

Designing and using a Geodatabase



**Gudmundur Hafberg, Andy MacDonald,
Tom Brown,**

Twentieth Annual ESRI International User Conference • June 26-30, 2000



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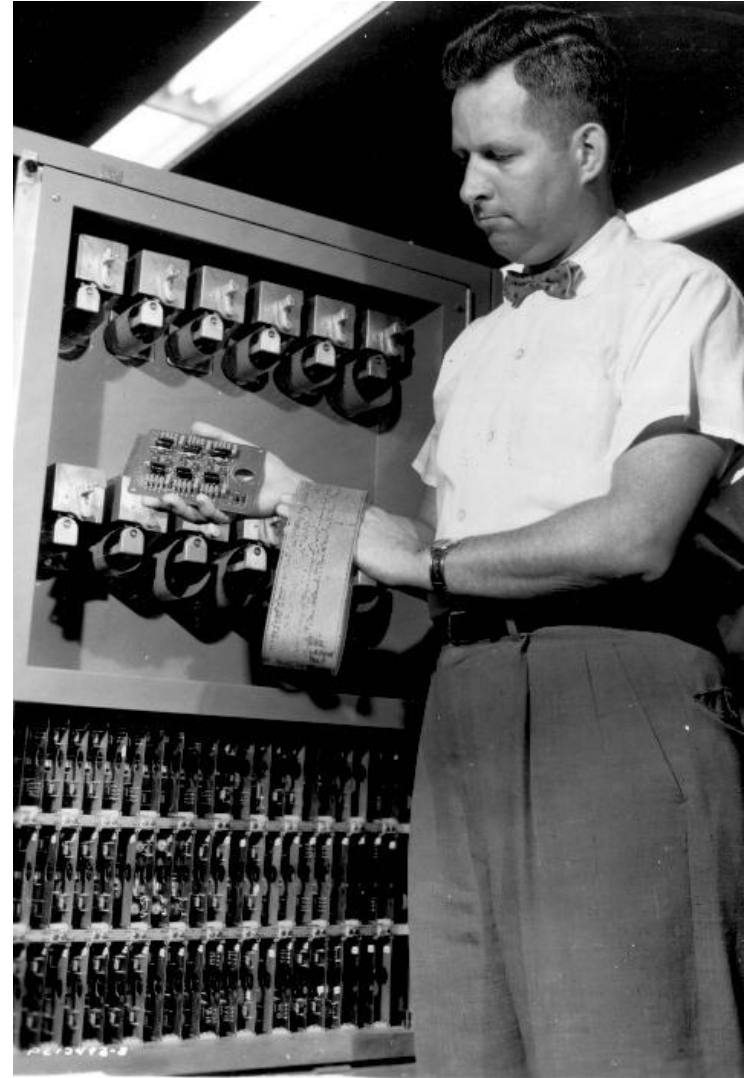
Goals

- **Understanding of:**
 - **Basic geodatabase data model design**
 - **The importance of a well tuned database**
 - **Data loading techniques**
 - **Effective use of ArcMap and ArcCatalog**
 - **Troubleshooting**



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Data model design



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Data model design

- **The geodatabase provides many powerful new concepts**
 - geometric networks
 - relationship classes
 - validation rules
- **Proper modeling is critical to good performance**



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Feature datasets

- **Container for feature classes**
 - shared spatial reference
- **Analogous to a coverage**
 - less restrictive
- **May also contain**
 - relationship classes
 - geometric networks



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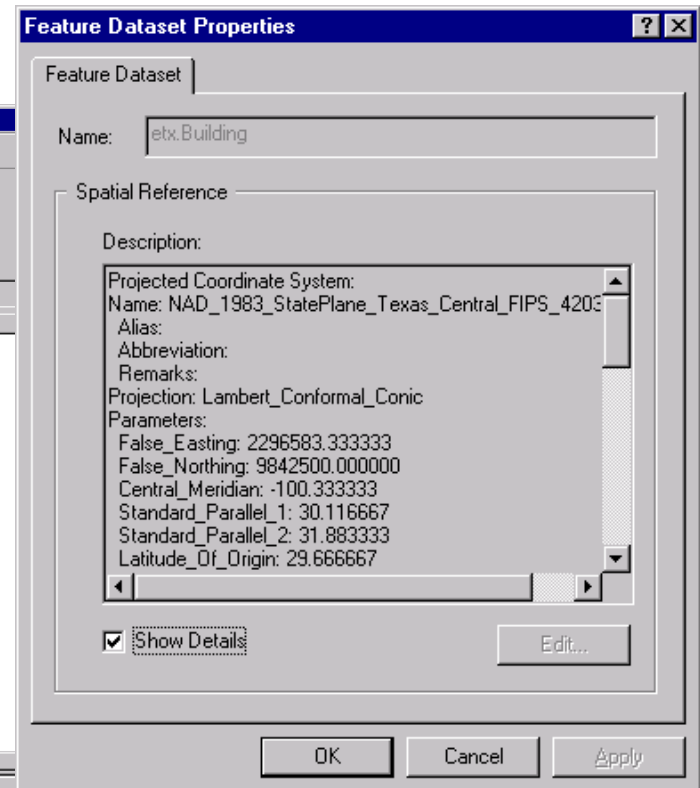
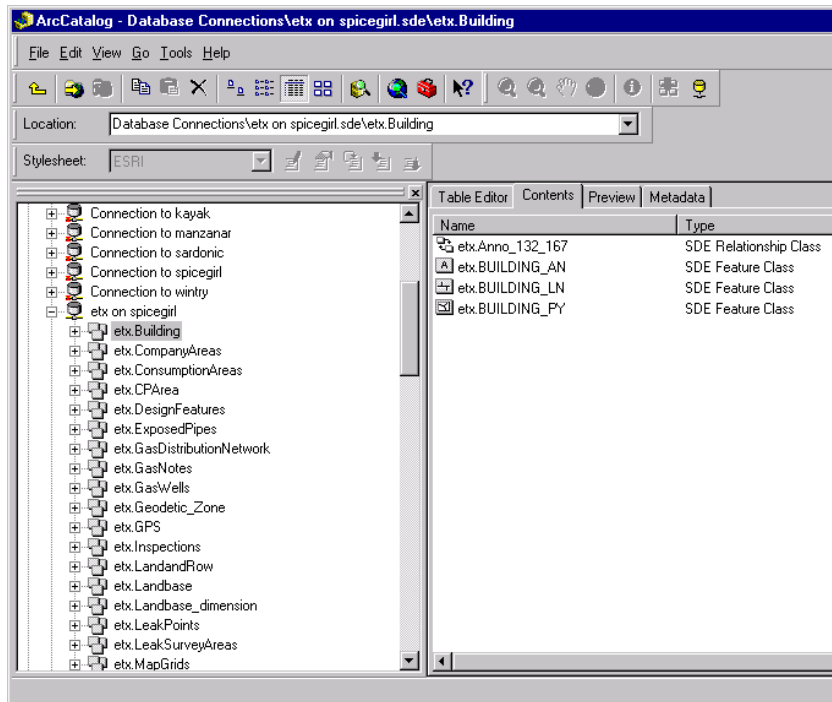
Feature datasets

