Intended Audience

You are.....
- A geodatabase administrator
- An accidental DBA
- A deliberate DBA

And you...
- Store your data in a Oracle database
- Are thinking about using Oracle

This is your session!
What makes a good Geodatabase administrator?

• Understanding of geodatabase admin tasks
  - Create GDB, manage users/roles, manage permissions on data, maintenance …etc.

• Understanding of GIS usage in your organization
  - Plan for admin tasks, organization of data storage…etc.

• Basic to intermediate DBA skills
  - Performance, trouble shooting, security … etc.
Agenda – Main geodatabase admin tasks

How do I …

- Configure Oracle to support geodatabases?
- Create geodatabases?
- Control access to my data?
- Use spatial data type?
- Make sure that my data is safe?
- Maintain good performance?
- What’s New in 10.6.x
How do I configure Oracle to support geodatabases?
How do I configure Oracle to support geodatabases?

- Install a supported version of Oracle
- Configure Oracle initialization and Memory parameters
- Configure 64 bit and/or 32 bit Oracle Client as needed
Install a supported version of Oracle database

- For OS version and level requirements reference system requirements
- Additional requirements for the ST_Geometry shape library

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Oracle 12c Database

• At 12c, a database can be
  - Multitenant 12c database
    - Geodatabase supported **only in pluggable databases**
    - NOT in a container database
    - Traditional 12c database (Deprecated starting at 12.2)

• Multitenant architecture can provide:
  - Rapid provisioning and cloning
  - Staging for patching and upgrades
  - Consolidation and unified management
  - Up to 252 PDB’s in a single CDB (with Enterprise licensing)
Memory and Initialization Parameters

• In most situations use default parameters

• Memory Tuning
  - SGA should not swap, configure enough virtual memory and don’t run out of space (quota on tablespaces)
  - Use Automatic Memory Management except for special cases

• Initialization Parameters
  - OPEN_CURSORS (2000 or higher - consult ArcGIS help)
  - SESSION_CACHED_CURSORS (minimum of 50, 50-150)

Memory and Initialization Parameters

• **UNDO_POOL**
  - Resource manager plan directive, can be set to allow for unlimited undo pool for SDE user (set up a consumer group) for large compress operations

• **Oracle Text Option (installed by default typically)**

• **Execute privileges on packages**
  - `dbms_lob`, `dbms_lock`, `dbms_pipe`, `dbms_utility`, `dbms_sql`, `utl_raw`,
  - `dbms_crypto` (*sde user only*)
  - after Geodatabase is enabled some privileges can be restricted
Configure Oracle Client

- 64 and/or 32-bit as needed
  - Desktop & Engine 32 bit, Server & Pro 64 bit
  - 64 before 32 in PATH when both
- Instant, Runtime or Admin client
- TNSNAMES & SQLNET files

How To: Configure the Oracle Instant Client to make Database Authentication and Operating System Authentication connections using ArcGIS Desktop - http://support.esri.com/technical-article/000012001

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<td>service name if default instance in listener</td>
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DEMO
Connecting to Oracle
Mandar Purohit
Create geodatabases?

How do I...
Databases vs Geodatabases

• An ArcGIS client can connect to any Oracle database and use simple features (points, lines and polygons) and attribute data.

• A geodatabase is an ArcGIS construct hosted in a database.
Database vs Geodatabase
Behaviors, Complex Features, Versioning and Distributed Data

• Database provides
  - Transaction management
  - Authorization/Security
  - Backup

• Geodatabase is an Oracle Database with an Administrative Schema

• Geodatabase provides
  - Behaviors (domains, subtypes)
  - Complex features (e.g., topologies, networks, parcel fabrics)
  - Versioning (long transactions) and Archiving

DBA’s typically will be confused by term “Geodatabase”, may be easier to say you need an application or administrative schema created.
Multiple Geodatabase in Oracle

- Multiple traditional Databases
- 12c Pluggable Database (Check licensing options with Oracle)
- User Schema
  - 10.6.x is last supported version
  - Deprecated starting at 10.7
  - Upgradable for next few release cycles
Controlling Storage

