

# **SDE Migration Prototyping for Geometric Network Geodatabase based on Simplified Water Distribution Data Model**

March 2003

Compiled by the Office of Information Systems-Geographic Data Services  
Kansas Department of Health and Environment  
with conjunction with the following contracts  
Kansas GIS Policy Board Contract 2002-2101, "Public Water Supply Infrastructure";  
KCC MOA Docket 710002 & USDOT Assistance No: DTRS56-01-G-0022, "GIS Database  
Development and Mapping of Rural Water Infrastructure for Damage Prevention Program"

# SDE Migration Prototyping for Geometric Network Geodatabase based on Simplified Water Distribution Data Model

## 1.0 Background

In compliance with the following project objectives, system prototyping was conducted to migrate a geometric network geodatabase from a personal to enterprise relational database.

*USDOT Goal A: Establish an infrastructure and system to support geographic information system (GIS) database development by and for water systems in Kansas*

*USDOT Goal B: Supply consistent and timely utility information to the Kansas One-Call Program*

*USDOT Task 2: Define a data development standard that will help guide any data collection among public water supply systems*

*USDOT Task 5: Provide contract services for scanning and data development.*

*KCC Application Proposal to USDOT and MOA, Goal A: Improve the quality of underground utility infrastructure information available to the Kansas One Call Program*

*KCC Application Proposal to USDOT and MOA, Goal B: Establish a standard for future mapping of public water supply systems*

*KCC Proposal Amendment to USDOT, Work Detail 2: Define a data development standard that will help guide any data collection effort among water systems. Budget reserve for consultant support to define data standard and build menu interface to work with ESRI™ software product line.*

*KCC MOA Authorized Statement of Work 1: KDHE will continue to research data development procedures to manage water infrastructure data in a geometric network geodatabase. These activities will include refining the geodatabase model to include a preliminary set of object rules and will include researching data collection and data management procedures to support the geometric network*

## 2.0 Introduction

Early development and testing of the geometric network geodatabase, based on the Simplified Water Distribution Data Model (SWD), used a “personal” form of the geodatabase format. To support public water infrastructure data management over the long term, an enterprise version of the geodatabase needed to be established and tested. One of the most significant differences between a personal and an enterprise geodatabase is that the latter allows versioning, multi-user editing and reconciliation tools to consolidate version edits. The enterprise version of the geodatabase uses ESRI’s Spatial Data Engine™(SDE) in conjunction with a fully relational business database system, in this case, Oracle®. Tests were conducted for data migration, modification, reconciliation. Example scripts of the type of testing conducted with the enterprise geodatabase are included in Appendix A, Enterprise Geodatabase.

### SDE Migration Prototyping for Geometric Network Geodatabase based on Simplified Water distribution Data Model

KCC MOA Docket 710002 & USDOT Assistance No: DTRS56-01-G-0022, “GIS Database Development and Mapping of Rural Water Infrastructure for Damage Prevention Program  
Kansas GIS Policy Board Contract 2002-2101, “Public Water Supply Infrastructure”;

### 3.0 Geodatabase Migration

The ESRI ArcGIS™ software suite simplifies migration between personal and enterprise geodatabase formats. Rather than the painstaking procedures to migrate between systems experienced by so many business database administrators, the spatial management module, ArcGIS-ArcCatalog™, simplifies the task significantly. ArcCatalog™ acts similar to a Windows® File Explorer window, but ArcCatalog™ handles spatial data formats. The advantage of this is that ArcCatalog™ will move the entire set of files comprising a spatial dataset as a single entity. This single function is a major administration aid for maintaining dataset integrity.

The procedure to migrate a geometric network geodatabase between a personal and enterprise database system begins with establishing an enterprise spatial database connection using ArcCatalog™.

This process entails stepping through a menu identifying the server, service, and user account, see Figure 1.

