Understanding ArcSDE
The Gateway to Your RDBMS

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Outline

- Overview
- ArcSDE in the System Architecture
- Variations of ArcSDE
- Spatial Data Model
- The Geodatabase
- Data Loading Options
- Implementation
- Q&A and Questionnaire
What is ArcSDE?

• A **gateway** that allows you to store and manage spatial data with other business data in an **RDBMS**.
Why Use ArcSDE?

- Powerful benefits from Relational Database Management Systems (RDBMS)
  - Leverage scalable architecture
- Integrated data model
  - Store GIS and tabular data together
  - Coordinated transactions
- Multi-user Geodatabase technology
  - Take advantage of feature intelligence
Why Use ArcSDE? (con’t)

- Centralized database
  - Facilitates data sharing
- Support for Windows and Unix
  - Client and server
- Industry Standards
  - Conforms to Open GIS Feature Specifications
  - Has open, documented architecture and APIs
- Modern networking solution
  - Uses TCP/IP protocol
ArcSDE in the System Architecture
ArcSDE Architecture

ArcSDE

Custom Apps

ArcExplorer™

ArcView

ARC/INFO

ArcIMS

MapObjects

Cad Client

2- & 3-tier client/server solutions

Your Database Solution
What does ArcSDE do?

- Supports spatial and non-spatial queries from clients
- Interacts with RDBMS server for data storage and retrieval
- Performs GIS operations on data
ArcSDE Operations

“Work with my RDBMS to store and retrieve data.”
“Fetch features for this map window and use this attribute constraint”
“Fetch features and project them on the fly.”
“Process this Geocoding Request”
ArcSDE In Client/Server Architecture

- a server-side application data server in a 3-tier system architecture
- an application-side software component in a 2-tier system architecture
ArcSDE 3-tier Client/Server Architecture

ArcSDE server is an application server for GIS clients.
ArcSDE 2-tier Client/Server Architecture

Client Application

ArcSDE Component

TCP/IP Network

RDBMS

Client uses ArcSDE component for direct access to RDBMS. RDBMS client is required.
Direct Access Example: Oracle Spatial Option

Clients enabled with ArcSDE 8.1, RDBMS Client Installed

Oracle

ArcExplorer™
ArcView
ARC/INFO
ArcIMS
MapObjects
Cad Client

Custom Apps

Other Vendor Apps
Configuration Choices

- **3-tier** (ArcSDE Server Process)
  - Minimizes network traffic with server-side data filtering, performance can be faster
Configuration Choices

• **2-tier** (Client direct to RDBMS)
  - No need for ArcSDE server management
  - Simpler client configuration
  - Available for all clients built with ArcSDE 8.1 client software
  - Supported in 8.1 with Oracle 8i and SQL Server 7, later version of ArcSDE will support Informix and DB2
Client Access

- ArcExplorer
- ArcView
- ARC/INFO
- ArcIMS
- MapObjects
- Custom Apps
- C or Java APIs
- See MO
- DB Access & Avenue
- ArcObjects/COM API
- XML w/ dlls
- Enhanced objects
- Extension to Microstation & AutoCAD
Creating a Connection to ArcSDE
ArcSDE and The RDBMS
ArcSDE Support for RDBMS’s

- Oracle
- SQL Server
- Informix
- IBM DB2
ArcSDE Leverages RDBMS

- Integrated data model (spatial and tabular data together)
- Scalable, robust system architecture
- Multi-user access
- Backup and Security
- Performance tuning
- Additional RDBMS functionality, i.e. replication, fail-over, etc
What if you don’t have an RDBMS?

ArcSDE for Coverages
Why Use ArcSDE for Coverages?

- TCP/IP access (no need for NFS)
- Client access is extended to all ESRI data formats
  - ex: ArcMap access to ArcStorm layers
- Applications developed now can be re-used* when migrating to ArcSDE for RDBMS
  *SQL and INFO syntax will be different.
ArcSDE Data Model
Integrated Data Model

A layer (feature class) is a collection of tables

**Visible to User**

<table>
<thead>
<tr>
<th>ID</th>
<th>Address</th>
</tr>
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<tbody>
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**Not Visible to User**

Feature table

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<thead>
<tr>
<th>ID</th>
<th>Geometry</th>
<th>Creation date</th>
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<td></td>
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<td>102</td>
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</tbody>
</table>

* Spatial Indexing

<table>
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<tr>
<td>102</td>
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</tbody>
</table>

ArcSDE Users can spatially enable their business data.
Spatial Indexing

- Spatial indexes are an essential construct to support efficient spatial data queries.

