



Enterprise Geodatabase: Topics in Oracle Administration

Amit Kesarwani & Mandar Purohit

A decorative background featuring a map with contour lines and several colorful, abstract geometric shapes (crosses and L-shapes) in shades of blue, green, and yellow, scattered across the slide.

SEE
WHAT
OTHERS
CAN'T

Intended Audience

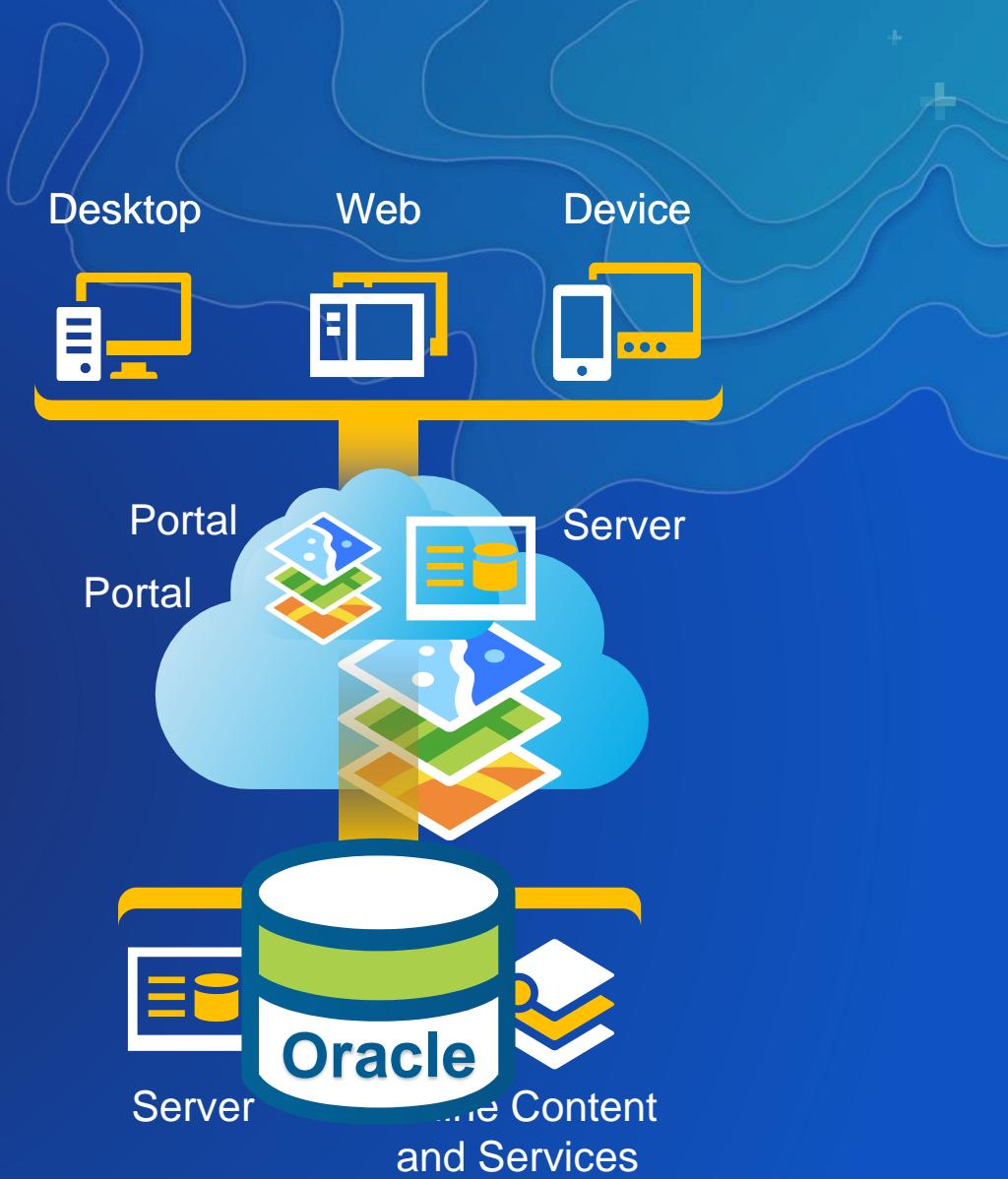
You are.....

