Administration for Oracle – An Introduction

Amit Kesarwani
Forrest Jones
Objectives/Scope

- Understand
  - The role of ArcSDE technology
  - ArcSDE installation and configuration process – Oracle DBMS
  - ArcSDE connections
- Perform basic ArcSDE administration tasks
Agenda

- System Architecture
- Installing and Configuring ArcSDE
- Users and Privileges
- Connecting to the Geodatabase
- Geodatabase Maintenance
- Storage Types
- Troubleshooting
- Resources
- Questions
Agenda

- **System Architecture**
  - ArcGIS Server / Enterprise GDB Software Stack
- Installing and Configuring ArcSDE
- Users and Privileges
- Connecting to the Geodatabase
- Geodatabase Maintenance
- Storage Types
- Troubleshooting
- Resources
- Questions
Agenda

- System Architecture
- Installing and Configuring ArcSDE
  - Pre-installation tasks
  - Configuration of Oracle instance and database
  - Install ArcSDE and run Post-Installation
  - Upgrade Considerations
- Users and Privileges
- Connecting to the Geodatabase
- Geodatabase Maintenance
- Storage Types
- Troubleshooting
- Resources
- Questions
Pre-installation Tasks

• Verify the system requirements are met
Pre-installation Tasks

- Verify the system requirements are met
Pre-installation Tasks

• Verify the system requirements are met
http://resources.arcgis.com/content/arcsde/10.0/oracle-system-requirements
Oracle configuration parameters

• Oracle Memory:
  - System Global Area (SGA) and Program Global Area (PGA)
  - Memory areas used for - Interpreting SQL statements, Fetching data and Submitting edits to database

• Use Automatic Shared Memory Management (ASMM)
  - Set SGA_TARGET through Oracle Enterprise Manager (OEM)

• Cursor Configuration:
  - Cursor: Points to rows returned by a SQL statement
  - Used to avoid re-parsing similar statements with bind variables
  - Stored in PGA and used extensively by ArcSDE
  - open_cursors = 2000 (or larger to avoid ORA-1000 error)
  - Tech Article #27024 – What is an appropriate value for the Oracle init.ora parameter ‘open_cursors’?
Installing ArcSDE

• Two parts
  - Install software (binaries)
  - Setup geodatabase repository

• Install guide is included with the media or available online:
  - http://resources.arcgis.com/content/geodatabases/10.0/arcsde-installation-guides

• Included with ArcGIS Server Enterprise Media
Install ArcSDE Software GUI - Windows

The first part of the ArcSDE installation

1. Writes software files in the SDEHOME directory

2. Modifies system environment variables (Win)
   - Creates %SDEHOME% - location of ArcSDE files
     - Default: “C:\Program Files\ArcGIS\ArcSDE\ora<10g/11g>exe”
     - Another location can be specified
   - Appends %SDEHOME%\bin to %PATH%
SDEHOME

Server libraries and executables

Configuration and log files
ArcSDE Post-Installation GUI - Windows

- Defines SDE DBA user
  - Creates SDE users and Grants appropriate privileges
- Creates geodatabase repository
  - Creates ArcSDE metadata tables (the ArcSDE repository) and packages in the database, thus creating a geodatabase
- Authorizes ArcSDE
  - With software license
- Creates ArcSDE service
Install on UNIX

- Set environment manually
  - Run `install -load` command
  - Installs libraries

- Post installation
  - Run `sdesetup -o install` command
  - Creates the ArcSDE repository and packages
  - Need to create SDE user and grant privileges manually

- Install guide included w/media or available online:
  - [http://resources.arcgis.com/content/geodatabases/10.0/arcgsde-installation-guides](http://resources.arcgis.com/content/geodatabases/10.0/arcgsde-installation-guides)
DBMS_PIPE / DBMS_LOCK

• What are they?
  - DBMS_PIPE: allows sessions to communicate through memory
  - DBMS_LOCK: Oracle’s api to create locks in DB from SQL

• For ArcSDE granted execute to public

• Remove privileges from public?
  - Tech Article #35408 – Can the public privilege be removed from Oracle’s dbms_pipe and dbms_lock packages?
Upgrade Considerations

- Always perform any upgrades in a test environment
- Always backup your database(s) (TEST RESTORE!)
- Backup any custom files in %SDEHOME%\etc directory
  - dbinit.sde
  - dbtune.sde
- Upgrade OS and Oracle first, if needed, then test
- Upgrade ArcSDE, then test
**Upgrade Workflow**

