



United States Department of Agriculture

ArcMap – Advanced Editing

Geospatial Technology and Applications Center



Geospatial Technology
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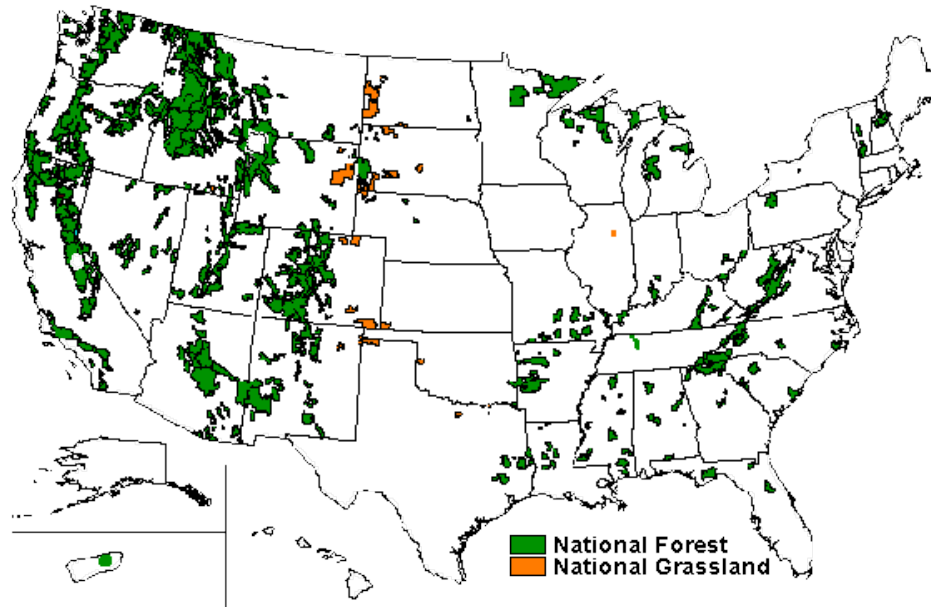


Forest Service



Course Overview

- Advanced Editing toolbar
- Editing with Topology
- ALP Vertical Integration tool





United States Department of Agriculture

Advanced Editing Tools

Advanced Editing Course - Lesson 1



**Geospatial Technology
and Applications Center**



Forest Service

Lesson 1 Overview

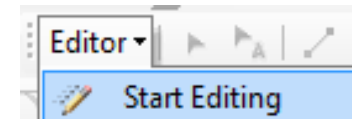
- Review the basic editing steps and tools in ArcMap
- Important data prep and map settings
- Advanced Editing toolbar
- Introduce other useful editing tools





Review: Editing Data

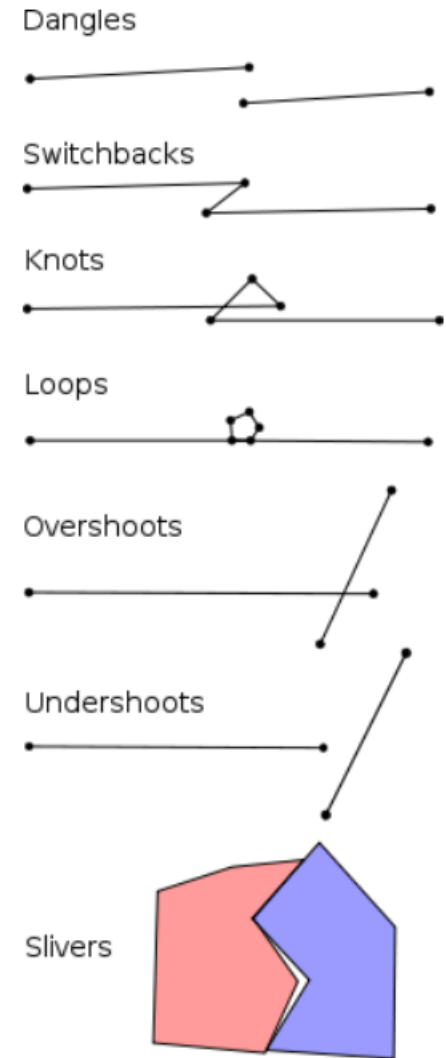
- Must start an edit session
- Limited to one workspace (geodatabase or a folder of shapefiles) at a time
- Can only edit the layers in one data frame at a time





Digitizing

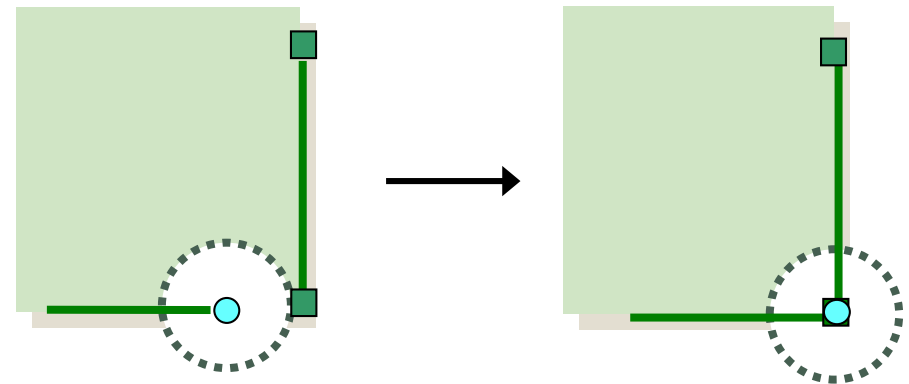
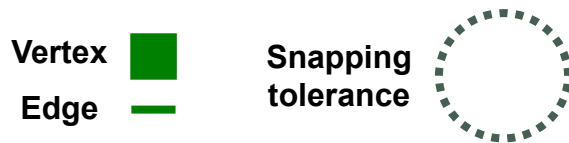
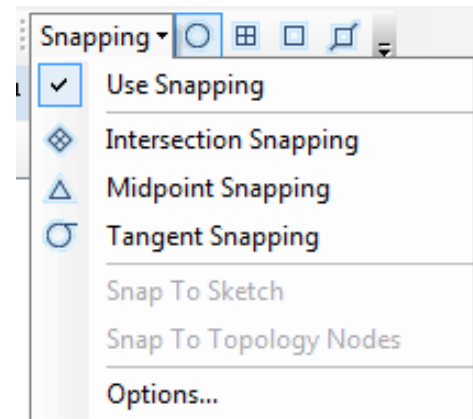
- Digitizing is the process of converting features into a digital format
- The most common is called heads-up digitizing on screen over an aerial photograph or other basemap
- Take care not to introduce digitizing errors!



TYPES OF DIGITIZING ERRORS IN GIS

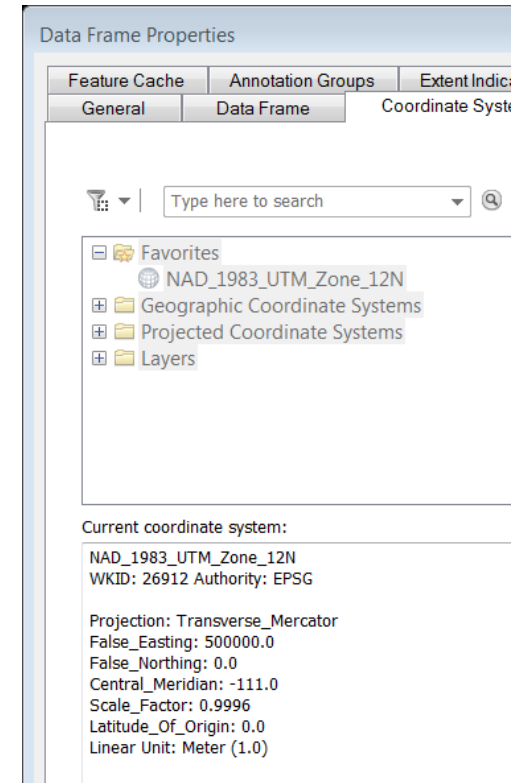
Review: Snapping

- Snap editing tool to an existing feature to avoid:
 - Undershoots (gaps)
 - Overshoots (dangles)
- You can snap to a feature's ...
 - Vertex
 - Edge
 - End
 - Point



Spatial Reference

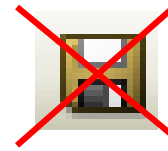
- Best practice when editing:
 - All layers should be the same spatial reference as the data frame
 - Be sure the spatial reference is appropriate for area and project
- If ArcMap has to project on the fly:
 - Can cause alignment problems
 - Adds error to snapping tolerance





Save Often!