• Configuration keyword and parameters for storage type, location, etc…
  • adjust for backup requirements, activity, size of segment (table, index)

• Geometry Storage

• VARCHAR2 vs. NVARCHAR2
  • UNICODE_STRING

Enabling a Geodatabase

Mandar Purohit
Points to remember

• Use GP Tools to create geodatabases
• More control over storage?
  - Use Oracle tools to create database first – more common at Oracle sites with Oracle DBA(s)
• Enable geodatabase tool
  - Create a geodatabase in an existing database, without sys privileges
Upgrading a geodatabase

• Review Pre-requisites and Requirements

• Test first, staging or test environment

• Review
  - ST_shapelib library
  - server_config and dbtune tables in sde schema
Upgrading a geodatabase

- Order of operations when upgrading both geodatabase and Oracle
  - One at a time
  - **Oracle needs to be at supported release for upgraded version**
    - Applies to geodatabase AND **ALL** connecting clients

- User-Schema Geodatabase

- Other Schemas (Data Reviewer, Workflow Manager)
How do I...

Control access to my data?
 Oracle Users and Roles

• Authentication
  - Oracle vs. External Authentication

• Authorization – Privileges
  - What can a user do in the database?
  - Admin (SDE) & Data Owner (DDL)
    - Use ArcGIS to grant object level privileges in Geodatabase
  - Editors (DML), Viewers/Read-Only
  - Roles
  - [Hyperlink]

[Hyperlink]
Additional Privileges

• SDE user
  - to create GDB in SDE and upgrade master GDB

• Other users
  - to create and upgrade user-schema GDB

• Optional Privileges to
  - enable SQL tracing
  - monitor Oracle and basic troubleshooting
  - integrate with other non-spatial databases
  - manage connections
Limit Permissions for Most Users

- **Admin**
- **Data Owners**
- **Data Editors**
- **Data Readers**

More privileges
Points to remember

• Creating a user does not give access to data in the database
  - It must be granted by the data owner

• ArcGIS tools manage permissions on all parts of a feature class

• Creating a user with the Create User tool will grant permissions sufficient for creating data
Managing Permissions, Roles and Objects

Mandar Purohit
How do I...

Use Spatial Data Types?
Geometry Storage

- Creation of Features through SQL
- Analysis through SQL
- Geodatabase behavior **not** supported through SQL
- `ST_Geometry` or `SDO_Geometry`

```
SELECT sa.id SA_ID, hs.id HS_ID
FROM SENSITIVE AREAS sa, HAZARDOUS SITES hs
WHERE sde.st_intersects (sde.st_buffer (hs.site, .1), sa.shape) = 1
ORDER BY sa.id;
```

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<tr>
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<th>HS_ID</th>
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<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
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ST_Geometry

- ESRI Spatial Type (Default)
- 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, became default at 9.3

```sql
SQL> desc gdb.streets_st_geom
Name                  Null? Type
OBJECTID              NOT NULL NUMBER<38>
CFFCC                NOT NULL NVARCHAR2<3>
SHAPE                NOT NULL SDE.ST_GEOMETRY
```
ST_Geometry spatial type configuration

- **st_shapelib library**
  - Needed for
    - executing ST_Geometry SQL functions from SQL clients.
    - query layer in ArcMap or ArcGIS Pro that executes SQL functions on ST_Geometry columns
    - publishing data from the Oracle database
  - Delivered with ArcMap, Download from MyEsri for ArcGIS Pro
Configure External Library – st_shapelib

• Check library matches version of Geodatabase

• 11g and 12c use extproc.ora located in ORACLE_HOME\hs\admin directory
  - EXTPROC_DLLS=ONLY:C:\mylibraries\st_shapelib.dll (Windows)
  - EXTPROC_DLLS=ONLY:/user/esrilibs/libst_shapelib.so (Unix)

• On Windows – Microsoft Visual C++ Redistributable Package
  - Versions needed for Desktop / pro are different
DEMO
Configuring St_Geometry Library
Mandar Purohit
SDO_Geometry: native Oracle spatial type

