Geodatabase: An Overview

David Crawford

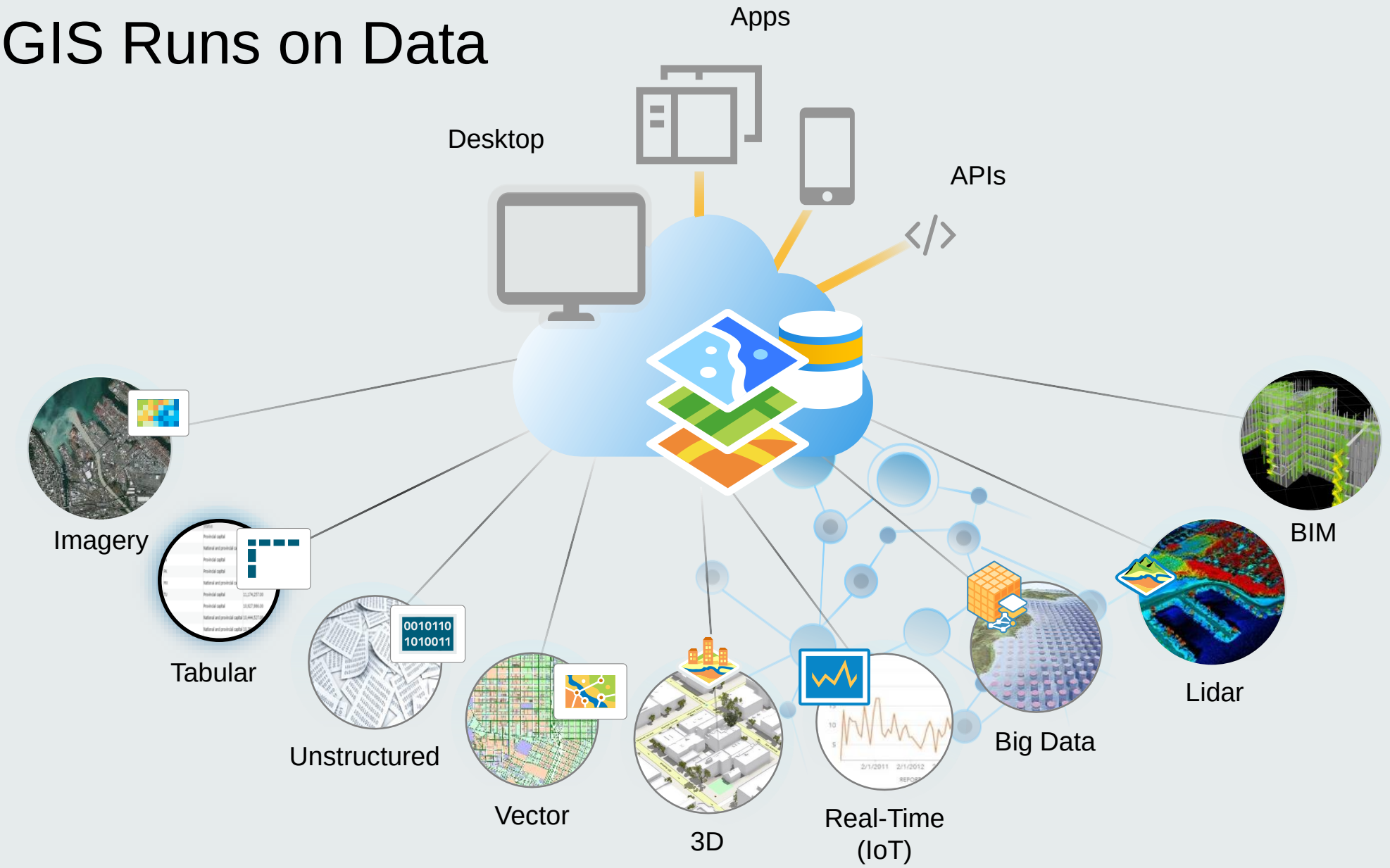
Shannon Shields

SEE WHAT OTHERS CAN'T

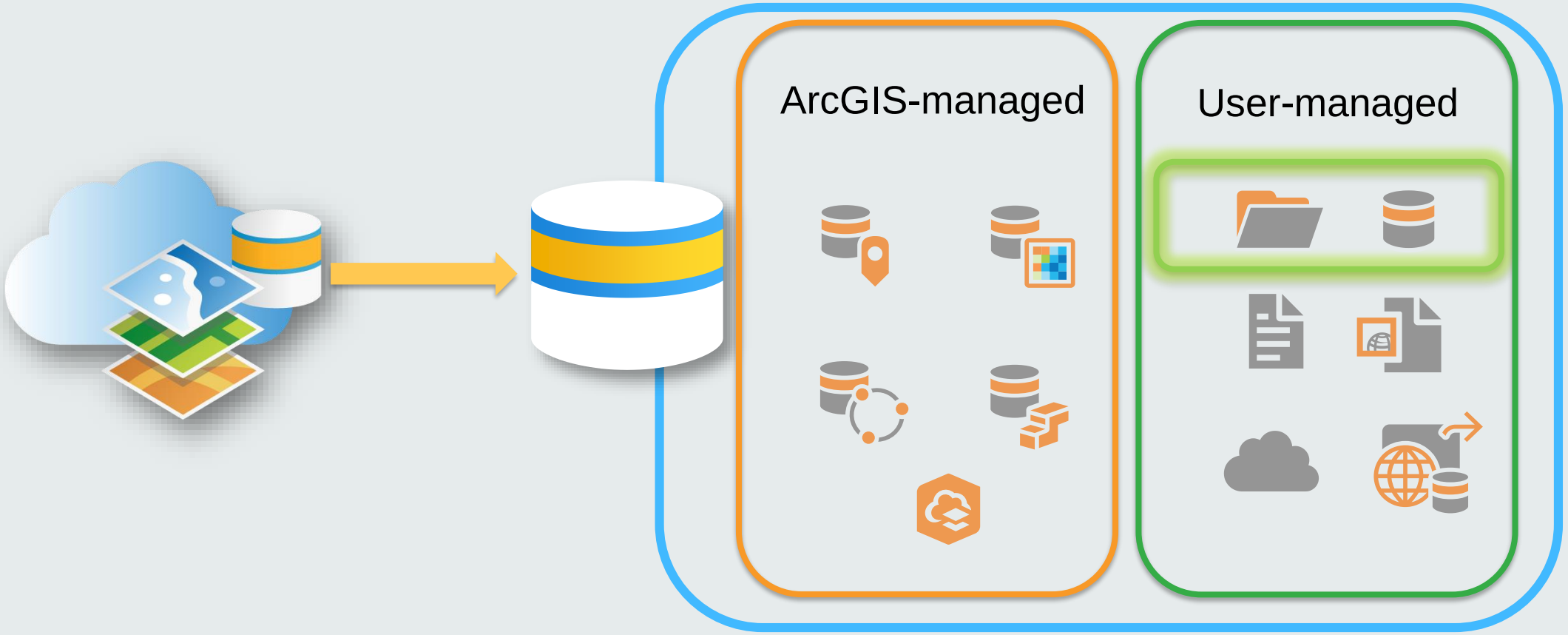
Contents

- ArcGIS runs on data
- Geodatabase building blocks
- Rules for your data
  - Attribute
  - Spatial
- Advanced models

