Esri International Developer Summit

Palm Springs, CA

Developer's Guide to Geodata Access in ArcGIS

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Presentation Outline

- Introduction
- Databases and Geodatabases
- SQL
- ArcObjects
- Plug In Data Sources
- BREAK
- Python
- File Geodatabase API
- Runtime
- Web Editing

Introduction

- 8:30 – 12:00 pm with break from 10:00 pm to 10:30 pm
- Assume you have a basic understanding of the geodatabase and databases
- Basic programming skills
  - Demos in various languages
    - C#, Python, SQL, JavaScript, etc

Introduction …

- We'll take questions throughout
  - May want to hold off until we get to the end of each topic
  - Hold questions to the end of demos
- Available at the break
- Showcase area over the next few days

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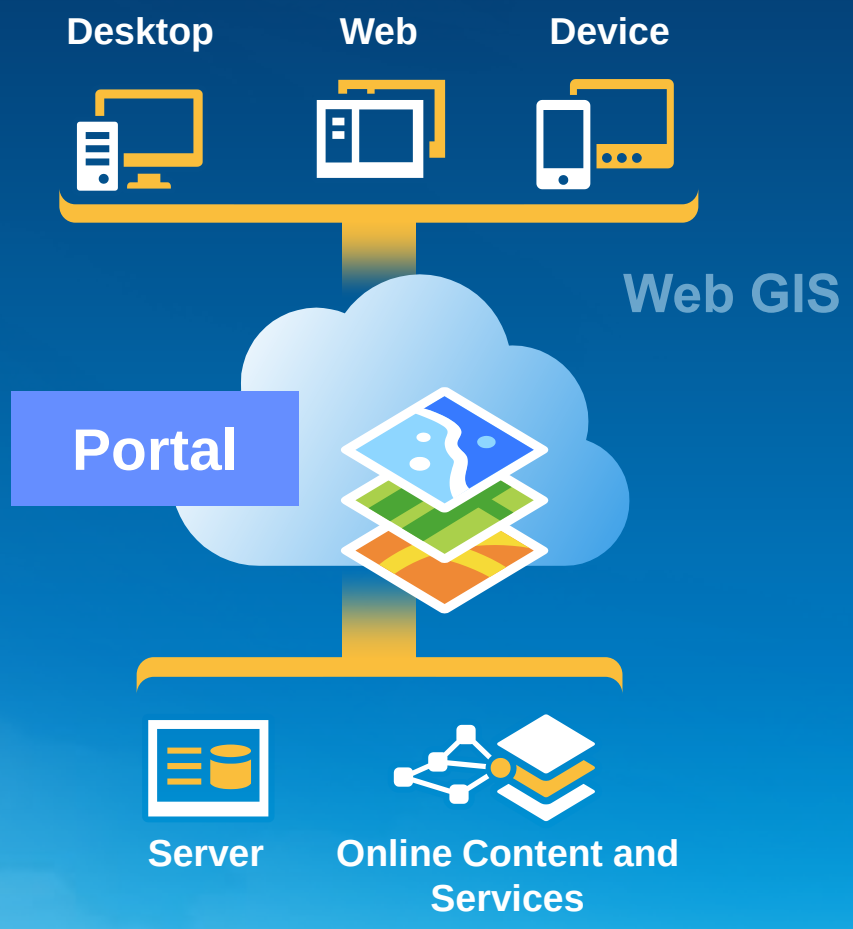
ArcGIS Is a Platform

Enabling Web GIS Everywhere

Simple

Integrated

Open



Available in the Cloud . . .
. . . and On-Premises

Databases

- You might have spatial/nonspatial data in a database for use in ArcGIS
  - Oracle, SQL Server, DB2, Informix, PostGreSQL, Netezza
- You can connect directly to a supported database and view the data in the tables by making a connection from the Catalog tree in ArcGIS for Desktop
- To filter what data appears in ArcMap, you can use a query layer
- Use SQL to access the data within the database

What can you access in a Database?

- Rows and Tables
  - Containing zero to many rows
  - One to many columns
  - All rows in the table have the same schema
- Can perform table management tasks
  - View and modify schema
  - Add and remove rows
  - Perform queries

RP	APPR_YEAR	ACCOUNT	RCD_TYPE	SEQNO	SALE_DATE	DEED_BOOK	DEED_PAGE	SALE_PRICE	GRANTOR	GRANTEE	VACA
R	2002	00562424	SALE	000	2/17/2000	14243	247	30000	Frieling, D Rynn	Fullwood, Troy	
R	2002	00565504	SALE	000	4/7/2000	14313	241	47500	Keele, Leslie D	Howell, Bobby & Ivy R	
R	2002	00565717	SALE	000	6/5/2000	14375	190	56752	Hudson, Richard J	Brant, Dorothy Laurestine	
R	2002	00566276	SALE	000	7/11/2000	14429	206	65000	Willis, Mary E	Copeland, Jerry Don	
R	2002	00567655	SALE	000	6/9/2000	14380	137	85000	Purcell, Charity F	Churkey, Dale Etux Johanna	
R	2002	00568066	SALE	000	5/23/2000	14356	330	145000	Hawkins, Gary D Etux Deborah L	Kjeldgaard, Larry Etux Linda M	

What can you access in a Database? …

- A table with a column that stores a spatial type
  - We call this a feature class
- Each row represents a feature
- The fields in each row represent various characteristics or properties of the feature
- One of the fields holds the feature geometry which is stored as a spatial type

Parcels

OBJECTID *	SHAPE *	PROPERTY_I *	Res	Zoning_simple	SHAPE_Length	SHAPE_Area
1	Polygon	5001	Non-Residential	<Null>	3597.780813	112552.418591
2	Polygon	5002	Non-Residential	<Null>	814.855837	18488.417709
3	Polygon	1003	Residential	Residential	489.655523	12815.591379
4	Polygon	1004	Residential	Residential	521.761248	14036.135346
5	Polygon	1005	Residential	Residential	453.479649	9816.352665

Viewing database data in ArcGIS

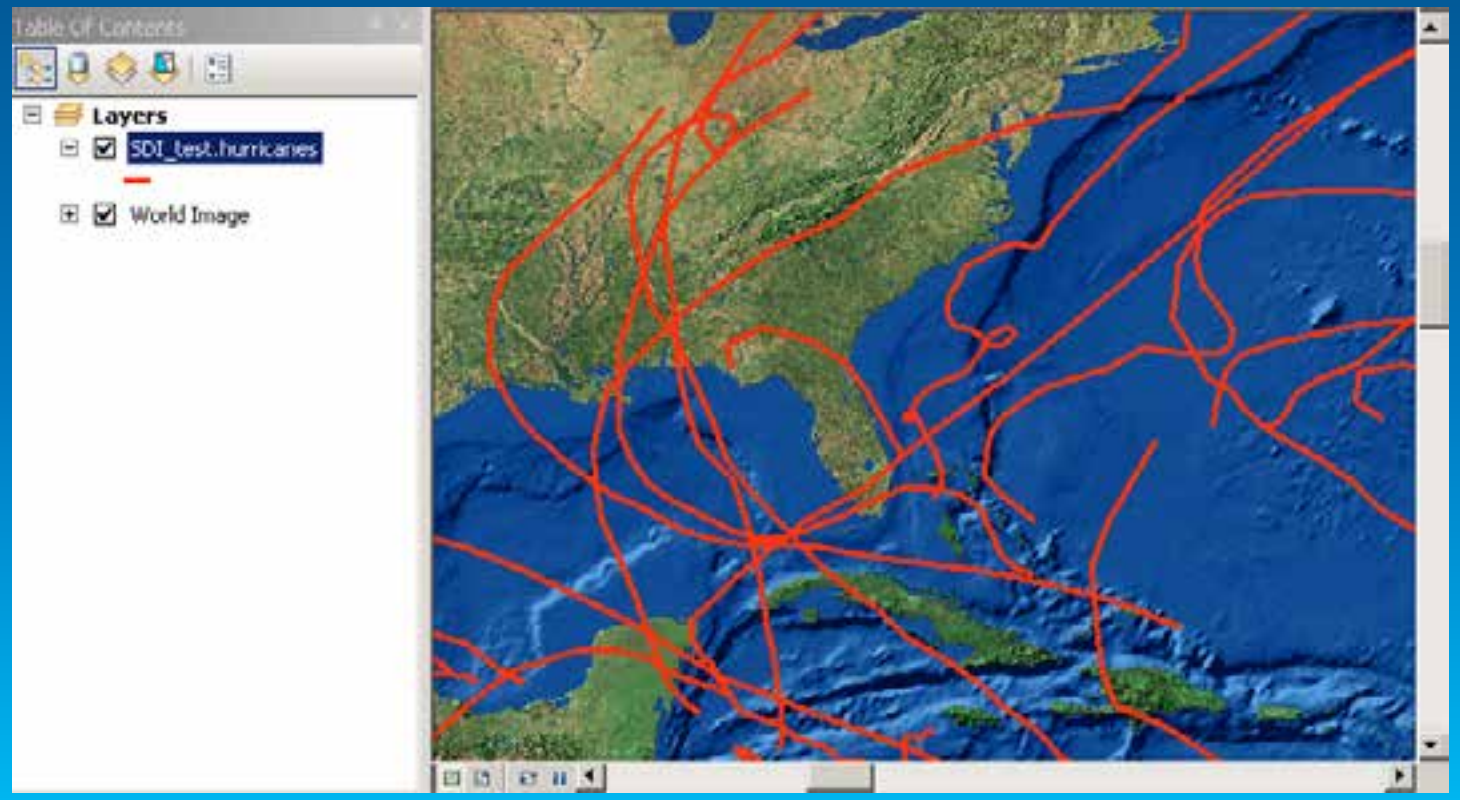
- Tables (with and without a spatial type) are viewed in ArcGIS through a query layer
  - Define the layer yourself or let ArcGIS discover how to define it

- Query Layer is a layer that is defined by a SQL query
  - Provide data integration with geodatabases as well as from databases
  - Can quickly integrate spatial and nonspatial information into GIS projects independently of where and how that information is stored

Viewing database data in ArcGIS

- **Simple SQL query**

```
SELECT * FROM dbo.HurricaneTracks_2005 hurricane
```



Viewing database data in ArcGIS

- **More complex SQL query that uses casting, derived columns and spatial operators**

```
SELECT county.id, county.State_name, county.NAME county_name,
county.POP1990 population, CAST(county.POP1990 as
decimal)/CAST(states.POP1990 as decimal)*100 PctStatePop,
county.Shape FROM dbo.HurricaneTracks_2005 hurricane, dbo.counties
county, dbo.states states WHERE hurricane.NAME = 'KATRINA' AND
hurricane.Shape.STIntersects(county.shape) = 1
```

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```

Viewing database data in ArcGIS

- **Most complex SQL query that uses casting, derived columns and spatial operators**

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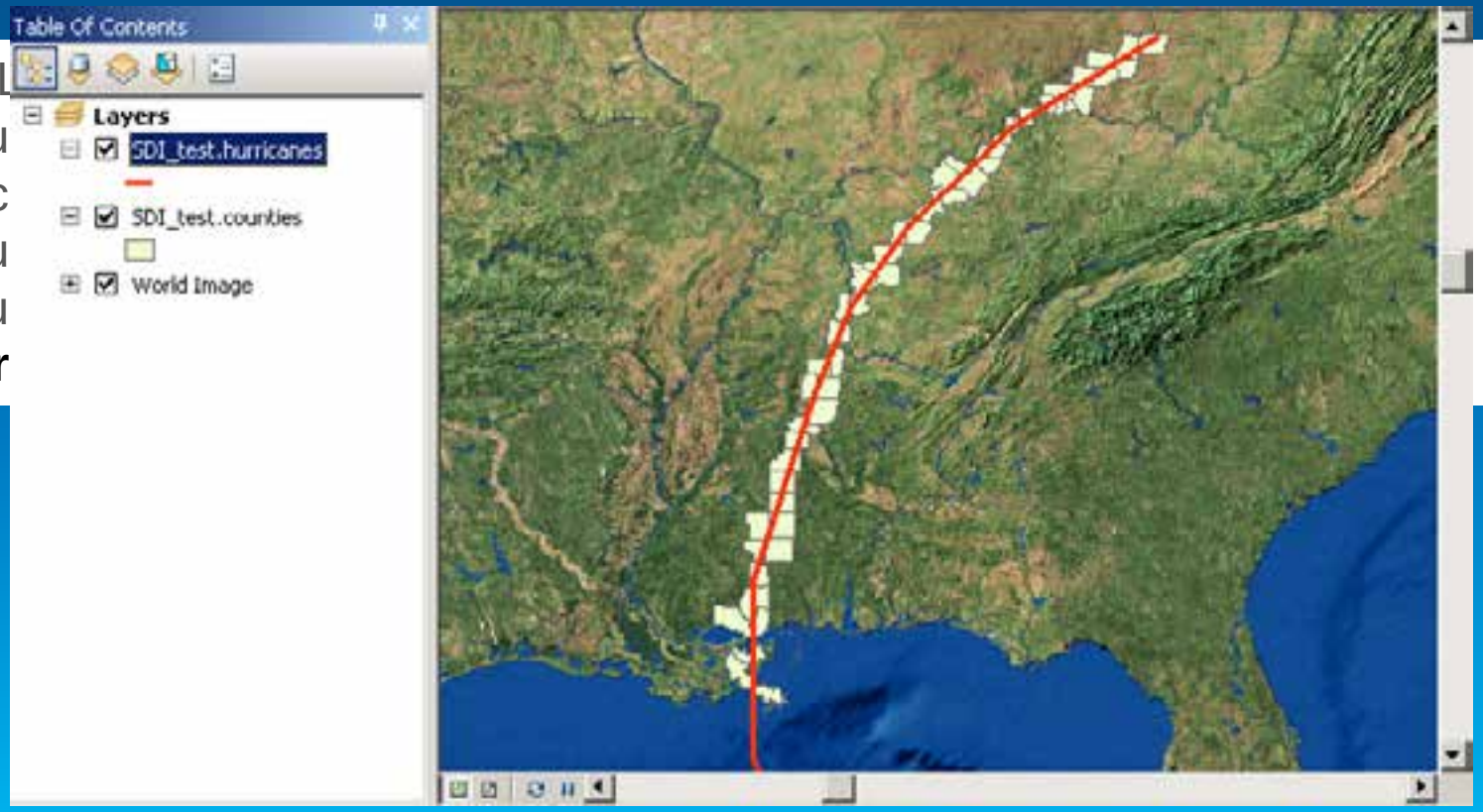


