ArcGIS Pro SDK for .NET Understanding Feature Services, a Guide for Developers

Charlie Macleod

Russell Brennan

2019 ESRI DEVELOPER SUMMIT
Palm Springs, CA

Agenda

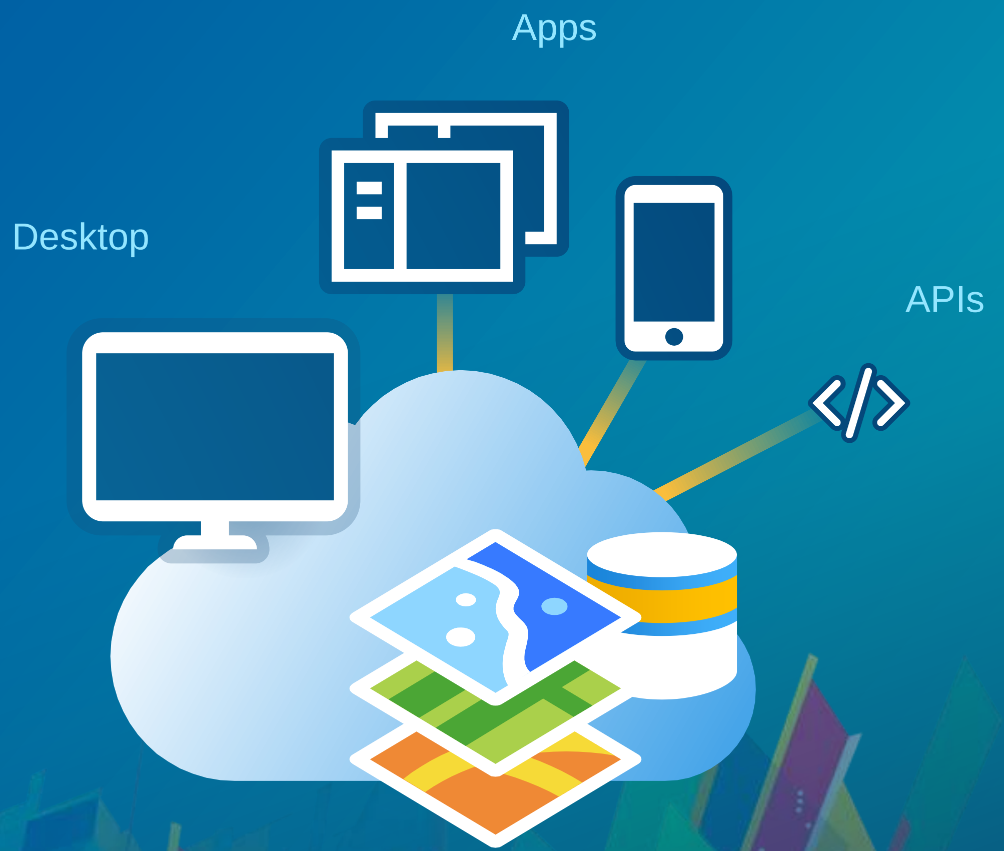
- Feature Service Overview
- General Info
- Branch Versioning
- Editing Feature Services
- Special Considerations

- Please silence your cell phones

Feature service overview

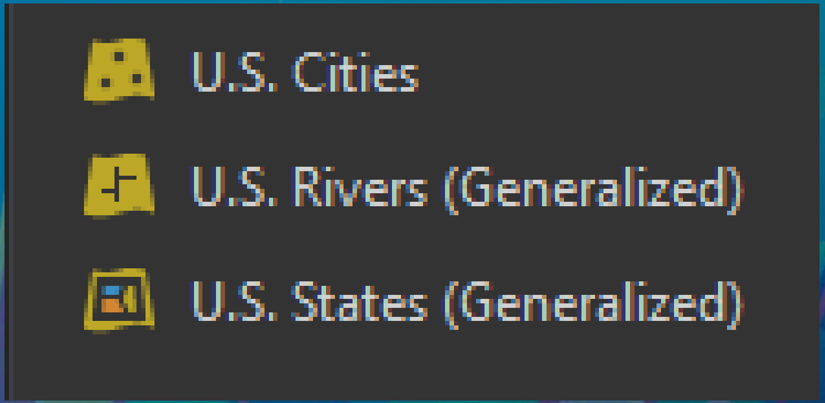
Feature services

- Platform feature access
- Access via
  - Web Browser
  - Desktop
  - Apps
- Branch versioning
- Distributed/disconnected editing via Sync
- Utility Networks
- Parcel Fabrics



Feature services

- Contain layers and tables
- Allows query and edit of feature geometry and attributes.
- Queries and edits are made via REST requests
- Platform naming:
  - web feature layers
  - sometimes just web layers
  - 1 web feature layer can have many sub layers
- Service naming:
  - 1 feature service can have many layers


U.S. Cities
U.S. Rivers (Generalized)
U.S. States (Generalized)

What types of data are supported?

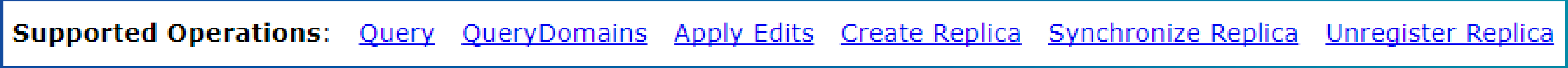
- Data structures supported by all feature services
  - Points
  - Lines
  - Polygons
  - Relationship classes
  - Attachments…
- Some feature services support more complex data
  - Utility Network, Annotation, Dimensions (10.7)
  - Parcel Fabric (coming soon)
  - Future ?

What else is included?

- Layers from a feature service contain more than just the row data
  - Renderer, symbols, etc.
  - Editing templates
  - Field visibility
  - Definition queries
  - Other layer properties…

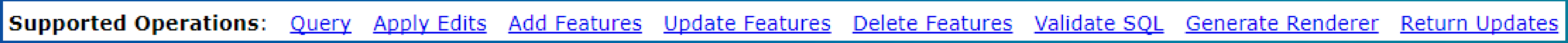
Feature Service REST API

- Operations on Service:



Supported Operations: Query QueryDomains Apply Edits Create Replica Synchronize Replica Unregister Replica

- Operations on Layer:



Supported Operations: Query Apply Edits Add Features Update Features Delete Features Validate SQL Generate Renderer Return Updates

- Service JSON (service resource)

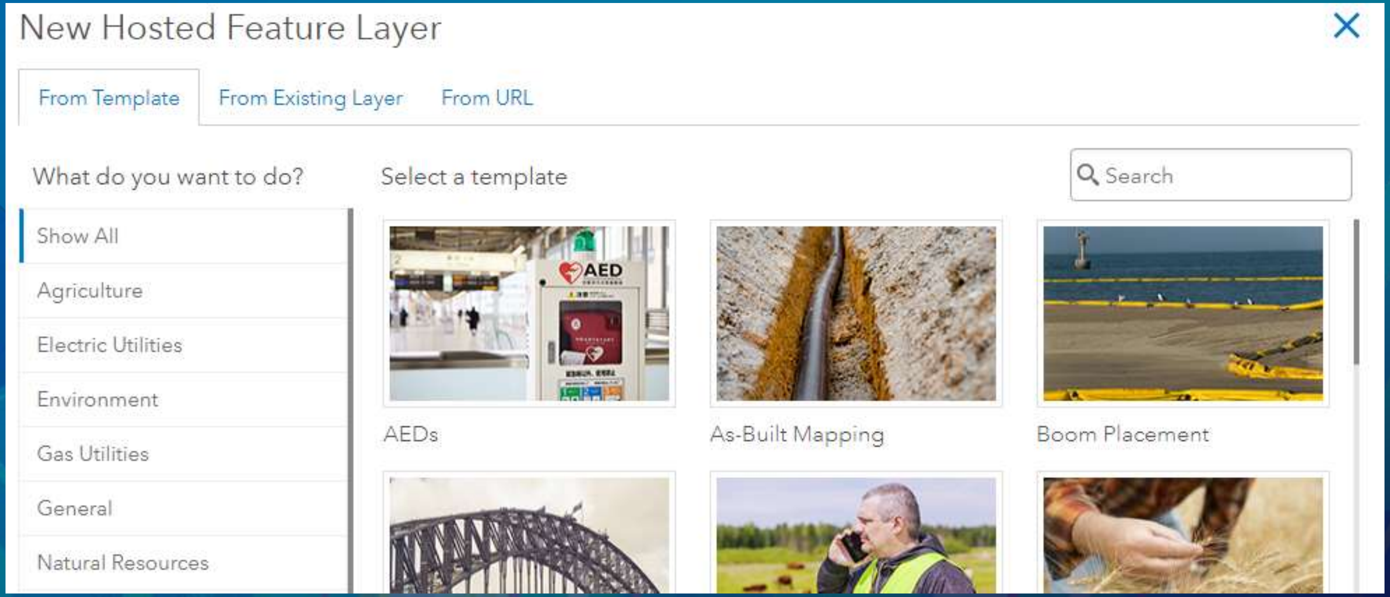
  https://< server >/server/rest/services/TrueCurveTest/FeatureServer?f=pjson