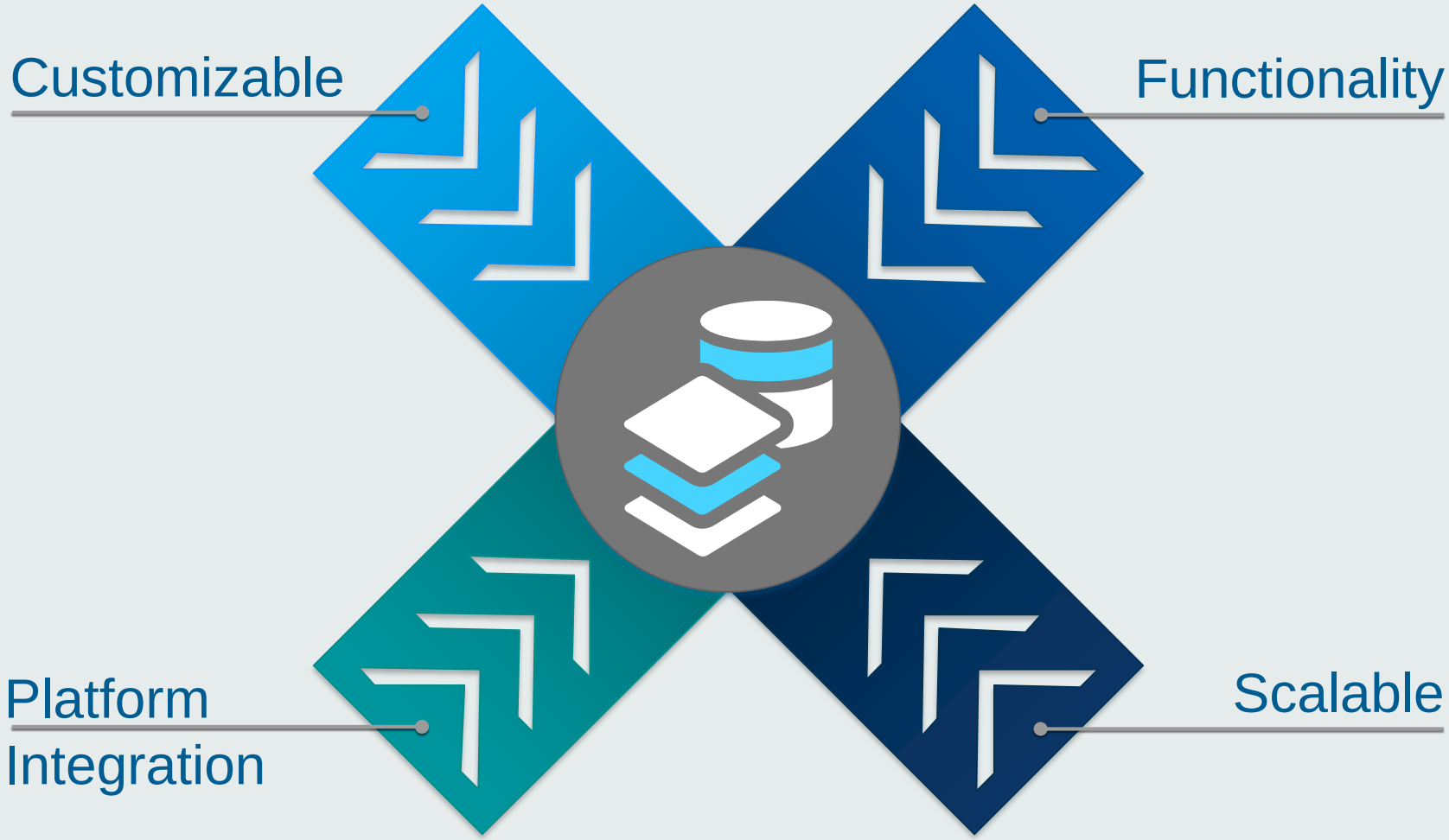
ArcGIS Runs on Data



Many data stores, many choices



Why use a geodatabase?