Once established, the folder schema of that data server appears in the application screen. The contents of the folders can be viewed and, where stored, spatial datasets are listed and represented by special icons

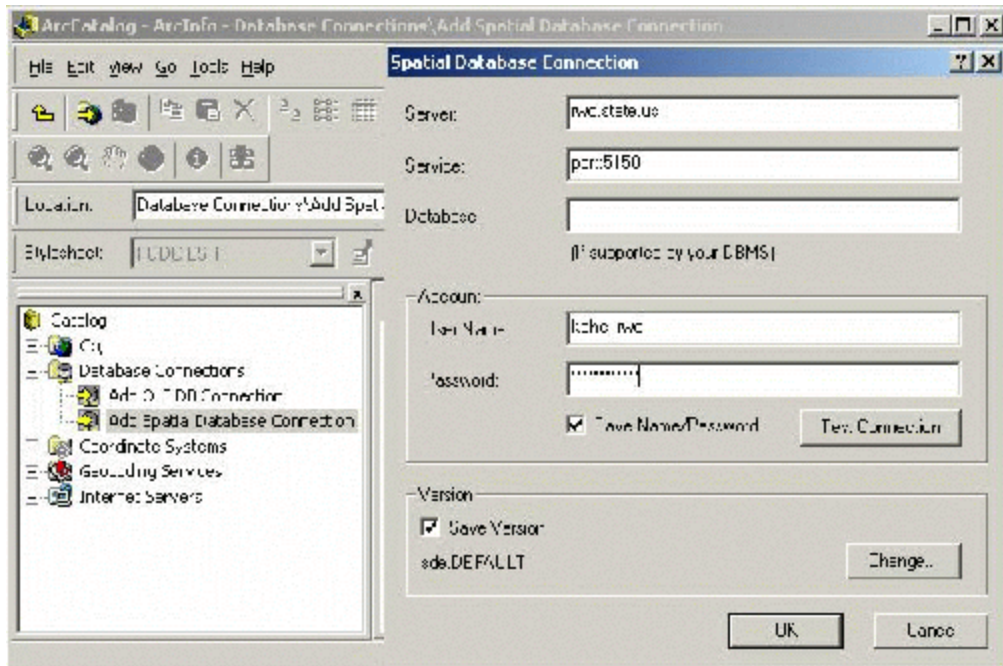


Figure 1. Establishing a data connection to SDE™ server

depicting the particular format of the dataset. The spatial database administrator(SDBA) navigates to the local folder containing the personal geodatabase. With the personal geodatabase selected, the SDBA opens a context menu and selects the copy option. The SDBA then navigates to an enterprise database folder on the remote server. Again, the SDBA opens a context menu and select the paste option, see Figure 2. This simple “cut and paste” operations moves all of the geodatabase table schema, all of the subtype and attribute domains, all of the spatial features, and all of the geometric rules. See report, “Simplified Water Distribution Data Model, Version 1.0,” to view geodatabase format elements, such as feature types, domains, and rules, to better appreciate the advantages that ArcCatalog gives the SDBA.

#### SDE Migration Prototyping for Geometric Network Geodatabase based on Simplified Water distribution Data Model

KCC MOA Docket 710002 & USDOT Assistance No: DTRS56-01-G-0022, “GIS Database Development and Mapping of Rural Water Infrastructure for Damage Prevention Program  
Kansas GIS Policy Board Contract 2002-2101, “Public Water Supply Infrastructure”;