- Scope for a spatial reference
- Scope for topology
- Opening a feature dataset containing lots of feature classes is slow the first time (ArcInfo 8.0.x)
 - opening a single feature class results in the feature dataset being opened
- **Don't overload feature datasets**
 - only group feature classes that you work with at the same time in a feature dataset



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Feature dataset



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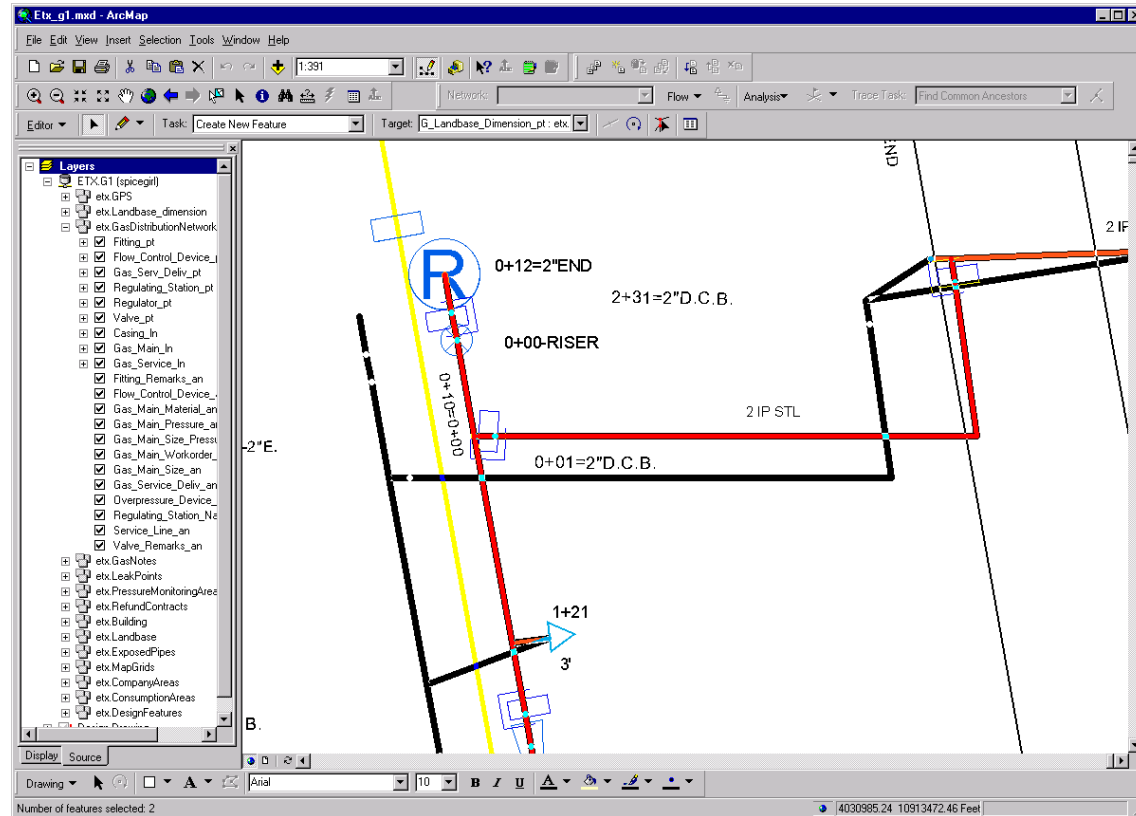
Geometric networks

- **Connectivity relationship between network feature classes**
- **Used to model network systems**
- **Network connectivity:**
 - based on geometric coincidence
 - always live
- **Feature classes in the same feature dataset**



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Network topology



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Geometric networks

- **Topology maintained on the fly**
 - connectivity based on geometric coincidence
 - when adding a new feature, all other feature classes are searched
- **Minimize the number of network feature classes**
 - utilize subtypes



