ArcGIS® 9
Building Geodatabases Tutorial
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IN THIS TUTORIAL YOU WILL LEARN

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It is easy to create a Geodatabase and add behavior to it, and it requires no programming when you use the data management tools in ArcCatalog—the application for browsing, storing, organizing, and distributing data. When querying and editing the Geodatabase in ArcMap—the application for editing, analyzing, and creating maps from your data—you can easily take advantage of the data and behavior in your Geodatabase without any customization.

This tutorial lets you explore the capabilities of the Geodatabase using an ArcEditor or ArcInfo licensed seat of ArcCatalog and ArcMap. This tutorial includes nine exercises. Each exercise takes between 10 and 20 minutes to complete.

In the first eight exercises of this tutorial, you will use ArcCatalog to create a Geodatabase that models a water utility network. You will add behavior to the Geodatabase by creating subtypes, validation rules, relationships, and a geometric network. You can use ArcMap to take advantage of the behavior by editing some of the existing features in the Geodatabase and adding some additional features.

The study area for the exercises is a portion of a hypothetical city. A Geodatabase that contains most of the data, a Shapefile representing water laterals, and a Microsoft Excel spreadsheet representing parcel owner data are provided with the software. You will import the Shapefile and spreadsheet into the Geodatabase, and then modify its properties to give it behavior.

The datasets for the exercises were created by ESRI using a database schema similar to that of the city of Montgomery, Alabama. The data is fictitious and has nothing to do with the actual city of Montgomery. This information may be updated, corrected, or otherwise modified without notification.
Exercise 1: Organizing your data in ArcCatalog

Before you begin the tutorial, you must find and organize the data that you will need. This can be done using ArcCatalog.

**Connecting to data**

In ArcCatalog, data is accessed through folder connections. When you look in a folder connection, you can quickly see the folders and data sources it contains. You will now begin organizing your data by creating a folder connection to it.

1. Start ArcCatalog by either double-clicking a shortcut installed on your desktop or using the Programs list in your Start menu.

2. Click the Connect To Folder button and navigate to the BuildingaGeodatabase folder on the local drive where you installed the tutorial data. The default installation path is C:\arcgis\ArcTutor\BuildingaGeodatabase. Click OK to establish a folder connection.

Your new folder connection—C:\arcgis\ArcTutor\BuildingaGeodatabase—is now listed in the Catalog tree. You will now be able to access all the data needed for the tutorial through that connection.
Exploring your data

Before you begin modifying the Geodatabase, explore the datasets provided for the tutorial.

1. Click the plus sign next to the C:\arcgis\ArcTutor\BuildingaGeodatabase folder connection to see the datasets contained in the folder. Click the Preview tab and

2. Click the laterals coverage to see its geometry.

3. Click the plus sign next to the Montgomery Geodatabase and double-click each feature dataset to see the feature classes and relationship classes it contains. Click each feature class to preview its geometry.

4. Expand Owners.xlsx then expand the worksheet list and click on Owners$(If you cannot find the Owner.xlsx then choose the Owner.xls). Notice how the Preview type automatically changes to Table and displays the table's records. This table contains the owner information for the Parcels feature class in the Montgomery Geodatabase. In the next part of this exercise, you will import this table into the Geodatabase and create relationships between the parcels and their owners.

You will perform most of the tasks for modifying the Montgomery Geodatabase schema with ArcCatalog. Later, you will use ArcMap to create annotation and edit the Geodatabase.

Now that you have found and organized your data in ArcCatalog, you are ready to start the first task in the tutorial—importing data into the Geodatabase.
Exercise 2: Importing data into your Geodatabase

Before you can start adding behavior to your data, you must get it into a Geodatabase. You will import two datasets into the Montgomery Geodatabase—laterals and owner.dat. The laterals coverage contains water laterals for the Montgomery water dataset, and the owner.dat INFO table contains owner information for the parcel features already in the Geodatabase.

Importing the coverage

1. In ArcCatalog, right-click the Water feature dataset in the Montgomery Geodatabase, point to Import, and click Feature Class (multiple).

You will use the Import Feature Class tool to import the arcs in the laterals coverage into the Water feature dataset. This tool is used to specify your input coverage, input feature class, and output feature class. Because you opened this tool by right clicking a feature dataset, the output Geodatabase, Montgomery, and feature dataset, Water, are already filled in for you.

There are several ways to set the input and output datasets. You can also drag a dataset or datasets from the ArcCatalog tree or Contents tab and drop them on the text box. Alternatively, you can click the Browse button to open the ArcCatalog mini-browser and navigate to your dataset or type the full pathname to the dataset in the text box.

2. Click the Browse button, navigate to the laterals Shapefile, and click Add.

3. Click OK.

A message appears showing the progress of your data import operation. When the tool is finished, the message indicates
that all the features have been imported. The laterals Shapefile is now in the Water feature dataset.

4. Click Close.

5. In the ArcCatalog tree, navigate to and click the laterals feature class. Press the F2 key, and type “Laterals” to rename the feature class.

6. Click the Preview tab to see the features.

7. Right-click Laterals and click Properties.

The names of feature classes and tables in a Geodatabase are the same as the names of the physical tables in the relational database management system (RDBMS) in which they are stored. When you store data in an RDBMS, the names for tables and fields are often unclear, and you need a detailed data dictionary to keep track of what data each table stores and what each field in those tables represents.

The Geodatabase lets you create _aliases_ for _fields_, tables, and feature classes. An alias is an alternative name to refer to those items. Unlike true names, aliases can contain special characters, such as spaces, because they do not have to adhere to the database’s limitations. When you use data with aliases in ArcMap, the alias name is automatically used for feature
classes, tables, and fields. However, in ArcCatalog these items are always represented by their true names.

You will now create aliases for your new feature class and its fields.

8. Click the General tab.

9. Type “Water laterals” for the alias for this feature class.

10. Click the Fields tab. Click the OBJECTID field and type “Feature identifier” for its alias.

11. Repeat step 10 for the following fields:
12. Click OK.

<table>
<thead>
<tr>
<th>Field</th>
<th>Alias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td>Geometry field</td>
</tr>
<tr>
<td>DEPTH_BURI</td>
<td>Depth buried</td>
</tr>
<tr>
<td>RECORDED_L</td>
<td>Recorded length</td>
</tr>
<tr>
<td>FACILITY_I</td>
<td>Facility identifier</td>
</tr>
<tr>
<td>DATE_INSTA</td>
<td>Installation date</td>
</tr>
<tr>
<td>TYPECODE</td>
<td>Subtype code</td>
</tr>
</tbody>
</table>

Now that you have imported the Laterals feature class into the Geodatabase and added some aliases, you are ready to import the owner.dat INFO table.