- A geodatabase administrator
- An accidental DBA
- A deliberate DBA

And you...

- Store your data in an Oracle database
- Are thinking about using Oracle

This is your session!



Agenda

How do I ...

- **Configure Oracle to support geodatabases?**
- **Use spatial data types?**
- **Demo - Configure Oracle and Connect from ArcGIS**
- **Make sure that my data is safe?**
- **Maintain good performance?**

What's New in 10.7.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
 - Other parameters
- **Configure 64 bit and/or 32 bit Oracle Client as needed**



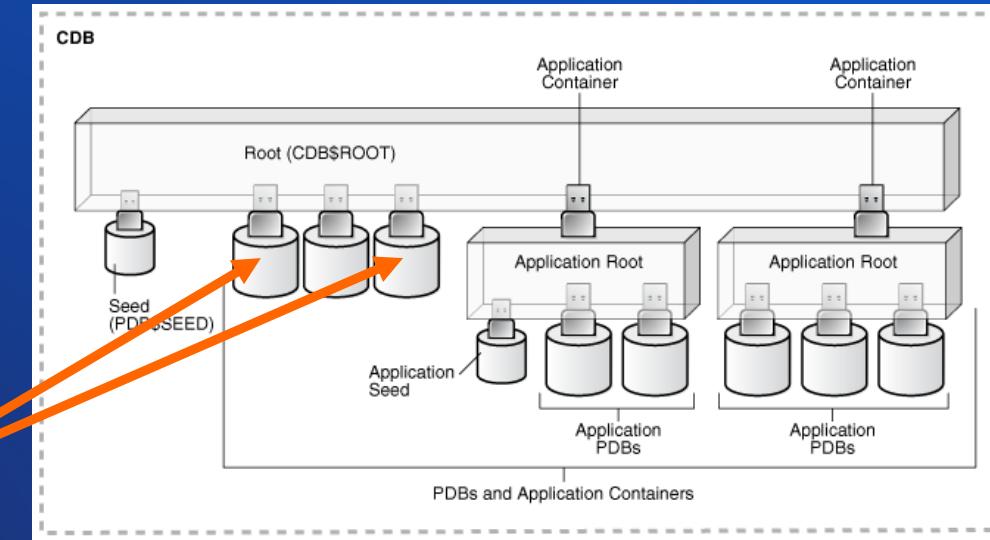
Install a supported version of Oracle database

- **See ArcGIS system requirements for supported OS versions and levels**
 - Additional requirements for the ST_Geometry shape library
- <http://desktop.arcgis.com/en/system-requirements/latest/database-requirements-oracle.htm>
- <https://support.esri.com/en/other-resources/product-life-cycle>

	10g	11g	12c	18c	19c
10.3.x	✓	✓	✓		
10.4.x		✓	✓		
10.5.x		✓	✓		
10.6.x		✓	✓	10.6.1 patch	
10.7.x		✓	✓	✓	?

Oracle 12c Database and later ...

- 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 provide:
 - Rapid provisioning and cloning
 - Staging for patching and upgrades
 - Consolidation and unified management
 - Up to 4096 PDB's (252 in 12.1.0.2) in a single CDB with Oracle enterprise licensing



Memory and Initialization Parameters

- In most situations use default parameters
- Memory Tuning
 - SGA should not swap. Configure enough virtual memory and place quotas on tablespaces
 - Use Automatic Memory Management except for special cases
- Initialization Parameters
 - **OPEN_CURSORS:** Set to 2000 or higher
 - <https://pro.arcgis.com/en/pro-app/help/data/geodatabases/manage-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>

Other Parameters ...

- **UNDO_POOL**
 - If you use traditional versioning, allow 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 you enable a geodatabase some privileges can be revoked from SDE user
 - <https://pro.arcgis.com/en/pro-app/help/data/geodatabases/manage-oracle/privileges-oracle.htm>

How do I...

Use Spatial Data Types?

