



ArcGIS Runtime SDKs

Building Offline Applications

Rama Chintapalli

Justin Colville

**GIS
INSPIRING
WHAT'S
NEXT**


Design for connectivity

Make connectivity as part of the application strategy

Connected

Disconnected

Occasionally connected

- Temporary interruptions due connection problems
 - Plan work as if in disconnected environment
- 

ArcGIS Runtime capabilities

You can leverage variety of capabilities with ArcGIS Runtime

- View and interact with maps
- Query data
- Synchronize features
- Edit features
- Find places and locations
- Solve routes and get directions
- Analysis (geoprocessing)

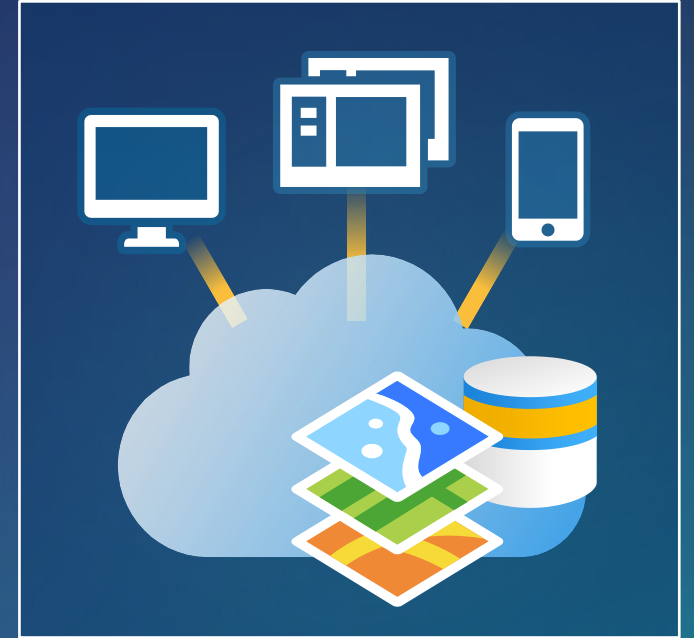
What we are covering and what not

- We are focusing on **maps** and the new workflows
 - Previously working with layers and tables directly
 - Focus moved to map instead
- Support for offline data formats **hasn't gone anywhere**
 - Tile packages, Vector tile packages, Rasters, Geodatabases
- Even **more** data types are now supported with extra functionality
 - OGC GeoPackages, Shapefiles, Electronic Navigational Chart (ENC)
 - Vector tiles export

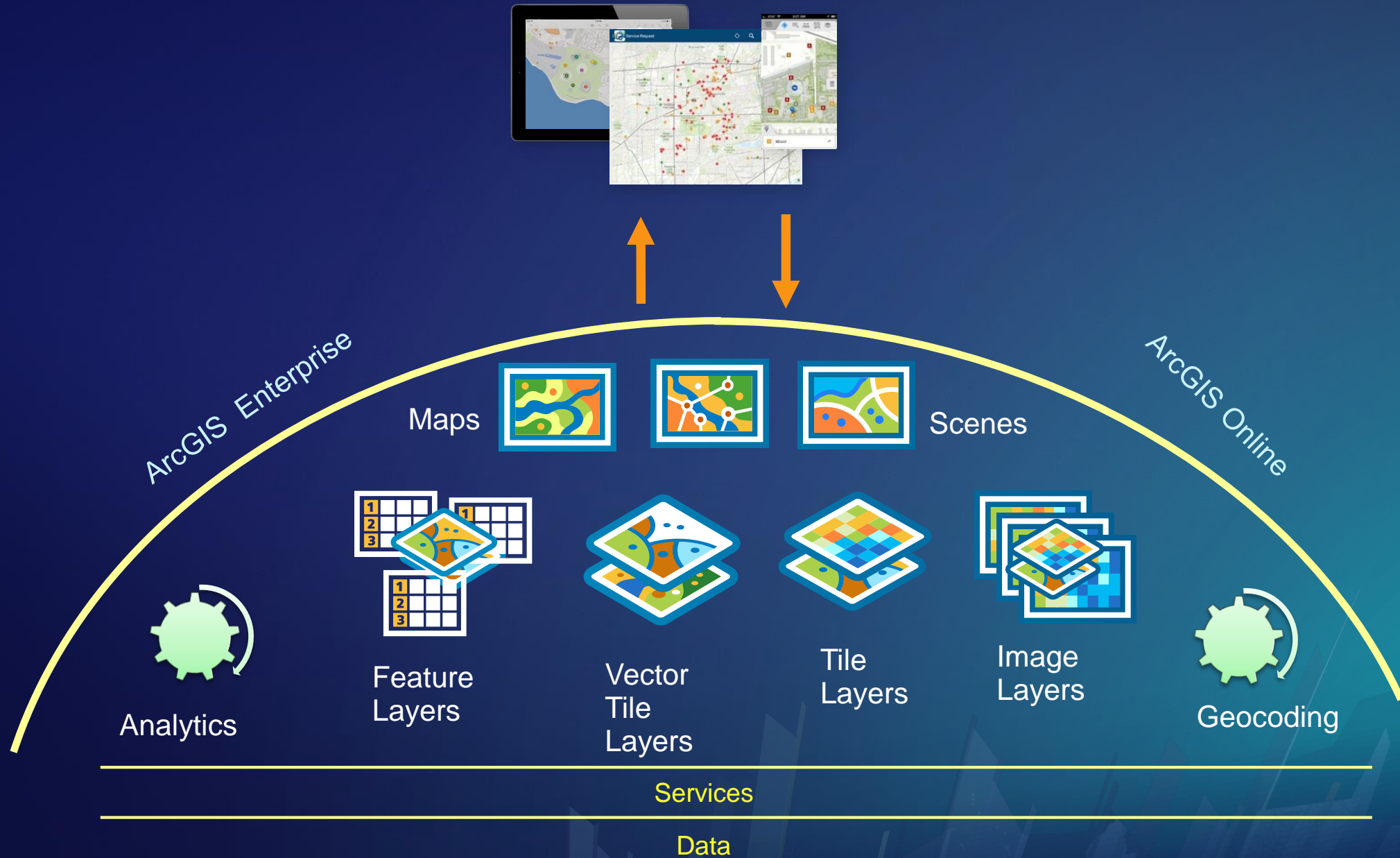
Check previous session recording from videos.esri.com
search term : ArcGIS Runtime: Working with Maps Online and Offline

What is a map?

