# Administering Your Oracle Geodatabase

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GIS INSPIRING WHAT'S NEXT

# Intended Audience

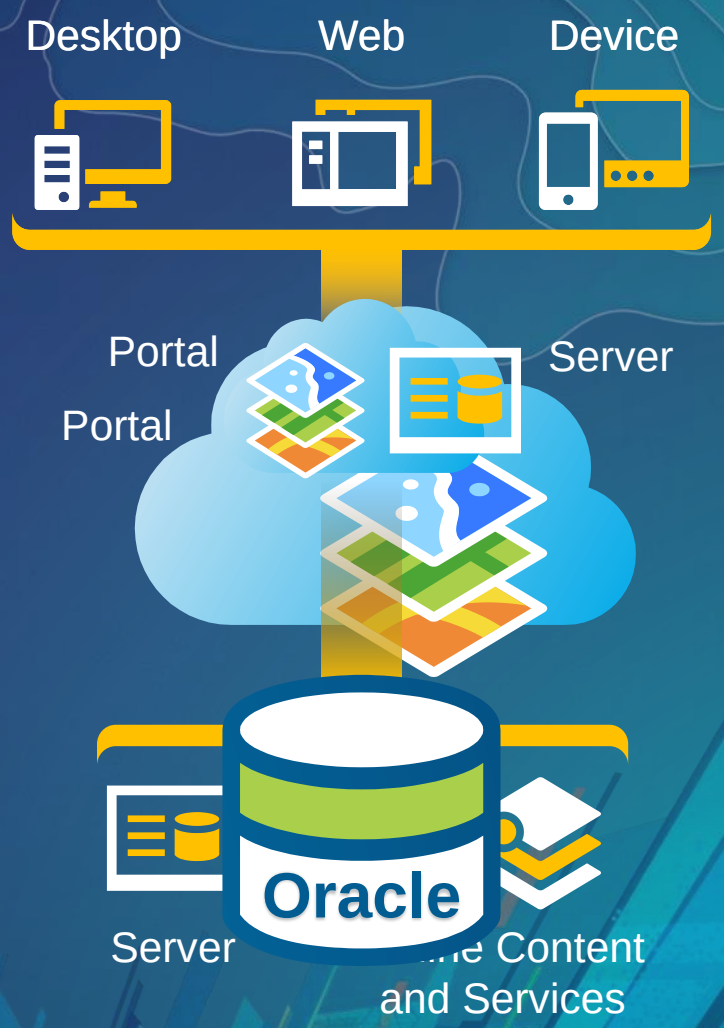
## You are…..

- 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

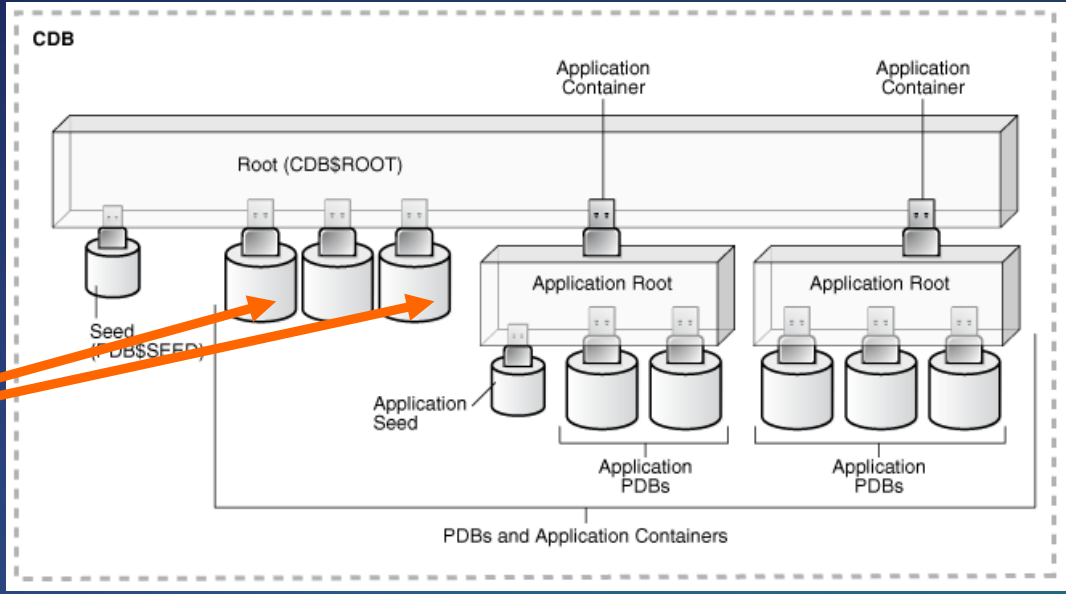
# Install a supported version of Oracle database

- **For OS version and level requirements reference system requirements**
  - **Additional requirements for the ST_Geometry shape library**
- http://desktop.arcgis.com/en/system-requirements/latest/database-requirements-oracle.htm

| | 10g | 11g | 12c |
|---|---|---|---|
| 10.2.x | ✓ | ✓ | ✓ |
| 10.3.x | ✓ | ✓ | ✓ |
| 10.4.x | | ✓ | ✓ |
| 10.5.x | | ✓ | ✓ |
| 10.6.x | | ✓ | ✓ |