Query Layers - Viewing database data in ArcGIS

- Display and use of the data is determined on the fly or defined by you within the layer
- Works well for viewing and querying spatial and non-spatial database information
- Cases where you want to do more with your data

Building on top of Database Functionality

- Store business rules with the data so they're available to everyone who accesses the data
- Advanced data modeling such as with transportation or utility networks
- Store and work with detailed cartography
- Multiple editors working on the same data at the same time without impacting each other

The Geodatabase

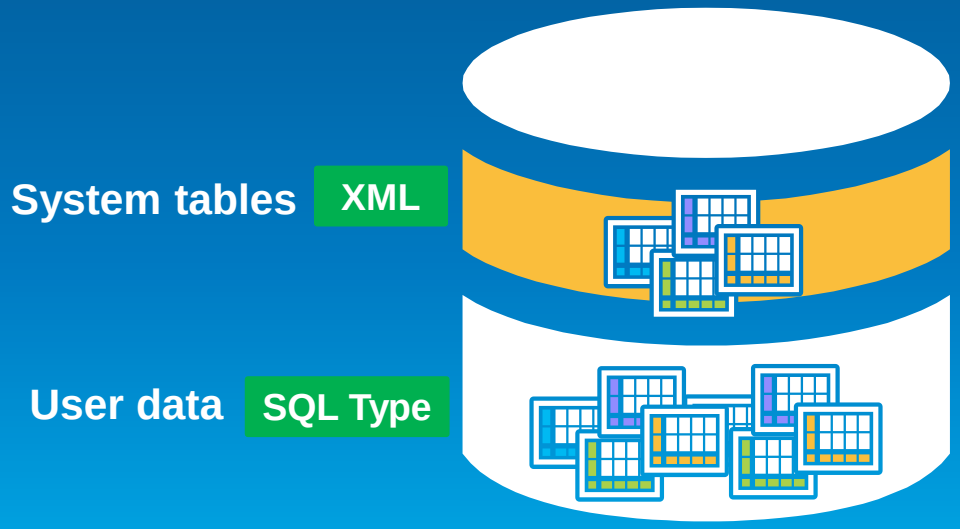
- A physical store of geographic data
  - Scalable storage model supported on different platforms
- Core ArcGIS information model
  - A comprehensive model for representing and managing GIS data
  - Implemented as a series of simple tables
- A transactional model for managing GIS workflows
- Set of components for accessing data

Geodatabase is based on relational principles

- The geodatabase is built on an extended relational database
- Leverages key DBMS principles and concepts to store geographic data as tables in a DBMS
- The core of the geodatabase is a standard relational database schema
  - a series of standard database tables, column types, indexes, and other database objects

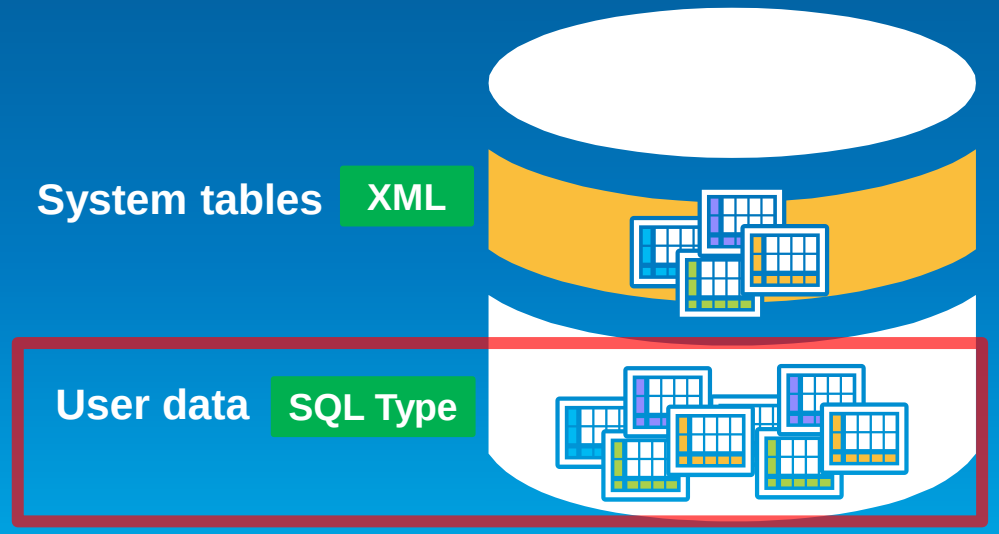
Geodatabase Schema

- There are two sets of tables:
  - Dataset tables (user-defined tables)
  - Geodatabase system tables



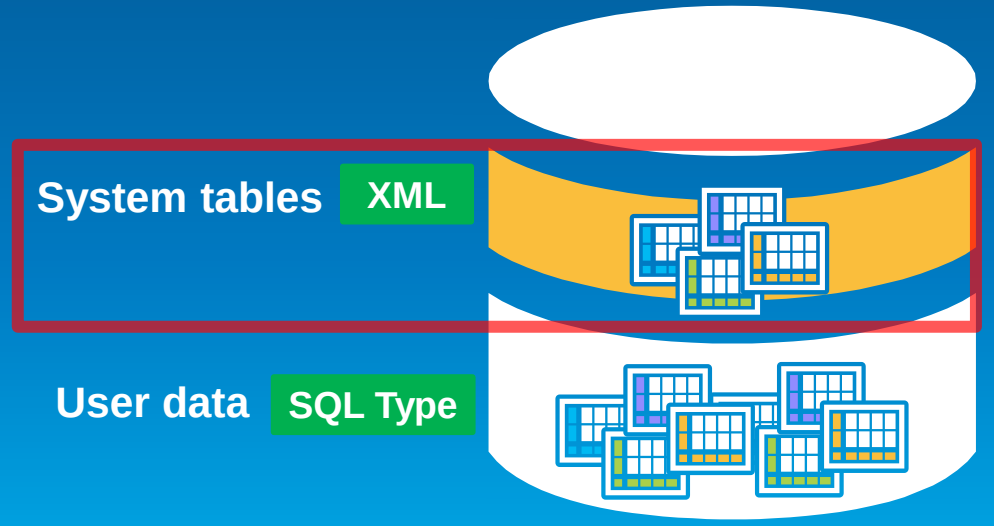
User-defined tables

- Stores the content of each dataset in the geodatabase
- Datasets are stored in 1 or more tables
- Spatial Types enhance the capabilities of the geodatabase
  - SQL access to geometry
  - Industry standard storage model and API

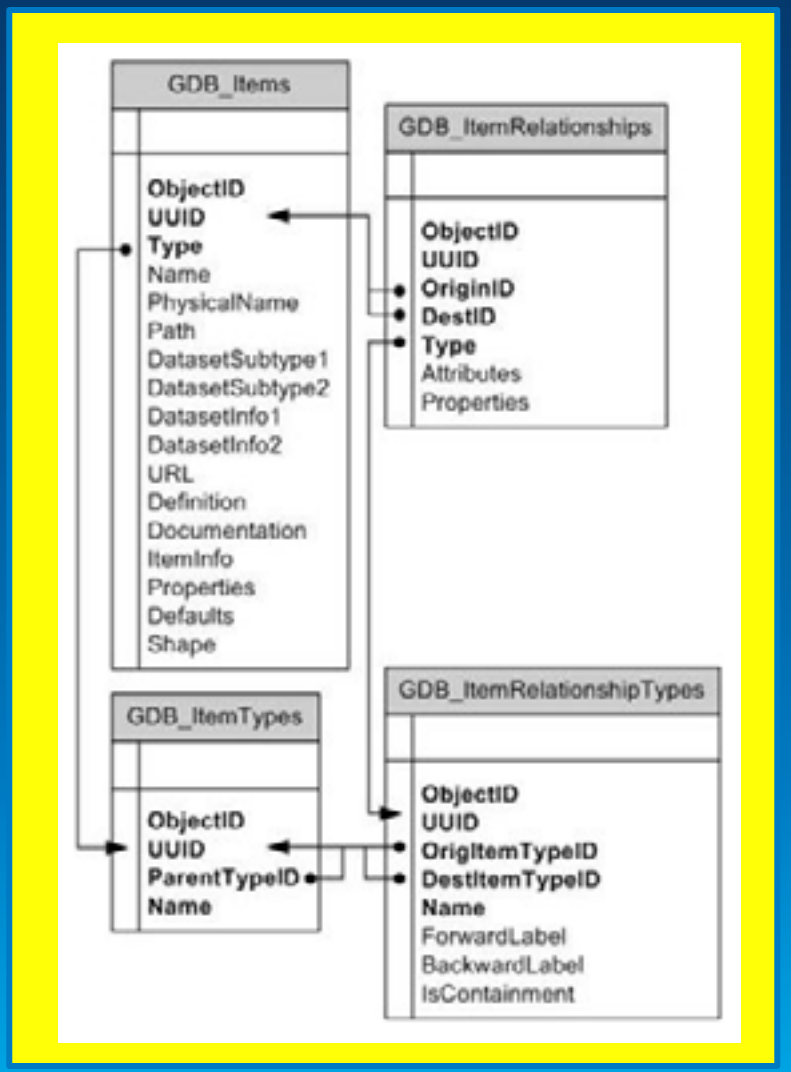


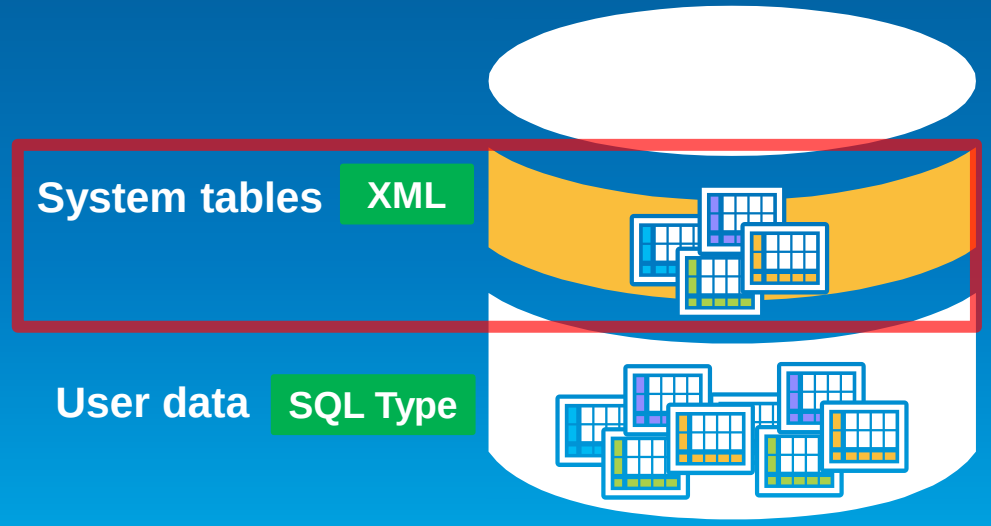
Geodatabase system tables

- System tables store definitions, rules, and behavior for datasets
- Tracks contents within a geodatabase
- 4 main system tables
- Geodatabase schema is stored primarily within an XML field

