Esri's ArcGIS Enterprise

IT4GIS
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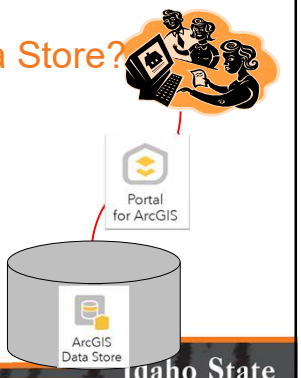
Today's Topics

- Part 1: ArcGIS Enterprise architecture
- Part 2: Storing and serving data for **The Enterprise**
- Part 3: Enterprise workflow
  - Versioning and Replication

ArcGIS Enterprise

What is the Data Store?

- A spatially-enabled Object-relational DBMS (postgreSQL is default)
- Stores Data (it is named the Data Store) and helps serve these data to clients via a network



Its All Just Data

- As far as PostgreSQL (or any ORDBMS) is concerned, our point, line, or polygon *feature classes* are no different from what Esri calls “stand-alone table”
- Why?

	OBJECTID *	Shape *	Fire Name	Fire Number	Fire Identifier *	Acres	Fire Year	Z	Sq. KM	Source Primary	Source Secondary	Shape_Length	Shape_Area
1	56845	Polygon ZM	August Complex	{92D7C997-9C52-482...	56854	1032648	2020	1	4178.080141	NIFC	Unknown	131613.097681	41799880141.021747
2	58010	Polygon ZM	Dixie	{E8D8628D-EF87-4C8...	58019	963405	2021	1	3898.763482	NIFC	IRWIN	1534117.145249	38987634B1.698577
3	975	Polygon ZM	Okanogan Complex	J1M4	38058	608684	2015	1	2462.9317	NASA RECOVER	DOI BB	1598021.631693	24626931700.410948
4	30807	Polygon ZM	n/a	0020	29468	578586	2007	1	2341.454579	NASA RECOVER	DOI BB	606524.367257	23414545B.887157
5	13029	Polygon ZM	NORTH FORK	WY447081102211988O...	11990	565116	1988	1	2286.942108	NASA RECOVER	DOI BB	707636.735797	22869421B8.29549
6	13071	Polygon ZM	LAKE CREEK	WY441571105191988O...	11732	564442	1988	1	2285.020929	NASA RECOVER	DOI BB	549028.695125	22850280828.889646
7	36912	Polygon ZM	n/a	00067	35573	562662	2012	1	2277.011882	NASA RECOVER	DOI BB	548757.538684	22770118B1.729461
8	35502	Polygon ZM	n/a	2011-020	34163	538151	2011	1	2177.821296	NASA RECOVER	DOI BB	602477.439694	21778215295.644401
9	23871	Polygon ZM	n/a	00000003	22532	501685	2002	1	2027.819356	NASA RECOVER	DOI BB	494117.278894	20278193S5.734615

Differentiation

- What differentiates a feature class from a stand-alone table?
  - The SHAPE field (recall *inheritance* from the Feature CLASS in the ArcObjects framework)
  - Area and Length fields are topologically derived from the SHAPE field
- What is the SHAPE field (really!)
  - It is a field (attribute) storing LOB data
  - This may seem *special* to us, but its just another DATA TYPE

So These are Really the Same

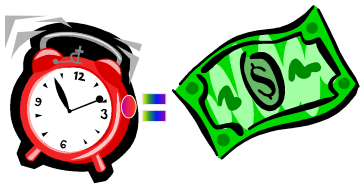
- To an ORDBMS, yes!

