# Administering Your Oracle Geodatabase

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# Intended Audience

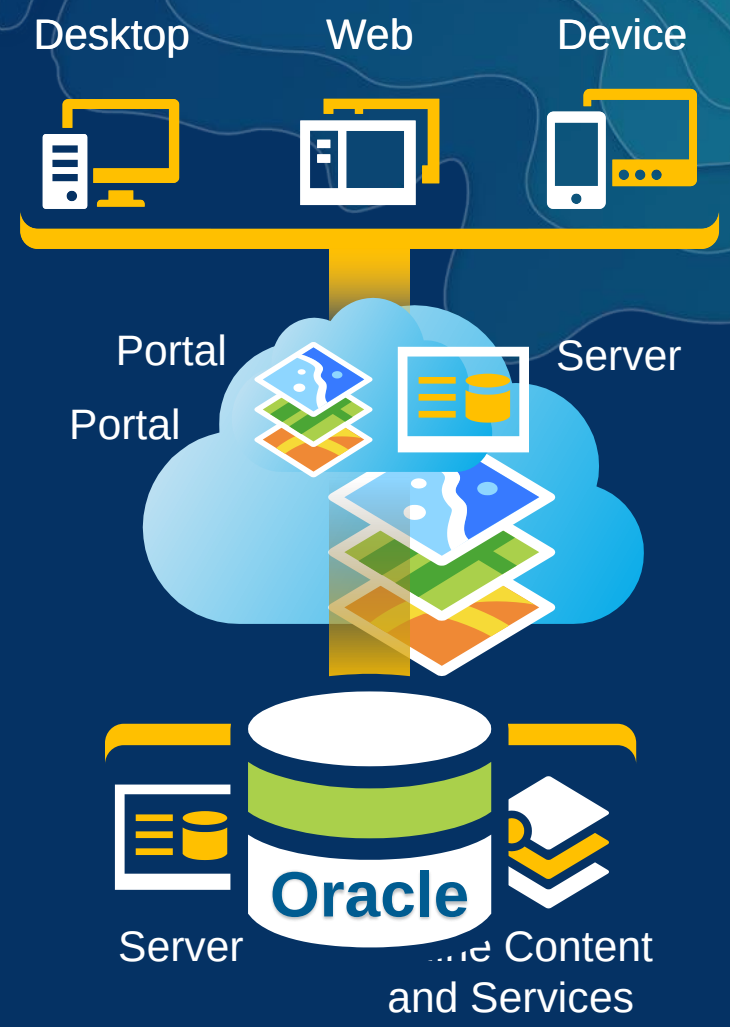
## You are…..

- A geodatabase administrator
- An accidental DBA
- A deliberate DBA
- Not sure what DBA means

## And you…

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

## This is your session!



# Agenda

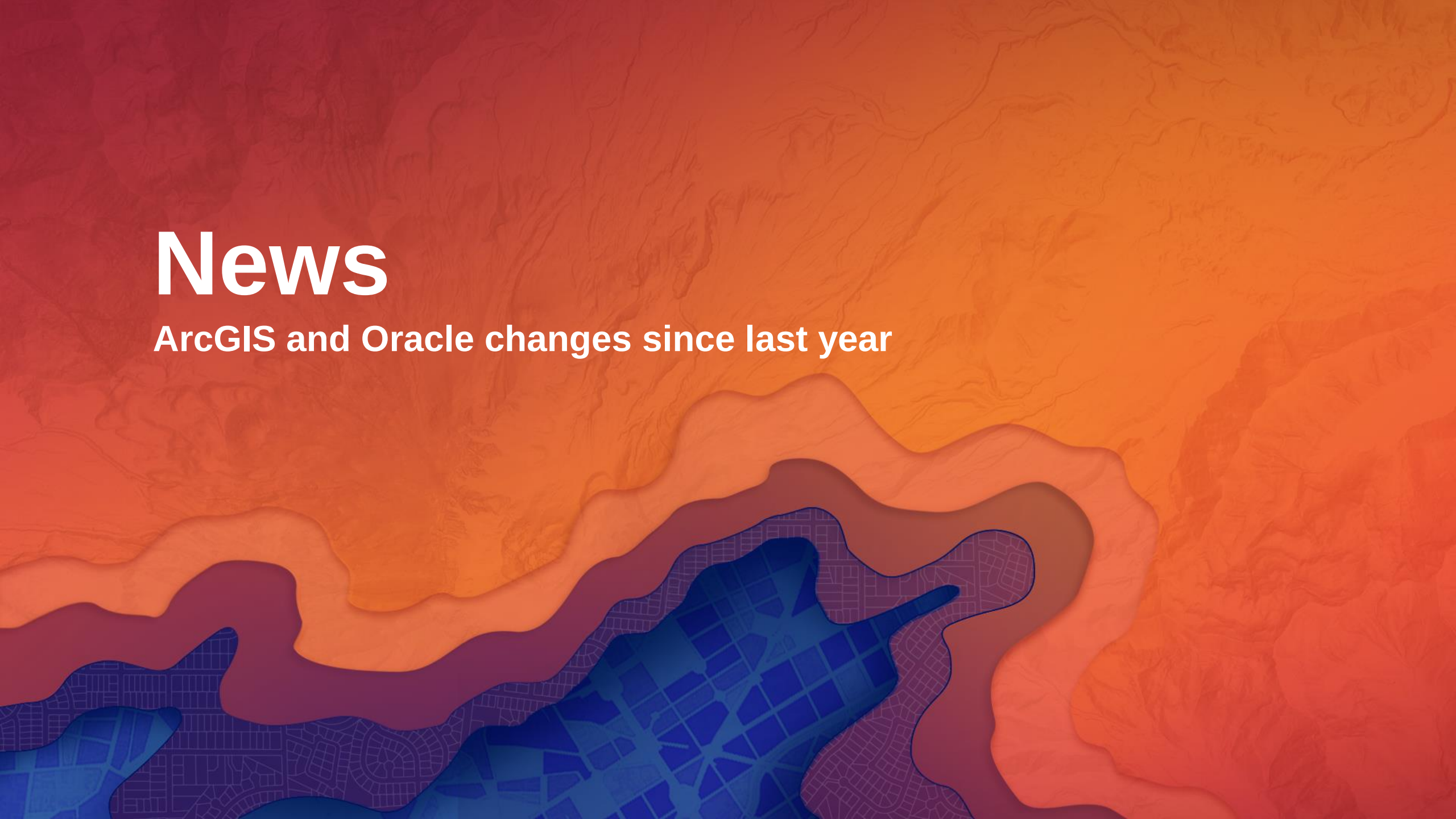
**News since the last UC**

**How do I …**

- **Configure Oracle to support geodatabases?**
- **Create geodatabases?**
- **Control access to my data?**
- **Make sure that my data is safe?**
- **Maintain good performance?**

# News

## ArcGIS and Oracle changes since last year



# What's new at 10.5.x

- **Register views with the geodatabase**
  - **Register with Geodatabase geoprocessing tool extended to views**
- **New Default Raster Storage Type**
  - **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**
  - **When connecting and user does not have sufficient privileges**
- **Create Database User tool creates log file tables**
  - **For new user, introduced at 10.4**

# Other notes at 10.5.x

- **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**
- **Read-Only Connection capability introduced at 10.3.1**
  - **For read-only operations, not selections**
  - **Dataguard**

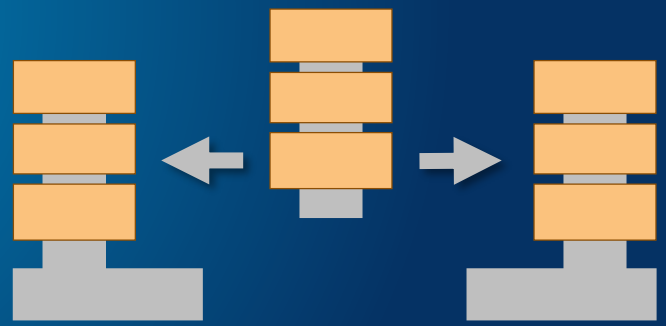
# Supported versions

- 10.3.x last release to support 10g
- 10.4.x & 10.5.x releases certified against 11.2.0.4 and 12.1.0.2
- 10.5.1 allows connections to 12.2.0.1
  - To be certified at next release
- For OS version and level requirements reference system requirements
  - AIX, Solaris, RHEL, SUSE, Windows, etc…
  - 10.4.x to 10.5.x similar but with updates to patch sets and levels