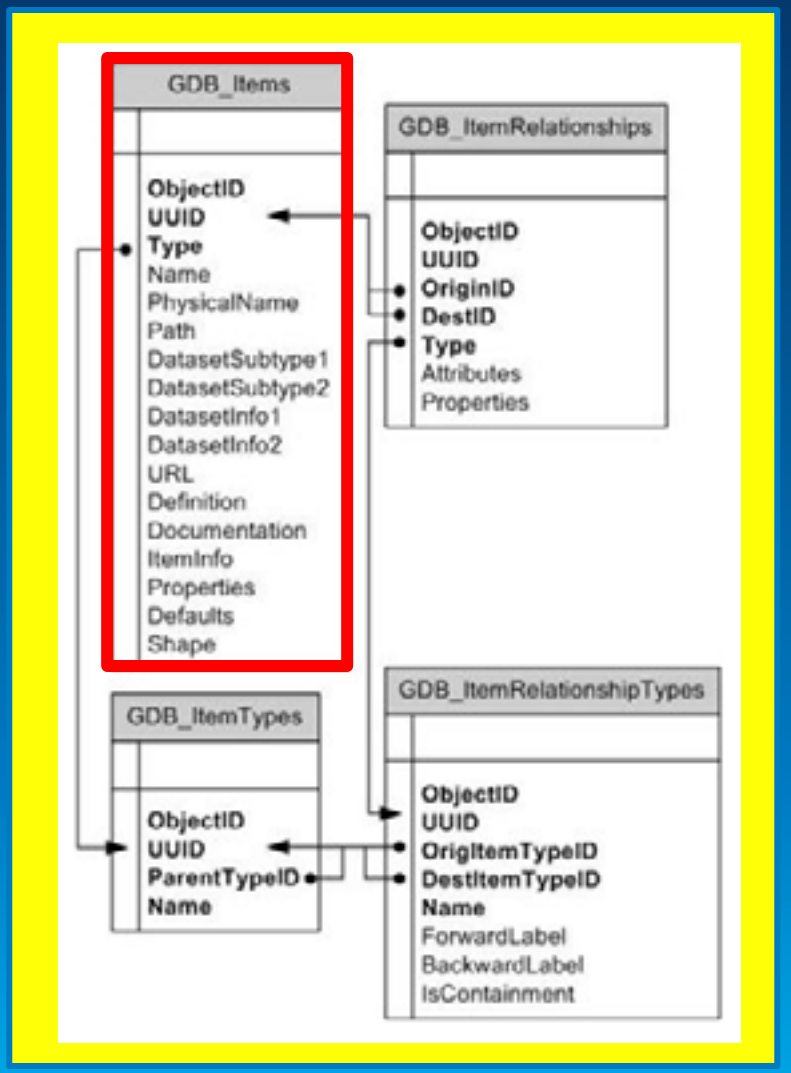


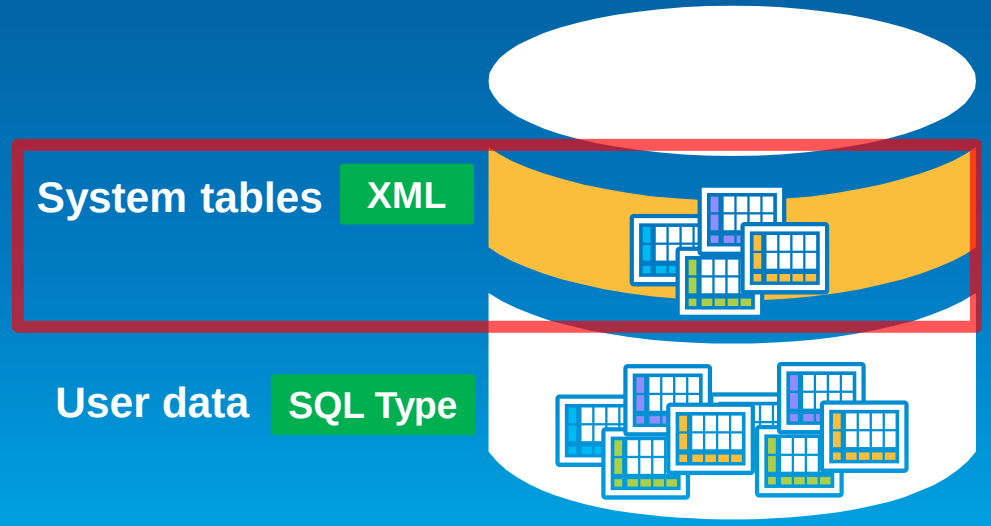
Geodatabase Schema…



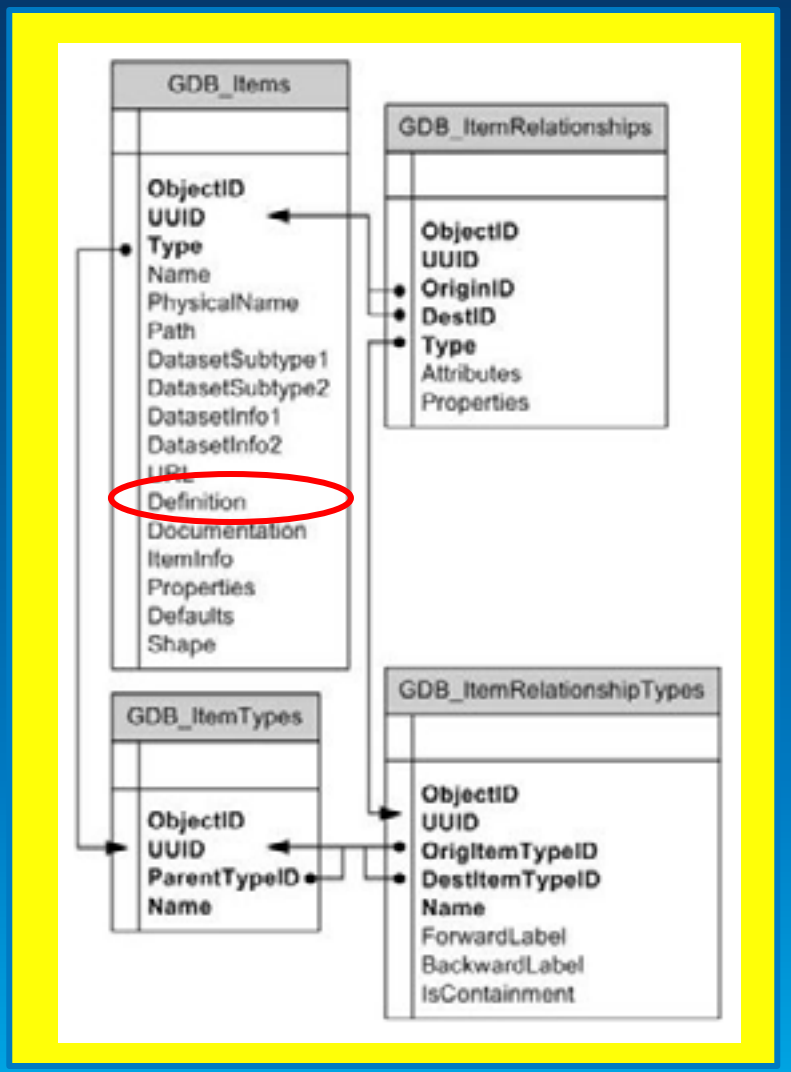


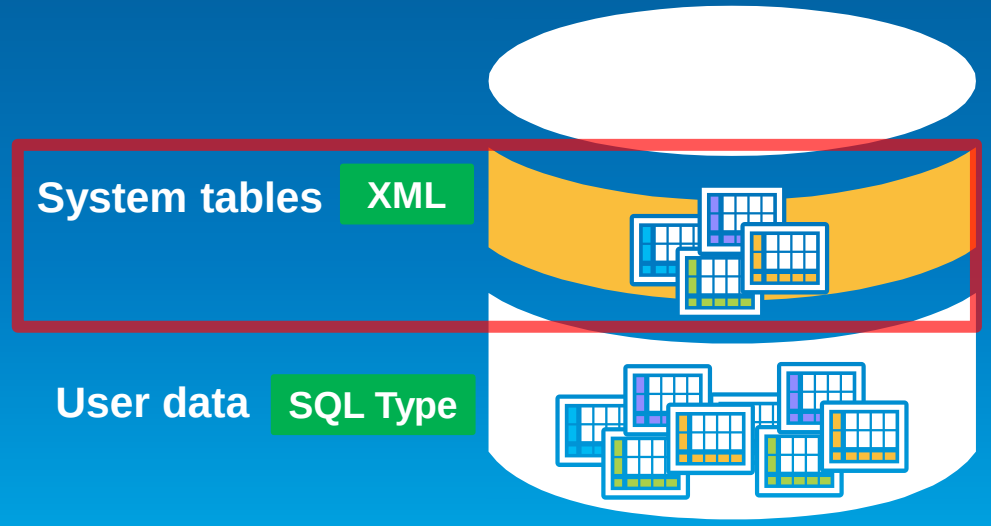
Geodatabase Schema…





Geodatabase Schema…

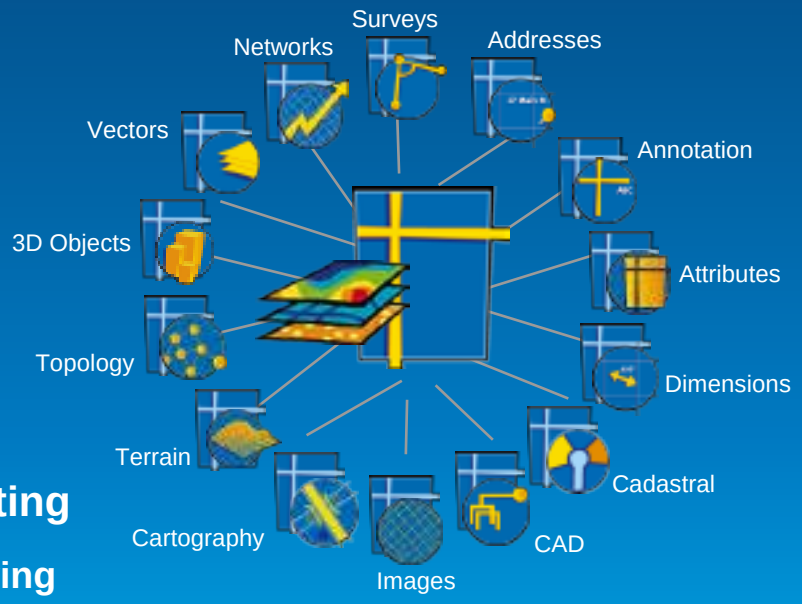




Modeling Real-World Data with the Geodatabase …

- The geodatabase enhances data and thematic layers by adding rules and behavior
  - Spatial and relational integrity rules
  - Data validation
  - Business logic
- Create thematic layers with behavior
  - Road and utility networks
  - Parcel fabrics
  - Terrain and 3D surfaces
  - Location services
- Extended framework for advanced workflows and editing
  - Multiuser editing, Data Replication, Editor tracking, Archiving

Geodatabase Functionality



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What is SQL (Structured Query Language)?

- A set of defined expressions and syntax used to query and manipulate data in a DBMS
- Most SQL based on an ANSI standard and then extended for each DBMS
  - SQL syntax across different DBMSs is slightly different
- SQL can be used to access, create, and update data
- Geometry is stored within a Spatial Type

What is a spatial type?

- A spatial type (ST) is a type that stores geometry data in a single spatial attribute
  - Geometry type, coordinates, dimension, spatial reference
- Spatial Index
  - Access path for quick retrieval
- Relational and geometry operators and Functions
  - Constructors
  - Accessor
  - Relational
  - Geometry

What are the benefits of a spatial type?

