

# Working with Geodatabase Topology

The screenshot displays several key components of the GIS topology workflow:

- Error Inspector:** Shows a table of errors for the 'Burn\_units - Must Not Overlap' rule. The table contains one entry:
 

Rule Type	Class 1	Class 2	Shape	Featu...	Featu...	Exception
Must Not Overlap	Burn_units		Polygon	18	35	False
- Topology Window:** Shows the active topology is 'Census\_Topology' with various tool icons for editing and validation.
- Context Menu:** A menu is open over a red polygon, offering options like 'Zoom To', 'Pan To', 'Select Features', 'Show Rule Description...', 'Subtract', 'Merge...', 'Create Feature', 'Mark as Exception', and 'Mark as Error'.
- New Topology Dialog:** Provides instructions on feature class ranks. It includes a table for specifying ranks:
 

Feature Class	Rank
boundary_Line	2
ROADS	3
Boundary_Poly	1
Burn_units	1
Fuels	2
PLSS	3
	4
	5
- Rule Configuration Dialog:** Shows the configuration for the 'Must Be Covered By Boundary Of' rule. It sets the 'Feature class' to 'PLSS' and includes a 'Rule Description' section with visual examples of line features coinciding with or not coinciding with area boundaries. The 'Show Errors' checkbox is checked.

Developed and Presented by Juniper GIS

# Working with Geodatabase Topology

## Course Objectives

Understanding how Geodatabase Topology works

Geodatabase Rules

Creating Geodatabase Topology

Editing with Geodatabase Topology

Geometric Networks – if time

This presentation will be available at [www.junipergis.com](http://www.junipergis.com)  
>links >presentations

*SCGIS Schedule Change - Local chapters scheduled for 2-3:30 Monday  
will be in Timbers from 1:30 to 2 as a discussion*

# Working with Geodatabase Topology

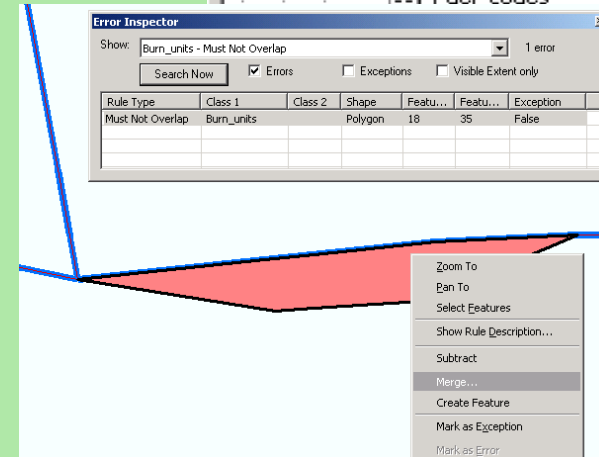
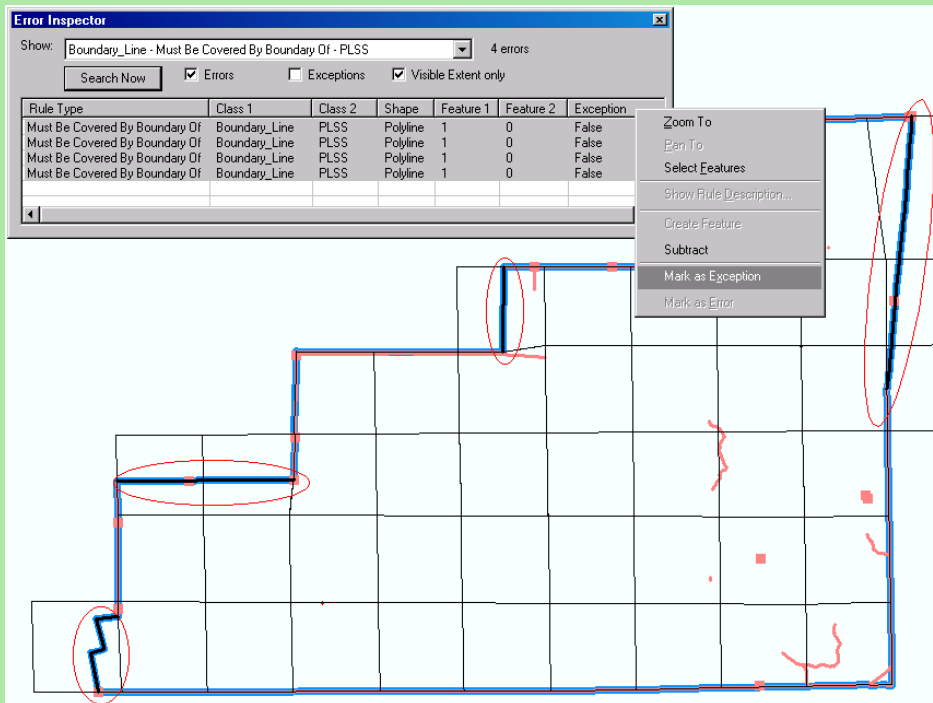
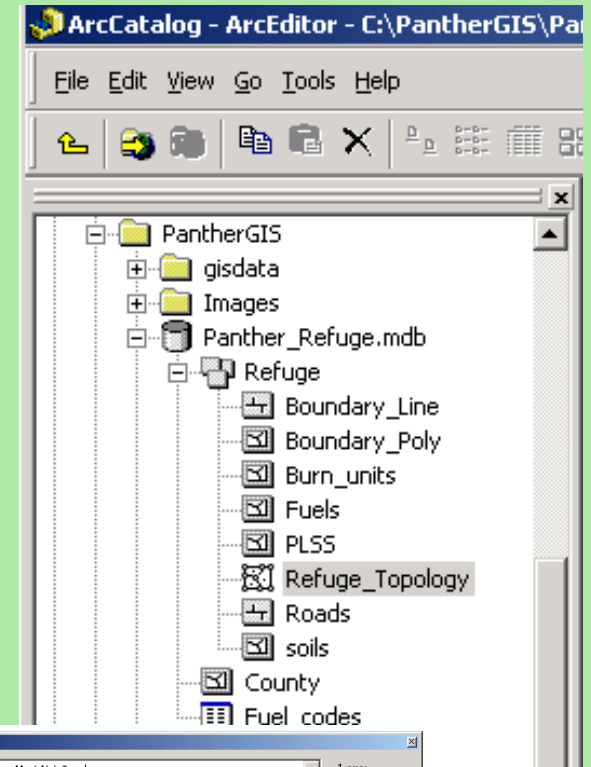
## Geodatabase Basics

What is the Geodatabase?

A container for spatial data

A tool that allows the user to more closely model reality

A tool to improve editing and data maintenance



# Working with Geodatabase Topology

## Geodatabase Basics

What is the Geodatabase?

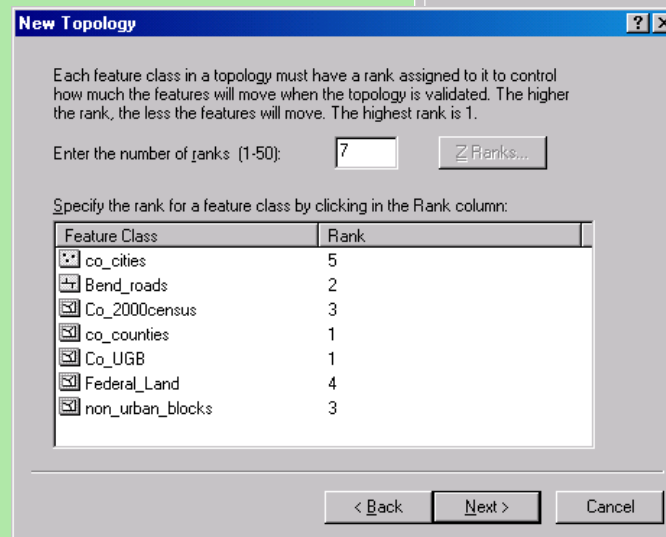
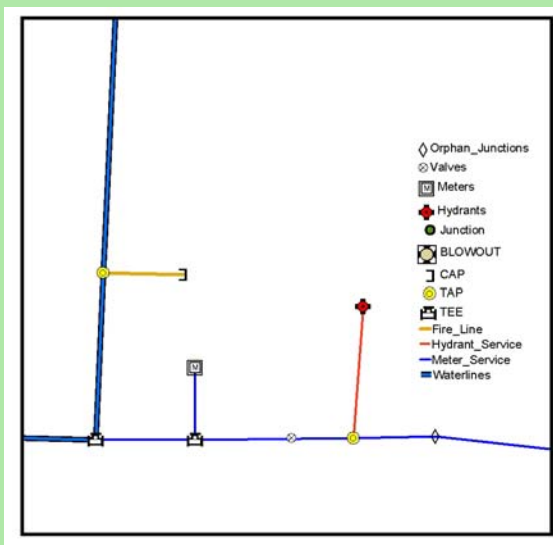
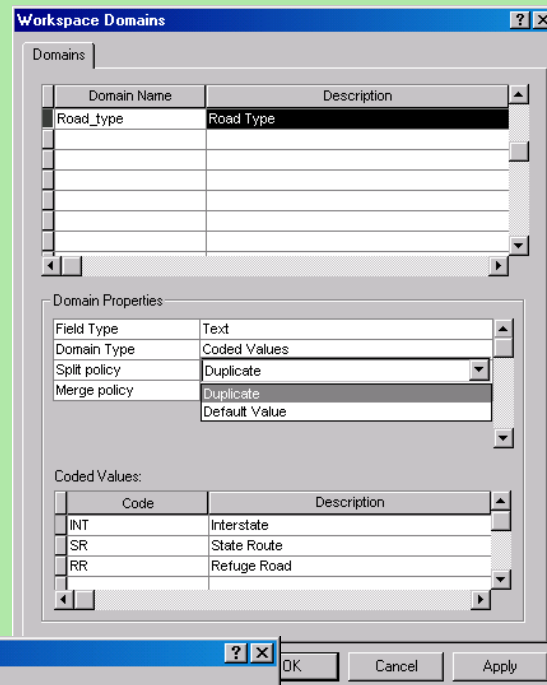
Allows for the ability to **provide behavior** for geographic and database objects

Domains

Subtypes

**Topology**

Geometric & Dataset Networks



# Working with Geodatabase Topology

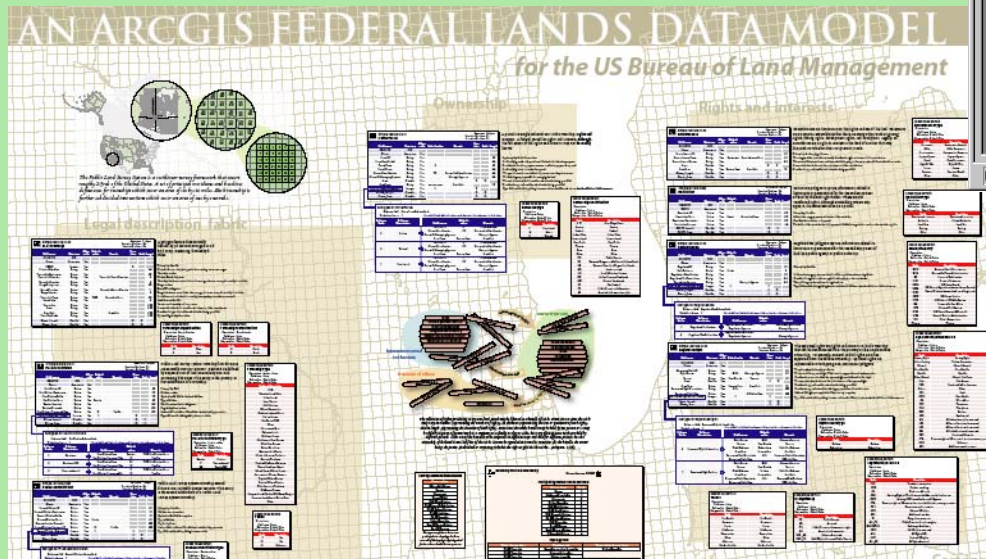
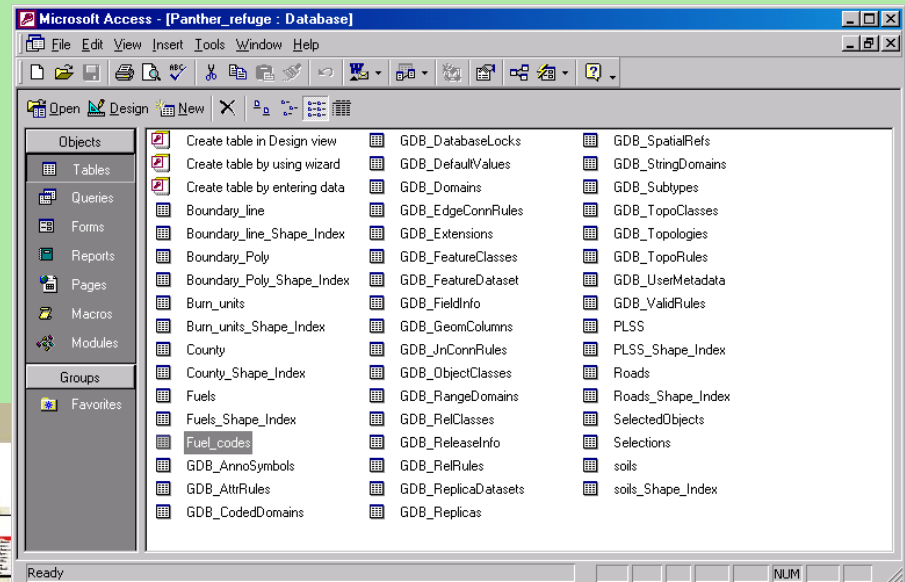
## Geodatabase Basics

What is the Geodatabase?

Scaleable to meet an organization's needs as they grow

Personal Geodatabases

Enterprise Geodatabases  
(SDE)

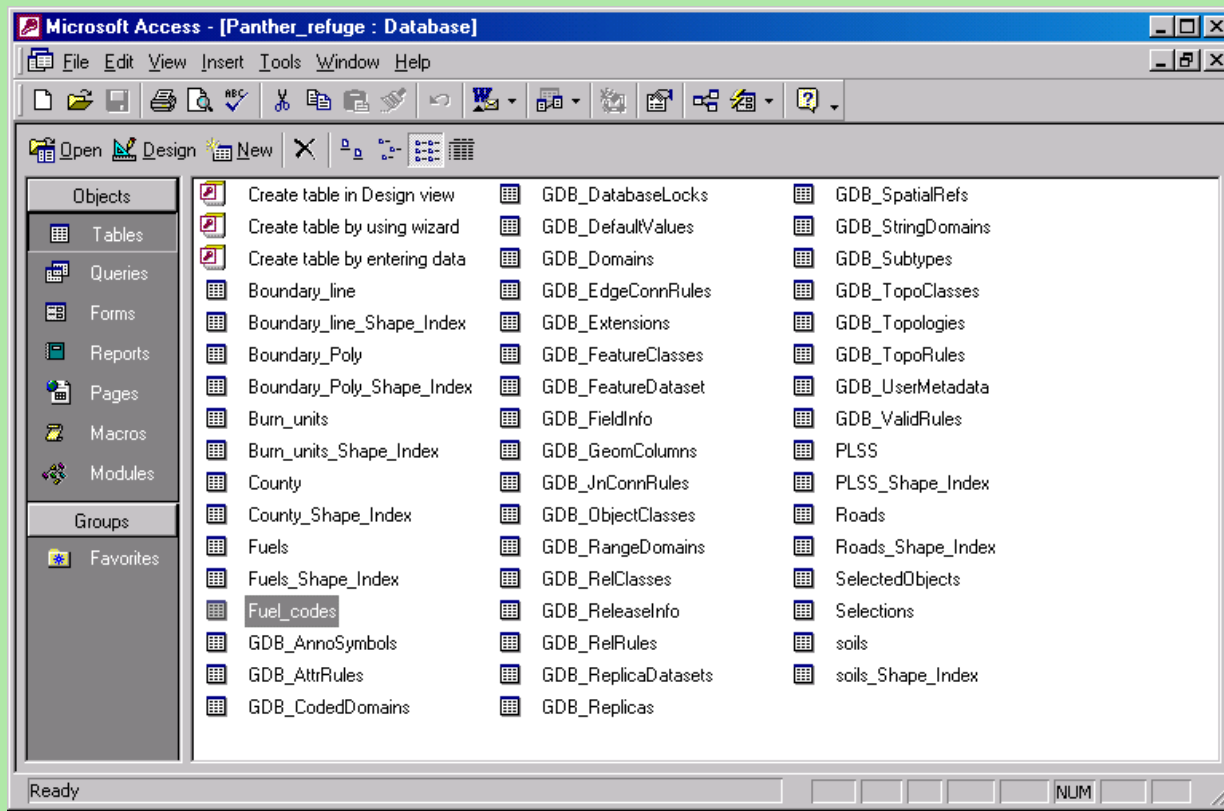


# Working with Geodatabase Topology

## Geodatabase Basics

### The Geodatabase Data Format

Stores spatial features and attributes in the same relational database management system (RDBMS), along with information on spatial references and **rules for interactions between features**, tables, and other objects.

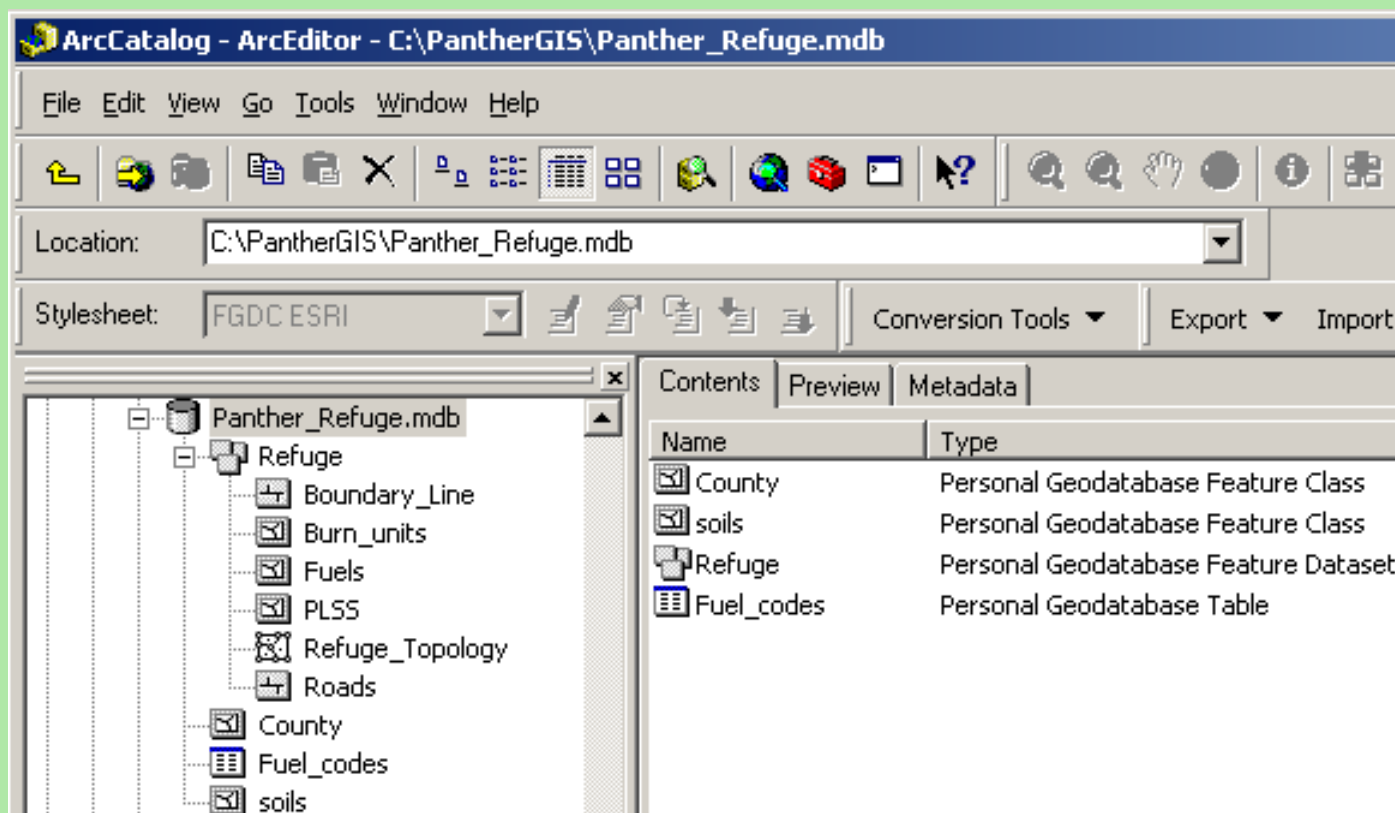


# Working with Geodatabase Topology

## Geodatabase Basics

### The Geodatabase Data Format

The primary spatial data format is the Feature Class, which can be stand-alone or grouped together in a Feature Dataset.