# Oracle 12c Database

- At 12c, a database can be
  - Multitenant 12c database
    - Geodatabase supported <u>only in pluggable databases</u>
    - 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

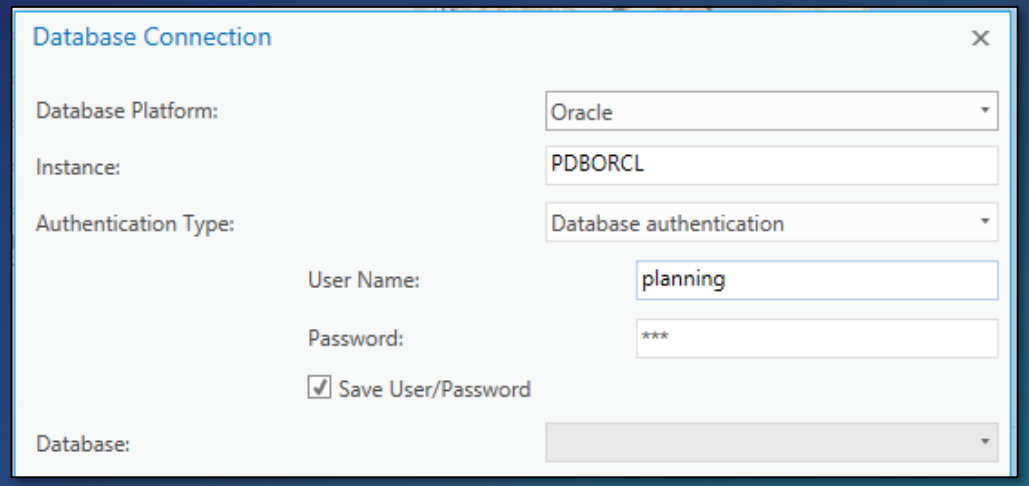
- In most situations use default parameters
- Memory Tuning
  - SGA should not swap, configure enough virtual memory and don't run out of space (quota on tablespaces)
  - Use Automatic Memory Management except for special cases
- Initialization Parameters
  - OPEN_CURSORS (2000 or higher - consult ArcGIS help)
    - http://desktop.arcgis.com/en/arcmap/latest/manage-data/gdbs-in-oracle/update-open-cursors.htm
  - SESSION_CACHED_CURSORS (minimum of 50, 50-150)
- http://desktop.arcgis.com/en/arcmap/latest/manage-data/gdbs-in-oracle/initialization-parameters-oracle.htm

# 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
  - http://desktop.arcgis.com/en/arcmap/latest/manage-data/gdbs-in-oracle/privileges-oracle.htm

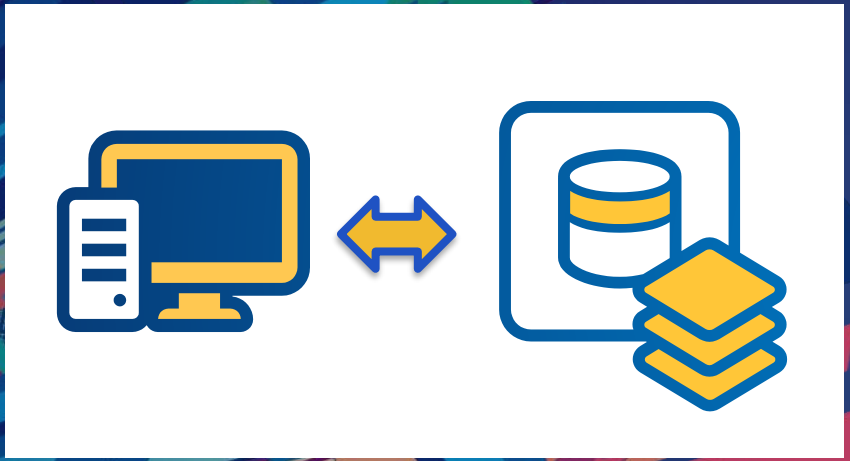
# Configure Oracle Client

- **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

| | |
|---|---|
| server name/service name (or ID) | `dbsrvr/orcl` |
| IP address of server/service name (or ID) | `10:10:10:10/orcl` |
| server name:port/service name (or ID) | `dbsrvr:60000/orcl` |
| service name if default instance in listener | `orcl` |



# DEMO

# Connecting to Oracle

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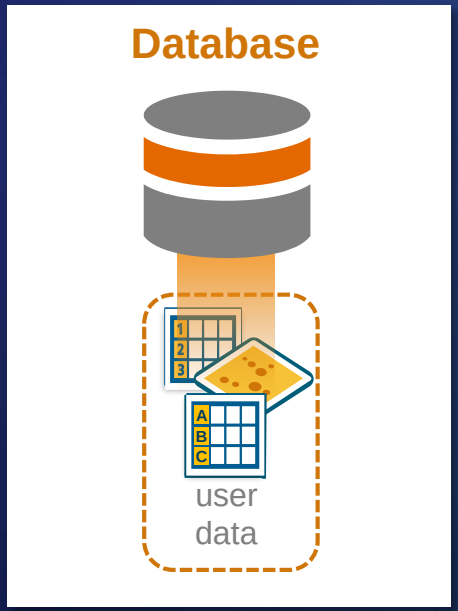
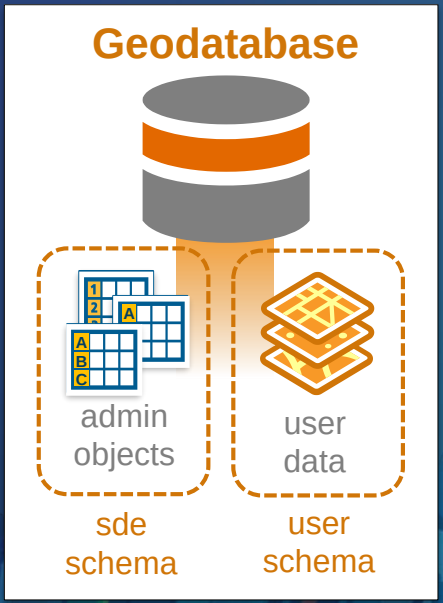
# How do I…