Importing the Excel Spreadsheets

The owner Excel spreadsheet contains owner information for the parcels in the Parcels feature class in the Montgomery Geodatabase. To be able to create relationships between the parcels and their owners, the owner information must be imported into the Montgomery Geodatabase. You will use the Table (single) import tool to import the owner Excel spreadsheet into the Montgomery Geodatabase. You will then create aliases for the table.

1. Right-click the Montgomery Geodatabase, point to Import, then click Table (single).

2. Expand Owners.xlsx and drag and drop the Owners worksheet from the Catalog tree to the Input Table box.
3. Type “Owners” in the Output Table text box, then click OK. A message informs you of the progress of the operation. When it finishes, click Close.

4. In the ArcCatalog tree, click the Owners table in the Montgomery Geodatabase. Click the Preview tab to see its rows.

5. Right-click the Owners table and click Properties to see the table’s properties.

6. Type “Parcel owners” for the alias for this table.

7. Click the Fields tab and type the following field aliases:

8. Click OK.

<table>
<thead>
<tr>
<th>Field</th>
<th>Alias</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBJECTID</td>
<td>Object identifier</td>
</tr>
<tr>
<td>OWNER_NAME</td>
<td>Owner name</td>
</tr>
<tr>
<td>OWNER_PERCENT</td>
<td>Percentage ownership</td>
</tr>
<tr>
<td>DEED_DATE</td>
<td>Date of deed</td>
</tr>
</tbody>
</table>

The data in the laterals coverage and owners.dat INFO table is now in the Montgomery Geodatabase. Now you can take advantage of the Geodatabase by applying behavior to your data. You will begin this task by creating subtypes and attribute domains.
Exercise 3: Creating subtypes and attribute domains

One of the advantages of storing your data in a Geodatabase is that you can define rules about how the data can be edited. You will define these rules by creating a new attribute domain for lateral diameters; creating subtypes for the Laterals feature class; and associating the new domain, existing domains, and default values with fields for each subtype.

Attribute domains are rules that describe the legal values of a field type. Multiple feature classes and tables can share attribute domains stored in the database. However, not all the objects in a feature class or table need to share the same attribute domains.

For example, in a water network, suppose that only hydrant water laterals can have a pressure between 40 and 100 psi, while service water laterals can have a pressure between 50 and 75 psi. You would use an attribute domain to enforce this restriction. To implement this kind of validation rule, you do not have to create separate feature classes for hydrant and service water laterals, but you would want to distinguish these types of water laterals from each other to establish a separate set of domains and default values. You can do this using subtypes.

To learn more about subtypes and attribute domains, see the topics on subtypes and attribute domains in the ArcGIS Desktop Help.

Creating an attribute domain

You will use ArcCatalog to create a new coded value attribute domain. This new domain will describe a set of valid pipe diameters for your new Laterals feature class.

1. Right-click the Montgomery Geodatabase and click Properties.

2. Click the Domains tab.

3. Click the first empty field under Domain Name and type “LatDiameter” for the name of the new domain. In the Description field, type “Valid diameters for water laterals” for the domain’s description.
You will now specify the properties of the domain. These properties include the type of field this domain can be associated with, the type of domain it is—range or coded value, the split and merge policies, and the valid values for the domain.

A range domain describes a valid range of numeric values, and a coded value domain describes a set of valid values. In this case, you will create a new coded value domain.

Domains have split and merge policies. When a feature is split or merged, ArcGIS looks to these policies to determine the values of the resulting feature or features for a particular attribute.

4. Click the Field Type to view a dropdown list and click Float for the field type for this domain.

5. Click the Domain Type to view a dropdown list and click Coded Values for the domain type.

6. Click the Split policy to view a dropdown list and click Duplicate for the split policy for the domain. The Merge policy will default to Default Value. You will type the valid values, or codes, for the coded value domain, and for each code, you will provide a user-friendly description. As you will see later in the tutorial, ArcMap uses the user-friendly description, not the code, for values of fields that have coded value domains associated with them.

7. Click the first empty field under Code and type “13” for the code; then click the Description field beside it and type “13” for the code’s description.

8. Add the following coded values to the list:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10&quot;</td>
</tr>
<tr>
<td>8</td>
<td>8&quot;</td>
</tr>
<tr>
<td>6</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4</td>
<td>4&quot;</td>
</tr>
<tr>
<td>3</td>
<td>3&quot;</td>
</tr>
<tr>
<td>2.25</td>
<td>2 1/4&quot;</td>
</tr>
<tr>
<td>2</td>
<td>2&quot;</td>
</tr>
<tr>
<td>1.5</td>
<td>1 1/2&quot;</td>
</tr>
<tr>
<td>1.25</td>
<td>1 1/4&quot;</td>
</tr>
<tr>
<td>1</td>
<td>1&quot;</td>
</tr>
<tr>
<td>0.75</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>-9</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

9. Click OK to add the domain to the Geodatabase.

10.
Creating subtypes and associating default values and domains

Now you will create subtypes for the Laterals feature class and associate default values and domains with the fields for each subtype. By creating subtypes, not all the water lateral features need to have the same domains, default values, and as you will see later in the tutorial, connectivity rules.

1. Right-click the Laterals feature class and click Properties.

2. Click the Subtypes tab. You will now specify the subtype field for the Laterals feature class. The subtype field contains the values that identify to which subtype a particular feature belongs.

3. Click the Subtype Field dropdown arrow and click TYPECODE.

You will now add subtype codes and their descriptions. When you add a new subtype, you will assign default values and domains to some of its fields.

4. Click the Description field next to subtype code 0 and type “Unknown” for its description.

5. Click the Default Value field next to H_CONFID and type “0” for its default value. Do the same for DEPTH_BURI and RECORDED_L. For the WNM_TYPE and PWTYPE fields, type “WUNKNOWN” as the default values.
6. Click the Default Value field next to DIAMETER and type “8” for the default value. Click the Domain dropdown list and click LatDiameter to set it as this field’s attribute domain for the Unknown subtype.