- **Backup database**
- **Stop any ArcSDE services**
  - Use `sdeservice -o list` for description of existing services (Win)
- **Uninstall existing ArcSDE software**
  - Allow installer to delete services, which must be recreated after software is upgraded
- **Install new version of ArcSDE**
- **Use ArcCatalog or Python script to run Upgrade Geodatabase**
  - This replaces repository upgrade from Post-Installation wizard or `sdesetup -o upgrade` command
- **Recreate ArcSDE services**
Upgrade Geodatabase

- Requires **sde** user **upgrade** permissions
- Requires a direct connection to geodatabase
- Pre-requisite check determines if geodatabase is upgradable
  - See “Preparing to upgrade a geodatabase in Oracle” topic for a full list of requirements

```python
# Process: Upgrade Geodatabase
arcpy.UpgradeGDB_management(<Connection file>,
"PREREQUISITE_CHECK", "UPGRADE")
```

Also see: Technical Workshop 20 Minute
Upgrading to ArcGIS 10.0 Geodatabases
Thursday 1:30pm Room 23B
Upgrade Geodatabase – from ArcCatalog
Demonstration

- Set Oracle parameters
- View SDE repository
Agenda

- System Architecture
- Installing and Configuring ArcSDE
- **Users and Privileges**
  - Creating users
  - Granting / revoking privileges
- Connecting to the Geodatabase
- Geodatabase Maintenance
- Storage Types
- Troubleshooting
- Resources
- Questions
Creating Users

- Create Users manually in OEM OR using a script in SQLPLUS

SQL> CREATE USER UC2010 IDENTIFIED BY PASSWORD DEFAULT TABLESPACE USERS TEMPORARY TABLESPACE TEMP;
Managing Users

Data Owners/Creators

- CREATE table, CREATE procedure
- Manage permissions through Oracle
- Dedicate user(s) to own/create data
Managing Users

Data Viewers/Editors
- CREATE SESSION to connect w/OEM
- Manage object permissions through ArcGIS

Viewers
- Grant SELECT

Editors
- Grant SELECT, INSERT, UPDATE, DELETE
# Geodatabase users

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>End user</strong></td>
<td>Must have Read or Read/Write access to geodatabase data</td>
<td>GIS analysis, Map production, Maintain edits</td>
</tr>
<tr>
<td><strong>Manager</strong></td>
<td>Must have data Ownership and Management rights</td>
<td>Data QA/QC, Versioning workflow, Geodatabase design, Data ownership</td>
</tr>
<tr>
<td><strong>SDE Admin</strong></td>
<td>Owns ArcSDE repository and has access to all geodatabase data</td>
<td>Configure DBTUNE for storage, Manage ArcSDE configuration, Compress, Manage data statistics, Monitor and rebuild indexes</td>
</tr>
<tr>
<td><strong>DBA</strong></td>
<td>Has DBMS Administrative access</td>
<td>Backup and recovery, Configure storage, Create users/roles, Grant database permissions</td>
</tr>
</tbody>
</table>
Database Roles

- Facilitate management of data permissions
- Group users with similar database access
- Can be created for each type of user, for example:
  - Owner, editor, reader
  - Departmental role (e.g., planners, analysts, etc.)
  - Project teams
Managing data permissions with ArcGIS

- Connect as data owner
- Specify user or role
- Grant/Revoke
  - SELECT
  - SELECT, INSERT, UPDATE, DELETE
Agenda

- System Architecture
- Installing and Configuring ArcSDE
- Users and Privileges
- **Connecting to the Geodatabase**
  - Direct Connection
  - Application Server connection
- Geodatabase Maintenance
- Storage Types
- Troubleshooting
- Resources
- Questions
Connection Choices

- **Direct Connection: Recommended choice**
  - NO ArcSDE service
  - SDE processing load on client
  - Connects directly to database using an oracle client
  - Drivers now provided for previous versions

- **Application Server Connection:**
  - ArcSDE service, giomgr
  - Increased server load – gsrvr spawned for every connection
Direct Connection Syntax - *Starting at ArcGIS 10*

Append oracle service name to service

```
Server:
<Service name>

Service:
sde:oracle11g:< SQL_Net_alias >

Database:

(Account)

Database authentication
Username:
<Username>
Password:
>Password>

(If supported by your DBMS)

Operating system authentication
```
Direct Connection Syntax