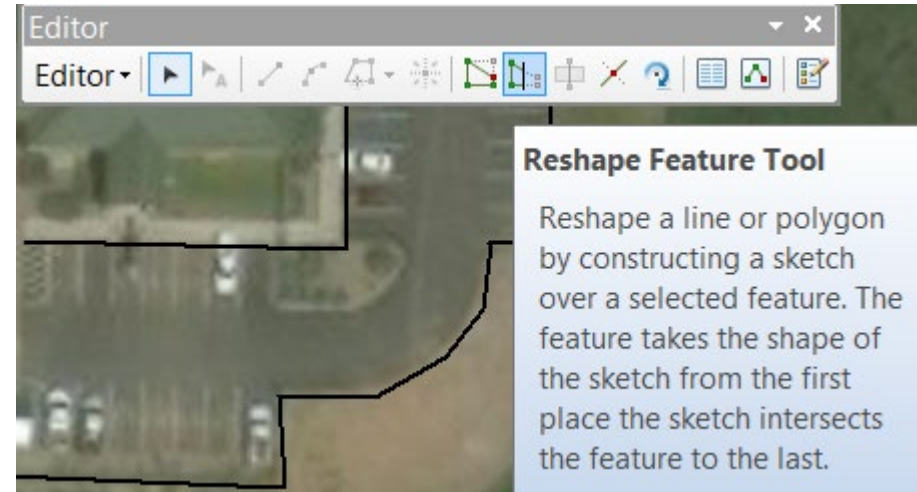
- Edits are temporary until you save and apply
- Saving a map document does not save the edits
- Saving edits modifies the data source



Save Edits

Toolbars for Editing

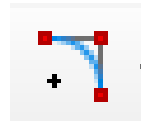
- Hover mouse over tools to see info pop-up
- Many tools are grayed out unless
 - Editing session is active
 - An appropriate feature is selected
 - A feature is being edited (parallel tool and perpendicular tool)



Advanced Editing Toolbar

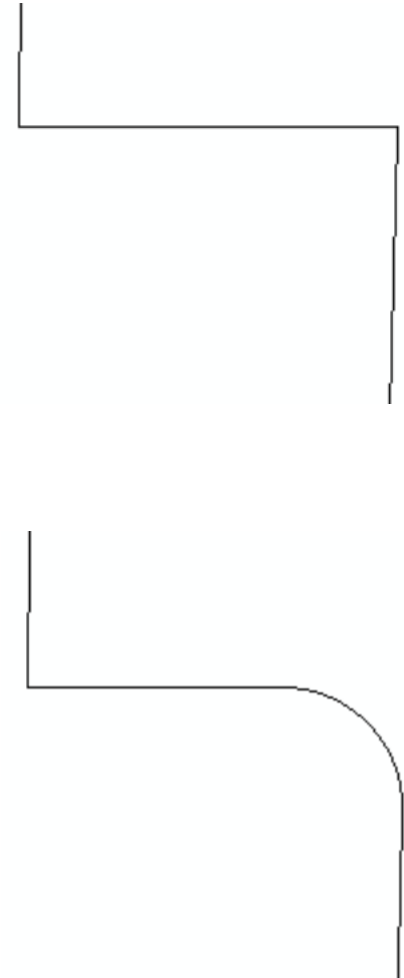
- Tools become available as appropriate features are selected





Fillet Tool

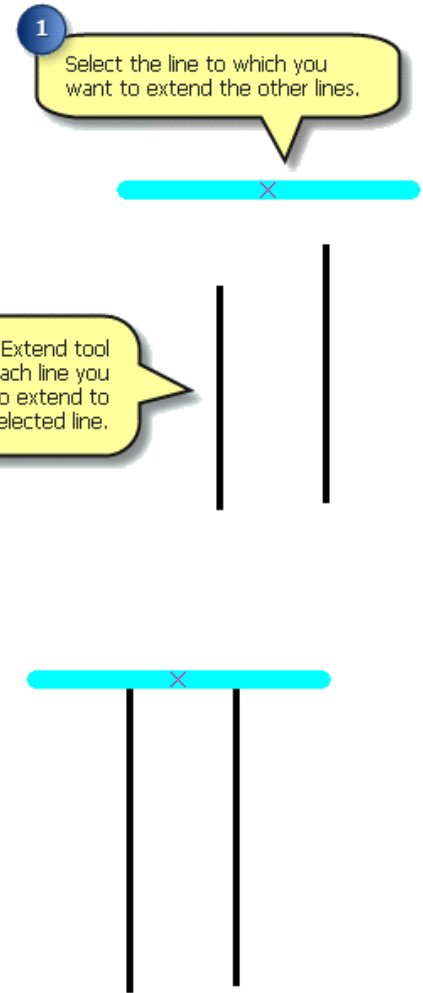
- The Fillet tool creates a circular arc that is tangential to two line segments. This will produce a smooth, curved connection between lines.
- Example: A rounded curb at a road intersection.

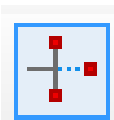




Extend Tool

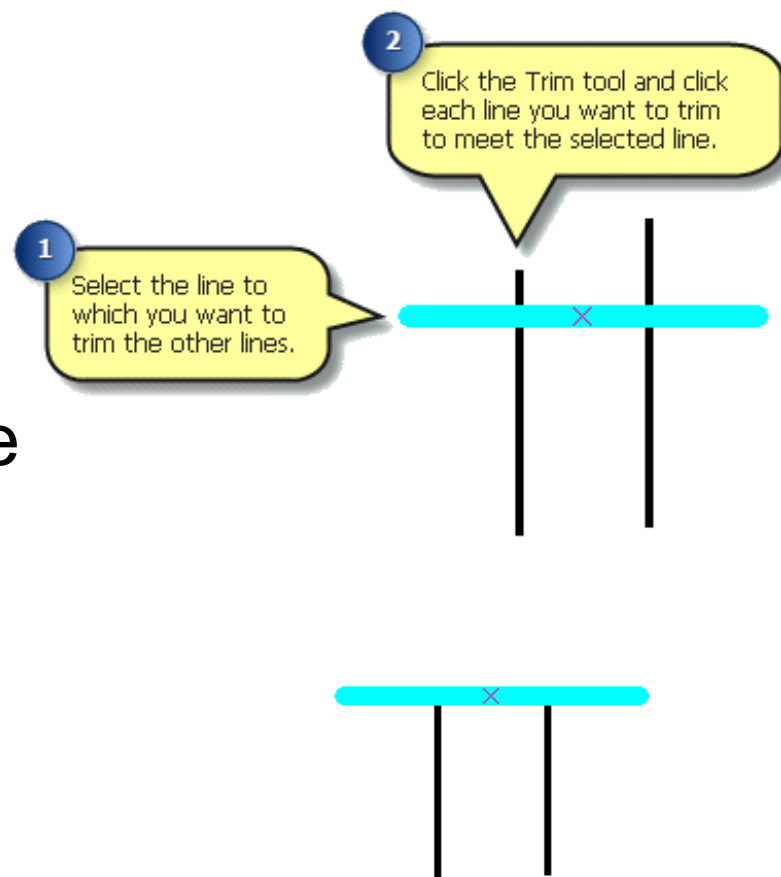
- The Extend Tool on the Advanced Editing toolbar lets you click a line feature and extend it to another selected line feature.
- To use the Extend tool, select the feature that you want to extend lines to, then start clicking the lines you want to extend.





Trim Tool

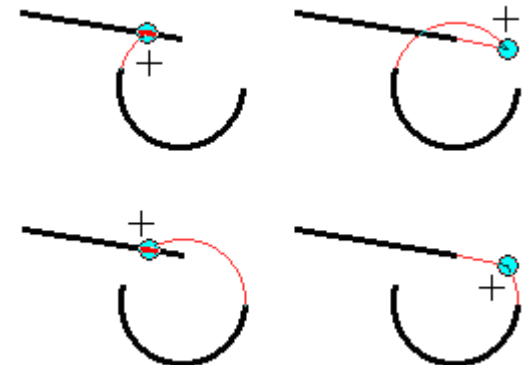
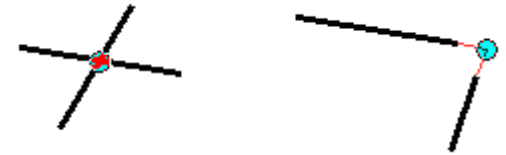
- To trim a line based on its intersection with a selected line feature.
- Select the feature that you want to use as a cutting line
- Click the intersecting line segments that you want to trim.
- The part of the lines that you click will be removed.