- Layer JSON (layer resource)

  https://< server >/server/rest/services/<service name>/FeatureServer/0?f=pjson

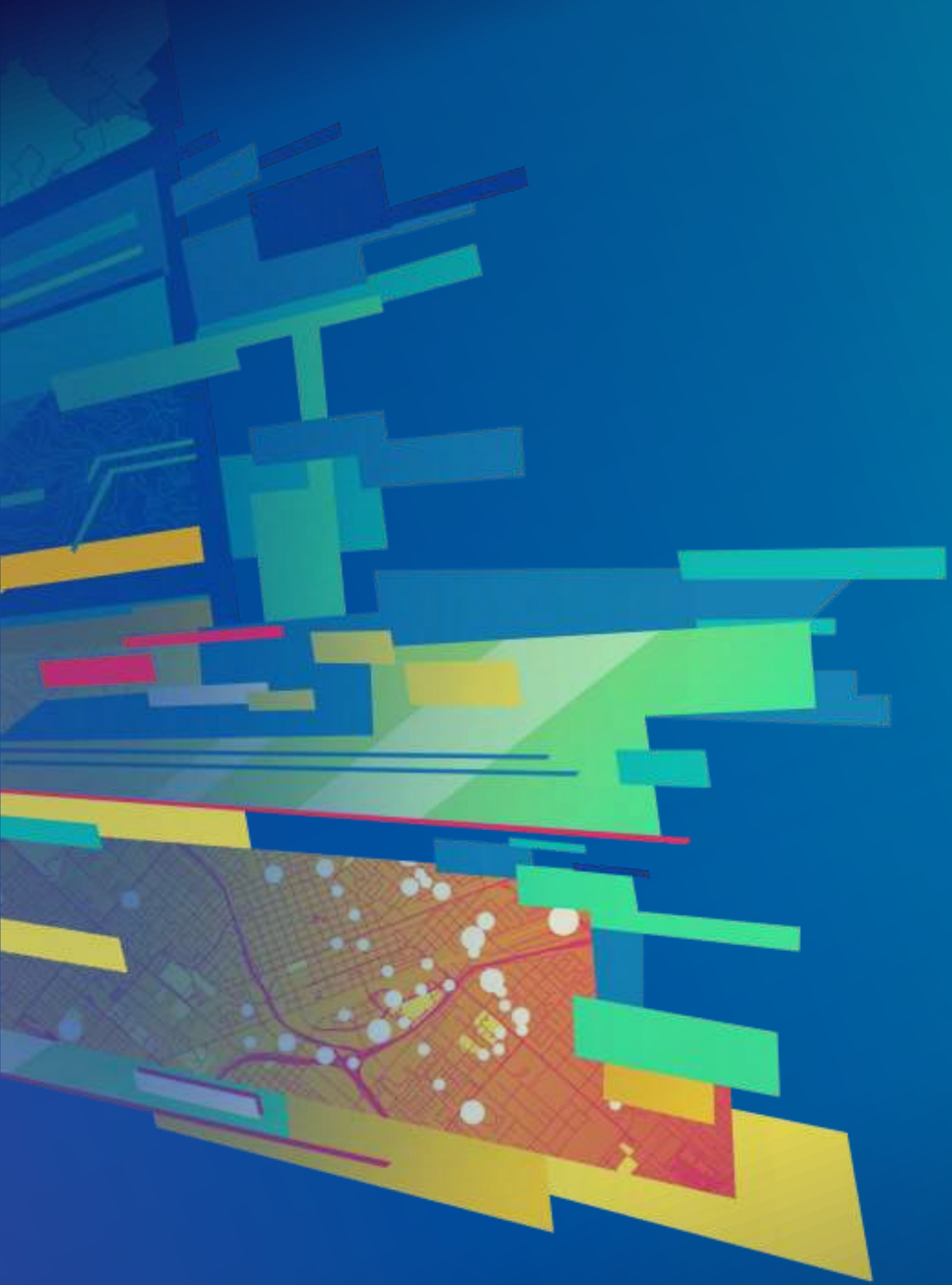
How do you create a feature service?

- Publishing from Pro or ArcMap
- REST
  - Upload SD files & making requests to publish
- Python API
- In Portals you can also:
  - Upload a file geodatabase
  - Upload an SD file
  - Create from another service
  - Create from a template



Using feature services in ArcGIS Pro

- Our goal is a seamless user experience
- Developers write code as though it were any other data source
  - Supports objects you would expect in a geodatabase data source
    - cursors, feature classes, dataset definitions, connection properties, etc.
- *In general*, code written for any data store will work for feature services



Demo

Basics - Creating connections

Creating Feature Service Layers in the Pro SDK

- **ArcGIS.Desktop.Mapping:**
  - `LayerFactory CreateLayer()` overloads*
    - Provide the service URI
  - `CreateLayer()` returns:
    - A GroupLayer if the end-point URI points to the service
      - Contains a feature layer added for each layer defined on the service
      - Adds any stand-alone tables for each table defined on the service
    - A FeatureLayer if the end-point URI includes a layer id

*`StandaloneTableFactory CreateTable()` for non-spatial tables

Creating Feature Service Layers in the Pro SDK

- **LayerFactory example:**

```
var hosted = @"https://<server1>/server/rest/services/Hosted/Foo/FeatureServer";
var by_ref = @"https://<server1>/server/rest/services/Bar/FeatureServer";
var portal = @"https://<server2>/portal/home/item.html?id=GUID HERE";

await QueuedTask.Run(() =>  {
  var groupLyr1 = LayerFactory.Instance.CreateLayer(
                          new Uri(hosted, UriKind.Absolute), MapView.Active.Map);

  var groupLyr2 = LayerFactory.Instance.CreateLayer(
                          new Uri(by_ref, UriKind.Absolute), MapView.Active.Map);

  var groupLyr3 = LayerFactory.Instance.CreateLayer(
                      new Uri(portal, UriKind.Absolute), MapView.Active.Map, 0);
```

Creating Feature Service Layers in the Pro SDK

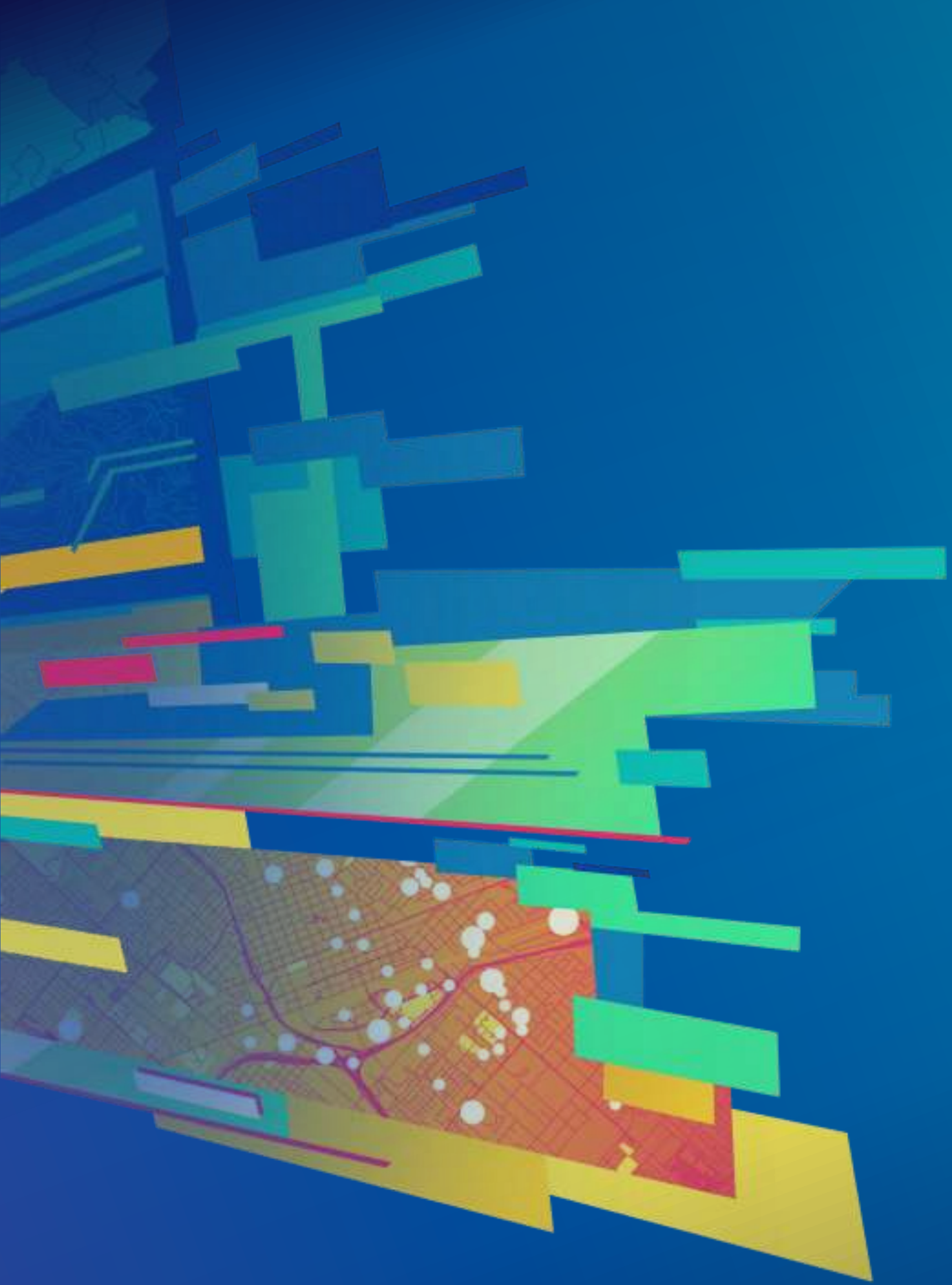
- ArcGIS.Core.Data
  - Connect to the `Geodatabase` via a `ServiceConnectionProperties` and the URI
    - Retrieve the relevant feature class(es) or table(es)
    - Use as the data source to LayerFactory or StandAloneTableFactory

```
//using ArcGIS.Core.Data

var url = @"https://<server1>/server/rest/services/Foo/FeatureServer";
await QueuedTask.Run(() =>  {

  var svc_props = new ServiceConnectionProperties(new Uri(url, UriKind.Absolute));
  var fs_db = new Geodatabase(svc_props);
  var dataset_name = ...;
  var fc = fs_db.OpenDataset<FeatureClass>(dataset_name);

  var featlayer = LayerFactory.Instance.CreateFeatureLayer(fc, MapView.Active.Map, 0);
```