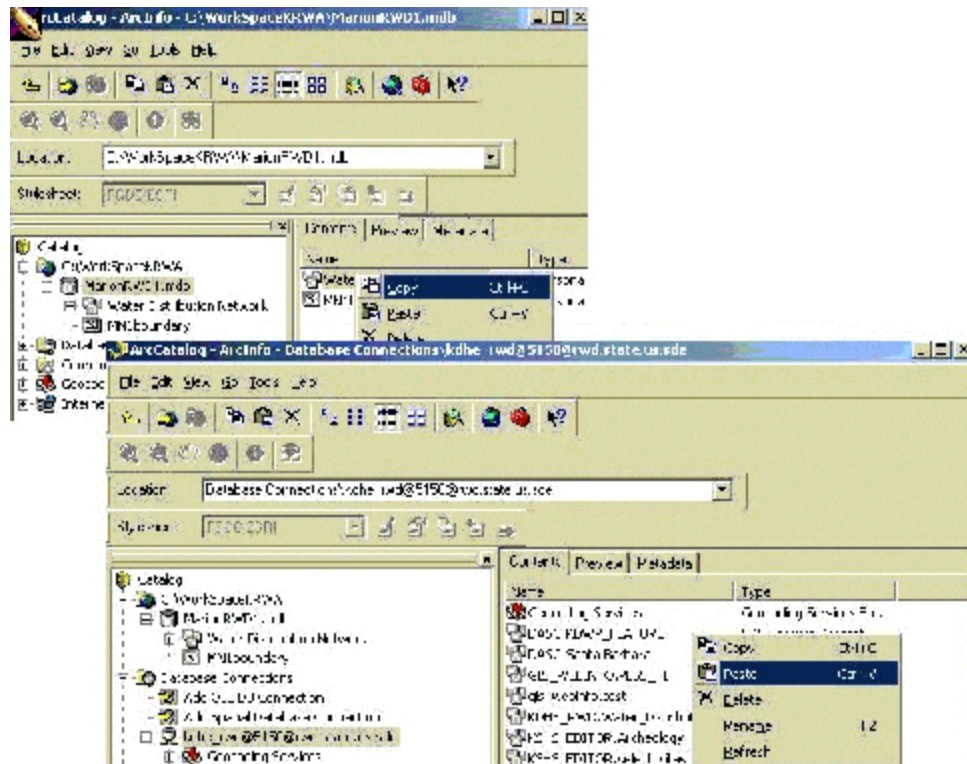


Figure 2. Personal to Enterprise Migration Operations

#### 4.0 Geodatabase Modification

Once the write operations are complete, the geodatabase, by default, is a read-only dataset. In order to make the geodatabase editable, the dataset must be registered as “versioned”. This procedure is completed by the database owner or SDBA by opening the context window associated with the geodatabase feature class and selecting the option, “Register as Versioned.” The versioned geodatabase is subsequently managed through a “Version Manager”. Available operations include Create, Change, Reconcile, Post, Conflicts, Refresh. The Create option makes a copy (child) of the original (parent) versioned geodatabase. The Reconcile and Post options initiate bulk edit operations merging edits recorded in a child version with either a parent or with another child. The Conflict Resolution dialog is used by the SDBA, quality-assurance manager or an authorized user to resolve edit conflicts.

Editing a versioned geodatabase requires a license of ArcGIS ArcEditor™ or ArcInfo™. All edit functions and edit environment constraints that are used to maintain a personal geodatabase are also available for an enterprise geodatabase. The following series of edit functions were successfully tested in the enterprise geometric network geodatabase:

- “Create New Feature” add new point or line to geodatabase
- “Select Features Using a Line” use line graphic or feature to select other objects
- “Select Features Using an Area” use area graphic or feature to select other objects
- “Extend/Trim Features” extend or trim a line feature

#### SDE Migration Prototyping for Geometric Network Geodatabase based on Simplified Water distribution Data Model

KCC MOA Docket 710002 & USDOT Assistance No: DTRS56-01-G-0022, “GIS Database Development and Mapping of Rural Water Infrastructure for Damage Prevention Program  
 Kansas GIS Policy Board Contract 2002-2101, “Public Water Supply Infrastructure”;

“**Mirror Features**” replicate and mirror selected features

“**Modify Feature**” interactively modify features by Moving, Deleting, Adding vertices or nodes on linear feature or moving, deleting, adding points in a point feature class

“**Reshape Feature**” altering a portion of the polygon or line

An important aspect of “Extend/Trim Features”, “Reshape Feature”, and “Modify Feature” with a geometric network geodatabase is that related objects are altered as a single entity. For example, if a meter related to a service line is moved, the service line will be repositioned at the same time that the meter is moved. Likewise if a meter is deleted, the service line leading up to the meter is also deleted. This relationship, found in the geometric network geodatabase, help to maintain the integrity of the water system network, minimizes orphaned network features, and reduces SDBA data management.

## 5.0 Geodatabase Reconciliation

As a versioned geodatabase, multiple edit sessions may be open on any of the geodatabase feature classes. This policy enables multiple users to access and edit the same features on the same version. Likewise, users may record the same edit on two separate versions. In either case, the possibility of a duplicate edit is created. These edit conflicts are most frequently reconciled by a SDBA or quality assurance manager through an edit session in ArcMap™. To reconcile, the “Versioning” toolbar is activated. From the toolbar, the “Reconcile” option is selected, opening a menu to identify a version file that is ready for reconciliation. As mentioned previously, the reconciliation process is a bulk editing operation, most often merging changes from a child back to a parent version.. The following table (excerpted from ESRI’s “Introduction to ArcSDE™, Lectures, March 2003”) documents how the changes in a child version (RECONCILE) are merged with the records of the second child version (EDIT).