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Subtypes

- **Different types of features or objects in an object class**
 - same attributes
 - same behavior
 - can have different validation rules
 - attribute domains
 - default values
 - connectivity rules
 - relationship rules
- **Defined by the subtype code field value**



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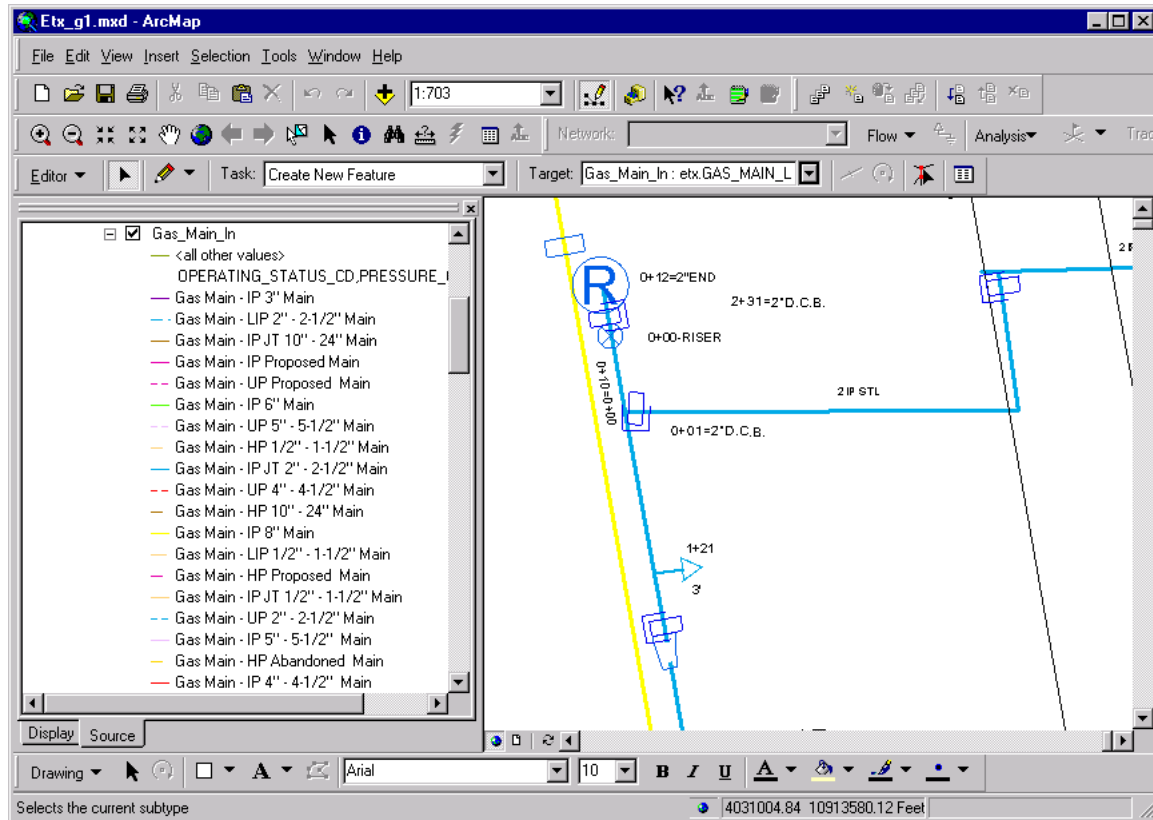
Subtypes

- **In a feature class which stores pipes**
 - steel pipes can be between 6 and 36 inches in diameter
 - concrete pipes can be between 24 and 240 inches in diameter
- **Steel and concrete are subtypes of the pipe feature class**
 - diameter attribute domain differs



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Subtypes



Geometric networks

- **When minimizing network feature classes**
 - *consider* fat classes
 - handle unpopulated attributes
 - *consider* denormalizing and subtyping
 - cache the necessary attributes
 - requires custom features



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Geometric networks

- **Subtyping caveats**
 - may require custom features
 - cannot snap to subtypes
 - cannot cloak fields
 - can be costly in certain circumstances (e.g. layer definition queries)



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Geometric networks

- When editing networks *always* use the Edit Cache
 - reduces the number of spatial queries against the server when discovering connectivity

(Edit cache stores select features in local memory – needs to be rebuilt when the AOI changes)



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Relationships

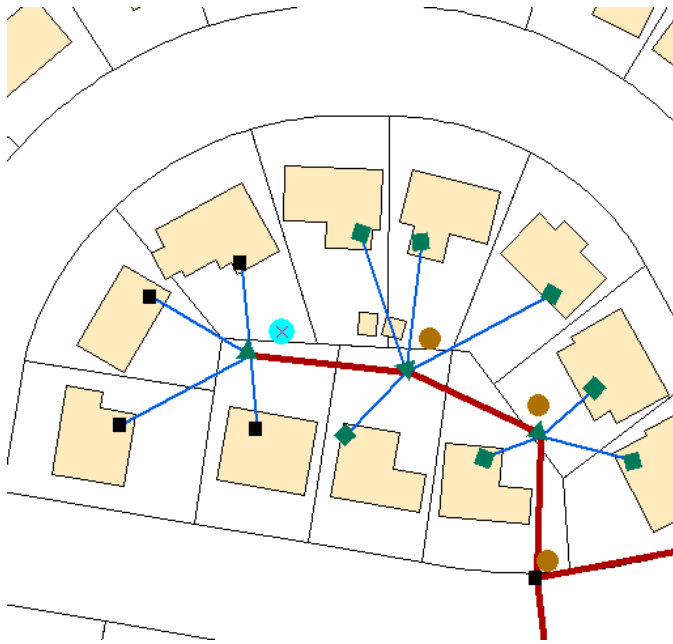
- **An association between objects**
 - feature to row, feature to feature...
- **Stored in a relationship class**
- **Related objects can message each other**
 - origin to destination, destination to origin, both, neither
 - can trigger behavior (cascade delete, move to follow, custom...)