Connecting to a USER schema in multiple GDB setup

Spatial Database Connection

- Server: <Server name>
- Service: sde:oracle11g:< SQL_NET_alias >:<schema_name>
- Database: 
  (If supported by your DBMS)

Account
- Database authentication
  - Username: <Username>
  - Password: <Password>

- Operating system authentication

Save username and password: ☑
Direct Connection Syntax

**Append oracle service name to password**

```
Username:  <Username>
Password:  <Password>@<SQL_Net_alias>
```
Direct Connection Syntax

**Append oracle service name to service**

```plaintext
<Server name>

```
sde:oracle11g:/;LOCAL=< SQL_Net_alias >
```

(Database connection parameters)

**Account**

- **Database authentication**
  - Username: `<Username>`
  - Password: `<Password>`
  - Save username and password

- **Operating system authentication**
Application Server Connection

Spatial Database Connection

Server: <Server name>
Service: <port number> or <sde service name>
Database: 
(If supported by your DBMS)

Account

- Database authentication
  - Username: <Username>
  - Password: <Password>

- Operating system authentication
  - Save username and password
Backwards Compatibility

- **Direct Connection**
  - ArcGIS 10.0 Client
  - 9.2 / 9.3 / 9.3.1 Direct connection drivers

- **Application Server Connection**
  - ArcGIS 10.0 Client
  - GDB

**Up to last 3 versions of ArcSDE Geodatabases**

**Any previous version of ArcSDE Geodatabases**
# Direct Connection Drivers

## Compatibility Matrix

<table>
<thead>
<tr>
<th></th>
<th>10 GDB</th>
<th>9.3.1 GDB</th>
<th>9.3 GDB</th>
<th>9.2 GDB</th>
<th>9.1 GDB</th>
<th>9 GDB</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 client</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>9.3.1 client</td>
<td>Y</td>
<td>Y</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>9.3 client</td>
<td>Y+</td>
<td>Y</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
<td>Y*</td>
</tr>
<tr>
<td>9.2 SP5+ client</td>
<td>Y*+</td>
<td>Y*+</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.2 SP 1–4 clients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>9.1 client</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>9 client</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>

* Additional Drivers need to be installed
+ Forward compatibility to version indicated

**Webhelp** - [Making a direct connection from ArcGIS Desktop to a geodatabase in Oracle](https://www.esri.com)
Demonstration

-Create User
-Making a connection
Agenda

- System Architecture
- Installing and Configuring ArcSDE
- Users and Privileges
- Connecting to the Geodatabase
- **Geodatabase Maintenance**
  - **Backup Recommendations**
  - **Compressing the Geodatabase**
  - **Statistics & Indexes**
- Storage Types
- Troubleshooting
- Resources
- Questions
Backup Recommendations

- Information stored in the SDE Repository
  - Registration of tables spatial and non-spatial
  - Tracking of Versioned Edits
  - ArcObject behaviors

- In a **Read/Write** database
  - Best to work with a point in time restores
  - Enable ARCHIVELOG mode
  - Test restore to a point in time on a test system
Compressing the Geodatabase

• Improves performance
  - Removes unnecessary rows related to versioned edits
  - Reduces overall retrieval times

• Critical to compress regularly
  - Nightly or weekly depending on number of edits
  - Update database statistics after running compress
  - Users connected during a compress will be excluded

• Must be performed by SDE user by using
  - ArcCatalog
  - Geoprocessing Tool
  - sdeversion -o compress
Oracle table statistics

- Describe segment characteristics for optimizer and DBA
  - Critical for maintaining performance
  - Current statistics increase Oracle IO performance
- Update when data changes significantly:
  - Loading
  - Major editing
- Analyze through ArcGIS

Create statistics on attributes, geometry, versioning delta tables and historical archive
Agenda

- System Architecture
- Installing and Configuring ArcSDE
- Users and Privileges
- Connecting to the Geodatabase
- Geodatabase Maintenance
- **Storage Types**
  - **Storage Options**
  - **Controlling Storage**
- Troubleshooting
- Resources
- Questions
ESRI Spatial Type – ST_GEOMETRY

- User Defined Type (UDT) used to store geographic features
- Allows access to spatial data through SQL functions
- Efficiency - Automatic geometry validation
- Conforms to ISO and OGC standards
- Available since ArcSDE 9.2