# Working with Geodatabase Topology

## Topology Basics

What is Topology?

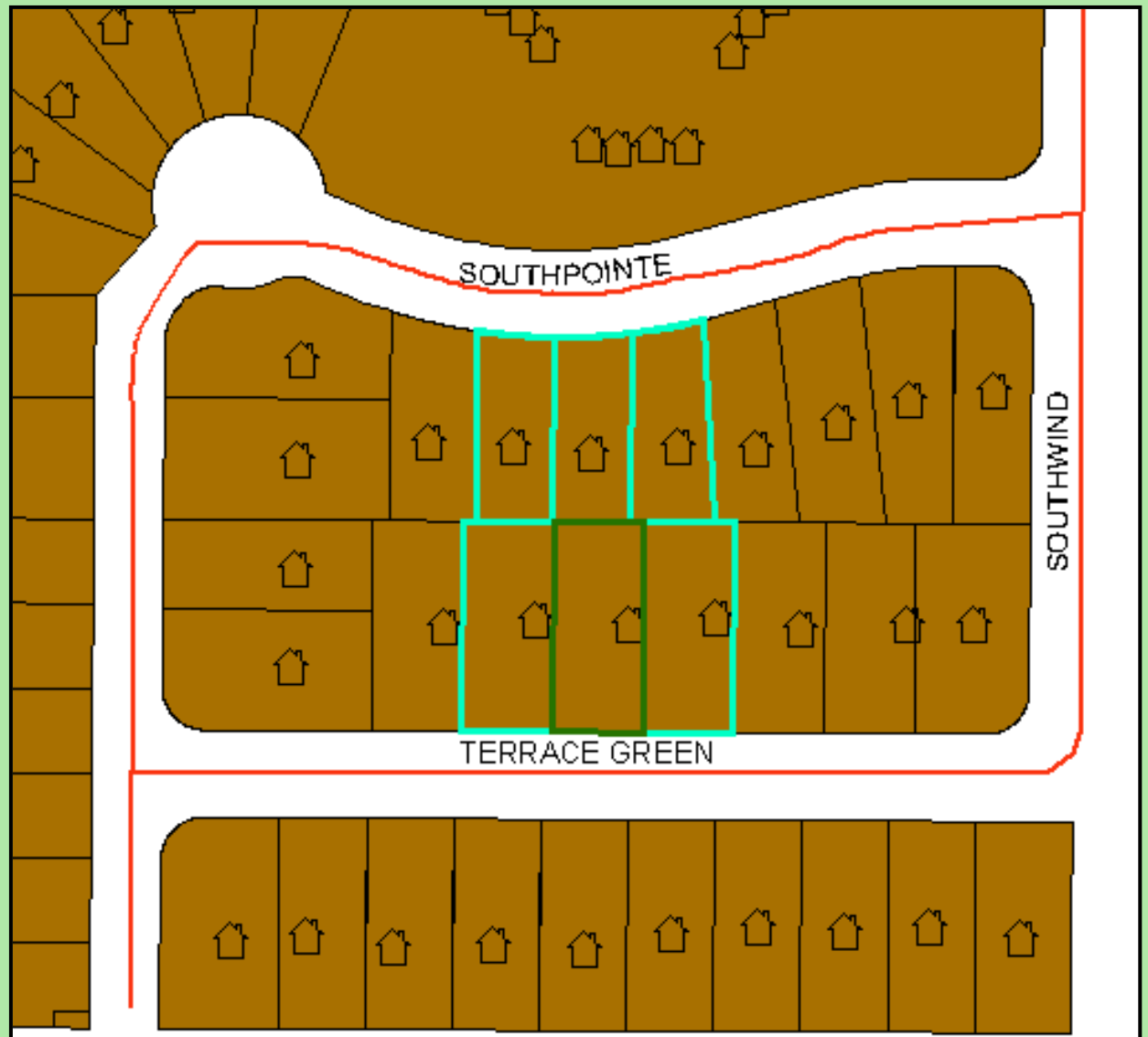
Adjacency

Connectivity

Containment

Coincidence

Length/Direction



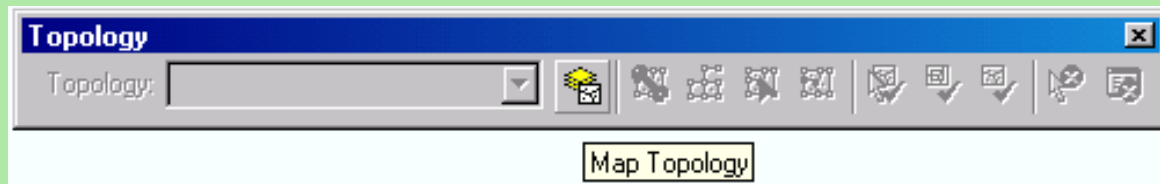


# Working with Geodatabase Topology

## Topology Basics

### Types of Topology - ArcMap Topology

Limited topology created in ArcMap at the ArcView or ArcEditor level.



Primarily works with coincident geometry. All vertices within the cluster tolerance will be snapped together to create coincident geometry.

For example, if Burn Unit boundaries are coincident with Road centerlines, when you edit the location of the Road centerline, the Burn Unit boundary will also change.

ArcMap topology is temporary for that edit session.

Works with shapefiles as well as geodatabase feature classes.

Cannot use Topology Rules or set Ranks

# Working with Geodatabase Topology

## Topology Basics

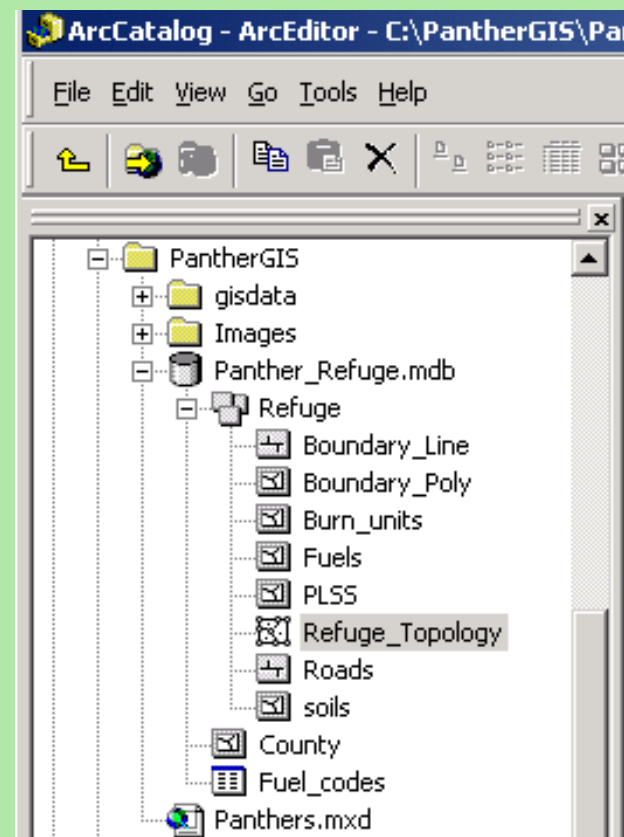
### Types of Topology - Geodatabase Topology

Requires ArcEditor

Created in ArcCatalog within a Feature Dataset

Topology can only be created for simple feature classes – points, lines, polygons, but not Annotation, Networks, or Dimensions.

Feature Classes can only participate in one topology or geometric network at one time.



# Working with Geodatabase Topology

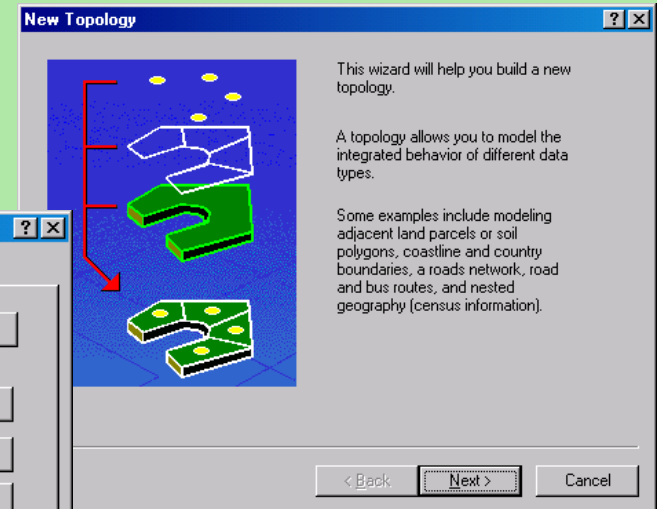
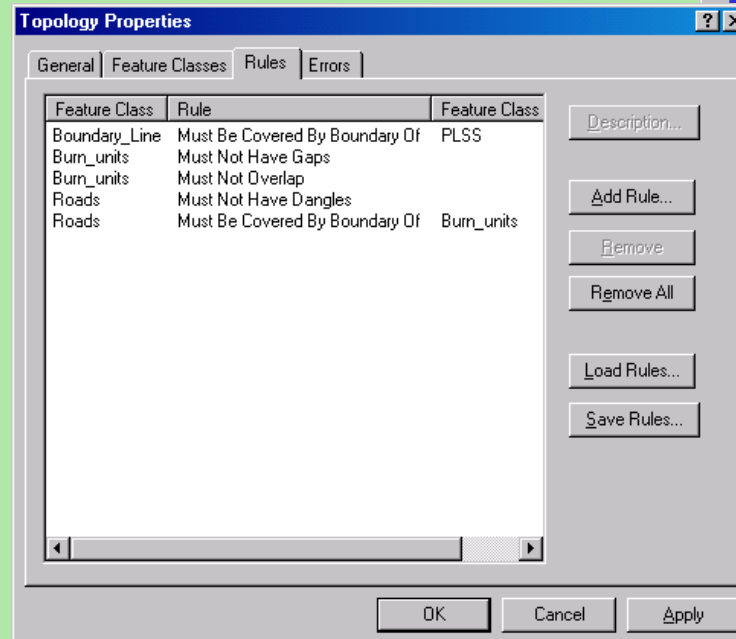
## Topology Basics

### Types of Topology - Geodatabase Topology

Topology is a property of the GDB.

The topology itself is not stored, but only the properties and rules for the topology.

Topology is discovered on-the-fly as needed or when validated.



# Working with Geodatabase Topology

## Topology Basics

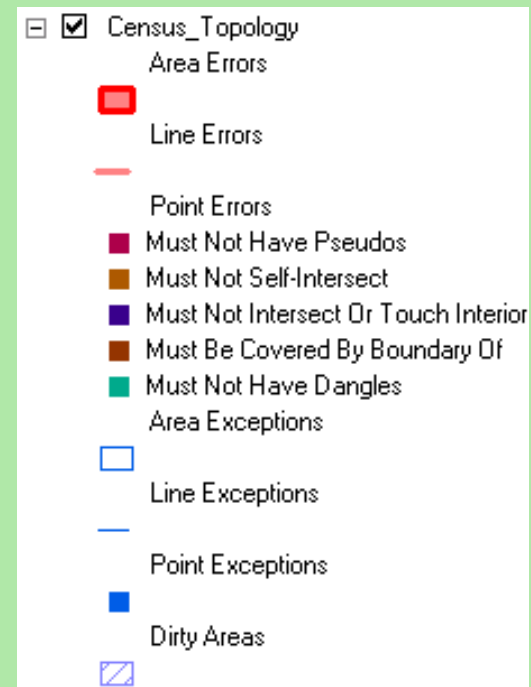
### Types of Topology - Geodatabase Topology

The topology class stores the errors, exceptions and dirty areas as a special type of feature class.

Errors – where features break the rules.

Exceptions – where features break the rules but we forgive them.

Dirty Areas – areas where features haven't been validated.



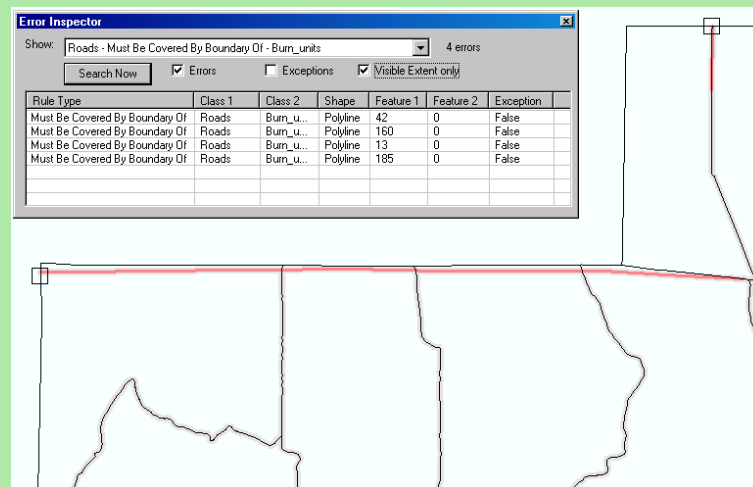
# Working with Geodatabase Topology

## Topology Basics

### Types of Topology - Geodatabase Topology

Has an extensive set of rules that can be applied.

Has a full set of editing tools to manage and fix topology.



Has several tools for creating new features from existing features.



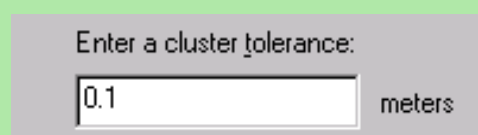
# Working with Geodatabase Topology

## Topology Basics

### Creating GDB Topology

Right-click the Feature Dataset that contains the feature classes for which you want to create topology. Select New>Topology

Enter a name and set the cluster tolerance.

A screenshot of a dialog box titled "Enter a cluster tolerance:". It contains a text input field with the value "0.1" and a label "meters" to its right.

All vertices within the cluster tolerance distance will be snapped together.

ESRI recommends setting the cluster tolerance to 1/10 of the most precise data. Too high a cluster could move coordinates you don't want moved.

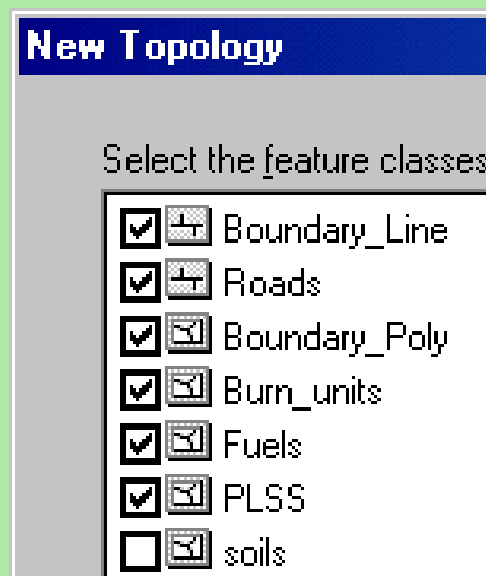
Cluster tolerance should not be used to perform bulk data adjustments.

# Working with Geodatabase Topology

## Topology Basics

### Creating GDB Topology

Select the feature classes that will participate in the topology.



# Working with Geodatabase Topology

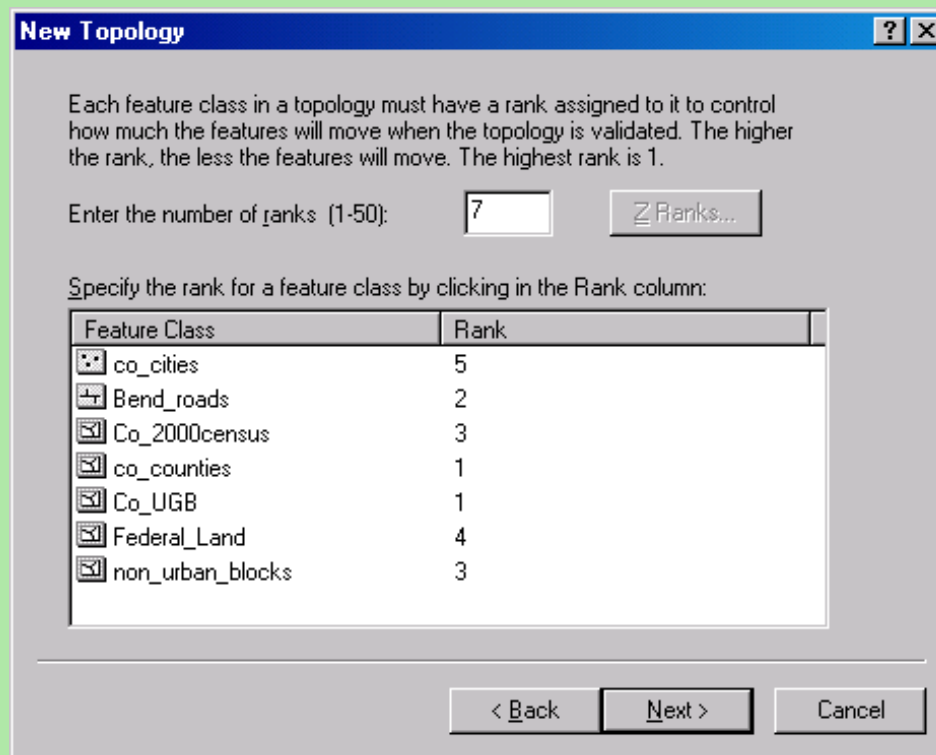
## Topology Basics

### Creating GDB Topology

Set ranks for the features.

Higher ranked features (lower number) will move less, lower ranked features (higher number) will move to match higher ranked features.

Can have up to 50 ranks





# Working with Geodatabase Topology

## Topology Basics

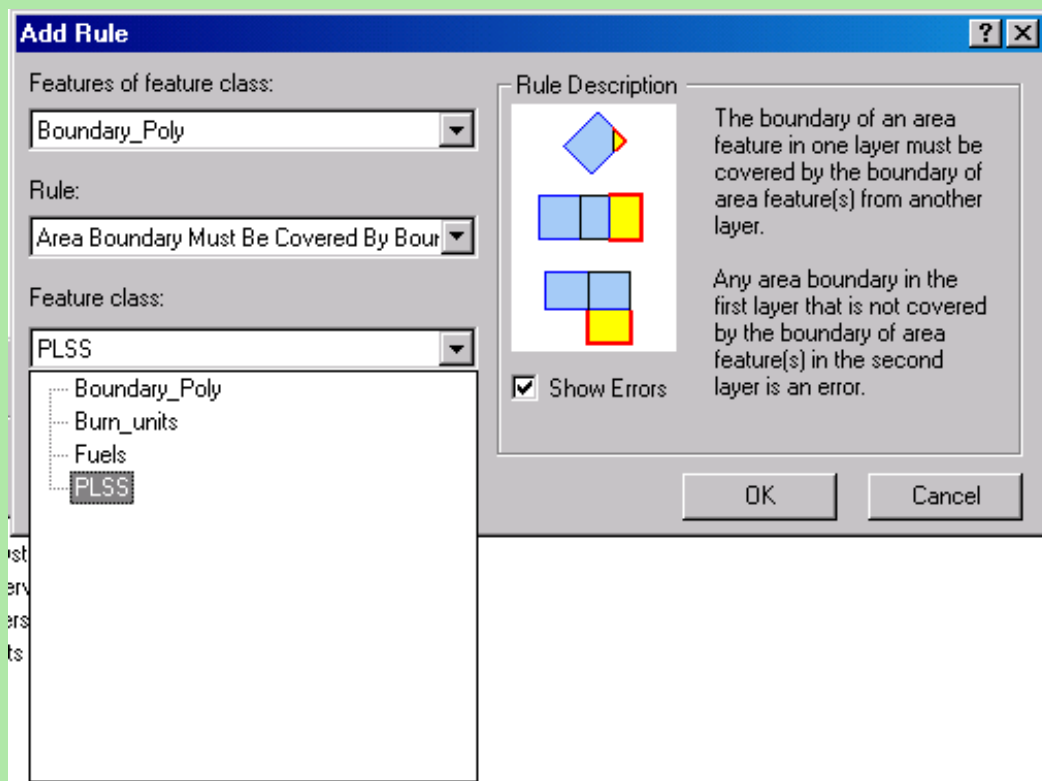
### Creating GDB Topology

#### Add Rules

Rules can be saved to use in other topologies.