- **Central** concept in ArcGIS
- Can be **shared** between multiple applications
- Contains
 - Basemaps
 - Operational Layers
 - Symbology
 - Popups
 - Metadata
- Authoring is done usually outside of Runtime
 - Can be updated outside of client application update cycle

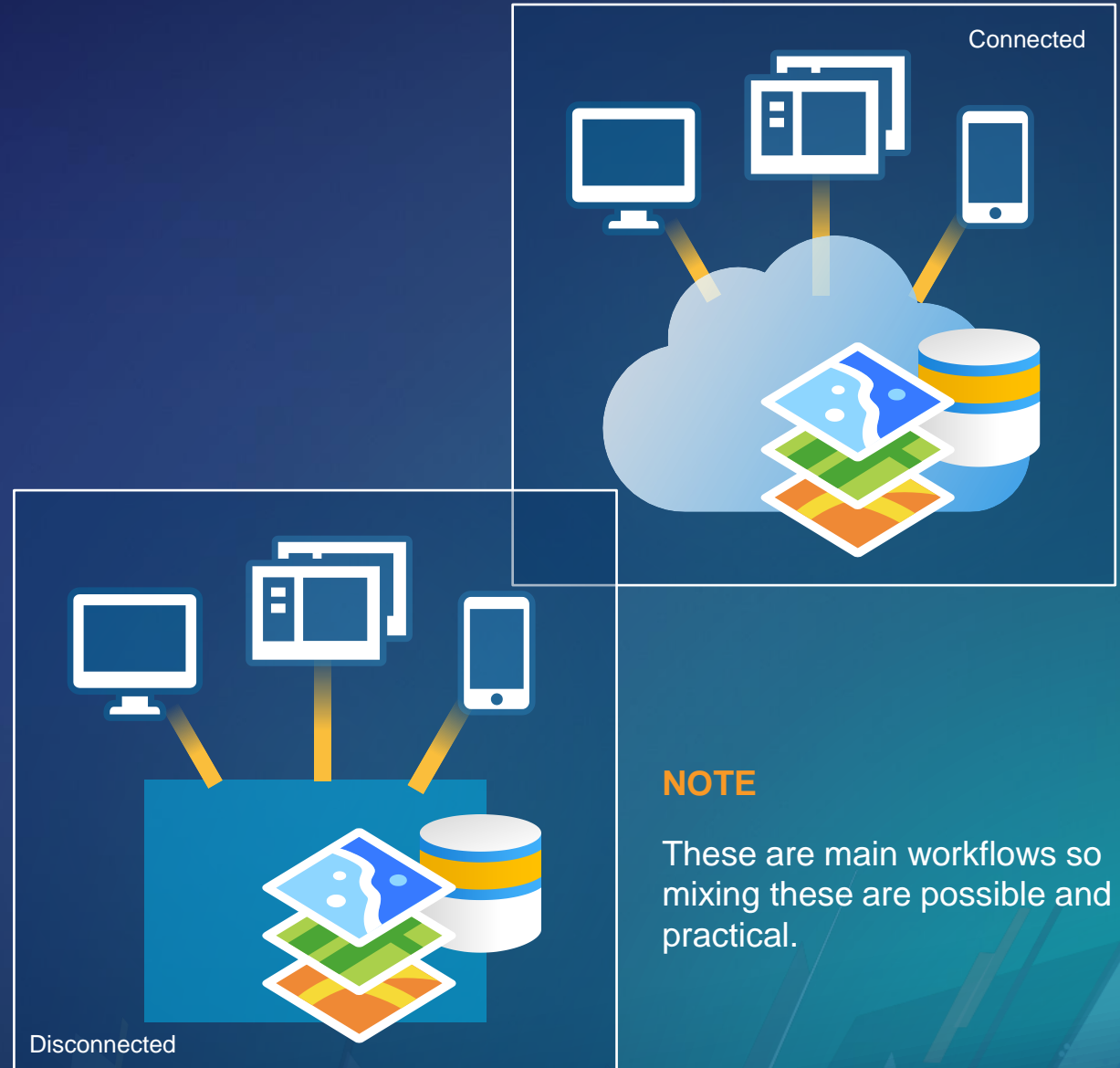


The ArcGIS Platform Information Model



Maps workflows

- **Connected** maps
 - Distributed through Portals
- **Preplanned** map areas
 - Prepackaged using ArcGIS API for Python or Geoprocessing tools
 - Downloaded using ArcGIS Runtime
- **On-demand** map areas
 - Generated and downloaded on request basis
- **Fully disconnected** maps
 - Authored using ArcGIS Pro
 - Side loaded to the devices



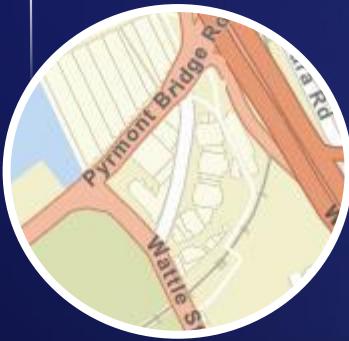
NOTE

These are main workflows so mixing these are possible and practical.

Working with offline maps

Supported data types

Vector
tiles



Raster
tiles



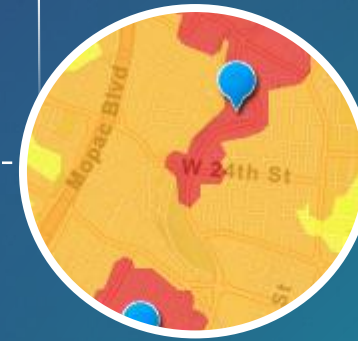
Features



Tables

	Status	
	Provincial capital	14,608,51.00
	National and provincial capital	13,076,300.00
.NI	Provincial capital	12,691,836.00
PK	Provincial capital	11,624,219.00
MX	National and provincial capital	11,285,654.00
TU	Provincial capital	11,174,257.00
	Provincial capital	10,927,986.00
	National and provincial capital	10,444,527.00
	National and provincial capital	10,390,000.00

Feature
collections



Enable for offline

NOTE

You can enable offline mode on publishing time or from the service management tools.

- Service authors has to enable support for offline use
 - Raster and Vector Tile Services

Offline Mode

☒ Allow this layer to be downloaded and used in an offline map.

- Feature services

Editing

☒ Enable editing.

☐ Keep track of created and updated features.