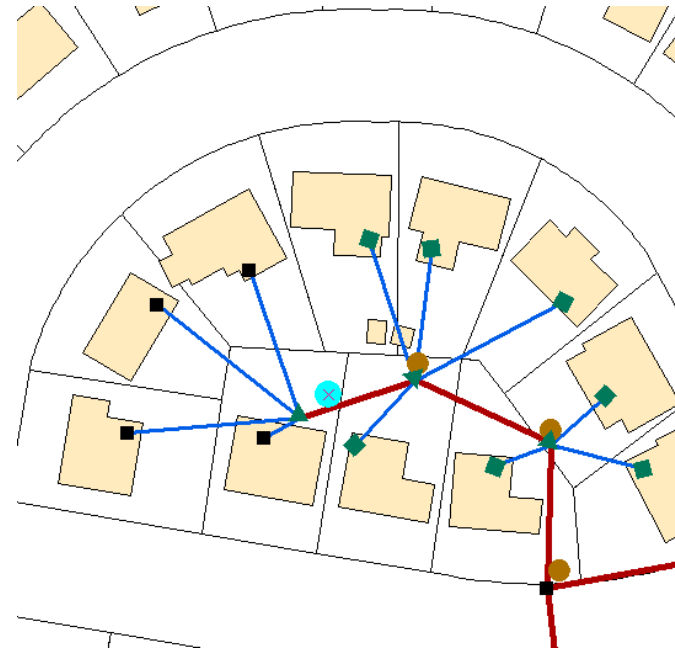
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Relationships

Composite relationship, Pole to Transformer



Select a pole and move it



...the transformer follows



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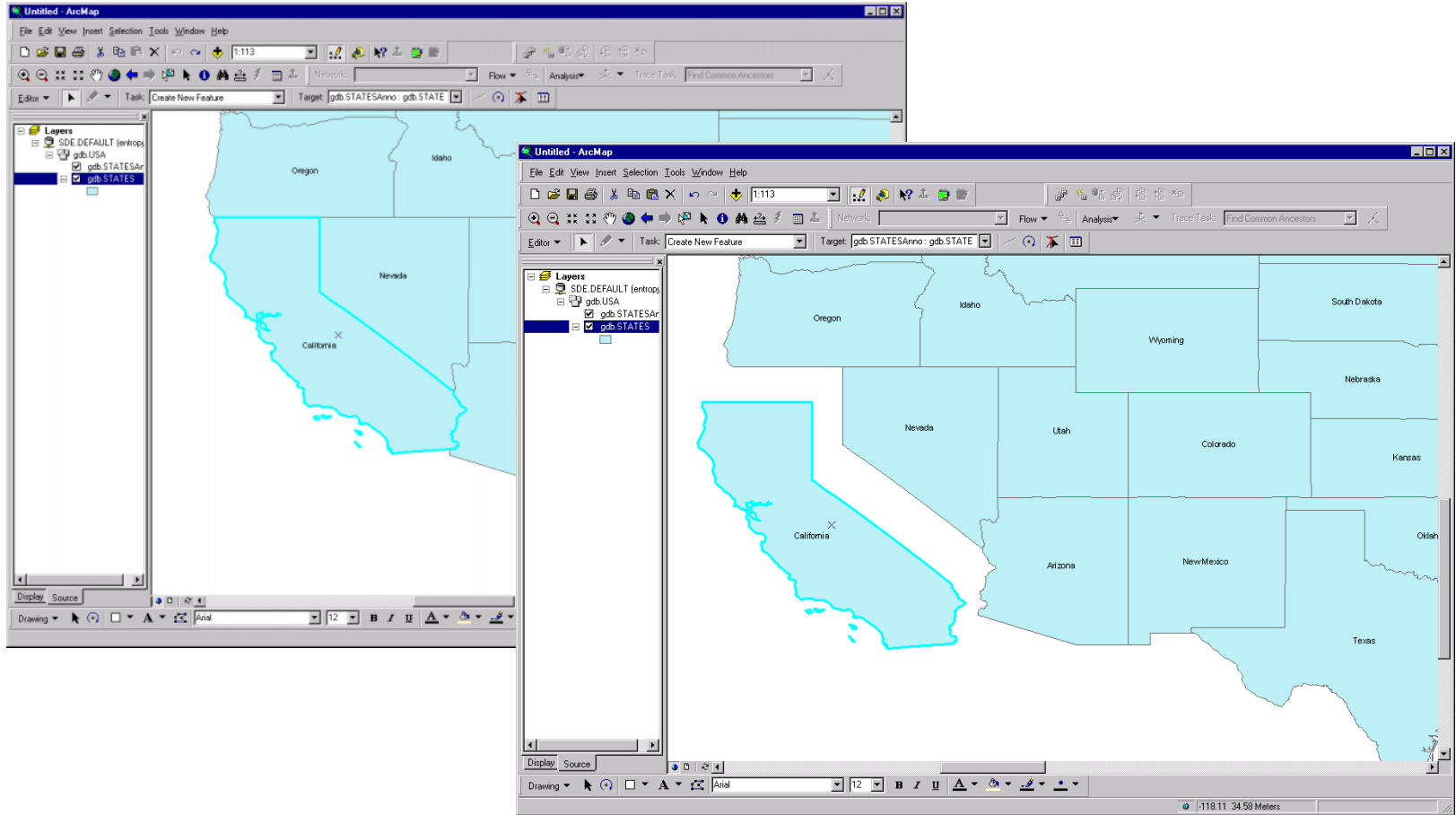
Relationship classes