7. Repeat step 6 for the MATERIAL field, typing “DI” for the default value. Click Material in the Domain dropdown list.

8. Add the following subtypes and set the default values and domains the same as for the Unknown subtype, except for the WNM_TYPE and PWTYPE field default values.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Fields</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydrant laterals</td>
<td>WNM_TYPE, PWTYPE</td>
<td>default value = WHYDLIN</td>
</tr>
<tr>
<td>2</td>
<td>Fire laterals</td>
<td>WNM_TYPE, PWTYPE</td>
<td>default value = WFIRELI</td>
</tr>
<tr>
<td>3</td>
<td>Service laterals</td>
<td>WNM_TYPE, PWTYPE</td>
<td>default value = WSERVICE</td>
</tr>
</tbody>
</table>

When adding new features to a feature class with subtypes in the ArcMap editing environment, if you do not specify a particular subtype, the new feature will be assigned the default subtype. Once you have added all the subtypes for this feature class, you can set the default subtype from those you entered.
9. Click the Default Subtype dropdown arrow and click Service laterals to set it as the default subtype.

10. Click OK.

You have now added behavior to the Geodatabase by adding domains and creating subtypes. Now you will add some additional behavior to the Geodatabase by creating relationships.
Exercise 4: Creating relationships between objects

In Exercise 2, you imported an INFO table containing owner objects into the Montgomery Geodatabase. The Geodatabase already has a feature class called Parcels that contains parcel objects. You will now create a relationship class between the parcels and the owners so that when you use the data in ArcMap you can easily find out which owners own which parcels.

1. Right-click the Landbase feature dataset, point to New, then click Relationship Class.

The New Relationship Class wizard opens. The first panel of the wizard is used to specify the name, origin, and destination feature class or table for the new relationship class.

2. Type “ParcelOwners” as the name of this relationship class.

3. Click Owners for the origin table.

4. Double-click Landbase and click Parcels for the destination feature class. Click Next. The next panel is used to specify the type of relationship class you are creating. You are creating a simple relationship class since owners and parcels can exist in the database independently of each other. You can, therefore, accept the default type—simple relationship class.

5. Click Next.

You must now specify the path labels and the message notification direction. The forward path label describes the relationship as it is navigated from the origin class to the destination class.

6. Click Next.
destination class—in this case, from Owners to Parcels. The backward path label describes the relationship when navigated in the other direction—from Parcels to Owners.

The message notification direction describes how messages are passed between related objects. Message notification is not required for this relationship class, so accept the default of “None”.

6. Type “owns” for the forward path label and type “is owned by” for the backward path label. Click Next.

You will now specify the cardinality of the relationship. The cardinality describes the possible number of objects in the destination feature class or table that can be related to an object in the origin feature class or table.

7. Click 1–M (one-to-many) to specify that one owner may own many parcels. Click Next.

You must now specify whether your new relationship class will have attributes. In this example, the ParcelOwners relationship class does not require attributes, which is the default.

8. Click Next.

9. Click the first dropdown arrow and click PROPERTY_ID for the origin table primary key.

The next step is to specify the primary key in the origin table (Owners) and the embedded foreign key field in the destination feature class (Parcels). Owners and Parcels that have the same value in these fields will be related to each other.

10. Click the second dropdown arrow and click PROPERTY_ID for the embedded foreign key in the destination feature class.

11. Click Next. A summary page appears. Once you have reviewed the summary, click Finish.
You have now added a second kind of behavior to the Geodatabase—relationships. Next, you will continue to add behavior to the Geodatabase by creating a geometric network and defining connectivity rules.
Exercise 5: Building a geometric network

Feature classes stored in the same feature dataset can participate in a geometric network. Geometric networks model network systems such as water networks. You will build a geometric network from the feature classes in the Water feature dataset in the Montgomery Geodatabase. You will then create connectivity rules to define which features can connect to each other in the network.

Creating the water network

1. Right-click the Water dataset, point to New, then click Geometric Network.

The Build Geometric Network Wizard opens. You can use this wizard to build a geometric network from existing feature classes or to create an empty geometric network. In this case, you will be building a network from the existing feature classes in the Water feature dataset.

2. Click Next. The second panel is used to specify whether to build a network from existing feature classes or to create an empty one. You want the default—Build a geometric network from existing features.

3. Click Next. You must now select which feature classes in the feature dataset will participate in the geometric network and what the name of the network will be.

4. Click Select All.

5. Type “WaterNet” for the name of the geometric network. Click Next.

The option to exclude features with certain attributes makes it easier to manage the state of parts of the network if you need to drop the network and rebuild it after you have been working with it for a while.

6. Click No, so that all features will participate in the geometric network. Click Next.
You will now specify which line feature classes will become complex edge feature classes in the geometric network. Complex edge features are not split into two features by the connection of another feature along their length; thus, they are useful for modeling water mains, which may have multiple laterals connected to them. By default, all line feature classes become simple edge feature classes.

7. Click Yes to specify that some of the line feature classes will become complex edges.

8. Check Distribmains and Transmains to make the water distribution and transmission mains complex edges.

9. Click Next.

Features in a geometric network must be precisely connected to one another. The input feature classes can be adjusted to ensure connectivity by snapping. You will specify whether these features need to be adjusted to snap to one another in the network-building process.

10. Click Yes to specify that some of the features need to be adjusted. Type “1.0” for the snapping tolerance.

11. Click Select All to indicate that the features stored in each feature class can be adjusted. Click Next.
You must specify which, if any, of the junction feature classes can act as sources and sinks in the network. Sources and sinks are used to determine the flow direction in the network.

12. Click yes to indicate that some of the junction feature classes will act as sources or sinks.

13. Check the Tanks feature class to indicate that tanks can be sources or sinks in the network. Click Next.

Now you can assign network weights. A network weight describes the cost of traversing an element in the logical network, such as the drop in pressure as water flows through a pipe. This geometric network does not require weights, which is the default.

14. Click Next. A summary page appears. Once you have reviewed the summary, click Finish.

A progress indicator appears, displaying the progress for each stage of the network-building process. Your new geometric network, WaterNet, has been created in the Montgomery Geodatabase. Next, you will establish connectivity rules for your water network.

Creating connectivity rules

Network connectivity rules constrain the type of network features that may be connected to one another and the number of features of any particular type that can be connected to features of another type. By establishing these rules, you can maintain the integrity of the network connectivity in the database.

1. Right-click WaterNet and click Properties. The Geometric Network Properties dialog box opens. The dialog box provides information about feature classes participating in the network and a list of the network weights. You can also add, delete, and modify connectivity rules using this dialog box.
2. Click the Connectivity tab.