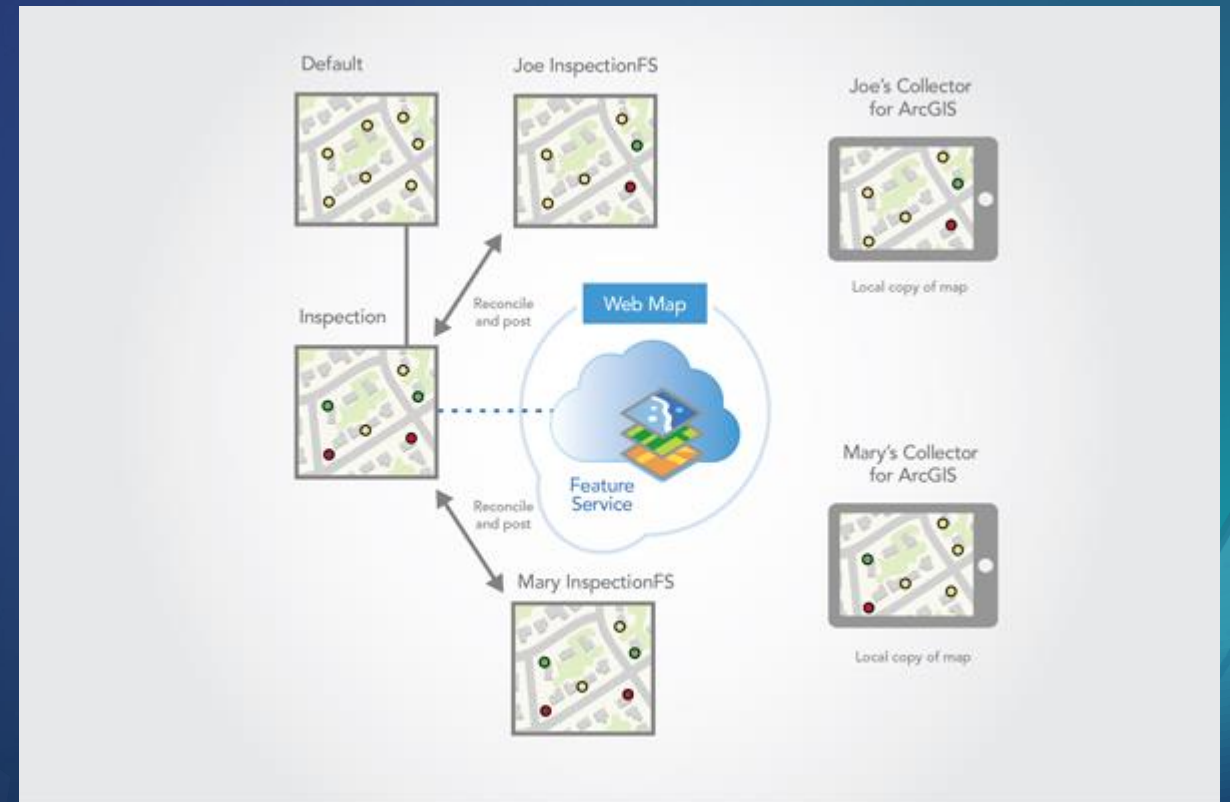
☒ Keep track of who created and last updated features.

☒ Enable Sync (disconnected editing with synchronization).

- Locators and Network datasets have to be side loaded to the device

Working with versions on ArcGIS Enterprise

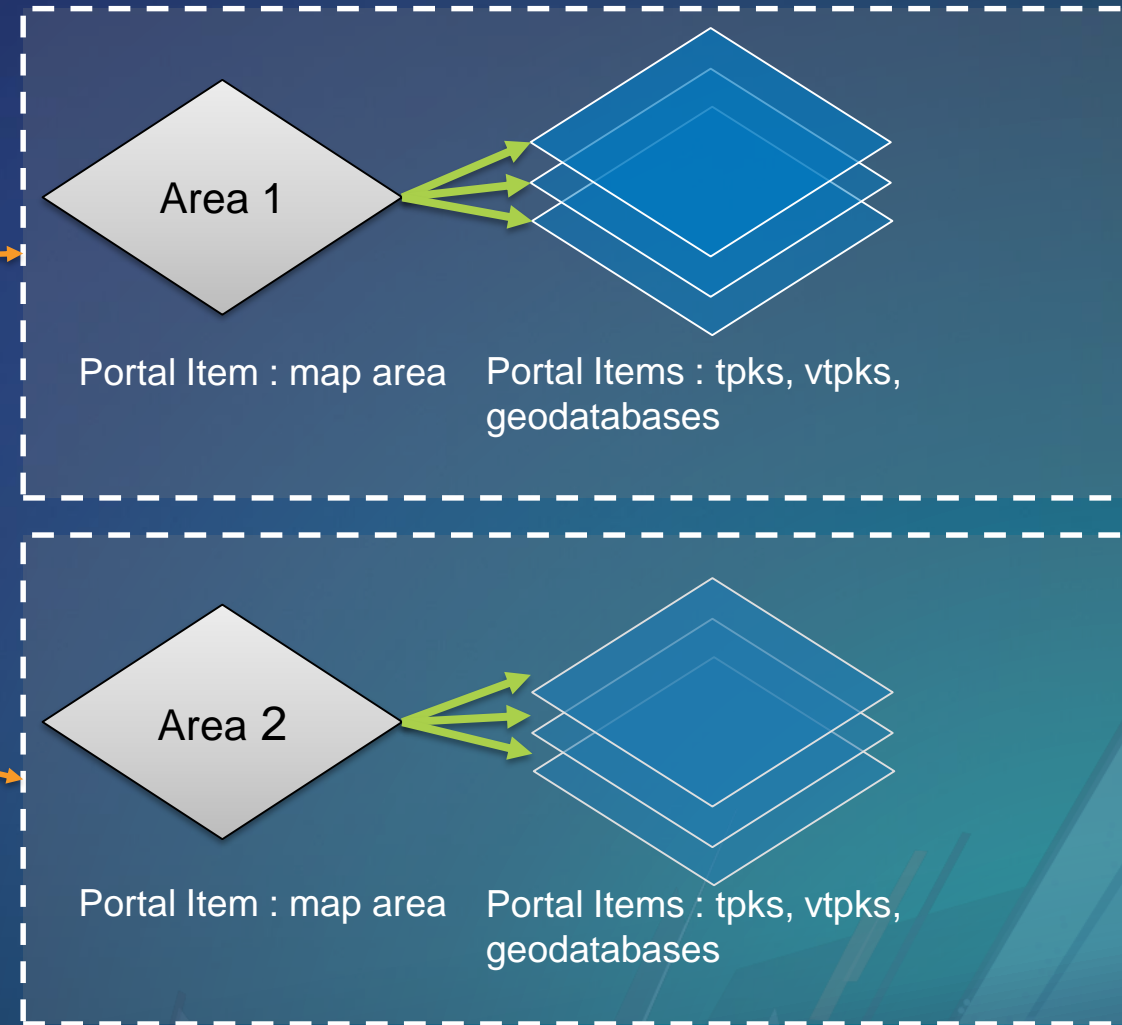
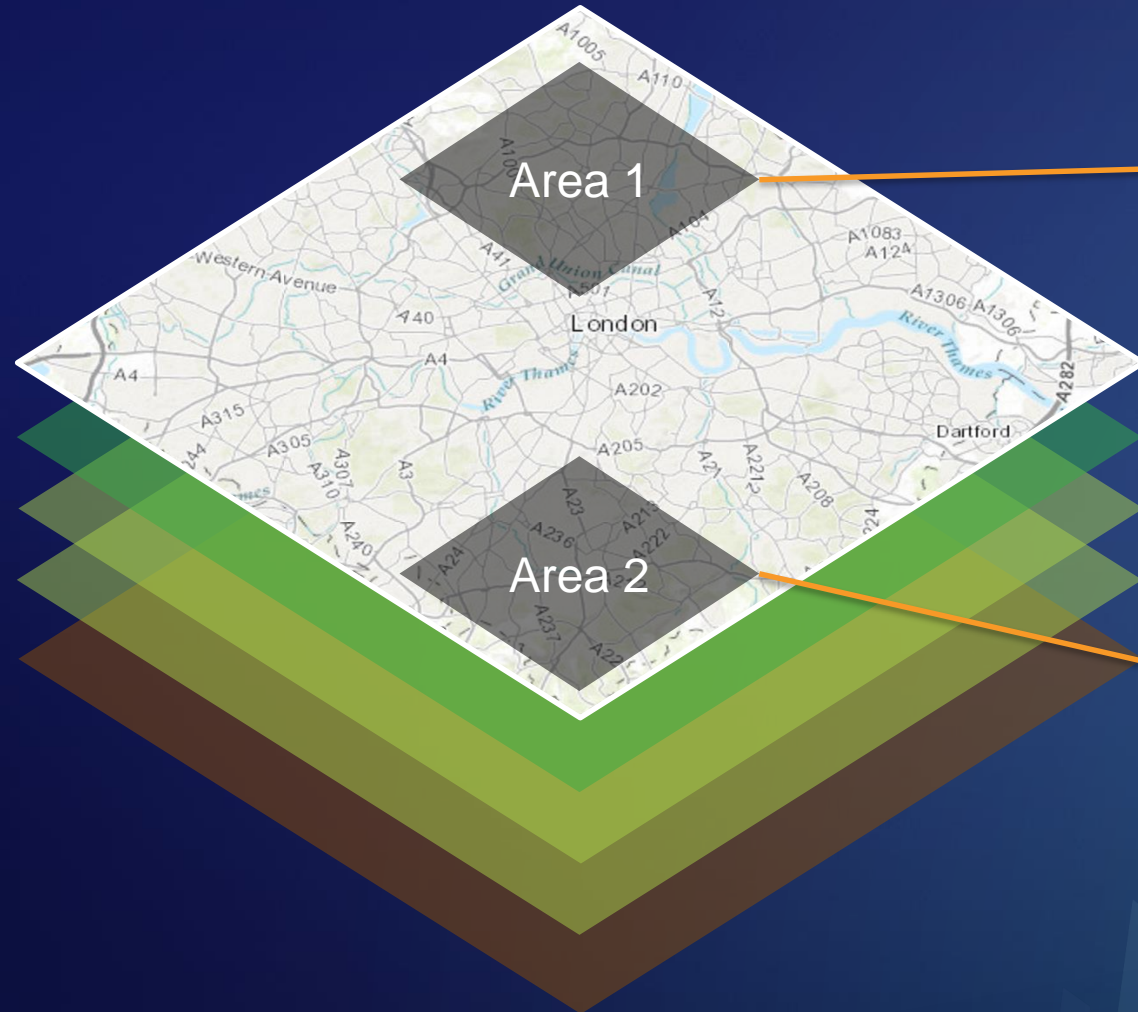
- Create a version for each offline map
- Create a version for each user
- Back-end reconcile and post procedure required