ST_Geometry – ESRI spatial data type

- Esri spatial type to store geographic features
 - Default in geodatabases since 9.3
- Created with a geodatabase
- Allows access to spatial data through SQL functions
- Efficiency - Automatic geometry validation
- Conforms to ISO and OGC standards
- Can be used in Oracle databases even if geodatabase isn't enabled

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

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**
- **Obtain the st_shapelib library**
 - **Delivered with ArcMap and ArcGIS Server or download from MyEsri**
 - **If using for a geodatabase, ensure library and geodatabase versions match**
- **On Windows, requires Microsoft Visual C++ Redistributable Package**
 - <http://desktop.arcgis.com/en/system-requirements/latest/database-requirements-oracle.htm>
 - **Versions needed for Desktop / Pro are different**

ST_Geometry Spatial Type Configuration

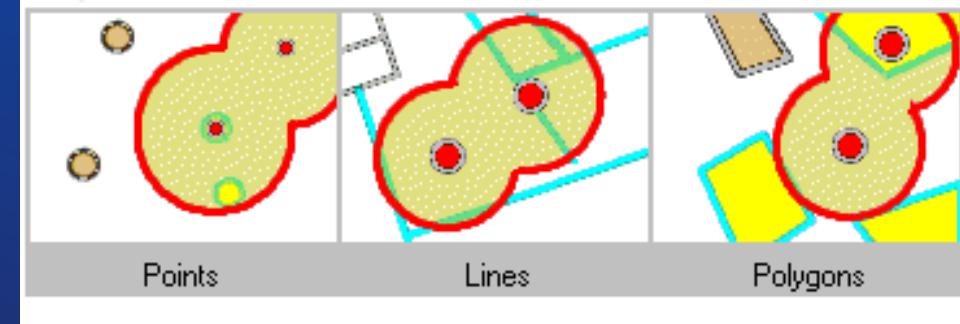
- **Edit extproc.ora**
 - 11g and 12c use extproc.ora located in ORACLE_HOME\hs\admin directory
 - EXTPROC_DLLS=ONLY:C:\mylibraries\st_shapelib.dll (Windows)
 - EXTPROC_DLLS=ONLY:/user/esrilibs/libst_shapelib.so (Unix)
- **To enable and upgrade the ST_Geometry spatial type in an Oracle database (not geodatabase), run the Create Spatial Type geoprocessing tool**
 - <https://pro.arcgis.com/en/pro-app/tool-reference/data-management/create-spatial-type.htm>

SQL and geodatabases in Oracle

If spatial data is stored in **ST_Geometry** or **SDO_Geometry** type, you can:

- Create simple tables using SQL
- Perform spatial analysis through SQL

Geodatabase behavior is **NOT** supported through SQL



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

Configure Oracle Client

- **Install 64 and/or 32-bit Oracle client on ArcGIS client machines**
 - ArcGIS Desktop & ArcGIS Engine require 32 bit
 - ArcGIS Server & ArcGIS Pro require 64 bit
 - When both installed on the same machine, place 64 bit before 32 bit in PATH
- Instant, Runtime or Admin client supported
- Update TNSNAMES & SQLNET files