```
SQL> desc gdb.streets_st_geom
Name          Null?    Type
-------------- ---------- ------------------
OBJECTID      NOT NULL  NUMBER(38)
CFCC          NCHAR(3)
SHAPE         SDE.ST_GEOMETRY
```
ESRI Spatial Type – ST_Raster

• New at 10.0
• Must be installed separately
  - sdesetup -o install_st_raster
• SQL Raster Functions
  - Load and edit raster data
  - Export raster data to GeoTIFF File
  - Build raster pyramids and mosaic
Using SQL with ST_GEOMETRY

- Needs an external dll
- Extproc needs to be set up for
  - Executing SQL commands on a ST_GEOMETRY column
  - For using ST_GEOMETRY operators
  - Definition and label queries inside ArcMap
- With SQL and ST you can
  - Create tables with a spatial attribute
  - Read and Analyze the spatial data
  - Insert, update and delete simple geometry data
- Geodatabase behavior not supported through SQL
Setting up the ExtProc

tnsnames.ora file:

EXTPROC_CONNECTION_DATA =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1))
    (CONNECT_DATA =
      (SID = PLSExtProc)
      (PRESENTATION = RO))
  )

listener.ora file:

LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1))
      (ADDRESS = (PROTOCOL = TCP)(HOST=AKLAP.esri.com)(PORT=1521))
    )
  )

Key must match

New Entry

Original Entry

Key must match
Setting up the ExtProc

listener.ora file:

LISTENER =
  (DESCRIPTION_LIST =
   (DESCRIPTION =
     (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1))
     (ADDRESS = (PROTOCOL = TCP)(HOST=AKLAP.esri.com)(PORT=1521))
   )
  )

SID_LIST_LISTENER =
  (SID_LIST =
   (SID_DESC =
     (SID_NAME = PLSExtProc)
     (ORACLE_HOME = C:\oracle\product\10.2.0\db_1)
     (PROGRAM = extproc)
     (ENVS="EXTPROC_DLLS=C:\Program Files\ArcGIS\ArcSDE\ora10gexe\bin\st_shapelib.dll")
   )
  )
Oracle ExtProc - for St_geometry

• Modify the listener.ora and tnsnames.ora files
  - Oracle Documentation
  - Webhelp topic - Configuring the Oracle listener to access the geodatabase with SQL
  - Technical articles:
    - 32188 - Error: ORA-28595: Extproc agent : Invalid DLL Path
    - 33003 - Error: ORA-06522: libsg.so: cannot open shared object file: No such file or directory
    - 33004 - Bug: ORA-06522: (path)\st_shapelib.dll: cannot open shared object file: No such file or directory
    - 38043 – Bug: Configure ST_GEOMETRY for use in Oracle 11G Release 2 on Windows
    - 39119 – How to: Check if the Oracle extproc is set up correctly for direct ST_GEOMETRY SQL queries
Controlling Storage

• Tablespace Management based on
  - Backup requirements
  - Activity
  - Size of segment

• SDE.DBTUNE table
  - Specifies configuration keyword, storage type, storage parameters
  - Dbtune entries store text for CREATE statements

• To create a keyword:
  - Export DBTUNE table to a file, edit it and import back to DBTUNE table

• To alter a keyword:
  - sdedbtune –o alter
Accessing DBTUNE keyword in ArcGIS

- DBTUNE keyword must contain a **UI_TEXT** parameter
Migration Tool

- **LONG RAW** data type being deprecated at Oracle 11g
- **Migrate Storage GP tool**
  - Easily convert GIS datasets from a different storage format to ST_GEOMETRY in Oracle
  - Changes data “in place”, no new datasets are created
  - Must be the data owner to execute
  - Supports versioned & archived datasets
Agenda

- System Architecture
- Installing and Configuring ArcSDE
- Users and Privileges
- Connecting to the Geodatabase
- Geodatabase Maintenance
- Storage Types
- Troubleshooting
  - SDE log files
  - DBMS log files
  - DBMS tracing
- Resources
- Questions
Diagnostic Files

- Log files are ArcSDE output about what SDE is doing
- Useful when encountering a problem such as
  - Service will not start, log file will tell you why
- ArcSDE logs stored in \SDEHOME\etc
  - giomgr_<service>.log – Client connection info
  - sde_<service>.log – Application Server error messages
  - sdedc_Oracle.log – Direct Connect error messages