## Create geodatabases?

# 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

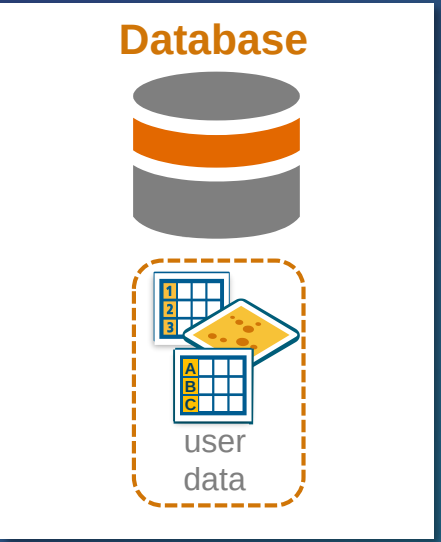


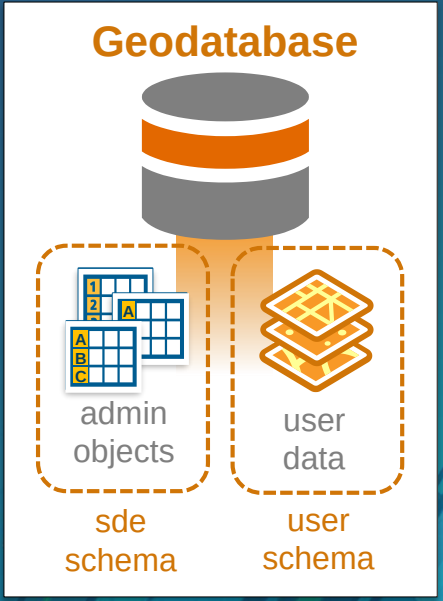



# Database vs Geodatabase

## 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

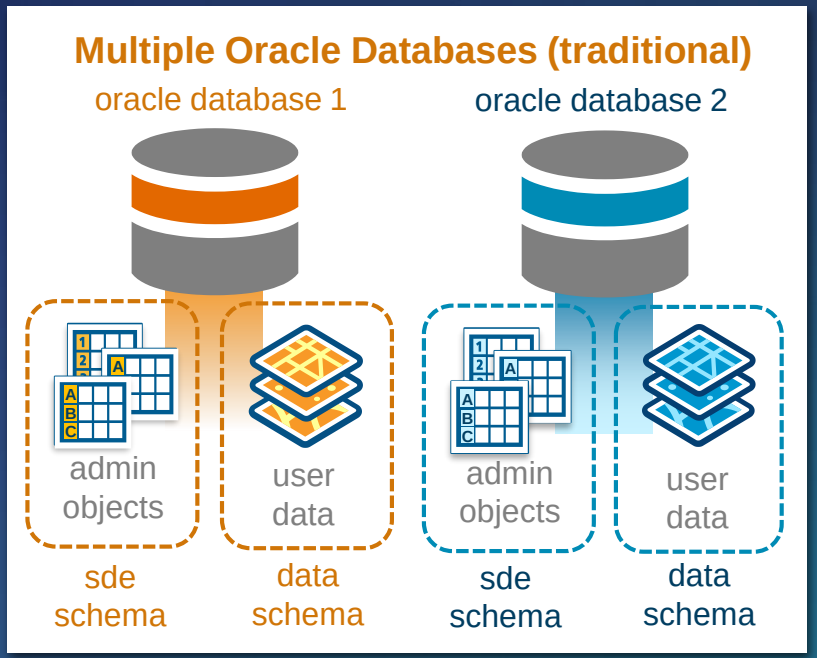


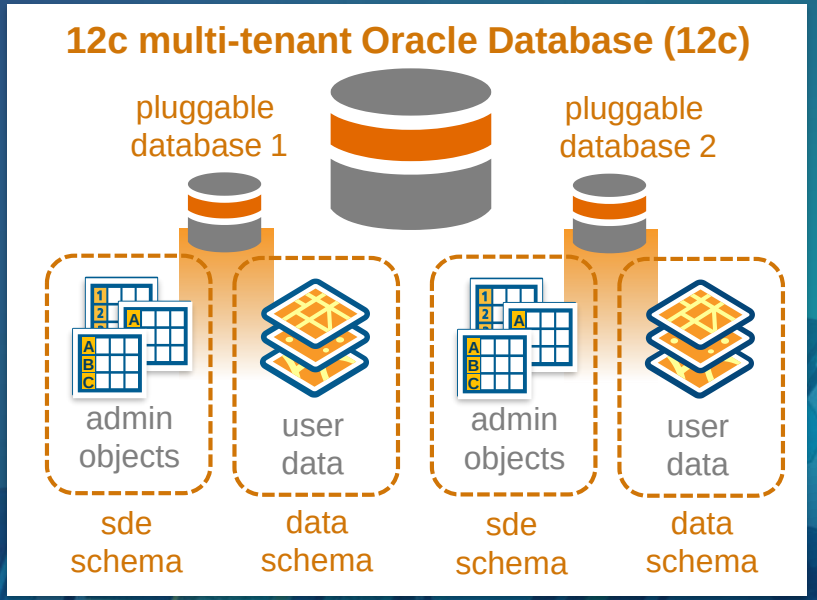




*DBA's typically will be confused by term "Geodatabase", may be easier to say you need an application or administrative schema created.*

# Multiple Geodatabase in Oracle

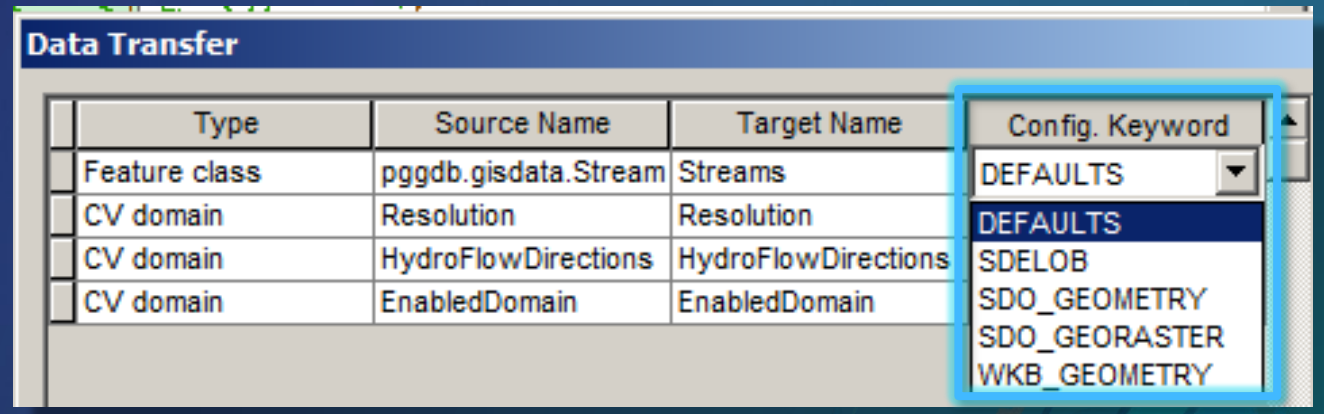
- **Multiple traditional Databases**
- **12c Pluggable Database**
  (*Check licensing options with Oracle*)
- **User Schema**
  - **10.6.x is last supported version**