Rules can be added or removed as needed.

Note: When adding or removing rules the whole topology needs to be validated and you will lose any exceptions you set.

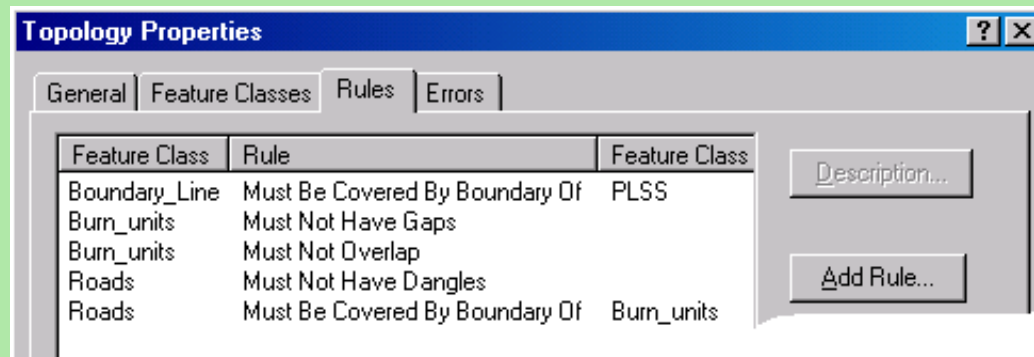


# Working with Geodatabase Topology

## Topology Basics

### Topology Rules:

There are currently 26 topology rules that specify how features interact within a feature class or across features classes.



Many of the rules are complimentary or contradictory.

For example, there is a rule that states that a point must be covered by an endpoint of a line; there is also a rule that states that an endpoint of a line needs to be covered by a point.

Search on **Topology rules poster** in ArcGIS Help for a poster showing the rules.

# Working with Geodatabase Topology

## Topology Basics

### Rule 1:

Feature must be larger than cluster tolerance. This is the default rule and is applied automatically. The features found in this rule, usually slivers, will not be deleted, but will be marked as errors.

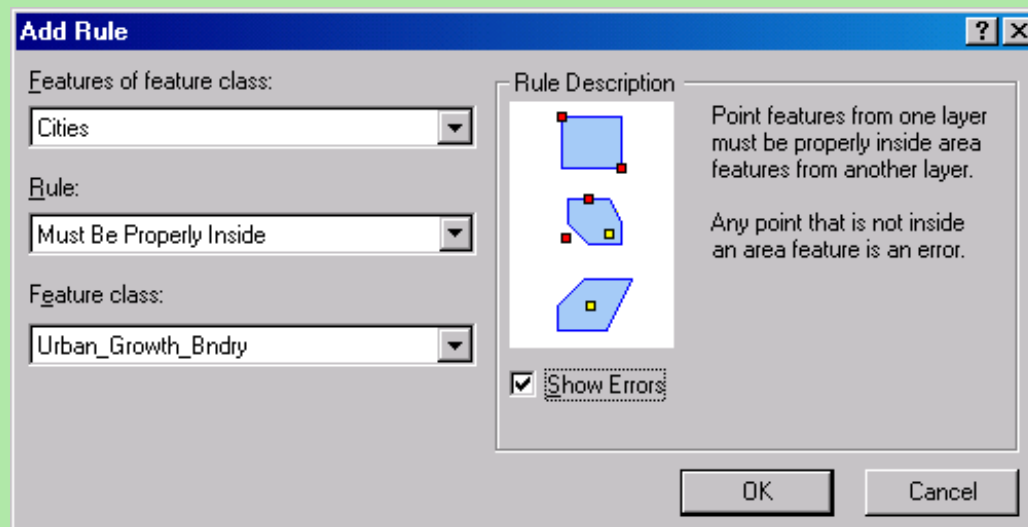
# Working with Geodatabase Topology

## Topology Basics

### Point Rules

#### Rule 2:

Points in one feature class or subtype **Must Be Properly Inside** polygons of another feature or subtype. Use this to ensure that points are completely within polygons.



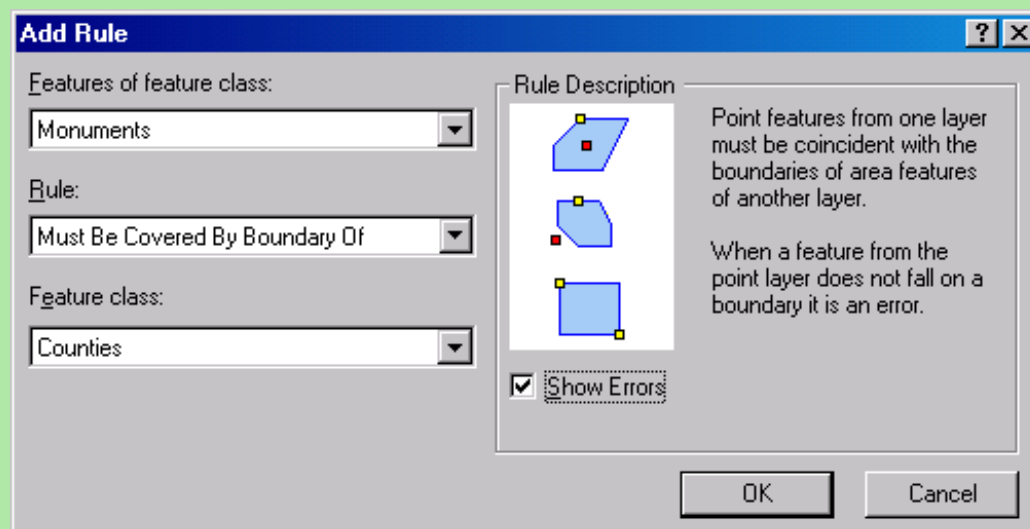
# Working with Geodatabase Topology

## Topology Basics

### Point Rules

#### Rule 3:

Points in one feature class or subtype **Must Be Covered By Boundary Of** polygons of another feature or subtype. Use this if points need to be on a polygon edge.



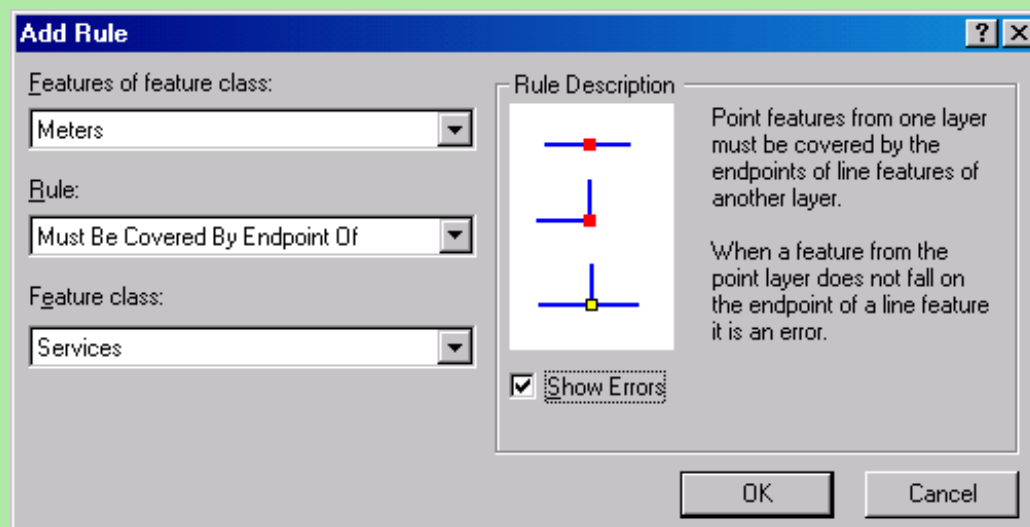
# Working with Geodatabase Topology

## Topology Basics

### Point Rules

#### Rule 4:

Points **Must Be Covered By Endpoint Of** a line in another feature class or subtype. Use this when points need to be at endpoints of lines.



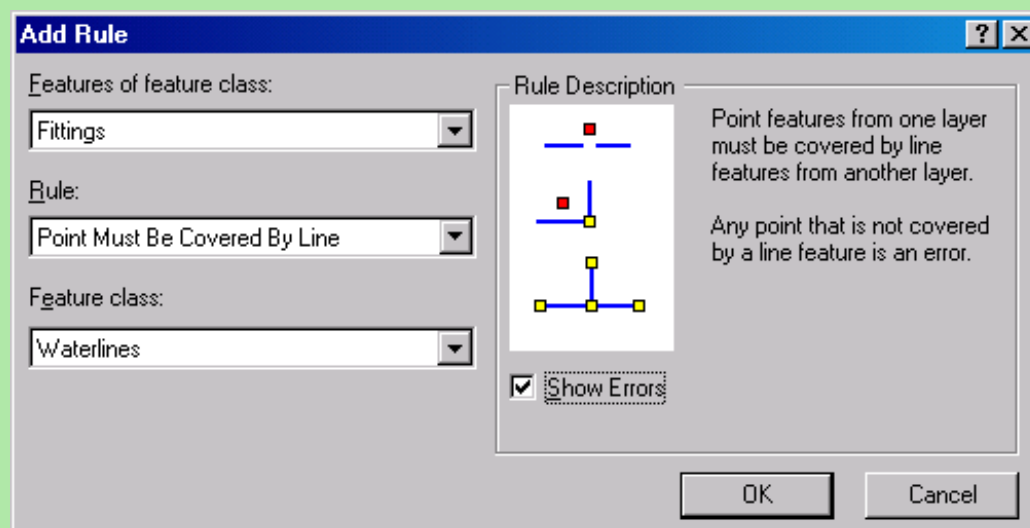
# Working with Geodatabase Topology

## Topology Basics

### Point Rules

#### Rule 5:

**Point Must Be Covered By Line**  
in another feature class or subtype. Use this if a point must be coincident with a line.



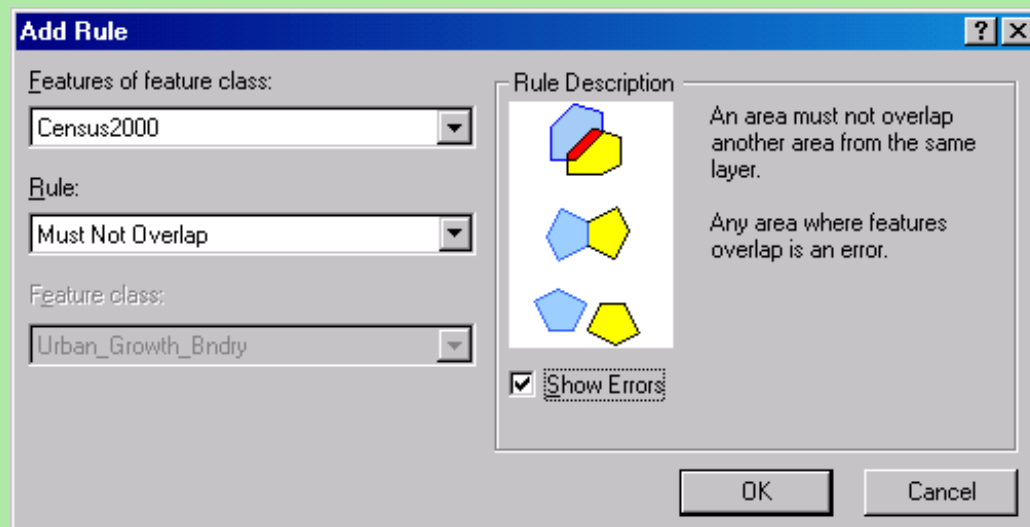
# Working with Geodatabase Topology

## Topology Basics

### Polygon Rules

Rule 6:

Polygons **Must Not Overlap**  
**within** a feature class or subtype.





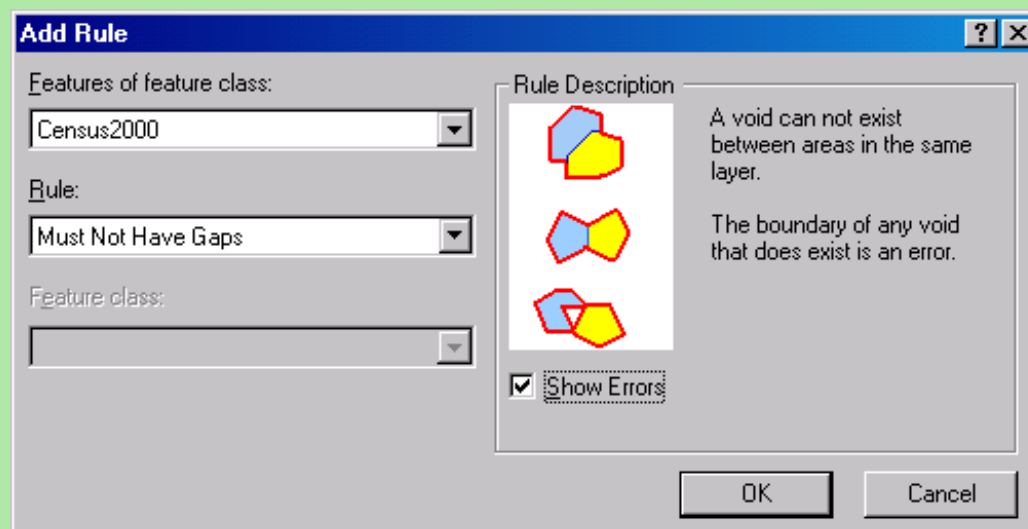
# Working with Geodatabase Topology

## Topology Basics

### Polygon Rules

#### Rule 7:

Polygons **Must Not Have Gaps** within a feature class or subtype. A common exception to this rule is the area or gap outside a set of polygons. This is equivalent to the universe polygon in coverage topology.



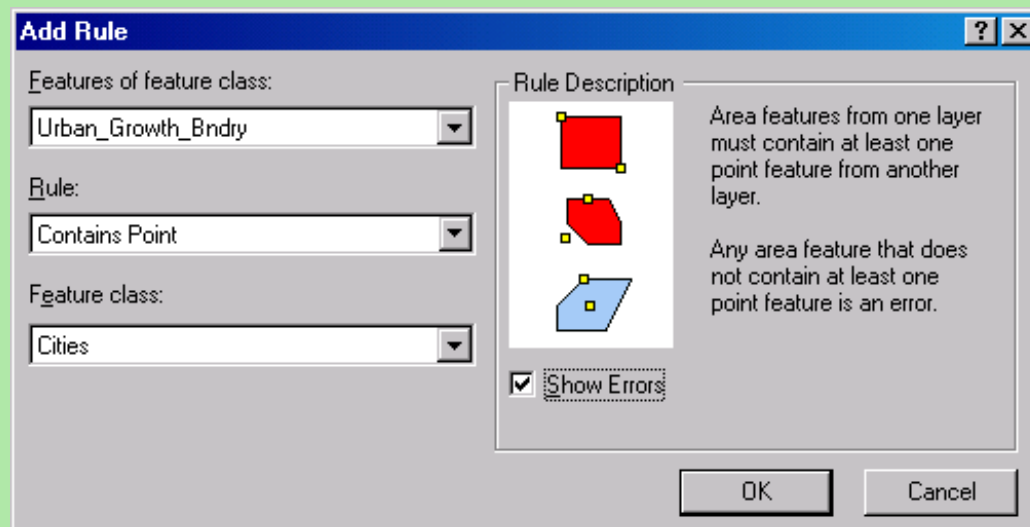
# Working with Geodatabase Topology

## Topology Basics

### Polygon Rules

#### Rule 8:

Polygon **Contains Point**. Each polygon of the first feature class or subtype must contain at least one point of the second class or subtype. Overlapping polygons can share a point.



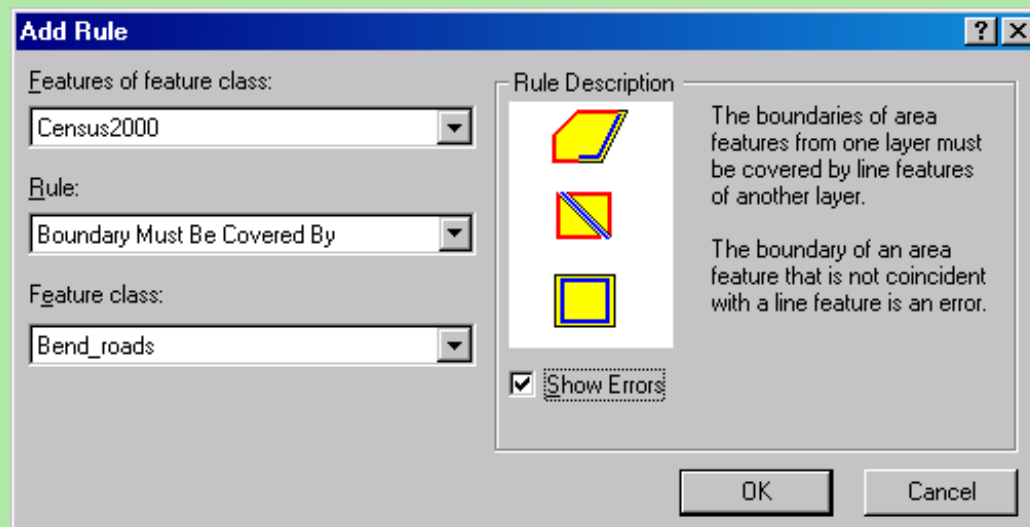
# Working with Geodatabase Topology

## Topology Basics

### Polygon Rules

Rule 9:

Polygon **Boundary Must Be Covered By** lines of another feature class or subtype.



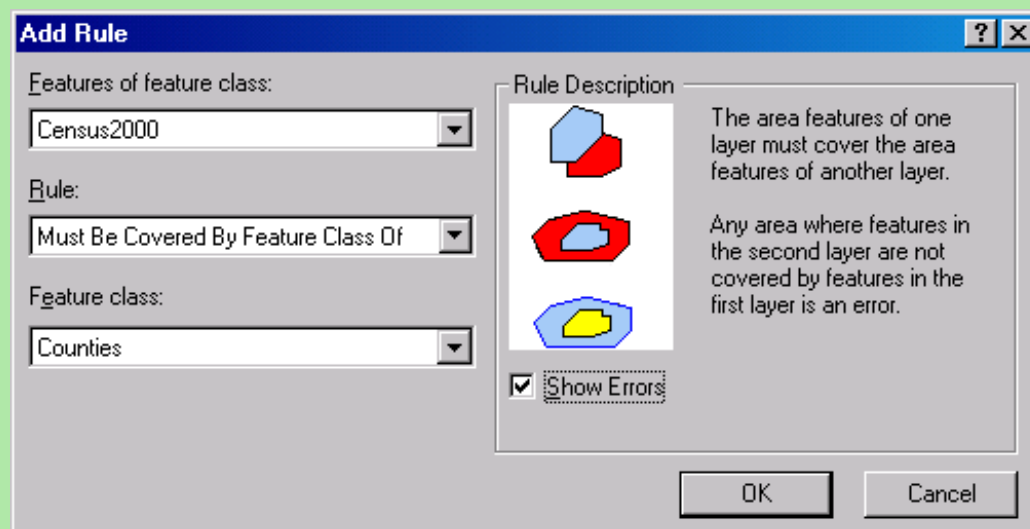
# Working with Geodatabase Topology

## Topology Basics

### Polygon Rules

#### Rule 10:

Polygons **Must Be Covered By Feature Class Of** another polygon feature class or subtype. Use this rule when each polygon in one feature class or subtype should be covered by all the polygons of another features class or subtype.