Features in EDIT version that are:	Features in RECONCILE version that are:	Editing operation in the EDIT version:
Not Changed	Not Changed	No Action
Not Changed	Updated	Updated in Edit Version
Not Changed	Deleted	Deleted from Edit Version
Absent	Inserted	Inserted into Edit Version
Updated	Not Changed	No Action
Updated	Deleted	Conflict Resolution
Updated	Updated	Conflict Resolution
Deleted	Updated	Conflict Resolution

### SDE Migration Prototyping for Geometric Network Geodatabase based on Simplified Water distribution Data Model

KCC MOA Docket 710002 & USDOT Assistance No: DTRS56-01-G-0022, “GIS Database Development and Mapping of Rural Water Infrastructure for Damage Prevention Program  
Kansas GIS Policy Board Contract 2002-2101, “Public Water Supply Infrastructure”;

Deleted	Deleted	No Action
Inserted	Absent	No Action

In the reconciliation tests conducted in this study, two (2) users, entering changes from different machines accessing the same enterprise geodatabase version, tested the following edit procedures. With joint editing, as tested here, a group of users can see edits made by other group members. In this instance, user 1 reshapes a line feature and saves his edits. User 2 sees that feature edit when the edit session is “Refreshed”. In the next scenario, two users edit the same feature. Both users are allowed to select and modify the feature. However, user 1 saved his edits before user 2. When user 2 attempts to save, a notice appears indicating the presence of an edit conflict. Based on the permissions granted by the SDBA, either user 2 or a quality assurance manager will review the two modifications and commit the more appropriate choice to the geodatabase version. In this case, user 2 was granted permission to review and resolve the conflict. The Conflict Resolution dialog listing the Pre-Edit Version (original record), the Edit Version (user 1 edits), and Conflict Version ( user 2 edits), see Figure 3. User 2 checks the spatial edits using the Display window of the application

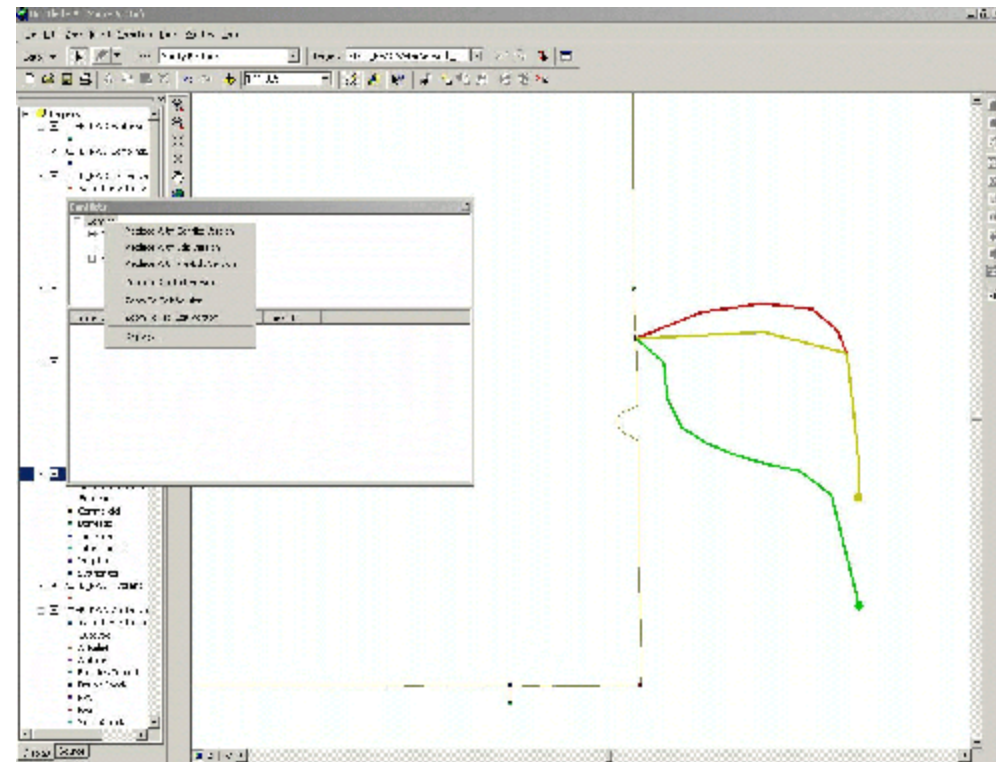


Figure 3. Conflict resolution dialog

and the attribute edits using the Conflict form. After reviewing, user 2 opens the context window associated with the modified feature with a right-click and chooses a replacement option, “replace with conflict, ...with edit, or ...with pre-edit version”.