Two flavors

File System

File geodatabase

Single Editor

RDBMS

Enterprise geodatabase

Multiple Editor

Oracle

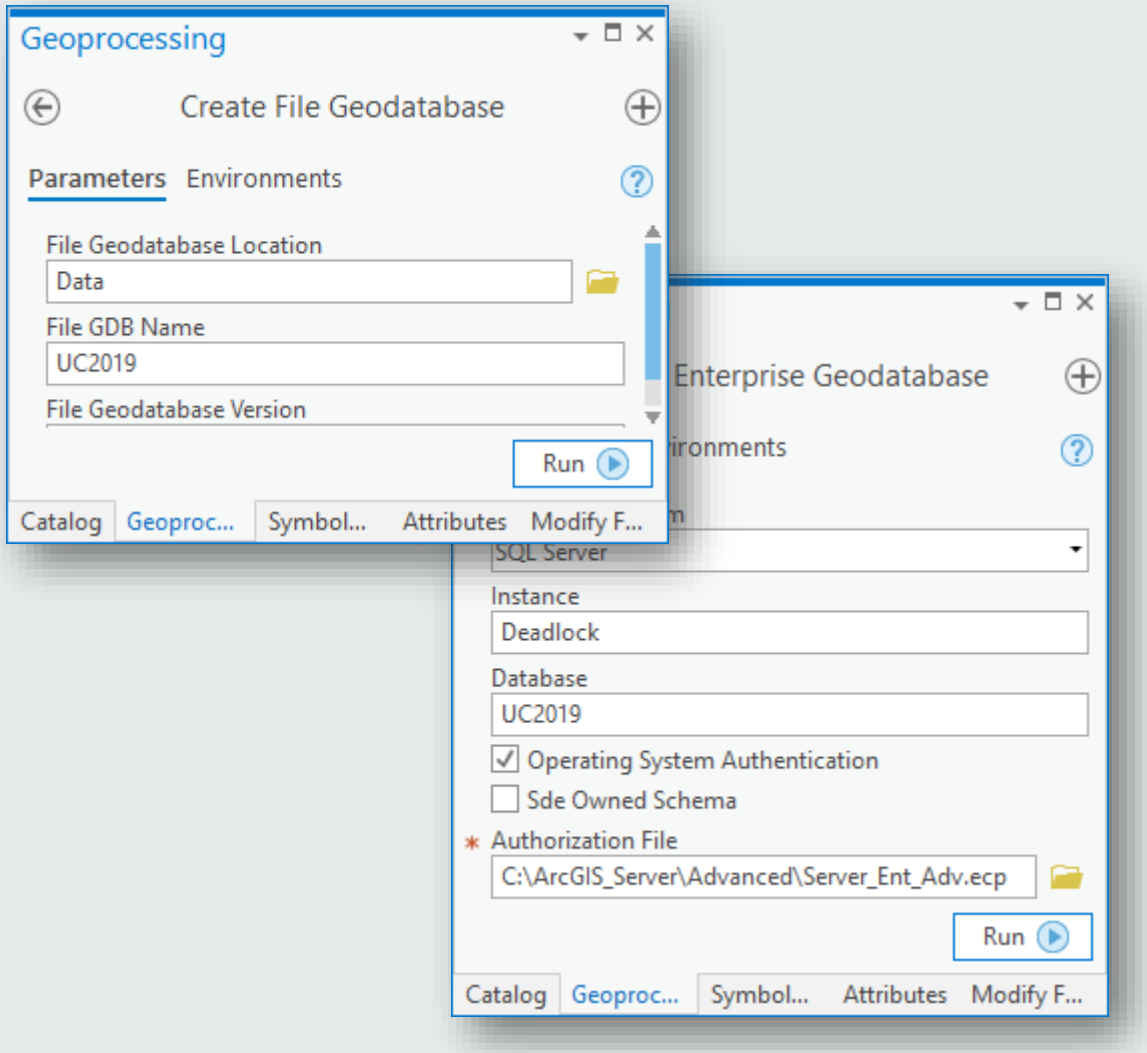
SQL Server

Postgre SQL

DB2

Informix

SAP HANA



Creating a geodatabase

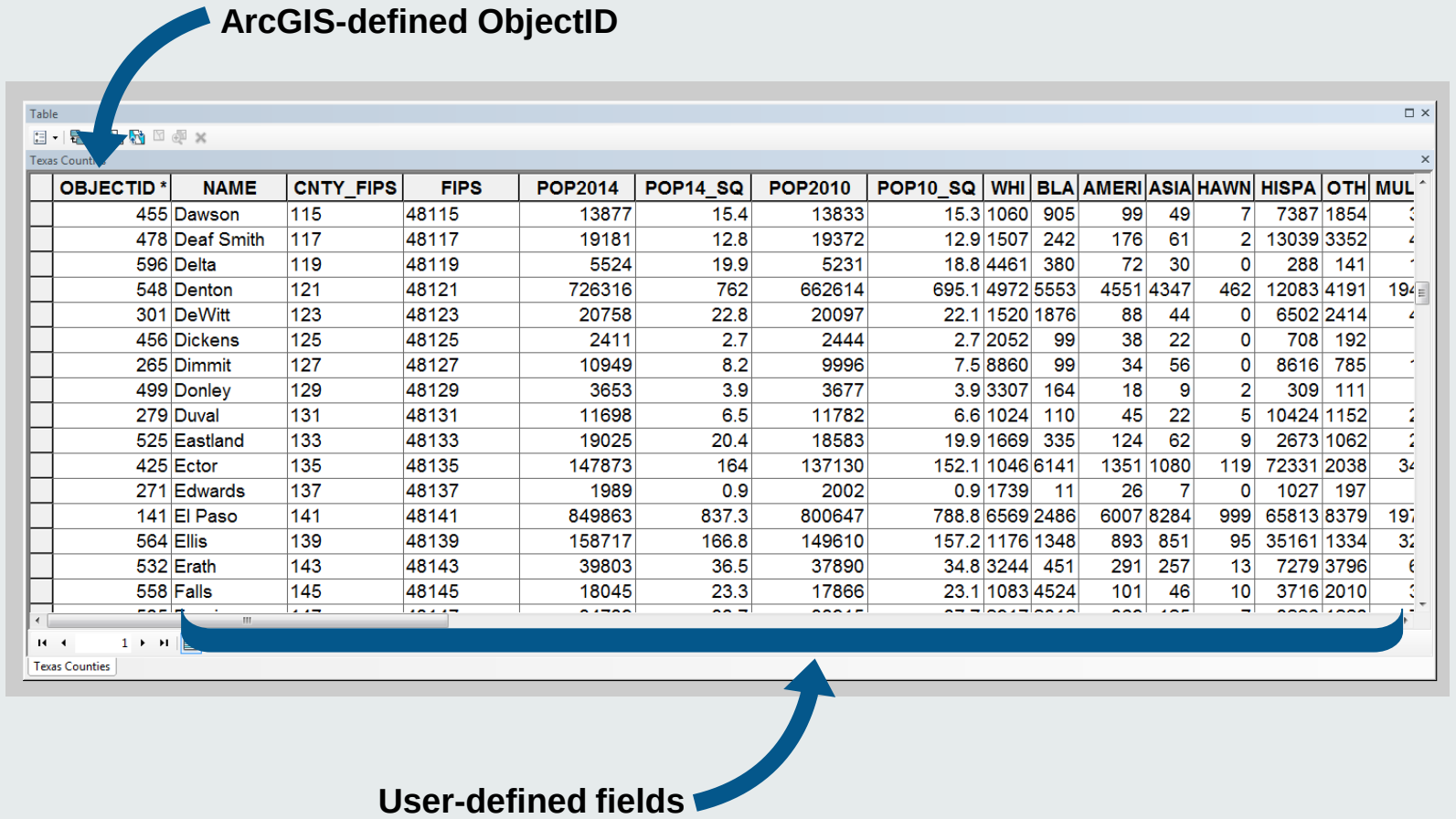
Demonstration

Geodatabase Building Blocks

Table

Geodatabase building blocks

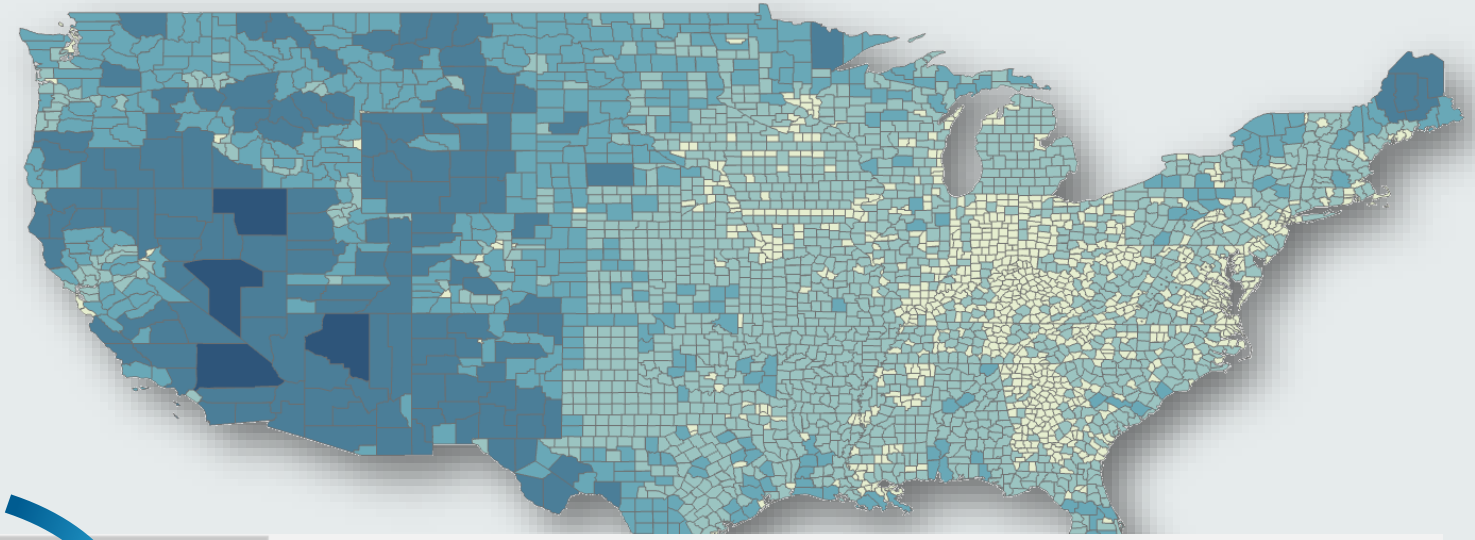
- Each row is a unique object
- Rows have same fields
- No spatial field



Feature class

Geodatabase building blocks

- Collection of features
  - Same geometry type
  - Same spatial reference
  - Same attribute fields
- Extended functionality
  - Multi-part features
  - Z and M values
  - Annotation / Dimension



Stores geometry

U.S. Counties (Generalized)

Field: Add | Delete | Calculate | Selection: Zoom To | Switch | Clear | Delete | Copy

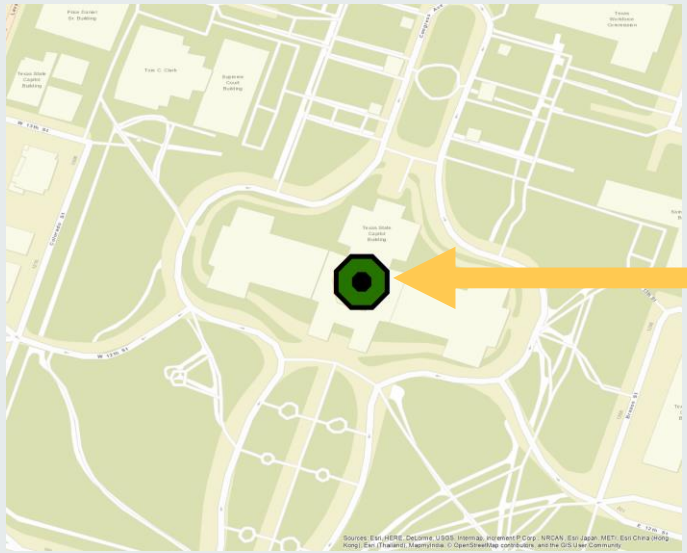
OBJECTID	Shape	NAME	STATE_NAME	STATE_FIPS	CNTY_FIPS	FIPS	AREA	POP1990	POP2000	POPS
1	Polygon	Lake of the Woods	Minnesota	27	077	27077	1784.0634	4076	4651	
2	Polygon	Ferry	Washington	53	019	53019	2280.2319	6295	7199	
3	Polygon	Stevens	Washington	53	065	53065	2529.9794	30948	40652	
4	Polygon	Okanogan	Washington	53	047	53047	5306.18	33350	38640	
5	Polygon	Pend Oreille	Washington	53	051	53051	1445.0286	8915	11752	
6	Polygon	Boundary	Idaho	16	021	16021	1279.2987	8332	10068	
7	Polygon	Lincoln	Montana	30	053	30053	3746.0908	17481	18859	
8	Polygon	Flathead	Montana	30	029	30029	5232.0306	59218	73438	
9	Polygon	Glacier	Montana	30	035	30035	3124.4572	12121	12626	
10	Polygon	Toole	Montana	30	101	30101	1943.2598	5046	4556	

0 of 3,141 selected Filters: 100%

Attachments

Geodatabase building blocks

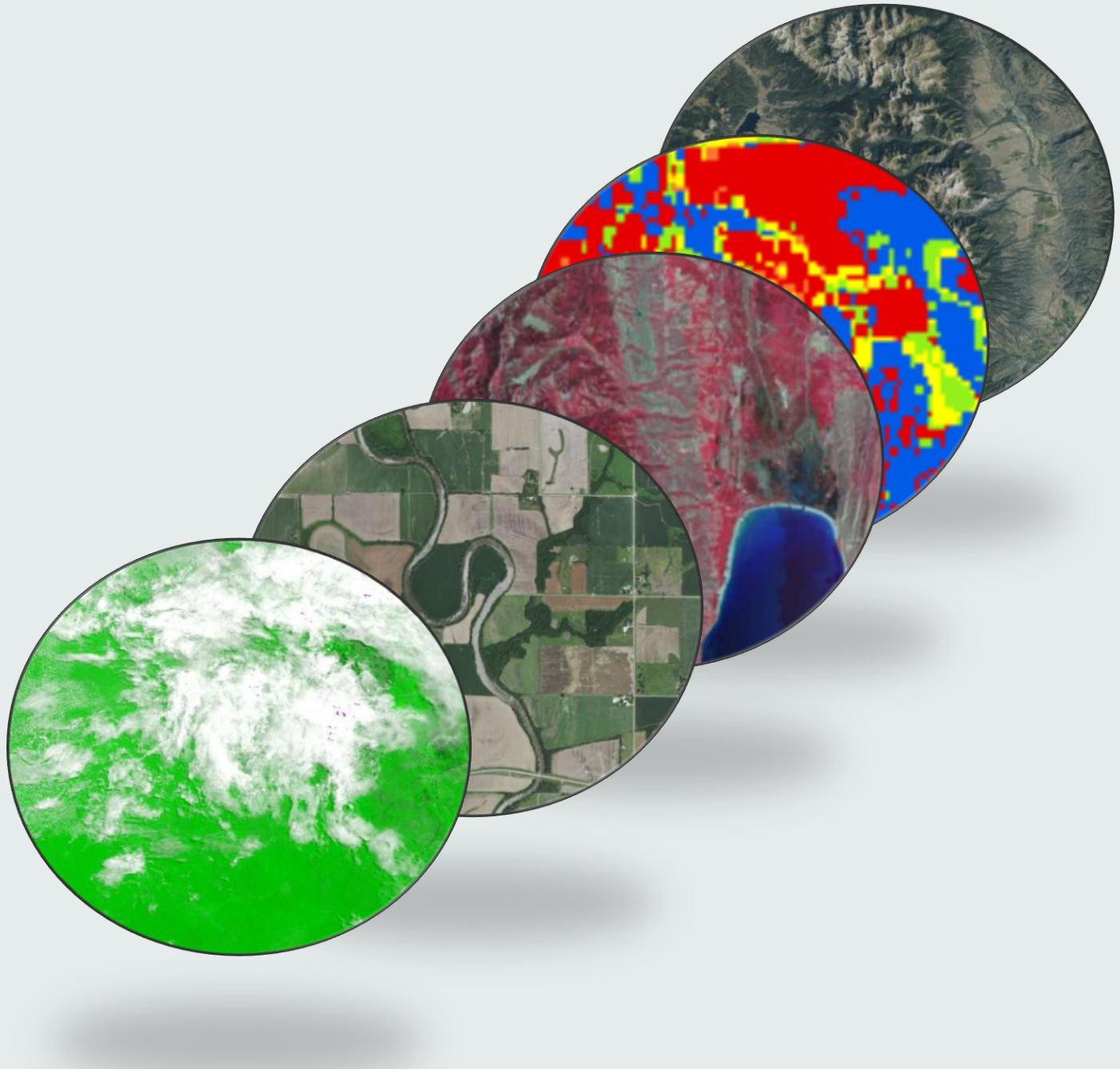
- Associate 1 or more files with a geographic feature
  - Stored within the geodatabase
- Accessible throughout the ArcGIS platform
  - Open files types recognized by OS
  - Download others
- Specialized implementation of a relationship class