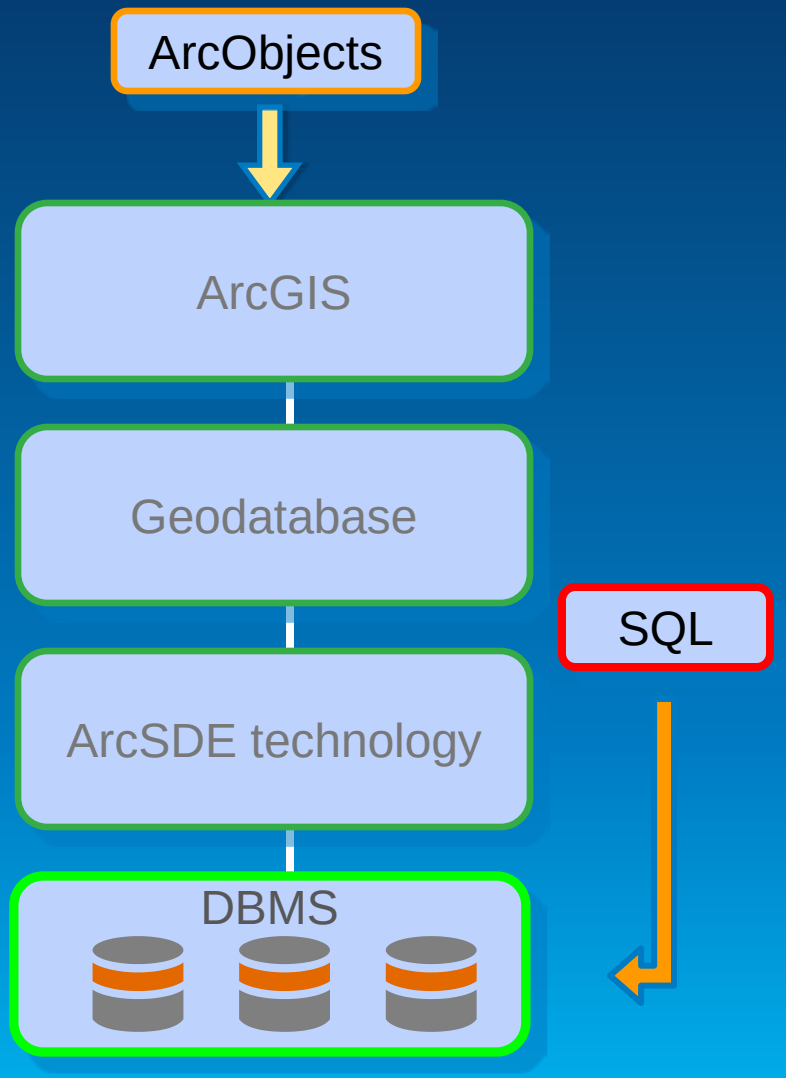
- Efficiency
  - Spatial data and methods are stored in the database
  - Applications access native dbms type
- Accessed using common API's and SQL
  - C, C++, C#, Java, OLEDB
  - Adheres to standards for SQL access
- With SQL and a ST you can
  - Create tables with a spatial attribute
  - Read and analyze the spatial data
  - Insert, update, and delete simple geometry data

Accessing Geodatabase through SQL

- Access schema and properties of existing datasets
  - Use SQL SELECT statements to query the Definition field in the GDB_ITEMS table
- Editing tables/feature classes, versioned or not
- Create tables with or without spatial type
- Use spatial SQL functions to evaluate attributes and spatial relationships, perform spatial operations, and return and set spatial properties

Accessing Geodatabase through SQL

- With SQL accessing the data at the DBMS level
  - Bypass behaviors and functionality enforced by the geodatabase or ArcGIS clients
- Need to be aware of what you can and cannot edit
  - Relationship classes
  - Geometric networks
  - Topology
  - ...



Schema Creation

- **You can use the native SQL of your DBMS to tables and populate tables**
  - **Need to register the table with the geodatabase to use geodatabase functionality**

- **Generally advise to not modify schema of geodatabase items (i.e domains) through SQL**

```
CREATE TABLE hazardous_sites (row_id integer NOT NULL, site_id
integer, name varchar(40), location sde.st_geometry);

Register with Geodatabase command
```

Editing tables/feature classes

- Editing ArcGIS feature classes with SQL
  - Simple features only
  - Points, lines, polygons (single or multipart)
  - Ability to modify geometry when stored as a spatial type
  - Without geodatabase behavior

- Use the Is_Simple function to determine whether your data can be updated

Editing tables/feature classes

- Editing tables/feature classes
  - Use SQL SELECT statements
  - Directly editing the database tables (no delta tables)
  - Nonversioned editing in ArcGIS terminology

- Requires a unique identifier (ObjectID) when inserting
  - Used to uniquely identify rows in tables in a geodatabase
  - Obtained from classes sequence or procedure
  - Object ID is used by ArcGIS to do such things as display selection sets and perform identify operations on features

Editing tables/feature classes

- Editing versioned tables/feature classes
  - Requires a versioned view
- Can use SQL to update, insert and delete data from tables that are not versioned
- Can leverage DBMS functionality
  - Unique indexes, constraints, referential integrity, default values, triggers

Editing versioned tables/feature classes

- Must use several stored procedures/commands installed with ArcSDE technology
  - Create versioned views through Desktop or with GP tool
  - Create a new version (create_version)
  - Set which version to access (set_current_version)
  - Start Edit session, perform edits within the new version and Stop Edit session (edit_version)

- Unlike nonversioned editing, ObjectID values for new records are automatically generated
  - Changes are made to the delta tables
  - Versions must be reconciled through ArcGIS

Demo

- SQL access with the Geodatabase demo
- Using SQL to Access Dataset Properties
- Using SQL to Access and Edit Geodatabase Data

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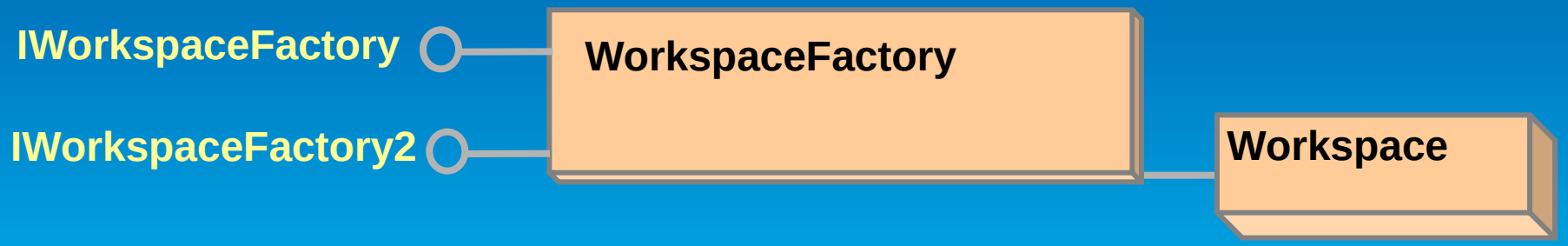
What is ArcObjects?

- ArcObjects is a library of Component Object Model (COM) components that make up the foundation of ArcGIS
- ArcObjects components are installed with the ArcGIS Desktop, ArcGIS Engine, or ArcGIS Server products and can be used in a number of ways:
  - To customize the ArcGIS Desktop applications
  - To build standalone mapping applications
  - To develop Web applications
- Grouped into over 65 assemblies based on relationships between objects
- Available for .Net, Java, C++

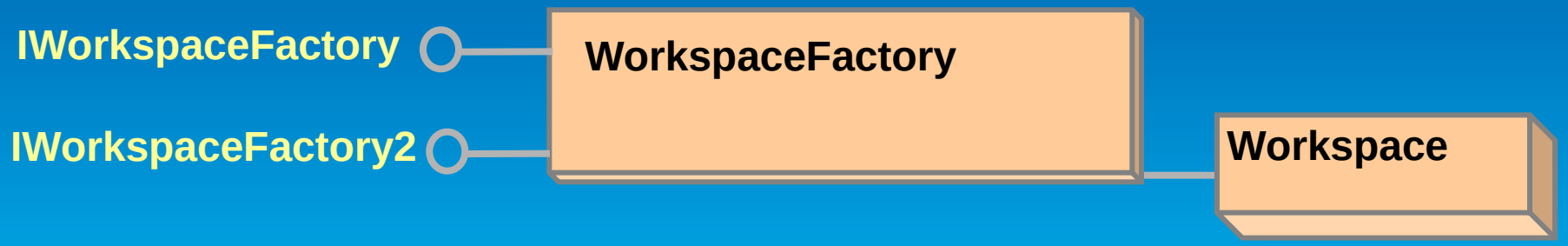
Workspace Factory and Workspaces

- Workspace Factory is a dispenser of workspaces
  - Personal, File, ArcSDE workspaces, SQL workspaces
  - Create a factory from a workspace factory coclass
- Workspace factories are singleton objects
  - One instance created per Component Object Model (COM) apartment
  - Further calls return a reference to the existing object



Workspace Factory and Workspaces

- A workspace is a container of datasets.
  - Database or Geodatabase
- Workspaces are not singleton objects
  - But, requesting a workspace with the same properties as an existing instance returns a reference to it
  - The Geodatabase guarantees unique instancing



Making a connection

- Create a workspace from a factory
  - Path to data and window handle (app ID)

```
IWorkspaceFactory sdeWkspFact = new SdeWorkspaceFactoryClass();
IPropertySet propset = new PropertySetClass();

propset.SetProperty("SERVER",“crimsontide");
propset.SetProperty("INSTANCE","5151");
propset.SetProperty("USER","brent");
propset.SetProperty("PASSWORD","brent");
propset.SetProperty("DATABASE","null");
propset.SetProperty("VERSION","SDE.DEFAULT");
propset.SetProperty("AUTHENTICATION_MODE","DBMS");

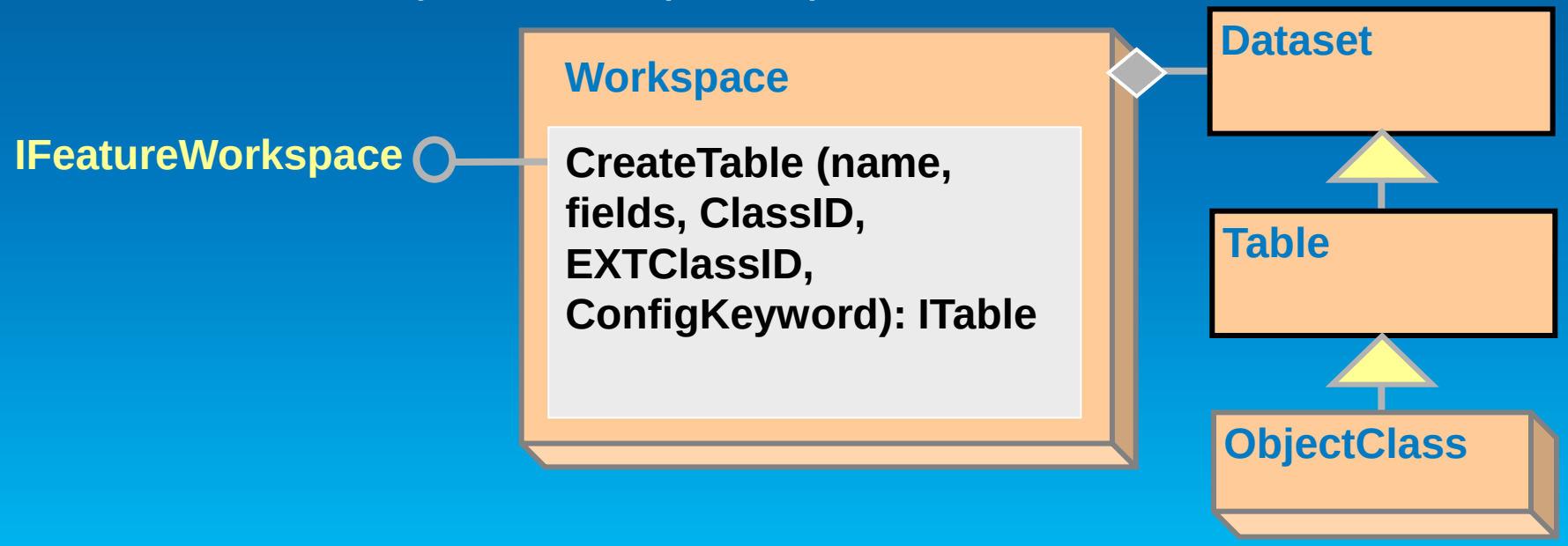
IWorkspace workspace = sdeWkspFact.Open(propset, 0);
```

- Connecting using a connection file

```
string nameOfFile = "D:\\data\\redarrow.sde”;
IWorkspace workspace = workspaceFactory.OpenFromFile(nameOfFile, 0);
```

Create an Object Class

- Creates an ObjectClass, returns ITable interface
  - ObjectID field. Values are Never Reused (can be viewed as a primary key)
- Can also use it to create a Table
- Custom behavior ID's *(can use null for EXTClassID)*
- Configuration keywords *(can use "")*
- Can create Fields first : IObjectClassDescription:RequiredFields