  - **Deprecated starting at 10.7**
  - **Upgradable for next few release cycles**



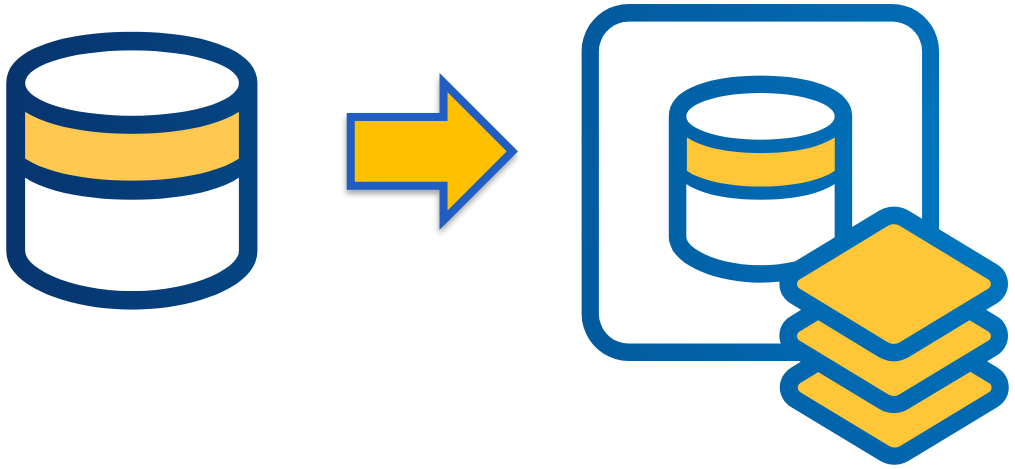



# Controlling Storage

- 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




- http://desktop.arcgis.com/en/arcmap/latest/manage-data/gdbs-in-oracle/configuration-keywords.htm



# DEMO

# Enabling a Geodatabase

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# 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
  http://desktop.arcgis.com/en/arcmap/latest/manage-data/gdbs-in-oracle/upgrade-geodatabase-oracle.htm
- Test first, staging or test environment
- Review
  - ST_shapelib library
  - server_config and dbtune tables in sde schema

