowledge Graph Layer
- Knowledge Graph Service
 - Search
 - Query
 - Apply Edits



Knowledge in the ArcGIS Maps SDK for JavaScript

Current Capabilities

- Web Link Charts
 - Create new link charts
 - Work with link chart portal items
-
- Link Analysis Tools
 - Expand
 - Connect
 - Filtered Find Path
 - Add/Remove Records

ArcGIS Maps SDK for JavaScript

Home Sample Code Refe

Search topics

Color
config
geometry
Graphic
Ground
Intl
kernel

WebLinkChart

AMD: `require(["esri/WebLinkChart"], (WebLinkChart) => { /* code goes here */ });`

ESM: `import WebLinkChart from "@arcgis/core/WebLinkChart.js";`

Class: `esri/WebLinkChart`

Inheritance: `WebLinkChart` → `WebDocument2D` → `Map` → `Accessor`

Powered by Esri

Esri, TomTom, FAO, NOAA, USGS

Powered by Esri

View, "esri/layers/LinkChartLayer"],

the WebLinkChart instance

Demo



Demo

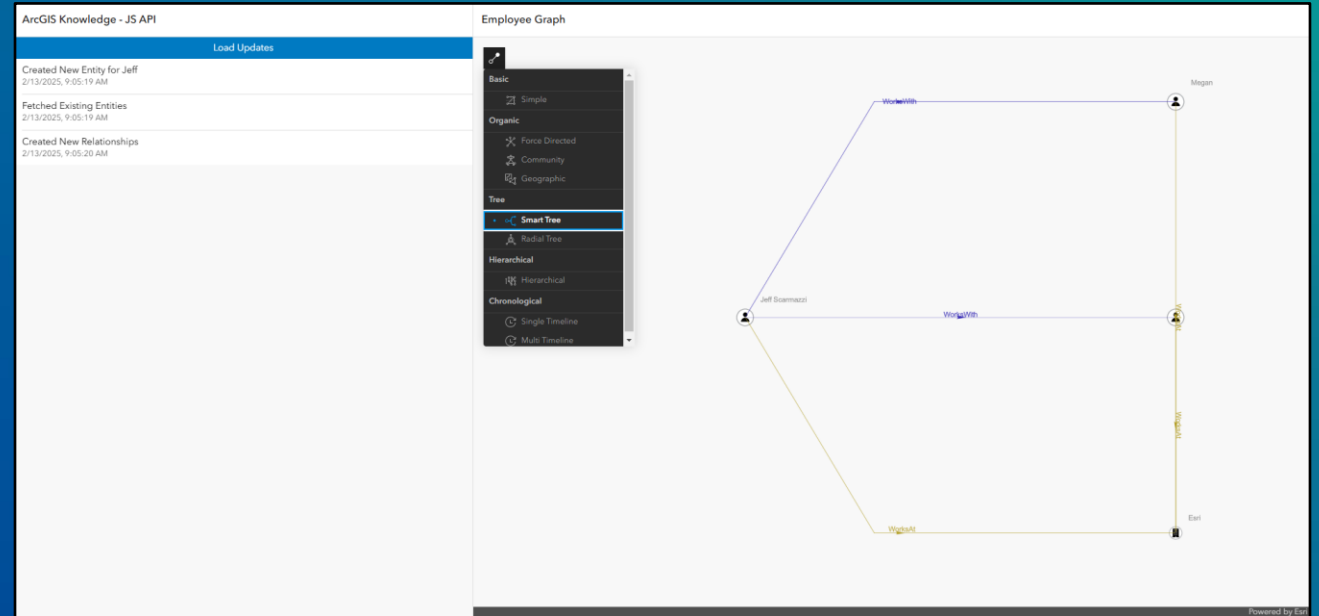
Link Chart Components with the JS SDK

```
linkChartComponent.addEventListener("arcgisViewReadyChange", (event) => {  
  
  webLinkChartView = event.target.view;  
  webLinkChart = event.target.map;  
  
  graphLayer = webLinkChart.activeLinkChartLayer;  
  
  loadButton.disabled = null;  
  graphPanel.loading = null;  
});
```