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

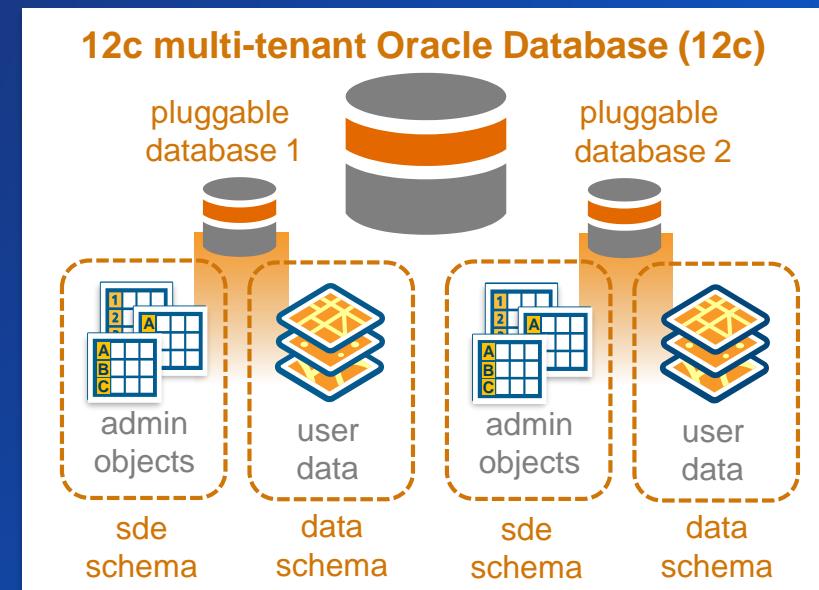
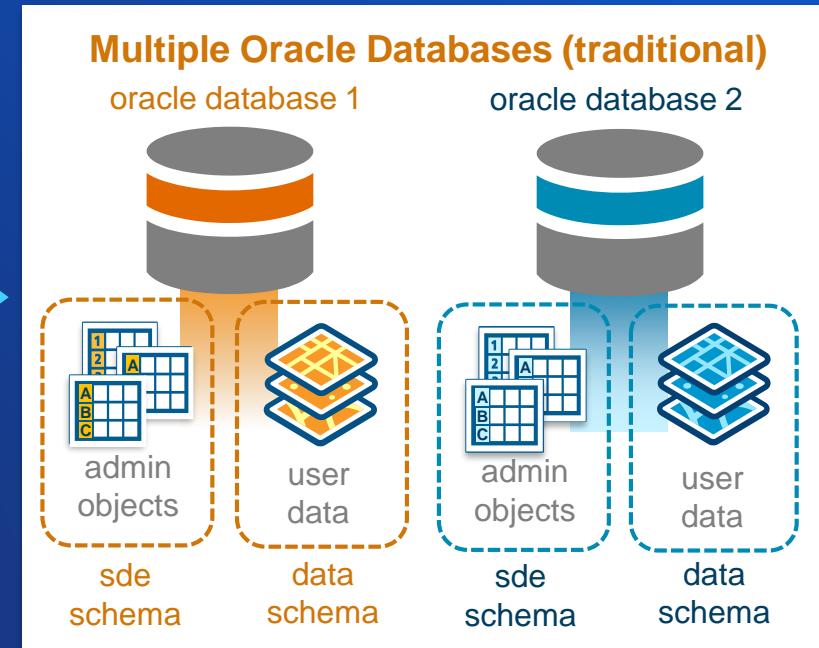
Create a Geodatabase

Two geoprocessing tool options. Use the one that meets your needs.

Create Enterprise Geodatabase	Enable Enterprise Geodatabase
Requires sys user credentials	Requires SDE user credentials
Creates <ul style="list-style-type: none">• SDE user• Tablespace for sde user (sde_tbs) using default tablespace location ("%ORACLE_HOME%/DATABASE" directory) and parameters• Grants necessary privileges to packages and SDE user	Requires the dba to <ul style="list-style-type: none">• Create the SDE user• Tablespace for sde user• Grant necessary privileges to packages and SDE user Allows flexibility for customizing tablespaces, as they are created before the tool is run
Creates database objects and ST_Geometry spatial type that compose a geodatabase	
Oracle cloud requires Wallet configuration - Needed for creating tablespaces	

Multiple Geodatabase in Oracle

- **Multiple traditional Databases**
- **12c Pluggable Database**
(Check licensing options with Oracle)
- **User Schema Geodatabases**
 - Deprecation plan
 - Desktop 10.6.x / Pro 2.3 is last supported version for creation of user schema geodatabases
 - Upgradable for next few release cycles