- Only Oracle Locator needed to use SDO_Geometry spatial type with ArcGIS
- Geometry validation is not the same between ArcGIS and SDO_Geometry
- All data in column must be same coordinate system
- Modifications of complex features only through ArcGIS
SDO_Geometry – Pre-Requisites

• be owned by the user registering the table.
• have a single SDO_GEOMETRY column.
• have no other columns of a user-defined type.
• have a valid entry in the view USER_SDO_GEOM_METADATA.
• have a single type of geometry (points, lines, or polygons), can be multipart.
• have an integer, unique, not-NULL column suitable as a registered row ID column.
• should have a spatial index.
• should pass Oracle's geometry validation tests.
• All spatial records must have not-NULL valid number values in the SDO_ORDINATES array.
How do I…

make sure my data is safe?
BACKUP YOUR DATA NOW !!!

(and practice restoring it)
Backup Options

• **Methods**
  - Recovery Manager (RMAN)
  - User Managed Backups – 3rd party
  - Data Pump Export/Import

• Backup all schemas, including SDE

• Test backup, use to refresh staging

• On restore, may have to compile SDE schema packages.
  - `DBMSUTILITY.COMPILE_SCHEMA('SDE')`
Points to remember

• Backups are the **ONLY** way to reliably prevent data loss
• Decide how much time you can afford to lose during a restore
• Create a restore plan that will achieve that goal
• Create a backup plan that supports your restore plan
• **Test your recovery plan regularly by using real backup media to restore to a system capable of being used in production**
How do I... maintain good performance?
How do I maintain good performance?

- **Standard maintenance**
  - Reconcile/Post/Compress
  - Rebuild Indexes
  - Update Statistics
- **Layer scale dependencies**
- **Database Statistics**
- **Indexing**
- **Spatial data performance - Spatial Index**
Performance Tips

• Make sure you maintain properly for the various workflows
  - Versioned editing, short-transaction editing, bulk data loads, read-only

• No editing, bulk data loads quarterly – statistics should be good

• SQL level ST_Geometry functions, tune as needed for specific workflow and data characteristics (e.g. complex polygons, etc…)
Performance Tips - continued

• Make sure indexing is good for queries.
  - Make sure index optimizer configuration parameters are at default settings
    (optimizer_index_caching = 0, optimizer_index_cost_adj = 100)

• Log File tables – shared or session
  - Consider Global Temp Tables (10.5.1)

• Many times performance issues are outside the database…

• Related workshop
  - Enterprise Geodatabase: Performance Troubleshooting
ArcGIS and Oracle changes since last year

News
What’s new

• Changes coming to Oracle release cycle
• SSL connections are supported starting from 10.6.1
• Register views with the geodatabase – 10.5.x
  - Register with Geodatabase geoprocessing tool extended to views
• New Default Raster Storage Type – 10.5.x
  - Rasterblob (BLOB) implements storage in business table for improved i/o
    not supported by ArcGIS client versions prior to 10.5 or ArcGIS Pro prior to 1.4
• Global Temporary Tables in SDE Schema for log file tables – 10.5.x
  • When connecting and user does not have sufficient privileges
Other notes ..

• Synchronize Open Cursors Setting
  - sde.gdb_util.update_open_cursors – to synchronize open_cursors setting in Oracle with Geodatabase introduced at 10.5

• 10.5 Oracle Insufficient Permission Error Patch
  • http://support.esri.com/Products/Desktop/arcgis-desktop/arcmap/10-5#downloads?id=7504

• SDO_GeoRaster can be viewed, but not created at 10.5

• Create Database User tool creates log file tables
  • For new user, introduced at 10.4

• Read-Only Connection capability introduced at 10.3.1
  • For read-only operations, not selections
  • Dataguard
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Select the session you attended

Select the Feedback tab

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## Other Geodatabase Related Workshops

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<tr>
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<td>SDCC - Room 29 C</td>
<td>Tuesday 4:00-5:00</td>
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<tr>
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Thank you

Questions?
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