Fetch Link Chart component when ready.

```
await graphLayer.addRecords(records, {  
  cascadeAddRelationshipEndNodes: true,  
});  
  
const bufferedExtent = webLinkChart.diagramNodesExtent.expand(1.5);  
  
webLinkChartView.goTo(bufferedExtent, {  
  animate: true,  
  speed: 0.5,  
  easing: "ease-in",  
});
```

Add new records & update view for the client.



```
<calcite-panel heading="Employee Graph" id="graph-panel" loading>  
  <arcgis-link-chart  
    id="link-chart"  
    item-id="bdf1c5d9cb314607867d4e842485af8e"  
  >  
    <arcgis-link-chart-layout-switcher></arcgis-link-chart-layout-switcher>  
  </arcgis-link-chart>  
</calcite-panel>
```

Quickly develop pleasant interfaces with Calcite and Web Components for Link Charts. Reference these components in your code to create custom workflows for your clients.

Demo

Link Chart Components with the JS SDK

```
const knowledgeGraph = await KnowledgeGraphModule.fetchKnowledgeGraph(url);

// #region Create New Entity
const jeffEntity = new Entity({
  typeName: "Person",
  properties: {
    name: "Jeff Scarmazzi",
    role: "Senior Technical Consultant",
    shape: { ...
  },
});

const editResults = await KnowledgeGraphModule.executeApplyEdits(
  knowledgeGraph,
  {
    entityAdds: [jeffEntity],
  }
);

const jeffGUID = editResults.editResults[0].adds[0].id;
```

Create Entities in your Knowledge Graph

```
const nameResults = await KnowledgeGraphModule.executeQuery(
  knowledgeGraph,
  {
    openCypherQuery: `
      WITH ['Megan', 'Tim'] as names
      MATCH (n: Person)
      WHERE n.name in names
      RETURN n
    `,
  },
);
```

```
let relationships = [];

nameResults.resultRows.forEach((row) => {
  const personGUID = row[0].properties.globalid;

  relationships.push(
    new Relationship({
      typeName: "WorksWith",
      originId: jeffGUID,
      destinationId: personGUID,
      properties: {},
    })
  );
});

const jeff2Esri = new Relationship({ ...
});
relationships.push(jeff2Esri);

const relationshipResults = await KnowledgeGraphModule.executeApplyEdits(
  knowledgeGraph,
  {
    relationshipAdds: relationships,
  }
);
```

Create Relationships in your Knowledge Graph

Resources

Knowledge in the ArcGIS Maps SDK for JavaScript

- Documentation

- <https://developers.arcgis.com/javascript/latest/knowledge-graph/knowledge-graph-intro/>
- <https://developers.arcgis.com/javascript/latest/api-reference/esri-rest-knowledgeGraphService.html>
- <https://developers.arcgis.com/javascript/latest/api-reference/esri-WebLinkChart.html>

- Samples

- <https://developers.arcgis.com/javascript/latest/sample-code/knowledgegraph-query/>
- <https://developers.arcgis.com/javascript/latest/sample-code/knowledgegraph-search/>
- <https://developers.arcgis.com/javascript/latest/sample-code/knowledgegraph-appliedits/>
- <https://developers.arcgis.com/javascript/latest/sample-code/linkchart/>
- <https://developers.arcgis.com/javascript/latest/sample-code/knowledgegraph-knowledgegraphlayer/>

Sessions Including ArcGIS Knowledge

- Tuesday 3/11

- 01:00 PM - 02:00 PM : Introduction to Knowledge Graphs & Data Engineering (Mesquite C)

- Wednesday 3/12

- 08:30 AM - 10:30 AM : Dev & Tech Summit Plenary (Oasis 3-4)

- Thursday 3/13

- 04:00 PM - 05:00 PM : ArcGIS Pro: The Road Ahead (Sierra)
- 05:30 PM - 06:30 PM : Building Web Applications with ArcGIS Knowledge (Smoketree C)