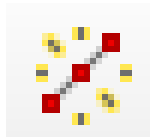




Line Intersection Tool

- Allows you to split line features at their intersections. The lines are split at the location where you click the mouse.
- The split operation updates the shape of the existing feature and creates a new feature using the default attribute values for the feature class.
- There can be many potential intersections between the lines' features.
- The top graphic shows the simplest case where there is a single intersection between the line features.
- In a more complicated example, the graphic on the right shows red lines leading to an implied intersection. Once you click the desired intersection, the lines will be extended to the intersection





Explode a Multipart Feature

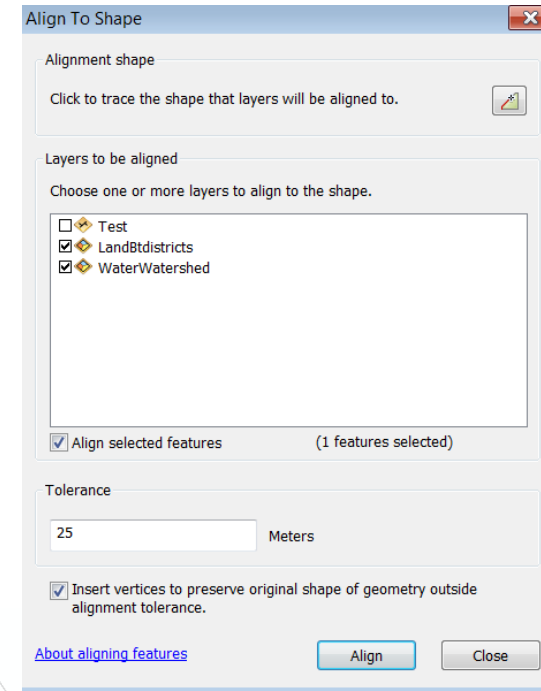
- Used to separate a multipart feature into its individual component features.
- To change attributes of the elements that were in a multipart feature.
- Delete one or more of the features.





Align to Shape

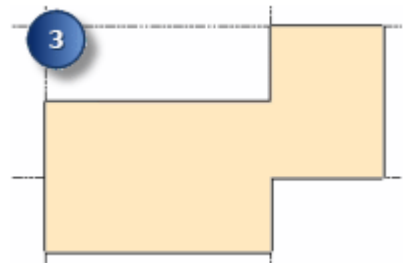
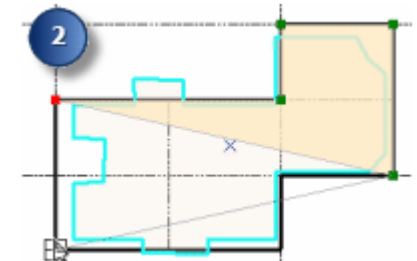
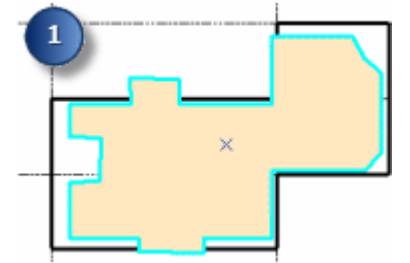
- To adjust layers to a shape you trace. This is useful if you want to align features to the edges of other features.
- To help fix a common problem when lines are digitized at different times or by different people so edges become braided, overlap, or have gaps between them.





Replace Geometry Tool

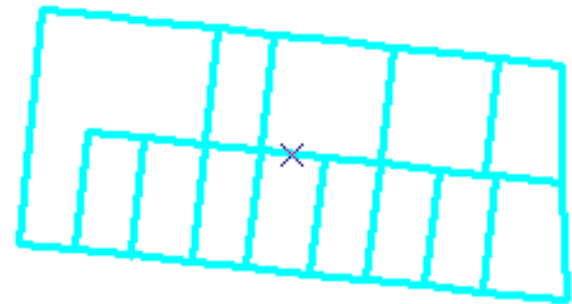
- To create an entirely new shape for a feature.
- Use when a feature's shape is significantly different from the existing feature and it is easier to replace than fix.
- Will keep the attributes and apply to the new shape.



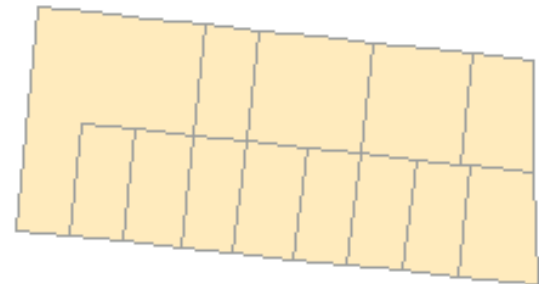


Construct Polygons Tool

- To create new polygons from the shapes of existing lines or polygons.
- Example: Create new parcel polygon features from lines.



Parcel lot lines used to create new polygons

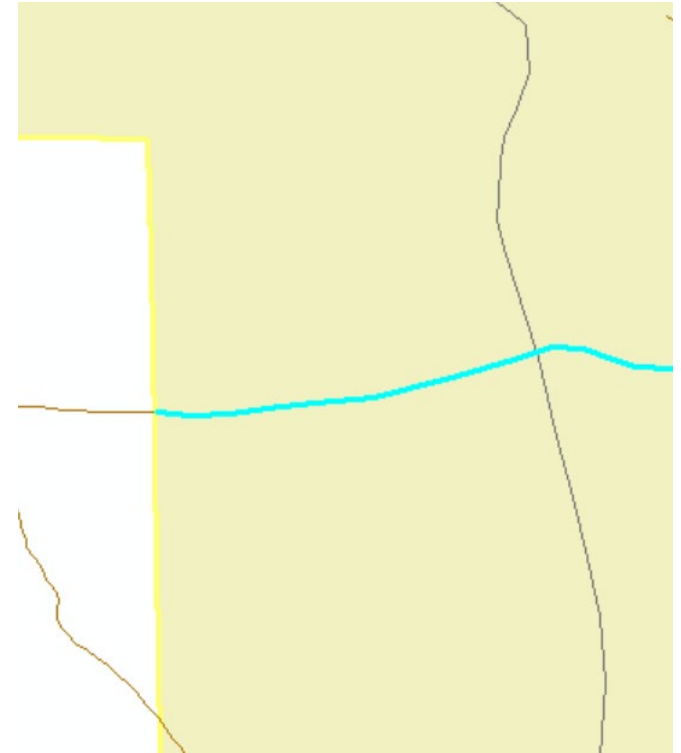


New polygons created from the selected lines



Split Polygons Tool

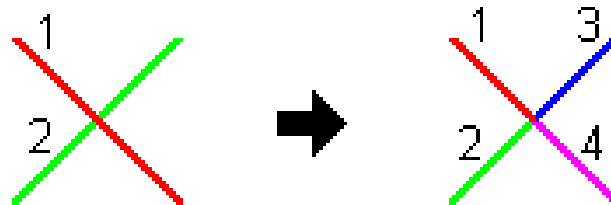
- To split one or many polygons using a feature from a different feature class.
- Select the line or polygon features to use to split the existing polygon/s.
- Click Split Polygons tool.
- Click the layer to use the attribute values from the existing feature.





Planarize Lines Tool

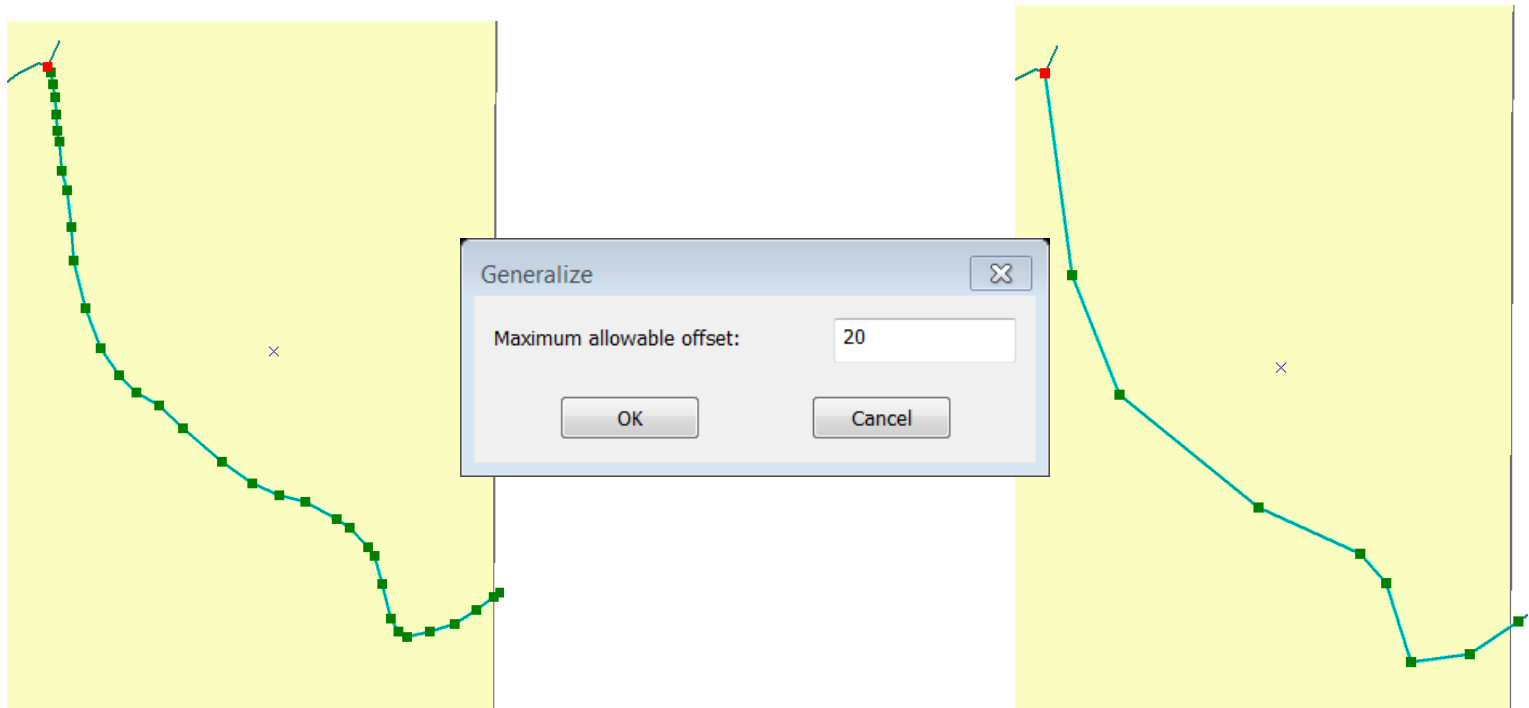
- You can split selected lines where they intersect using Planarize Lines on the Advanced Editing toolbar.
- Useful tool for large related datasets.