# Oracle 12c Multitenant

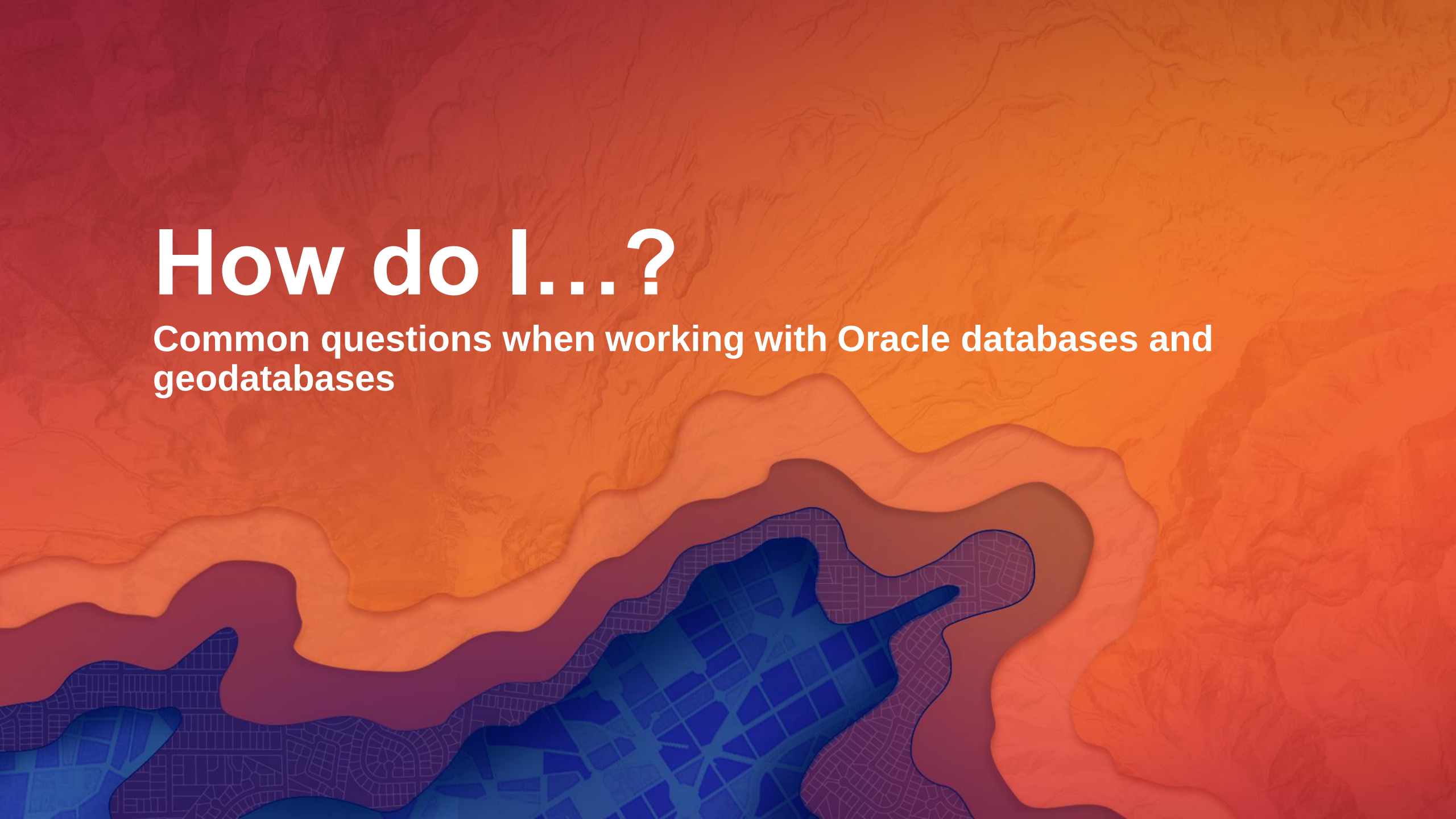
## Pluggable databases

- At 12c Geodatabase can be in
  - Traditional 12c instance or
  - 12c pluggable database not container
- Can provide
  - Rapid provisioning and cloning
  - Staging for patching and upgrades
  - Consolidation and unified management
- May require additional licensing
- Up to 252 PDB's in a single CDB



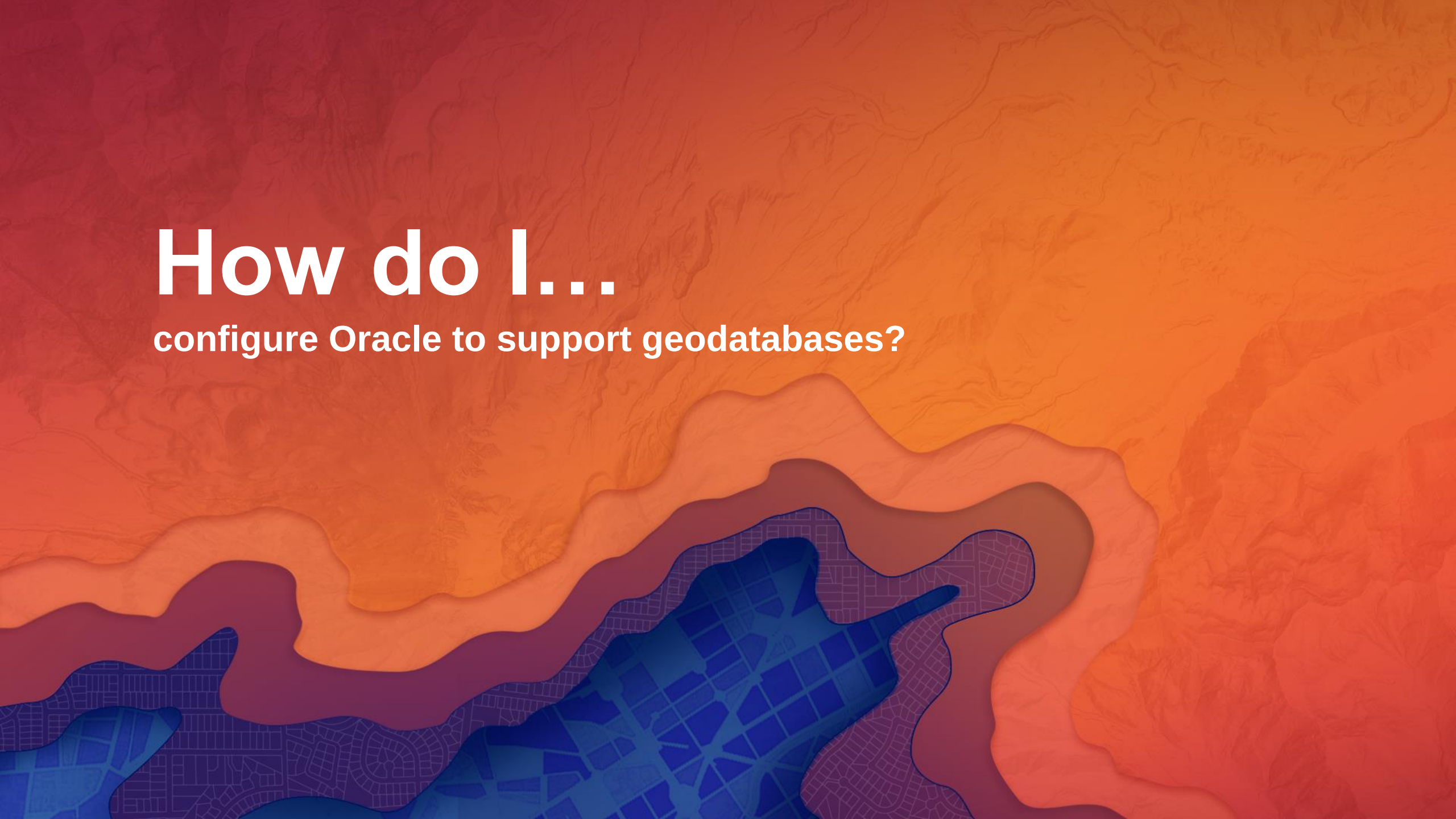
# How do I…?