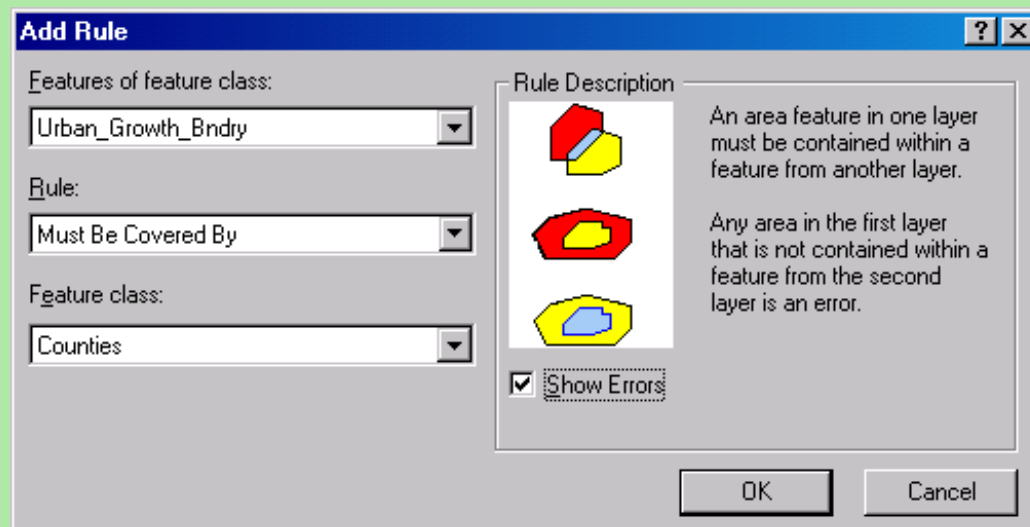
# Working with Geodatabase Topology

## Topology Basics

### Polygon Rules

#### Rule 11:

Polygons **Must Be Covered By** a **single** polygon from another feature class or subtype. Use this when you want one set of polygons to be covered by some part of another single polygon in another feature class or subtype.



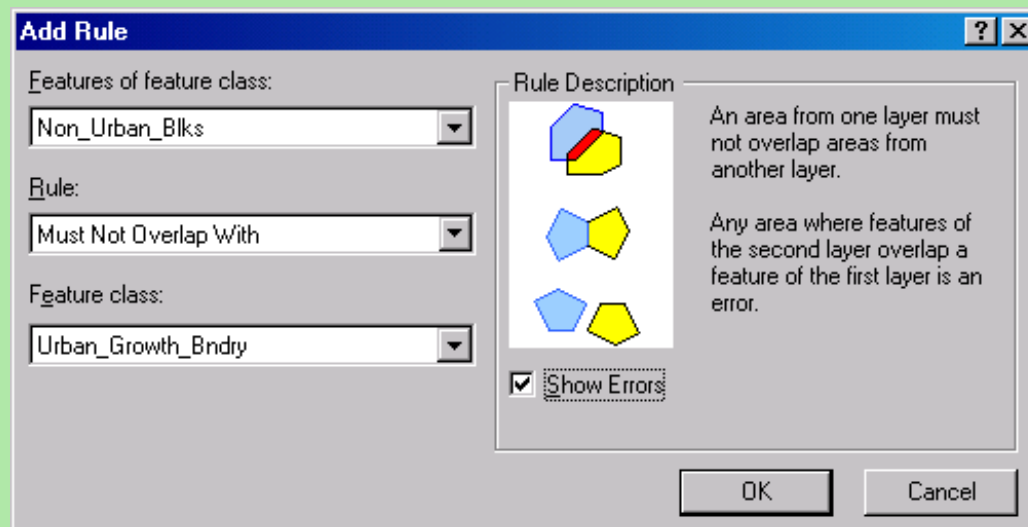
# Working with Geodatabase Topology

## Topology Basics

### Polygon Rules

Rule 12:

Polygons **Must Not Overlap With** polygons of **another** feature class or subtype.



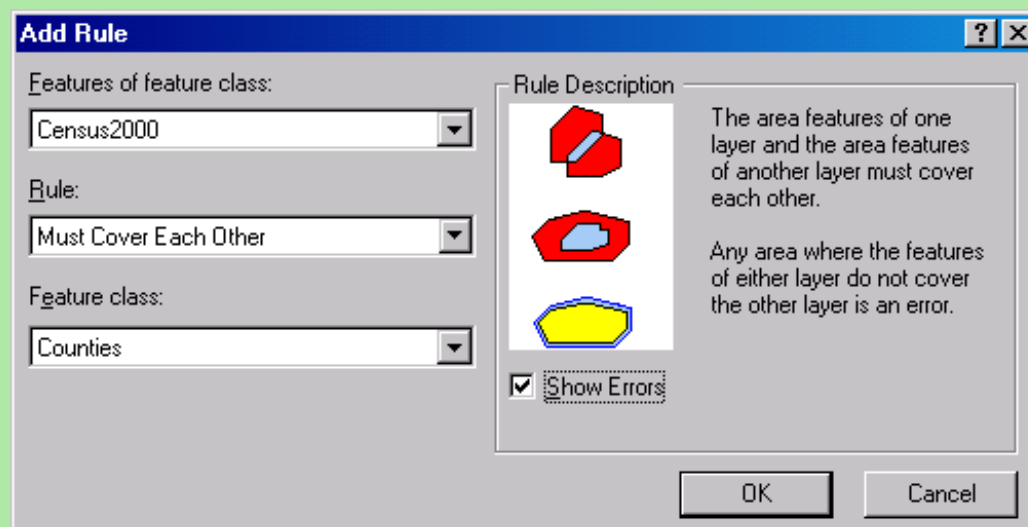
# Working with Geodatabase Topology

## Topology Basics

### Polygon Rules

#### Rule 13:

Polygons of the first feature class or subtype and all polygons in the second class **Must Cover Each Other**. Use this rule when you want polygons from two feature classes or subtypes to cover the same area.



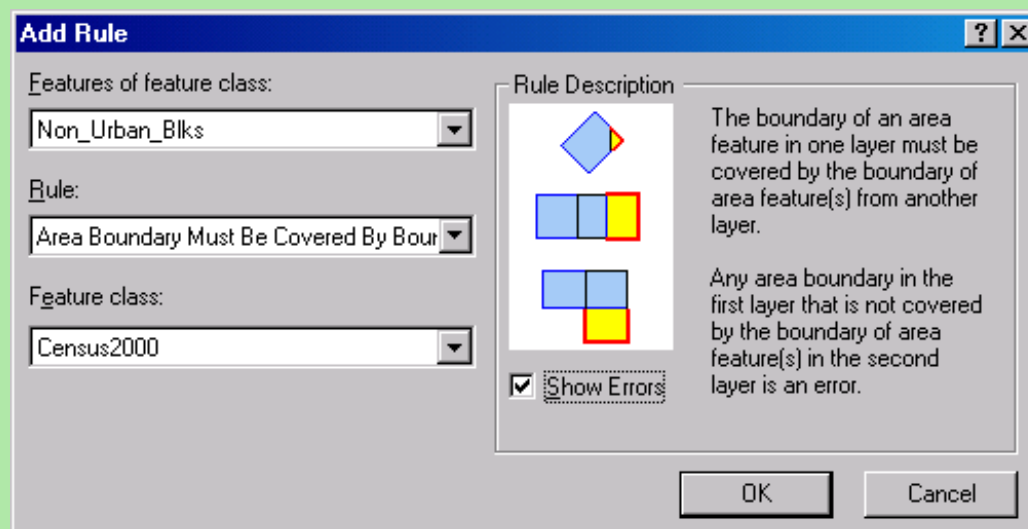
# Working with Geodatabase Topology

## Topology Basics

### Polygon Rules

#### Rule 14:

**Area Boundary of a polygon Must Be Covered By Boundary** Of another polygon feature class or subtype. Use this when the boundaries in one feature class or subtype should align with the boundaries of polygons in another feature class or subtype.





# Working with Geodatabase Topology

## Validating Topology

### Validating Topology - Validating Procedure

**Cracking** – Vertices added to features within the cluster tolerance so they can be coincident with other features

### Snapping –

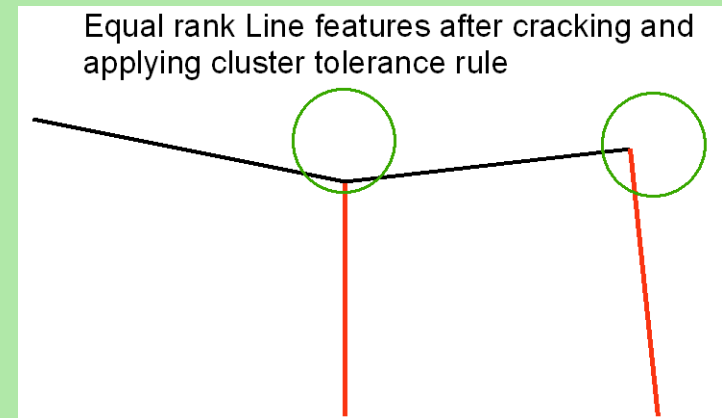
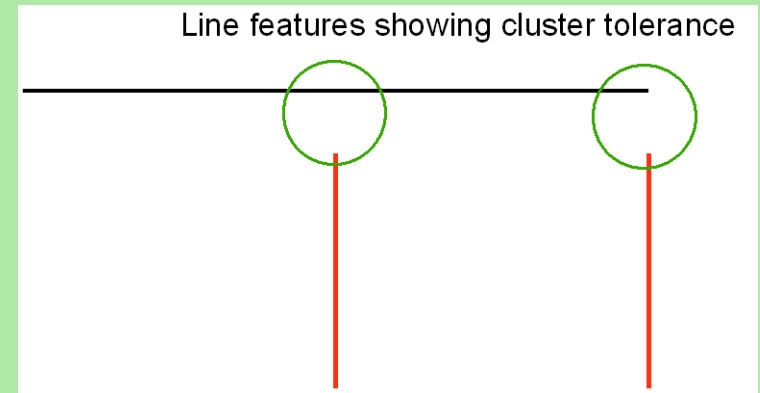
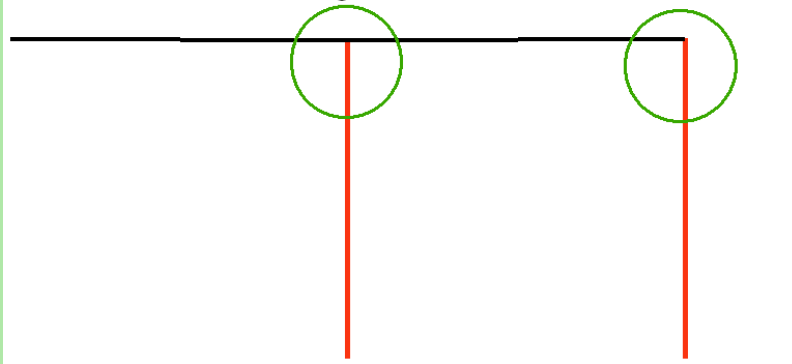
Two line ends will be clustered together

Two line vertices will be clustered together

A line vertex will be snapped to a line end

### Ranking –

After cracking and applying cluster tolerance when black features are higher ranked than red features



# Working with Geodatabase Topology

## Validating Topology

### Validating Topology - Validation states

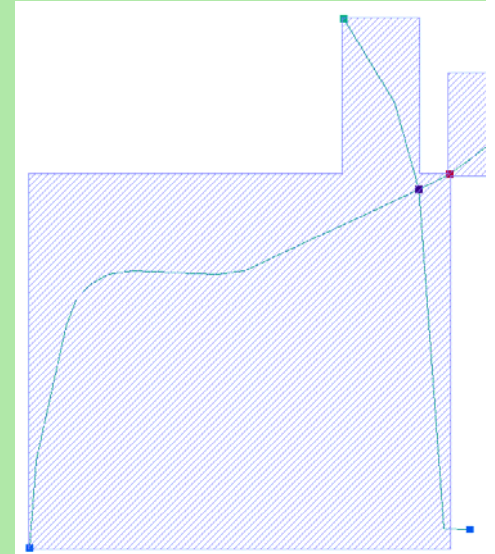
Not validated – “dirty” areas exist.

A dirty area is any area where feature classes participating in the topology have not been validated. Anytime features are edited, ArcGIS will treat them as a dirty area until they have been validated.

When working with topology in ArcMap, you can display the dirty areas with a shaded symbol.

Validated – Errors exist. This is the case where all dirty areas have been validated and errors have been found.

Validated – No errors. This means all the topology is correct.



# Working with Geodatabase Topology

## Validating Topology

### Validating Topology - When to Validate

In ArcCatalog, after creating or changing topology.

In ArcMap at any time. Must be done in an edit session.

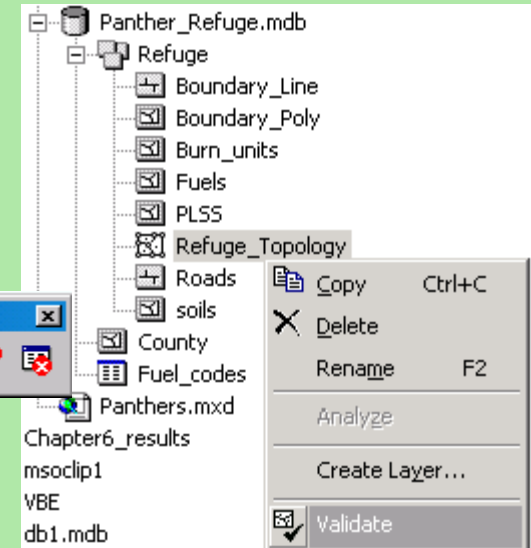
After any editing is done on features in the topology.

On a regular schedule.

Validation can be done on the entire topology or just a portion.

Validation done in ArcMap can be undone, at least until you end the editing session.

Validation done in ArcCatalog **cannot** be undone. This could be a problem if the cluster tolerance was set too high.



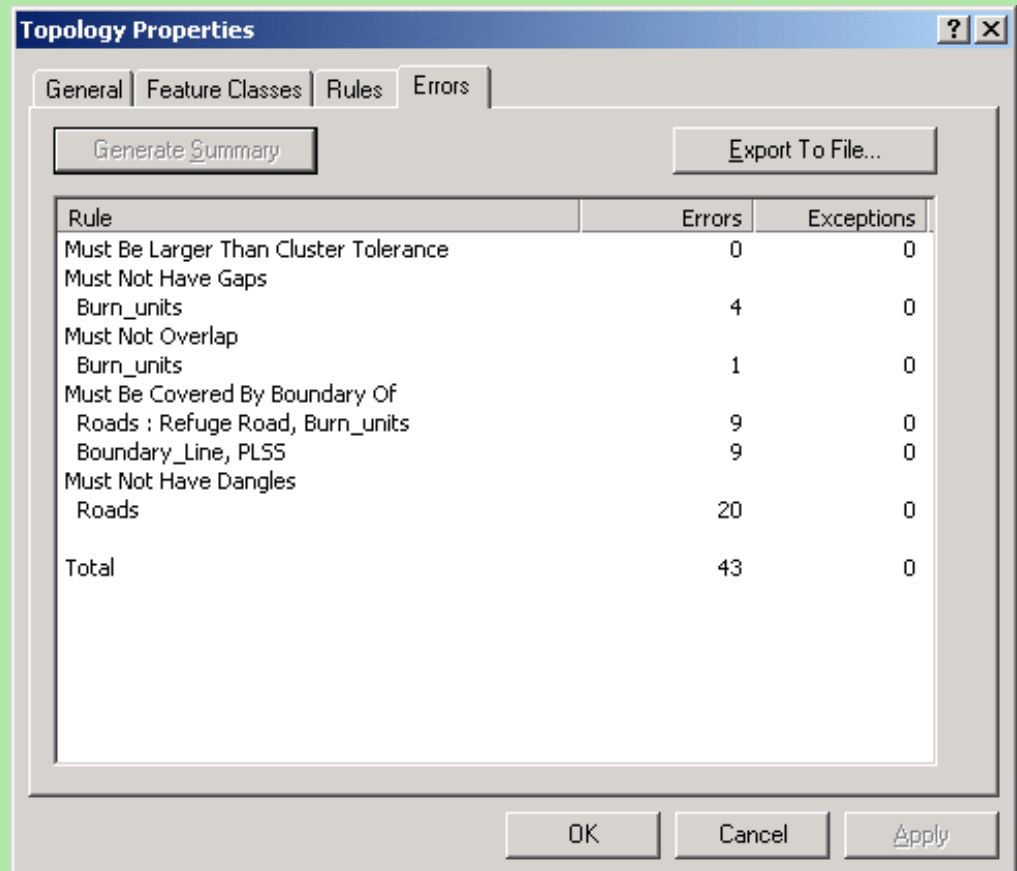
# Working with Geodatabase Topology

## Validating Topology

### Validating Topology - Validation Error Summary

To view a list of the errors and the rules that were validated, open the properties for the Topology, select Errors, and then click on Generate Summary.

ArcGIS also creates a file named Validate.txt with information on which features were adjusted.



Rule	Errors	Exceptions
Must Be Larger Than Cluster Tolerance	0	0
Must Not Have Gaps Burn_units	4	0
Must Not Overlap Burn_units	1	0
Must Be Covered By Boundary Of Roads : Refuge Road, Burn_units	9	0
Boundary_Line, PLSS	9	0
Must Not Have Dangles Roads	20	0
<b>Total</b>	<b>43</b>	<b>0</b>

# Working with Geodatabase Topology

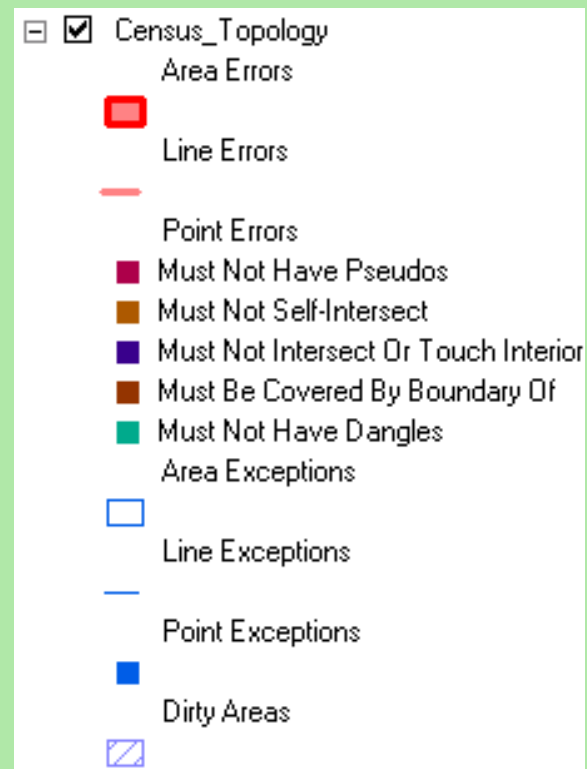
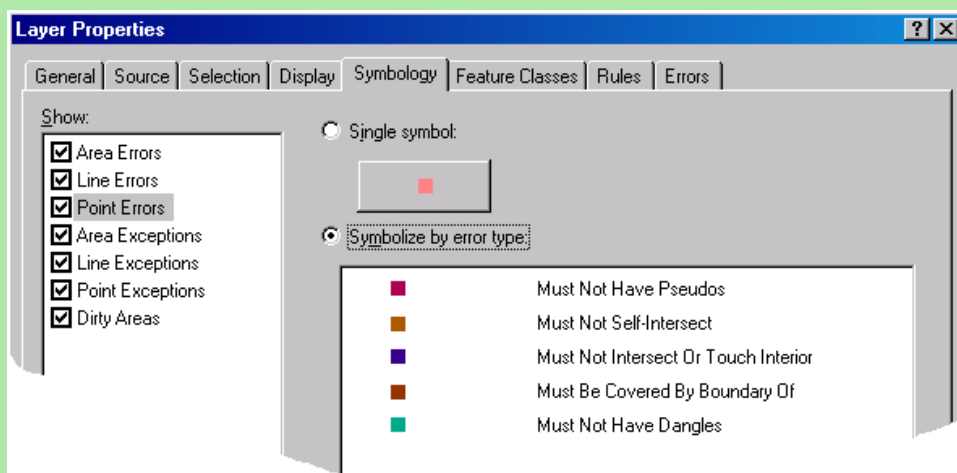
## Validating Topology

### Validating Topology - Managing Topology Errors

During validation, **error** features are created. These are point, line, or area features depending on the type of error, and can be displayed to help you find and fix errors.