Spatial indexing example used with ArcSDE binary data type in Oracle and SQL Server.
ArcSDE Feature Types

<table>
<thead>
<tr>
<th>Feature Type</th>
<th>Single Part</th>
<th>Multi-Part</th>
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<tbody>
<tr>
<td>Point</td>
<td><img src="image" alt="Point Single Part" /></td>
<td><img src="image" alt="Point Multi-Part" /></td>
</tr>
<tr>
<td>Line</td>
<td><img src="image" alt="Line Single Part" /></td>
<td><img src="image" alt="Line Multi-Part" /></td>
</tr>
<tr>
<td>Area</td>
<td><img src="image" alt="Area Single Part" /></td>
<td><img src="image" alt="Area Multi-Part" /></td>
</tr>
<tr>
<td>Annotation</td>
<td><img src="image" alt="Annotation Single Part" /></td>
<td><img src="image" alt="Annotation Multi-Part" /></td>
</tr>
</tbody>
</table>
ArcSDE Feature Attributes

- 2D or 3D features and Measures

2D
- (x,y)
- (x,y,z)
- (x,y,m)

3D
- (x,y,z)
- (x,y,z,m)
- (x,y,z,m)

2D with Measure
- (x,y,m)

3D with Measure
- (x,y,z,m)
ArcSDE CAD Client

- Data is shared between GIS and CAD users
- Data maintained in single environment
- Supports both AutoCAD and MicroStation
ArcSDE and Addresses

• User defines a geocoding service

• Address data (site and range) are stored in the RDBMS
  - Can use proprietary or StreetMap data

• ArcSDE processes geocoding requests
ArcSDE Raster Layers

... are just like other ArcSDE feature classes

- Virtually all formats can be imported (40+)
- Raster pyramid layers supported
ArcSDE 8.0 and the Geodatabase

Introducing Intelligent Features…
ArcSDE and the Geodatabase

The Geodatabase is an object-relational data model whose purpose is to allow storage of intelligent features and enhanced editing functionality.

Intelligent features can have properties, behaviors, and relationships with other features.
Geodatabase Access

- Geodatabase
  - Geodatabase Metadata Tables
    - “Intelligence”
  - ArcSDE Metadata Tables
  - Simple Feature Layers

Intelligent Features

Simple Features

ArcGIS Applications
- ArcMap
- ArcCatalog
- ArcToolbox
- ArcView 8.1

Custom Applications
- ArcIMS
- ArcView3.x
- MapObjects
- CAD Client
- Workstation ArcInfo
- Custom Applications
Why use a Geodatabase with ArcInfo 8?

More intelligent data means less application development.
Attribute Domains
Object Display Behavior

More Control Over How Features are Drawn

Behavior is...
Annotation displayed along a straight section of contour

Behavior is...
Multiple coincident wires depicted as a set of parallel lines with standard offset
Network Relationships

Select Pole and Move

All connected features follow
Long Transactions…

- Are database changes that are not immediately committed
- Are supported by versions in the database; version management is carried out by ArcSDE
Versions...

are multiple logical representations of data

contain only changes

are required for geodatabase editing
Getting Data into the Geodatabase
Data Loading Options

- **Simple Feature Layers**
  - Command line loading utilities
    - shp2sde, cov2sde, tbl2sde, ...
  - Workstation ArcInfo LAYERIMPORT
  - Microstation/AutoCAD with CAD Client
  - Custom application using API

- **Geodatabase Feature Classes**
  - ArcCatalog and ArcToolbox
    - Can register simple feature layers as feature classes
    - GUI for importing various data formats
Data Loading with ArcCatalog
# Geometry Storage Options

<table>
<thead>
<tr>
<th>RDBMS</th>
<th>Geometry</th>
<th>Column Type</th>
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</thead>
<tbody>
<tr>
<td>Oracle</td>
<td>ArcSDE Compressed Binary</td>
<td>Long Raw, LOB</td>
</tr>
<tr>
<td></td>
<td>* Spatial Cartridge Normalized schema</td>
<td>Number</td>
</tr>
<tr>
<td></td>
<td>* Oracle8i Spatial Object</td>
<td>SDO_Geometry</td>
</tr>
<tr>
<td>SQL Server</td>
<td>ArcSDE Compressed Binary</td>
<td>Image</td>
</tr>
<tr>
<td>Informix</td>
<td>Geometry Object</td>
<td>ST_Geometry</td>
</tr>
<tr>
<td>IBM DB2</td>
<td>Geometry Object</td>
<td>ST_Geometry</td>
</tr>
</tbody>
</table>

* requires Oracle Spatial
Implementing ArcSDE Technology
Implementing... The RDBMS

- RDBMS software install and configuration
- Database Design
- Administration Tasks
- Performance Tuning
- Backup and Recovery

Implementing ArcSDE is really Implementing an RDBMS with spatial data; therefore RDBMS skills are important.
Implementing…

ArcSDE

- Geodatabase design
- ArcSDE instance configuration
  - Data storage type(s)
  - 2- or 3-tier (or combination)
- Feature class loading, spatial indexing, administration, etc.
Implementing…
System Configuration

• The Server
  – Processing power
  – Memory
  – Disk arrays
  – Resource requirements

• The Network
  – Bandwidth requirements
  – Intranets and Internets
geography
our global network