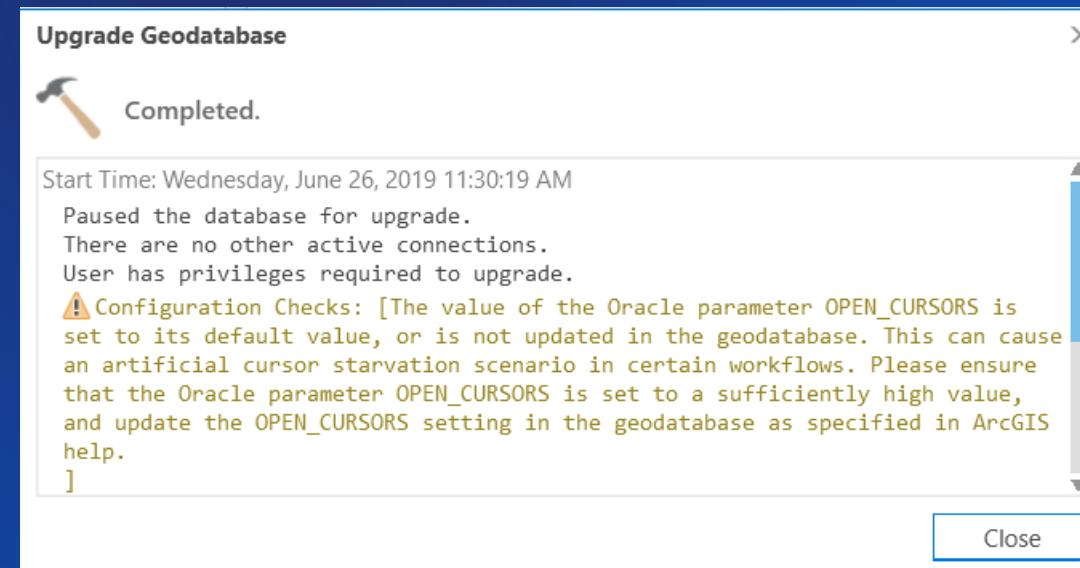


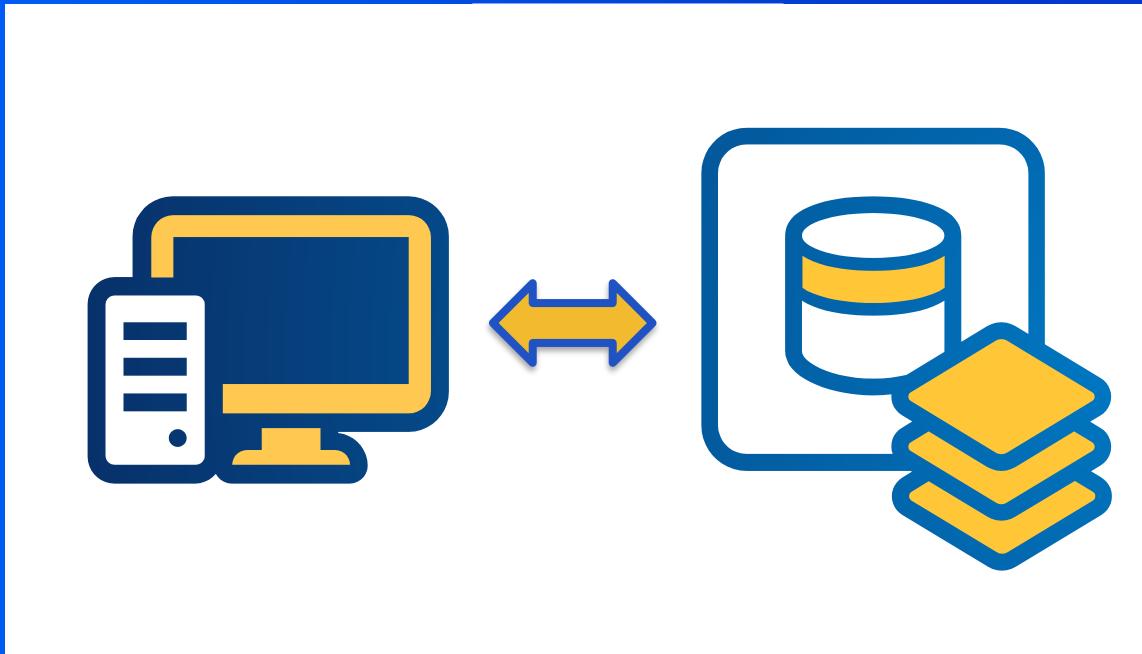
Upgrade a geodatabase

- **Review pre-requisites and requirements**
 - <https://pro.arcgis.com/en/pro-app/help/data/geodatabases/manage-oracle/upgrade-geodatabase-oracle.htm>
- **Test first (staging or test environment)**
- **Order of operations when upgrading both geodatabase and Oracle**
 - One at a time: OS->Database->Geodatabase
 - **Oracle needs to be at supported release for target geodatabase version**
 - **Applies to geodatabase **AND** ALL connecting clients**
 - **User-schema geodatabases**
 - **Other schemas (Data Reviewer, Workflow Manager)**

Upgrade a geodatabase

- **Review**
 - **ST_shapelib library version**
 - **The open_cursor parameter must match the Oracle parameter value**
 - **Starting at 10.7.1 and ArcGIS Pro 2.4, a warning is thrown if these values do not match**
 - <https://pro.arcgis.com/en/pro-app/help/data/geodatabases/manage-oracle/update-open-cursors.htm>





DEMO

**Configure Oracle
and
Connect from ArcGIS**

Mandar Purohit



Configure Geodatabase Storage

- **SDE.DBTUNE** - Mostly legacy and defaults work well
- Configuration keyword and parameters for storage type and location
 - Can adjust for backup requirements, activity, size of segment (table, index)
- **Geometry storage**
- **VARCHAR2 vs. NVARCHAR2**
 - **UNICODE_STRING**

<https://pro.arcgis.com/en/pro-app/help/data/geodatabases/manage-oracle/configuration-parameters-oracle.htm>



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

To register an existing Oracle table that contains an SDO_Geometry column requires that the table...

- Be owned by the user registering the table
- Contains a single SDO_GEOMETRY column
- Contains no other columns of a user-defined type