## Common questions when working with Oracle databases and geodatabases



# How do I…

## configure Oracle to support geodatabases?



# How do I configure Oracle to support geodatabases?

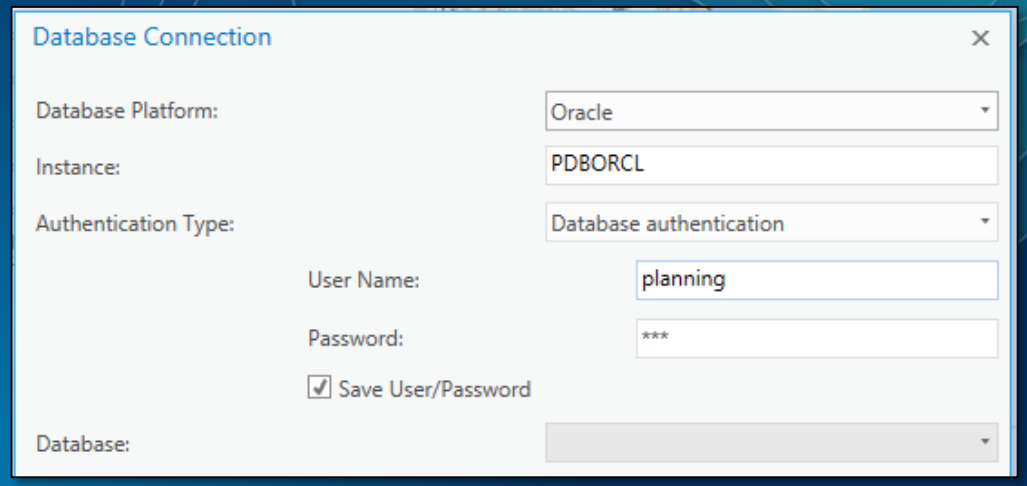
- Install a supported version of Oracle
  - Oracle database requirements for ArcGIS
- Configure 64 bit and/or 32 bit Oracle Client as needed
- Oracle Text Option (installed by default typically)
- Execute privileges on packages
  - dbms_lob, dbms_lock, dbms_pipe, dbms_utility, dbms_sql, utl_raw,
  - dbms_crypto (*sde user only*)
  - after Geodatabase is enabled some privileges can be restricted

# 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 online help)
  - SESSION_CACHED_CURSORS (minimum of 50, 50-150)
- 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

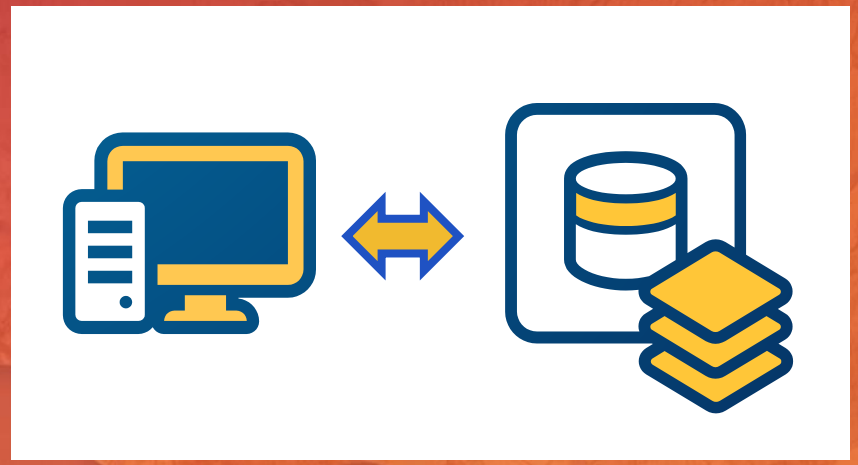
# Oracle Client Notes

- **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` |



# Connecting to Oracle

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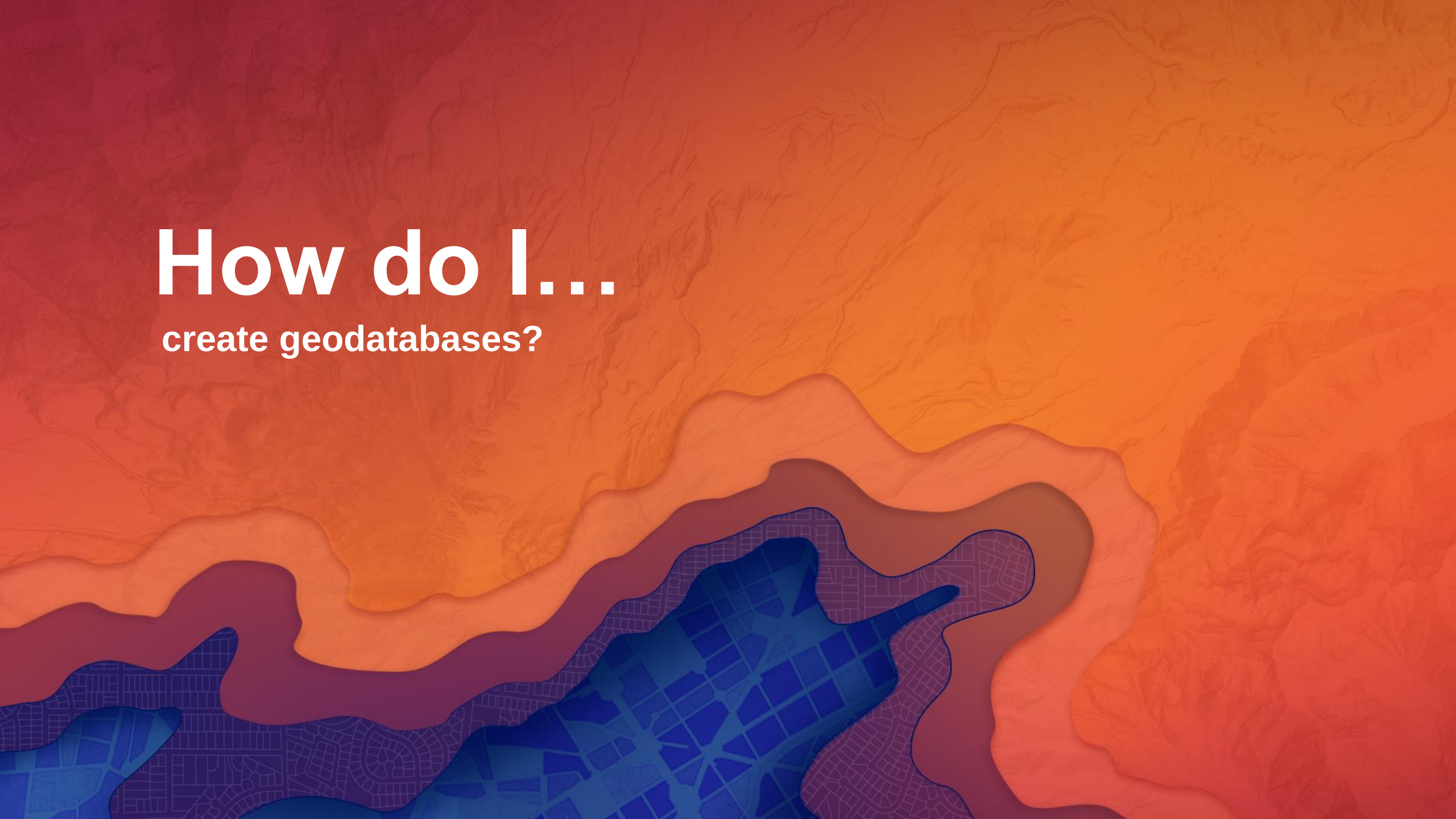
# How do I…