- Friday 3/14

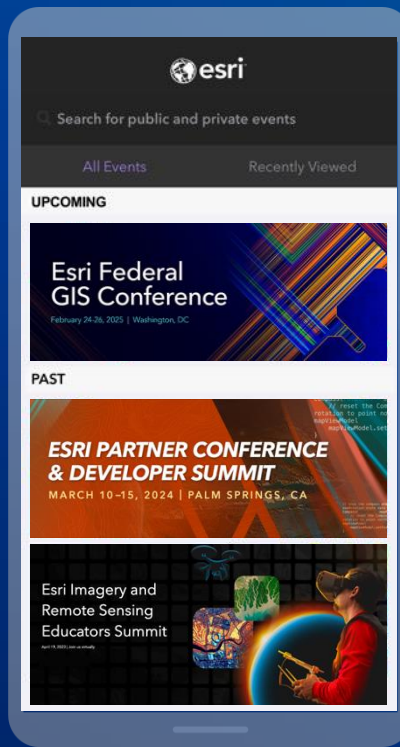
- 08:30 AM - 09:30 AM : ArcGIS Pro SDK for .NET: Introduction to the Knowledge Graph API (Mesquite B)

Questions

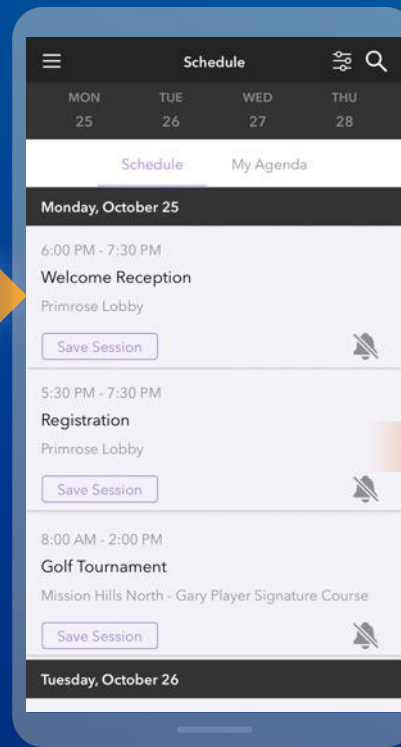


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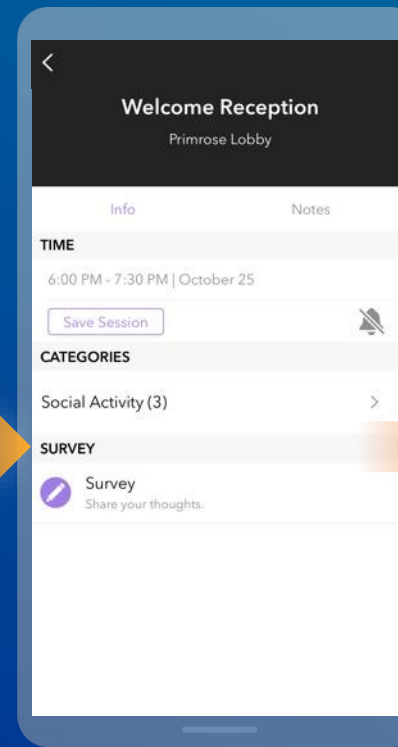
Download the Esri Events app and find your event



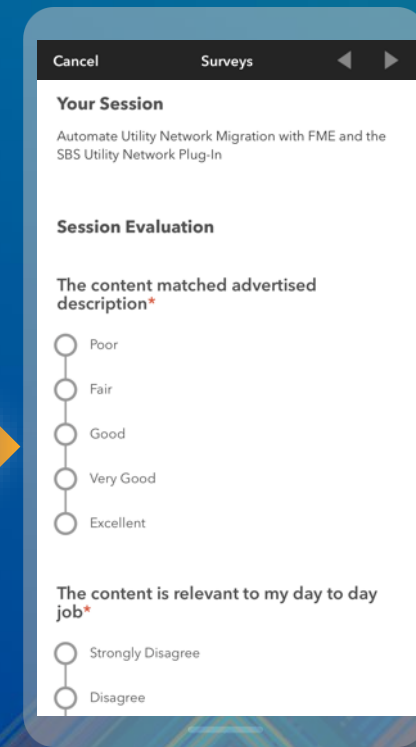
Select the session you attended



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Log in to access the survey





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OF
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