Raster

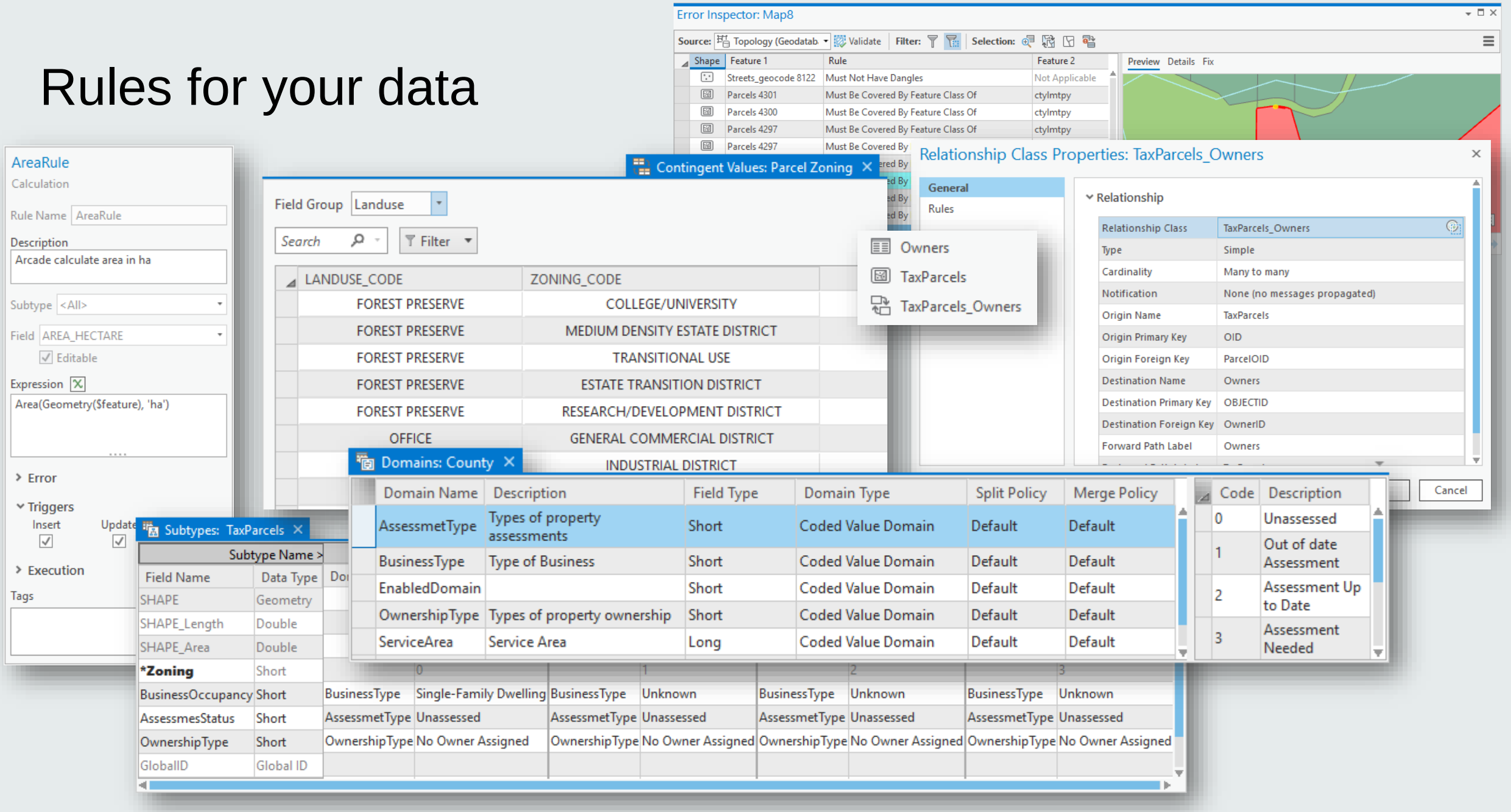
Geodatabase building blocks

- Cell / Pixel-based data
  - Discrete / Continuous data
  - Multiple formats
- Geodatabase
  - Mosaic Dataset
    - Manage multiple rasters
    - Store as a catalog, view as a mosaic
    - Advanced querying and processing
  - Raster dataset
    - Manage single raster



Rules for your data

Rules for your data

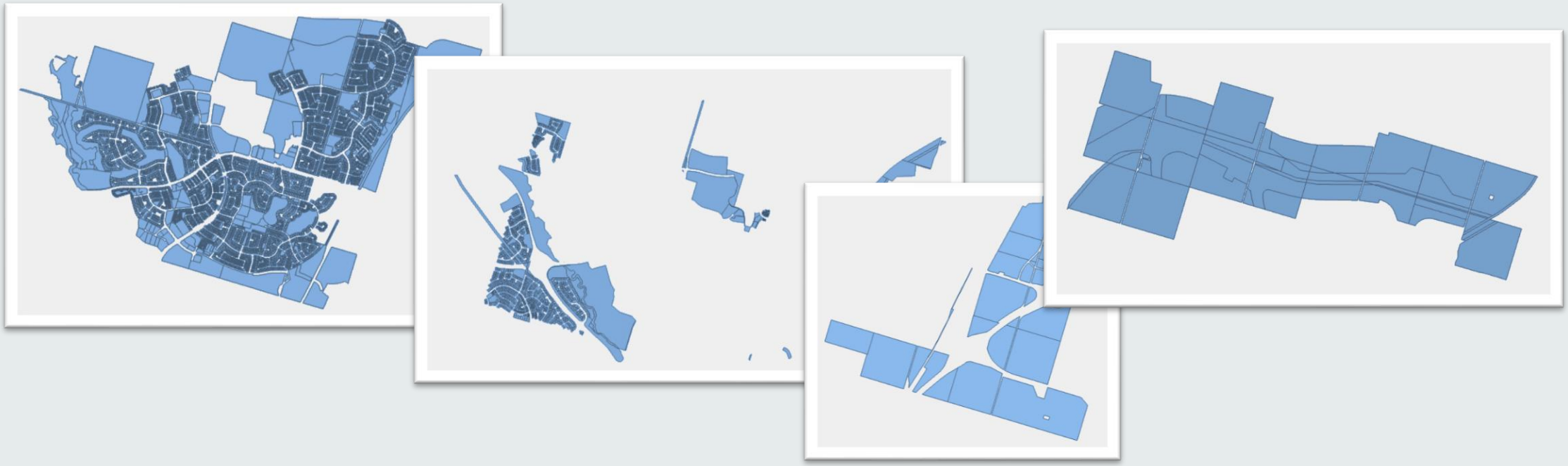


Rules for maintaining attribute data quality

- Subtypes
- Domains
- Contingent Values
- Relationship classes
- Attribute Rules