- **Relationships link objects**
 - updates trigger notification
 - composites trigger behavior
 - navigation more expensive than INFO relates
- **Feature-linked annotation is maintained through composite relationships**



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F-linked annos (example)



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Relationship classes

- **Index primary and foreign keys**
- **Add all related classes to the map**
 - open/close cycle...
- **Try to symbolize based on attributes in the feature class (joins are expensive!)**
- **Update on the source class can trigger update on the target class (ex. F-linked annos)**



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Database tuning



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Tuning

- **Poorly tuned DBMS results in a poorly performing geodatabase**
- **Follow RDBMS and ArcSDE tuning guides**
 - **configure the RDBMS to reduce disk contention**
 - control, redo log and archive files
 - system and user tablespaces, etc

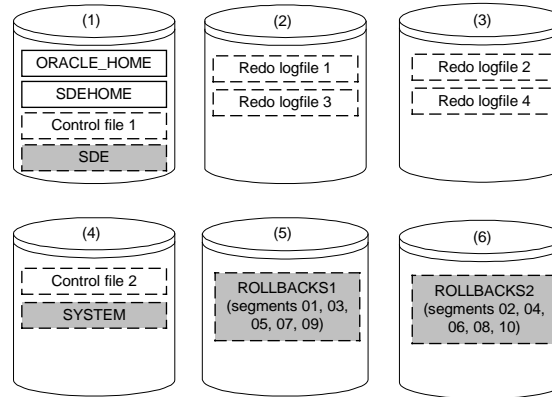


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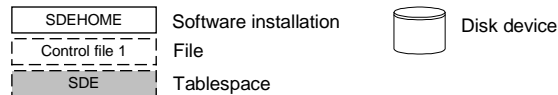
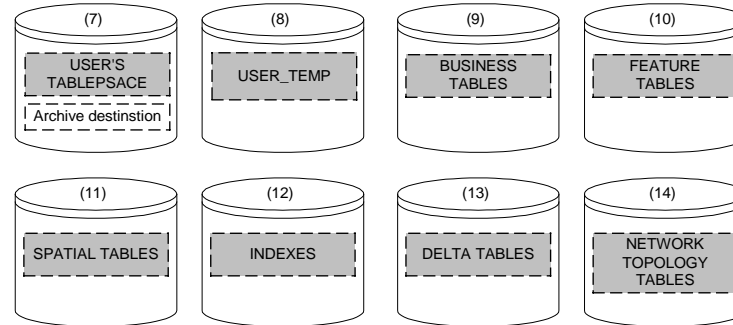
I/O

Database

System files



Application data



Tuning (cont)

- **Allocate “enough” memory on the server for your database**
- **Use servers with multiple CPU’s**
- **Physical network – there is a lot of client/server traffic ongoing → the throughput of the network is critical to the performance of the client application.**



Hardcore DBMS tuning

- **Sessions**

- *Tuning and configuring ArcSDE for Oracle SQL server and Informix*
- *Administering a multi-versioned ArcSDE database*



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Data loading



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Data loading

- Try to load all data
 - before building networks
 - before versioning the data
- Pre-process the data using SQL before versioning
 - simple attribute updates
 - linking imported coverage annotation



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Data loading

- If large data loads are required after the database is versioned
 - run compress to get new features into the base table



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Data loading – Strategy 1

- **Schema Generation Wizard to create empty geodatabase schema**
- **Delete any networks**
- **Simple Data Loader to load data into simple feature classes**
- **Build networks**
- **Reapply Schema Generation Wizard**
 - **connectivity rules and class extensions**
- **Register data as versioned**



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Data loading – Strategy 1

- **Advantages**
 - fast – no network connectivity
 - no versioning impact
- **Disadvantages**
 - custom creation behavior not executed
 - feature-linked annotation
 - generate after loading



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Data loading – Strategy 2

- **Schema Generation Wizard to create empty geodatabase schema**
- **Simple Data Loader to load data into simple feature classes**
- **Register data as versioned**
- **Object Loader to load data into network classes**
- **Run compress**



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Data loading – Strategy 2

- **Advantages**
 - executes all custom feature creation behavior
- **Disadvantages**
 - slow – impractical for large numbers of network features (no edit cache)
 - versioning (data in delta tables, requires compress)



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Loading annotation

- **Converting labels to annotation**
- **Converting coverage annotation**
- **Convert your annotation before versioning your data**
 - delta tables, compress
- **Convert your annotation before building networks**
 - feature snapping does not message annotation



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Pre-processing using SQL

- Do not update records in SQL after the data is versioned
- Do not modify attributes that trigger behavior in other objects
- **Never** update the following fields
 - OBJECTID
 - Enabled or AncillaryRole (logical network will not be updated)
 - Network weight fields



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Compressing your database

- **Performance can degrade over time as more edits are made to the database**
- **Compress will remove unreferenced database states and redundant rows**
 - improves performance
 - can only be run when no-one is working on the database