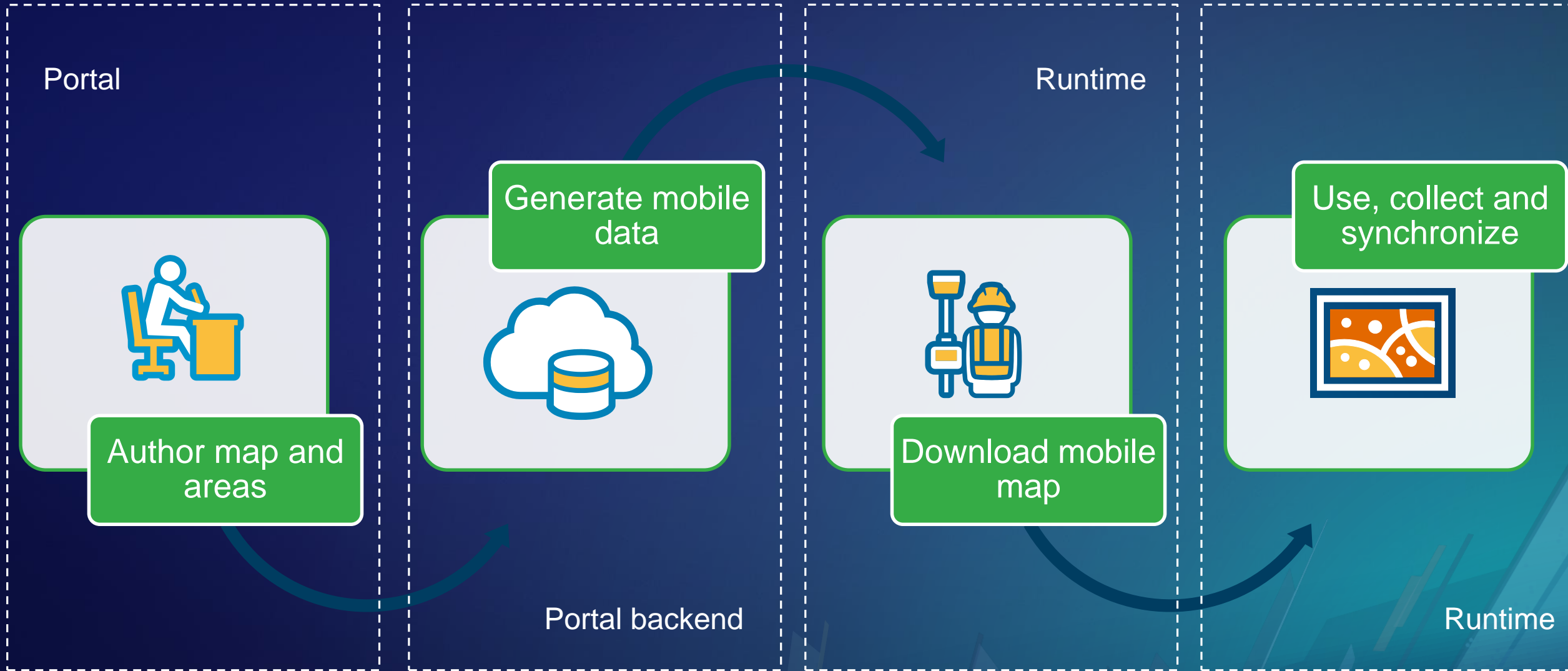
Preplanned workflow

The background is a solid dark blue. In the top-left corner, there are several diagonal lines in shades of teal and light blue. In the bottom-right corner, there is a complex geometric pattern featuring overlapping rectangles and lines in teal, orange, and light blue, creating a sense of depth and movement.