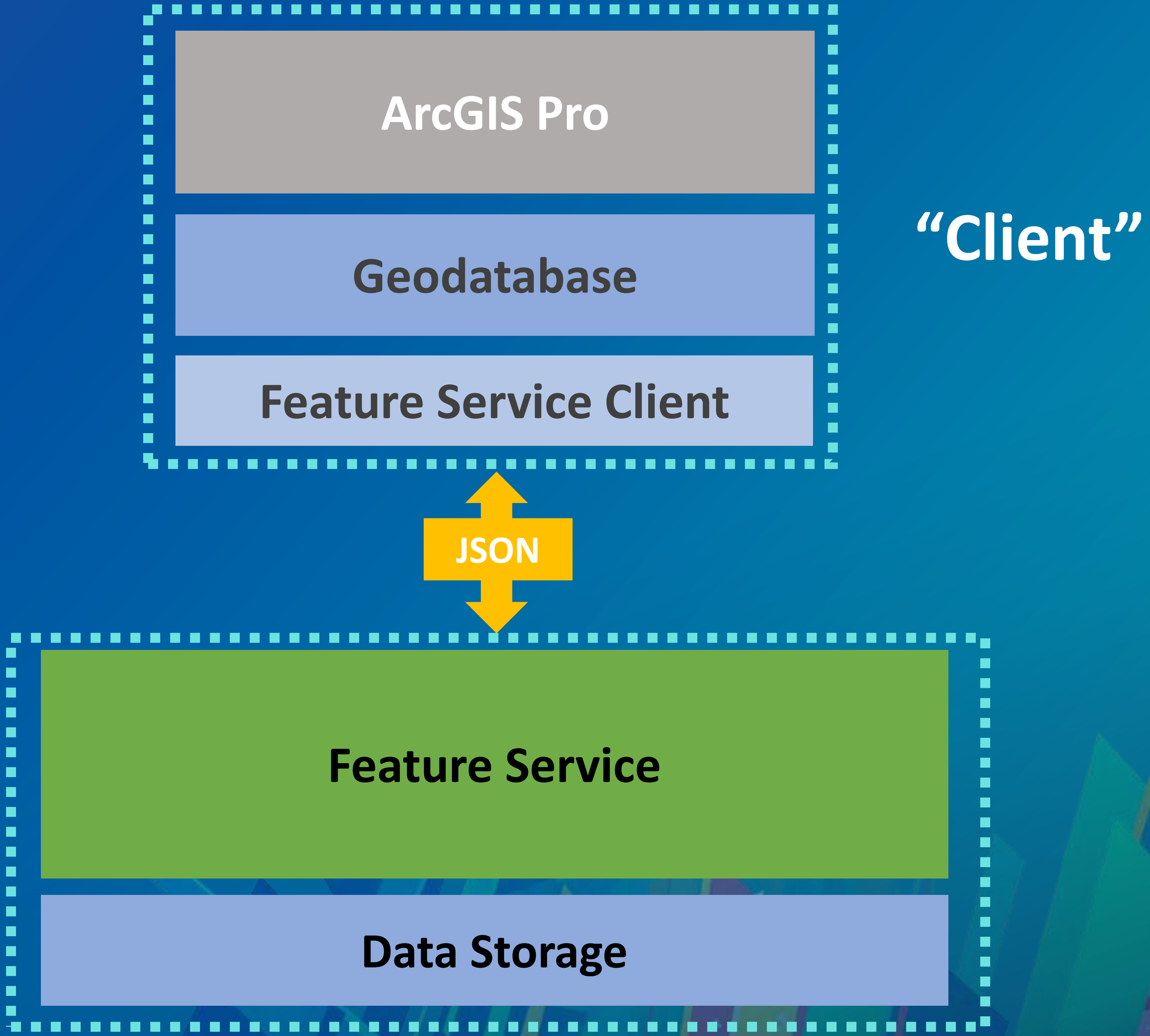
Demo

Basics - Creating connections

General information

Services

Architecture

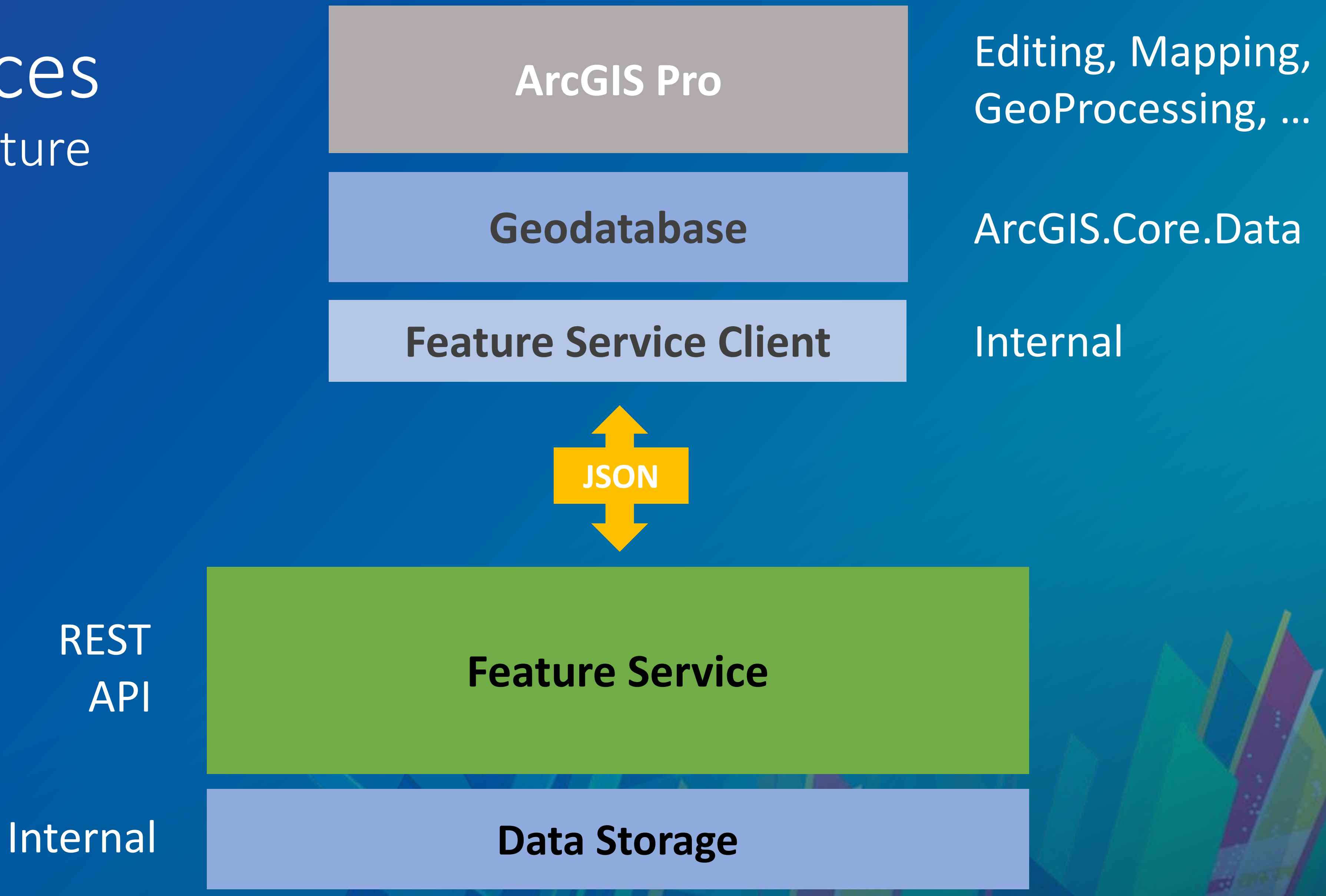


"Server"

Enterprise, Online, ArcGIS Server

Services

Architecture

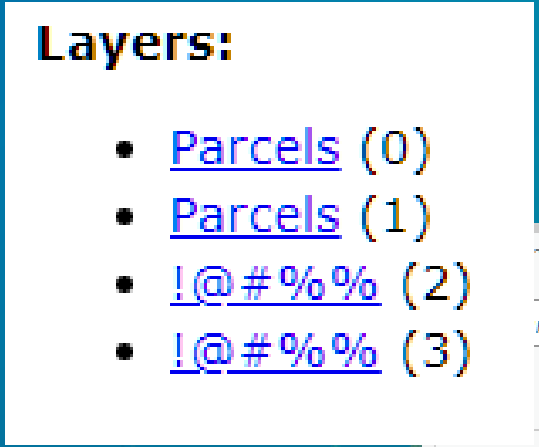


Common translations by the feature service client

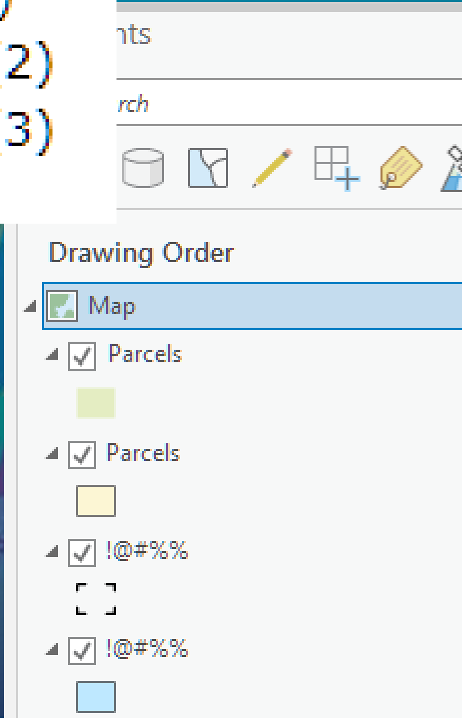
Pro SDK API	REST API
Search Cursor	FeatureService Query
Insert or update cursor	FeatureService ApplyEdits
EditOperation.Create > Execute	FeatureService ApplyEdits
Open feature class	FeatureService layer resource
Open datastore	FeatureService server resource, relationships resource, queryDomains
… many more	

Technical details – feature class and layer naming

- Service has a layer which has an ID and a name
- Name is not unique for the service
- Internally we need the name to be:
  - Parse-able for SQL queries
  - Unique for the datastore
- Feature class name is L + layer ID + cleaned up name
  - Allows internal SQL parsing
  - Eg: L1Parcels, L217Highways, …