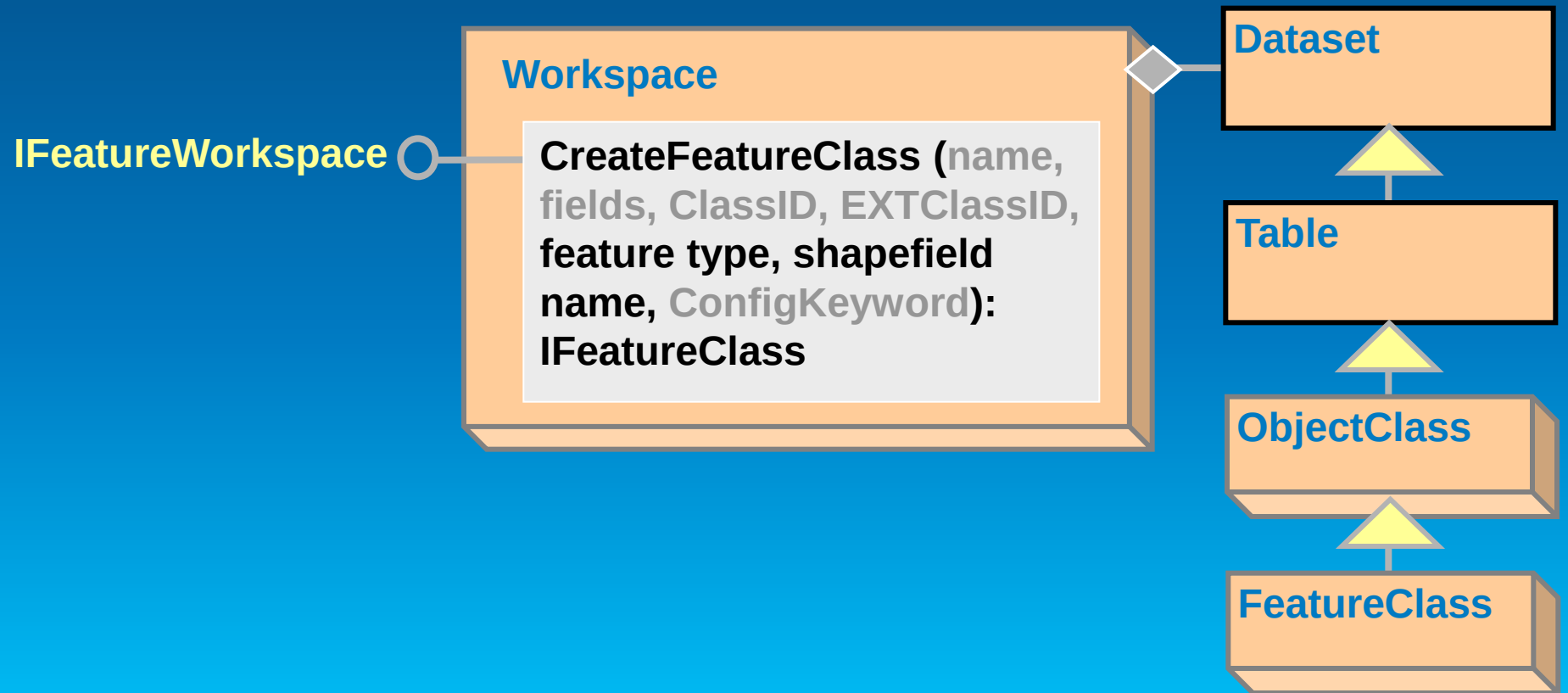


Create an Object Class …

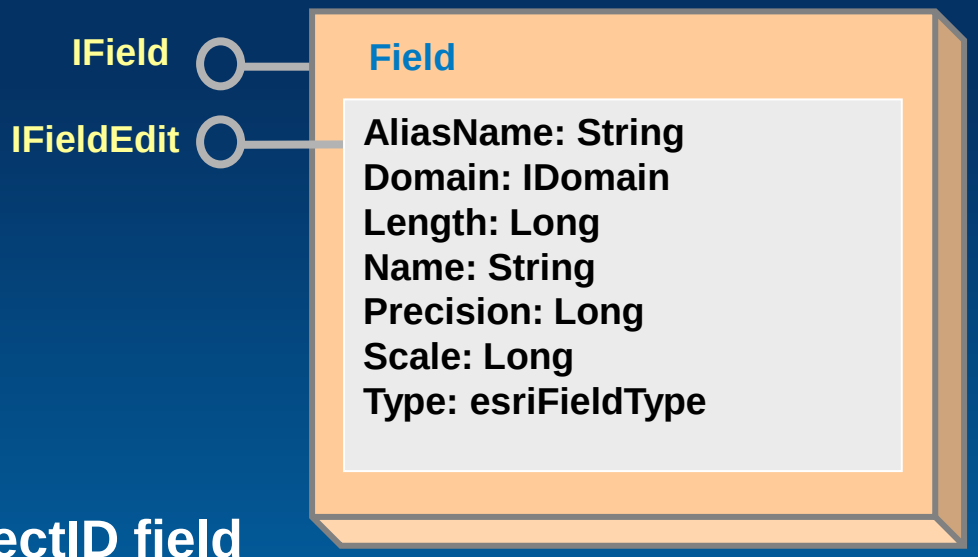
- Object Classes have geodatabase specific functionality that Tables do not, through several interfaces
  - IObjectClass
    - AliasName
    - ObjectClassID
    - RelationshipClasses
  - ISubtypes
    - AddSubtype
- Standard table operations, such as queries and row creation, are still performed on an object class using the ITable interface.

Create a Feature Class

- Same as CreateTable except requires Shape type and Shape field name
  - IGeometryDefEdit used when defining new feature class
  - Use IObjectClassDescription:RequiredFields



Create a Field



- Synonymous with a column
- Set properties with IFieldEdit
- Geodatabase tables/feature classes require ObjectID field
  - Using Class Descriptions will take care of this
- Use a Field collection (Fields) when creating datasets
  - For existing tables use IClass::AddField method to add fields and IClass::DeleteField method to delete fields
- Set properties for the Field with the IFieldEdit interface

Demo

- Database Access with ArcObjects

Feature Datasets …

- A container object for datasets with the <u>same spatial reference</u>
  - Only exist within a Geodatabase

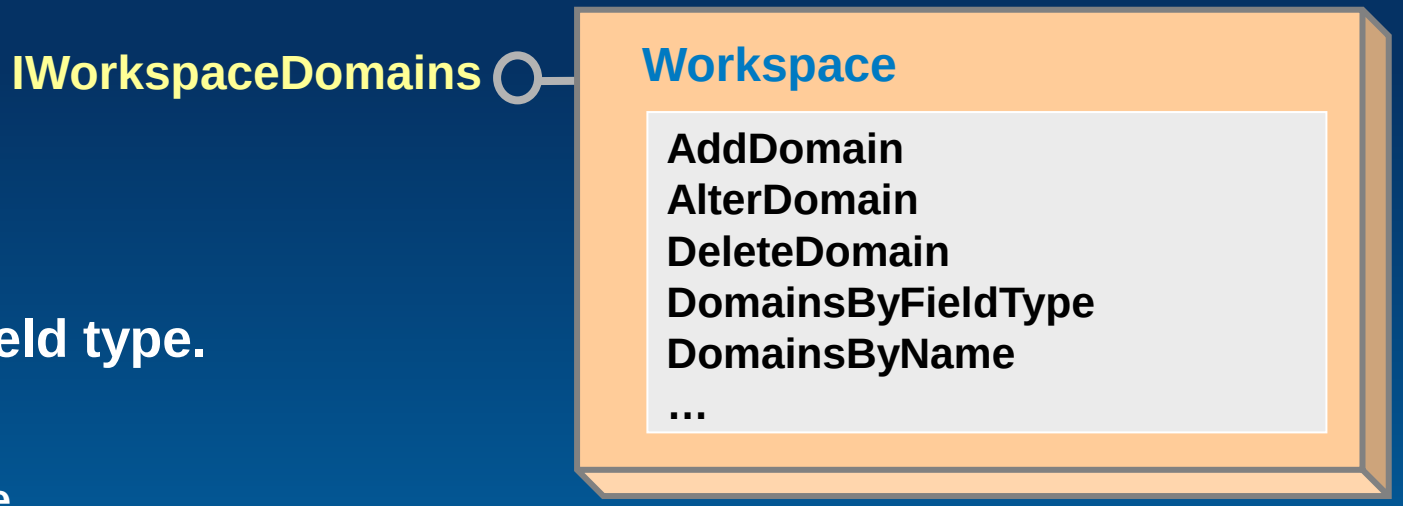
- Need to remember that feature classes may or may not belong to a feature dataset
  - The following code assumes a feature dataset exists and may fail:

```
IFeatureDataset featureDataset = featureClass.FeatureDataset;
IWorkspace workspace = featureDataset.Workspace;
```

  - This piece of code will work for standalone feature classes and those in feature datasets:

```
IDataset dataset = (IDataset)featureClass;
IWorkspace workspace = dataset.Workspace;
```

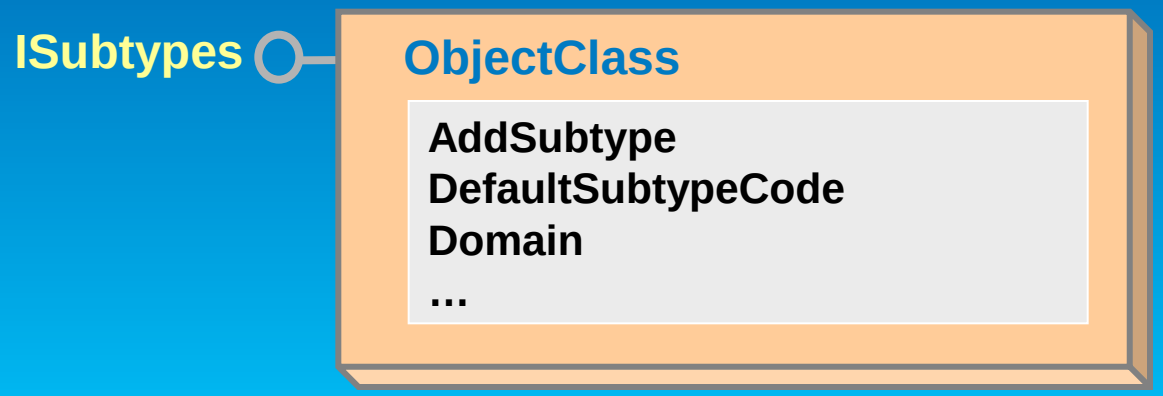
Domains



- Describe the legal values of a field type.
  - Used to ensure attribute integrity
  - Two types: Range and Coded Value
- Use the IWorkspaceDomains interface to manage the collection of domains found within a workspace.
  - Since Domains are shared amongst feature classes; the management of them is at the workspace level
- DeleteDomain will fail if the domain is associated with a field
- Domain names are unique across a workspace
  - Need to check for existence of Domain name prior to creation or trap for the error

Subtypes

- Subtypes are specific to feature class
  - Partition the objects in a class into like groups
- Once set, need to check attribute, connectivity and relationship rules at subtype level
- Each object class has a default subtype code
  - Important for feature creation and editing
- ISubtypes interface is used for managing subtypes and the associated default values and attribute domains



Demo

- Database Access with ArcObjects Part Deux

Creating Rows and Features

- Basic process to create row or feature
  - CreateRow or CreateFeature
    - Can also use InsertCursor, more later
  - If subtypes present, set IRowSubtypes::SubtypeCode
  - If default values, call IRowSubtypes::InitDefaultValues
  - Set attribute values
  - Create geometry and set Shape
  - Call Store
    - Writes the values to the record in the table

Simple vs. Complex Features

- Within the geodatabase, behavior is dependent upon whether a feature is simple or complex
- Simple features
  - Point, line, polygon, multipoint, multipatch features
  - Simple Relationships
- Complex features
  - Network features (simple edge, simple junction, complex edge)
  - Annotation features
  - Dimension features
- Any dataset specific behavior (i.e.: for features created in geometric networks) is handled at creation time
  - Not required to call Connect or create Dirty Areas

Demo

- **Creating Features**
  - **Walk through basic process to create a feature**

Geodatabase Editing - Edit Session

- Geodatabase explicitly stores change information when edited
- Only see the changes you've made within the edit session
  - Changes made by other applications are not seen
  - Until Save or Discard
- Edits should be made within an edit operation
  - StartEditOperation – StopEditOperation
  - Perform the edit as quickly as possible
  - Keep edit operation "tight and compact"
  - Collect the required information before starting the edit operation

Geodatabase Editing - Edit Session …

- Each edit operation represents a transaction
  - Stop commits the change
  - Abort rolls back, like undo
- Applications are responsible for calling:
  - AbortEditOperation when errors are detected
  - StopEditOperation to complete edit operations
    - Pushes the edit operation onto the undo stack
- UndoEditOperation, RedoEditOperation
  - Geodatabase moves the operation between the undo and redo stacks

Editing the Geodatabase

- When to use edit sessions?
  - Must use with topologies, geometric networks, etc
  - Use IObjectClassInfo2::CanBypassEditSession
- When to use IEditor or IWorkspaceEdit?
  - Use IEditor to edit within an application, like ArcMap
  - Ensures undo/redo consistency between edits made programmatically and through the UI
  - Must use IWorkspaceEdit in Engine environment
- Similar methods on each

Other Useful Method When Editing

- IDatasetEdit.IsBeingEdited
  - Determine if a particular dataset is participating in the edit session
- IWorkspaceEdit2.IsInEditOperation
  - Determine if the workspace is currently in an edit operation
  - Use when deciding whether to start an edit operation
- IWorkspaceEdit2.EditDataChanges
  - Determine which features have been changed with the scope of an edit session or edit operation.