# Upgrading a geodatabase

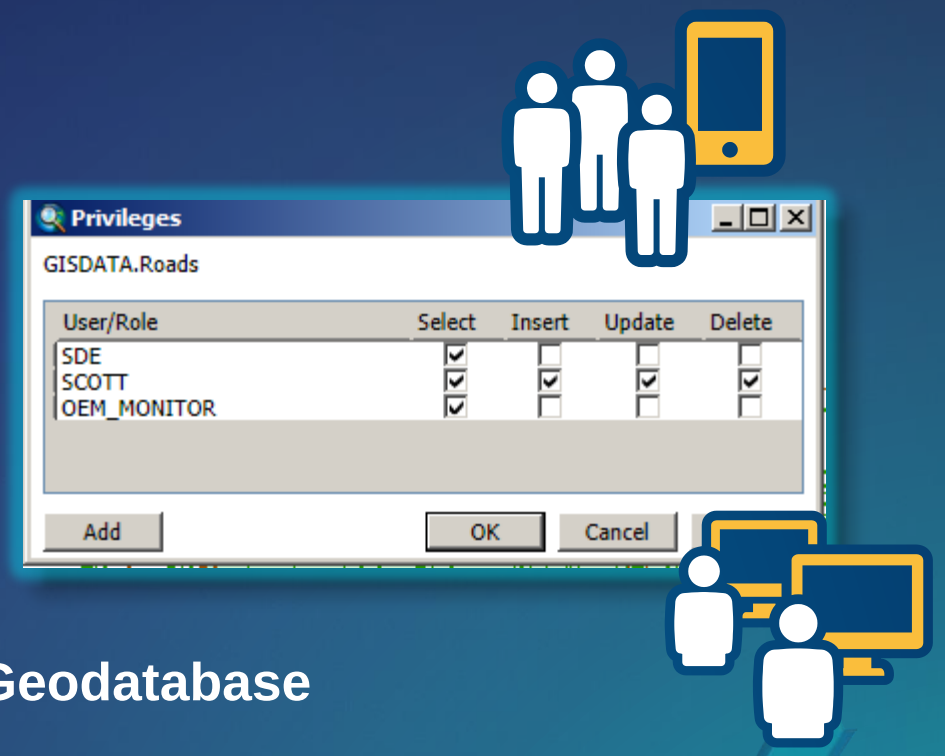
- Order of operations when upgrading both geodatabase and Oracle
  - One at a time
  - Oracle needs to be at supported release for upgraded version
    - Applies to geodatabase AND ALL connecting clients
- User-Schema Geodatabase
- Other Schemas (Data Reviewer, Workflow Manager)

# How do I…

## Control access to my data?

# Oracle Users and Roles

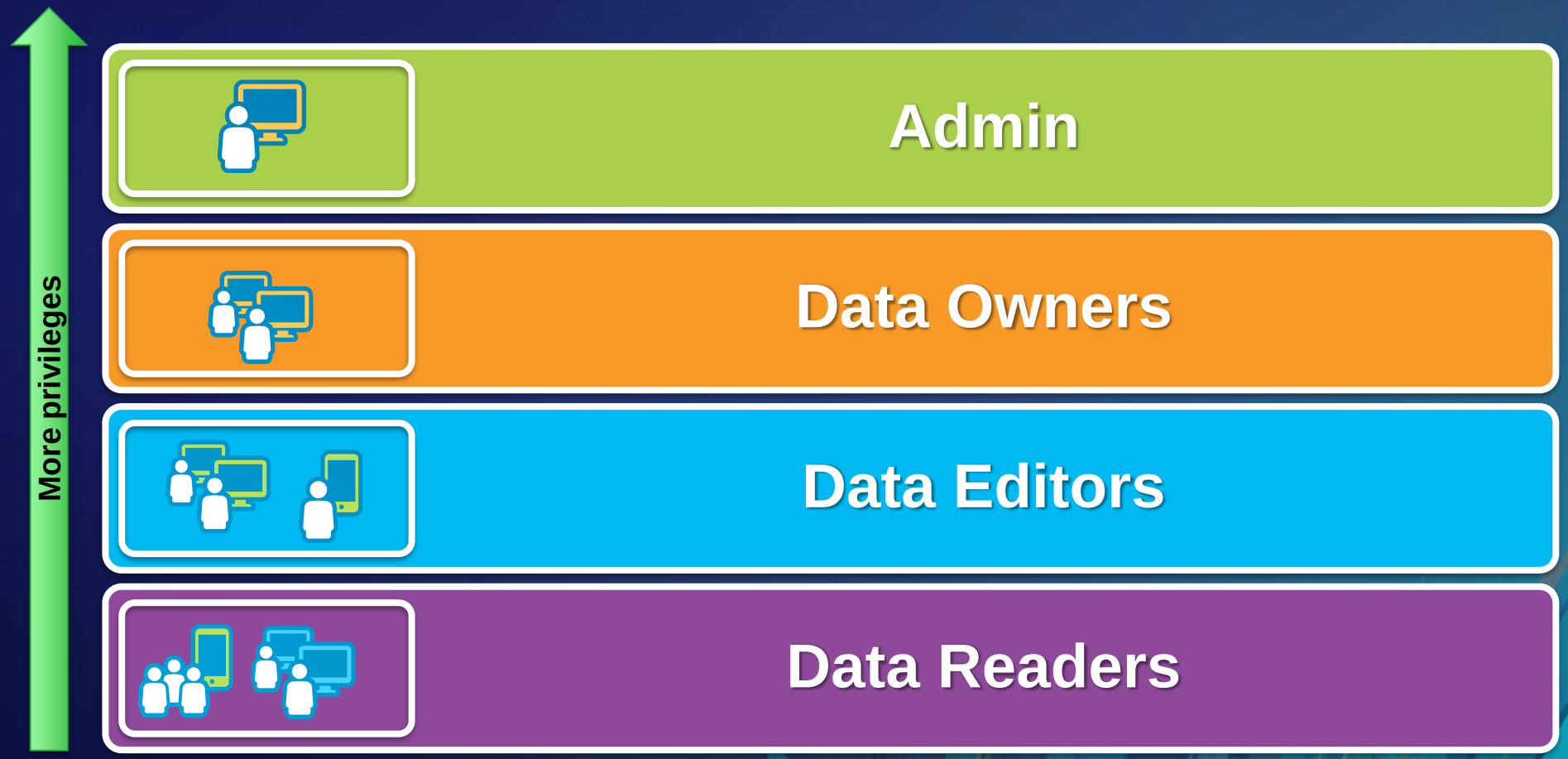
- Authentication
  - Oracle vs. External Authentication
- Authorization – Privileges
  - What can a user do in the database?
  - Admin (SDE) & Data Owner (DDL)
    - Use ArcGIS to grant object level privileges in Geodatabase
  - Editors (DML), Viewers/Read-Only
  - Roles
  - http://desktop.arcgis.com/en/arcmap/latest/manage-data/gdbs-in-oracle/privileges-oracle.htm