Generalize Tool

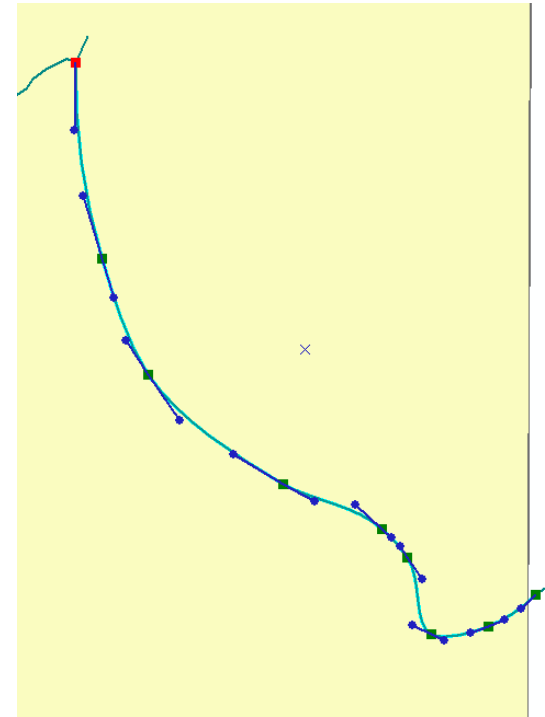
- To simplify the geometry (reduce number of vertices) one selected feature at a time.





Smooth Tool

- The Smooth command, smooths only one selected line.
- To smooth multiple lines, use the geoprocessing tool.

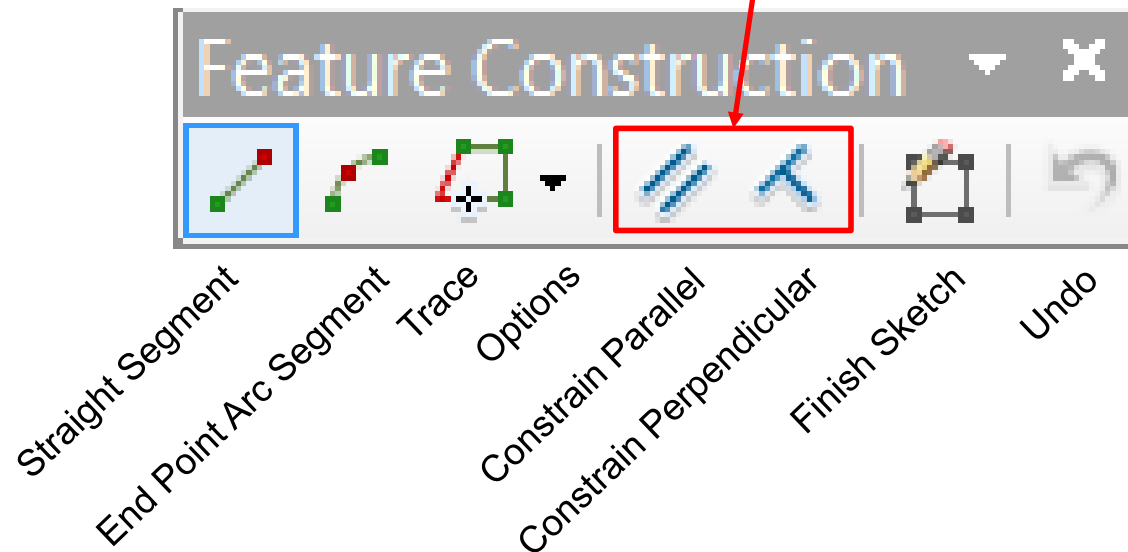




Feature Construction Toolbar

- Tools become available as appropriate features are selected

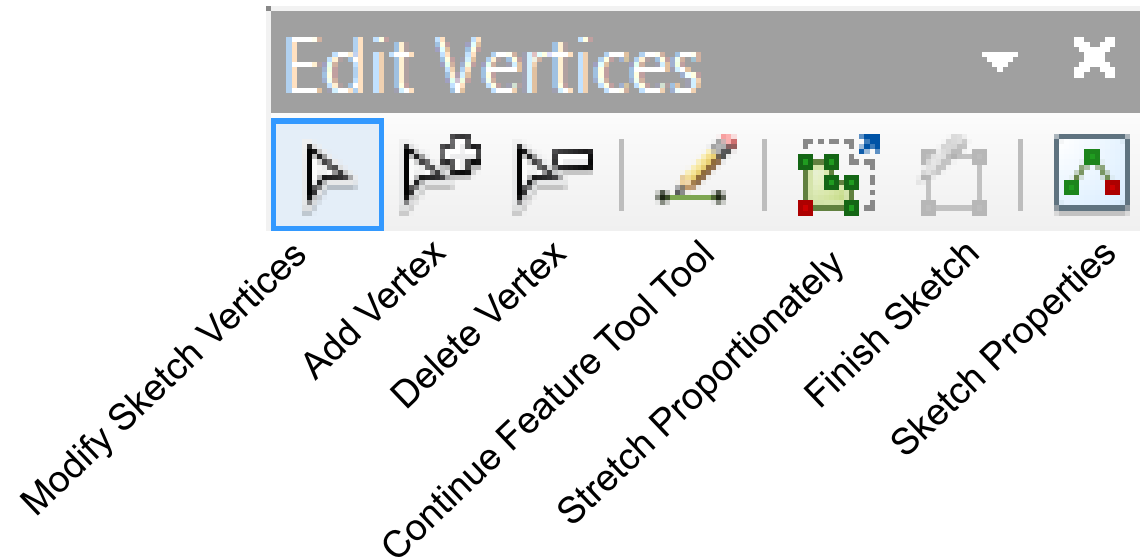
Only when a feature is being edited





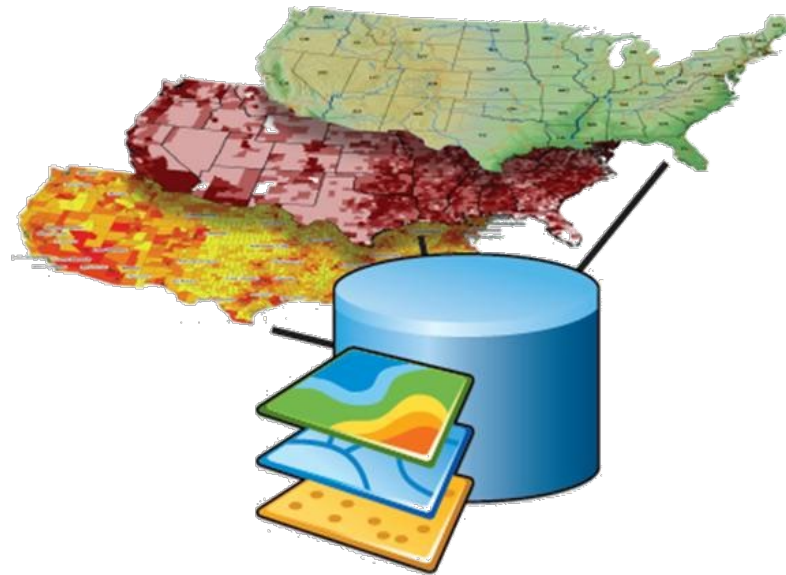
Edit Vertices Toolbar

- Tools become available as appropriate features are selected





Demonstration





United States Department of Agriculture

Editing with Topology

Advanced Editing Course - Lesson 2



Geospatial Technology
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Forest Service