- Has a valid entry in the view USER_SDO_GEOM_METADATA
- Stores a single type of geometry (points, lines, or polygons), can be multipart
- Contains 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
- 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.**
 - `UTL_RECOMP.RECOMP_SERIAL('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**
 - Set layers on/off based on the scale
- **Database Statistics**
- **Indexing**
- **Spatial data performance - Spatial Index**



Performance Tips

- **Make sure you maintain properly for the various workflows**
 - Traditional versioned editing, branch 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**
 - **Global temp tables are default starting at 10.7.1**
 - **Created when “add database user GP tool” is used**
 - **OR when a selection of over 100 features happens for the first time**
 - **Pre 10.7.1 option of using shared or session based**
- **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 in Oracle release cycle**
- **Support for long table names (128 characters) for Oracle 12.2 and later releases**
- **Changes Related to Logfile tables implementation**
 - Create Database User tool creates log file tables for new users at 10.4
 - Logfile tables for SDE user created as global temporary tables at 10.5
 - Used by read only user
 - Logfile tables for all users created as global temporary tables at 10.7.1

Other notes from previous releases..

- SSL connections are supported starting at 10.6.1
- Register views with the geodatabase – 10.5.x
 - Register with Geodatabase GP 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
- SDO_GeoRaster can be viewed, but not created at 10.5
- **10.5 Oracle Insufficient Permission Error Patch**
 - <http://support.esri.com/Products/Desktop/arcgis-desktop/arcmap/10-5#downloads?id=7504>