Layers:

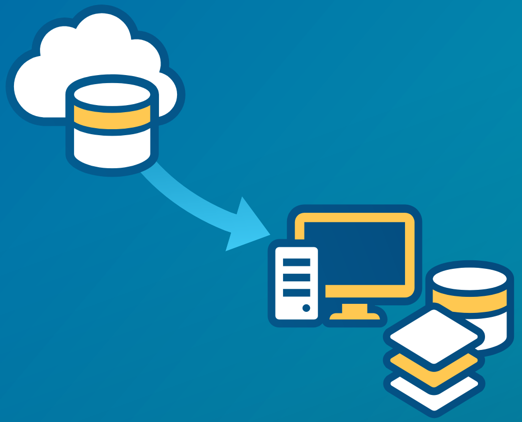
- Parcels (0)
- Parcels (1)
- !@#%% (2)
- !@#%% (3)

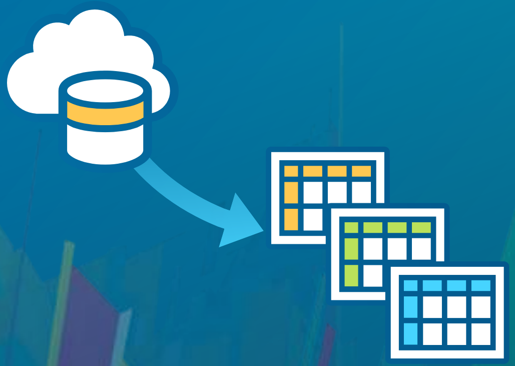


Technical details – functionality unique to Pro

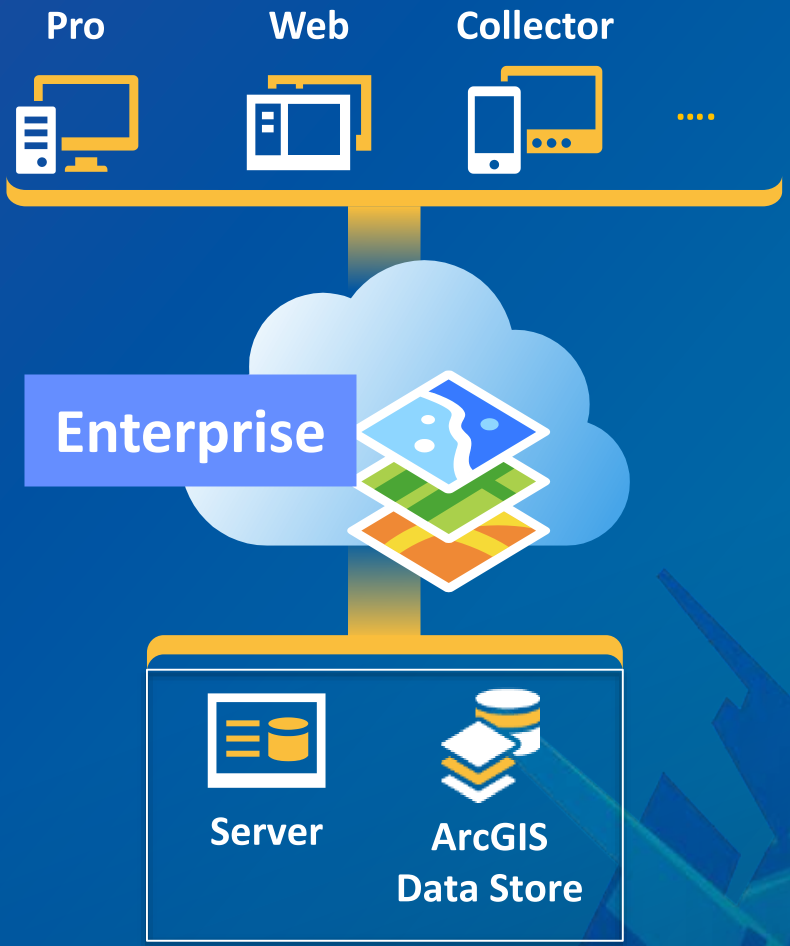
- Caching
  - Local copy of the data used for editing and querying
  - Improves query performance
  - Write through – updated as edits happen locally

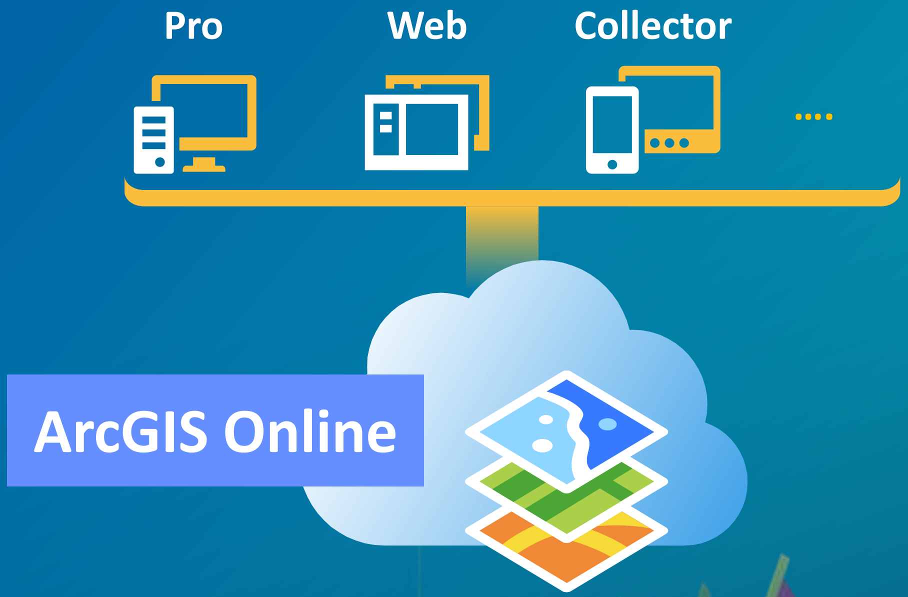
- Pagination
  - Gets records a page at a time
  - All queries will return full result sets