Preplanned map areas



Preplanned workflow





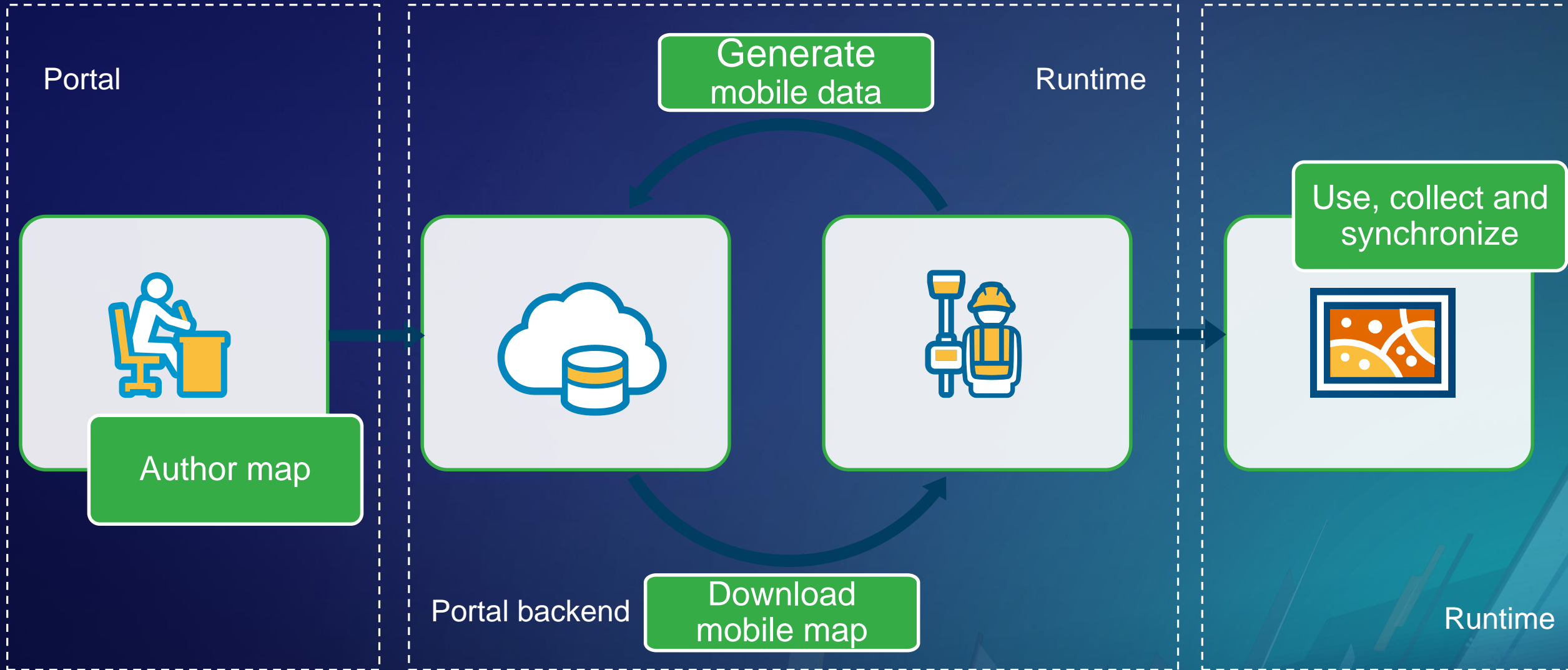
Authoring and using preplanned map areas

ArcGIS Runtime for .NET 100.2.1

```
// Create task that is used to access the area information and download functionality
var task = await OfflineMapTask.CreateAsync(Map);
// Get areas that are created for the map
var areas = await task.GetPreplannedMapAreasAsync();
// Create job that handles the download operation. Remember to took progress indication
// if that is needed and log messages for debugging
var job = task.DownloadPreplannedOfflineMap(areas.First(), offlineDataFolder);
// Start download and wait until the area is downloaded
var results = await job.GetResultAsync();
// Use results. Remember to check possible errors as well.
Map = results.OfflineMap;
```

On demand workflow

On-demand workflow





Take map offline on-demand

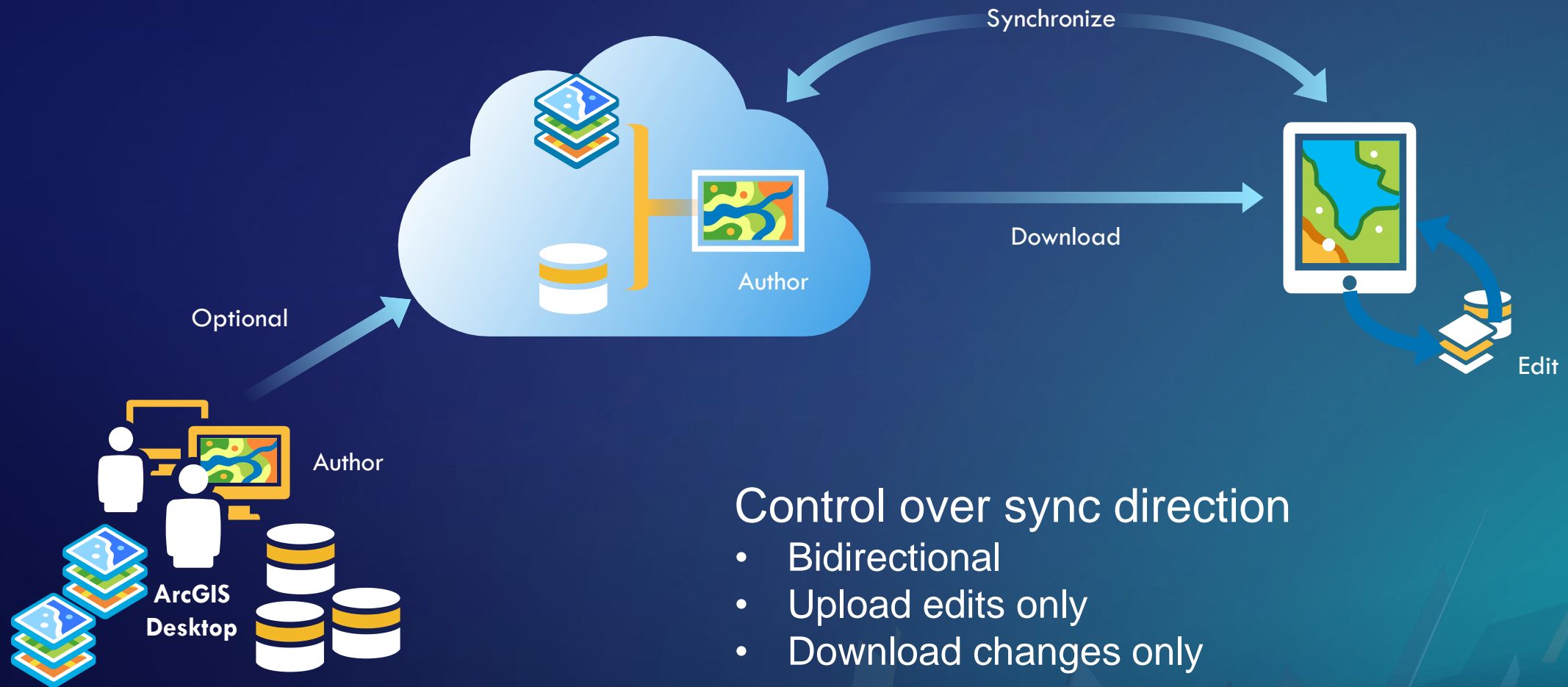
ArcGIS Runtime for .NET 100.2.1

```
// Create task that is used to generate offline area
var task = await OfflineMapTask.CreateAsync(Map);
// Create parameters. By default all levels of details are included.
var parameters = await task.CreateDefaultGenerateOfflineMapParametersAsync(
    areaOfInterest);
// Create job that handles the generation and download operations.
// Remember hook progress if that is needed and log messages for debugging
_job = task.GenerateOfflineMap(parameters, offlineDataFolder);
_job.ProgressChanged += ProgressChanged;
// Start generation and wait until area is downloaded
var results = await _job.GetResultAsync();
// Use results. Remember to check possible errors as well.
Map = results.OfflineMap;
```