   ![Connectivity Tab](image)

This tab lets you add and modify connectivity rules for the geometric network. You will first create a new *edge–junction rule*, which states that hydrants can connect to hydrant laterals; it also indicates that when a hydrant lateral is created, a hydrant junction feature should be placed at its free end.

3. Click the dropdown arrow and click Laterals.

4. In the list of subtypes in the feature class, click Hydrant laterals. You will now click the types of junctions that hydrant laterals can connect to in the network. For simplicity, hydrant laterals can only connect to hydrants.

5. Check Hydrants in the list of subtypes in the network. You should also specify that when you create a hydrant lateral, if an end of the lateral is not connected to another edge or junction, then a hydrant is placed at that end.

6. Click the plus sign to expand Hydrants, right-click Hydrants under it, then click Set as Default. A blue D will appear next to the hydrant subtype, indicating that it is the default junction for this edge subtype.

   ![Default Setting](image)

You will now create a new *edge–edge rule* that states that hydrant laterals can connect to distribution mains through taps, tees, and saddles. The default junction for connections between hydrant laterals and distribution mains will be taps.
7. In the network subtypes list, click the plus sign to expand Distribmains and check Distribmains under it.

8. In the Junction subtypes list, click the plus sign to expand Fittings and check Tap, Tee, and Saddle in that order. Notice that Tap has a blue D next to it; this means that Tap is the default junction. Check WaterNet_Junctions, which is the generic, or default, network junction type.

9. Click OK.

You have now added behavior to your Geodatabase by defining connectivity rules. You would normally define many more connectivity rules for a network. However, for this tutorial, you only need to define the connectivity rules specified here. In the next part of the tutorial, you will create feature-linked annotation for your new hydrant lateral feature class.
Exercise 6: Creating annotation

In Exercise 1, you browsed through the existing feature classes in the Montgomery Geodatabase. One of these feature classes contained annotation that was linked to features in the Distribmains feature classes. You then imported the water laterals from a Shapefile into the Water feature dataset. Now you will create labels for the water laterals in ArcMap and convert them to an annotation feature class that is linked to the laterals.

Creating labels for the lateral subtypes

You will start ArcMap and add the Laterals feature class.

1. Click the Launch ArcMap button. Start a new, empty map document.

2. Click the Laterals feature class, drag it from ArcCatalog, and drop it on the ArcMap table of contents.

Because you created subtypes for the Laterals feature class, each subtype is automatically drawn with unique symbols. You will create different label classes for the subtypes.

3. In ArcMap, right-click Laterals and click Properties.
4. Click the Labels tab.

5. Check the box to Label features in this layer.

6. Click the Method dropdown list, click Define classes of features, and label each class differently.

7. Click Get Symbol Classes. Now the layer has several label classes defined—one for each subtype and one for other values.

**Defining the labels for the hydrant laterals**

The different subtypes of laterals have different roles in the water system. For example, service laterals bring water from the distribution mains to residences or businesses, and hydrant laterals bring water from mains to fire hydrants. You will make the labels for the hydrant laterals red to make it easy for map-readers to differentiate hydrant laterals from other laterals.

1. Click the Class dropdown list and click Hydrant laterals.

2. Click the text color dropdown arrow and click a red swatch from the palette.

3. Click the Bold and Italic buttons.

4. Click Expression.

Sometimes you want to label features with the content of a single field. The Label Field dropdown list lets you select a single field with which to label features. At other times, you may want to create labels that are more complex. The Label Expression dialog box lets you construct labels by concatenating one or more fields and other text. You can also add logic to the label expression using a scripting language. To create the labels for the hydrant laterals, you will load a label expression that has been saved to a file.
5. Click Load.

The label expression has been saved to a file called “lateral_exp.lxp” in the Layers folder for the BuildingaGeodatabase tutorial folder.

6. Navigate to the Layers folder, click lateral_exp.lxp, and click Open.

This VBScript expression evaluates the length of each lateral; if its value is greater than 200, it labels the lateral with the contents of the DIAMETER field, a space, and the contents of the MATERIAL field. If the length is less than 200, it labels the lateral with the contents of the DIAMETER field.

You will adjust this expression for the Hydrant laterals so that Hydrant laterals longer than 100 feet get the more complete labels.

7. Click in the Expression box and change the value in the If statement from 200 to 100. Click Verify.
The expression is tested and a sample is displayed.

8. Click OK on the Label Expression Verification dialog box and click OK on the Label Expression dialog box.

You have created an expression for the Hydrant laterals label class. Next, you will create expressions for the label classes of the other subtypes.

### Defining the labels for the service laterals

The service laterals tend to be shorter than the hydrant laterals. For this exercise, it is only important to show their material type when they are longer than 200 feet, so you will load the label expression again and use it without modifying it.

1. Click the Class dropdown list and click Service laterals.

Now you can set up the label parameters for this label class.

2. Use the same procedure that you just used to define the labels for the Hydrant laterals, but make these labels black, and do not modify the label expression after you load it.

### Defining the labels for other laterals

You have loaded label expressions for the Hydrant laterals and Service laterals. Now you will define the labels for Fire laterals, Unknown laterals, and the <all other values> class. Because these classes are less common and only the diameter is of interest, you will use the Diameter field alone to label these features.

1. Click the Class dropdown list and click Service laterals.

Now you can set up the label parameters for this label class.
1. Click the Class dropdown list and click Fire laterals.

2. Click the Label Field dropdown list and click DIAMETER.

3. Use the same procedure to set the labels for the Unknown and <all other values> label classes.

4. Click OK on the Layer Properties dialog box. The labels are drawn on the map. The Hydrant laterals are labeled in red, and because of the label expression, the longer ones are also labeled with their material type.

You have created labels for the different subtypes of laterals, using the symbology classes in ArcMap to derive the label classes. Now you will convert the labels to annotation in the Geodatabase.

**Setting the reference scale for the labels**

Labels are dynamic—they are regenerated when you pan and zoom around the map. By default, they will be drawn using the same size symbol, regardless of the scale to which you zoom. Not all features can be labeled using an 8-point font at the full extent of the feature class, but if you zoom in, there will be more space around the features, so more labels will be drawn.

Unlike labels, annotation is static. Annotation features are stored. They have a fixed location and a reference scale, so when you zoom in, the text gets larger on the screen. You can make labels behave more like annotation by setting a reference scale. This should be the scale at which the map will most commonly be used. When you convert the labels to annotation, you want the annotation to have the right reference scale so it will be drawn at the right size, relative to the features, on the maps you create.