The problem

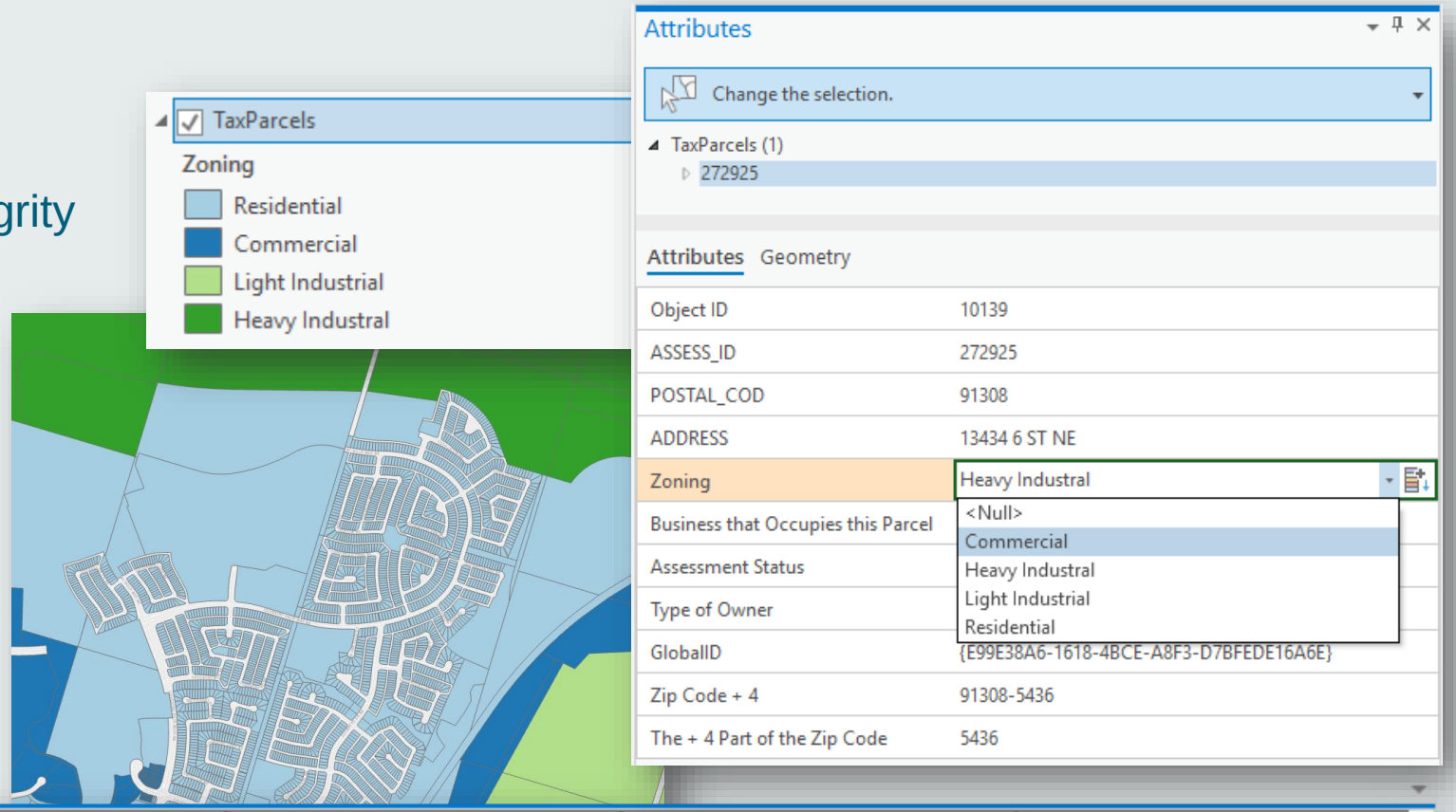
- Maintaining equivalent data in multiple files



Solution: Subtype

Geodatabase functionality – attribute integrity

- Define categories / classes
- Set rules for each field by category
  - Default values
  - Domains
  - Behaviors
- Property of table or feature class



Subtypes: TaxParcels

Subtype Name >		Residential		Commercial		Light Industrial		Heavy Industrial	
Field Name	Data Type	Domain	Default Value	Domain	Default Value	Domain	Default Value	Domain	Default Value
SHAPE	Geometry								
SHAPE_Length	Double								
SHAPE_Area	Double								
***Zoning**	Short		0		1		2		3
BusinessOccupancy	Short	BusinessType	Single-Family Dwelling	BusinessType	Unknown	BusinessType	Unknown	BusinessType	Unknown
AssessmesStatus	Short	AssessmetType	Unassessed	AssessmetType	Unassessed	AssessmetType	Unassessed	AssessmetType	Unassessed
OwnershipType	Short	OwnershipType	No Owner Assigned	OwnershipType	No Owner Assigned	OwnershipType	No Owner Assigned	OwnershipType	No Owner Assigned
GlobalID	Global ID								

Subtype Field

Subtype description

Subtype code (Integer)

The problem

- Editors want to be more efficient
- Editors make mistakes
  - Values out of range or invalid
  - Data entry errors

Solution: Domain

Geodatabase functionality – attribute integrity

- Specify valid values
  - List of valid values
  - Min and max value
- Apply to multiple attribute fields
- Property of geodatabase

Coded Value Domain
BusinessOccupancy in
(“Single-Family Dwelling”, “School”, “Warehouse”…)

Fields: TaxParcels (Map5)

Current Layer: TaxParcels (Map5)

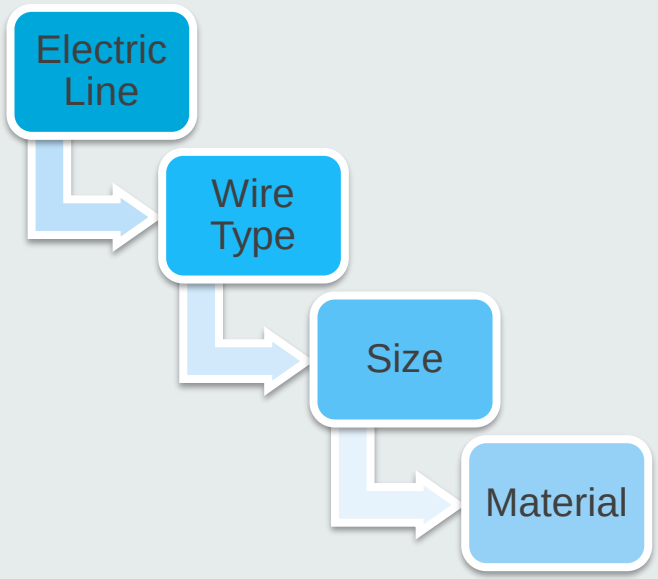
Visible	Read Only	Field Name	Alias	Data Type	Allow NULL	Highlight	Number Format	Domain	Default	Length
☑	☑	OID	Object ID	Object ID	☐	☐	Numeric			
☑	☐	ASSESS_ID	ASSESS_ID	Long	☑	☐	Numeric			
☑	☐	POSTAL_COD	POSTAL_COD	Text	☑	☐				255
☑	☐	ADDRESS	ADDRESS	Text	☑	☐				255
☑	☐	SHAPE	Shape	Geometry	☑	☐				
☐	☑	SHAPE_Length	SHAPE_Length	Double	☑	☐	Numeric			
☐	☑	SHAPE_Area	SHAPE_Area	Double	☑	☐	Numeric			
☑	☐	***Zoning**	Zoning	Short	☑	☐	Numeric		0	
☑	☐	BusinessOccupancy	Business that Occupies this Parcel	Short	☑	☐	Numeric	BusinessType		
☑	☐	AssessmesStatus	Assessment Status	Short	☑	☐	Numeric	AssessmetType		
☑	☐	OwnershipType	Type of Owner	Short	☑	☐	Numeric	OwnershipType		
☑	☑	GlobalID	GlobalID	Global ID	☐	☐				
☑	☑	ZipCode_Plus4	Zip Code + 4	Text	☑	☐				255
☑	☐	FurtherZipCode	The + 4 Part of the Zip Code	Text	☑	☐				255
☑	☐	PercentValued	Land Valuation Complete	Short	☑	☐	Numeric	PercentRange		

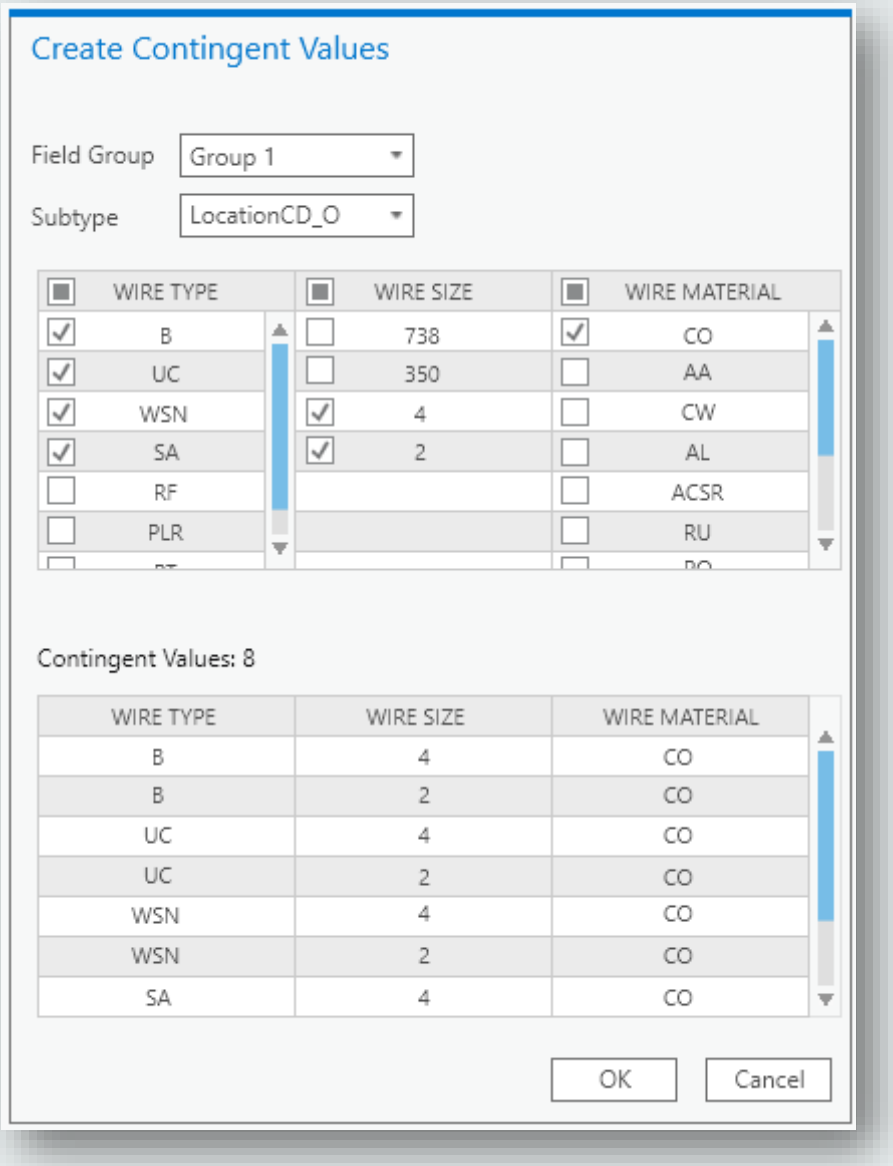
Range Domain -
PercentValued between 1 & 100