Offline based editing

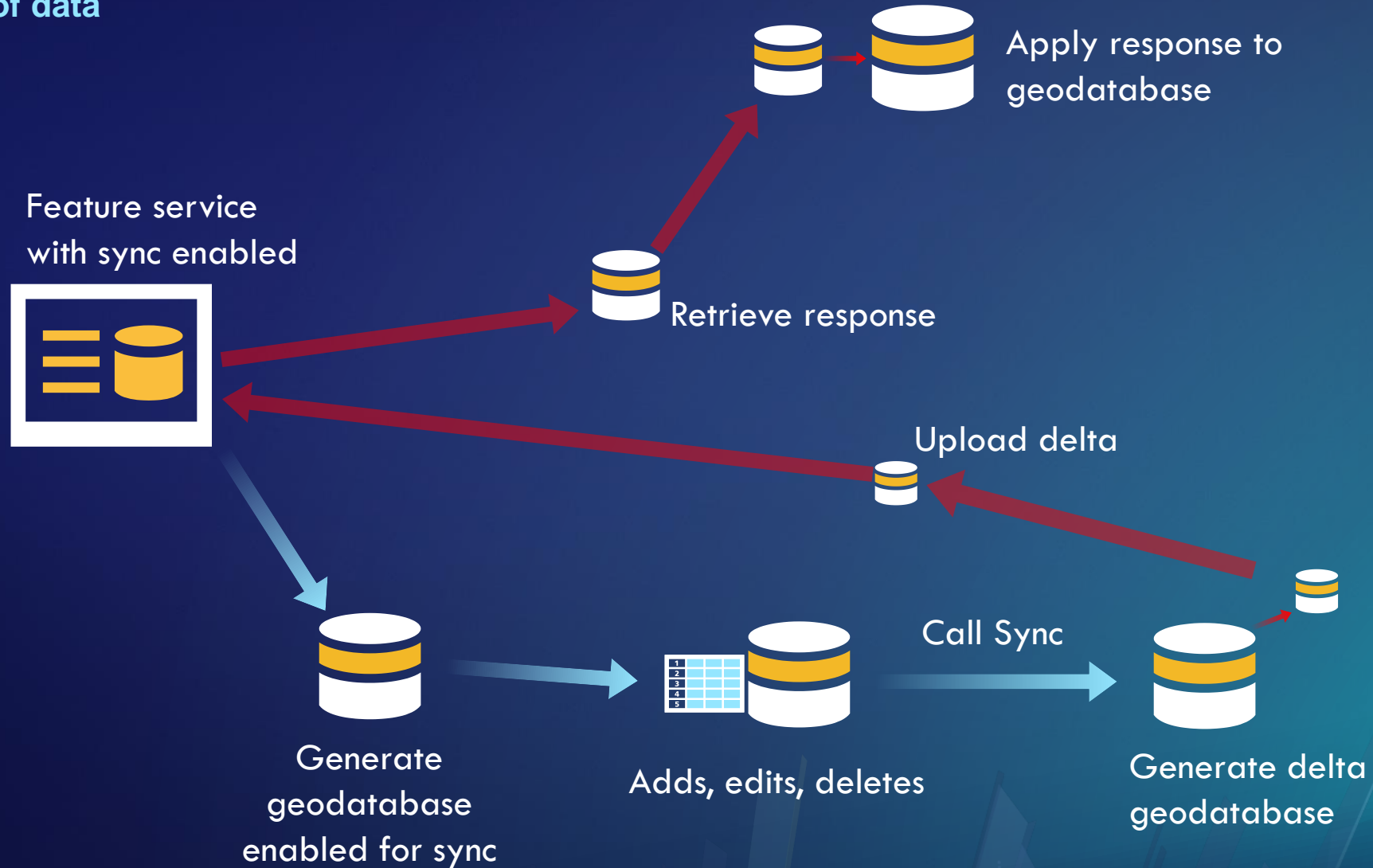
Working with sync and geodatabases

ArcGIS Online – Editing Offline



How Does Sync Work?

The flow of data



Synchronizing map

OfflineMapSyncTask

- Targets every feature layer in the map
- Simplifies usage
- Restricts options
- Designed to work with **OfflineMapTask**

```
// Create task that is used to synchronize the offline map
var task = await OfflineMapSyncTask.CreateAsync(Map);
// Set sync direction
var parameters = new OfflineMapSyncParameters()
{
    SyncDirection = SyncDirection.Bidirectional,
};

// Create job that does the work asynchronously
var job = task.SyncOfflineMap(parameters);
job.ProgressChanged += OnProgressChanged;

// Run sync and continue when it is finished
var results = await job.GetResultAsync();
// Handle errors
if (results.HasErrors)
{
    // handle nicely
}
```