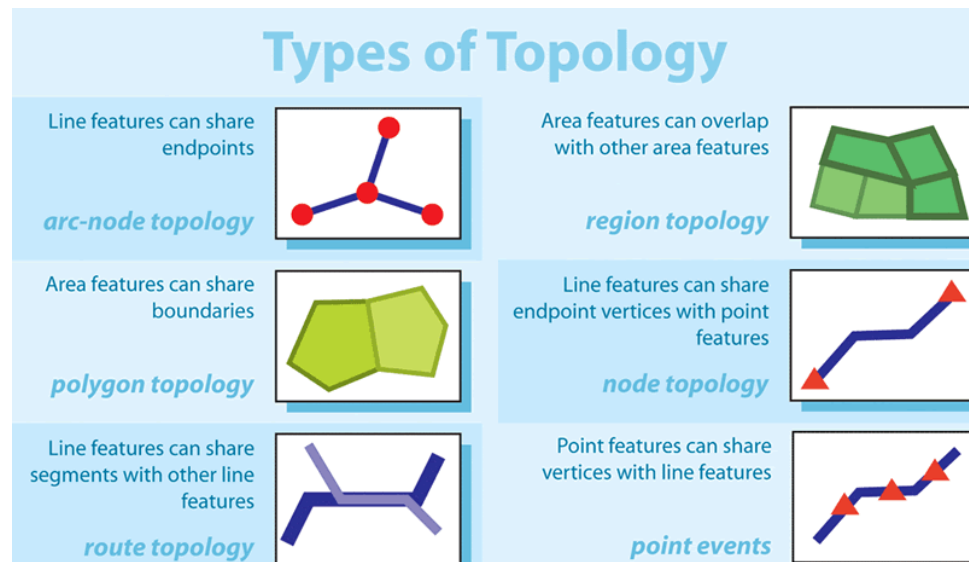
Topology Lesson Overview

- Editing using Topology
 - ArcMap has two types of Topology:
 - Map Topology
 - Geodatabase Topology



What is Topology?

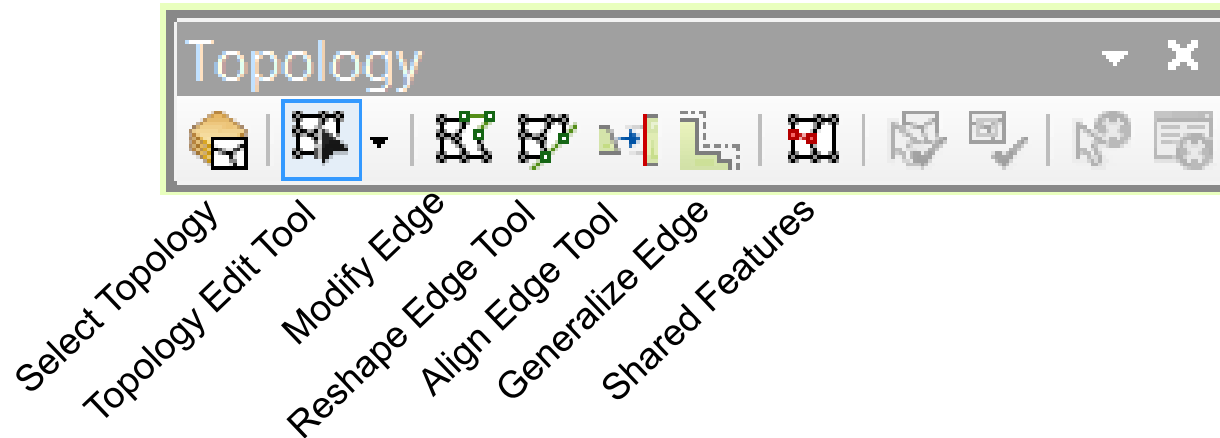
- ESRI definition:
 - Topology is a collection of rules that, coupled with a set of editing tools and techniques, enables the geodatabase to more accurately model geometric relationships.



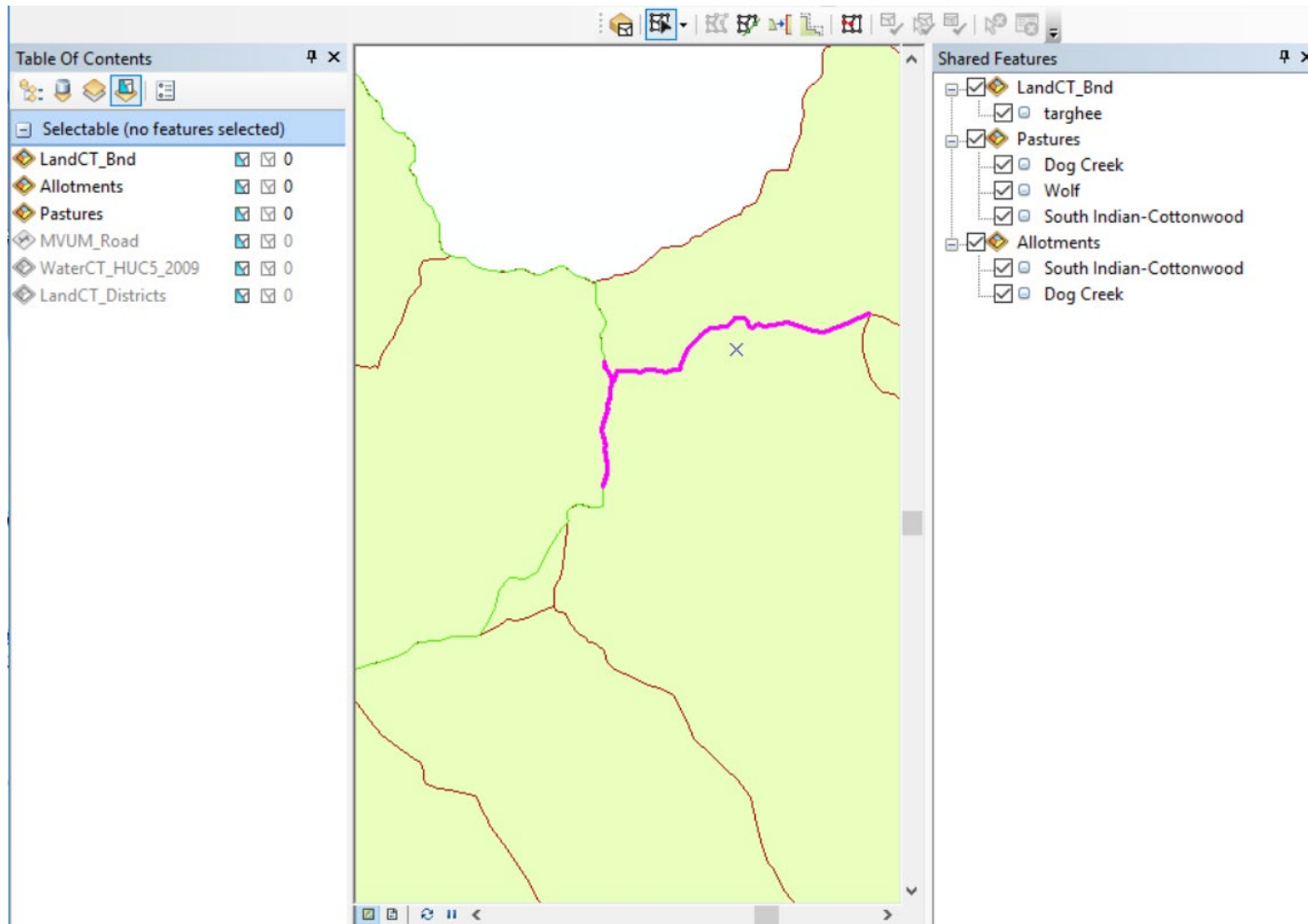


Topology Toolbar

- Map Topology Tools



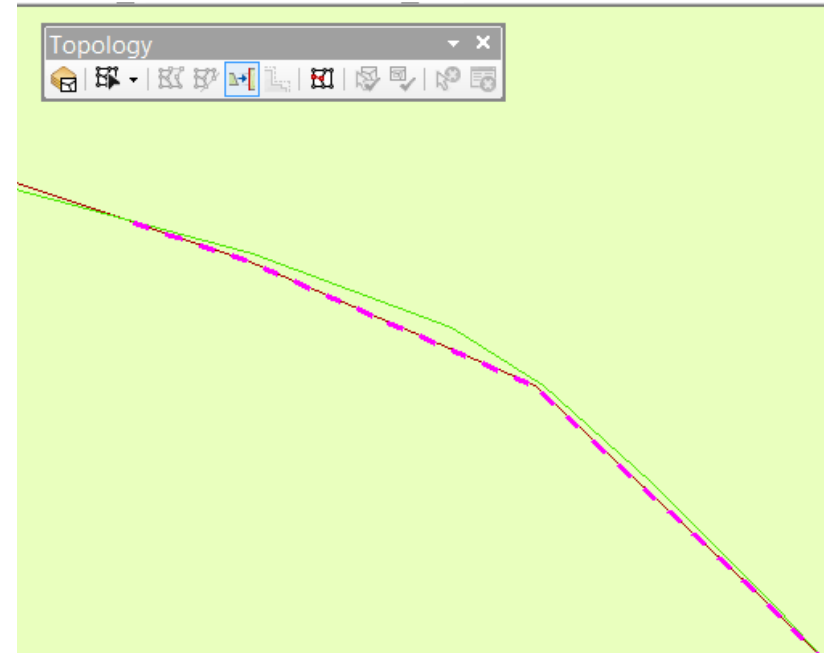
Shared Features Tool





Map Topology

- Creates topological relationships between the parts of features that are coincident.
- Map topology tools allow you to simultaneously make edits to coincident features or feature classes.