## create geodatabases?



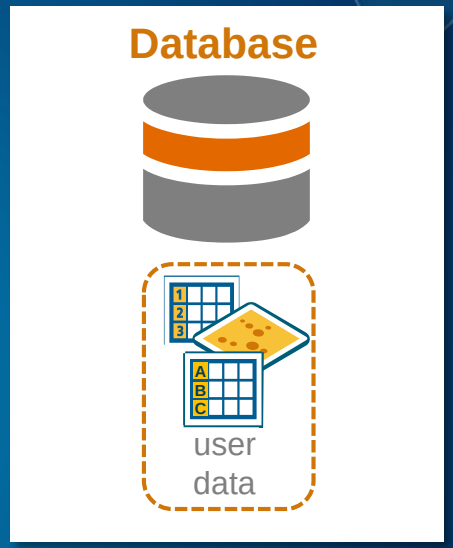
# Databases and Geodatabases

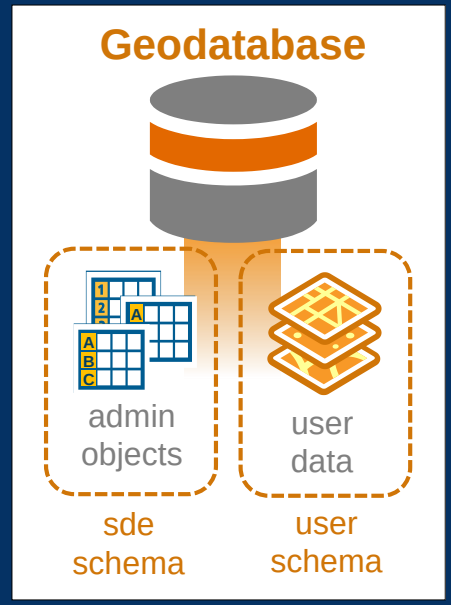
- An Oracle **database** lives in an Oracle database
- A **geodatabase** is an ArcGIS construct hosted in a database
- Options for creating geodatabases
  - Use a GP tool to create a new geodatabase
  - Use a GP tool to create (enable) a new geodatabase in an existing Oracle database – more typical with Oracle

# Database and 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

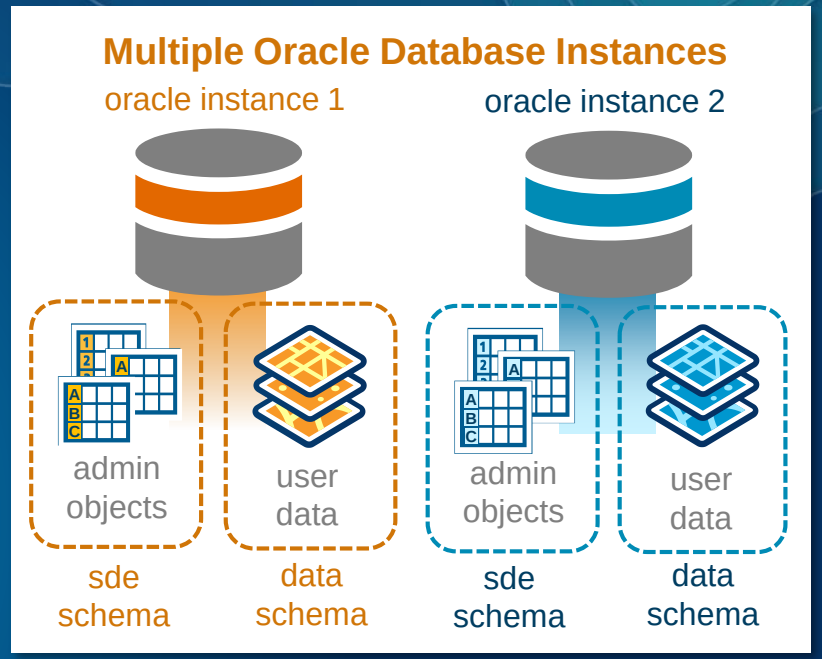


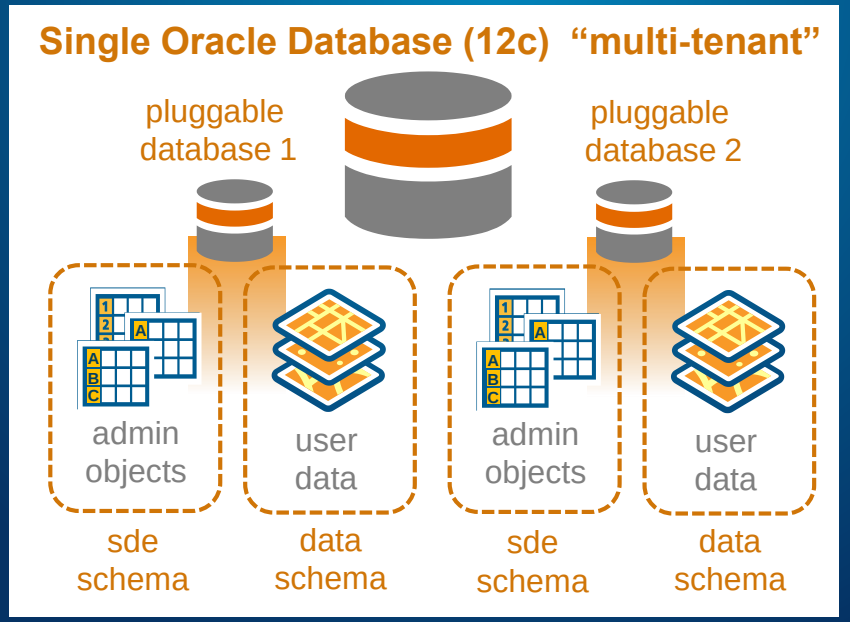




*DBA's typically will be confused by term "Geodatabase", may be easier to say you need an application or administrative schema created.*

# Multiple Geodatabase in Oracle

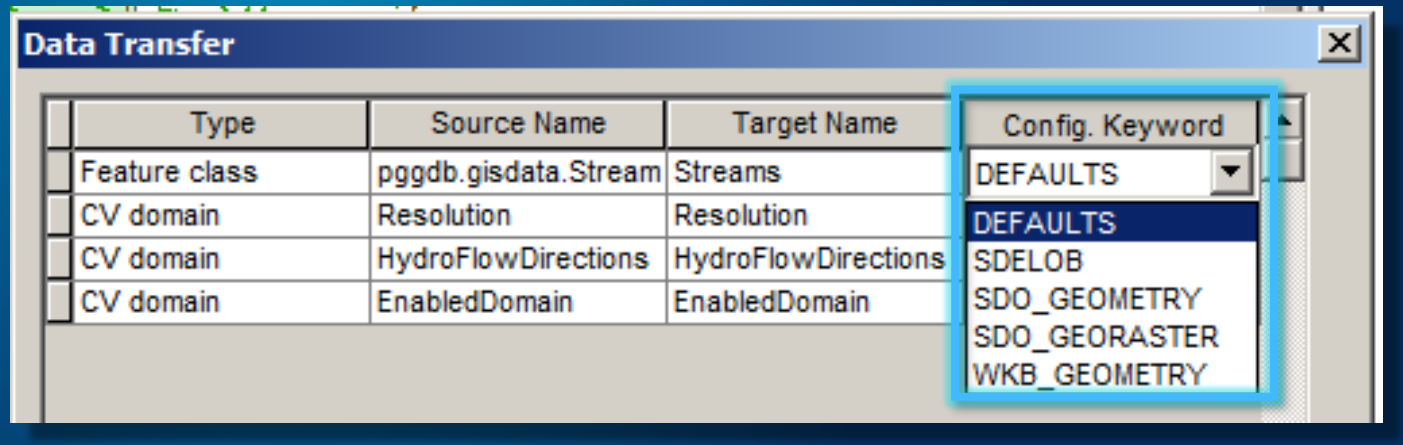
- **Multiple Instances**
- **12c Pluggable Database**
  (*possible additional cost*)
- **User Schema**
  - **Legacy, recommend not using**