Editing Demo

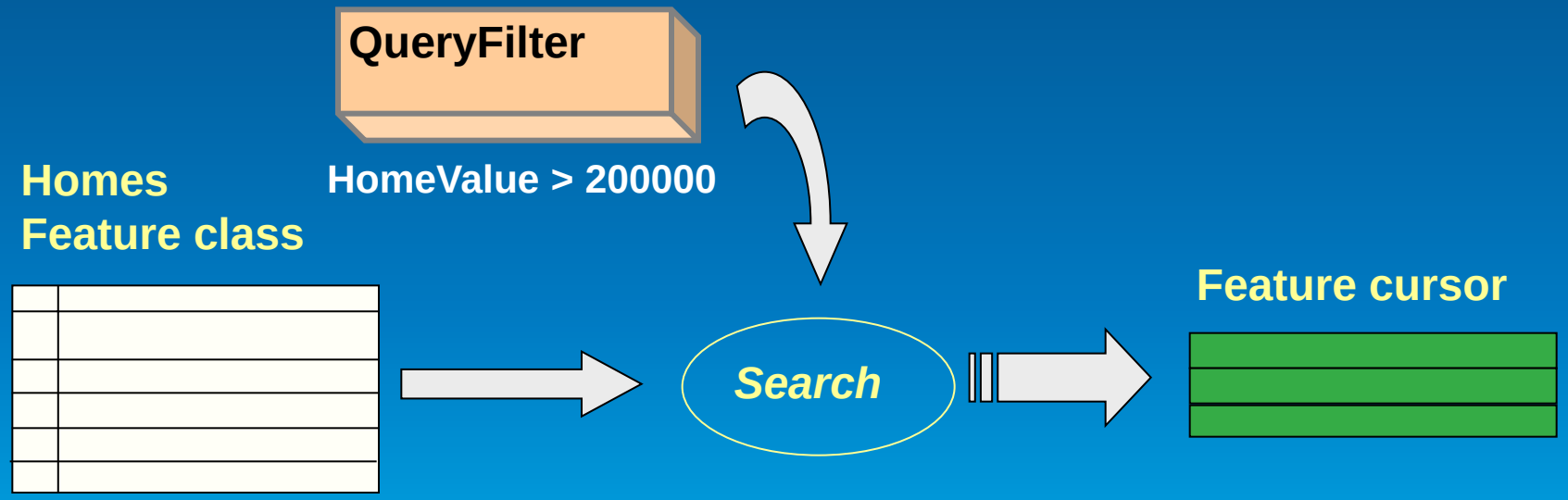
- Edit Operations

Cursors

- A geodatabase object used for the iteration of records returned from a query
- 3 Class Cursors
  - Search (general query cursor)
  - Update (positioned update cursor)
  - Insert (bulk inserts)
- A table and a query return a cursor
- Used to:
  - Iterate over a set of rows in a table
  - Insert new rows into a table
- A cursor gives you access to one row at a time

Creating a Cursor

- QueryFilter contains a SQL-like statement
- The cursor contains a subset
  - No filter\nothing, all rows returned



IQueryFilter

- IQueryFilterDefinition::PostFixClause
  - Supports functions such as ORDER BY

```
IQueryFilter queryFilter = new QueryFilterClass();
queryFilter.SubFields = "OBJECTID,FULLNAME,ParcelID";
queryFilter.WhereClause = “FULLNAME like ‘D%’";

IQueryFilterDefinition queryFilterDef =
(IQueryFilterDefinition)queryFilter;
queryFilterDef.PostFixClause = "ORDER BY FULLNAME";

IFeatureCursor featureCursor = featureClass.Search(queryFilter, true);
```

Creating a Cursor …

- SpatialFilter need a geometry and relationship
- Below the geometry is a polygon
- Below the spatial relationship is *contains*

Contains

Crosses

Intersects

Overlaps

Touches

Within

ISpatialFilter

- Used to query spatial aspects of a feature class
  - Inherits from IQueryFilter

```
ISpatialFilter spatialFilter = new spatialFilterClass();

spatialFilter.SubFields = “OBJECTID,FULLNAME,ParcelID,SHAPE”;
spatialFilter.Geometry = envelope;
spatialFilter.SpatialRel = within;
spatialFilter.WhereClause = “FULLNAME like ‘D%’”;

IFeatureCursor featureCursor = featureClass.Search(spatialFilter, true);
```

Types of Class Cursors

- Search cursors
  - Returns rows specified by a Query or Spatial Filter
- Update cursors
  - Update and delete rows specified by the filter
  - Specify the ObjectID field
- Insert cursors
  - Used for inserting rows into a table
- Accessed by
  - Corresponding methods on table or feature class

Types of Class Cursors …

- Forward only, do not support
  - Backing up and retrieving rows already retrieved
  - Making multiple passes
  - Resetting
- Solution:
  - Re-execute the query
- Release Class Cursors with
  - Marshal.ReleaseComObject
  - Cleaner.release()

Types of Class Cursors …

- Insert cursors are used to bulk insert rows
  - Faster for loading simple data than IFeature.Store
    - Bypasses events
    - IObjectClassInfo2 and IWorkspaceEditControl to override
  - Not Faster for non-simple data
    - Behavior, composite relationships, and notification
    - Need CreateRow and Store methods, so no performance gain
  - Use of Buffering is key
    - Pre-define attribute values
    - Buffers inserts on client, sends to database on Flush
- Flush – Call or not
  - Interval flushing: Check for room or handle errors
  - Careful: Insert cursors flush on destruction
    - No chance to detect errors

Types of Class Cursors …

- Scope cursors to edit operations
- Cursor is bound to a specific state of the geodatabase
- When state of the geodatabase changes cursor is no longer valid and should not be used
  - Performing edits on a cursor that is incorrectly scoped can cause unexpected behavior.

Recycling Method

- Recycling
  - A recycling cursor is a cursor that does not create a new client side row object for each row retrieved from the database
  - Allocate a single row object
    - Re-hydrate on each fetch
  - Performance advantages
  - Primarily used for reading data
- Non Recycling
  - A different row object on each fetch
  - Always has full set of fields, even if IQueryFilter::Subfields used

```
pCursor = theMeds.Update(pFilter, false)
```

Cursor demo

- Cursors examples
  - Search
  - Update
  - Insert

Presentation Outline

- Introduction
- Databases and Geodatabases
- SQL
- ArcObjects
- Plug In Data Sources
- BREAK
- Python
- File Geodatabase API
- Runtime
- Web Mapping

What are Plug-In Data Sources?

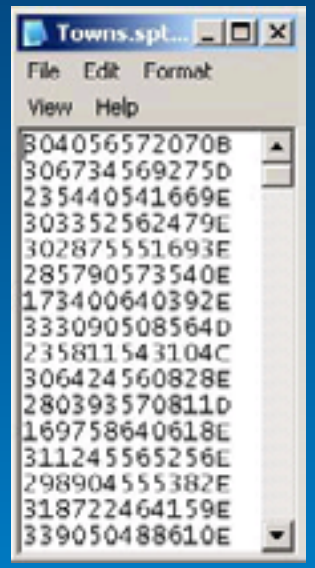
- Integrates a new data format into ArcGIS in a read-only manner
- Provides ability to:
  - browse, preview, and manage the data in Catalog
  - select, render, query, label, and join the data in ArcMap.
  - program with the data source using normal geodatabase interfaces such as IWorkspace and IFeatureClass.
- Supports simple feature types; tables, feature classes and feature datasets

The Case for a Plug-In Data Source

- Receive a regular supply of text files containing geographic locations
  - Data in the files has an unusual/non-standard format
- Don’t want to convert data every time a new file is received to use with ArcGIS
  - Need to work with data in its native format within ArcGIS

The Case for a Plug-In Data Source

- Example ASCII text file
  - Point data
- The first six characters are the x-coordinate
- The next six characters contain the y-coordinate
- The trailing characters contain an attribute value.



Creating a Plug-In Data Source

- To make a plug-in data source, you must implement four required classes:
  - plug-in workspace factory helper
  - plug-in workspace helper
  - plug-in dataset helper
  - plug-in cursor helper
- Other optional classes that can also be implemented

Demo

- Plug-In Data Sources walkthrough

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What is Python?

- Cross-platform, open source programming language
- Does not require a compiler
- Programs written with Python are called scripts

Why Python?

- Free
- Simple and easy to learn
- Modular
- Easy to maintain
- Scalable
- Cross platform (Windows and Linux)
- Wide-acceptance
- Scheduling

Why Python …

- **Significantly reduces the amount of time spent on a project.**
  - **Quickly execute & re-execute tools or functions**
  - **Automate common tasks**

- **It is designed to be easy to read and learn**
  - **"Maintainability" – easy to modify and keep up to date**

What is ArcPy?

- A cornerstone for automation in ArcGIS
  - Data analysis, data conversion, data management, map automation, geodatabase management
- ArcPy is a native Python site-package
  - Site package is Python's term for a library that adds additional functions to Python
  - Access to 800+ geoprocessing tools
  - Embedded reference documentation for each function, class and module
  - Code completion for ArcGIS components in your favorite Python editor

Running Python Code

- Through the Python window
  - An interactive window that lets you enter Python code, execute it, and view the results in your active map.
- Script tool/Python tool
  - Create a geoprocessing tool that executes a Python script
- Operating system prompt
  - Execute a Python script that uses ArcPy routines
  - Need an ArcGIS application, does not need to be running
- Various Python IDE’s
  - PyScripter, Wing IDE, PythonWin, PyDev/Eclipse etc.

Demo

- Python demo

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File Geodatabase API

- Provide a non-ArcObjects based means by which advanced developers can work with File Geodatabases
- C++ API with coarse grained access to File Geodatabase
- Will not replace other APIs as the recommended approach to interacting with the File Geodatabase

File Geodatabase API…

- Leveraging the work done with simplifying the Geodatabase
  - Will only support file geodatabases created with 10.0 and newer clients
  - No support for pre-10.0 file geodatabases
- Target audience
  - Advanced developers who require access to the File Geodatabase without an ArcObjects license for purposes of interoperability

Coarse-Grained Tasks possible with API

- Create, Open, Delete file geodatabases
- Read the schema of a geodatabase
  - All content within a geodatabase can be opened for read access
- Create schema for objects within the simple feature model:
  - Tables
  - Point, Line, Polygon feature classes
  - Feature datasets
  - Domains
  - Subtypes

Coarse-Grained Tasks possible with API…

- **Read the contents of datasets in a geodatabase**
  - **The majority of dataset content within a geodatabase can be read**
    - **Some exceptions such as network indexes**

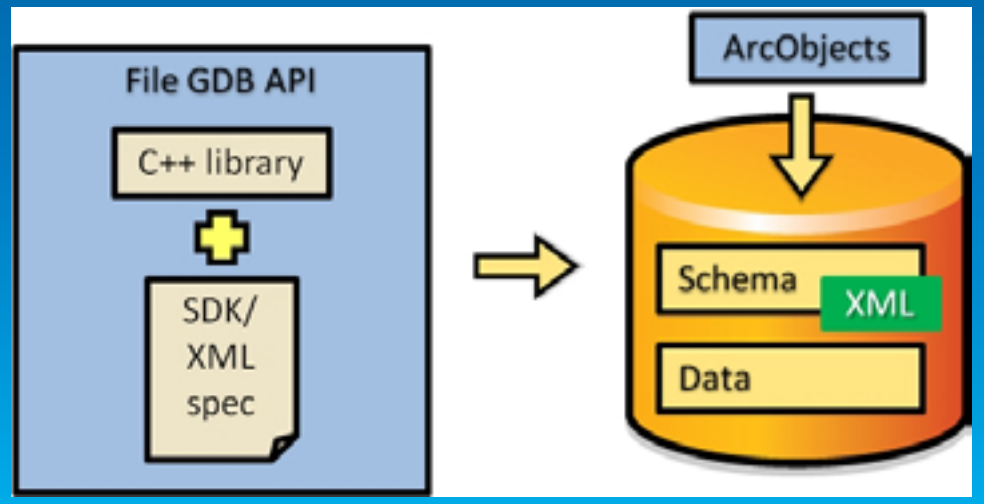
- **Insert, Delete and Edit the contents of simple datasets:**
  - **Tables**
  - **Point, Line, Polygon, Multipoint, Multipatch feature classes**

Coarse-Grained Tasks possible with API…

- Perform attribute and (limited) spatial queries on datasets
  - Spatial queries will be limited to the envelope-intersects operator
- Spatial References are limited to pre-defined GCS, PCS and Unknown
  - Custom coordinate systems are not supported
- Supports for a subset of the SQL 92 standard
  - e.g. Select statements, Order By

File Geodatabase API Overview

- Single downloadable ZIP file containing:
  - C++ library (single dll, lib, .h) built on Windows, Linux, Mac OS platforms
  - API documentation (html) and Samples
- Freely available from the Geodatabase Resource Center
  - Version 1.3 is available
  - Version 1.4 coming soon



Demo

- File API demo

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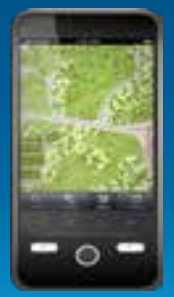
Lightweight Applications and Runtime SDKs