	OBJECTID *	Shape *	Fire Name	Fire Number
1	56845	Polygon ZM	August Complex	{92D7C097-9C52-4
2	58010	Polygon ZM	Dixie	{E9DB628D-DF87-4
3	975	Polygon ZM	Okanogan Complex	J1M4
4	30807	Polygon ZM	n/a	0020
5	13029	Polygon ZM	NORTH FORK	WY447081108211981
6	13071	Polygon ZM	LAKE CREEK	WY441571105191981
7	36912	Polygon ZM	n/a	00067
8	35502	Polygon ZM	n/a	2011-020
9	23871	Polygon ZM	n/a	00000003

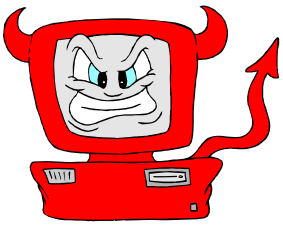
	Fire Identifier * OBJECTID *	Acres Alt_Fire_Number	Fire Year	Z	Sq. KM FireID *	Source Primary	Source Secondary	Shape_Length	Shape_Area
1	3	{5DE1D05D-6D37-4C0...			38425	NIFC	Unknown	1316130.97681	417898041.021747
2	4	2016-WYCMX-016116			38425	NIFC	IRWIN	1534117.145249	389876348 1.698577
3	7	{F0B9A702-C047-4FD...			38427	NASA RECOVER	DOI BB	1598021.631693	2462931700.410948
4	8	2016-WYNAX-016290			38427	NASA RECOVER	DOI BB	606524.367257	2341454578.887157
5	9	{384BE67E-085E-4848...			38428	NASA RECOVER	DOI BB	707636.735797	228694210 8.29549
6	10	2016-WYWRA-16-009			38428	NASA RECOVER	DOI BB	549028.695125	2285030928.886646
7	11	{18907D48-FB0D-46B...			38429	NASA RECOVER	DOI BB	348757.538684	2270111881.729461
8	12	2016-WYNAX-016231			38429	NASA RECOVER	DOI BB	602477.439694	2177821295.64401
9	13	{2D4B3472-609D-4DE...			38430	NASA RECOVER	DOI BB	404117.278894	2027819355.734615
10	14	2016-WYWRA-16-006			38430				
11	15	{5AB228C9-E093-482...			38431				

Why use ArcGIS Enterprise?

- **Advantages:**
  - Enable *versioning* to prevent data loss or degraded data integrity
  - Centralize data management
  - Make the most current geospatial data is available always



Why? (cont'd)



- **Disadvantages**
  - Data management role
  - RDBMS administration role
  - Capital expenditure

To Use Enterprise…or Not …

- What will help make this decision?
  - ROI
  - TCO
  - Is this the correct technology for the problem?

ArcGIS Data Structures

The GDB

- **Can** store tables, vector feature classes (layers), relationship classes, topology layers, and raster layers

Layers and Layer Files

- All GIS data are considered LAYERs in ArcGIS.
- BTW, A LAYER FILE is different than a LAYER.
  - It is a file you save in ArcGIS Pro to retain customized settings and appearance for a LAYER.
  - The LAYER FILE refers to the LAYER (feature class, shape file, image, or grid), as well as…
  - Provideing instructions regarding visualization/symbology, text/labelling, scale/display thresholds, etc.

The Workspace

- ArcView
  - Collection of ArcView shape files in a folder
- Geodatabase

Geodatabases

- Personal pGDB (not supported in ArcGIS Pro)
- Mobile GDB
- File-based fGDB
- Enterprise
  - Data Store (formerly known as ArcSDE Personal or ArcSDE Professional)

Mobile Geodatabases

- Limitations
  - 2TB
  - Only vector feature classes are actually stored inside the Access database
  - Multiple readers allowed but only one editor
  - Does not support versioning
  - Uses SQLite RDBMS

File-based Geodatabase

- fGDB
- Stores vector and raster layers in the file/folder structure.
- Limitations
  - Multi-user (max = 10)
  - 1 Editor (no versioning)
  - Max size is 1 TB

The GeoPackage

- Is a relatively new database for geospatial data based on SQLite
  - It is open and platform independent
- A GeoPackage database can store:
  - Vector features
  - Raster imagery
  - Stand-alone attribute tables
- Supported in ArcGIS but not controlled by Esri