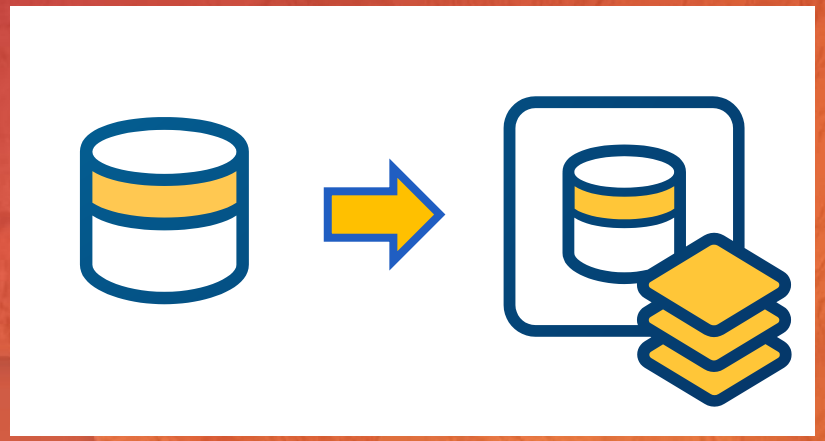


# Controlling Storage

- Configuration keyword and parameters for storage type, location, etc…
  - adjust for backup requirements, activity, size of segment (table, index)
- Geometry Storage
- VARCHAR vs. NVARCHAR
  - UNICODE_STRING





# 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

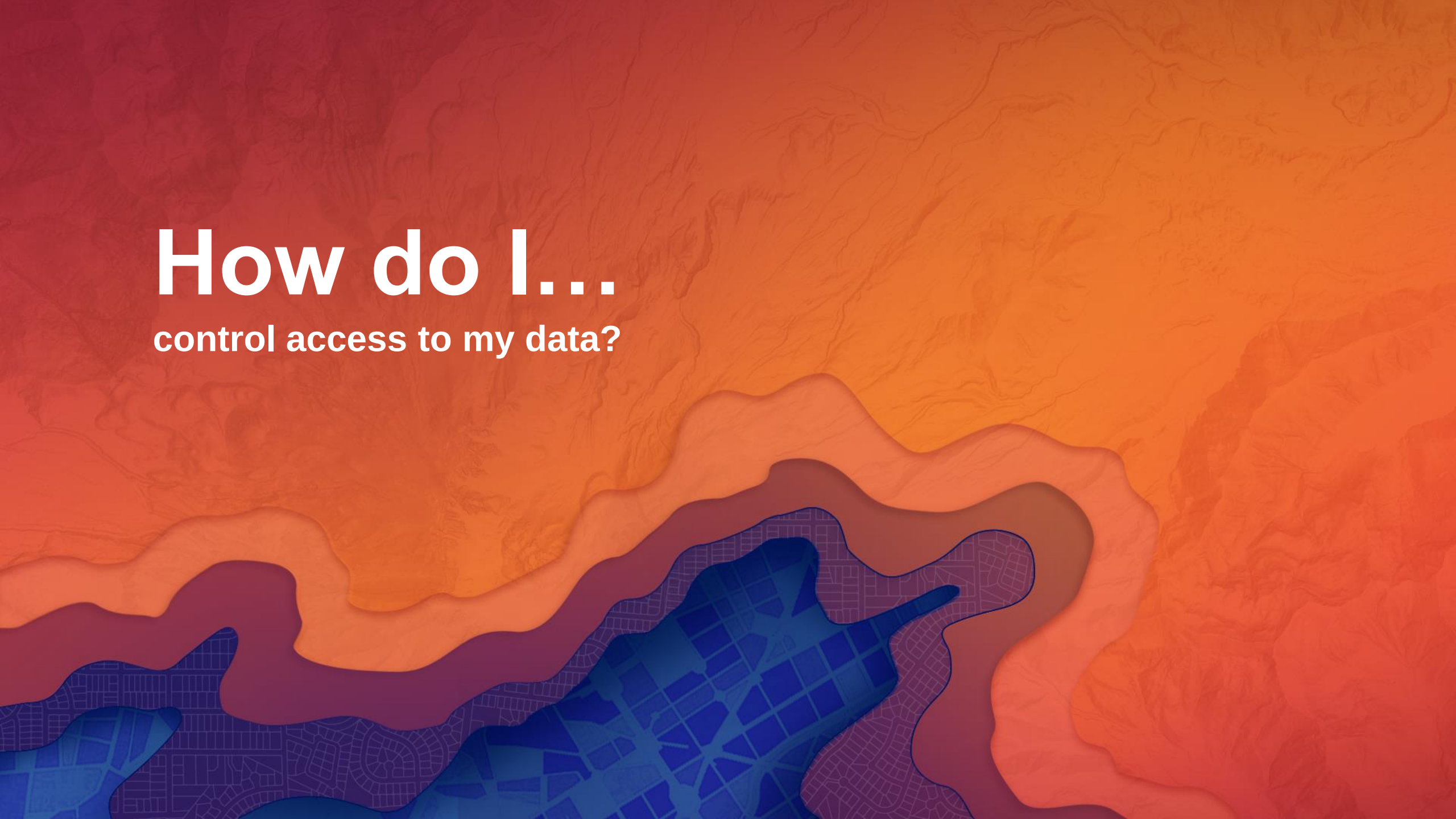
- Review Pre-requisites and Requirements
  http://desktop.arcgis.com/en/arcmap/latest/manage-data/gdbs-in-oracle/upgrade-geodatabase-oracle.htm
- Test first, staging or test environment
- Review
  - ST_shapelib library
  - server_config and dbtune tables in sde schema
  - DBMS_PIPE - Values in the pipe can cause connection problems