Error features cannot be deleted, unless you fix the error or mark it as an exception.

Symbology can be set for error features, including different symbols for different types of errors.



# Working with Geodatabase Topology

## Demonstration: Creating and Validating Topology

**New Topology**

This wizard will help you build a new topology.

A topology allows you to model the integrated behavior of different data types.

Some examples include modeling adjacent land parcels or soil polygons, coastline and country boundaries, a roads network, road and ge...

- Panther\_Refuge.mdb
  - Refuge
    - Boundary\_Line
    - Boundary\_Poly
    - Burn\_units
    - Fuels
    - PLSS
    - Refuge\_Topology
    - Roads
    - soils
    - County
    - Fuel\_codes
    - nthers.mxd
    - results

Context menu for Refuge\_Topology:

- Copy (Ctrl+C)
- Delete
- Rename (F2)
- Analyze
- Create Layer...
- Validate

**New Topology**

Each feature class in a topology must have a rank assigned to it to control how much the features will move when the topology is validated. The higher the rank, the less the features will move. The highest rank is 1.

Enter the number of ranks (1-50):

Specify the rank for a feature class by clicking in the Rank column:

Feature Class	Rank
<input type="checkbox"/> boundary_Line	2
<input type="checkbox"/> ROADS	3
<input checked="" type="checkbox"/> Boundary_Poly	1
<input checked="" type="checkbox"/> Burn_units	1
<input checked="" type="checkbox"/> Fuels	2
<input checked="" type="checkbox"/> PLSS	3
	4
	5

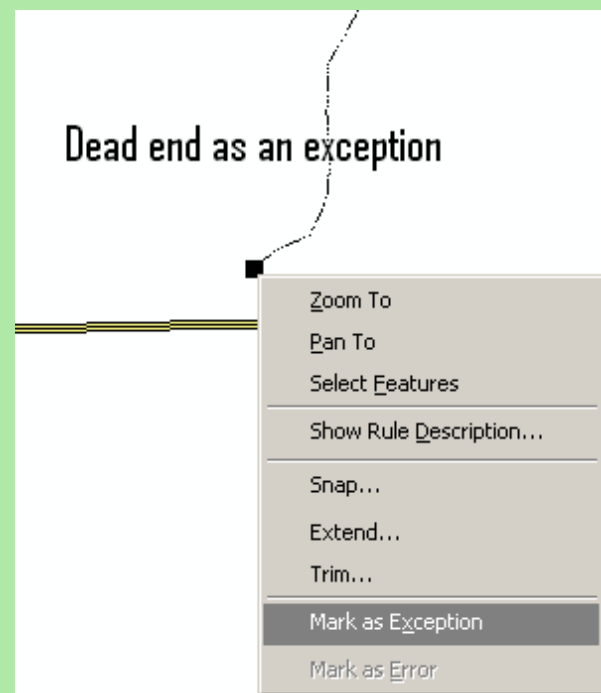
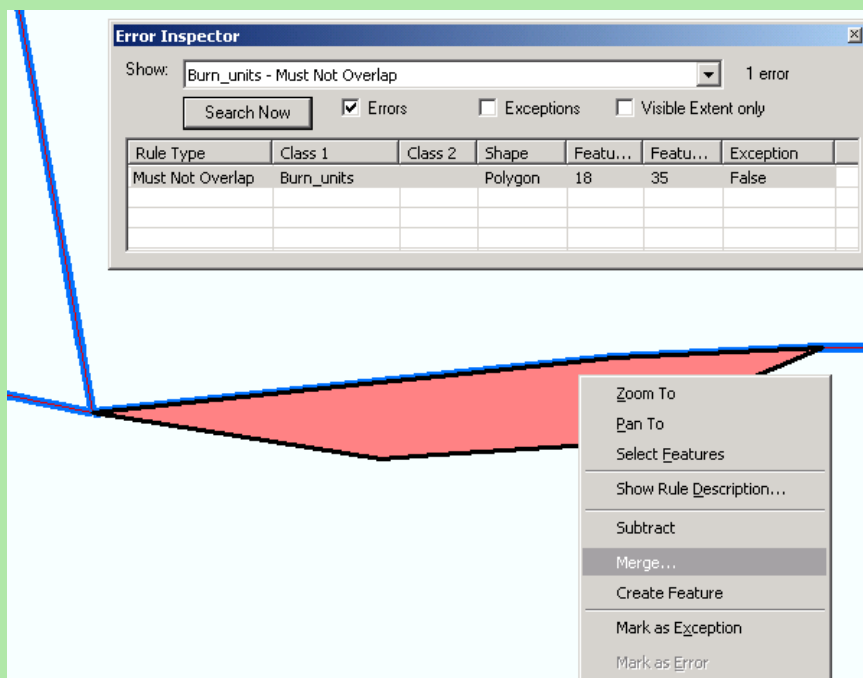
# Working with Geodatabase Topology

## Editing Topology Errors

Geodatabase Topology is used to find spatial errors and then help correct those errors.

Some errors aren't really errors and then we can mark them as exceptions.

For most true errors, there are many topology and edit tools to correct the errors.

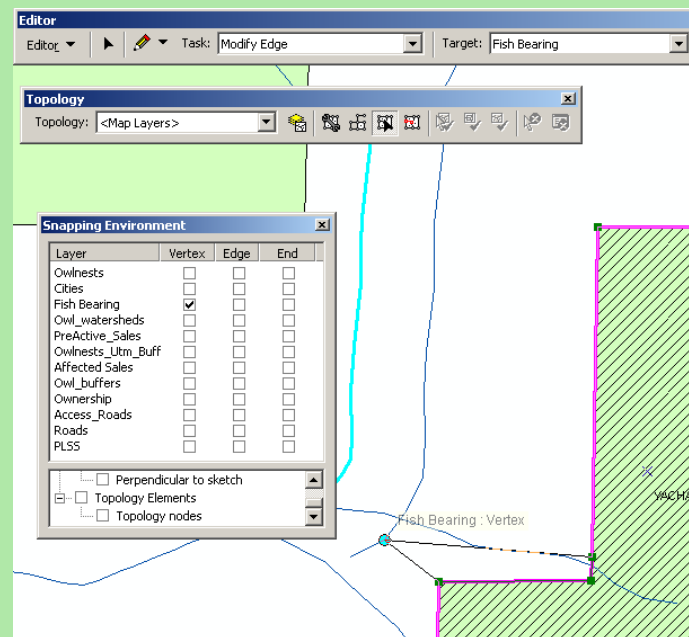
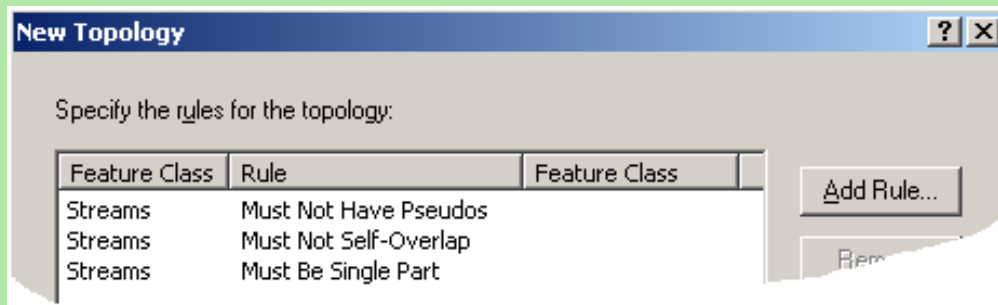


# Working with Geodatabase Topology

## Editing Topology Errors

Usually most efficient to work with logical sets of errors rather than correcting every possible error at once.

After data has been cleaned, or when you have clean data, you can use Map Topology and good editing practice to maintain topology.





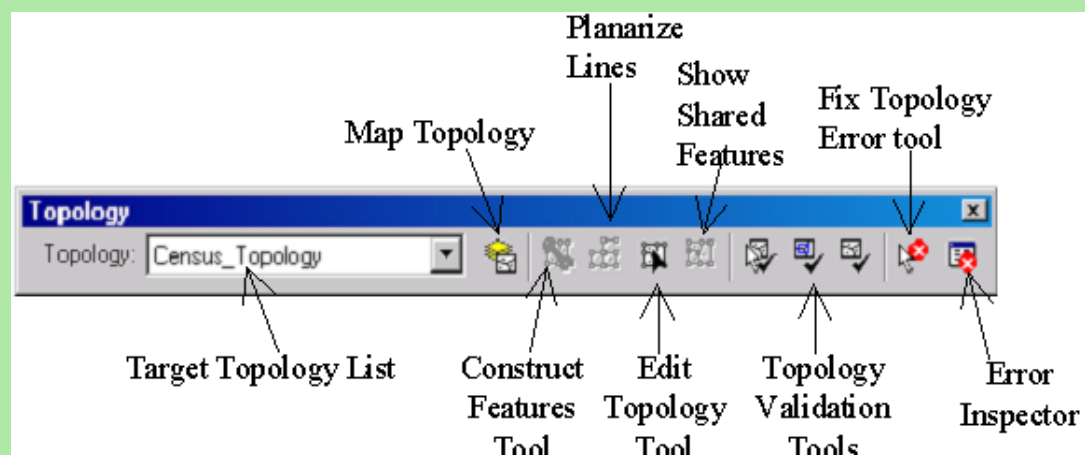
# Working with Geodatabase Topology

## Editing Topology Errors

### The Topology Toolbar

Target Topology List –  
List of Topologies  
in the map.

Map Topology –  
Creates Topology on  
the fly, can be used with  
ArcView for  
feature classes and shapefiles.

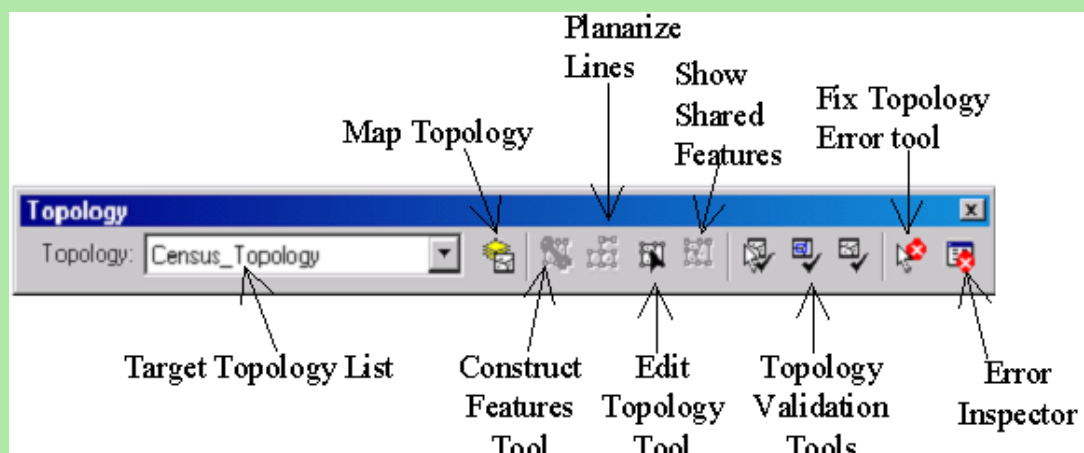


# Working with Geodatabase Topology

## Editing Topology Errors

### The Topology Toolbar

Construct Features Tool – can be used to split lines in the target layer; to create polygons from polylines; to create polylines from Polygons. This tool does not require topology.



Polygons can also be constructed from polylines within a feature dataset. Optionally, you can use a point feature class to assign attributes to the polygon.

Planarize Tool – splits selected line features where they intersect from a selection of features in the same layer. This tool does not require a topology.

These two tools require ArcEditor

# Working with Geodatabase Topology

## Editing Topology Errors

### The Topology Toolbar

**Topology Edit Tool** – used to select and modify coincident edges and nodes.

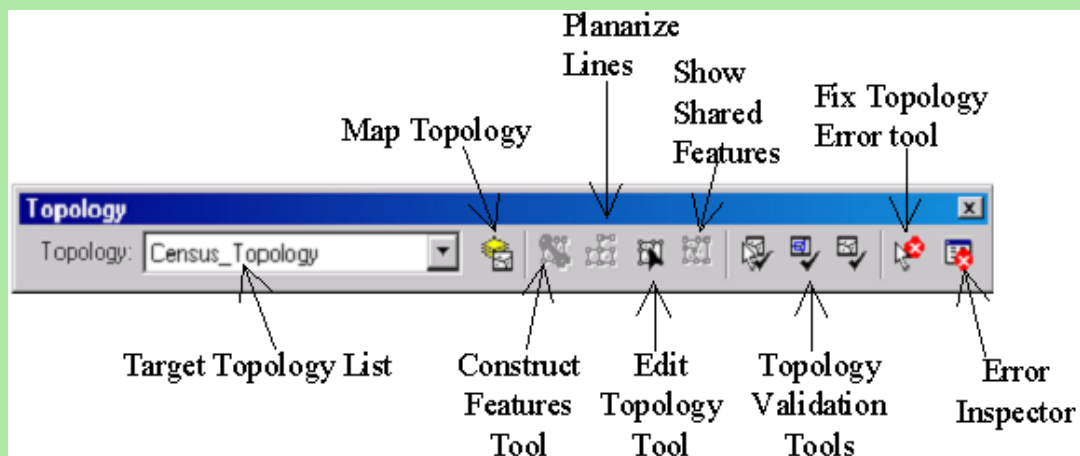
**Show Shared Features** –

Used with the map topology tools to specify which layers are to be modified.

**Topology Validation Tools** – Allows you to validate Geodatabase topology within ArcMap

**Fix Topology Error Tool** – select a GDB topology error and apply fixes.

**Error Inspector** – provides a tabular format for finding and fixing GDB errors.



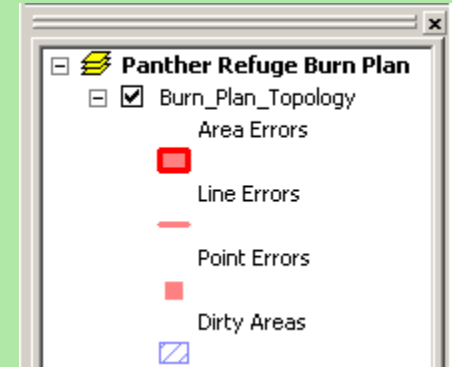
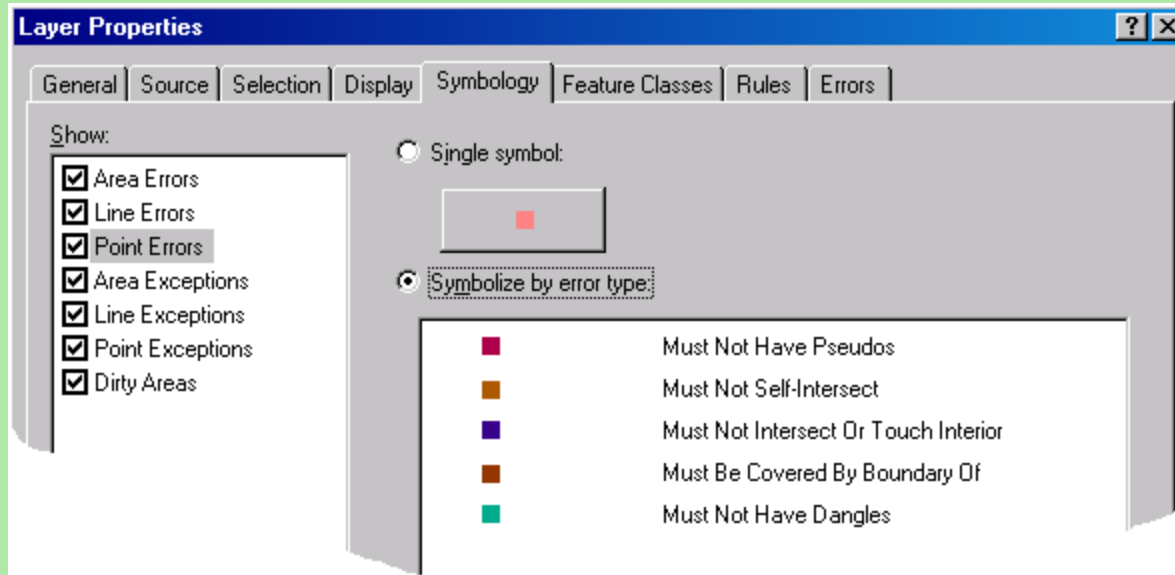
# Working with Geodatabase Topology

## Editing Topology Errors

Editing Geodatabase Topology - Displaying GDB Topology features

Set as property of the Topology Layer.

Can decide which symbols to display, helps with editing.



# Working with Geodatabase Topology

## Editing Topology Errors

### Validating Geodatabase Topology

Can be done in ArcCatalog or ArcMap

In ArcMap you can validate anytime during an edit session.

Validate after each edit or after each set of edits.

All edits create Dirty Areas that should be validated.

### Topology Validation Tools in ArcMap



Validate within specified area

Validate within current extent

Validate entire topology

# Working with Geodatabase Topology

## Editing Topology Errors

### Editing Geodatabase Topology

Fix Topology Error Tool – select a GDB topology error or errors, then right-click to apply standard fixes.

