Session Path

- The Geodatabase
  - What is it?
  - Why use it?
  - What types are there?

- Inside the Geodatabase
- Advanced Behavior
- Geodatabase Extension Datasets
What is the Geodatabase?

- Core ArcGIS data model
  - A comprehensive model for representing and managing GIS data

- A physical store of geographic data
  - Scalable storage model supported on different platforms

- A transactional model for managing GIS workflows

- Set of COM components for accessing data
Why use the Geodatabase?

- Simple!
- The model to best support the ArcGIS system within an organization

Why use the Geodatabase?

- Campus Viewer
- Showing business logic
Session Path

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  - What is it?
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- Inside the Geodatabase
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3 Types of Geodatabases

- **Personal Geodatabase**
  - Single user editing
  - Stored in MS Access
  - Size limit of 2 GB

- **File Geodatabase**
  - 1 TB per table
  - Cross platform

- **Enterprise Geodatabase**
  - Stored in an enterprise DBMS
  - Supports multi-user editing via versioning
  - Extremely large datasets
### 3 Types of Geodatabases

<table>
<thead>
<tr>
<th></th>
<th>Personal GDB</th>
<th>File GDB</th>
<th>Enterprise gdb (3 Types)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cool Graphic</strong></td>
<td><img src="image1" alt="Cool Graphic" /></td>
<td><img src="image2" alt="Cool Graphic" /></td>
<td><img src="image3" alt="Cool Graphic" /></td>
</tr>
<tr>
<td><strong>Storage Format</strong></td>
<td>Microsoft Access</td>
<td>Folder of binary files</td>
<td>DBMS</td>
</tr>
<tr>
<td><strong>Storage capacity</strong></td>
<td>2 GB</td>
<td>1 TB per table*</td>
<td>Depends on edition</td>
</tr>
<tr>
<td><strong>Supported OS platform</strong></td>
<td>Windows</td>
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</tr>
<tr>
<td><strong>Number of users</strong></td>
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*By default; option to have 256 TB per table*
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<td>![Database Icon]</td>
<td>![Folder Icon]</td>
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Editing Geodatabases…

- ArcGIS datasets in the geodatabase are editable
  - Modify building footprints in parcel management
  - Add water mains to a water network
  - Update land owners information stored in a table
  - Etc…

- Transaction model for editing in ArcGIS
  - Edits are performed in an edit session
    - Open session – edit – save edits / don’t save edits
  - A series of edit operations constitutes a transaction
    - The transaction is either committed or rolled back
Editing Geodatabases...

- **Personal Geodatabases**
  - Mainly single user editing on small datasets
  - Multiple readers
  - Editing locks at geodatabase level
    - Two editors cannot edit within the same geodatabase at the same time

- **File Geodatabase**
  - Mainly single user editing small to very large datasets
  - Multiple readers
  - Editing locks at the dataset level
    - Multiple editors cannot edit the same table or stand-alone feature class at the same time
    - Multiple editors cannot edit feature classes in the same feature dataset at the same time
Editing Geodatabases...

- **Enterprise Geodatabases**
  - Extend the transaction model with Versions
  - Multiuser editing without locking
  - Unique isolated view of the geodatabase

- **Benefits of versioned editing**
  - Multiple editors, editing over long periods of time
  - Undo / Redo
  - Archiving
  - Replication
Creating a Geodatabase

- Using ArcCatalog
- Creating a Geodatabase
- Loading existing data (shapefile)
Session Path

• The Geodatabase
• Inside the Geodatabase
  - Object Classes, Feature Classes, Rasters
  - Feature Datasets
  - Validation Rules
  - Domains, Subtypes, Relationship Classes
  - Annotation, Dimensions
  - Exploring a Geodatabase DEMO
• Advanced Behavior
• Geodatabase Extension Datasets
Inside the Geodatabase

• A geodatabase contains datasets
• Datasets represent collections of information with a real-world interpretation
• Types of geographic datasets:
  - Tables, feature classes, raster
  - Feature datasets
  - Networks, Topologies, Terrains
• Datasets have associated information
  - Manage integrity, behavior, and interpretation
  - Domains, Relational integrity, Topology, Metadata
Geodatabase Elements

Geodatabase

Feature dataset
- Spatial reference
- Polygon
- Line
- Point
- Annotation

Feature Classes

Raster Datasets
- Parcel fabrics
- Terrain datasets
- Representations
- Locators

Additional geodatabase elements

Relationship classes

Geometric networks

Topology

Network datasets

Tables

Behavior
- Attribute defaults
- Attribute domains
- Split/merge policy

Connectivity rules
- Relationship rules
- Topology rules

Toolboxes
- Tool
- Model
- Script
Objects and Object Classes – Tables

- Objects are entities with properties and behavior
- An object is an instance of an object class
- All objects in an object class have the same properties and behavior
Features and Feature Classes

- Builds on the Relational Model
- A feature is a spatial object
- A feature is an instance of a feature class
- Extended the relational model
  - Geometry attribute type

A feature class is a table of rows, where each row has a geographic column.