Contingent Values

Geodatabase functionality – attribute integrity

- Extends the subtype/domain restrictions for valid input
  - Attribute value in one field is dependent on values from other attributes





The problem

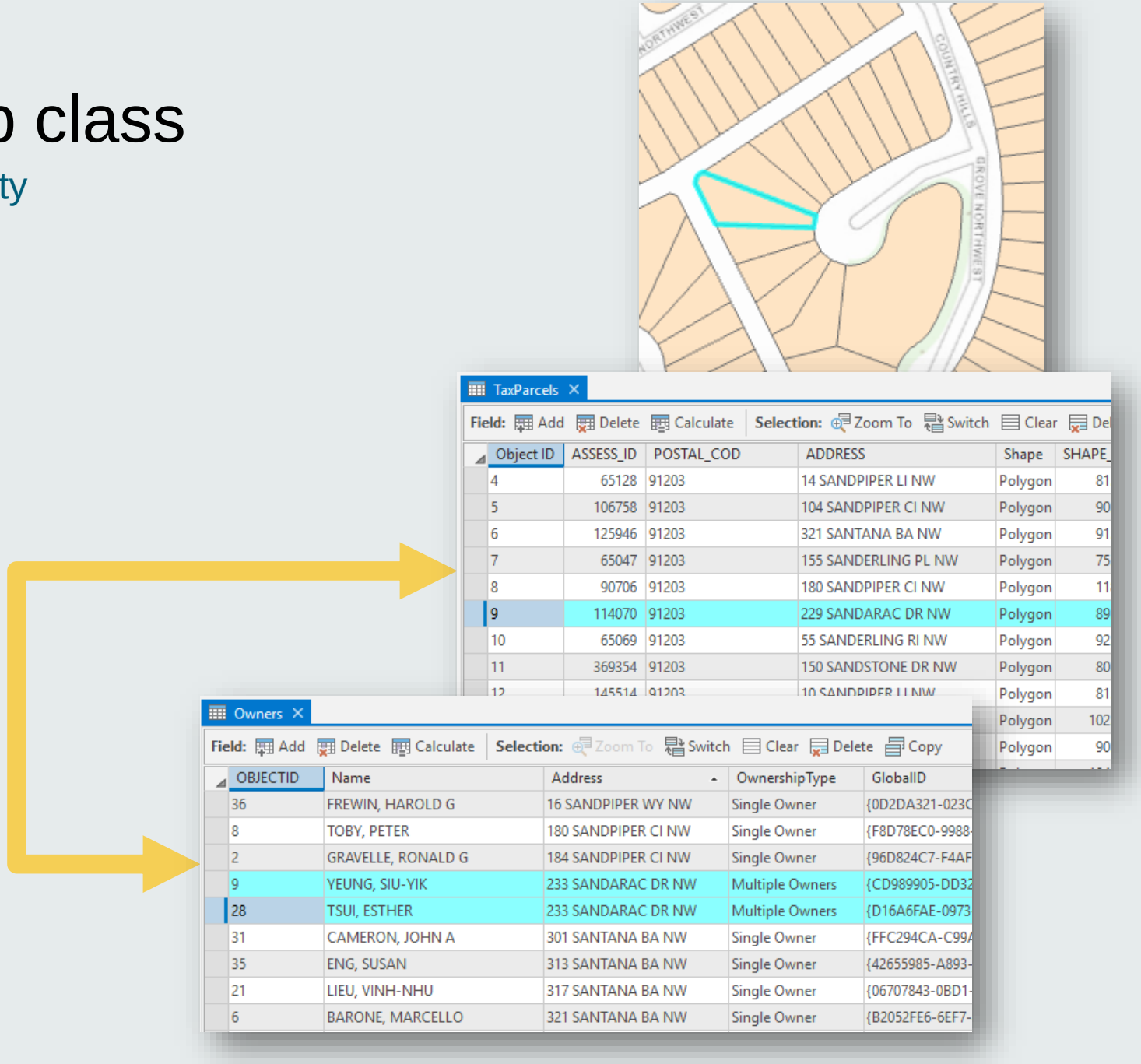
- Owners and parcels are isolated in different tables
  - Need to relate owners to parcels, parcels to owner
  - A parcel can have many owners, an owner can own many parcels

m:m

The solution: relationship class

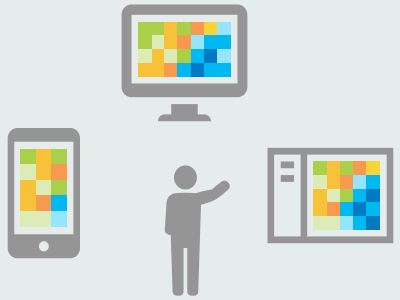
Geodatabase functionality – attribute integrity

- Define association between geodatabase objects
- 1:1, 1:M, M:N cardinalities
- Simple or composite
- Apply rules and attributes
- Edit across relationship



The problem

- Automatically calculate values for new records
  - Editors using ArcGIS Pro, web & mobile apps
- Validate new business rules on existing data
- Return errors for invalid values



Parcel Zoning

Field: Add Delete Calculate | Selection: Zoom To Switch Clear Delete Copy

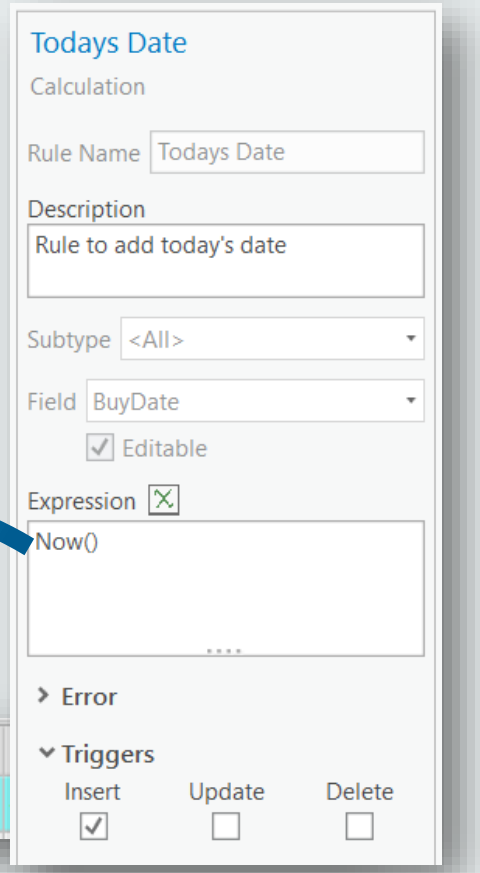
	Zoning Variance	Area in Hectares	Area Value Measured	Lot Number	PLANNING_S	Comprehensive	Is Inc
UD	N	27	ACT	124	H	EAST SECTOR	Y
UD	N	0	ACT	18	C	EAST SECTOR	Y
MF PUD	N	1	ACT	5	E	EAST SECTOR	Y
	U	2	ACT	9	H	EAST SECTOR	N
	N	0	EST	pt1&pt4	D	EAST SECTOR	Y
	U	1	ACT	168	D	EAST SECTOR	N
SF PUD	N	0	EST	37	H	EAST SECTOR	Y
ISTRICT	N	1	ACT	76	G	SECTOR G	Y
MF PUD	N	1	EST	70	E	EAST SECTOR	Y
		0	EST				

The solution: attribute rules

Geodatabase functionality – attribute integrity

- Automatically populating/controlling field values for features on edit
- Arcade scripting language is cross-platform
  - edits performed anywhere (desktop, mobile, web)