Data storage options - hosted

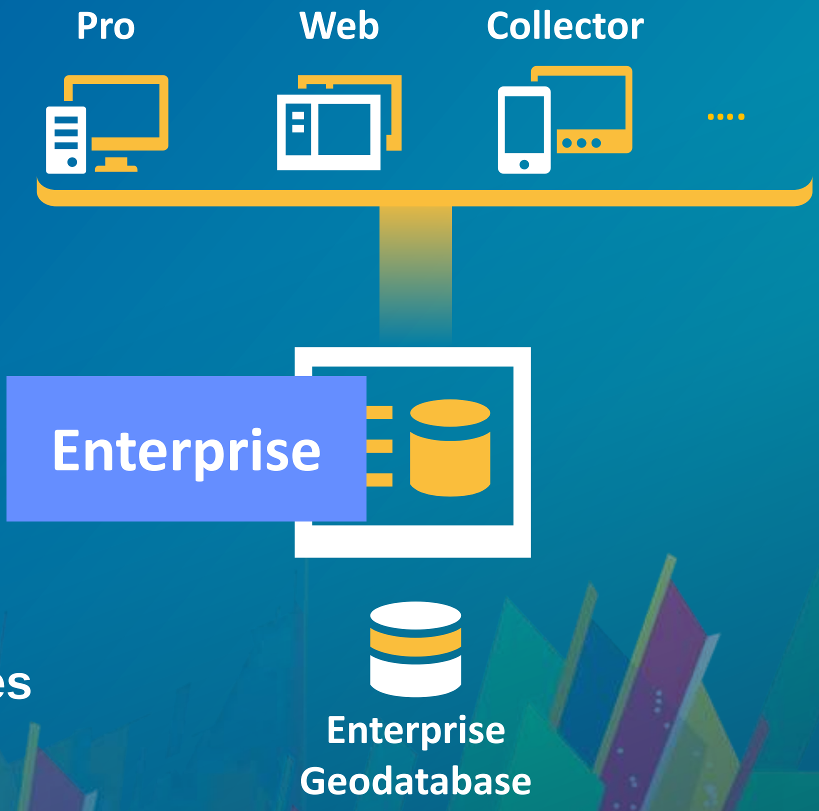


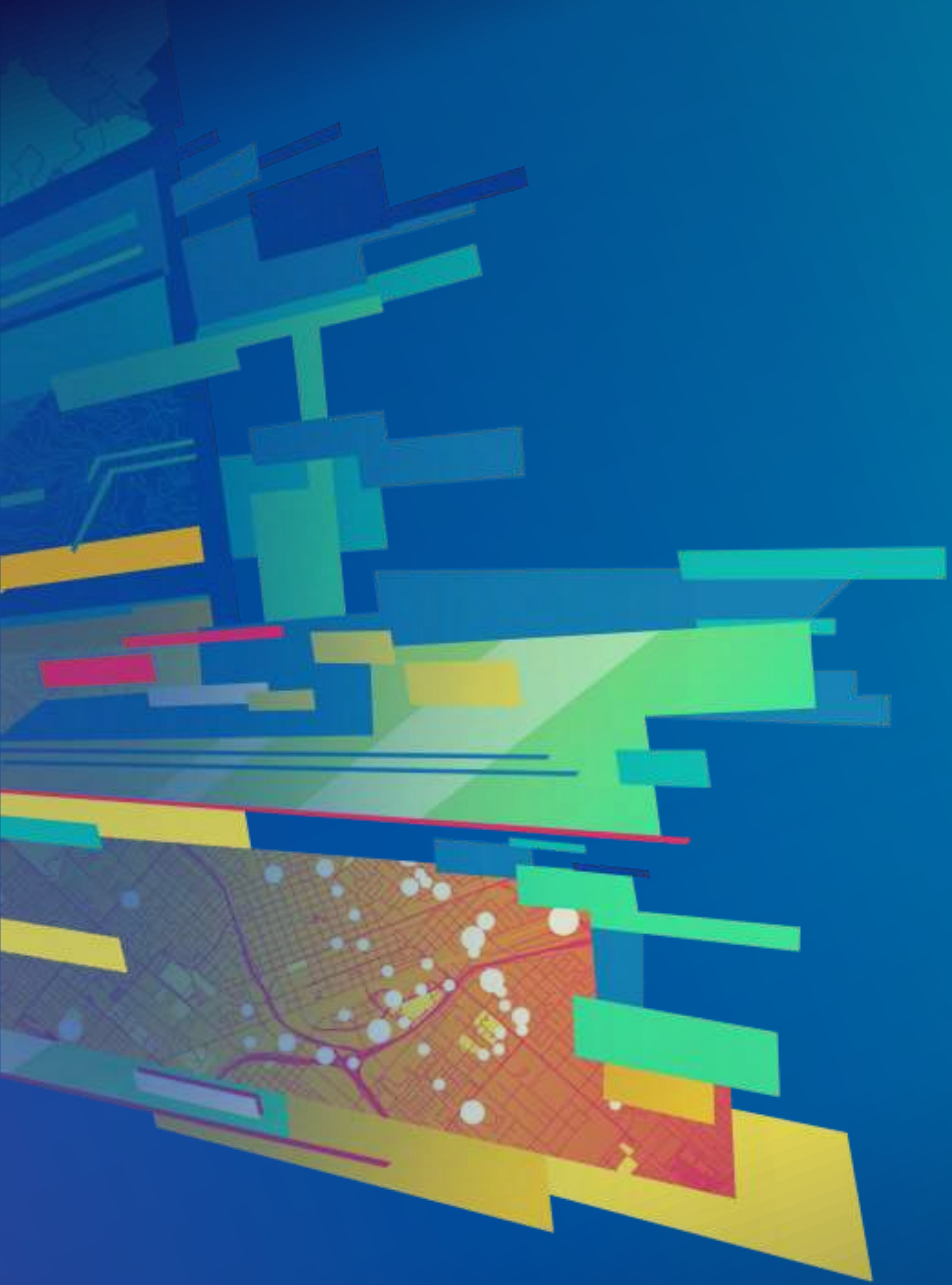


Data storage options – by reference

- **Feature Services referencing an Enterprise Geodatabase**
  - **ArcGIS Enterprise (federated)**
  - **ArcGIS Server (unfederated / stand alone)**

- **Only implementation to support:**
  - **Versioning, utility networks, true curves, annotation, dimensions, attribute rules, contingent attribute values**





Demo

General Info

Branch versioning

Branch versioning – what is it?

- Mechanism behind long transactions in services
- Same types of versions
  - Private - Only owner/admin can view or edit
  - Protected - Everyone can view, Only owner/admin can edit
  - Public - Everyone can view/edit
- Same basic workflows as before
  - Make edits
  - Reconcile
  - Post

Version A
Version B

Branch versioning – enhancements

- Timestamp based
- Conflict resolution over multiple sessions
- Enhanced editor tracking for deleted features
- Undo/redo with services
- No compress

Branch versioning – special considerations

- Only versioning model for newer datasets
  - Parcel fabric
  - Utility network
- Only for by reference services not available for hosted services
- Only editable via feature service
- Single level of versions
  - Ability to change ownership

More about versions and permissions

- Services can be secured or unsecured
  - Secured – shared within your Organization or within your ArcGIS Server
  - Unsecured – shared with everyone

- Feature service and version access based on the Portal user not DBMS user
  - Due to version access it is recommended to use secured services
  - Editor tracking comes from portal user

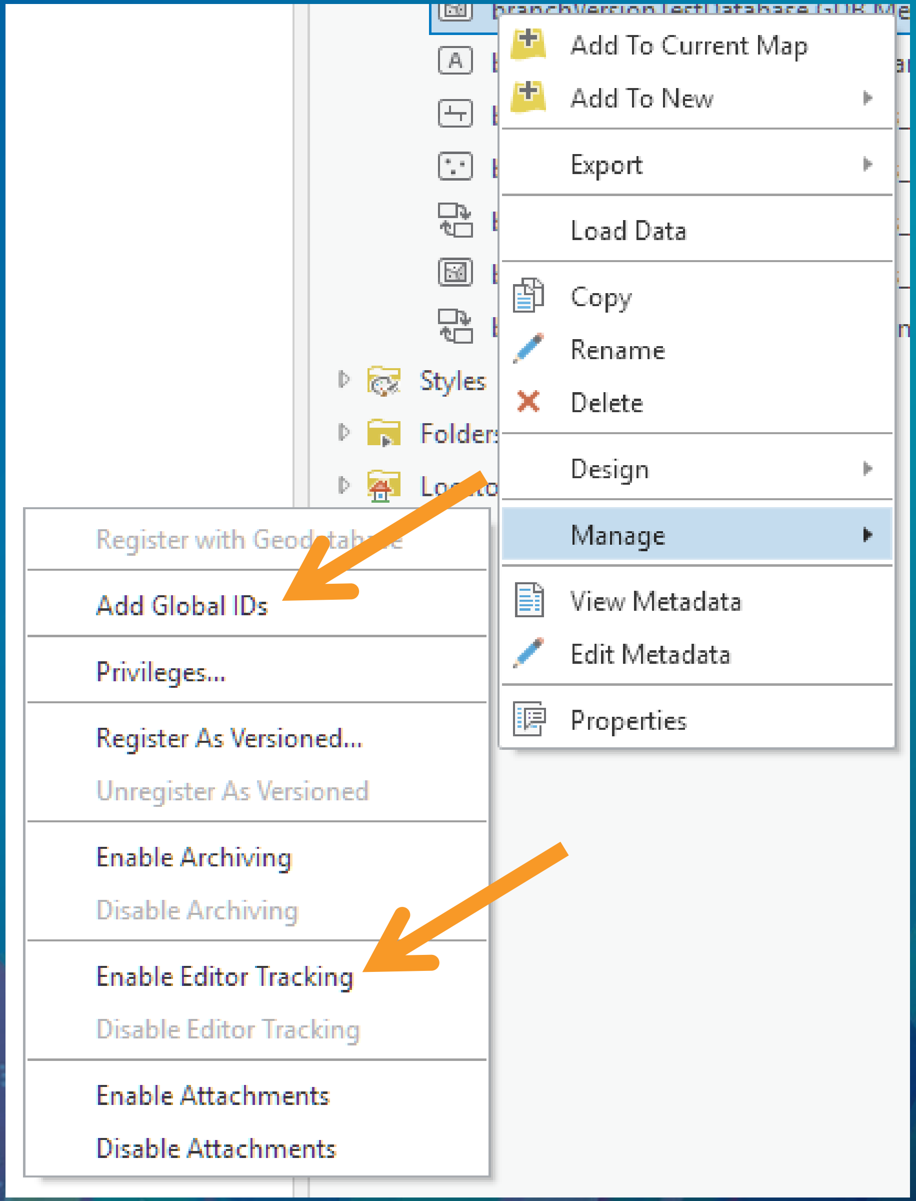
- Esri suggests using a protected version for the Default version
  - Other users can create versions from it
  - Allows QA by admin before data is posted

Preparing data for branch versioning

- Create tables, set up schema, load data
  - Add global id’s
  - Enable editor tracking
  - Relationships cannot be OID based
- Make a branch version connection in Pro
- Register as branch versioned
- Publish to Enterprise ‘by reference’ feature service
- Enable version management capability

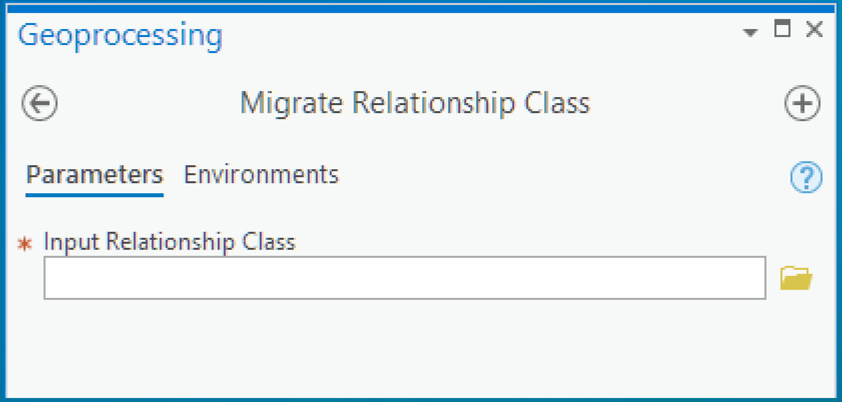
Preparing data for branch versioning

- Create tables, set up schema, load data
  - Add global id's
  - Enable editor tracking
  - Relationships cannot be OID based
- Make a branch version connection in Pro
- Register as branch versioned
- Publish to Enterprise 'by reference' feature service
- Enable version management capability