# 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



# 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

# DEMO

# Managing Permissions, Roles and Objects

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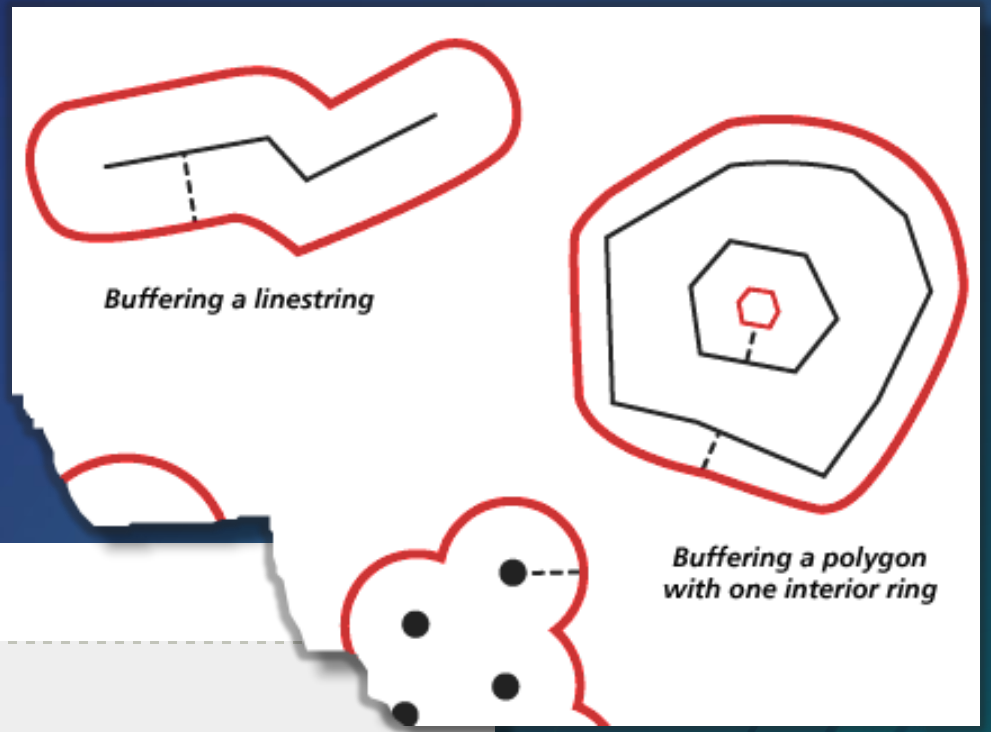
# How do I…

## Use Spatial Data Types?

# Geometry Storage

- Creation of Features through SQL
- Analysis through SQL
- Geodatabase behavior <u>not</u> supported through SQL
- ST_Geometry or SDO_Geometry




**Oracle**

```
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;

SA_ID      HS_ID

    1          5
    2          5
```