Other Geodatabase Related Workshops

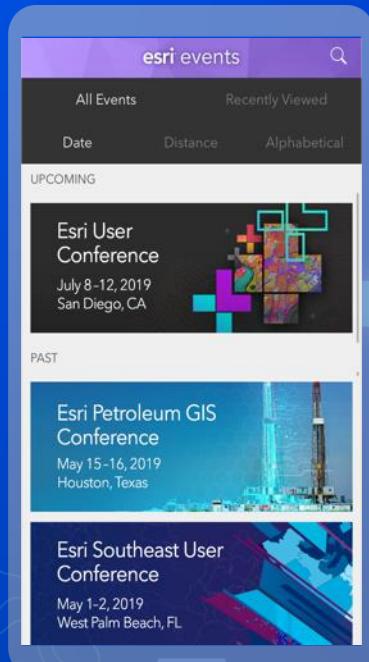
Workshop	Location	Time Frame
Geodatabase: An Overview	SDCC - Room 05 B	Tue - 08:30 AM - 09:30 AM
	SDCC - Room 14 A	Wed - 08:30 AM - 09:30 AM
Enterprise Geodatabase: Introduction to Multi-User Geodatabases	SDCC - Room 05 B	Tue - 10:00 AM - 11:00 AM
	SDCC - Room 14 A	Wed - 10:00 AM - 11:00 AM
Enterprise Geodatabase: Introduction to Multi-User Editing	SDCC - Room 30 D	Tue - 04:00 PM - 05:00 PM
	SDCC - Room 30 E	Wed - 01:00 PM - 02:00 PM
Enterprise Geodatabase: Performance Troubleshooting	SDCC - Room 16 A	Tue - 01:00 PM - 02:00 PM
	SDCC - Room 9	Wed - 01:00 PM - 02:00 PM
Esri Best Practices: Implementing an Enterprise Geodatabase	SDCC - Room 31 A	Wed - 02:30 PM - 03:30 PM
Geodatabase: Ensuring Data Quality with Attribute Rules and Contingent Values	SDCC - Room 31 B/C	Tue - 01:00 PM - 02:00 PM
	SDCC - Ballroom 06 E	Thu - 04:00 PM - 05:00 PM
Geodatabase: Ensuring Data Quality with Topology	SDCC - Room 14 A	Wed - 01:00 PM - 02:00 PM



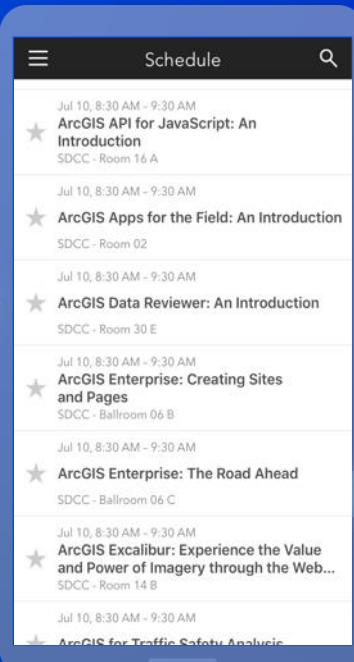
Thank you
Questions?

Please Share Your Feedback in the App

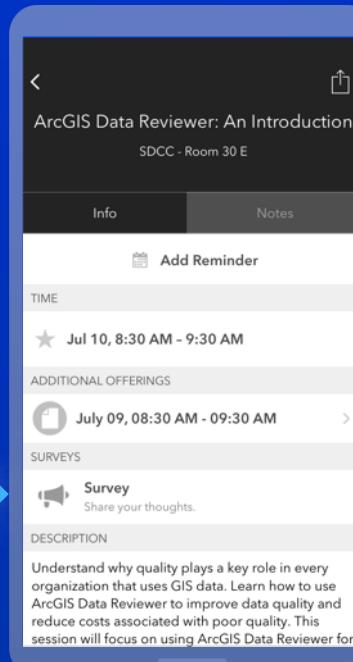
Download the Esri Events app and find your event



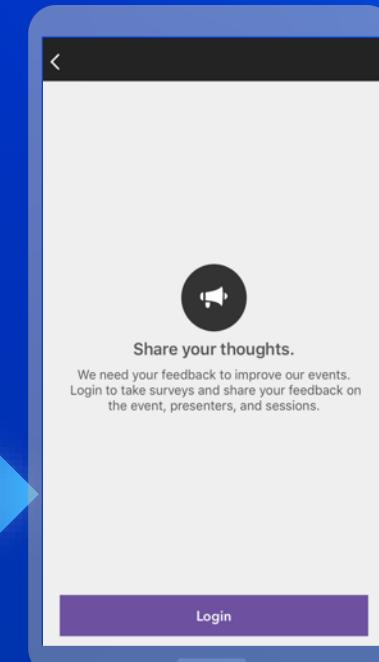
Select the session you attended



Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"