- Oracle log files, contain DBMS logged information
  - System alert log: alert_<sid>.log
  - Background process logs
Oracle Trace Output – using tkprof

The output contains SQL execution paths, row counts and wait events

Demo theatre – **Wednesday 11:30 am to 12:00 pm - Using Oracle Trace to Troubleshoot**

<table>
<thead>
<tr>
<th>call</th>
<th>count</th>
<th>cpu</th>
<th>elapsed</th>
<th>disk</th>
<th>query</th>
<th>current</th>
<th>rows</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parse</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Execute</td>
<td>16</td>
<td>0.17</td>
<td>0.19</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fetch</td>
<td>189</td>
<td>2.96</td>
<td>3.53</td>
<td>0</td>
<td>1605</td>
<td>0</td>
<td>17820</td>
</tr>
<tr>
<td></td>
<td>205</td>
<td>3.14</td>
<td>3.72</td>
<td>0</td>
<td>1605</td>
<td>0</td>
<td>17820</td>
</tr>
</tbody>
</table>

Misses in library cache during parse: 0

Elapsed times include waiting on following events:

<table>
<thead>
<tr>
<th>Event waited on</th>
<th>Times Waited</th>
<th>Max. Wait</th>
<th>Total Waited</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQL*Net message to client</td>
<td>200</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>SQL*Net message from client</td>
<td>199</td>
<td>0.52</td>
<td>2.50</td>
</tr>
<tr>
<td>SQL*Net more data to client</td>
<td>923</td>
<td>0.00</td>
<td>0.09</td>
</tr>
<tr>
<td>direct path read</td>
<td>44</td>
<td>0.05</td>
<td>0.15</td>
</tr>
<tr>
<td>log file sync</td>
<td>12</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Demonstration

- Set up extproc
- Show keywords
- Show Logfiles
Agenda

• System Architecture
• Installing and Configuring ArcSDE
• Users and Privileges
• Connecting to the Geodatabase
• Geodatabase Maintenance
• Storage Types
• Troubleshooting
• Resources
  • Product Information
  • UC Events and Workshops
• Questions
Resources:

• Product Information
  - http://resources.arcgis.com/
  - http://support.esri.com/

• User forums and groups
  - http://forums.esri.com/forums.asp?c=158 (read only)

• UC events and Workshop

  Exhibit Hall C - Geodatabase Island
  Tuesday and Wednesday - 9:00 am – 6:00 pm
  Thursday 9:00 am – 1:30 pm
Training resources

http://www.esri.com/training

• Instructor-Led Courses
  - Building Geodatabases
  - Introduction to the Multiuser Geodatabase
  - Data Management in the Multiuser Geodatabase
  - ArcGIS Server Enterprise Configuration and Tuning for Oracle

• Free Web Training Seminars
  - Understanding ArcSDE Table Relationships
  - Introduction to ArcGIS Data Models
Agenda

- System Architecture
- Installing and Configuring ArcSDE
- Connecting to the Geodatabase
- Users and Privileges
- Geodatabase Maintenance
- Storage Types
- Troubleshooting
- Resources
- Questions?

Please fill out the evaluation & Thanks for attending!
Other Sessions

Technical Workshop 20 Minute

• Road Ahead – GDB Admin
  Thursday 3:40 Room 27B

• Road Ahead – Geodatabase
  Thursday 9:20am Room 6B
Technical Workshops

• Administration for Oracle – Advanced
  Tuesday 10:15am Room 4       Wednesday 3:15pm Room 4

Geodatabase Management Demo Theatre Presentations

• Using Oracle Trace to Troubleshoot
  Wednesday 11:30am       Thursday 11:30am

• Using SQL with your Geodatabase
  Thursday 10:30am

Technical Workshop 20 Minute

• Migrating Data to the Geodatabase
  Wednesday 3:40pm Room 6B
www.esri.com/sessionevals

Technical Workshop 20 Minute

- **Troubleshooting Performance Issues with Enterprise Geodatabases**
  
  **Thursday 10:40am Room 24A**

- **Upgrading to ArcGIS 10.0 Geodatabases**
  
  **Thursday 1:30pm Room 23B**

- **Using Spatial Data in ArcGIS with Query Layers**
  
  **Thursday 1:55pm Room 23B**

- **Implementing Database Roles in the Enterprise Geodatabase**
  
  **Thursday 3:15pm Room 3**

- **Enterprise Geodatabase Administration – Tips and Tricks**
  
  **Thursday 3:40pm Room 3**