Workgroup Geodatabase

- Uses MS SQL Server Express
- Limitations
  - 10 GB
  - Supports versioning/replication but only one editor
- **NOT** an enterprise solution but a great way to learn the enterprise workflow

Enterprise Geodatabase

- Uses PostgreSQL, DB2, Oracle, SQL Server, and SAP HANA
- No software size limits and unlimited number of users
- **Can** accommodate vector and raster data

Given all these differences, there are really many similarities

Geospatial Data Storage (Vector)

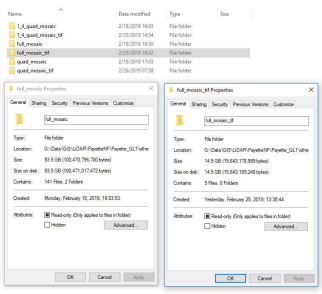
- Vector geospatial data are stored as Feature classes
- Non-spatial data are stored as stand-alone tables
- Relationship classes can be used to connect feature classes and stand-alone tables

Geo-spatial Data Storage (Raster)

- Two methods
  - Stand-alone raster dataset
  - Mosaic Dataset
- The Enterprise GDB is not the best solution to store raster GIS data
  - Size considerations
  - Performance issues
- This is because raster data is handled by ArcGIS and not natively by the ORDBMS

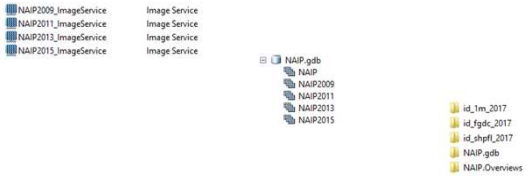
Stand-alone Raster Datasets

- Do not store these within a GDB
  - Performance is slow
  - Consumes a lot of space in the GDB



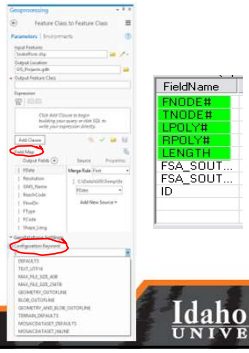
Mosaic Datasets

- Fantastic use of the fGDB



Loading Vector Data into a GDB

- PART 1: Feature classes



Leveraging Common Computing Architecture

The Future…

- Works seamlessly across all devices
- Reduces need for custom applications
- Platform for integration with other business systems
- Cross organizational collaboration
- Ready to use content and services
- Content management system

Questions…

Geodatabases in an Enterprise Workflow

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Presentation and Discussion

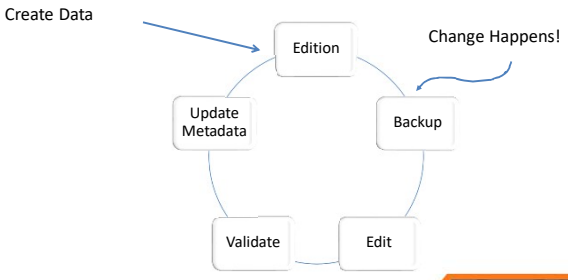
UNDERSTANDING AND MANAGING WORKFLOW

Let's Get Started

- GIS is…
  - Data-driven
  - Powerful
  - Dynamic

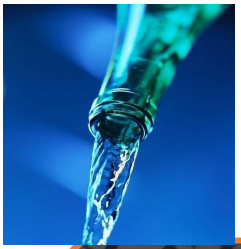
•Adjectives

GIS Data Life Cycle

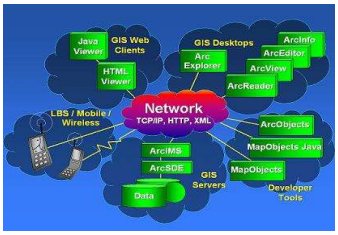


The Bottleneck

- Distributing the new edition via the network



The Solution



- Networks and the Internet

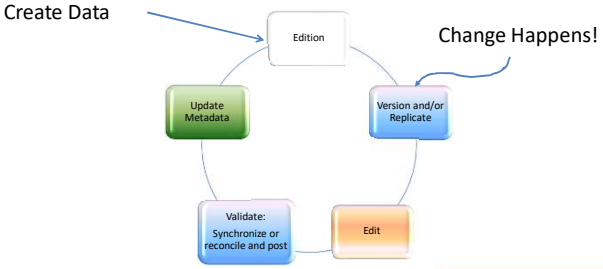
A New Problem is Born

- "MY" version

GIS Grows Up!