Configurable applications and native ArcGIS Runtime SDKs

iOS	Android	Windows Phone	Windows Mobile	Windows	Linux
Applications • ArcGIS	**Applications** • ArcGIS	**Applications** • ArcGIS	**Applications** • ArcGIS	**Applications** • ArcGIS Explorer*	**Applications** • None
Runtime SDK • Objective C	**Runtime SDK** • Java	**Runtime SDK** • Silverlight	**Runtime SDK** • .NET	**Runtime SDK** • WPF, Java, Qt	**Runtime SDK** • Qt, Java
					

Introducing the ArcGIS Runtime for Desktop

A GIS Runtime for Windows and Linux

- Integrated into the ArcGIS Ecosystem
- Small Footprint
- Fast Display
- Easy to Deploy

ArcGIS Runtime for Desktop Specifics

- New Architecture
  - Native 32 and 64 bit code execution
  - Utilizes hardware (Cores, CPUS,..)
  - Asynchronous programming pattern
- Simplified Deployment
  - No install required
  - Deploy only needed components
  - Side-by-Side deployment
  - Independent of other ArcGIS installs
- SDKs
  - WPF, Java, Qt,
  - Builds on the ArcGIS APIs

Its Not Just About Writing Code

- ArcGIS Desktop Used to Provision Content
- Content is Authored
  - Map Packages
  - Tile Packages
  - Locator Packages

- Functionality Can Be Authored
  - Geoprocessing Packages

- Packages can be delivered on Media, or downloaded from online
- ArcGIS Server Can Deliver Content to Clients

Available Functionality

- Fully Supports ArcGIS Cartography Including Representations, Annotation and Labeling
- Geocoding
- Geoprocessing Tools, Scripts and Models Supported
  - System Tools Available Depend on Level of the Runtime
- Geodatabase Feature Editing
  - File and Enterprise Geodatabase
  - Simple Feature Editing
  - Attributes and Shape
- Feature Services

Desktop Developer

Development Options

ArcGIS Desktop

ArcGIS Engine

Runtime

ArcGIS
Mobile Tablet

ArcGIS Explorer

ArcReader

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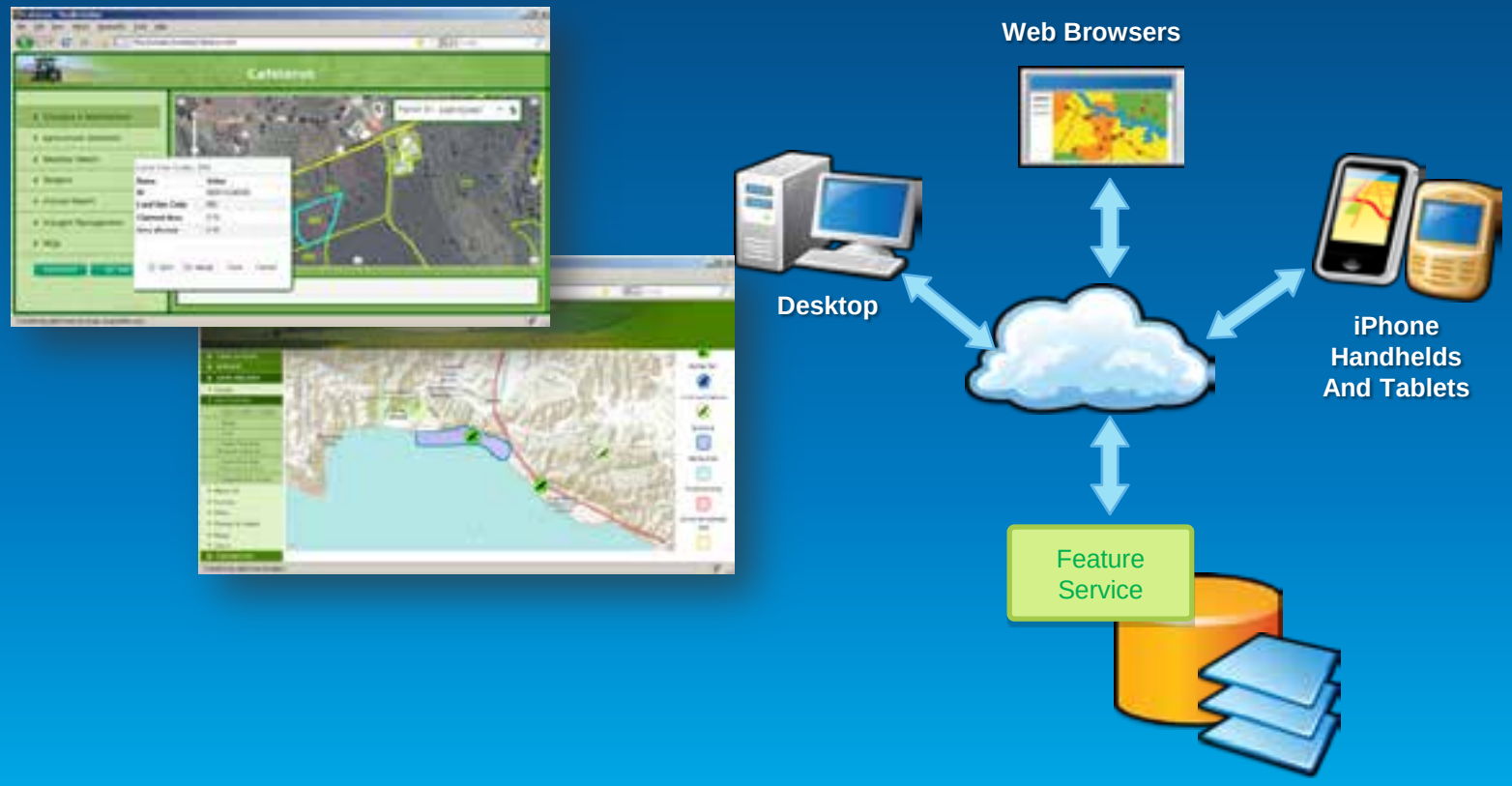
Agenda

- The basics of Web Editing in ArcGIS Server
- Web Editing scenarios
  - Attachments
  - Editor tracking
  - Ownership Based Access Control
  - Handling complex symbology/geometries
  - Disable geometry edits
  - Editing versions
  - Sophisticated Web Editing

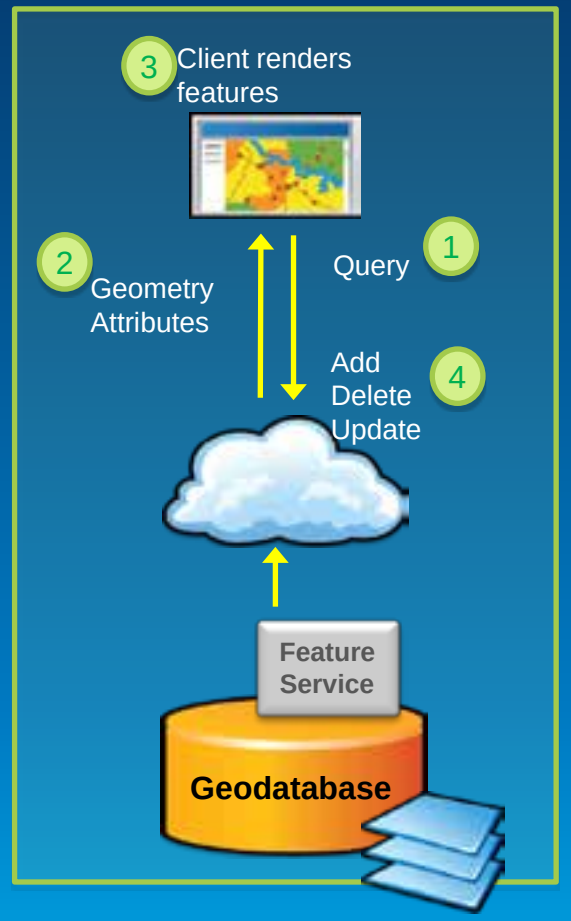
Feature Services in ArcGIS

From simple sketching to sophisticated editing through web services



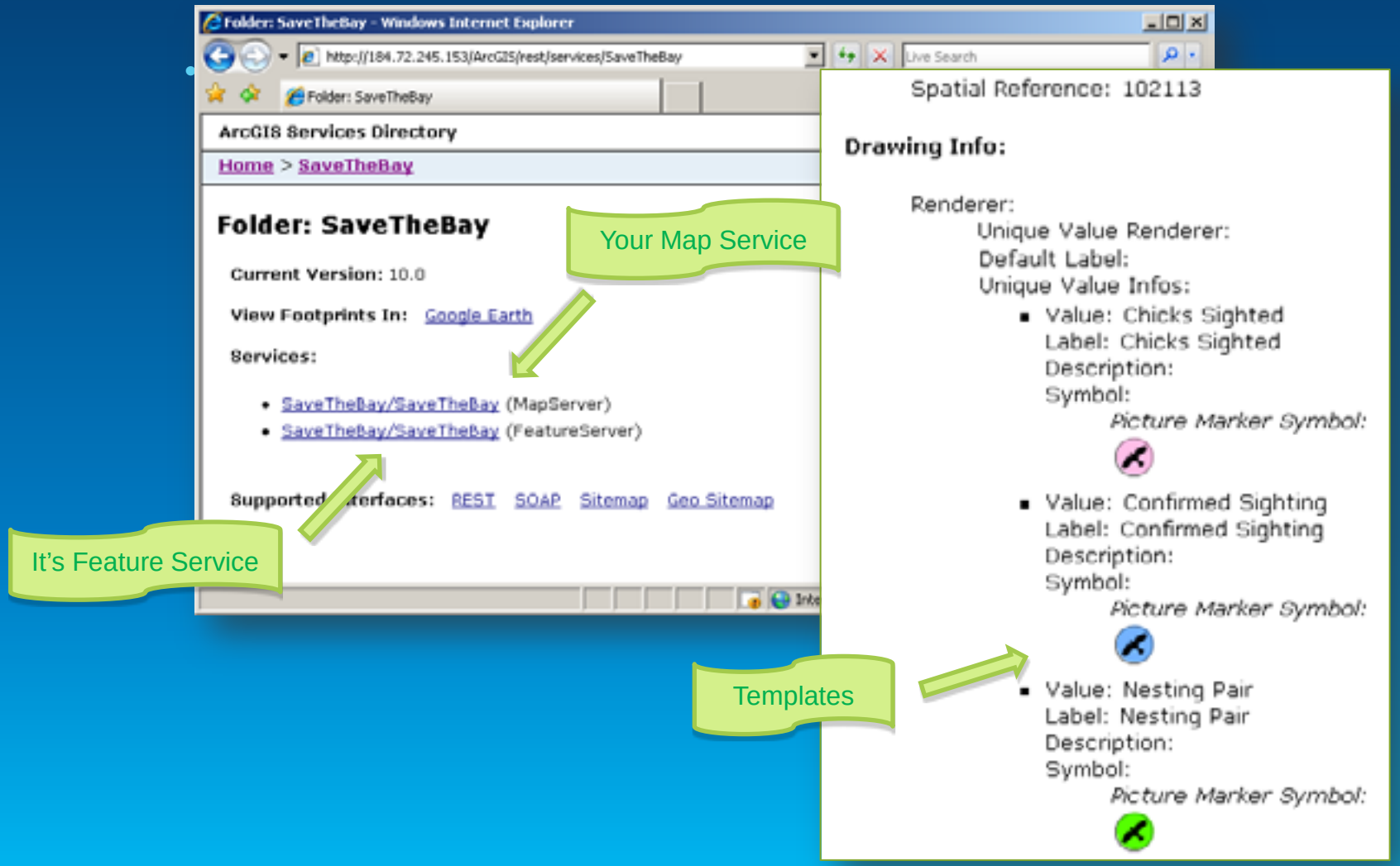
What is a Feature Service?

- Added in ArcGIS 10
- Designed for web editing
  - Push changes into the geodatabase over the internet
  - Feature template-based editing
- Also excellent for querying
  - Fetch geometries and attributes
  - Client renders features (Thematic mapping, maptips…)
- Stateless, quick, RESTful service



How Feature Services work? (Simplified)

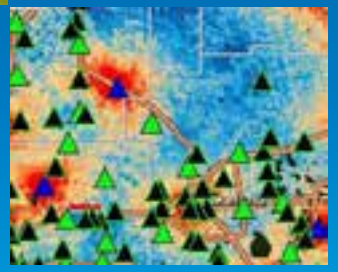
The Services Directory view



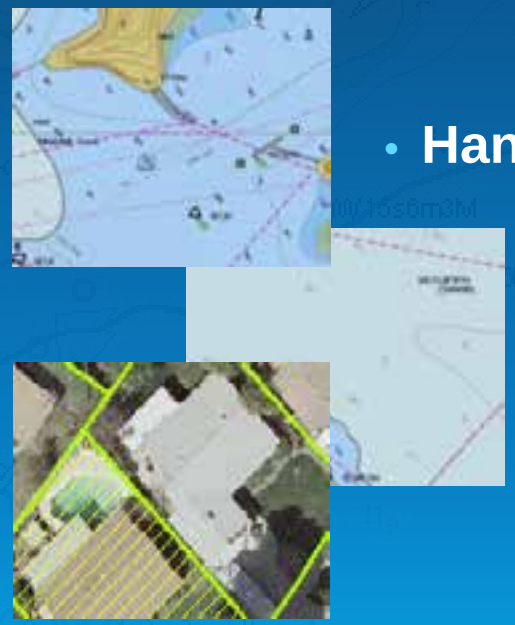
How to create a web editing application?