1. Click the Zoom In tool and click and drag a box around some of the laterals on the eastern edge of the data.

Labels are now drawn for more of the laterals.
2. Type 1000 in the Scale box and press Enter.

Even more of the labels are now drawn. This is the scale at which the data will usually be drawn, so you will now set the reference scale for the map and the annotation that you create from it.

3. Right-click Layers, point to Reference Scale, and click Set Reference Scale.

Now, when you zoom in or out, the labels will get larger or smaller.

**Converting the labels to annotation**

Now that the reference scale is set, you can convert the labels to annotation and store them in your Geodatabase. You will convert the label classes into subtypes of a single feature-linked annotation feature class. This process requires an ArcEditor or ArcInfo licensed seat of ArcMap. With an ArcView seat, you can create annotation from labels but not feature-linked annotation.

1. Right-click Layers and click Convert Labels to Annotation.

2. Click in the Annotation Feature Class column for the Laterals feature layer and rename the output annotation feature class “LateralsAnno”.

1
3. Click the Properties button.

4. Check the box to require symbol to be selected from the symbol table.

This will reduce the storage space needed in the Geodatabase for the annotation. Each annotation feature will reference a symbology table in the Geodatabase, rather than storing all its own symbology information. You will not be able to store graphics in this annotation feature class. The check boxes for the two feature-linked annotation editing behavior options are checked by default. New annotation will be created when new laterals are added, and existing annotation will move when laterals are moved or reshaped.

5. Click OK.

6. Click Convert.

A message box will appear showing the progress of the conversion process. After a short time, it will finish. The labels are converted to a set of annotation classes within a single annotation feature class. A relationship class is also created that links the annotation to the laterals.
7. Close ArcMap.

You have created an annotation feature class in the Geodatabase. The annotation classes within it correspond to the subclasses of the laterals feature class. Some of these annotation classes have special symbology, as well as logic to annotate certain features with extra information. When the Laterals feature class is edited in ArcMap, the corresponding annotation features will be created or modified using the symbology and annotation expression you created.
Exercise 7: Creating layers and Cartographic Representations for your Geodatabase data

To make browsing for and symbolizing data more convenient, you can create layers from your Geodatabase data and use these layers in ArcMap. Most of the layers you will need have been created for you; they are stored in the Layers folder in your tutorial directory. In this exercise, you will create new layers for the Laterals and the LateralsAnno feature classes.

Creating the Laterals layer

1. In ArcCatalog, right-click the Laterals feature class and click Create Layer.

2. Browse to the Layers folder under your tutorial directory and type “Water Laterals” for the name of the new layer.

3. Click Save.

The new layer is created. You will modify the properties of the layer to add symbology.

4. Open the Layers folder in the ArcCatalog tree, right-click the Water Laterals layer, and then click Properties.

You can use the Layer Properties dialog box to modify many aspects of a layer, such as its visible scale and transparency. In this case, you will modify its symbology.
5. Click the Symbology tab.

By default, the unique values classification based on the subtype field is used to symbolize the layer. This is the setting you want, but you must modify the symbology of each subtype.

6. Double-click the colored line next to Hydrant laterals. The Symbol Selector dialog box appears. You will use this dialog box to set the symbol properties for the laterals.

7. Click the Color dropdown arrow and click a purple patch on the color palette to make the line purple.

8. Type “1.5” in the width text box to give the line a width of 1.5.

9. Click OK.

10. Repeat steps 6 through 9 for the Fire laterals, making the symbol a red line with a width of 1.5.

11. Repeat steps 6 through 9 for the Service laterals, making the symbol a dark blue line with a width of 1.5.

12. Click OK to close the Properties dialog box. Your Water Laterals layer is complete. You can now create the annotation layer for the water laterals.
Creating the Lateral Diameter layer

1. Right-click the LateralsAnno feature class and click Create Layer.

2. Navigate to the Layers folder and type “Water lateral diameter annotation” for the name of the new layer.

3. Click Save.

The new annotation layer is created. Since this layer points to an annotation feature class, the symbology is a property of the annotation, so it does not have to be set in the layer.

Setting a visible scale range for the layer

Annotation features are most useful within a narrow range of map scales in which they are legible. It is often helpful to set a minimum and maximum scale within which annotation feature classes will be drawn. You can make this visible scale range a property of the annotation feature class itself or set it as a property of a layer that points to the annotation feature class.

For large annotation feature classes and in multiuser environments, the former approach is best, as it is the most effective way to prevent large numbers of annotation features from being needlessly requested from the server.

For this exercise, assume that users of this feature class will usually add the layer you have created, rather than adding the annotation feature class directly.

1. In ArcCatalog, right-click Water lateral diameter annotation.lyr and click Properties.

2. Click the General tab.

3. Click the do not show layer when zoomed button, type “2500” in the Out beyond box, and click OK.

To set the scale range for an annotation feature class, right click the annotation feature class in ArcCatalog, click Properties, and click the Annotation Classes tab. You can set a separate scale range for each annotation class in the
annotation feature class. Click the Scale Range button to set the minimum and maximum visible scales.

**Cartographic Representations**

So far, you have learned how to create layer file that stores symbology and properties about your data in a static file. One of the advantages of the Geodatabase is that you also have the ability to store symbology directly inside the Geodatabase using Cartographic Representations.

Feature class representations let you store symbology with your features in the Geodatabase and edit the appearance of individual features on your maps. Tools to help you manage representations include a new layer symbology option to display layers with a representation, an interface for configuring individual symbols within a representation, and a set of editing tools to modify the appearance of features symbolized with representations.

Representations let you control the appearance of features in a way that previously required exporting your map to a dedicated graphics program. You can now store alternate feature geometry that is used only for symbology, not for processing or analysis. Representation information is stored in Geodatabase files. Only Geodatabase feature classes can store representations. A single feature class can have multiple representations to support a variety of maps from a single data source.

To get started we need to create a new feature class.
1. Open ArcMap by going to Start > All Programs > ArcGIS > ArcMap and browse for an existing map. Navigate to C:\ArcGIS\ArcTutor\BuildingaGeodatabase\Maps\Montgomery.mxd and choose open.

The map looks like any ordinary map with a few layers turned on and quite a few turned off.

2. From the menu choose bookmarks and select the Detail bookmark.

Once you are zoomed in, you will notice that several layers have turned on including the Water system we created earlier.