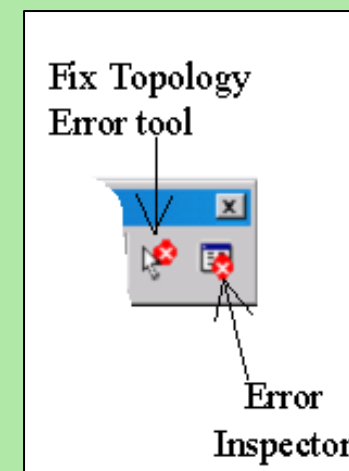
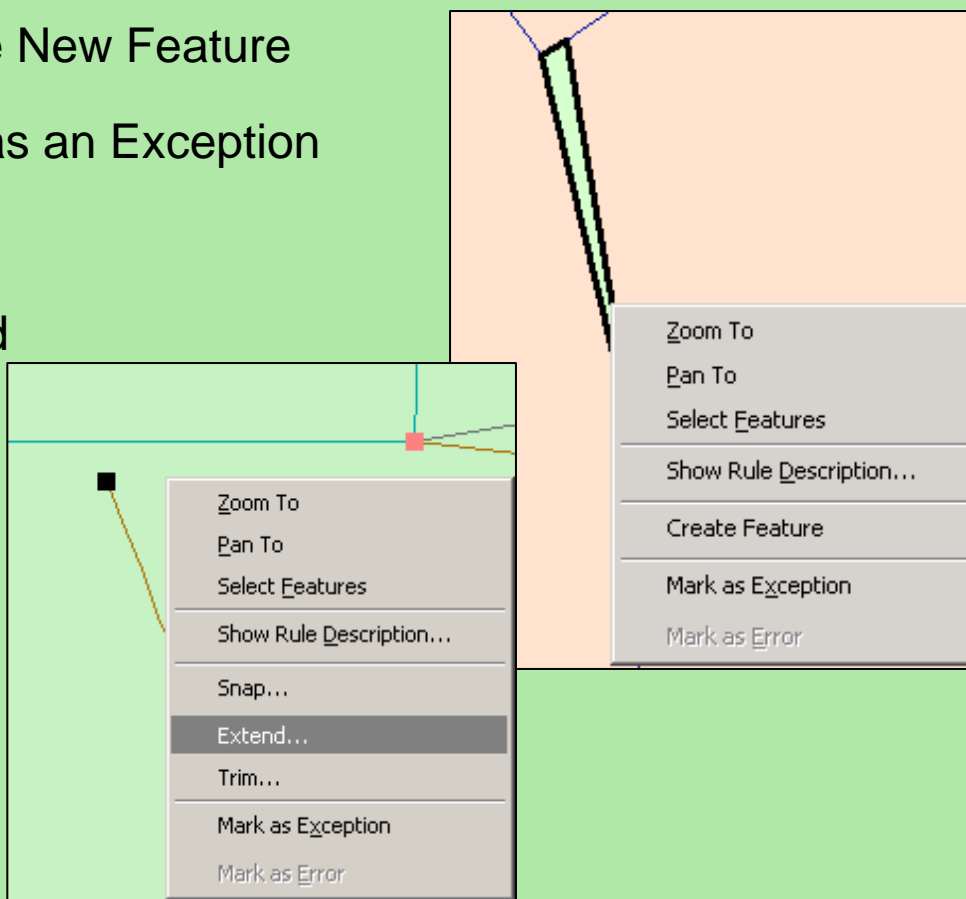
Create New Feature

Mark as an Exception

Snap

Extend

Trim



# Working with Geodatabase Topology

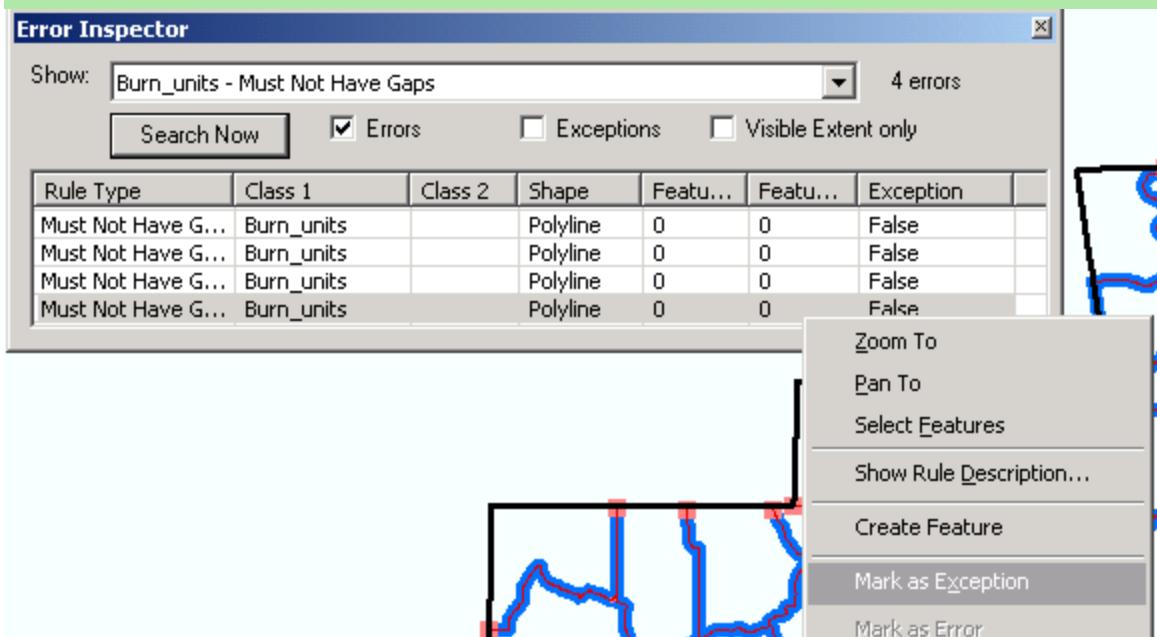
## Editing Topology Errors

### Editing Geodatabase Topology

Error Inspector – provides a tabular format for examining and fixing GDB errors.

Choose the type of errors or the extent to search

Right-clicking an error(s) provides choices to



Rule Type	Class 1	Class 2	Shape	Featu...	Featu...	Exception
Must Not Have Gaps	Burn_units		Polyline	0	0	False
Must Not Have Gaps	Burn_units		Polyline	0	0	False
Must Not Have Gaps	Burn_units		Polyline	0	0	False
Must Not Have Gaps	Burn_units		Polyline	0	0	False

Zoom/Pan to the error

Select Features that are part of the error

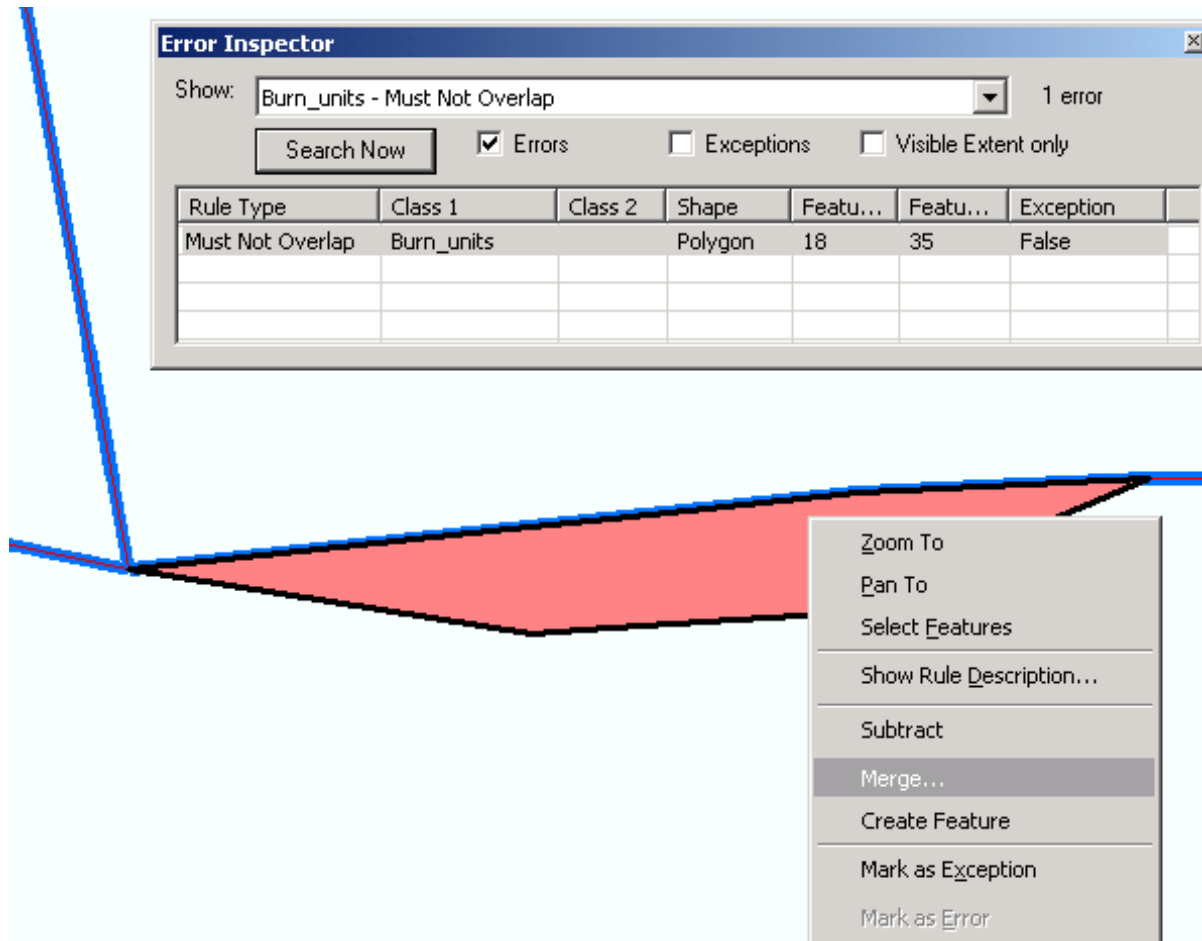
Show the rule description

Snap.../Extend...Trim

Mark as Exception/Error

# Working with Geodatabase Topology

## Demonstration: Editing Topology Errors



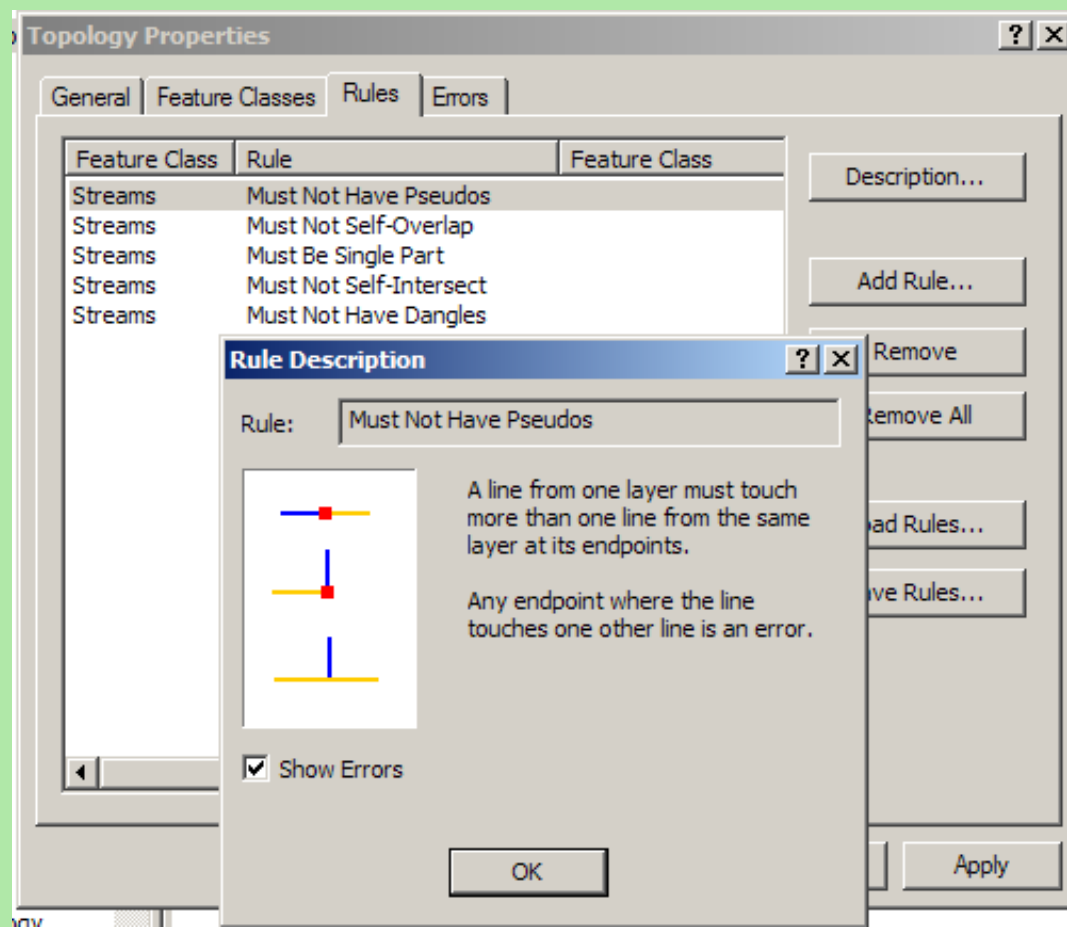


# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Creating Topology for Line Polyline Features

Works same as with other features, just different set of rules to use.



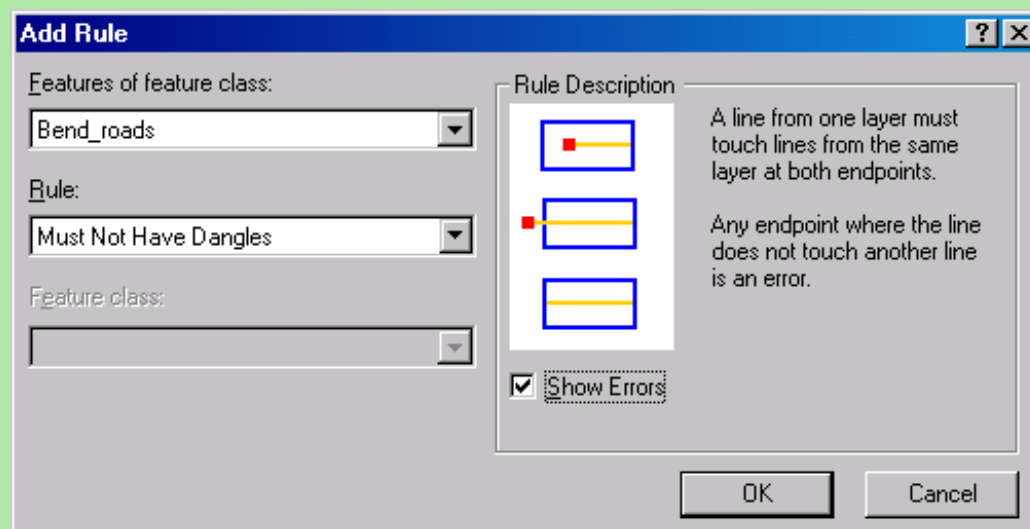
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 15:

Lines in a feature class or subtype **Must Not Have Dangles**. Use this rule when you want lines to connect to each other. One common exception would be cul-de-sacs or dead end roads in a street network.



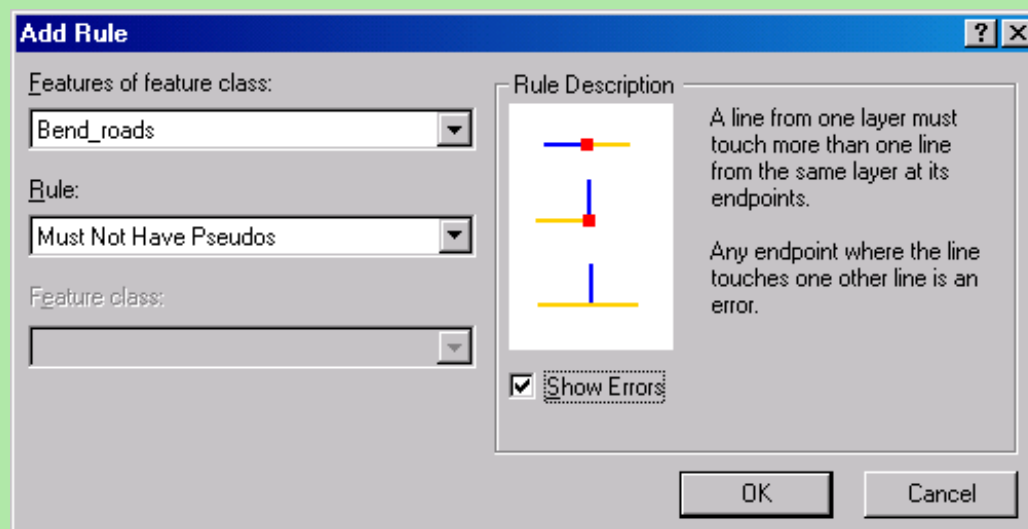
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 16:

Line features **Must Not Have Pseudos**. A pseudo-node is where a node is shared by only two lines. Use this rule to clean up data with inappropriately subdivided lines.



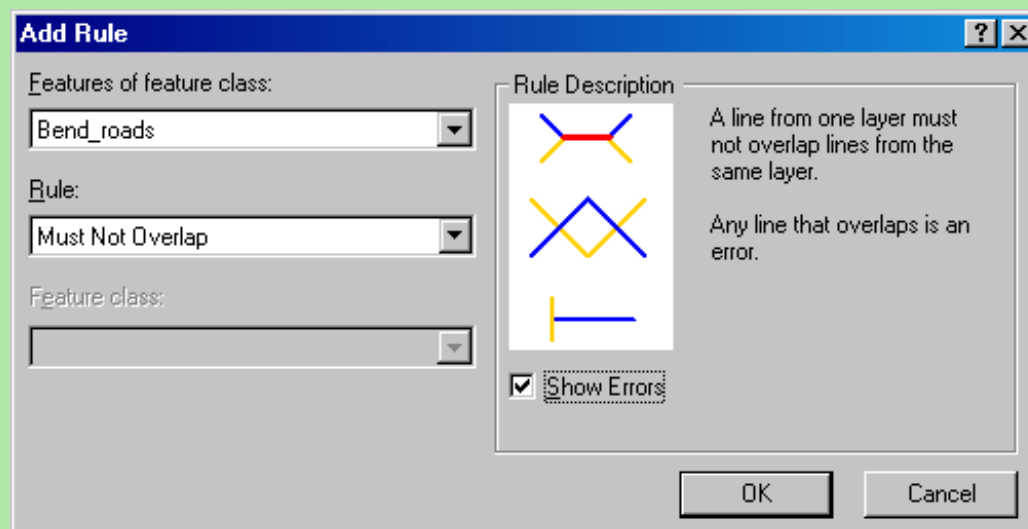
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 17:

Lines in a feature class or subtype **Must Not Overlap** with lines in the **same** layer. Use this with lines that should never occupy the same space with other lines in the same layer.



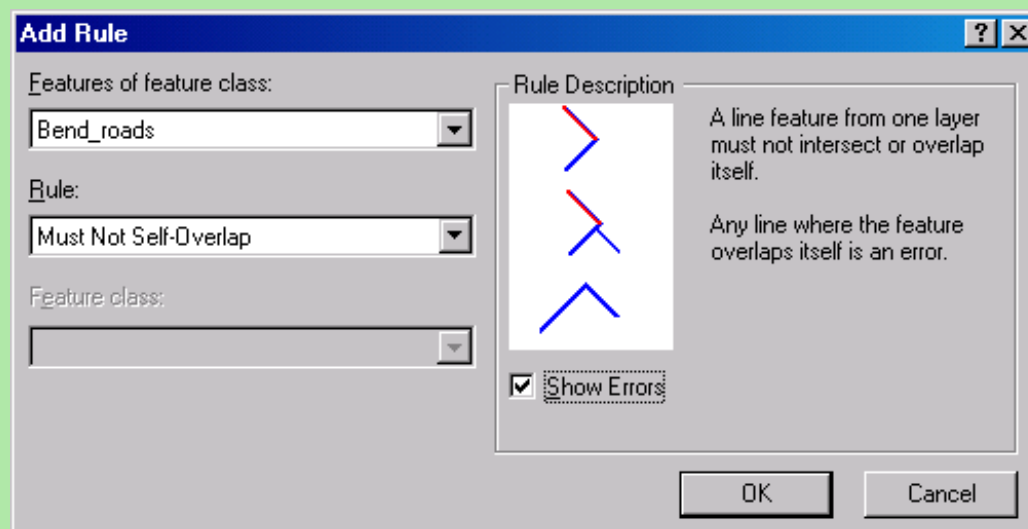
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 18:

Lines in a feature class or subtype **Must Not Self-Overlap** with itself. Use this rule when line segments should never occupy the same space as another segment of the same line.



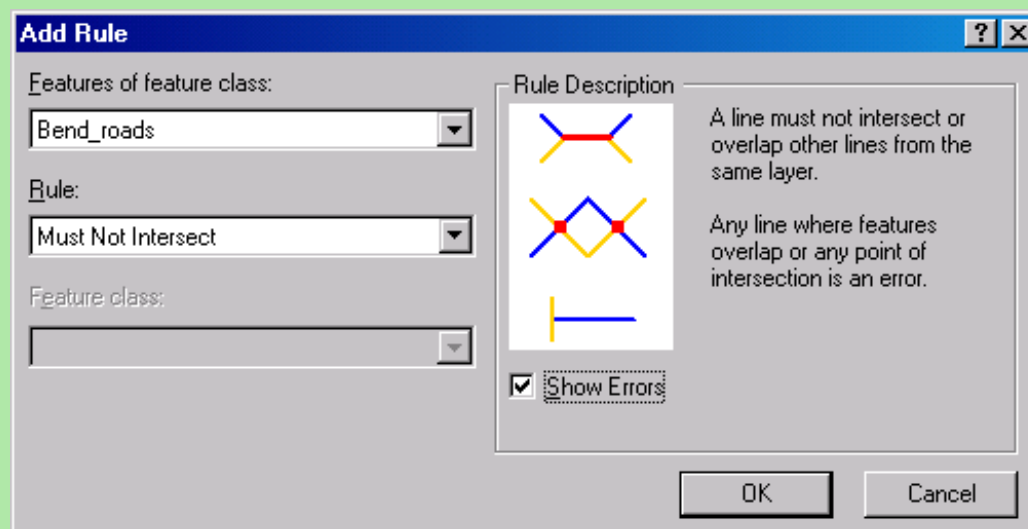
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 19:

Lines **Must Not Intersect** or overlap lines from the **same** layer. Normally, where lines cross, there should be a node to mark the intersection. Some exceptions might be a freeway crossing a local road.