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Compressing your database

- **Compress should be run periodically throughout the lifetime of a database**
- **To get the most out of compress**
 - **For each outstanding version**
 - **reconcile and post against DEFAULT**
 - **delete the version**
 - **Run Compress**
 - **Recreate the versions as needed**



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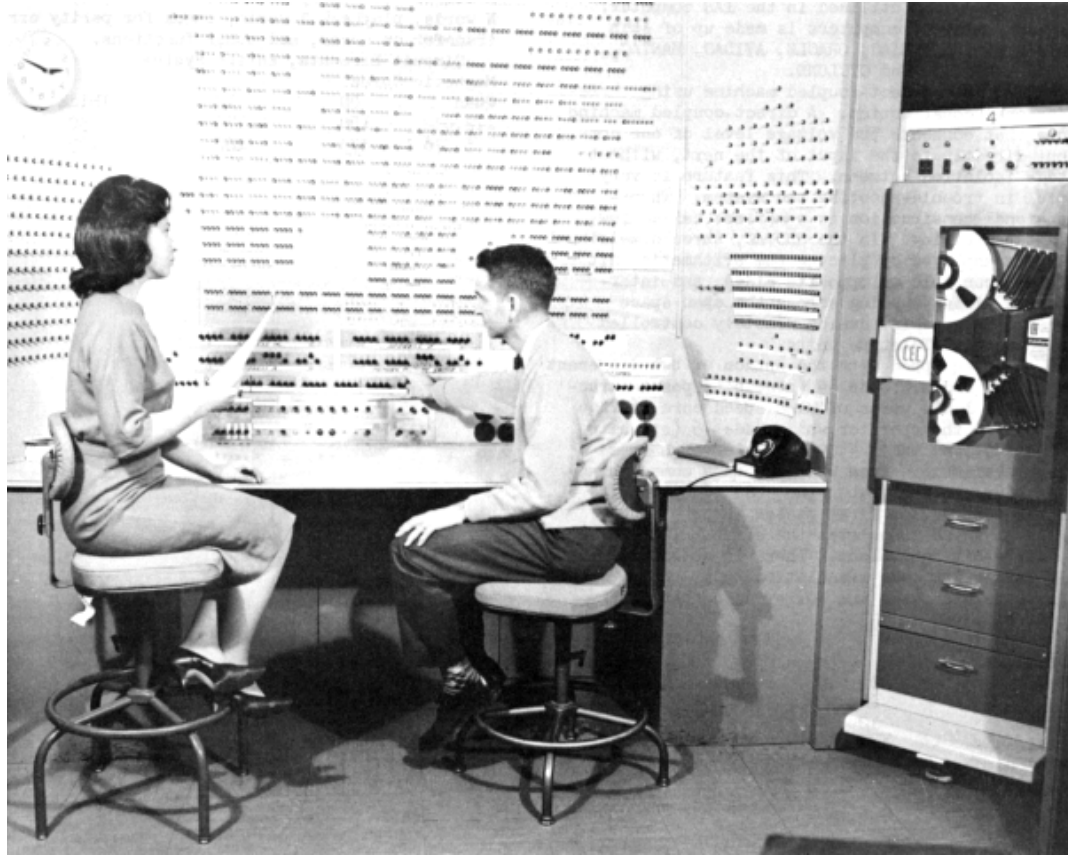
Compressing your database

- **Update database statistics after running compress**
 - `sdetable` administration command
 - OR
 - `ANALYZE <table> COMPUTE STATISTIC` (Oracle)
-
- **Update DBMS statistics periodically**



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Bulk appending data



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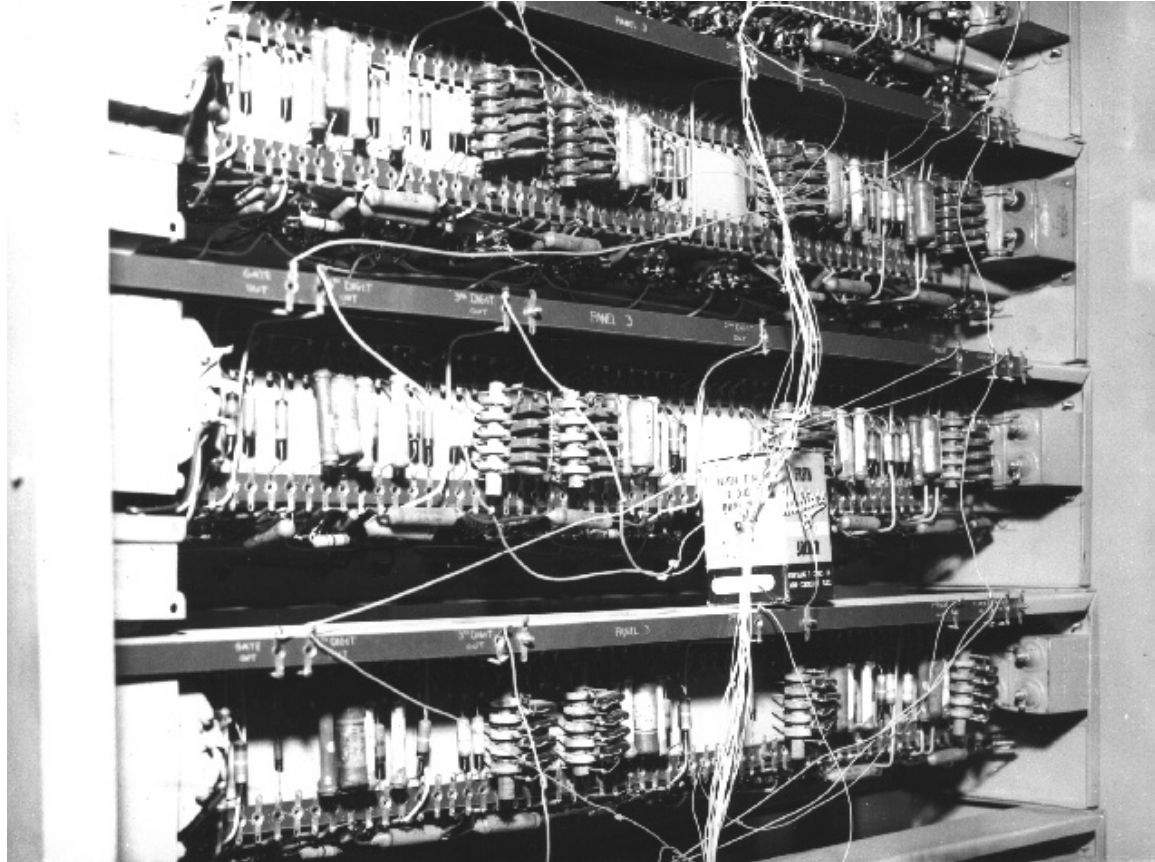
Bulk appending data