# 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)

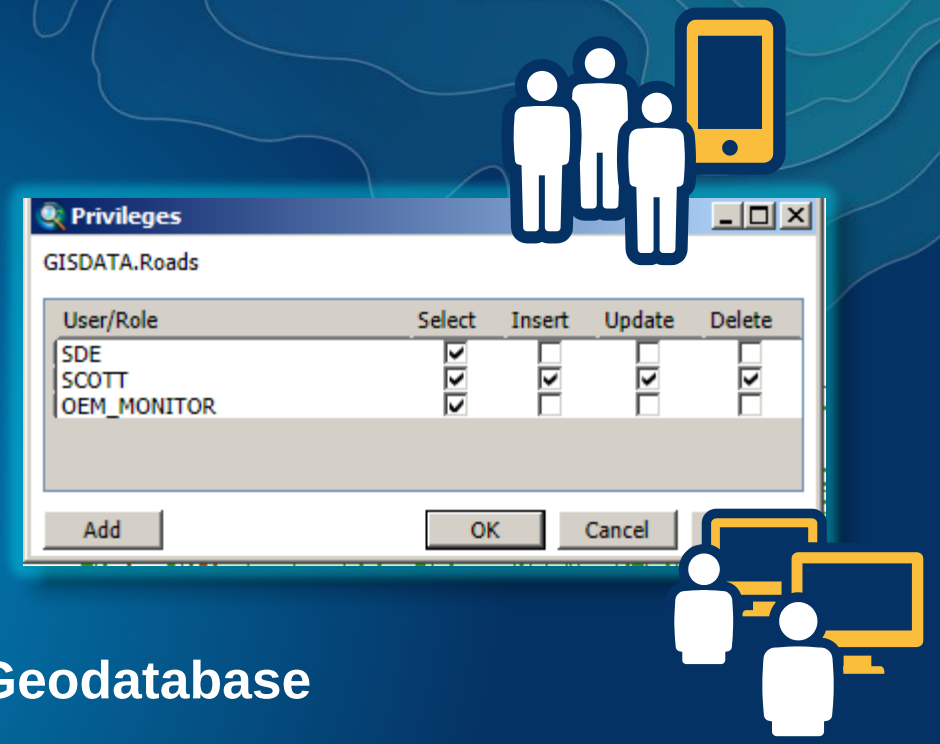
# How do I…

## 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
- Schemas (Data Owners) = Containers



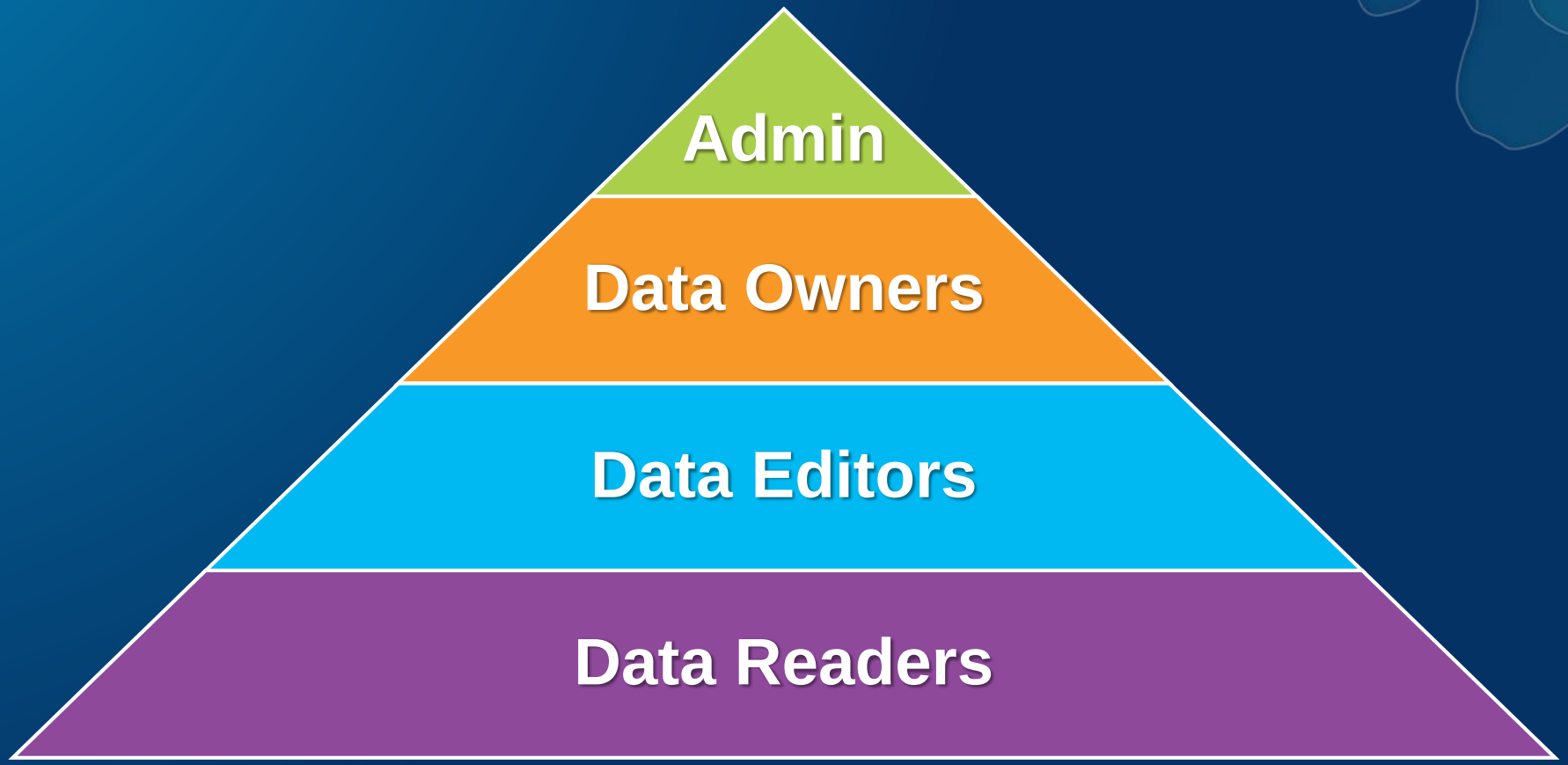
# Additional Privileges

- 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

# 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

# Limit Permissions for Most Users



# Managing Permissions, Roles and Objects

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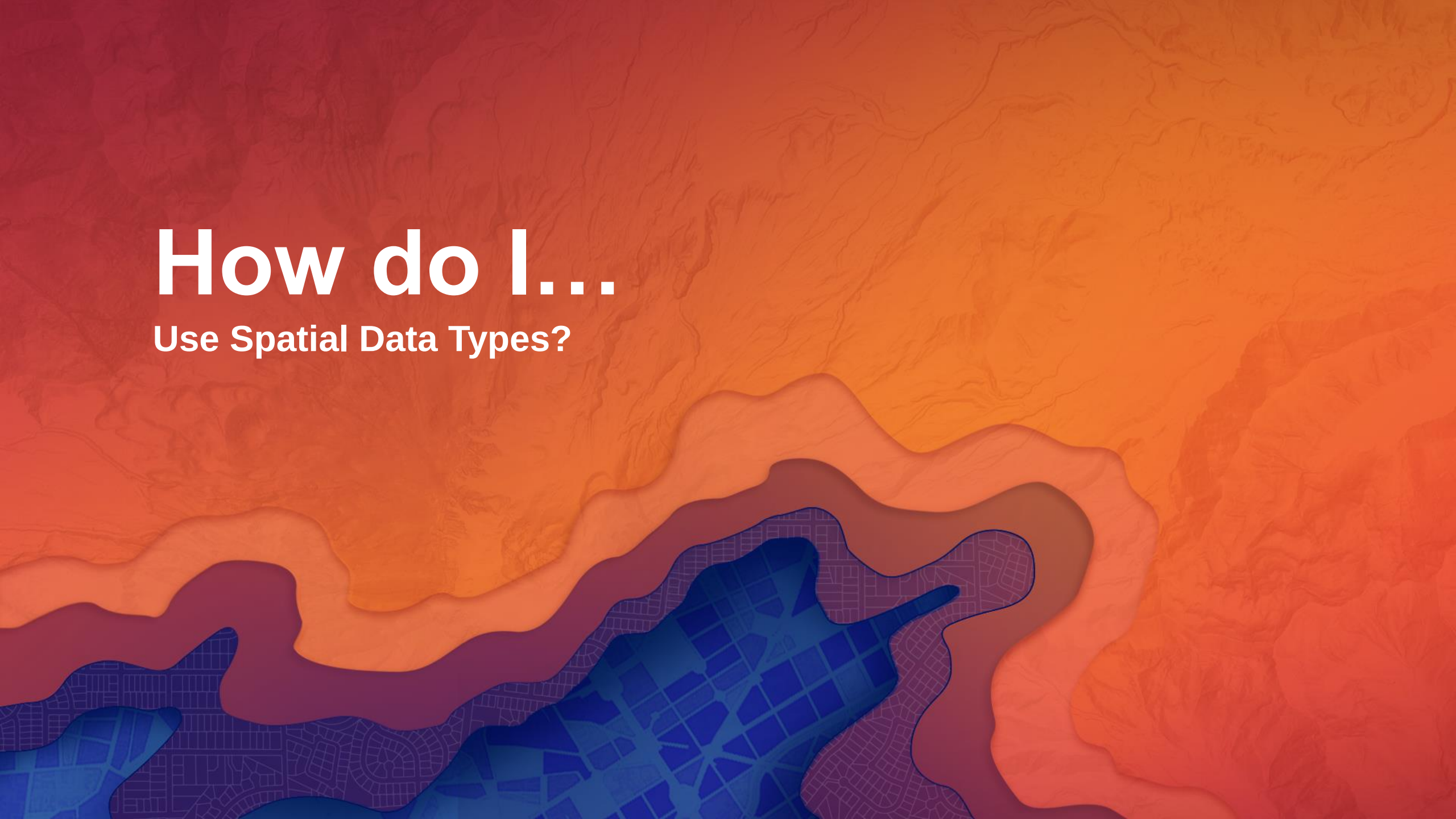
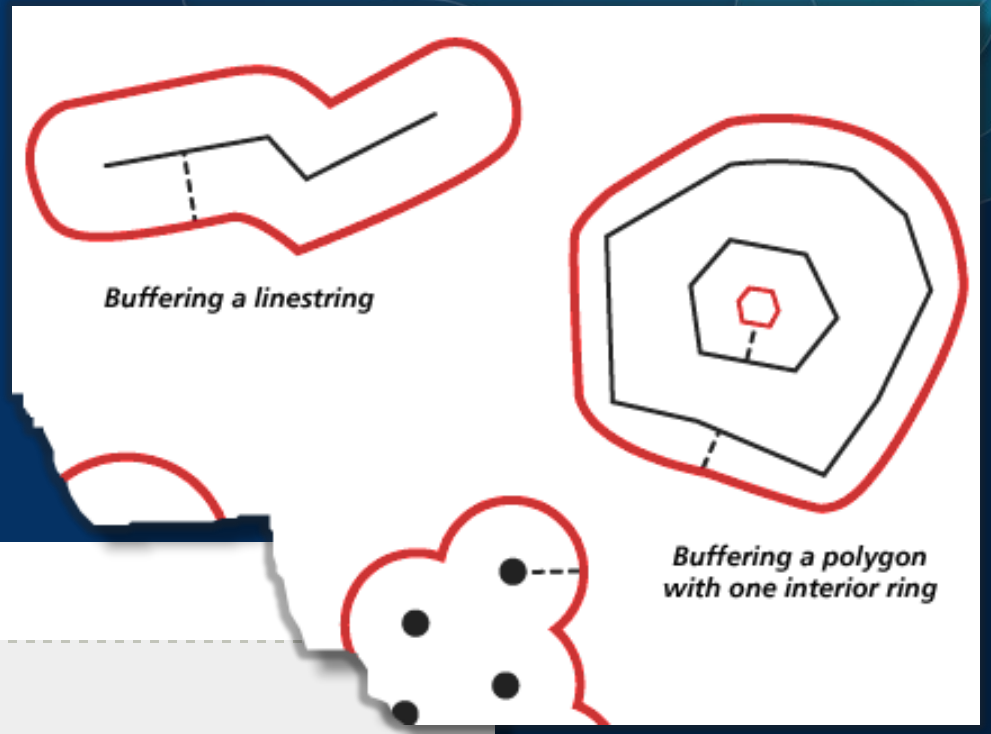
# How do I…