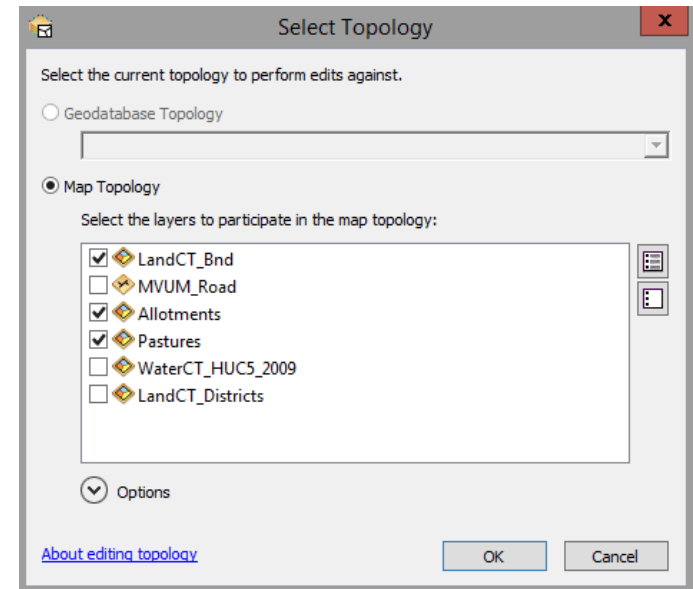
Why Map Topology?

- Many vector datasets have features that share geometry. For example:
 - Within a dataset: Coincident features within a Land Cover dataset
 - Between Datasets: A District boundary coincident with a grazing allotment boundary
- Topology allows you to edit coincident features simultaneously so they continue to share geometry.



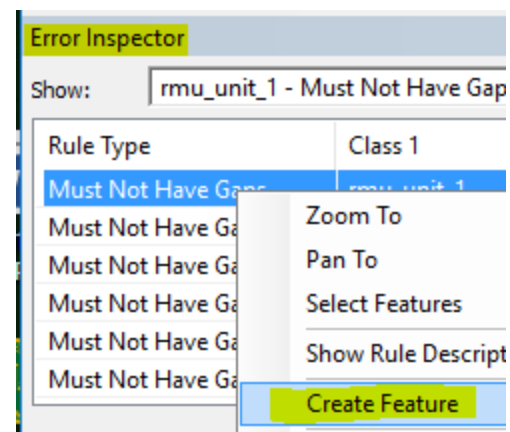
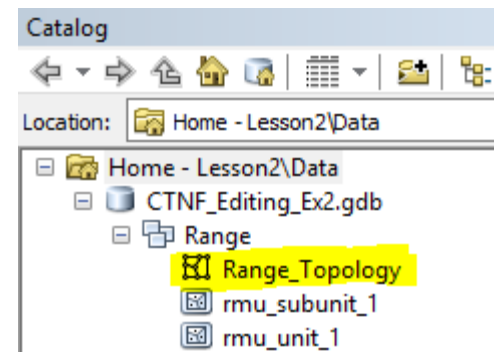
Map Topology Creation

- Click Select Topology button  on the Topology toolbar to open the dialog box.
- Choose the layers that you want to participate in the map topology.



Geodatabase Topology

- Working definition of Geodatabase topology: The arrangement that defines how point, line, and polygon features share coincident geometry.
- Geodatabase topology allows you:
 - To find spatial features that don't meet the defined data standards, and to use specialized tools to fix the errors.





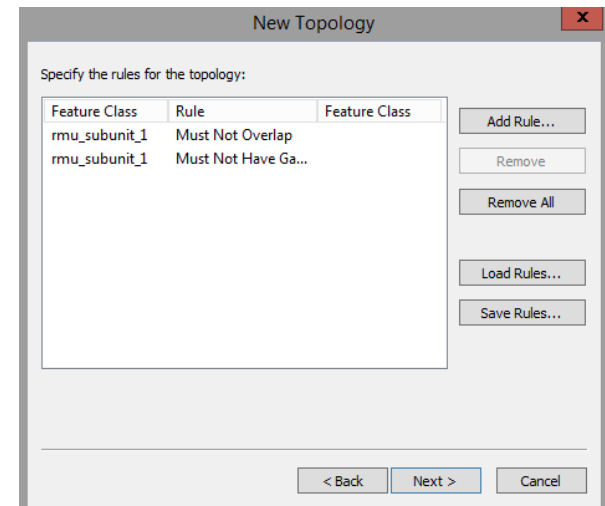
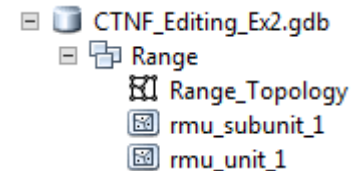
Why Geodatabase Topology?

- Geodatabase topologies help you manage your data and ensure data integrity.
 - You set the topology rules that control the relationships between features in a feature class, and between features in different feature classes.
- ArcMap has a window to display topological relationships, errors, and exceptions.
- ArcMap also includes a set of topology tools for query, editing, validation, and error correction.



Geodatabase Topology Workflow

- Using Catalog:
 - Create a feature dataset in a geodatabase
 - Load feature classes into feature dataset
 - Create the topology and select the rules
 - Build and validate your topology



Topology Toolbar

- Geodatabase Topology Tools



Select Topology

Validate Topology in Specified Area

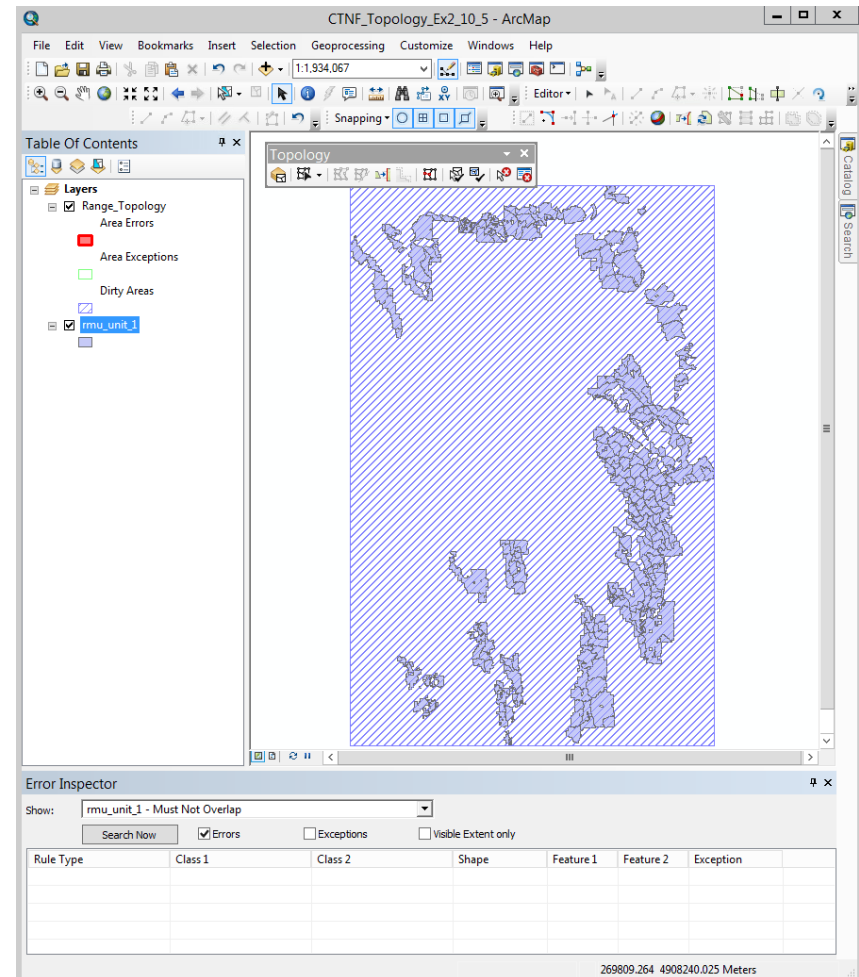
Validate Topology in Current Extent

Fix Topology Error Tool

Error Inspector

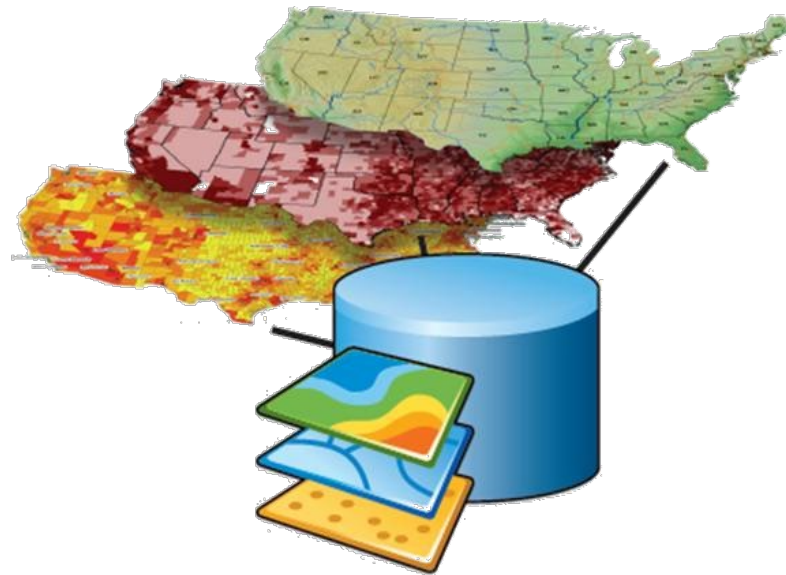
Geodatabase Topology Workflow

- In ArcMap:
 - Add the topology to the TOC
 - Use the editing environment to identify and fix errors
 - Manage updates to feature classes
 - Perform many other common editing tasks