- **Standard approach**
 - use the Object Loader
 - run compress
- **This interactively builds network connectivity**
 - slow process
 - impractical for large numbers of network features (no edit cache)
- **All object behavior is executed**



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Hardcore bulk appending data



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Hardcore bulk appending data

- **Faster way to bulk append data**
 - heavy workflow impact
 - be careful!



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Hardcore bulk appending data

- Follow this sequence
 - reconcile and post all outstanding versions to **DEFAULT** and delete the versions
 - compress the database
 - unversion the data
 - drop the network
 - load the new data (Simple Data Loader)
 - rebuild the network, reapply Schema Wizard
 - register the data as versioned
 - recreate versions as required



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Hardcore bulk appending data

- **Limitations with this method**
 - can't handle complex junctions with custom connection points
 - disconnected network features will be re-connected
 - will not execute any object behavior (feature-linked annotation)



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Application tuning



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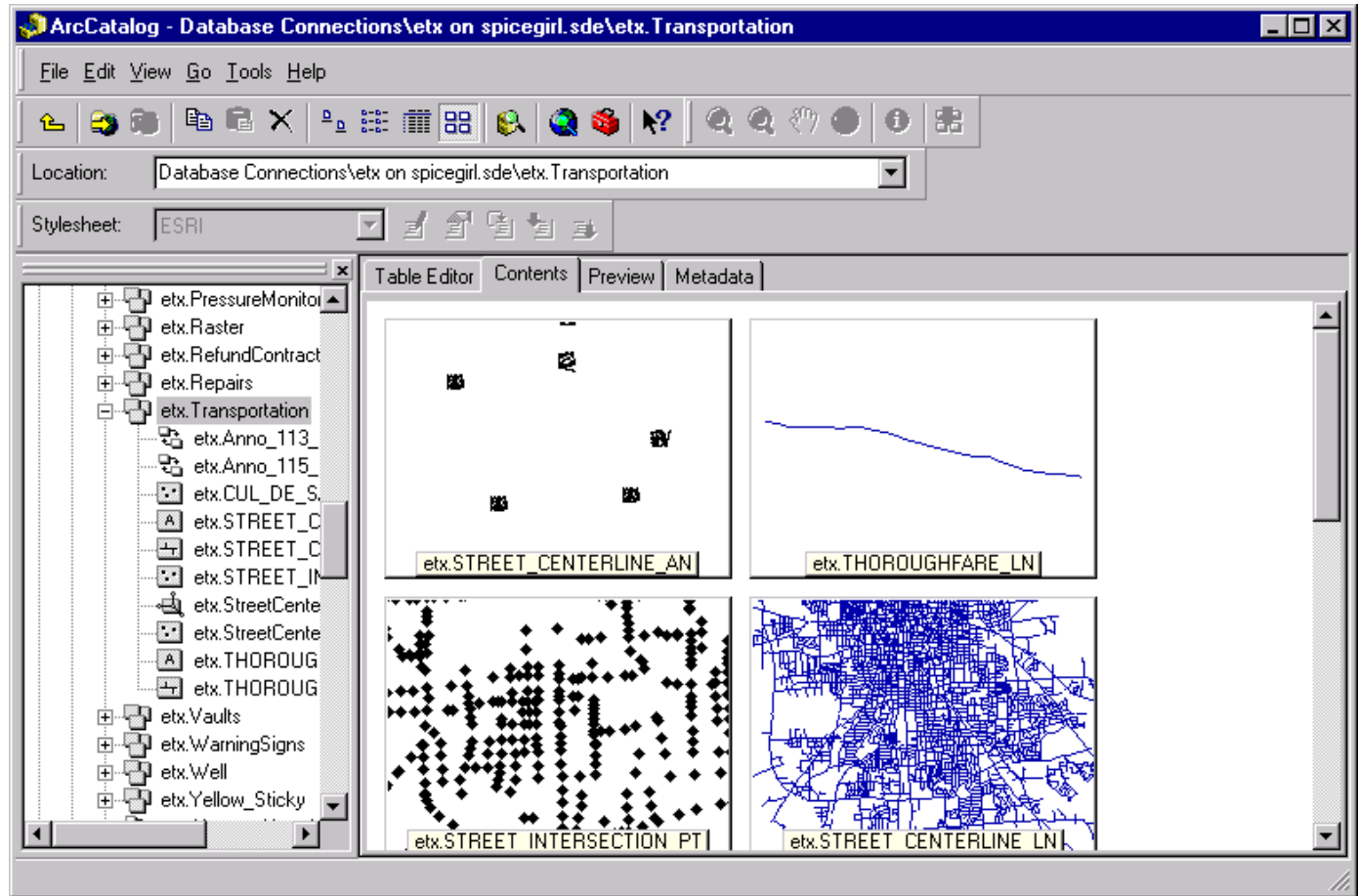
Application tuning