Feature Service Basics Demo

- Authoring the Map and Editing Templates
- Publishing the service
- Using it



Web Editing Scenarios



- Attachments
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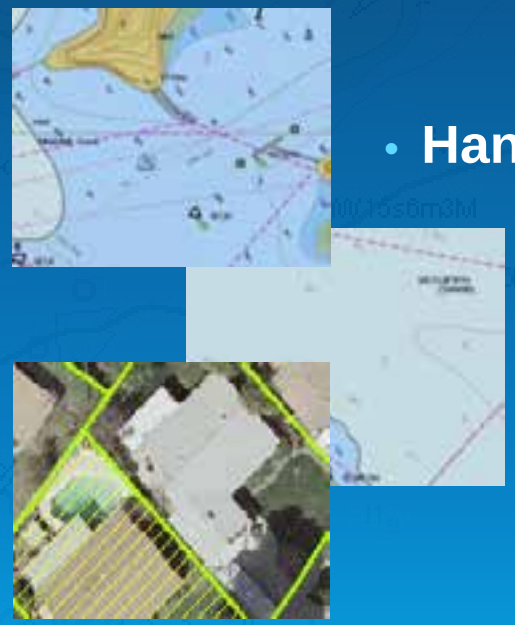

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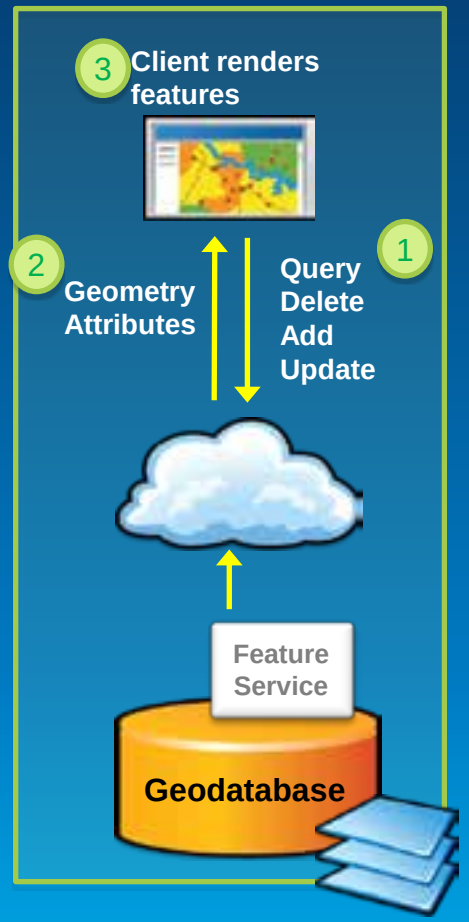
Feature Service usage web editing patterns I

Feature Service to edit and graphics render

- Render features in the client (Feature Layer)
- Fetch all at once (Snaphsot mode)
- Or as needed (On demand mode)

- Subset of ArcGIS symbology
- No more than a few hundred features in display*
- Careful with large polys/polylines
- Take advantage of maptips (popups)



Render features client-side

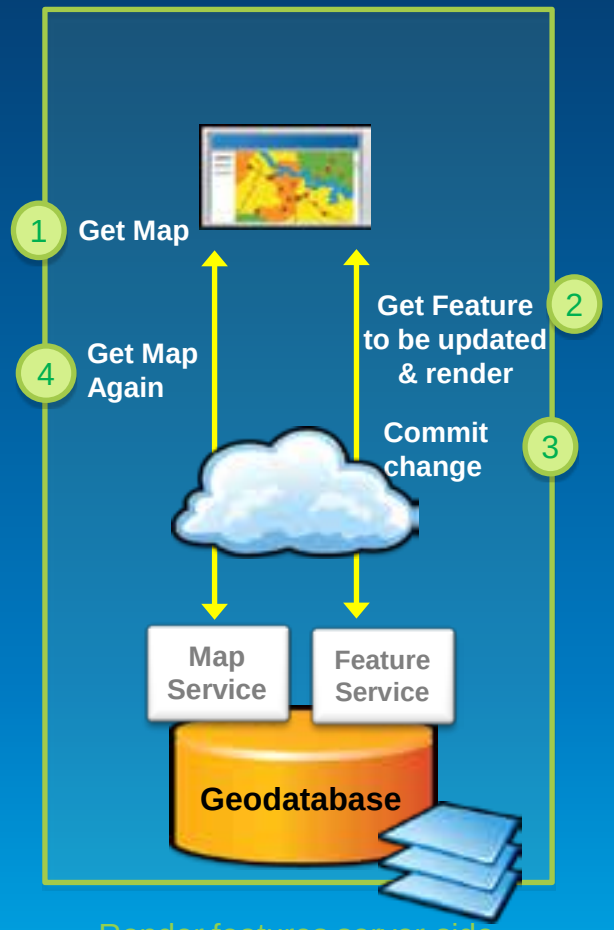
* Be smart about using scale dependencies, generalize, filter…

Feature Service usage web editing patterns II

Feature Service to edit and map service to render

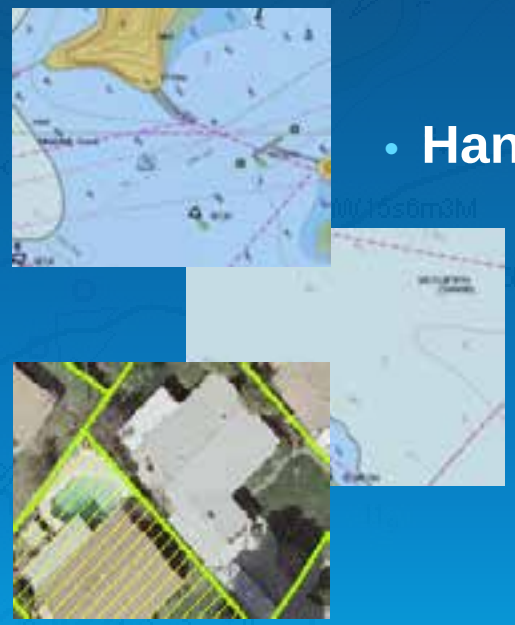
- Render features in the server (Map service)
- Refresh map after every update
- Features being edited displayed in client
  - Through FeatureLayer Selection mode

- Full symbology
- Many and complex features



Render features server-side

Web Editing Scenarios



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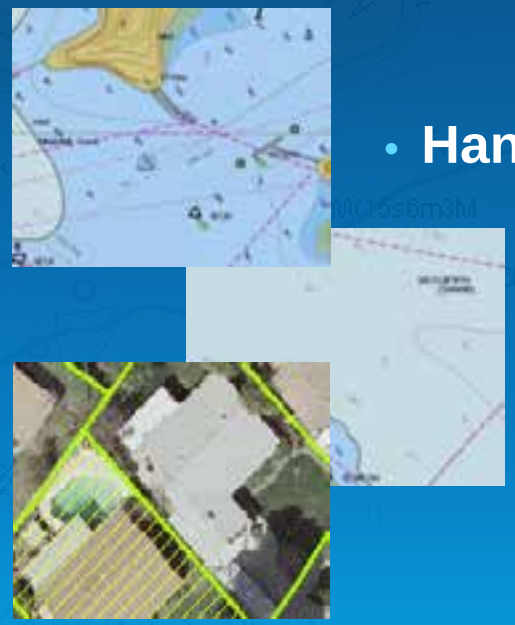

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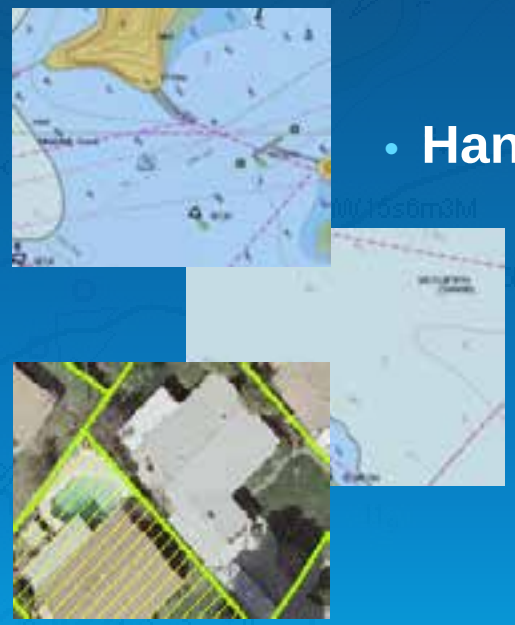

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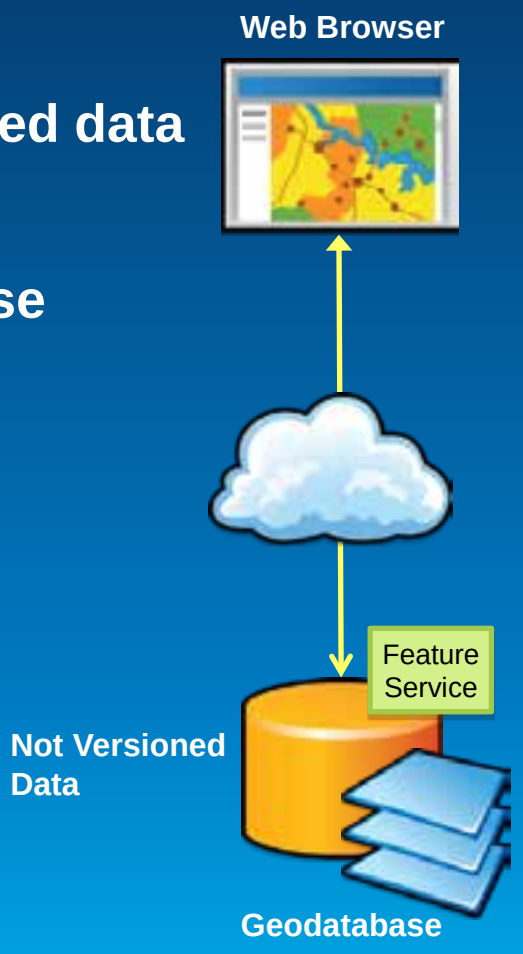
Sophisticated Web Editing

- Edit toolbar available with the web APIs
- Geometry Service
  - ArcGIS Server service for geometry manipulation
- Server Object Extensions
  - how you extend ArcGIS Server
- ArcGIS desktop
  - Tools to edit and sync a local copy

Editing native spatial types in databases

- Feature service against non versioned data
- Last-in wins
- Changes directly applied on database
- Use Spatial Data Server



The challenge is the user experience

- Adding many tools is an easy and often unnecessary part
- Build focused editing apps
  - The necessary tools, no more
  - The workflow drives the design, not the opposite!
- Start by selecting the right client
  - Do not reinvent the wheel
  - Do not push the technology beyond its comfort level
  - Or your users!
- Develop if needed

Summary

- ArcGIS Server features built-in web editing capabilities
- Enabling many exciting applications
  - Crowd sourcing, geocollaboration, web editing…
- Feature Services
- Out of the box editing clients
  - ArcGIS.com Viewer
  - ArcGIS Viewer for Flex
- ArcGIS Web Mapping APIs
  - FSVersionedEditing app on ArcGIS.com
- Geometry Service and Server Object Extensions

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- Questions and other information

Sessions

- Effective Geodatabase Programming
  - Tuesday; 1:00 – 2:00. Pasadena/Ventura/Sierra
- Administering your Enterprise Geodatabase through Python
  - Tuesday; 2:30 – 3:30. Primrose B
- Using the File Geodatabase API
  - Tuesday; 2:30 – 3:30. Demo Theater 1
- Accessing you Enterprise Geodatabase through SQL
  - Tuesday; 4:00 – 5:00. Primrose C/D
- Big Data: Using ArcGIS with Apache Hadoop
  - Thursday; 8:30 – 9:30. Catalina/Madera
  - Thursday; 1:00 – 2:00. Smoketree F

Additional Resources

- **Showcase at Night**
  - **Tuesday at 6:30 – 8:30 pm**
- **ESRI Showcase**
  - **Monday 11:00am – 7:30pm**
  - **Tuesday 12:30pm – 5:30pm**
  - **Wednesday 10:00am – 4:00pm**
- ***ESRI Resource Centers***
  - **PPTs, code and video**

Final Notes

- Please fill out session surveys
  - Helps us improve the session
- All sessions are recorded and will be available on the Resource Center
  - Slides and code samples will also be available
- Still have questions?
  - Geodatabase area in the Showcase

esri

Understanding our world.