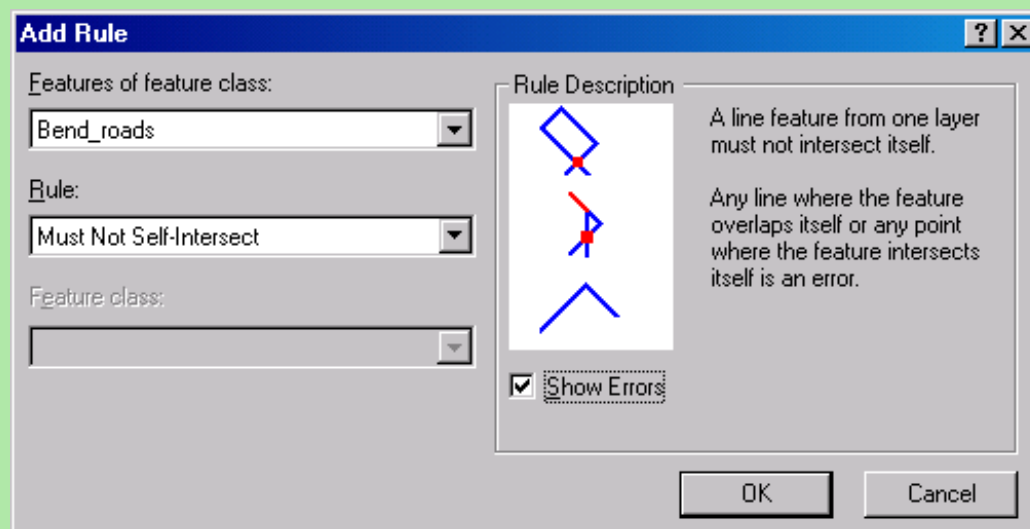
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 20:

Lines **Must Not Self Intersect**.  
Use this where lines must not cross themselves.



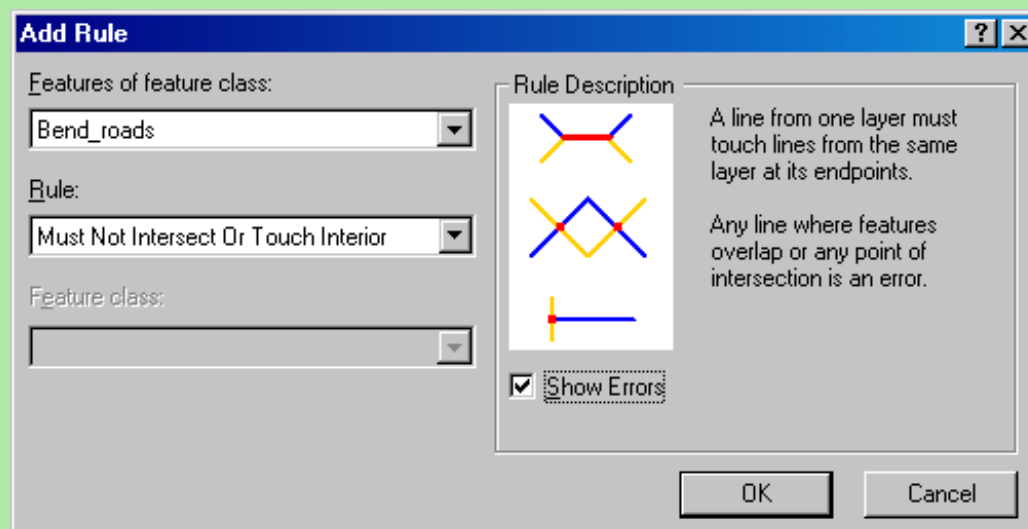
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 21:

Lines **Must Not Intersect Or Touch Interior**. Use this when you want lines to connect to endpoints or nodes and not to edges of other lines.





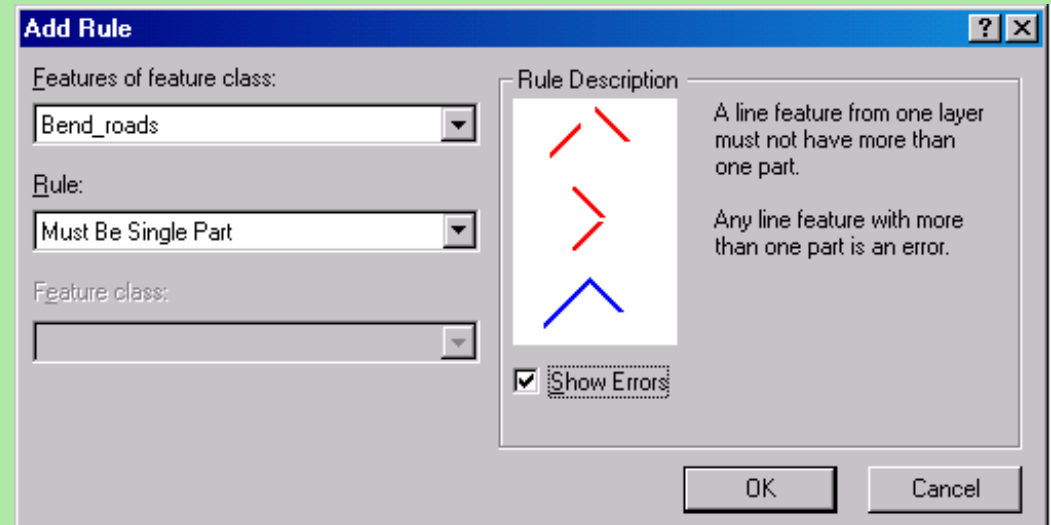
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 22:

Lines **Must Be Single Part**. Use this when you want lines to be composed of a single series of connected segments.



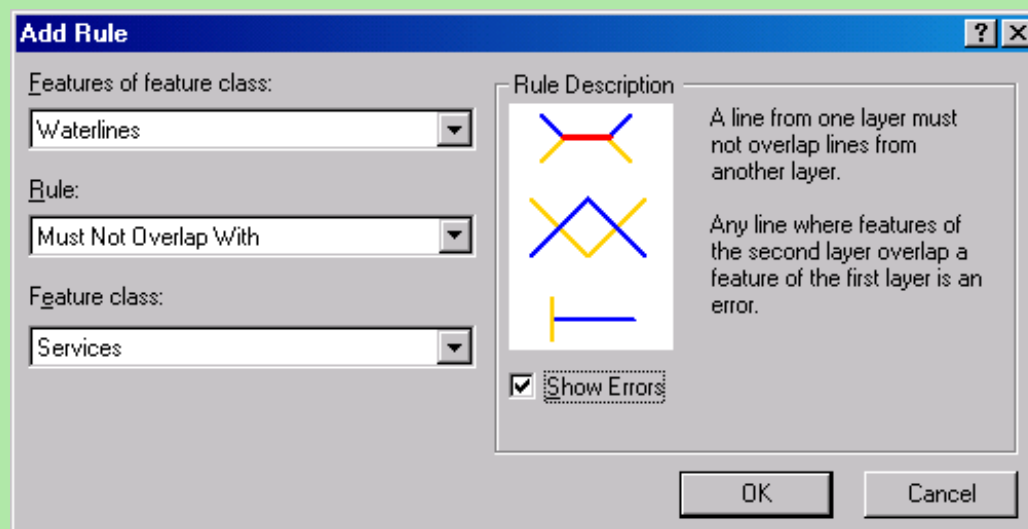
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 23:

Lines in one feature class or subtype **Must Not Overlap With** lines **from other feature classes** or subtypes. Use this when lines in one layer should not occupy the same space as lines in another layer.



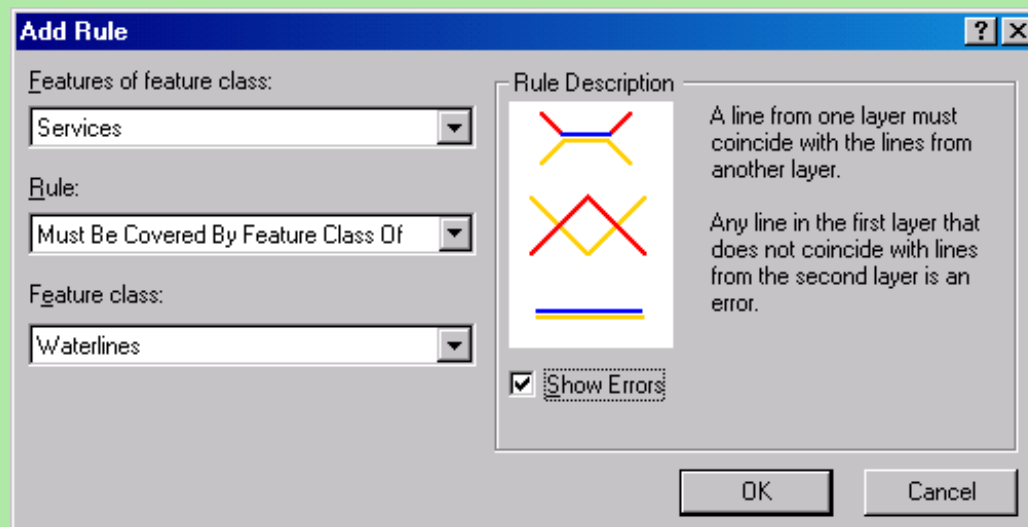
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 24:

Lines in one feature class or subtype **Must Be Covered By Feature Class Of** another line feature class or subtype. Use this when lines from two layers must be coincident. This is the opposite of the rule above.



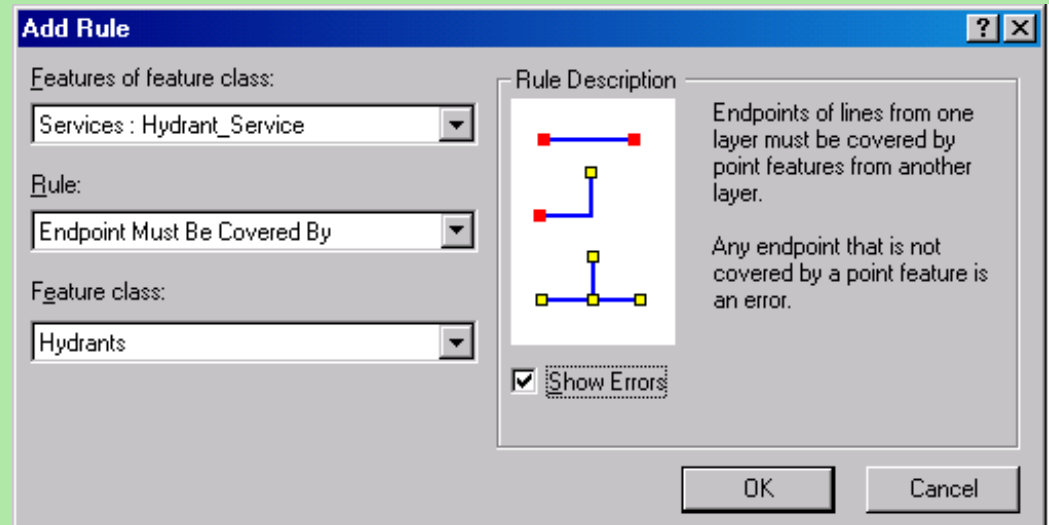
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 25:

Line **Endpoint Must Be Covered** By points in another feature class or subtype. Use this when you want the endpoints of lines to be coincident with point features from another layer.



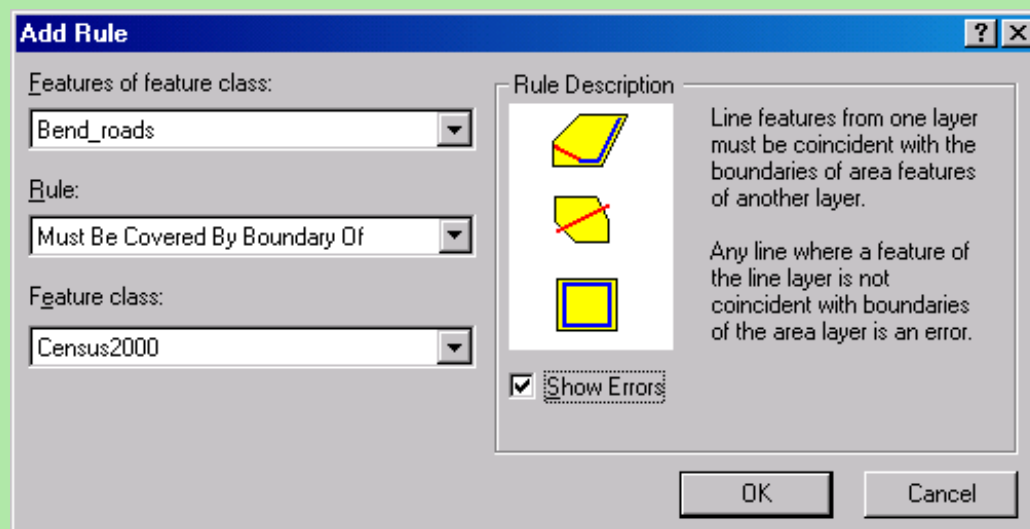
# Working with Geodatabase Topology

## Working with GDB Topology and Polyline Features

### Line Rules

#### Rule 26:

**Line Must Be Covered By Boundary Of** polygon feature class or subtype. Use this when line features need to be coincident with polygon edges.



# Working with Geodatabase Topology

## Demonstration: Working with GDB Topology and Polylines

**Error Inspector**

Show: <Errors from all rules> 8 errors

Search Now  Errors  Exceptions  Visible Extent only

Rule Type	Class 1	Class 2	Shape	Feature 1	Feature 2
Must Not Have Pseudos	Streams		Point	169	
Must Not Have Pseudos	Streams		Point	1	
Must Not Have Pseudos	Streams		Point	9	
Must Be Single Part	Streams		Polyline	38	
Must Be Single Part	Streams		Polyline	157	
Must Be Single Part	Streams		Polyline	157	
Must Be Single Part	Streams		Polyline	161	
Must Be Single Part	Streams		Polyline	190	

Trapper Creek

- Route Measure Editing
- Insert Vertex
- Delete Vertex
- Move...
- Move To...
- Flip
- Trim to Length...
- Delete Sketch Ctrl+Delete
- Finish Sketch F2
- Finish Part
- Properties...

White River

Little Wenatchee River

Lake Wenatchee

Rule Type	Class 1
Must Not Have Pseudos	Streams
Must Not Have Pseudos	Streams

# Working with Geodatabase Topology

## Topology Review

### Creating and Using GDB Topologies

Doesn't need to be always "on" – can create and change as needed

Can work with uncorrected data

Usually more efficient in smaller increments

Use proper cluster tolerance and minimize validating

### Editing GDB Topology

You are not editing the "topology" but using the topology to show errors in the underlying features. What you are really editing are the features and you can use whatever editing tool works best.

Use "Map Topology" edit tools, in conjunction with good editing practices such as snaps and AutoComplete Polygon, to maintain topology.

# Working with Geodatabase Topology

## Geometric Networks

### Geometric Network Basics

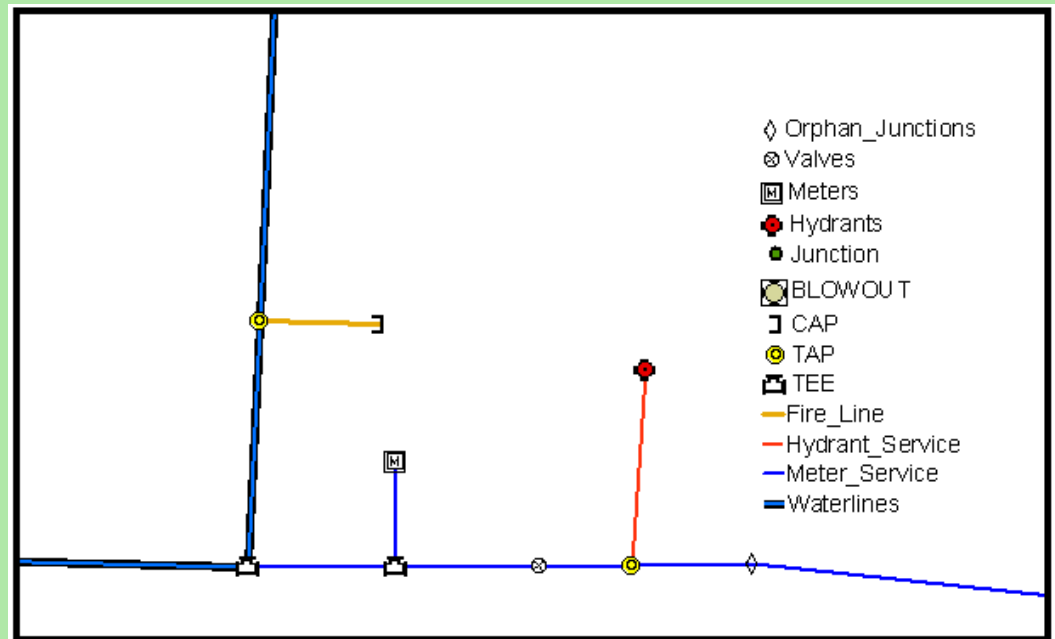
#### Network Types—Geometric Networks

Directed flow, away from sources and towards sinks, with the resources having no travel decisions

Primarily utility or stream networks

Built on coincidence between the features that compose the network

Will verify connectivity of features





# Working with Geodatabase Topology

## Geometric Networks

### Geometric Network Basics

#### Network Types—Topological

Resources make their own travel decisions

Primarily traffic networks

Allows for turns and more restrictions

Not available for ArcGIS 8.3; possibly in a post 9.0 release

# Working with Geodatabase Topology

## Geometric Networks

### Network Features

**Lines** in a feature class become **Edges** in a Logical Network

Edges can be simple or complex

Simple edge cannot have any connection except at endpoints; any new connection to a simple edge divides that underlying line feature into multiple features.

Complex edge can have multiple connections anywhere along the edge, without dividing the underlying line feature

Edges must always have a junction at each end.

# Working with Geodatabase Topology

## Geometric Networks

### Network Features

**Points** in a feature class become **Junctions** in a Logical Network

Orphan Junctions are a special type of junction that are created at the end of line features or where two line features meet whenever a point feature does not already exist at that location

Orphan junctions are stored as a feature class

Orphan Junctions can be left in place, or they can be replaced by point features during editing, or as a result of rules that set default junctions.

# Working with Geodatabase Topology

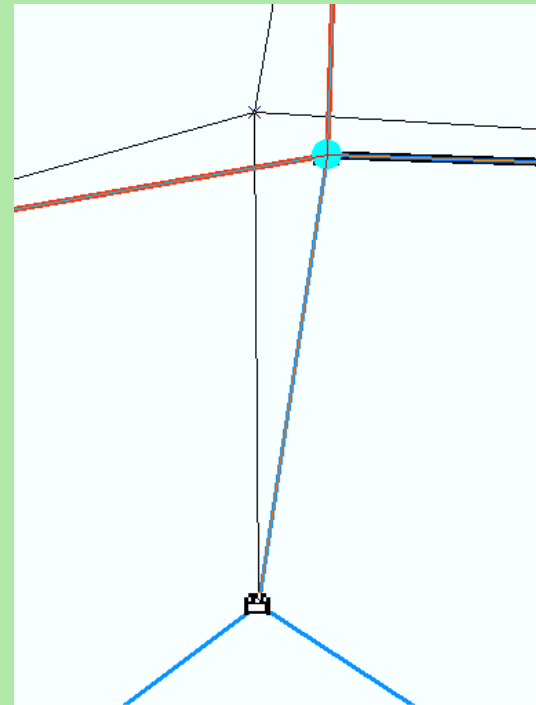
## Geometric Networks

### Network Features

The **Logical Network** is a set of hidden tables that store the connectivity and rules applied to the geometric network

Rules can include edge to edge and edge to junction connectivity rules as well as weights that impede flow, and rules that set sources and sinks.