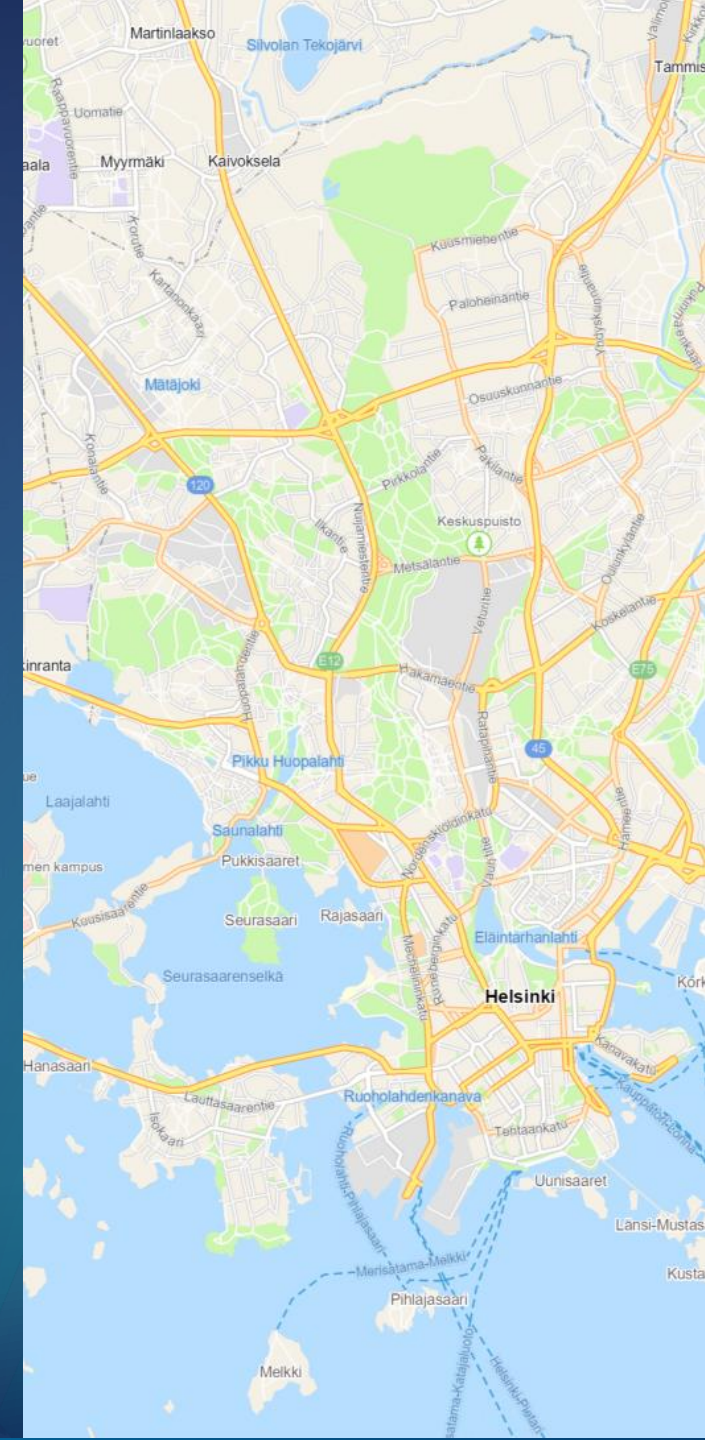
Synchronizing map


ArcGIS Runtime for .NET 100.2.1

Working with disconnected maps

Desktop pattern

- **Read-only** workflow
- **Mobile Map Packages** authored with ArcGIS Pro
- Locators and network dataset needs to be created with this pattern
- Has to be **side loaded** to the clients
- **Street Map Premium for ArcGIS** offers very good dataset for disconnected scenarios
 - Contains basemap
 - Locator
 - Network dataset



An abstract graphic on the left side of the slide. It features a dark blue background with a complex arrangement of overlapping, semi-transparent map layers. These layers include various map features such as roads, rivers, and land parcels. Overlaid on these map layers are numerous colorful, geometric shapes in shades of blue, green, orange, red, and purple. These shapes appear as if they are floating or layered on top of the map, creating a sense of depth and complexity. The overall effect is a dynamic and modern representation of geographic information.

Authoring and using a mobile map package

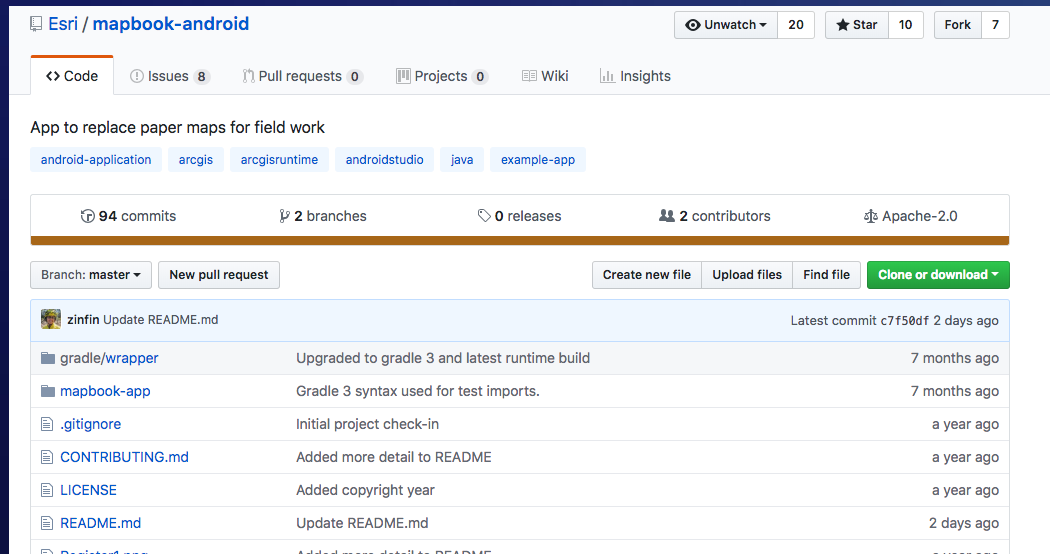
ArcGIS Runtime for Android

Summary

- Preplanned workflow is **complementing** the offline story – not replacing it
 - Use **Preplanned workflow** if you can plan the work and/or the work is done in the same areas
 - Use **On-demand workflow** if you need to provide support for ad-hoc offline work
- Try to adapt the **WebGIS pattern** since it is the most versatile way to provide maps that works well both in online and offline modes
- Take the **connectivity design as a core requirement** for your system and applications
- Hybrid approaches work well – choose the approach based on **YOUR** requirements