<table>
<thead>
<tr>
<th>OBJECTID</th>
<th>SHAPE</th>
<th>PARCEL_ID</th>
<th>ZONE_CODE</th>
<th>SHAPE_Len</th>
<th>SHAPE_Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>4513</td>
<td>Polygon</td>
<td>67970</td>
<td>W</td>
<td>544.05</td>
<td>9259.20</td>
</tr>
<tr>
<td>4514</td>
<td>Polygon</td>
<td>67971</td>
<td>W</td>
<td>158.54</td>
<td>774.60</td>
</tr>
<tr>
<td>4515</td>
<td>Polygon</td>
<td>67973</td>
<td>P6OM</td>
<td>400.00</td>
<td>7490.96</td>
</tr>
<tr>
<td>4516</td>
<td>Polygon</td>
<td>67974</td>
<td>B1</td>
<td>236.13</td>
<td>2905.89</td>
</tr>
<tr>
<td>4517</td>
<td>Polygon</td>
<td>67982</td>
<td>B1</td>
<td>550.45</td>
<td>17499.01</td>
</tr>
</tbody>
</table>
Geodatabase Supports Advanced Geometry

- Point, lines, polygons
  - Single and multipart features

- Text and surfaces

- Flexible coordinates
  - XY, Z, M
• **Support for many formats**
  - Tiff, bmp, GRID, among others

• **Attribute field in a table**

• **Mosaic dataset**
  - Data model for managing raster collections
  - Stored as a catalog, viewed as a mosaic
  - Advanced querying and processing
Feature Datasets

- A container object for other datasets
  - Same spatial reference

- Analogous to a coverage
  - Less restrictive

- Contain geometric networks, topologies, terrains, etc...
  - Optionally relationship classes

Subdivision
  - ParcelCorner
  - Parcel
  - ParcelAnno
  - LotLines
  - Parcel_Topo
  - LotDimensions
  - BoundaryLines
Validation Rules

• Attribute, connectivity, and relationship rules
  - Stored on objects as part of the geodatabase

• Predefined, parameter driven
  - Attribute range rule
  - Attribute set rule
  - Connectivity rule

• Perform custom validation by writing code
Domains

- **Describe the legal values of a field type**
  - Used to ensure attribute integrity
- **Defined at the geodatabase level**
- **Types of domains:**
  - **Range**
    - Valid values between a min / max range
    - A tree can have a height between 0 and 300 feet
    - A road can have between one and eight lanes
  - **Coded Value**
    - Valid values chosen from a set list
    - A tree can be of type oak, redwood, or plain
    - A road can be made of dirt, asphalt, or concrete
Subtypes

- Categorize objects or features into groups
  - Share the same attributes
- Defined at the class level
- Select a field to base the subtype on
  - Short or long integer field
  - Can have different default values and domains for each field
  - Can define behavior rules between subtypes
Relationship Classes

- Association between objects in one class and another
  - A class may participate in multiple relationship classes
- Simple relationships
- Composite relationships
  - Related objects can message each other
  - Can trigger behavior (cascade delete, move to follow, custom, etc.)
- Associate rules with relationship classes
  - Each Parcel can have between 1 to 3 Buildings
Relationship Classes

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Annotation

- Annotation feature classes
  - Placing text and graphics on the map
  - Feature linked or Non-feature linked
- Composite relationship manages link
- Can store text as well as other graphics
  - Lines, arrows, boxes, etc...
  - Visible scale range

<table>
<thead>
<tr>
<th>Feature Class</th>
<th>Composite Relationship class</th>
<th>Annotation Feature class</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>21 41 92</td>
<td>92 Placerville</td>
</tr>
<tr>
<td>43</td>
<td>23 43 94</td>
<td>94 Sacramento</td>
</tr>
<tr>
<td>47</td>
<td>27 47 95</td>
<td>95 Topanga Canyon</td>
</tr>
<tr>
<td>49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dimension Features

- Type of annotation that displays specific distances on a map
- Graphic features stored in a dimension feature class
  - Can be created automatically from features
  - Set of editing tools
  - Define a style, description of symbology
Object Behavior

• You can:
  - Control the default value and acceptable values for any attribute. (Domains)
  - Partition the objects into like groups. (Subtypes)
  - Instantiate classes with predefined behavior. (Dimensions and Annotation)
  - Control the general relationships in which an object can participate. (Relationship Classes)

• Out of the Box in ArcGIS!
  - Configurable, no programming required
Exploring a Geodatabase

• Tables / Feature Classes
• Subtypes
• Domains
• Relationship Classes
• The Geodatabase
• Inside the Geodatabase
• Advanced Behavior
  - Attachments
  - Geometric Networks
  - Network Datasets
  - Geodatabase Topology
  - Advanced Behavior DEMO