**SDE Migration Prototyping for Geometric Network Geodatabase based on Simplified Water distribution Data Model**

KCC MOA Docket 710002 & USDOT Assistance No: DTRS56-01-G-0022, “GIS Database Development and Mapping of Rural Water Infrastructure for Damage Prevention Program  
 Kansas GIS Policy Board Contract 2002-2101, “Public Water Supply Infrastructure”;

## 6.0 Enterprise ArcSDE™ Advantages

The enterprise ArcSDE™ environment, offers four significant advantages to the SDBA:

- 1) The job of managing long transactions is aided using versions. Logical units of work, such as a water system repair or a series of expansion designs, can be grouped in a version or set of versions. Multiple users can be assigned varying levels of access on any given version or versions, expediting group participation or isolating individual contributions.
- 2) Versioning eases the burden and necessity of historical tracking. After being created, a historical version is set aside as a static representation of the geodatabase, included in the regular backup routines, and is available for retrieval if needed.
- 3) Using versions, changes to the geodatabase can be modeled, the modifications tested, and the versions deleted or archived without impacting regular processing or creating numerous copies.
- 4) Versions are effective tools to manage workflow, spawning versions for each phase and archiving as-builts as work is completed.

### **SDE Migration Prototyping for Geometric Network Geodatabase based on Simplified Water distribution Data Model**

KCC MOA Docket 710002 & USDOT Assistance No: DTRS56-01-G-0022, "GIS Database Development and Mapping of Rural Water Infrastructure for Damage Prevention Program  
Kansas GIS Policy Board Contract 2002-2101, "Public Water Supply Infrastructure";

## Appendix A

# Enterprise Geodatabase

### Loading Data into Enterprise Geodatabase:

- Steps for loading the **complex feature dataset**, i.e. geometric network, stored in a personal geodatabase into ArcSDE/Oracle:
  - 1. Copy the desired feature dataset in ArcCatalog and paste into the Oracle instance.
  - 2. Register ArcSDE feature dataset (Enterprise Geodatabase) as versioned.

### Editing of Data in Enterprise Geodatabase:

- Editing data in the Enterprise Geodatabase requires the use of ArcGis ArcEditor or ArcInfo. All functionalities available for personal gdb editing are available for editing in the enterprise gdb. Rules that were created in the personal gdb are in place and usable. Tasks that were tested and worked were: **Create New Feature** (Add new point or line to gdb), **Select Features Using a Line** (Graphic selection tool), **Select Features Using an Area** (Graphic selection tool), **Extend/Trim Features** (Extends or trims a linear feature while maintaining connectivity with network features), **Mirror Features** (Mirrors the selected features), **Modify Feature** (Interactively modify features by moving, deleting, adding vertices or nodes on linear feature or moving points in a point feature class), **Reshape Feature** (Allows for reshaping linear features using graphic tools).

### Multi-user Editing of Data in Enterprise Geodatabase:

- Editing data in the Enterprise Geodatabase requires the use of ArcGis ArcEditor or ArcInfo. All functionalities available for personal gdb editing are available for editing in the enterprise gdb. Rules that were created in the personal gdb are in place and usable.
- This test involved 2 users on different machines editing the same enterprise gdb. If each user created new features and saved them, the new features showed on the others data view when it was refreshed. If each user edited the same feature, one of them saved prior to the other saving, the one who saved last will receive a message that a conflict occurred when saving the edited feature. The user then must decide which edit is correct and select the other users edit, his/her edits, or the original. This process can be set up to go to a QC person to review each edit and make the decision.

#### **SDE Migration Prototyping for Geometric Network Geodatabase based on Simplified Water distribution Data Model**

KCC MOA Docket 710002 & USDOT Assistance No: DTRS56-01-G-0022, "GIS Database Development and Mapping of Rural Water Infrastructure for Damage Prevention Program  
Kansas GIS Policy Board Contract 2002-2101, "Public Water Supply Infrastructure";