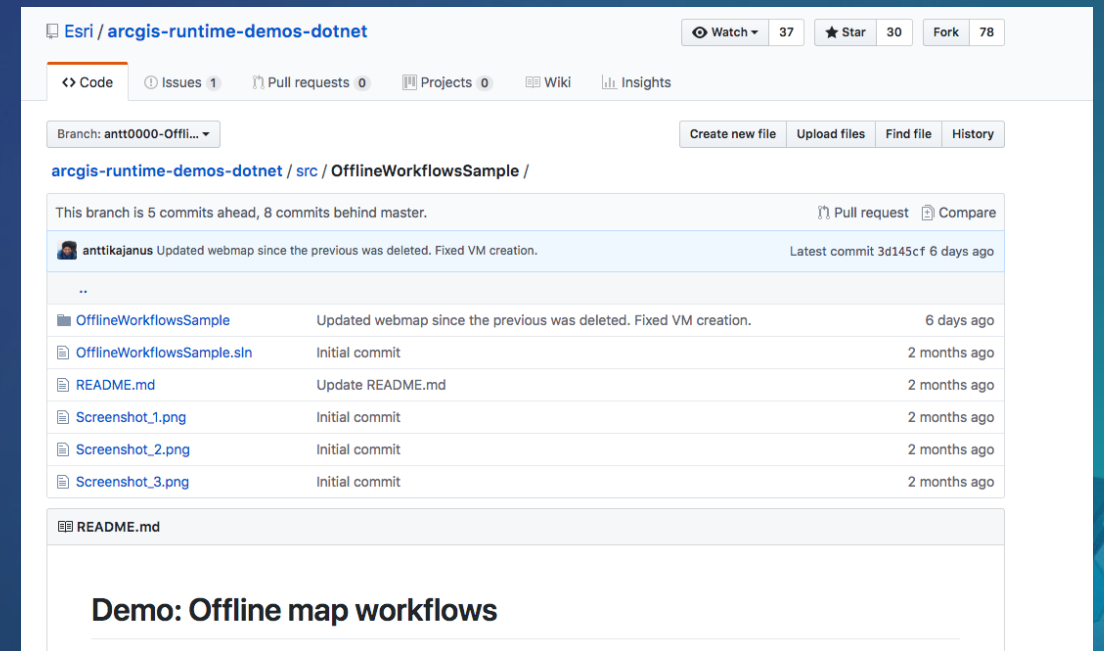
Get the code now

- <https://github.com/Esri/arcgis-runtime-demos-dotnet/tree/antt0000-OfflineWorkflowSample>
- <https://github.com/Esri/mapbook-android>



The screenshot shows the GitHub repository page for `Esri / mapbook-android`. The repository is described as "App to replace paper maps for field work". It has 94 commits, 2 branches, 0 releases, 2 contributors, and is licensed under Apache-2.0. The current branch is `master`. The file list includes:

File	Description	Time
zinfan Update README.md	Latest commit c7f50df 2 days ago	
gradle/wrapper	Upgraded to gradle 3 and latest runtime build	7 months ago
mapbook-app	Gradle 3 syntax used for test imports.	7 months ago
.gitignore	Initial project check-in	a year ago
CONTRIBUTING.md	Added more detail to README	a year ago
LICENSE	Added copyright year	a year ago
README.md	Update README.md	2 days ago
Register1.png	Added more detail to README	3 years ago



The screenshot shows the GitHub repository page for `Esri / arcgis-runtime-demos-dotnet`. The current branch is `antt0000-OfflineWorkflowSample`. The repository has 37 watchers, 30 stars, and 78 forks. The file list includes:

File	Description	Time
OfflineWorkflowsSample	Updated webmap since the previous was deleted. Fixed VM creation.	6 days ago
OfflineWorkflowsSample.sln	Initial commit	2 months ago
README.md	Update README.md	2 months ago
Screenshot_1.png	Initial commit	2 months ago
Screenshot_2.png	Initial commit	2 months ago
Screenshot_3.png	Initial commit	2 months ago

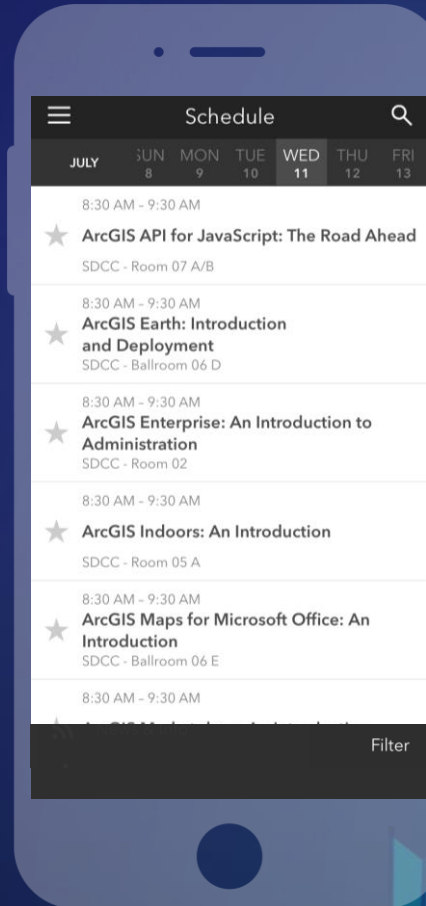
The `README.md` file content is visible, showing the title "Demo: Offline map workflows".

Please Take Our Survey on the App

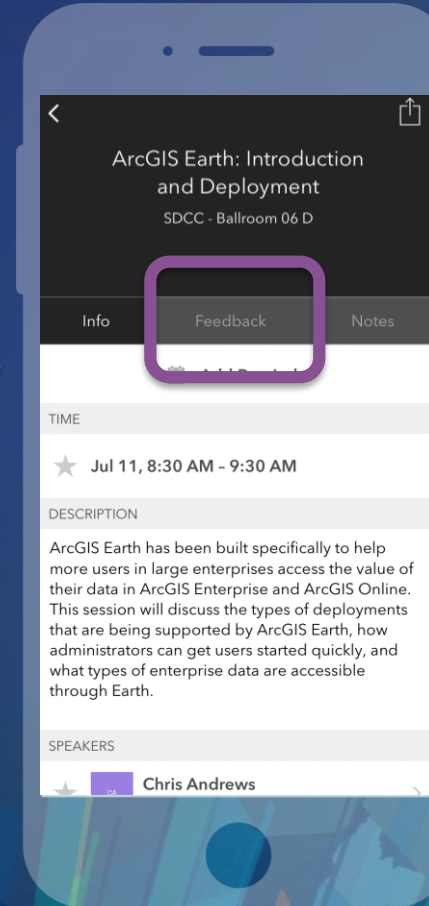
Download the Esri Events app and find your event



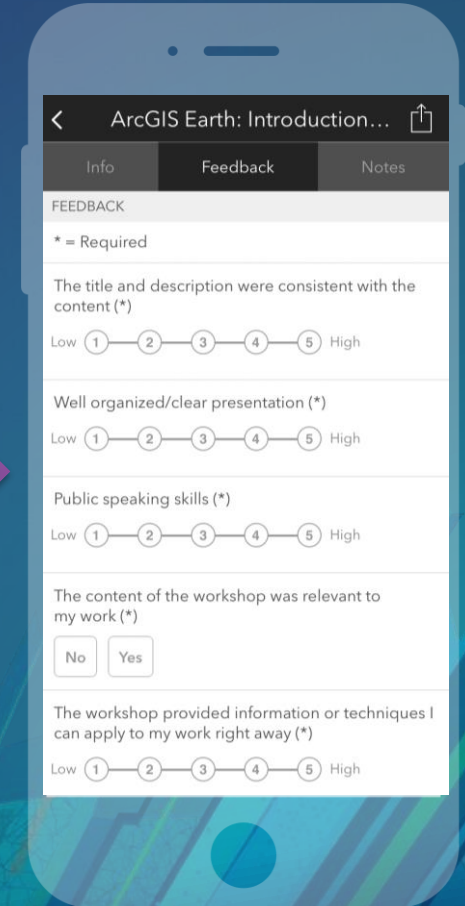
Select the session you attended



Scroll down to find the feedback section



Complete answers and select "Submit"





esri

THE
SCIENCE
OF
WHERE