ArcGIS - Working with the Geodatabase

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   - Raster Data

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Introduction
Geodatabase is spatial database that is optimized to store and query data related to objects in space. [Wikipedia]
Shapefile limitations:

- Field names cannot exceed 30 characters.
- Field types can be limited to specific data types.

![Field Name Error]

![Attribute Table Example]
What can we store in the geodatabase?

- vector features (points, lines, polygons or 3D objects)
- raster data
- tables (standalone or related)
- relations
- topology
- annotations
- domains and subtypes
- ...
Vector features:

- similar to shapefile, in GDB it is called *Feature Class*

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annotation_Feature_Class</td>
<td>Personal Geodatabase Feature Class</td>
</tr>
<tr>
<td>Line_Feature_Class</td>
<td>Personal Geodatabase Feature Class</td>
</tr>
<tr>
<td>MultiPatch_Feature_Class</td>
<td>Personal Geodatabase Feature Class</td>
</tr>
<tr>
<td>Point_Feature_Class</td>
<td>Personal Geodatabase Feature Class</td>
</tr>
<tr>
<td>Polygon_Feature_Class</td>
<td>Personal Geodatabase Feature Class</td>
</tr>
</tbody>
</table>
Raster data:

- raster maps, photo documentations, raster analysis outputs, ...
Tables:

- attributes that have no geometry
- standalone / related
Relations:
- relations between tables, feature classes, raster catalogues
- 1:1, 1:M, N:M
- primary key, foreign key

Relationship Class
Topology:

- Describes spatial relations.
- Checking overlaps, gaps, dangles, ...

![Topology Diagram]
Annotations:

- labels stored in GDB
- each annotation feature can be edited as a feature in the shapefile or feature class

Annotation_Feature_Class  Personal Geodatabase Feature Class
Domains and subtypes:
- domains define possible attribute values
- by range or coded values
- subtype divides class into main categories
- domains can be assigned to each category

ALLOWED ATTRIBUTE VALUES

coded value domain example:  range domain example:

<table>
<thead>
<tr>
<th></th>
<th>lava dome</th>
<th>from 3 to 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>lava dome</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>scorrea</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>pumis</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>pyroclastic flow</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>lava flow</td>
<td></td>
</tr>
</tbody>
</table>
**SUBTYPES**

For each subtype the different domain can be set:

- **endodynamic domain**
  - 1. tectonic processes
  - 2. volcanic processes

- **exodynamic domain**
  - 1. denudational processes
  - 2. accumulativeal processes
  - 3. erosional processes
  - 4. gravitational processes

Subtypes define symbology categories:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>endodynamic</td>
</tr>
<tr>
<td>2</td>
<td>exodynamic</td>
</tr>
</tbody>
</table>

**Attribute table example:**

<table>
<thead>
<tr>
<th>GENESIS</th>
<th>PROCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>exodynamic</td>
<td>accumulativeal processes</td>
</tr>
<tr>
<td>endodynamic</td>
<td>volcanic processes</td>
</tr>
<tr>
<td>exodynamic</td>
<td>tectonic processes</td>
</tr>
<tr>
<td>exodynamic</td>
<td>gravitational processes</td>
</tr>
<tr>
<td>endodynamic</td>
<td>gravitational processes</td>
</tr>
</tbody>
</table>
Creating a new geodatabase
In ArcCatalog browse the folder where you want to create the new geodatabase.

Right-click it, point to *New* and select Personal Geodatabase.

Type a new name for this GDB.
Create Domains

- domains are common to the entire database.
- Right-click the new geodatabase and point to Properties.
- Select the Domains tab and create a new domain by typing the domain name.
- For each domain you can choose the type (range or coded values).
- Specify the range for the range domain type or codes for the coded values domain type.
- Range domains do not have built-in validation! You have to manually validate in ArcMap! In the edit session, select features you want to validate and use Validate Features on the Editor menu.

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### Database Properties

#### General

<table>
<thead>
<tr>
<th>Domain Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>endodynamic process</td>
<td></td>
</tr>
<tr>
<td>exodynamic process</td>
<td></td>
</tr>
<tr>
<td>alteration</td>
<td></td>
</tr>
<tr>
<td>shear zone</td>
<td></td>
</tr>
<tr>
<td>sampling</td>
<td></td>
</tr>
<tr>
<td>paenontology</td>
<td></td>
</tr>
<tr>
<td>geological risk</td>
<td></td>
</tr>
</tbody>
</table>

#### Domain Properties:

- **Field Type**: Long Integer
- **Domain Type**: Coded Values
- **Split policy**: Default Value
- **Merge policy**: Default Value