## Use Spatial Data Types?



# Geometry Storage

- Creation of Features through SQL
- Analysis through SQL
- Geodatabase behavior not 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
```

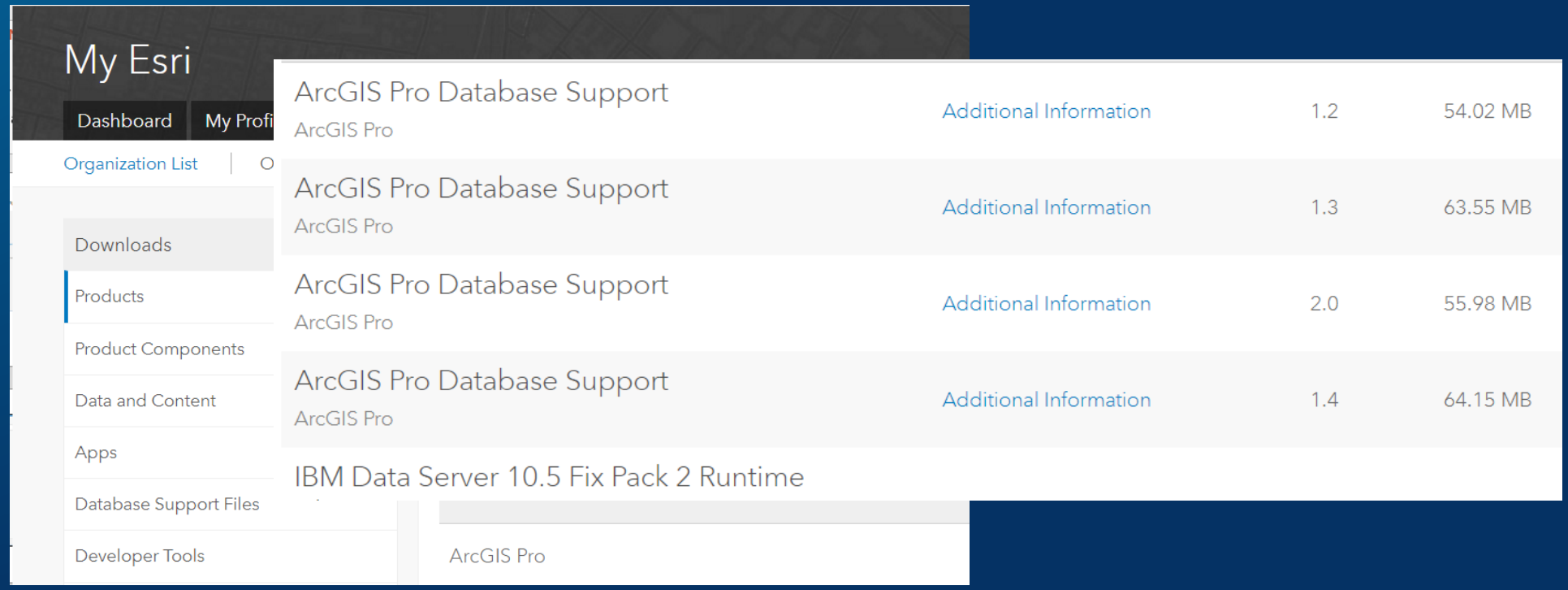
# ST_Geometry

- 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
  - Delivered with ArcMap, Download from MyEsri for ArcGIS Pro
- extproc.ora (11g or later)
- or listener.ora/tnsnames.ora configuration



# 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**

  **ArcMap 10.5.1: MS Visual C++ 2013 Redistributable**

  **ArcGIS Pro 2.0: MS Visual C++ 2015 Redistributable**

# Configuring ST_Geometry Library

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# SDO_Geometry: native Oracle spatial type

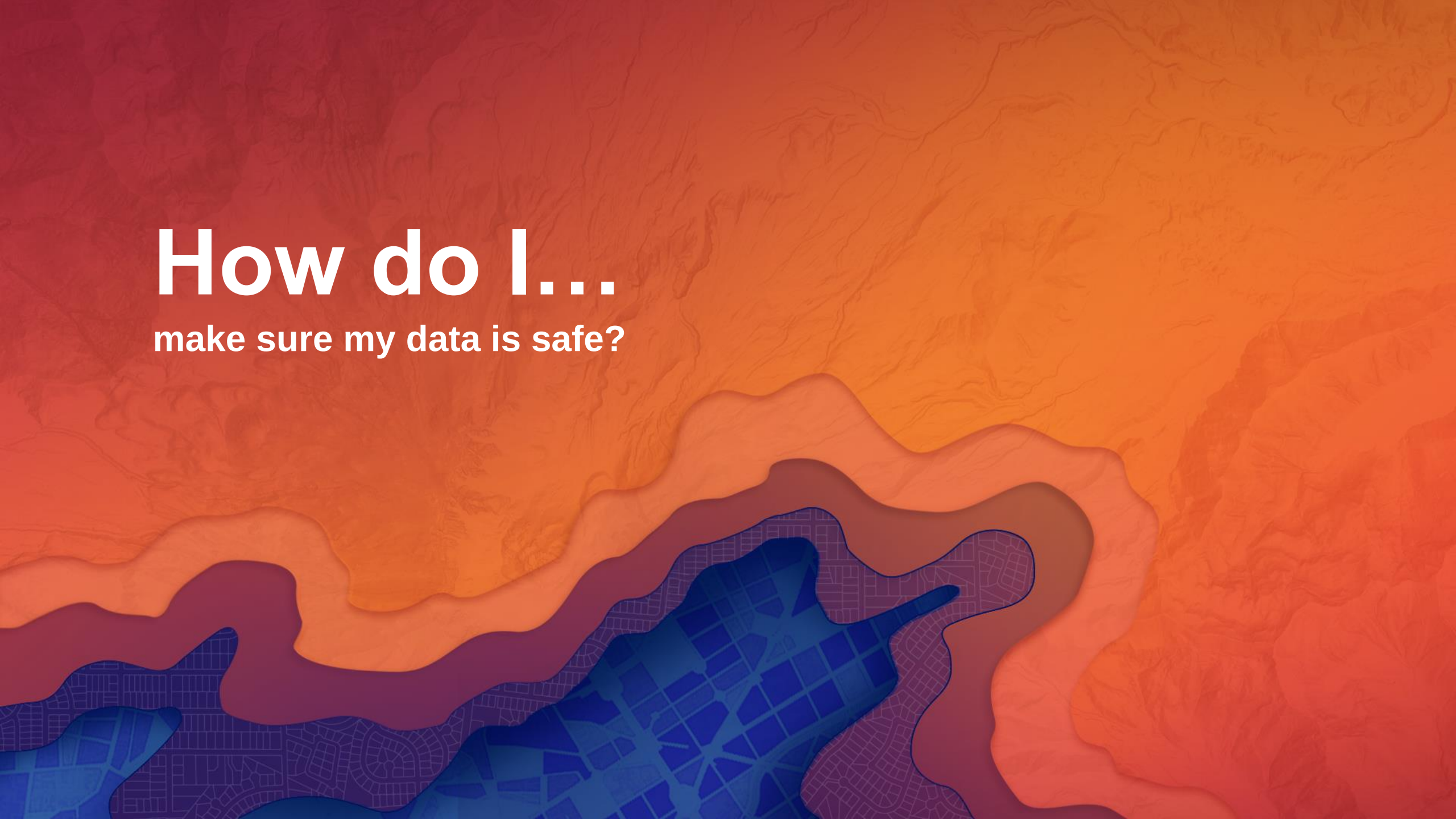