- There are dos and don'ts for the effective use of ArcCatalog and ArcMap
- ArcCatalog
 - create thumbnails for browsing the contents of your database
 - no need to open the feature class
 - prevents unnecessary data retrieval



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Thumbnails



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Application tuning

- **ArcMap**

- use scale suppression, especially with annotation
- always start with a zoomed in view
- create overview layers for browsing
- only include necessary classes in the map
- include all related classes
- simplify your symbology
- use the edit cache



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Application tuning

- Drawing annotation is expensive
 - use scale suppression
- Shared editing tools work on all classes in a feature dataset
 - include all classes in the map
- Related classes will be opened on demand
 - include related classes in the map



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Application tuning

- **Use the edit cache**
 - caches features on the client
 - makes network editing faster (reduces the number of spatial queries against the server)
 - caches editable features in the map extent
 - cleared when you stop editing
 - cache must be rebuilt after pan
 - user manages the edit cache



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Application tuning

- **Different database accounts for different users**
 - avoids contention writing to the selection log tables
 - edit cache caches only those feature which are being edited



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Troubleshooting



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Troubleshooting

Look for bottlenecks in your system to improve performance

- Application tuning
- Database design and indexing
 - Look for missing indexes, make sure you tables are analyzed
 - Avoid over-indexing
- Database tuning
 - **ArcSde performance=DBMS performance**



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Patch 8.0.2-10ds

- **Get the latest Arc8 patch (both ArcSde and ArcInfo fixes) – Patch 802-10ds for Oracle8i**
- **Available on ArcOnline**



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802-10ds

- ArcInfo Desktop:
- ArcMap:
- CQ00108637 - Expose Interface(s) required to convert Coverage Annotation to Geodatabase Annotation programmatically (ArcMap Anno)
- CQ00111000 - Annotation disappearing when moved (ArcMap Anno)
- CQ00111065 - Completely within query is SDE does not select all the features (ArcMap Selection)
- CQ00112805 - normal.mxt being overwritten (ArcMap App Framework)
- CQ00113734 - Need to be able to update annotation feature class extension properties (ArcMap Anno)
- CQ00115275 - 8.0.2 VQFE provide mechanism for changing the size of geodb annotation (ArcMap Anno) Geometry:
- CQ00109455 - ArcMap blows up if you only enter two points while tracking a polygon
- CQ00115707 - Rendering geometries with parametric curves (sde) crashes ArcMap GeoDatabase:
- CQ00112405 - weights not being copied over when merging changes
- CQ00112649 - Fix error chaining for Oracle errors in network building
- CQ00112782 - Undo not working for network weight fields
- CQ00113890 - conflict on a table that is not a FeatureClass, CConflictsDlg::FillList crashes
- CQ00115335 - IWorkspaceEdit::StopEditOperation failing under certain conditions
- CQ00116131 - Net builder not pushing weights for junction to the LN correctly
- CQ00116393 - Creating point feature with linked anno - anno not getting populated correctly Network DO:
- CQ00107769 - FindPath causes runtime error when CAD layer in map
- CQ00108521 - ResultEdges causes ArcMap to explode after use Versioning:
- CQ00109000 - map fatals when encountering an unique scenario of a delete/delete conflict
- ArcSDE:
- Oracle 8i:
- CQ00108631 - We need to bind all the variables in our version queries to improve the hit ratio (scalability issue)
- CQ00114287 - workaround for Oracle long raw bug TAR 1091134.999 (affects anno and network data) Server:
- CQ00105969 - Server hanging on occasion when making call to license executable
- CQ00111949 - Creating a new feature with f-linked annos on point f-classes does not populate the text attribute
- CQ00113178 - The spatial query for non-versioned gdb annotations fails
- CQ00115222 - Timeout error when connecting to SDE from ArcIMS and ArcMap
- CQ00115994 (CQ00116275 - CQ00116237) - the gsrvr crashes when programmatically setting the extent beyond the dataset extent Versioning:
- CQ00114289 - Throw an error when Oracle 1000 element for an IN function is reached. (the fix just prevents corruption due to an Oracle limitation). Performance:
- CQ00114290 - Improve difference query (reconcile performance)



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Further Info

- **ESRI ArcOnline**
 - www.esri.com/usersupport/arconline
- **ESRI white papers**
 - Multi-user GIS systems with ArcInfo 8
- **ArcInfo documentation**
 - ArcSDE 8 Tuning Guide
 - Building a Geodatabase
 - Modeling Our World



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UC 2K gdb/sde sessions

- **Tuning and configuring ArcSDE for Oracle, SQL server & Informix**
- **Migrating your data to the Geodatabase**
- **Working with a Versioned Geodatabase**
- **Administering a multi-versioned ArcSDE Geodatabase**
- **Geodatabase and Object Model design using CASE tools**
- **Managing and Editing Geometric networks**
- **Extending the Geodatabase with class extensions**
- **Extending the Geodatabase with custom objects**



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Technical Workshop Survey

- **Please fill out the Evaluation Form before you leave!**