Demonstration





United States Department of Agriculture

Forest Service Vertical Integration Tool

Advanced Editing Course - Lesson 3



Geospatial Technology
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Forest Service

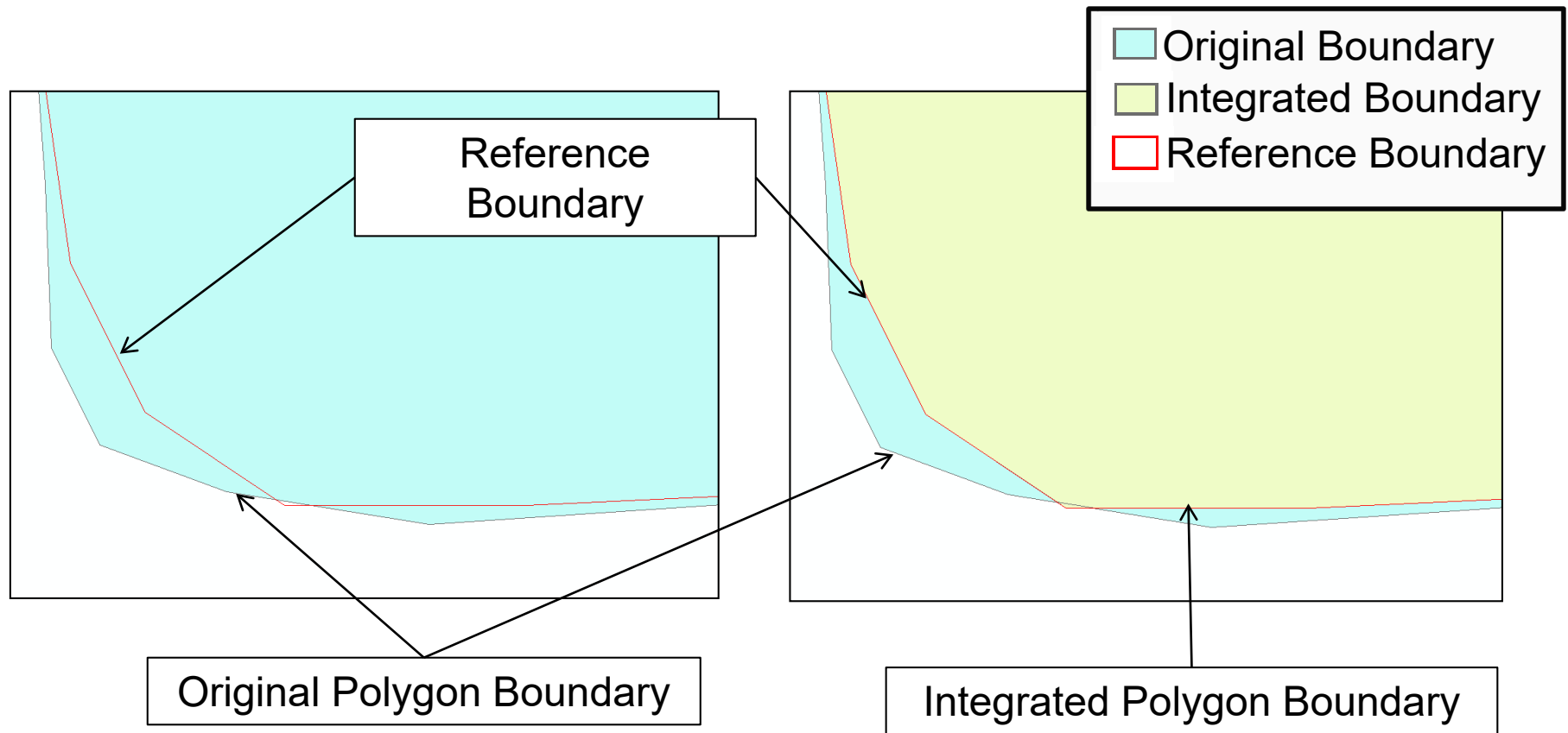
Vertical Integration Toolbox

- Set of Python Scripts
 - Created by GTAC
 - For the Automated Lands Program (ALP)
 - To automate the process of aligning large GIS datasets





What is vertical integration?



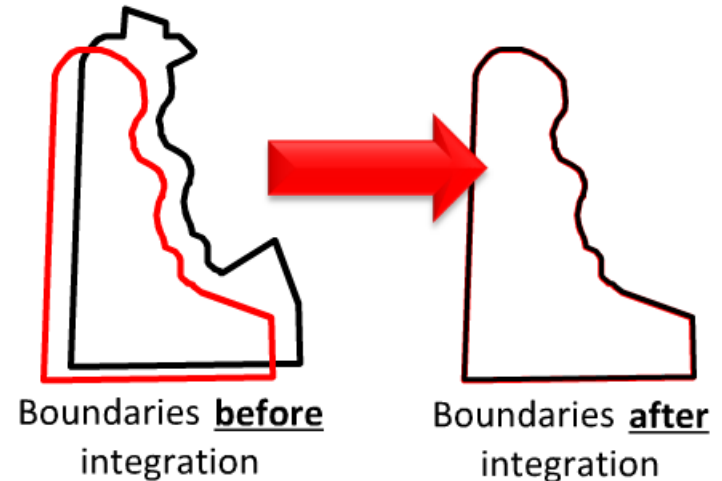
What is Vertical Integration?

- Our working definition:
 - The process of snapping, registering, or aligning spatial data to corresponding reference data assumed to represent the desired feature locations
- Applied when the same features in separate spatial datasets do not geographically match
- Data are aligned vertically—or when layers are stacked above one another
- **Training materials in this tutorial focus on aligning polygons only**



Vertical Integration Example

- Polygon boundaries represent the same location from different data sources
- Clearly boundaries do not spatially match
- Boundaries must be aligned to represent the same location
- Assume the red boundary line represents the true location of the boundary
- The black boundary line must be snapped to the red boundary line



Red=Reference Data
Black=Data that must be aligned

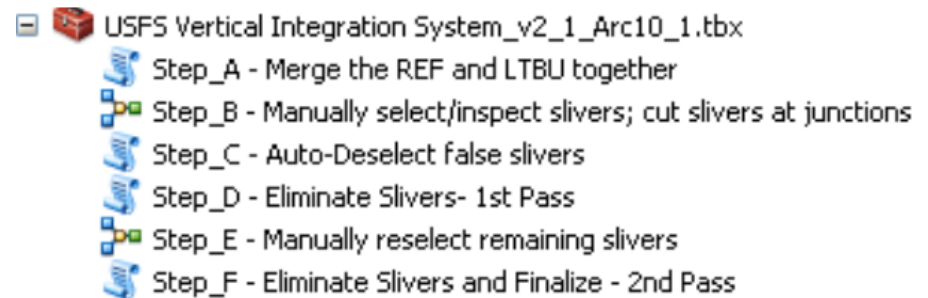
The goal is to snap the data that must be aligned to a reference data source.

Terminology

- These are vertical integration terms you need to know before you proceed:
 - **Reference Boundary Layer (REF):** Spatial data that represents (or assumed to represent) the true location of features. This layer serves as the reference for other layers to be integrated to.
 - **Layer to be Updated (LTBU):** Spatial data that must be integrated to an associated reference boundary layer.

Install the Tools

- The USFS Vertical Integration Toolbox contains the steps as individual models that you will run the data against in order to vertically integrate.
- You will learn how to use them in a subsequent section
- These individual models do require a certain amount of judgment calls to be made by the user.