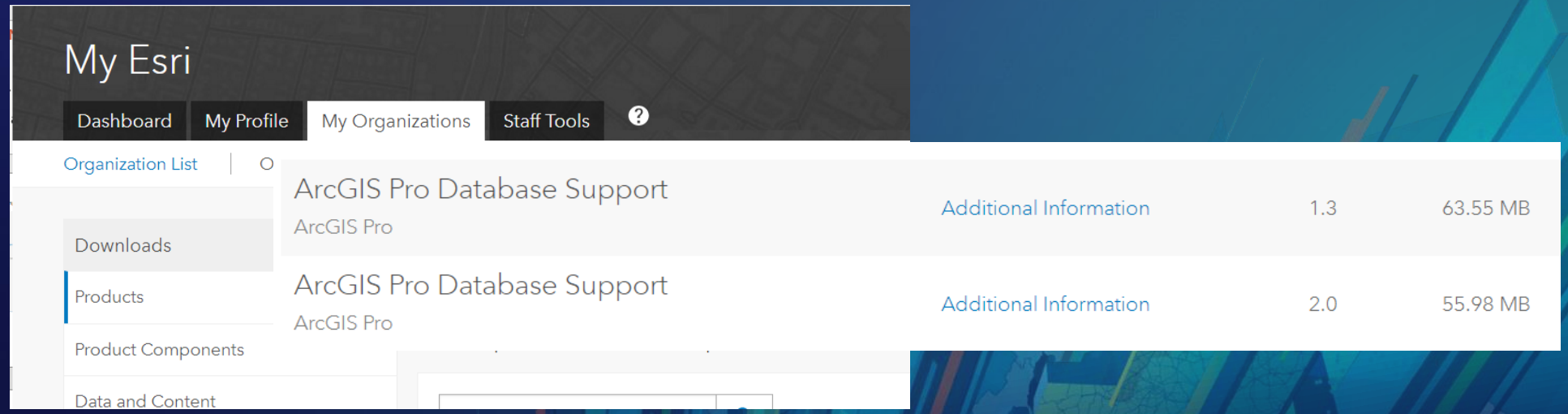
# ST_Geometry

- 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> desc gdb.streets_st_geom
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------
 OBJECTID                                  NOT NULL NUMBER(38)
 CFCC                                               NVARCHAR2(3)
 SHAPE                                              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

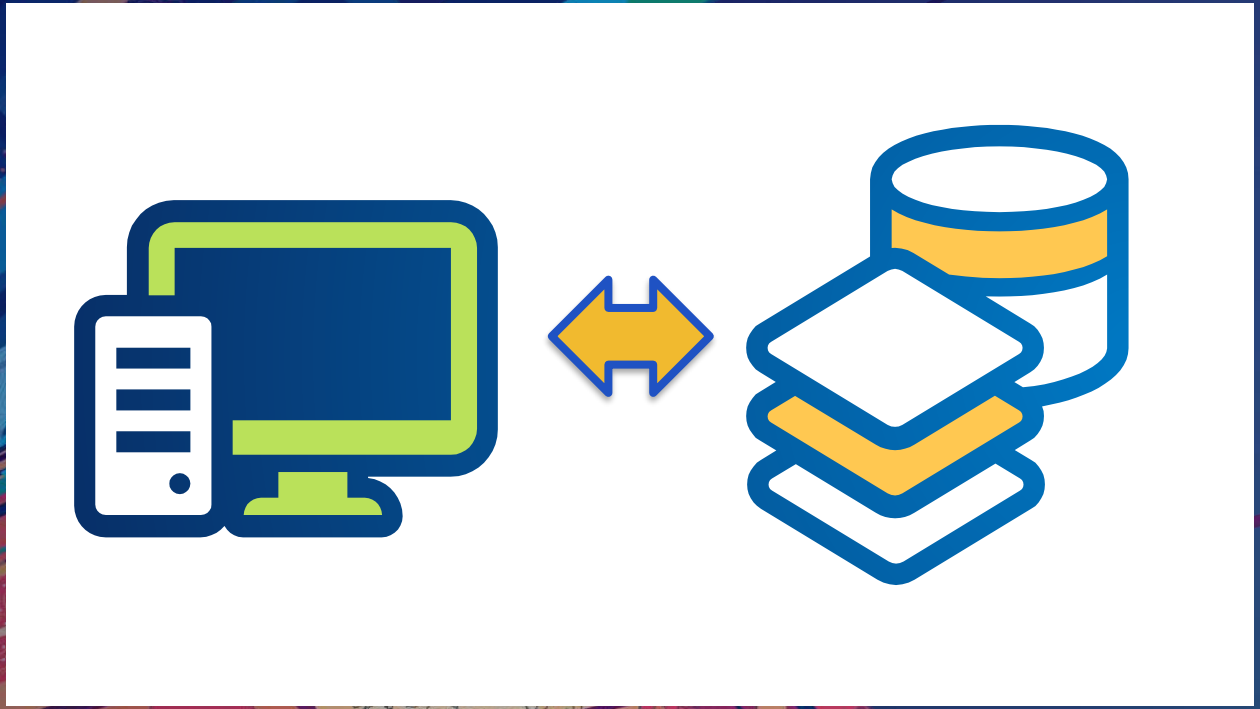


# Configure External Library – st_shapelib

Configuring the Oracle extproc to access the geodatabase with SQL

Geodata » Administering geodatabases » Geodatabases in Oracle

- 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
  - http://desktop.arcgis.com/en/system-requirements/latest/database-requirements-oracle.htm
  - Versions needed for Desktop / pro are different



# DEMO

# Configuring St_Geometry Library

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# 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.
  - DBMS_UTILITY.COMPILE_SCHEMA(‘SDE’)

# Points to remember

- Backups are the <u>ONLY</u> 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