3. From the table of contents select the Parcels layer, right click and choose properties.

4. Choose the symbology tab and notice how an additional option from the show box titled Representations. This indicates that a cartographic representation was created for this layer and is currently being used to symbolize the data on the map.
5. Click Cancel and Right Click on the Parcels Layer and choose Open Attribute Table.

You will notice at the far right of the table that there are two fields called RuleID and Override.

The RuleID field is an integer field that stores a reference to the representation rules. Representation rule information is stored within system tables of the Geodatabase. Since it is an integer field (with a coded value domain), you can manually edit the values in the field to assign a different representation rule to a feature. You can also use the Representation Properties dialog box during an ArcMap editing session to do this.

The Override field is a binary large object (BLOB) field that stores feature-specific overrides to the representation rules. Overrides are changes to the representation properties at the feature level and may include changes to feature representation geometry; depending on how the, editing behavior of the representation is set.

6. Open ArcToolbox by clicking on the Toolbox icon on the standard toolbar

7. In ArcToolbox expand Data Management Tools and then expand Feature Class. You will find a tool titled Create Feature Class
8. We are going to import building footprints from a CAD file so we need to create the new feature class in the LandBase Feature Dataset and call the new feature class Buildings.

You will notice that I did have you specify a coordinate system. Because this new feature class is inside a feature dataset, it inherits the coordinate system information from the dataset.

The Building layer is automatically added to the map but has no data. We are going to add data now.

9. Click on the Add Data button and browse to the BuildingaGeodatabase directory and search for the GreenAcres.dwg file. Double click on the file to reveal the sub layer menu and choose polygon and click add.
10. Start an edit session by going to View > Toolbars Editor. On the Editor Dropdown choose start editing and set the building as the target layer.

11. Right Click on GreenAcres.dwg Polygon and choose Selection > Select All

12. Choose Copy and then Paste and the buildings will copy from the CAD file to the Geodatabase Feature Class. This only works if the features you are copying are of the same geometry type as the destination feature class.
13. Now that the buildings have been added, go to the editor dropdown menu.

14. Save Edits and then Stop Editing.

15. Right click on the buildings layer and choose properties then click on the symbology tab. Set the symbology similar to the graphic below.

16. Click OK to close the Symbol Selector and the click OK again to close the Building Properties.

17. Right Click on the Buildings Layer and choose Convert Symbology to Representation
18. Uncheck “Add new layer to map symbolized with this representation” and choose Convert

19. Right click on the buildings layer, choose Properties, and then choose the Symbology Tab. In the Show: Menu choose Representations and you will see the newly created Buildings_Rep

20. Click Add new Fill Layer to add an additional polygon fill to the representation.
21. Drop the new fill below our first fill by clicking twice on the down arrow.

22. Change the color of the fill to be a dark brown and click on the Add Geometric Effect Tool to add the Move Effect.

23. From the list of Geometric Effects Choose Move from the list.

24. On the Move tool set the X offset to -2 pt and the Y offset to -3pt and click OK.
The results give the building depth and they appear as if they are 2 ½ D.

It was mentioned earlier that multiple representations could be created for a feature class. This would quickly allow users to assemble maps based on different products that an organization may need to provide to its customers like Full Color Maps, Black and White Engineering Maps, Web Applications and Mobile applications.

You have successfully imported Shapefile, Excel and AutoCAD DWG data into your Geodatabase. You created subtypes, rules, a geometric network, and feature-linked annotation and Cartographic Representations. Now you will create a topology.
Exercise 8: Creating a topology

In Exercise 5, you created a geometric network. A geometric network is a specialized type of topological relationship that allows network tracing, analysis, and editing. In this exercise, you will create a Geodatabase topology. A Geodatabase topology allows you to specify rules that control the spatial relationships of features in a dataset. There is a variety of topology rules that you can apply to your data, depending on your organization’s requirements. You will only apply two topology rules to this dataset.

Creating a topology

You will create the topology to regulate two types of spatial relationships in this dataset. The first is that parcels should not overlap, and the second is that parcels that have been classified as residential must fall within blocks that are also classified as residential.

1. Navigate to the Landbase dataset in ArcCatalog.
2. Right-click Landbase, point to New, and then click Topology.
3. Click Next.
4. Type “0.01” to set the new cluster tolerance, and then click Next.
5. Check Blocks and Parcels.

These feature classes will participate in the topology.
One of the topology rules that you will create will concern the Parcels feature class, and the other will be between one subtype of Parcels and one subtype of Blocks, so both Blocks and Parcels feature classes must participate in the topology. If one of these feature classes were already participating in another topology or a geometric network or if they were registered as versioned in a multiuser Geodatabase, it would not appear in the list of feature classes available to add to this topology.

6. Click Next.

The next page of the wizard allows you to set the number of topology ranks and the rank of each feature class in the topology.

Ranks allow you to ensure that more accurately collected features are not snapped to the position of less accurately collected ones when the topology is validated. For example, if you were including a feature class that was collected using a survey grade global positioning system (GPS) unit and a feature class digitized from a 1:1,000,000-scale source map in the same topology, you might assign the GPS feature class a rank of 1 and the 1:1,000,000-scale source feature class a rank of 5. If you were to validate the topology, parts of features that fell within the cluster tolerance would snap together, with the less accurate ones moving to the location of the more accurate ones. The GPS features would not be moved to the position of the 1:1,000,000-scale features.

You can assign up to 50 different ranks, with 1 being the highest rank. In this topology, you will assume that all the feature classes are based on equally accurate data, so you will not assign more than one rank. Parcels and Blocks have equivalent levels of accuracy, since the Blocks feature class was derived from the parcel features.

7. Type “1” for the number of ranks.

8. Click Next.

9. Click Add Rule.
Topology rules allow you to define the permissible spatial relationships of features within and between feature classes that participate in the topology.

Landownership parcels are usually not allowed to overlap each other. You will add a rule to prevent your parcel features from overlapping each other.

10. Click the feature class dropdown arrow and click Parcels.

11. Click the Rule dropdown arrow and click Must Not Overlap.

12. Click OK.

You have created a rule governing the topological relationship of features within the same feature class. Next, you will create a topology rule governing the topological relationship of features in particular subtypes of two different feature classes. Specifically, you will make sure that residential parcels are covered by or contained within blocks also designated as residential.

13. Click Add Rule.

14. Click the feature class dropdown arrow, click the plus sign to expand Parcels, and click Residential.

Residential is a subtype of the Parcels feature class that the planning department uses to represent parcels where people live.