#### Coded Values:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>accumulative processes</td>
</tr>
<tr>
<td>2</td>
<td>denudational processes</td>
</tr>
<tr>
<td>3</td>
<td>erosional processes</td>
</tr>
<tr>
<td>4</td>
<td>gravitational processes</td>
</tr>
</tbody>
</table>

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Arrange Your Data
Vector Data

Organizing vector data in feature datasets

- grouping data with the same coordinate system
- thematic content
- spatial location

Organizing raster data in raster catalogues

- grouping raster data (photos, raster maps)

Feature_Dataset
Personal Geodatabase Feature Dataset

Raster_Catalog
Personal Geodatabase Raster Catalog

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Create a New Feature Dataset

- Right-click the geodatabase, point to New and select Feature Dataset.
- Type name and specify coordinate system.
Create a New Feature Class Within the Feature Dataset

- Right-click the feature dataset, point to New and select Feature Class.
- Type name and create new fields (can be created later).
- Coordinate system is taken from the feature dataset.
Add Domains to Feature Class

- Create a new feature class in the same manner as described on the previous slide.
- Create field with data type *long integer* and select domain you want to add (on field properties).
Create the Subtype

- Create a new field with data type *long integer*
- (in ArcCatalog click the feature class, select *Preview* tab, on drop-down menu select *table*, click the *Options* button and point to *Add Field...*)
- Name the field and select *Long Integer* type. Let the Domain property empty.
- Now on the feature class properties dialog open *Subtypes* tab and find your subtype field.
- Only one subtype can be defined to the feature class.
- Fill in subtypes (codes and description) in the same manner you define domains.
Subtype and related domains

- On the Subtype tab of the feature class properties dialog, click a code value you want and set domains for this code in the Default Values and Domains table. Click another code and assign different domains to it.

- open ArcMap, start editing and see what happens on domains fields when you change the subtype value.
Raster Data

- Raster data can be included to the GDB using *Raster Catalog*.
- Right-click your GBD in ArcCatalog, point to *New* and select *Raster Catalog*...
- Type name of the Raster Catalog and select *Raster Management Type*.
- *Managed* type means that rasters will be stored within GDB.
- *Unmanaged* type creates only links to existing photos.
Load Rasters

- To load rasters right-click the raster catalog, point to *Load* and select *Load Data*. 
Add ID to rasters

- In ArcMap open the raster catalog. Open attribute table and add a new field with photo id information.
- This field will serve as the primary key for relating your tables to rasters.
- Typically you can relate the documentary points feature class to the photo documentation.
Relate a table

- Create a new feature class `Documentary_samples` with the field called `Photo_id`.
- Digitize few points and assign them an existing photo id from raster catalog.
- In ArcCatalog right-click the feature dataset that contains feature class `Documentary_samples`, select `New` and `Relationship Class`.
- On the wizard dialog relate documentary samples to the raster catalog, choose simple relationship, check `no messages propagated`, select cardinality `one to many` and choose the primary and the foreign key (photo_id).
Now add documentary samples and raster catalog to ArcMap and select a documentary point by *Identify* tool. You can see that photos are related to the point.
Editing Data
Creating Polygons

- The simplest way to create polygons is to use the *Editor* tool in ArcMap.
- But this manner brings lot of inaccuracies - overlap or gaps!
- To avoid these errors it is better to use *Polygon Feature Class From Lines* tool.
- In ArcMap you simply create lines (borders of areas) within the line feature class.
- Furthermore, using point feature class there is possibility to add attribute to polygons.
Polygon Feature Class From Lines

- Open ArcCatalog, right-click the feature dataset, select *New* and *Polygon Feature Class From Lines*.
- On the tool dialog type name of a new polygon feature class and select the input line and the point feature class.
Creating Annotations

**Labels**
- automatically generated text
- Label parameters are defined for layers.
- unable to define parameters separately for each text element

**Annotations**
- generated from labels
- stored in geodatabase as features
- Label parameters are defined for each feature.
- can be edited as feature classes (attribute table, geometry)
In ArcMap label the layer you want to create annotations from.

Right-click the layer on the Table Of Contents and select Convert Labels To Annotations.

Check In a database and All features and select the destination geodatabase.

Feature linked means that annotations will be linked to features that are labelled. So when you change the position of the feature, the linked annotation position will be automatically changed.

By Append tool you can append new annotations to existing annotations.
Creating Annotations

Store Annotation
- In a database
- In the map

Reference Scale: 1:529

Create Annotation For
- All features
- Features in current extent
- Selected features

Feature Layer: doc_points
Feature Linked: ✓
Append: ☐
Annotation Feature Class: doc_pointsAnno

Destination: MyGeodatabase.mdb\Hazards\doc_pointsAnno

Convert unchecked labels to unplaced annotation
Convert Cancel