# News

## ArcGIS and Oracle changes since last year

# 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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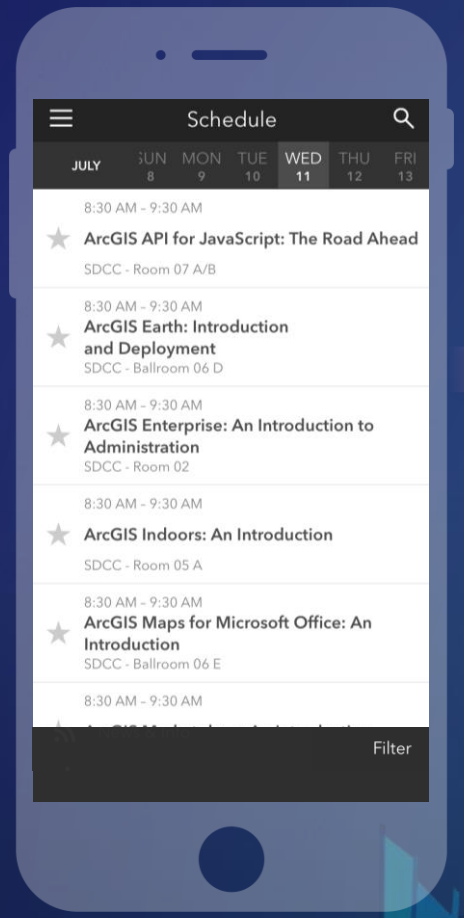
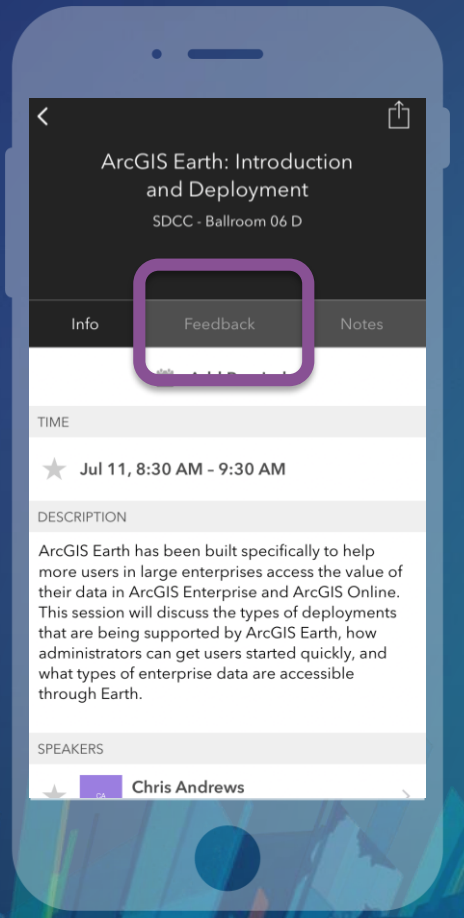
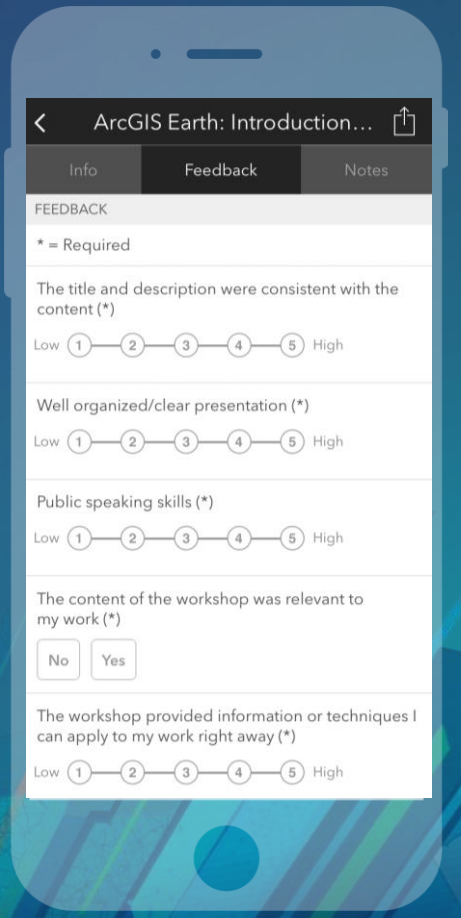



Select the Feedback tab




Complete answers and select “Submit”



# Other Geodatabase Related Workshops

| WORKSHOP | LOCATION | TIME FRAME |
|---|---|---|
| • Editing Multiuser Geodatabases: An Introduction | • SDCC - Room 29 C | • Tuesday 4:00-5:00 |
| • Esri Best Practices: Implementing an Enterprise Geodatabase | • SDCC - Room 17 B<br>SDCC – Room 05 B | • Wednesday 8:30-9:30<br>Thursday 10:00-11:00 |
| • Geodatabase Administration: An Introduction | • SDCC - Room 15 A<br>SDCC – Room 15A | • Wednesday 1:00-2:00<br>Thursday 4:00-5:00 |
| • ArcGIS Enterprise: Cloud Operations using Microsoft Azure | • SDCC - Room 31 A | • Thursday 8:30-9:30 |
| • Enterprise Geodatabase: Performance Troubleshooting | • SDCC - Room 09 | • Thursday 10:00-11:00 |
| • Geodata Best Practices | • SDCC – Room 04 | • Thursday 2:30-3:30 |

# Thank you

# Questions?

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