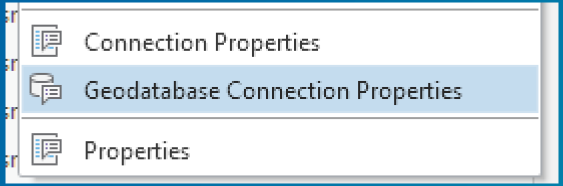
Preparing data for branch versioning

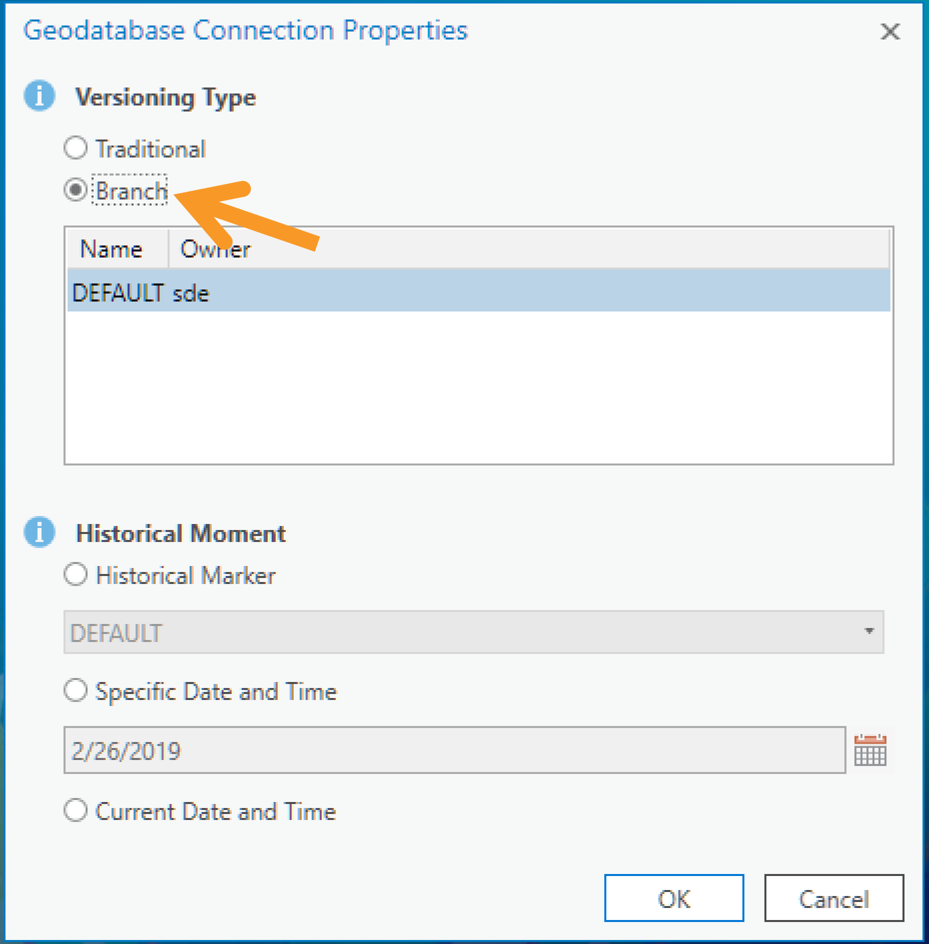
- Create tables, set up schema, load data
  - Add global id’s
  - Enable editor tracking
  - Relationships cannot be OID based
- Make a branch version connection in Pro
- Register as branch versioned
- Publish to Enterprise ‘by reference’ feature service
- Enable version management capability



Preparing data for branch versioning

- Create tables, set up schema, load data
  - Add global id's
  - Enable editor tracking
  - Relationships cannot be OID based
- Make a branch version connection in Pro
- Register as branch versioned
- Publish to Enterprise 'by reference' feature service
- Enable version management capability



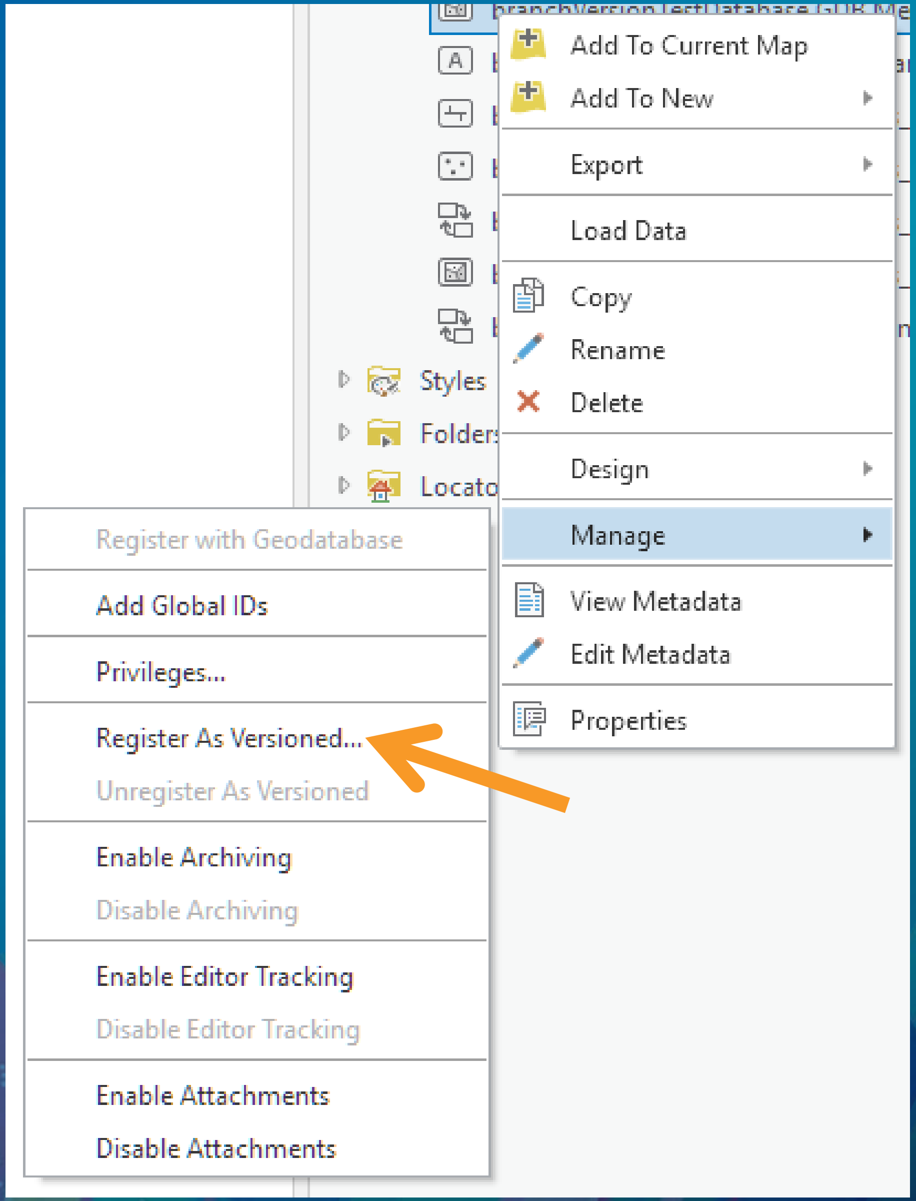


Traditional [✓ Branch]

Name	Owner
DEFAULT	sde

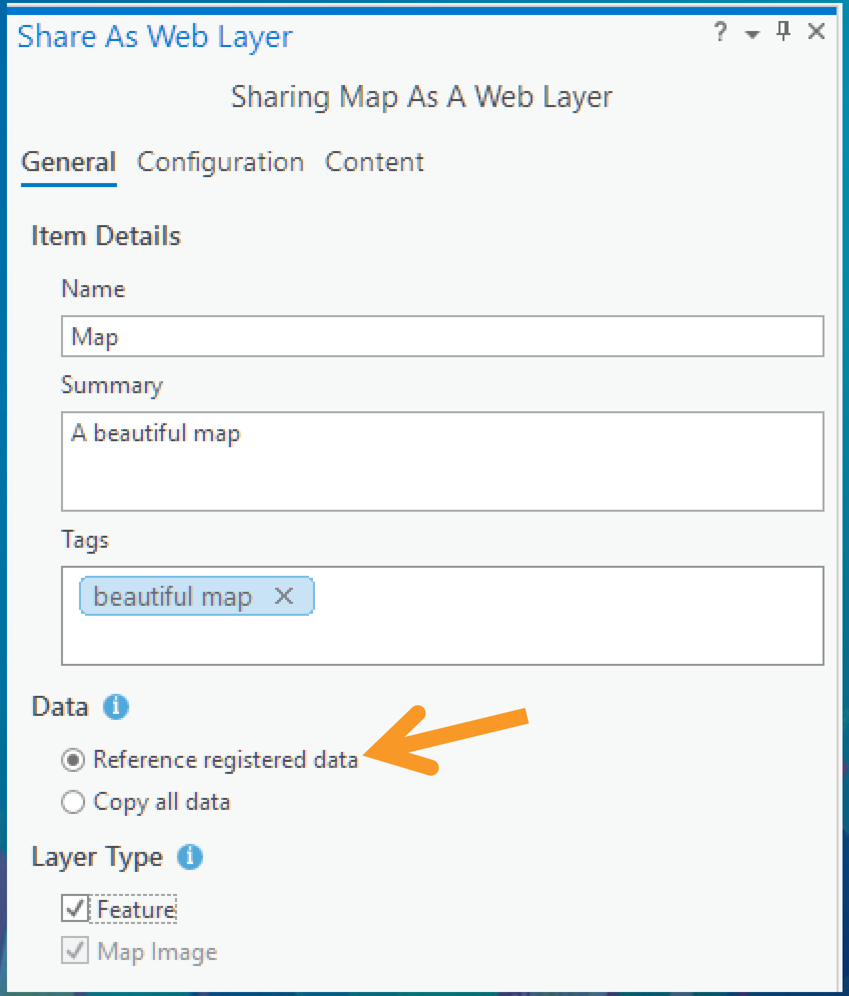
Preparing data for branch versioning

- Create tables, set up schema, load data
  - Add global id's
  - Enable editor tracking
  - Relationships cannot be OID based
- Make a branch version connection in Pro
- Register as branch versioned
- Publish to Enterprise 'by reference' feature service
- Enable version management capability



Preparing data for branch versioning

- Create tables, set up schema, load data
  - Add global id's
  - Enable editor tracking
  - Relationships cannot be OID based
- Make a branch version connection in Pro
- Register as branch versioned
- Publish to Enterprise 'by reference' feature service
- Enable version management capability