Once a network is created, if you move one feature, all the connected features move.



# Working with Geodatabase Topology

## Geometric Networks

### Creating a Geometric network

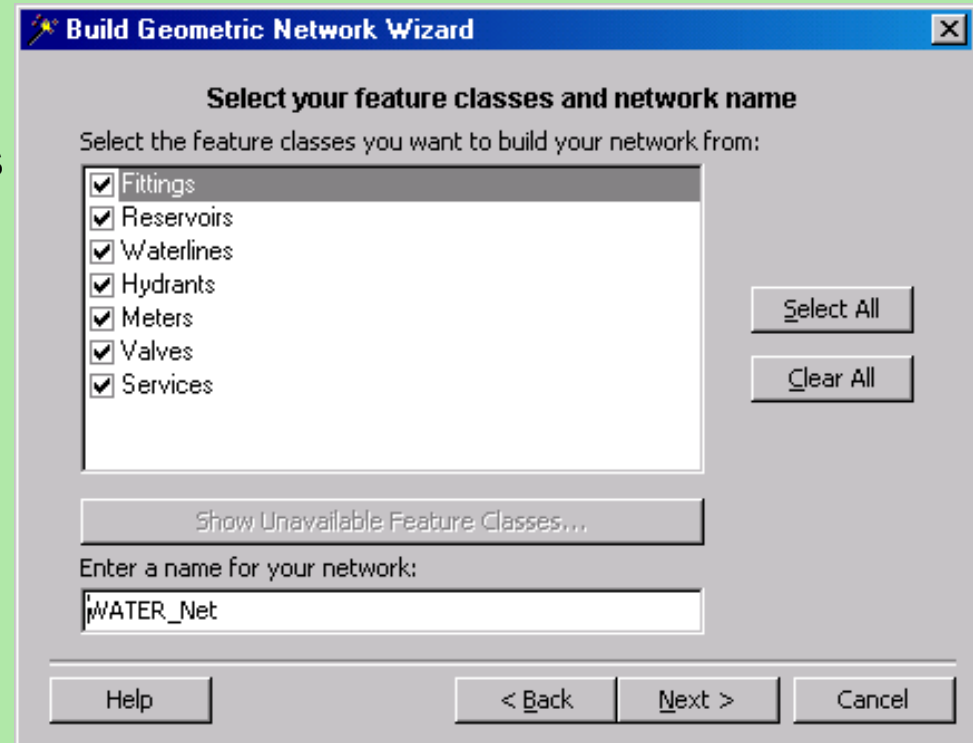
Created within a Feature Dataset using ArcCatalog or ArcToolbox.

Can be built from existing feature classes or features classes can be added later

Best to build from existing feature classes and to make any changes to attribute tables in advance.

If you need to load data, some cases may require that you delete the network first.

Requires ArcEditor/ArcInfo



# Working with Geodatabase Topology

## Geometric Networks

### Creating a Geometric network

All Feature classes that are part of the network must be within that same Feature Dataset

Feature classes must have the same spatial reference

Features classes can only be in one network or topology at a time

Multiple networks can be created in one feature dataset

Only line and point feature classes can participate in a network

Specify which line feature classes will contain complex edges.

Snap tolerance can be set and user can specify which features can be moved.

Not as flexible as Topology but a good tool to set and check connections between line and point feature classes.

# Working with Geodatabase Topology

## Geometric Networks

### Creating a Geometric network

Weights can be assigned to features in the network

Must be assigned when the network is built, cannot be done after a network is built

### Weight types

Integer—could be numeric value or a code

Single/Double—numeric, such as length or resistance

Bitgate—used to restrict certain activities, such as a bus-only lane.

Based on a attribute such as length or calculated from other fields

If you need to calculate a weight, do that before creating the network

# Working with Geodatabase Topology

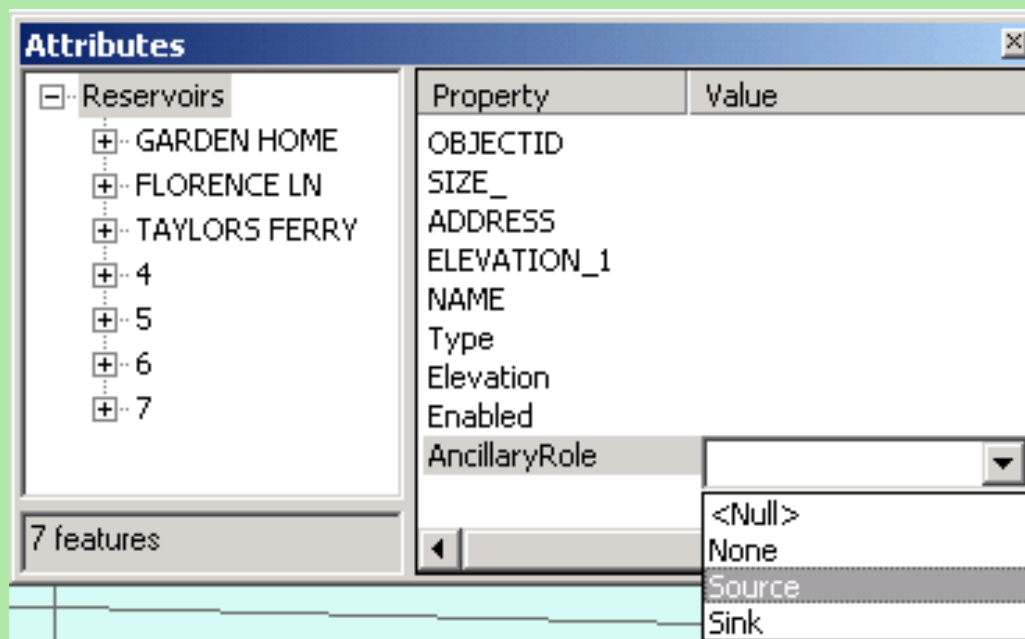
## Geometric Networks

### Creating a Geometric network

Sources & Sinks can be set

Use this if you need to determine flow

Creates a field named AncillaryRole. By default the value is set to “None” and then the user can change the value to Source or Sink as needed





# Working with Geodatabase Topology

## Geometric Networks

### Connectivity Rules

Establishes how edges and junctions interact

Connectivity is created in ArcCatalog after the network is built, based on the snap tolerance, but without rules in place.

User adds rules which can include the number of connections between edges and junctions and the default connection between types of edges.

Connectivity rules are set between subtypes. If subtypes are not part of the feature class, ArcGIS will create subtypes that include all features in the feature class.

By default, all features are valid; but once one rule is set, all rules have to be set because connections are only valid if there is a rule defining that connection

# Working with Geodatabase Topology

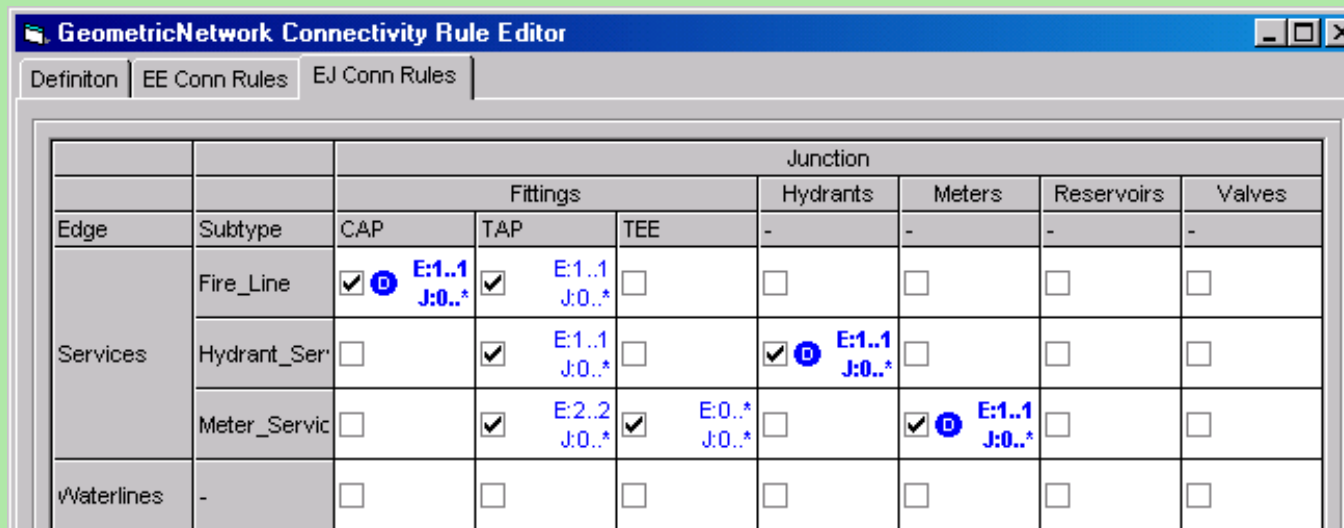
## Geometric Networks

### Connectivity Rules

Can be tedious but once done, provides tools that dramatically speed up editing and improve data integrity

Best to set up a matrix to chart all possible combinations of connections

Setting rules for one combination of connections might also set rules for related connections



The screenshot shows the 'GeometricNetwork Connectivity Rule Editor' window. It has three tabs: 'Definition', 'EE Conn Rules', and 'EJ Conn Rules'. The 'EJ Conn Rules' tab is active, displaying a connectivity matrix. The matrix has columns for 'Edge' and 'Subtype', and a 'Junction' section with sub-columns for 'Fittings' (CAP, TAP, TEE), 'Hydrants', 'Meters', 'Reservoirs', and 'Valves'. The 'Services' edge type has three subtypes: 'Fire\_Line', 'Hydrant\_Serv', and 'Meter\_Serv'. The 'Waterlines' edge type has a '-' subtype. Checkmarks and blue circular icons with 'E' and 'J' codes are present in several cells, indicating specific connectivity rules.

Edge	Subtype	Junction						
		Fittings			Hydrants	Meters	Reservoirs	Valves
		CAP	TAP	TEE	-	-	-	-
Services	Fire_Line	<input checked="" type="checkbox"/> E:1..1 J:0..*	<input checked="" type="checkbox"/> E:1..1 J:0..*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Hydrant_Serv	<input type="checkbox"/>	<input checked="" type="checkbox"/> E:1..1 J:0..*	<input type="checkbox"/>	<input checked="" type="checkbox"/> E:1..1 J:0..*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Meter_Serv	<input type="checkbox"/>	<input checked="" type="checkbox"/> E:2..2 J:0..*	<input checked="" type="checkbox"/> E:0..* J:0..*	<input type="checkbox"/>	<input checked="" type="checkbox"/> E:1..1 J:0..*	<input type="checkbox"/>	<input type="checkbox"/>
Waterlines	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# Working with Geodatabase Topology

## Geometric Networks

### Connectivity Rules: Edge-Edge rules

Sets valid junctions between edges

Edge-edge rules are really edge-junction-edge rules because a junction is needed to connect two edges.

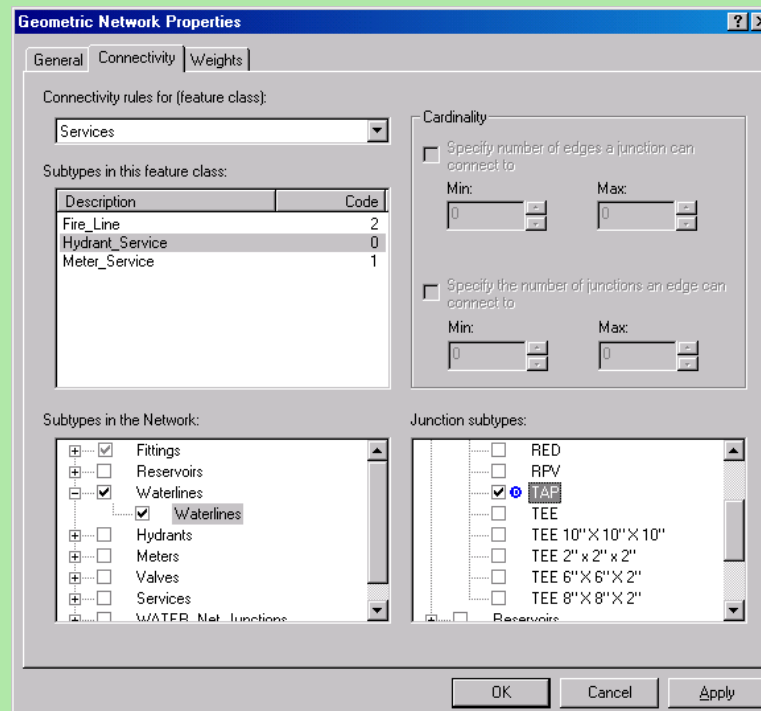
Each edge-edge rule must have a default junction for the junction between the edges.

Setting Edge-Edge rules—open Properties>Connectivity for the network

Select an edge feature class and edge subtype

Then select the edge subtype to connect to

Then the junction used for that connection.



# Working with Geodatabase Topology

## Geometric Networks

Connectivity Rules: Edge-Junction rules

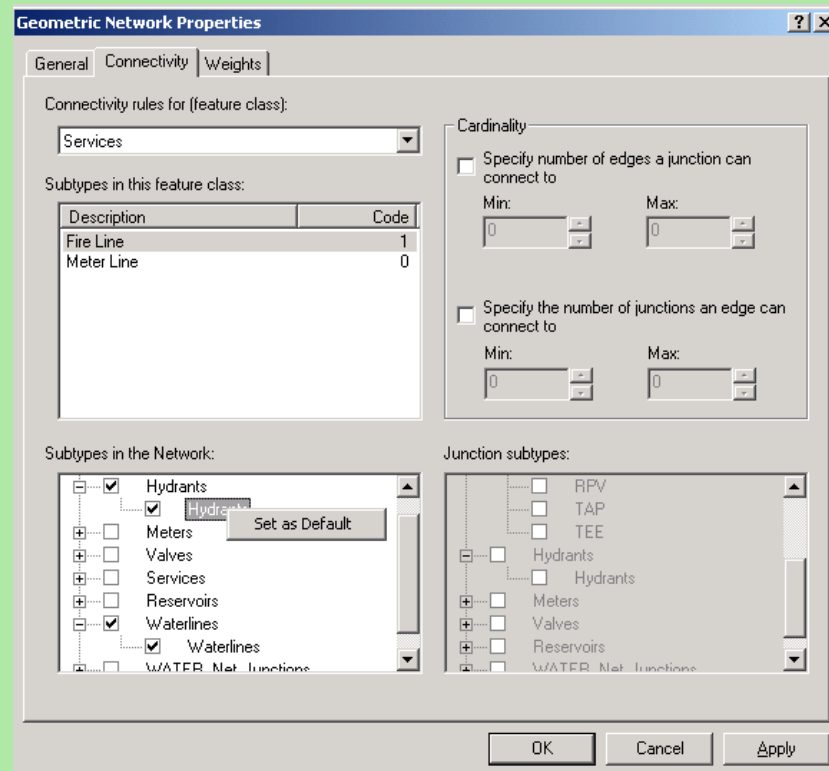
Sets rule for how Junction subtypes intersect with Edge subtypes.

Some Edge-Junction rules might have been set as part of an Edge-Edge rule

Define cardinality—how many edges can connect to a junction

Using cardinality and defaults, it is possible to create edges with specific junctions at each end. When you add a new edge to a network, both junctions are automatically added and snapped.

Defining rules with default junctions will automatically replace orphan junctions where the rule applies.



# Working with Geodatabase Topology

## Geometric Networks

### Editing Networks

Because of connectivity, editing a network requires a separate set of tools.

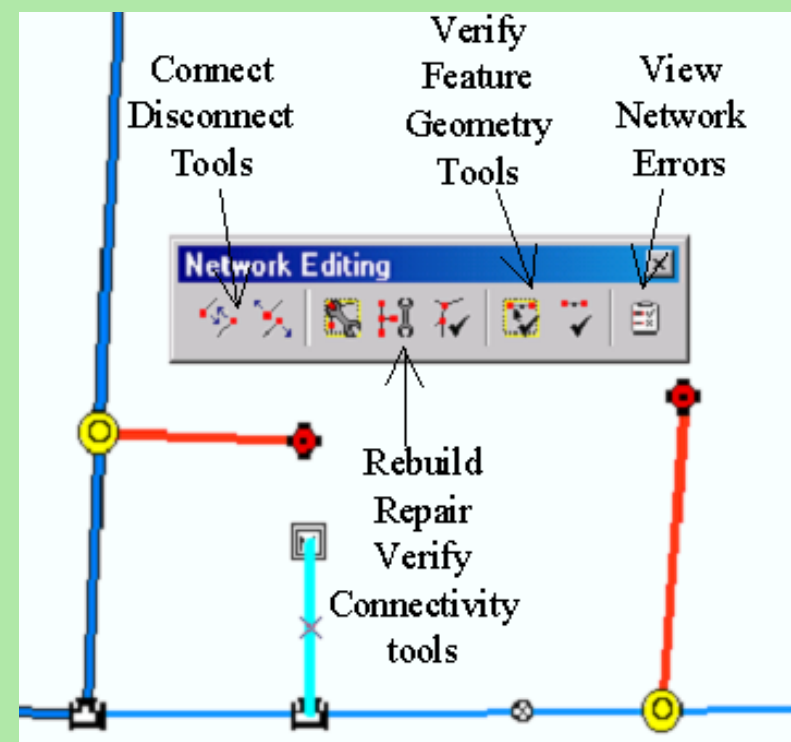
Connect and disconnect features for editing

Rebuild, Repair or Verify connectivity as tools or commands

Verify Feature Geometry tools and commands

View Network errors.

Regular edit rules and tools also apply.



# Working with Geodatabase Topology

## Geometric Networks

### Network Analysis

ArcGIS provides network analysis tools based on tracing connectivity through a network

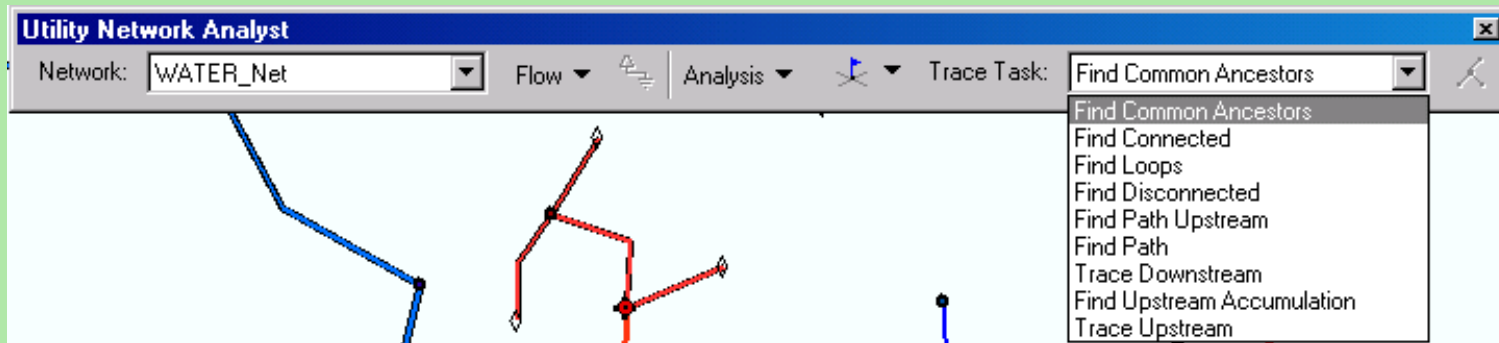
Accessed through the Utility Network Analyst Toolbar

9 trace solvers available, custom traces could be written through ArcObjects

Analysis can be done in ArcView, does not require ArcEditor/ArcInfo

Some network analysis requires knowing the flow—upstream to downstream, high pressure to low pressure.

Flow can be set in networks from sources and sinks and can use weights



# Working with Geodatabase Topology

## Geometric Networks

### Network Analysis

#### Performing Traces

Set Trace Options under the Analysis drop-down

Set Options for Weights, Filters, Results

Set flags and barriers

Select Trace Task

Click on Solve button