15. Click the Rule dropdown arrow and click Must Be Covered By.
16. Click the Feature class dropdown arrow, click the plus sign to expand Blocks, and click Residential.

17. Click OK.

The topology rule is added to the list of rules for this topology.

18. Click Next.

After the topology is created, you have the opportunity to validate it. You do not need to validate the topology immediately after creating it. Depending on your data and your workflow, it may make sense to assign different areas to data editors to validate and edit within ArcMap.

20. Click Yes.

The topology appears in the Landbase dataset.

19. Click Finish.
Exercise 9: SDE & Geodatabase Replication

ArcGIS Desktop (ArcEditor and ArcInfo), ArcGIS Engine, and ArcGIS Server Workgroup come with an executable file that installs SQL Server Express and enables the SQL Server Express instance to store ArcSDE Geodatabases.

These Geodatabases use the ArcSDE direct connect libraries installed with the ArcGIS Desktop, ArcGIS Engine, or ArcIMS client to connect from the client application to the SQL Server Express database. You must have administrative privileges on the computer on which you want to install SQL Server Express. Users with administrative privileges on the machine automatically have administrator privileges in the database server except when SQL Server Express is installed on a machine with a Windows Vista operating system. During installation, a database server administrator can be added to the instance.

To administer an ArcSDE database server, you add a database server connection in the Catalog tree. This is a connection to a SQL Server Express instance set up to store Geodatabases. Adding a database server creates a database server connection file and an icon in the Database Servers folder for that connection. Once you are connected to a database server, you are able to administer the database server itself as well as add, remove, or administer the Geodatabases on the database server.

How to add a database server

1. In the Catalog tree, expand the Database Servers folder.
2. Double-click Add Database Server.
3. In the Add Database Server dialog box, provide the name of the ArcSDE database server. This will be in the form `<server_name>\<instance_name>`, where the server name is the name of the server on which SQL Server Express is installed and the instance name is the name of the SQL Server Express instance. For this exercise the database server is named Localhost\SQLEXPRESS. Localhost is the server name and SQLEXPRESS is the instance. Normally you would use the computer hostname however; in a lab setting the hostname Localhost is more appropriate.

Why Localhost?

In computer networking, **Localhost** (meaning "this computer") is the standard hostname given to the address of the loopback network interface. The name is also a reserved domain name set aside to avoid confusion with the narrower definition as a hostname. Localhost is specified where one would otherwise use the hostname of a computer. For example, directing a web browser installed on a webserver to http://localhost will display the home page of the website being served from the computer running the browser, but only if the web server is configured to service the loopback interface.

4. Click OK.
5. The server icon will appear under Database Servers in the Catalog tree.

Add users and groups to a database server

1. Right-click the database server to which you want to add a user or group.

2. Click Permissions.

3. Click Add user on the Permissions dialog box.

4. Specify the location where you want to search for the user or group. For this exercise, we will use the username that we use to login.

5. Type the name of the user or group you want to add. You can click the advanced button to do a more specific query to find the desired user.

6. Click Check Names to verify

7. Click OK.

8. The newly added user or group is automatically highlighted on the Permissions dialog box, so if you want to make this user a database server administrator, simply click Server administrator on the database server Permissions dialog box.

Creating new Geodatabases

1. In the ArcCatalog tree, right-click the ArcSDE database server on which you want to create a new Geodatabase.

2. Click New Geodatabase.

3. Type the name Montgomery for the new Geodatabase in the Geodatabase name text box.
*Geodatabase names must begin with a letter, cannot contain spaces or special characters (such as #, @, or *), and has a maximum length of 31 characters when combined with your server name.

4. If you want to change the database file location, specify the new location in the Geodatabase file text box by clicking the ellipsis button (...) and browsing to the location.

   In the case of a partitioned hard drive or second hard drive where you have a C and D drive, a best practice is to store data on the D drive away from the OS and program files. This can add a slight performance boost to the I/O of your data.

5. Type the size of the new Geodatabase in the Initial Size text box to be 1 and choose MB from the Units drop-down menu. You can choose to set the initial size to be MB or GB and can accept the default size of 100 MB. (Regardless of the initial size, the Geodatabase will grow, as it needs to, up to 4 GB.) However, the initial size of the Geodatabase cannot be smaller than that of the model database in the SQL Server Express instance. The model database is the system template for all new databases. The size of the model database determines the minimum size of any database created in that SQL Server Express instance. The model database is the system template for all new databases. The size of the model database determines the minimum size of any database created in that SQL Server Express instance. If you attempt to create a Geodatabase smaller than this minimum size, database creation will fail and the following error message will be returned:

   Error creating this Geodatabase:

   CREATE DATABASE failed. Primary file must be at least <size of model> to accommodate a copy of the model database.

   19. Click OK.

A progress bar will display while the database file and Geodatabase schema are created. When complete, the new Geodatabase will appear on the Contents tab and in the ArcCatalog tree.

NOTE: You cannot create a new Geodatabase on a database server (nor delete an existing Geodatabase) if you are connecting with an ArcView license.

Tip: It can take some execution time to create a new Geodatabase, especially if the initial file size is large.

Load Data into SDE

Now we are ready to load the SDE Geodatabase with data. There is a perception that this is a daunting and cumbersome task but the reality is that it is as simple as copy and paste. Because our data is loaded in a File Geodatabase, loading the database is complete. The Geodatabase is highly scalable and much like ArcView, ArcEditor and ArcInfo as you upgrade your Geodatabase you unlock functionality. Once data is loaded into any Geodatabase that data can be copied to any type of Geodatabase, as Geodatabases do not discriminate against one another.

1. In ArcCatalog go to C:\ArcGIS\ArcTutor\BuildingaGeodatabase\ choose the contents tab and select Landbase and Water and right click choose copy.
2. In ArcCatalog browse for Database Servers\localhost_sqlexpress.gds\Montgomery (VERSION:DBO.DEFAULT) and choose Paste

3. The next dialog verifies the layers that you are about to paste... click OK

Now that the data is loaded into SDE, we will set up a Geodatabase Replica, which can be used to share data.

Geodatabase Replication

Geodatabase replication allows you to create copies of data across two or more Geodatabases such that changes to the data may be synchronized.