Share As Web Layer

Sharing Map As A Web Layer

General Configuration Content

Item Details

Name: Map

Summary: A beautiful map

Tags: beautiful map

Data

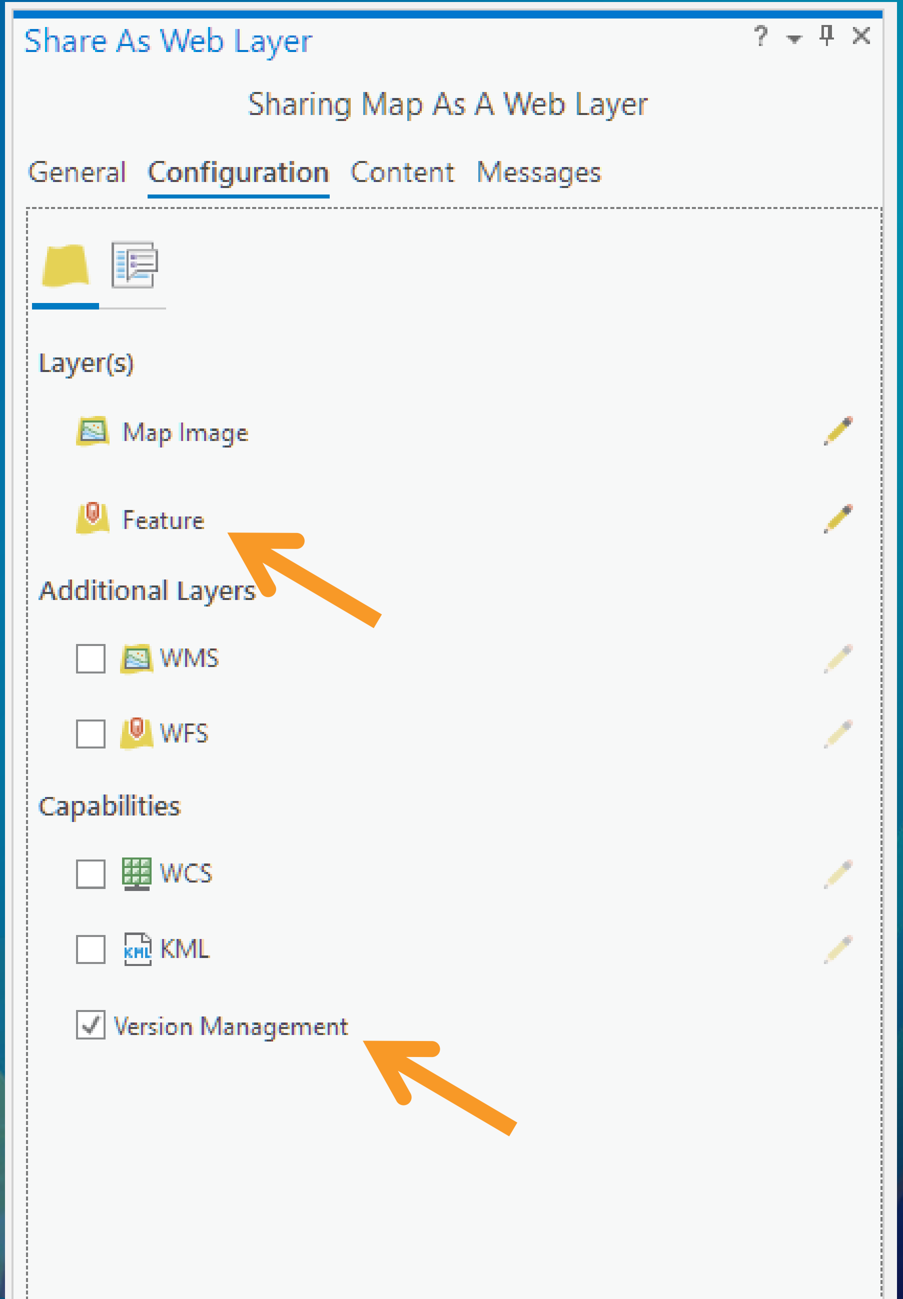
[✓ Reference registered data]
Copy all data

Layer Type

[✓ Feature]
[✓ Map Image]

Preparing data for branch versioning

- Create tables, set up schema, load data
  - Add global id's
  - Enable editor tracking
  - Relationships cannot be OID based
- Make a branch version connection in Pro
- Register as branch versioned
- Publish to Enterprise 'by reference' feature service
- Enable version management capability (VMS)


Share As Web Layer

Sharing Map As A Web Layer

General | Configuration | Content | Messages

Layer(s)
- Map Image
- Feature

Additional Layers
- [ ] WMS
- [ ] WFS

Capabilities
- [ ] WCS
- [ ] KML
- [✓] Version Management

Editing feature services

Feature service editing permissions

- Permissions
  - Query, Insert, Update, Delete
  - Service level, not on the individual layer

- Ownership based access control
  - Unique to feature services
  - Row level security based on editor tracking

Transaction model

- Feature Service only
  No VMS

- Applies to all hosted services
  - Short transactions, last in wins
- Applies to ‘by reference’ services if VMS is not present
  - Even when data is versioned
- No edit sessions

- Feature Service with
  Version Management (VMS)

- Long transaction editing behavior for Pro
  - Create versions
  - Edit in version
  - Reconcile
  - Review conflicts
  - Post
  - Delete version

VMS = version management server

Determining Editing Behavior

Check underlying `GeodatabaseType` and `RegistrationType` of the feature class:

```
((Geodatabase)featLayer.GetFeatureClass().GetDatastore()).GetGeodatabaseType();

 featLayer.GetFeatureClass()?.GetRegistrationType();
```

GeodatabaseType	RegistrationType	Version	EditOperationType	Example
Service	NonVersioned	N/A	SHORT	Hosted or By Reference
Service	Versioned	Default	LONG*	Branch Versioned
Service	Versioned	Named	LONG	Branch Versioned

*no undo/redo

Edit Behavior

- Summary of characteristics by Long and Short type

GeodatabaseType	RegistrationType	CancelEdit	Group Edits	Undo/Redo	Save/Discard
Service	Versioned (Named)	YES	YES	YES	YES
Service	Versioned (Default)	YES	YES	NO	NO
Service	NonVersioned	YES*	NO	NO	NO

🟦 LONG ⬜ SHORT

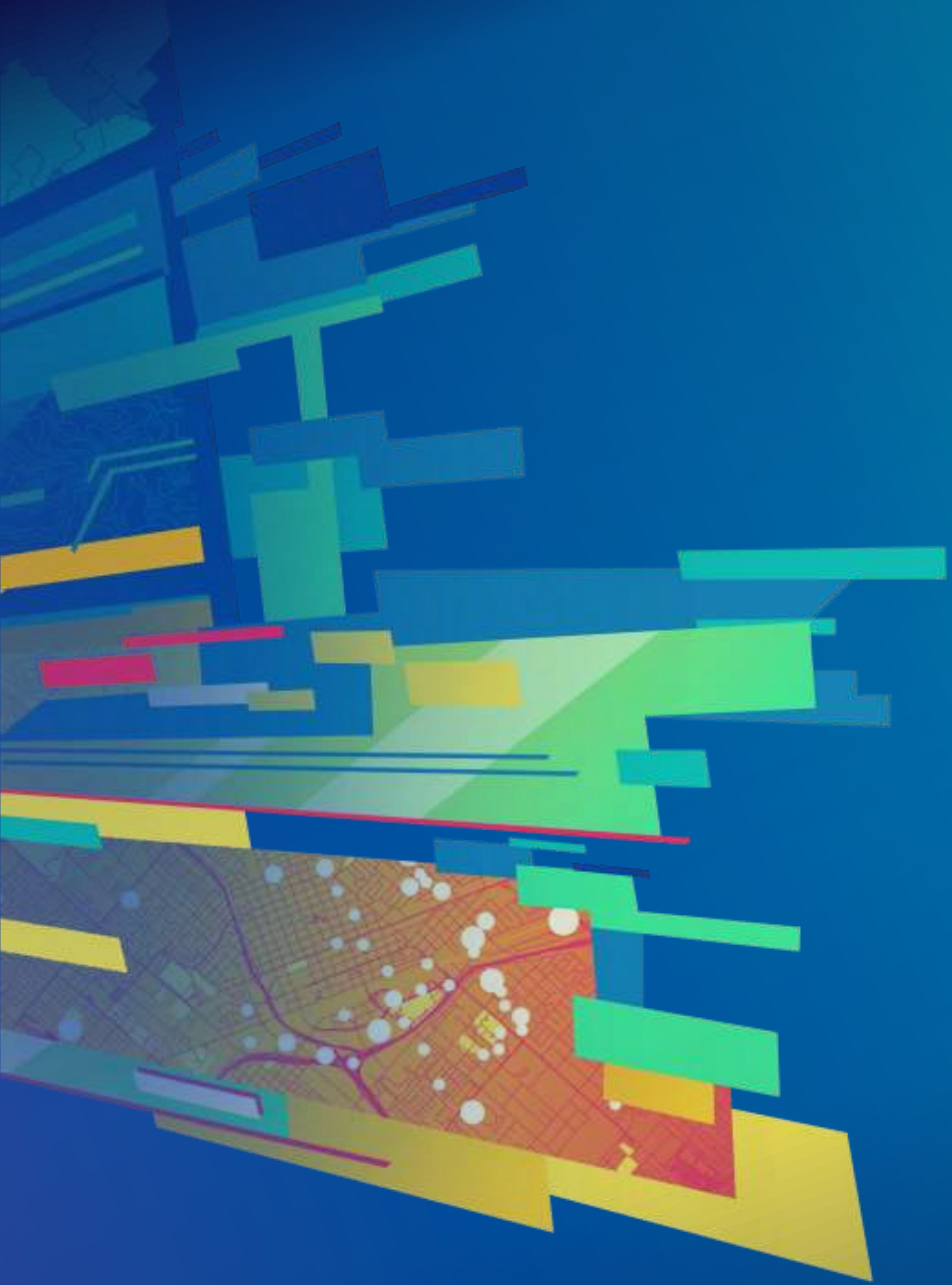
*2.2 and earlier - Create cannot be canceled

Locking model – named version

- Editing in a named version is single editor, multiple viewer model
  - One edit session at a time per version
- Connecting to version takes a shared lock
- Editing in a version takes an exclusive lock
  - Starts edit session
  - Cannot take exclusive when a second shared lock exists.
- Save or discard releases exclusive lock
  - Stops edit session
- Releasing the data store releases shared lock.