- ORDBMS
  - Keep the benefits of network connectivity
  - Eliminate the problem of "MY" version
  - Eliminate the bottleneck
  - And, change the cycle of events

GIS Data Life Cycle



Backup vs. Versioning

- Backups and archiving are still critical steps for the enterprise.
- BUT, not part of the GIS Life Cycle any longer

In the Beginning…

- Backups were made in case we really messed up
- Edits were made to the original
- Copies of the “clean” new edition were distributed

Today…

- The original [`parent`] is versioned [a child is born]
- Edits are made to the child, not the parent
- "Clean" edits are copied [synchronized or posted] to the parent.

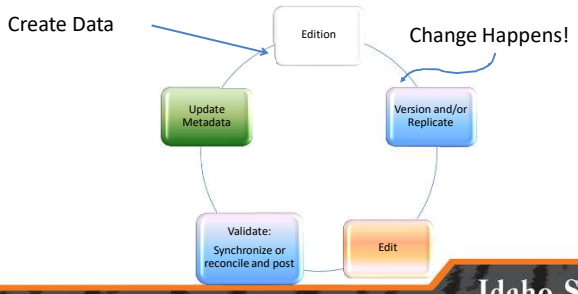
Benefits Of This Approach

- Brainstorm!!!
  - Minimize downtime
  - Processes completed within the RDBMS

The Role of Backups

- Data retention and deletion
- Legal requirements

GIS Data Life Cycle…Today



Questions/Discussion?

Presentation and Discussion

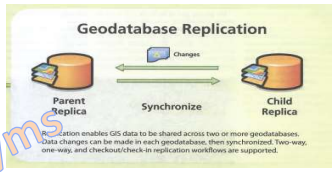
REPLICATION AND VERSIONING

What is Versioning

- A framework enabling multiple, simultaneous edits to a feature class in **high isolation** (i.e., other users in the enterprise cannot see your edits)
- It tracks changes to the feature class. It is not a copy of the feature class

What is Replication?

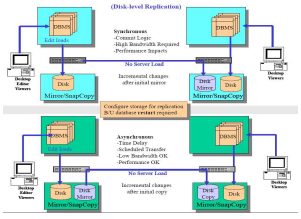
- Duplication
- Copying
- Mirroring



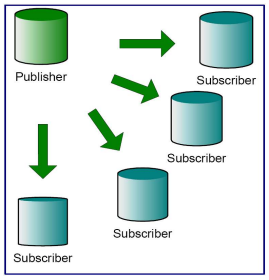
•Synonyms

True Replication…

- Does not need ArcGIS
- Every RDBMS can be replicated natively
- However, using ArcGIS to perform the replication
  - Is easy
  - Better supports GIS workflows



Why Replicate?



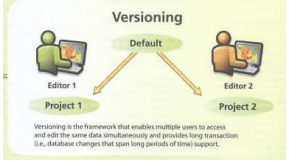
- Enable *disconnected* editing for:
  - Performance/load balancing
  - Network load reduction
  - Publishing data to subscribers

Network Load Reduction

- The **network is a primary bottleneck** in the Enterprise

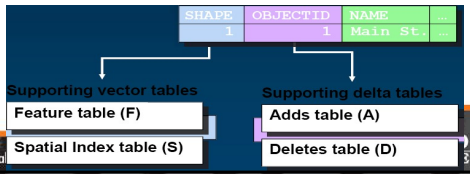
Focus on Versioning…

- One database
- `Parent` edition (tables) remains live/usable
- `Child` edition(s) simultaneously edited
- Roll-up is seamless



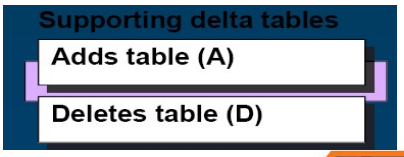
Versioning: Principal Concepts

- Edits are stored in “Supporting Tables”
- Geographic changes (linework) are stored in Supporting Vector Tables
- Attribute changes are stored in Supporting Delta Tables.