Replica creation involves the user defining the data to replicate from a source Geodatabase and then running a process to create replicas. The process copies data from the source Geodatabase to a target Geodatabase and then creates a replica in each Geodatabase. The replica describes what data has been replicated and contains the information needed to synchronize changes. The replica in the source Geodatabase is known as the parent replica and the replica in the target Geodatabase is called the child replica. Each combination child and parent replica is called a replica pair. The term relative replica refers to the other replica in a replica pair.

The source must be an ArcSDE Geodatabase and therefore parent replicas can only be hosted by ArcSDE Geodatabases. You can also
create multiple replicas from a single source Geodatabase. For example, you can create a replica for each county from your statewide enterprise Geodatabase. The data involved in each replica may also overlap. The diagram below shows multiple replicas created from a single source Geodatabase.

Preparing Data for Replication

1. In ArcCatalog go to the newly created feature dataset Montgomery.DBO.Landbase right click and choose Register as Versioned.

2. Click ok and leave the checkbox unchecked.

Complex data such as Topologies and Geometric Networks cannot be registered as versioned with the option of moving edits to base.

Data that is registered as versioned with the move edits to base option cannot be archive enabled or participate in replication.

3. Repeat steps 1 and 2 for Montgomery.DBO.Water

4. Right click on the Montgomery.DBO.Landbase and choose Add Global IDs...
Global IDs store registry style strings consisting of 36 characters enclosed in curly brackets. These strings uniquely identify a feature or table row within a Geodatabase and across Geodatabases. This is how features are tracked in one-way and two-way Geodatabase replication.

5. Click yes to confirm that you want to create global ids... By choosing, the Feature Dataset to create global ids each feature class will generate global ids at instead of creating them for each feature class individually.

6. Repeat steps 4 and 5 for Montgomery.DBO.Water

Create a Geodatabase Replica

In the following scenario, imagine that you are an employee of the City of Montgomery IT department and you are responsible for maintaining the Water Utility data from the City Water Department and Parcel data from the County Assessor’s office. Your job is to ensure that all five, city departments that participate in the City’s Enterprise GIS get timely updates of the Water and Parcel information. These departments depend on timely updates, as they are responsible for Zoning Inspections, coordinating Capital Improvements between City Water and the Streets Department as well as generating work orders and a host of other activity. It was common to cut data updates to a CD/DVD or copy data to the various servers. However as more departments become involved in GIS it is harder to manage the updates especially when some departments require daily updates, some weekly and some even multiple times in a day. Replication is a perfect mechanism to accomplish this task because not only can you initiate the process but so can the department requesting the new data. In addition, many of the departments used to require Shapefiles but now that the Geodatabase is being used, Replication will allow us to preserve annotation, cartographic representations, topology, geometric networks, subtypes and domains.

1. Go to the maps Directory and open Montgomery-SDE.mxd. This map is pointing to the new SDE Geodatabase we will create a replica from this.

2. Go to View > Toolbars > Distributed Geodatabase and click on the button Create Replica

3. Choose One-Way Replica and click Next
In order to use replication the feature classes to be replicated must be identical... meaning that a parcels feature class in one database has different data from a parcels feature class in another Geodatabase. Since we created our SDE Geodatabase from a File Geodatabase, we will use the Register Existing Data Only option. Otherwise, we would create a new copy from scratch.

4. Select Register Existing Data and select the C:\ArcGIS\ArcTutor\BuildingaGeodatabase\Montgomery.gdb and call the replica Planning. Finally choose to show the advanced options and click next.

5. Choose Full Model and click Next

6. The next screen allows you to specify what is going to be replicated. You can specify the current extent, a graphic
boundary, the full extent or type your own extent. You can also specify what data to include and whether or not to include related data. For our purposes choose Full Extent and click next.

7. Choose No Further Action and Finish.

**Update Data and Replicate Changes**

1. Open the Montgomery-Oneway.mxd and minimize it so that only Montgomery-SDE.mxd is visible.

2. On the Editor Toolbar Start Editing and Set the building layer as the target.
3. Modify the building in the picture below... it does not have to be exactly like the caption but make it noticeably different.

4. Save Edits and Stop Editing.

5. Minimize the Montgomery-SDE.mxd and Maximize the Montgomery-OneWay.mxd and take notice of the parcel we just edited. It has not changed or has not been modified in anyway.

6. Go to View > Toolbars > Distributed Geodatabase Toolbar and choose Synchronize Changes

Notice that Geodatabase 1 is the File Geodatabase and Geodatabase 2 is the SDE Geodatabase. Also, notice that the Replica type is 1-Way and we are Synchronizing in the direction of the SDE GDB to the File GDB.

7. Click Finish
Notice that the Montgomery-OneWay.GDB has been updated to reflect the changes of the edits made to the SDE Geodatabase.

As long as you are connected to the Local Area Network, you can update a one way Geodatabase with changes. Typically, this is a popular model because it allows organizations update webservers very easily while maintaining security by keeping web servers separate from production servers. Typically, most organizations will implement 2-way replication when multiple departments are involved. This allows each department to own and manage their own datasets while providing a convenient open access central data warehouse that other agencies can access for secondary data sets that they may require. The only difference being between 2-way replication and 1-way replication is that the second database must also use SDE rather than a File Geodatabase. The minimum SDE Geodatabase required is the Desktop SDE which comes with ArcInfo and ArcEditor and can be installed free of charge. If your organization has at least ArcEditor, you can create multi editor environments with Desktop SDE and perform Replication. ArcGIS Server allows you to take the principals we just learned one-step further replicate over the internet. This allows organizations to expose Geodatabases as a web service and update remotely without being connected to the Organizations network.

You learned how to create a database connection to Desktop SDE and Microsoft SQL Express. Then you learned how to prepare data for replication and finally you setup the replica, made changes to the data and update the child replica.
Summary:

In the first exercise in this tutorial, you learned how to begin organizing data for a Geodatabase in ArcCatalog.

In Exercise 2, you learned how to import tables and feature classes into a Geodatabase.

In Exercise 3, you learned how to create subtypes and attribute domains in a Geodatabase.

In Exercise 4, you learned how to create relationships between objects in a Geodatabase.

In Exercise 5, you learned how to build a geometric network in a Geodatabase.

In Exercise 6, you learned how to create feature-linked annotation in a Geodatabase.

In Exercise 7, you learned how to create layers files and Cartographic Representations of feature classes in a Geodatabase.

In Exercise 8, you learned how to create a Geodatabase topology.

In Exercise 9, you learned how to Load Data into SDE and Setup Geodata Replication

To learn more about these topics see the ArcGIS Desktop Help system.