- Attribute rule types:
  - Calculation rules – calculates value of field based on expression
    - Immediate – rule runs on edit
    - Batch – runs at specific time on all data
  - Constraint rules – controls data entry, raises error for invalid data
  - Validation rules – highlights errors on existing data



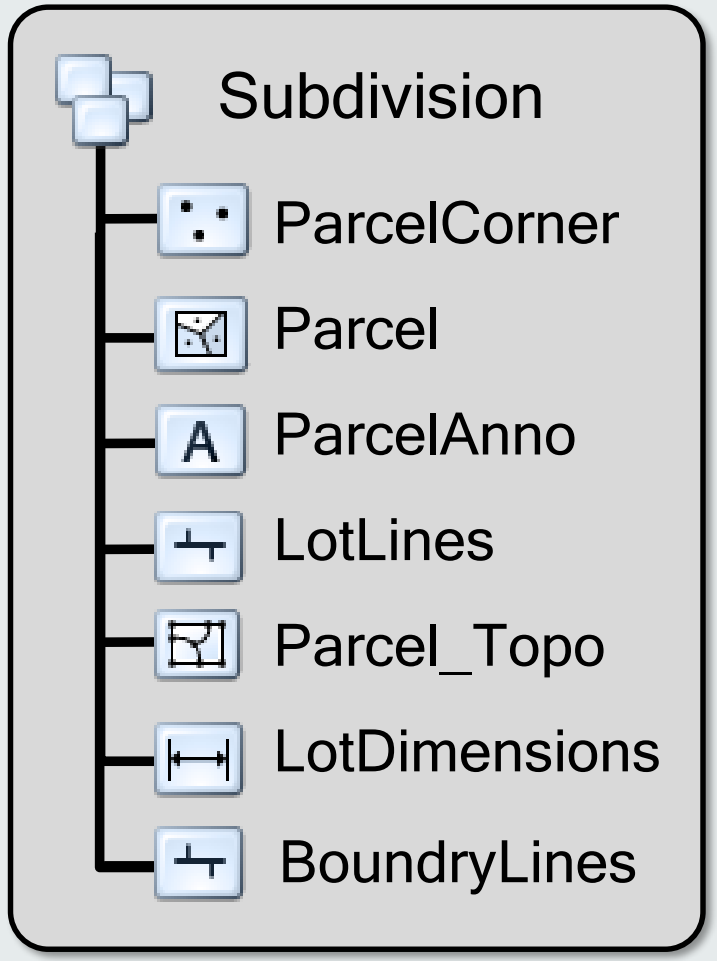
OBJECTID	Name	Address	BuyDate	BuyAmount	OwnershipType
38	DAVE CRAWFORD	235 SANDARAC DR NW	7/6/2019 6:14:55 PM	1000000	Single Owner

Rules for maintaining spatial data quality

Feature dataset

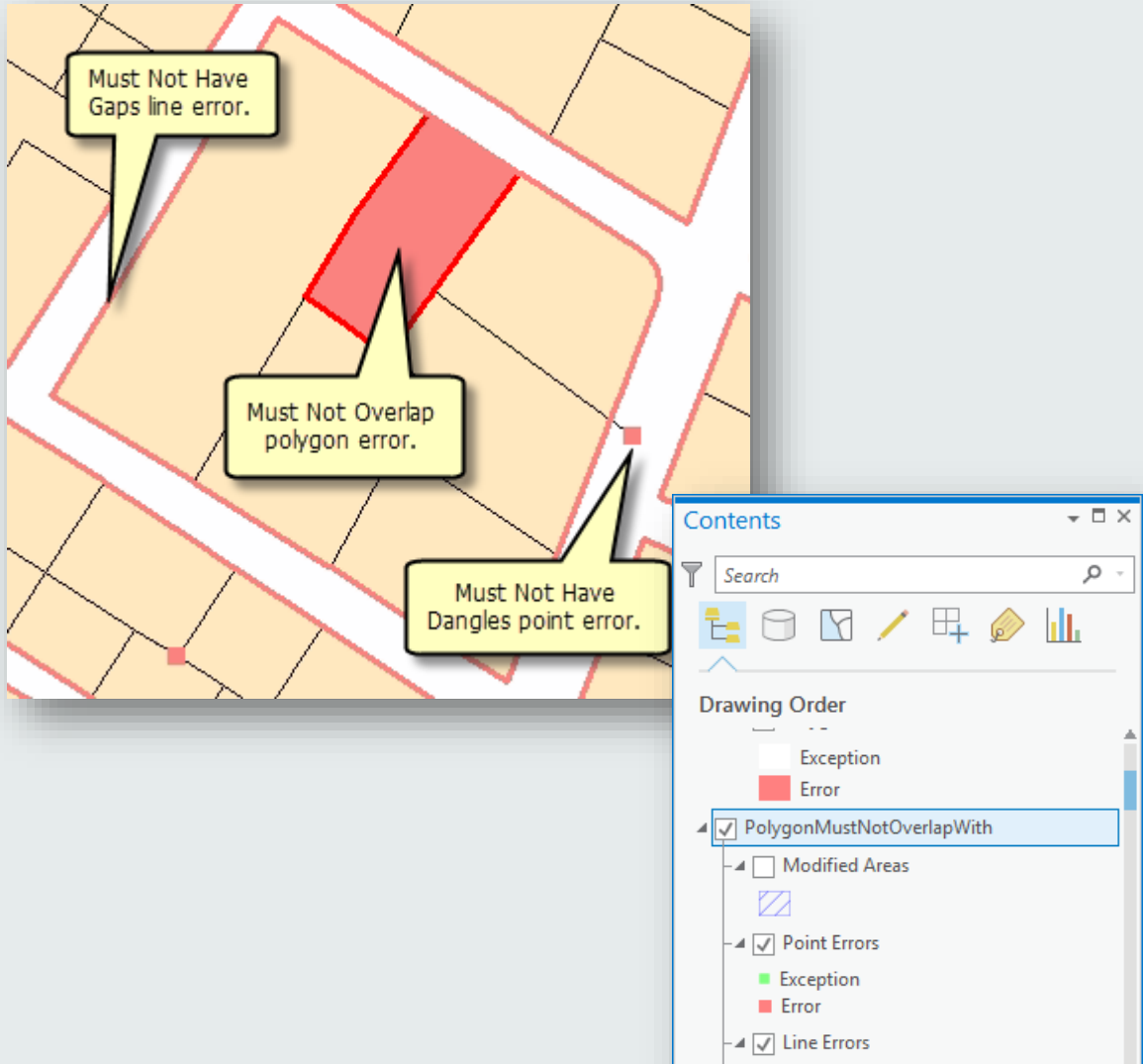
Geodatabase functionality – spatial data integrity

- Container for advanced datasets
  - Topologies
  - Networks
  - Parcels
- Single spatial reference
- Not a folder
  - Treated as a single object



The problem

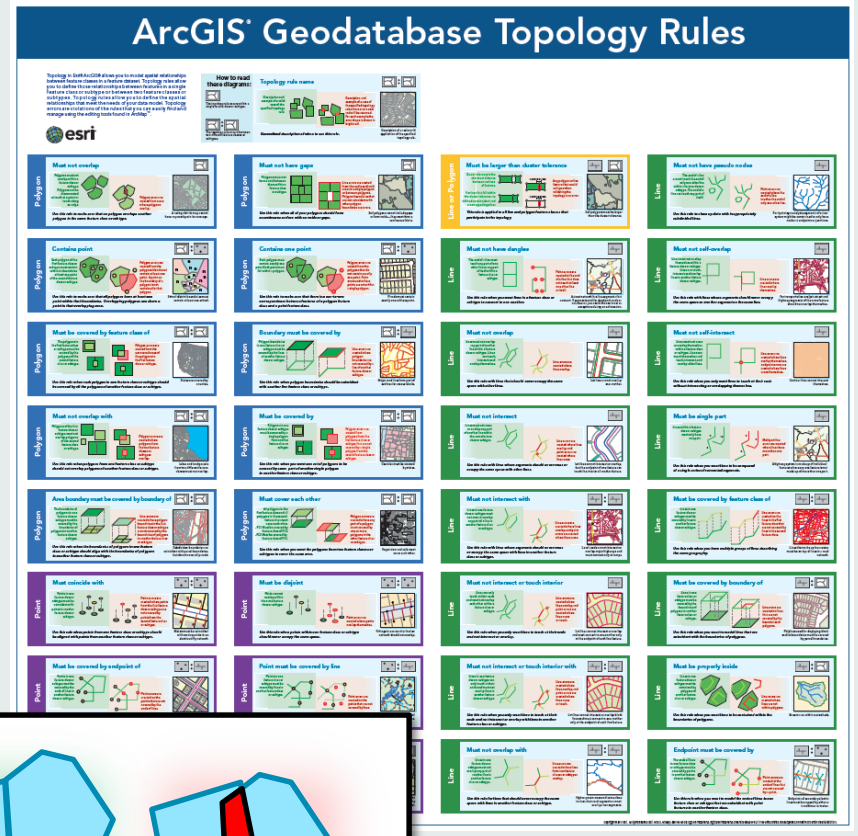
- Need to easily identify spatial errors
- Need a series of rules to make sure that our parcels are accurate