Delta Tables

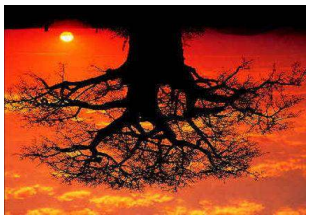
- A = Add (insert)
- D = Delete
- U = Update (delete existing then add)



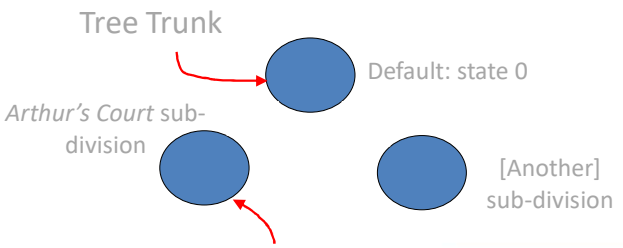
A Tree is Formed

- As versions are created and changes are made, a tree grows
  - Q: What kind of tree?
  - *A: A State Tree*

Sort of an Upside-down Tree



The State Tree



Multiple Versions

- Multiple versions are allowed
  - Versions can be based upon location (north edits, south edits), projects (sub-divisions), or other logic decided upon by the GIS Manager.
- Batch reconcile and post are supported

The Day of Reconciliation

- Arthur's Court sub-division edits have been completed
  - Time to **reconcile**
  - This process looks for conflicts
  - Once all conflicts have been resolved…
  - Reconciliation is complete

Post

- To roll-up the edits back to the "trunk of the state tree" we **Post**

Two Approaches to Versioning

- **Classic/traditional versioning** where the editor connects directly to the RDBMS and makes edits within the database
- **Branch versioning** where the editor connects via the web and makes edits through a feature services model (not directly connected to the RDBMS)

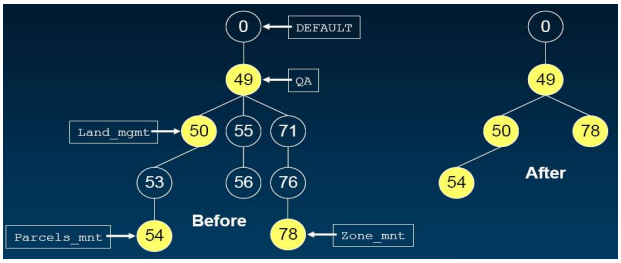
Under Traditional Versioning

- Performance can degrade with active databases
  - Workflow itself can generate unnecessary versions
  - Delta tables will become large over time
- Substantial role for the DB Admin and GIS Manager

The Cure

- For many of these ArcGIS-centric performance issues is *compressing the database*
  - Moves common rows from delta tables into base tables
  - Reduces depth of the state tree by removing states no longer needed

Compression Example



Under Branch Versioning….

- DB Admin role is nearly eliminated
  - Compression is not needed
- All versions are flat, `Parent-Child` relationships
- No “grand-child” versions
- You will learn Branch versioning

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Key Concepts

- Object-Relational databases enable GIS for the Enterprise
- The enterprise geodatabase centralizes data management
- Understand Enterprise workflow

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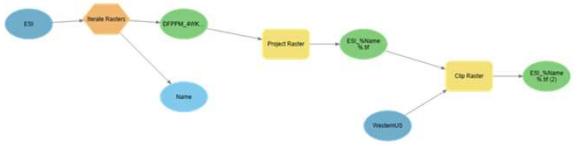
Professional Hints and Tips

- Work Smarter not Harder
  - Processing lots of files with Model Builder and File Iterator



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Questions/Discussion?

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