Data Prep

- Data Prep Overview
 - Data prep is required—it's not a trivial prerequisite!
 - Can be cumbersome
 - Make sure it's correctly performed; otherwise, procedures may not work or provide you with expected results



Data Prep

- General Requirements & Considerations
 - Reference boundary layer should represent the authoritative source
 - All data must be available as **feature classes in a File Geodatabase** before using procedures
 - Convert from other data formats
 - Layer to be updated and reference boundary layer must be located in the same geodatabase
 - Data must contain matching spatial reference information
 - Best Practice: Match reference boundary layer to layer to be updated



Data Prep

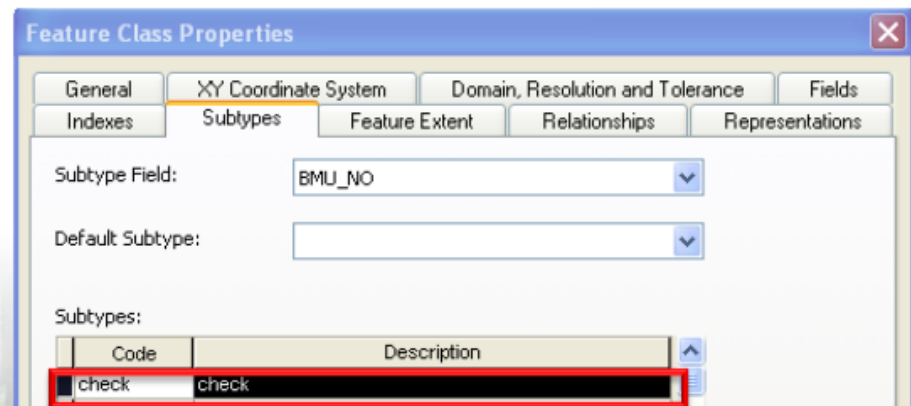
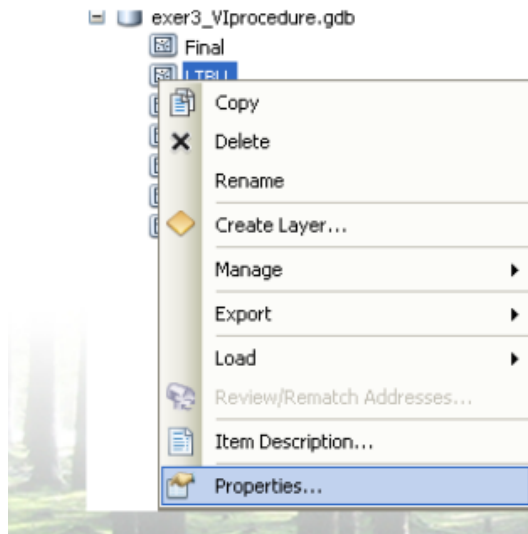
- General Requirements & Considerations
 - Helpful if layers contain similar data extents
 - Reduces processing time
 - Ensure data do not contain topological errors
 - Specifically for polygons that require integration
 - Problems may arise
 - e.g., overlapping polygons



Data Prep

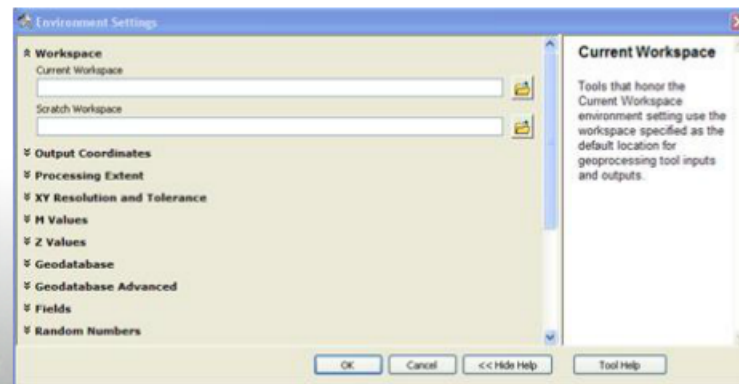
Remove Subtypes.

1. Right-Click on a featureclass inside ArcCatalog | **Properties | Subtypes.**
2. Select a subtype inside the table below and then hit the delete key on your keyboard.



Data Prep

- Set Geoprocessing Environment
 - Your *Current Workspace* and *Scratch Workspace* should always be set to the geodatabase that contains your layer to be updated and reference boundary layer. All outputs using the vertical integration workflows will be saved here.
 - Intermediate data is also stored there as well.



Data Prep

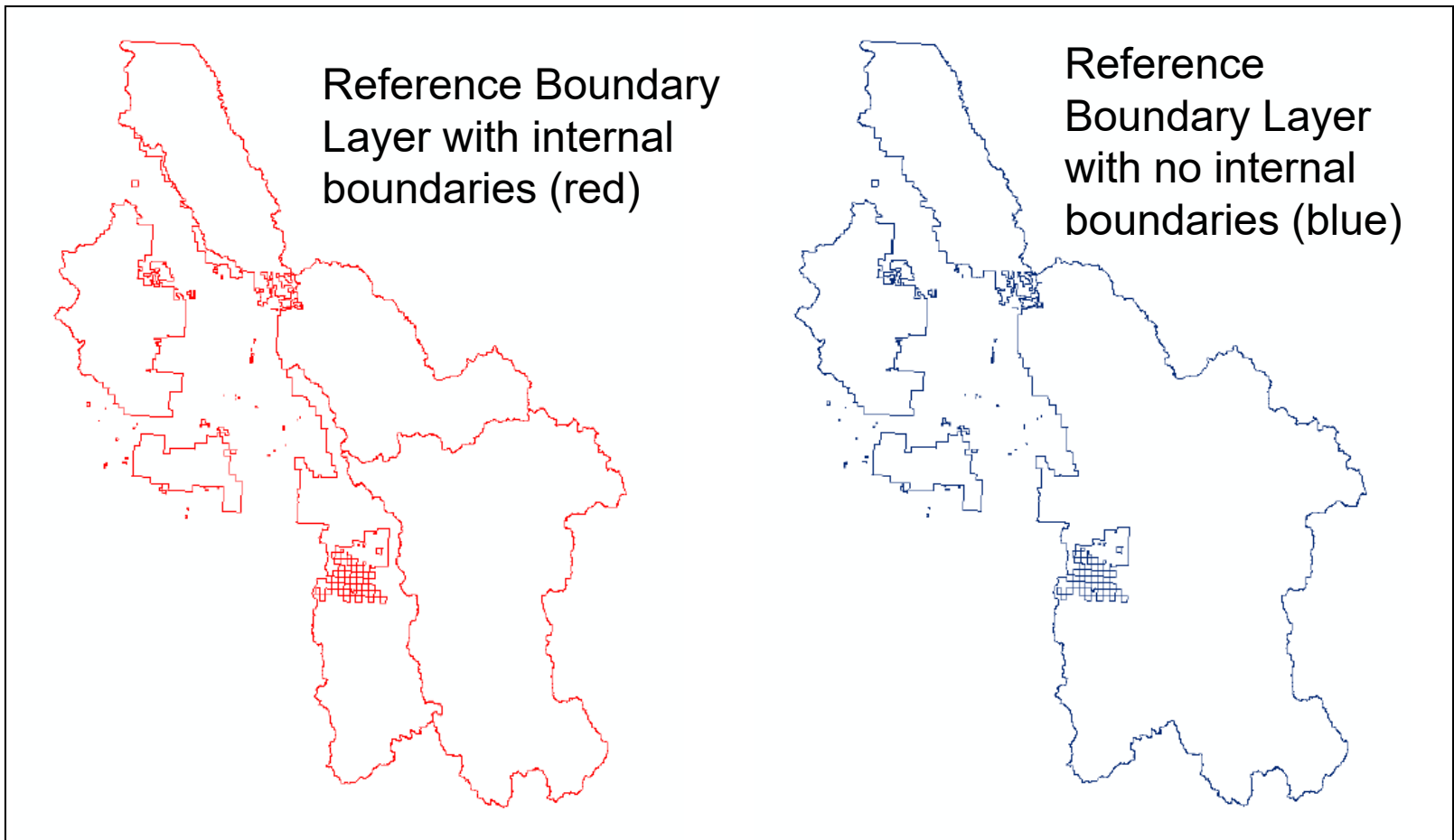
- Data Prep
- Make sure to apply all general data prep requirements
 - Reference Boundary Layer
 - Dissolve internal boundaries—only an outer boundary should be present
 - Assess isolated polygons or polygon groups when there is no corresponding layer to be updated data coverage
 - ❖ Retain if you wish to add these areas to your layer to be updated
 - ❖ Remove if you do not wish to add these areas to the layer to be updated



Data Prep

Procedure:

Dissolve reference boundary layer internal boundaries...



Apply Vertical Integration System

- Vertical Integration System Overview
 - The Vertical Integration System is a system that combines scripts and toolbox/models to aid you.
 - There is a certain percentage of careful manual steps to apply the user's judgment, within the system, however.
 - Be careful and meticulous with those judgment calls as this directly affects the final outcome.



Summary

- Vertical Integration:
 - Is the process of aligning geospatial data
 - Is needed as it's critical for analysis, helps improve operations of field and local units, and helps maintain the integrity of the agencies data
- There are three primary vertical integration procedures: Procedures 1, 2, & 3
- Characteristics of your data determine which integration procedure to apply
- Be sure to prepare your data appropriately