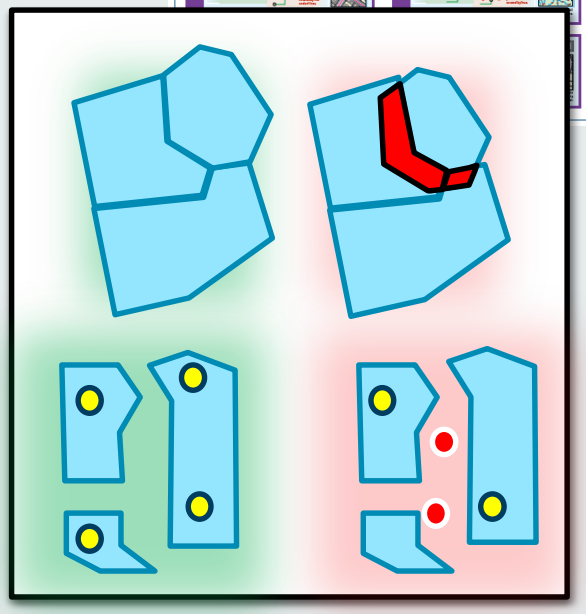


The Solution: Geodatabase topology

Geodatabase functionality – spatial data integrity

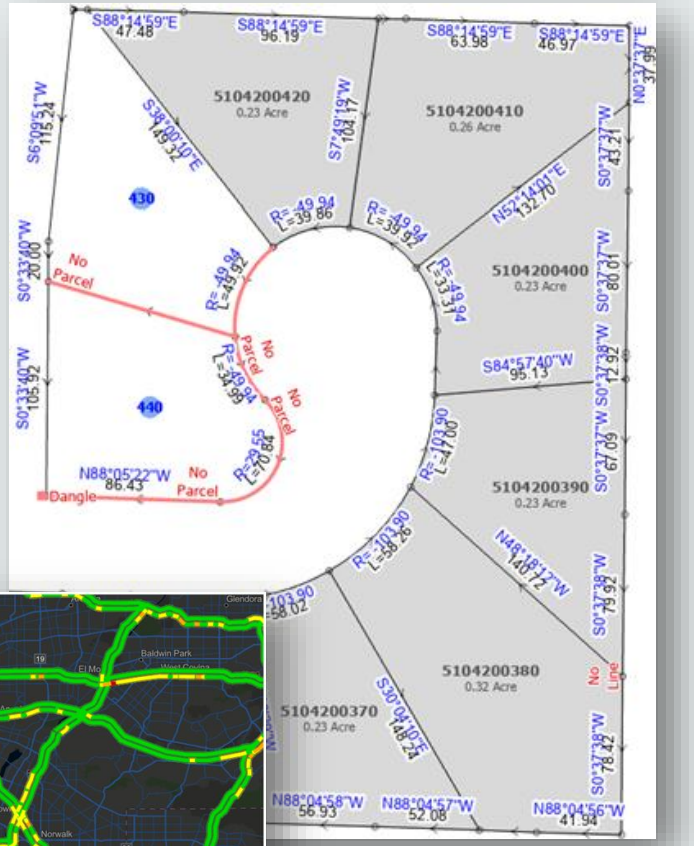
- Manage shared geometry
  - Within a feature class
  - Between feature classes
- Rules-based
  - Select rules based on spatial relationships
  - Apply rules by validating data
  - Make corrections or mark exceptions

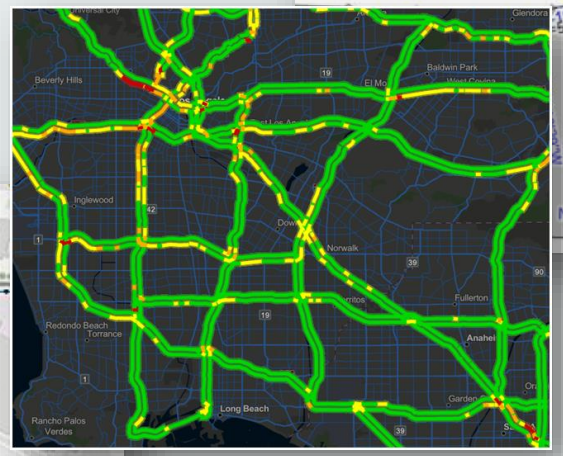




Advanced Models

- Advanced capabilities
- Industry-specific rules & models
  - Utility networks
  - Transportation networks
  - Parcel management





In conclusion

- ArcGIS runs on data
- Lots of data stores, lots of choices
- Geodatabase
  - Unique functionality
  - Data integrity rules
  - Advanced models

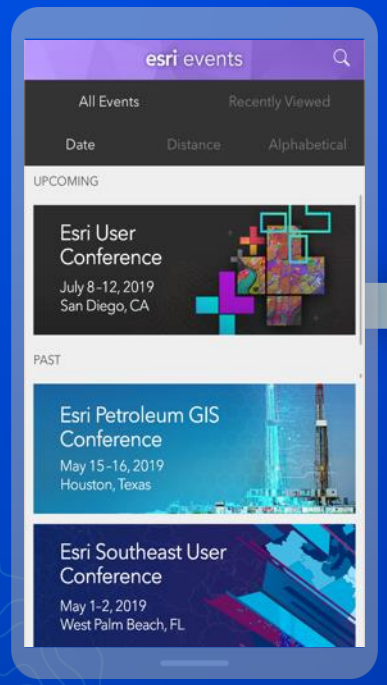
To learn more…

- Attribute data integrity:
  - Geodatabase: Setting Up Your Geodata Schema in ArcGIS Pro
  - Geodatabase: Leveraging Relationship Classes
  - Geodatabase: Ensuring Data Quality with Attribute Rules and Contingent Values
- Multi-user geodatabases:
  - Enterprise Geodatabase: Introduction to Multi-User Geodatabases
  - Enterprise Geodatabase: Introduction to Multi-User Editing
- Spatial data integrity
  - Geodatabase: Ensuring Data Quality with Topology
  - ArcGIS Pro Editing: Data Alignment and Management
- Networks
  - Utility Network Management in ArcGIS: Introduction to the Utility Network
  - Network Analyst: An Introduction
- Parcels
  - Parcel Editing: Managing Parcels with ArcGIS Pro

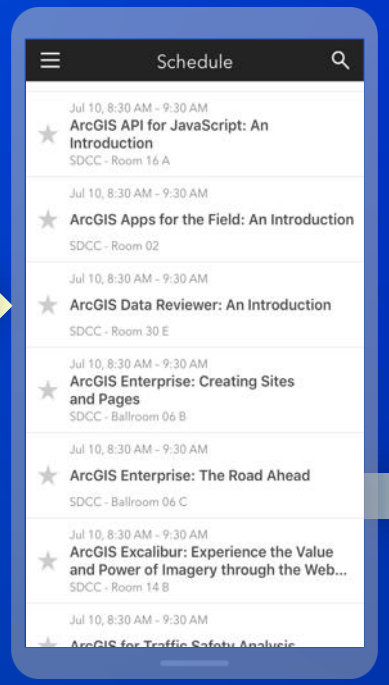
Questions?

Please Share Your Feedback in the App

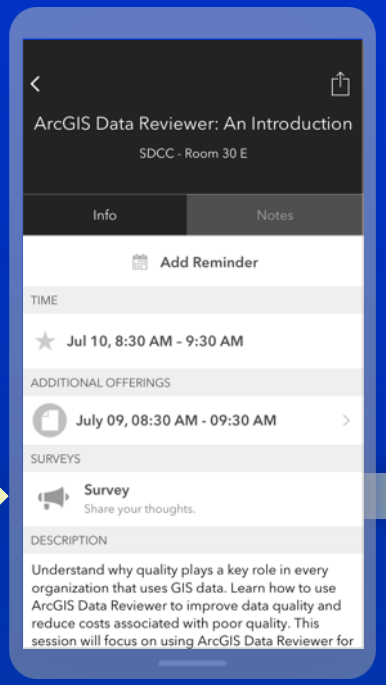
Download the Esri Events app and find your event



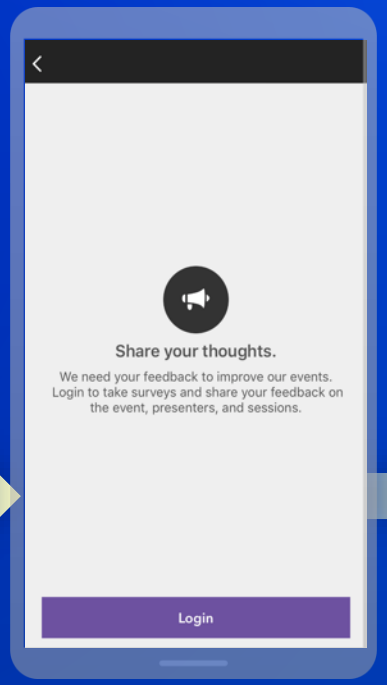
Select the session you attended



Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"