Mixed mode editing

- "Mixed Mode" is the default in Pro
  - Data from multiple datasources can be edited at the same time
  - Contents pane may include data with "Short" and "Long" transaction semantics
    - Long transactions go on the undo/redo stack
    - Short transactions are committed immediately
  - Can lead to inconsistent UI experience for Undo/Redo, Save/Discard when both are edited together



Demo

Editing Feature Services

Special considerations

aka Tips and Tricks

Performance

- Counting rows
  - Table.GetCount
- Calculating values
  - use calculate field with SQL >>> uses REST API
- Bulk loading:
  - Go to back end data for by ref
  - Go to Append API if possible for hosted
- Beware of pagination
  - Can appear like bad performance

Other considerations

- DDL via GP for hosted services
  - Add field, delete field, add index, delete index are supported for hosted data
  - More to come, **let us know what you want!**
- Rows can disappear when editing
  - Was a definition query was applied when publishing?
  - Are the service capabilities ‘insert only’?
- Read only feature access to map service sub layers is also available

Feature caching

- Turned on by default
- Multiple editor scenarios
  - Non versioned: refresh map to see other’s edits
  - Branch default: refresh version to see other’s edits
  - Named version: single editor nobody else can edit
- User can disable for NonVersioned (no VMS) services
- Available for both map service and feature service

Offline feature services

- Ability added at 2.2
- When offline the layer data store changes to mobile geodatabase
  - Feature class is accessible from feature layer not from data store
- No undo/redo (coming soon)

ArcGIS Pro SDK for .NET – Technical Sessions

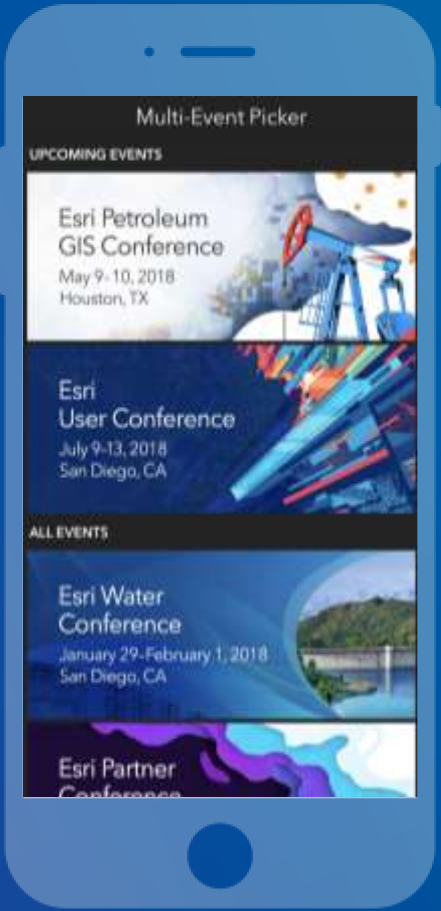
Date	Time	Session	Location
Thu, Mar 07	9:00 am – 10:00 am	Understanding Feature Services, a Guide for Developers	Primrose C-D
	10:30 am - 11:30 am	An Overview of the Utility Network Management API	San Jacinto
	1:00 pm – 2:00 pm	An Overview of the Geodatabase API	Mesquite G-H
	5:30 pm - 6:30 pm	Advanced Pro Customization with focus on Categories and Custom Settings	Smoketree A-E
Fri, Mar 08	8:30 am – 9:30 am	Advanced Editing with Focus on Edit Operations, Transaction Types, and Events	Mesquite C
	10:00 am - 11:00 am	Demonstrating Pro Extensibility with Add-Ins	Mesquite B

ArcGIS Pro – Road Ahead Session

Date	Time	Session	Location
Thu, Mar 07	4:00 pm – 5:00 pm	ArcGIS Pro: The Road Ahead	Primrose B

Please Take Our Survey on the App

Download the Esri Events app and find your event



UPCOMING EVENTS

Esri Petroleum GIS Conference
May 9-10, 2018
Houston, TX

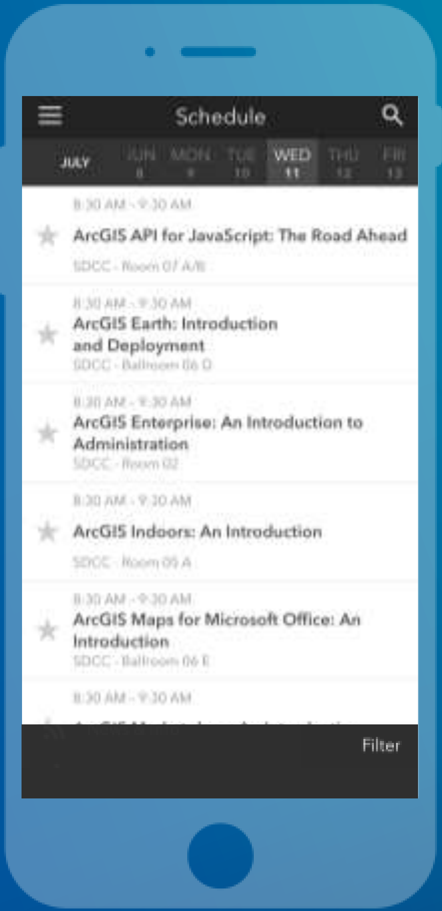
Esri User Conference
July 9-13, 2018
San Diego, CA

ALL EVENTS

Esri Water Conference
January 29-February 1, 2018
San Diego, CA

Esri Partner

Select the session you attended



8:30 AM - 9:30 AM
ArcGIS API for JavaScript: The Road Ahead
SDCC - Room 07 A/B

8:30 AM - 9:30 AM
ArcGIS Earth: Introduction and Deployment
SDCC - Ballroom 06 D

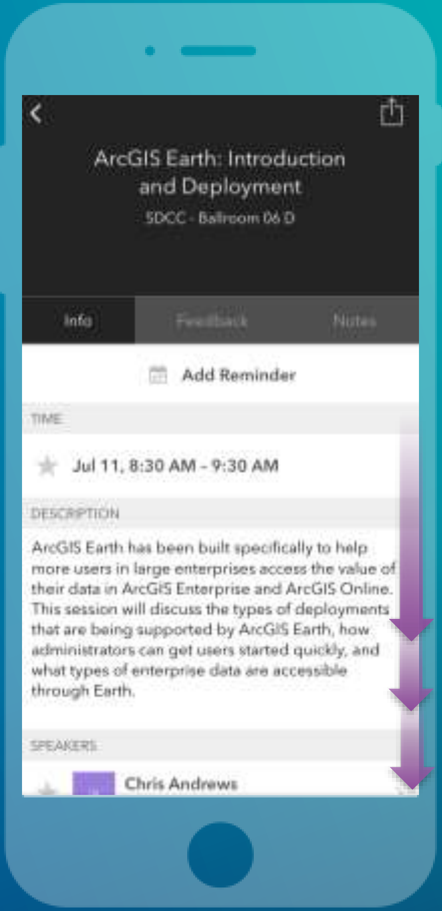
8:30 AM - 9:30 AM
ArcGIS Enterprise: An Introduction to Administration
SDCC - Room 02

8:30 AM - 9:30 AM
ArcGIS Indoors: An Introduction
SDCC - Room 05 A

8:30 AM - 9:30 AM
ArcGIS Maps for Microsoft Office: An Introduction
SDCC - Ballroom 06 E

8:30 AM - 9:30 AM

Scroll down to find the feedback section



ArcGIS Earth: Introduction and Deployment
SDCC - Ballroom 06 D

TIME

Jul 11, 8:30 AM - 9:30 AM

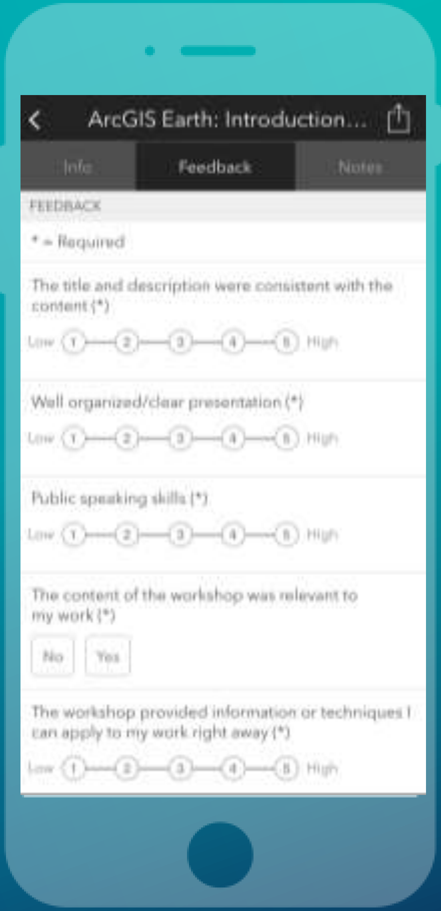
DESCRIPTION

ArcGIS Earth has been built specifically to help more users in large enterprises access the value of their data in ArcGIS Enterprise and ArcGIS Online. This session will discuss the types of deployments that are being supported by ArcGIS Earth, how administrators can get users started quickly, and what types of enterprise data are accessible through Earth.

SPEAKERS

Chris Andrews

Complete answers and select "Submit"



FEEDBACK

* = Required

The title and description were consistent with the content (*)
Low 1 2 3 4 5 High

Well organized/clear presentation (*)
Low 1 2 3 4 5 High

Public speaking skills (*)
Low 1 2 3 4 5 High

The content of the workshop was relevant to my work (*)
No Yes

The workshop provided information or techniques I can apply to my work right away (*)
Low 1 2 3 4 5 High

esri | THE SCIENCE OF WHERE