• Geodatabase Extension Datasets
Attachments

• Associate any type of file with a feature
• Available on a Feature Identify
• In ArcMap if the file type is known by Windows it can be directly accessed.
**Geometric Networks**

- Uses edges and junctions to model network systems
- Built in a feature dataset
  - Each feature class has a role in the network
- Connectivity relationships between feature classes
  - Based on geometric coincidence
  - Can associate connectivity rules with the network
  - Connectivity is maintained on the fly
Geometric Networks

- A geometric network is associated with a logical network
  - Each network feature is associated with one or more elements in the logical network
- Trace solvers on the logical network provide
  - Connectivity tracing, cycle detection, flow directions
  - Upstream / downstream tracing, isolation tracing
Network Datasets

- Network designed for the transportation industry
- Multimodal scenarios
- Edges & Junctions
- Attributes
  - Properties to control traversability
  - Travel time, restrictions, speeds
  - On-the-fly calculation of costs
  - Improves analysis
Network Dataset Functionality

- **Multimodal**
  - Points span multiple connectivity groups
  - Used to create connectivity between lines in different groups

- **Turns**
  - Turns do not alter connectivity, but traversability (e.g. U-Turn restriction)
• A topology manages a set of simple feature classes that share geometry

• Topology is used to:
  - Constrain how features share geometry
  - Define data integrity rules
  - Control editing tools
  - Validate features
  - Ensure the quality of your data
Topological Integrity

• Create topologies in a feature dataset
  - Participating feature classes / subtypes
  - Cluster tolerance, ranks and rules
    - Cluster Tolerance for XY and Z

• Define rules when creating the Topology
  - Rules are evaluated during validation

• Violations are expressed as error features
  - Managed in the database as a part of the topology
  - Error and Exceptions
  - Examine and Fix errors in ArcMap
• Rules enforced to maintain topological integrity
  - 25+ topology rules in ArcGIS
Editing with a Topology

• Editing creates a dirty area
  - Area has been edited and may contain errors
  - Can be symbolized

• Errors are found during validation
  - Errors have properties
    - What rule was violated
    - Which feature(s) created the error

• Your options:
  - Ignore the error
  - Mark as exception
  - Fix the error

Parcels overlap
Exploring a Geodatabase

- Topology
- Geometric Network
- Attachments
Session Path

- The Geodatabase
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- Geodatabase Extension Datasets
  - Terrains
  - Cartographic representations
  - Parcel fabrics
  - Geocoding
**Terrains**

- Massive point datasets, multi-resolution, on-the-fly TIN
  - Dataset for modeling 3D surfaces
  - Modeled within a feature dataset
  - User defined terrain (pyramid) levels
    - Different resolutions & vertical tolerances

- Requires 3D Analyst
  - Extension to define & edit
  - No license needed to view
Cartographic Representations

- **Property of a feature class**
  - Stores info about feature symbology

- **One feature class – multiple representations**

- **Rules and overrides**

- **Representation Management Toolset**
Parcel Fabric

- **Solution for parcel data management**
  - Pre-10.0 requires the Survey Analyst extension
  - As of 10.0 no longer requires the extension

- **Storage, maintenance and editing of parcels**

- **Create in a feature dataset**

- **Parcel editor toolbar**
  - Streamline workflows
  - Increase spatial accuracy
Geocoding

• Address matching and location services
  - Use a locations description to find a location
    - Coordinates, street name, place name
    - Points of Interest, addresses

• Address locators
  - Rules for interpreting addresses
    - Parsing and matching address elements
    - Standard street components
    - Reference map data
Summary

- **The Geodatabase**
  - Data model, Storage, Transaction model, COM components

- **Inside the Geodatabase**
  - Datasets, Validation rules, data behavior and integrity

- **Advanced Behavior**
  - Geometric Networks, Network Datasets, and Topology

- **Geodatabase Extension Datasets**
  - Terrains, Representations, Parcel fabrics, Geocoding
Other Geodatabase Resources

• Geodatabase Island in the Showcase Area
  Meet the specialists!
• Geodatabase Resource Center
• Inside the Geodatabase Blog
• ArcGIS.com

• Check out the Demo Theatre schedules at the Islands in the Showcase Area
Thanks for listening!

- Fill out surveys – Esri.com/ucsessionsurveys
  Offering ID: 601

- Questions?
Other Relevant Sessions

Technical Workshops

• Automating Geodatabase Creation with Geoprocessing Tools
  - Thursday 3:15pm – Room 07 A/B

• Editing Versioned Geodatabases: An Introduction
  - Thursday 1:30 – Ballroom 6F

• Geometric Networks: An Introduction
  - Wednesday 8:30am – Ballroom 6F
  - Thursday 8:30am – Ballroom 6D

• Topology in the Geodatabase: An Introduction
  - Wednesday 10:15am – Ballroom 6C

• Using the ArcGIS System to Access your Geodata
  - Wednesday 3:15pm – Ballroom 6D
  - Thursday 3:15pm – Ballroom 6F