- Validation is not the same between ArcGIS and SDO_Geometry
- Spatial reference metadata synchronization between SDE and MDSYS administrative schemas
- All data in column must be same coordinate system
- Modifications of complex features only through ArcGIS

# 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

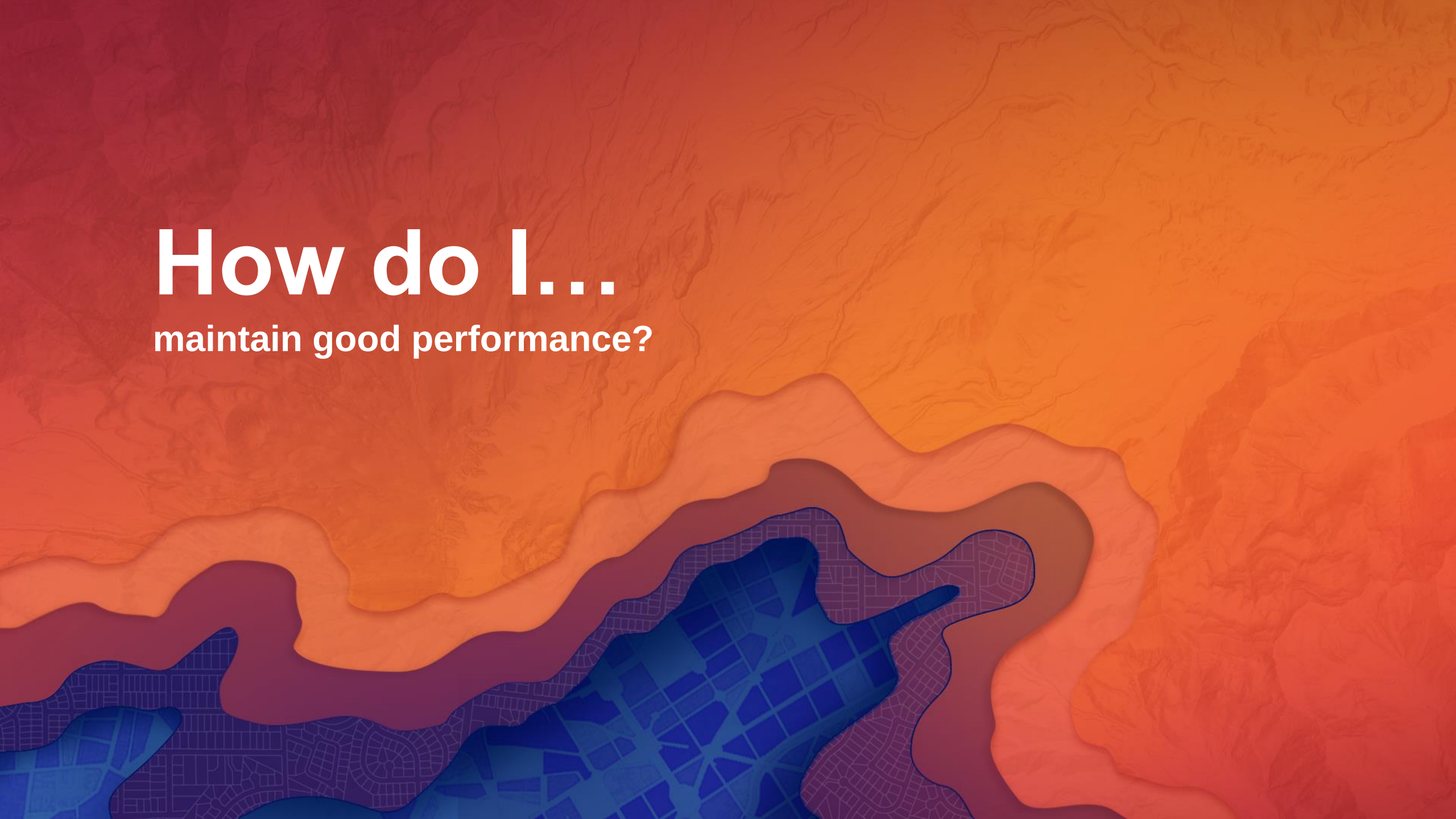
- Methods
  - Recovery Manager (RMAN)
  - User Managed Backups – 3rd party
  - Data Pump Export/Import
- Backup all schemas, including SDE
- Test backup, use to refresh staging
- On restore, may have to compile SDE schema packages.
  - DBMS_UTILITY.COMPILE_SCHEMA('SDE')

# Points to remember

- Backups are the ONLY way to reliably protect your data
- 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…**

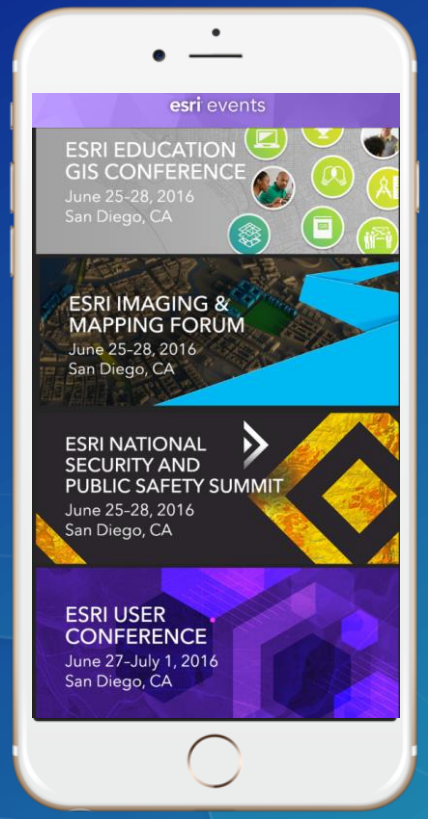
# Thank you

# Questions?

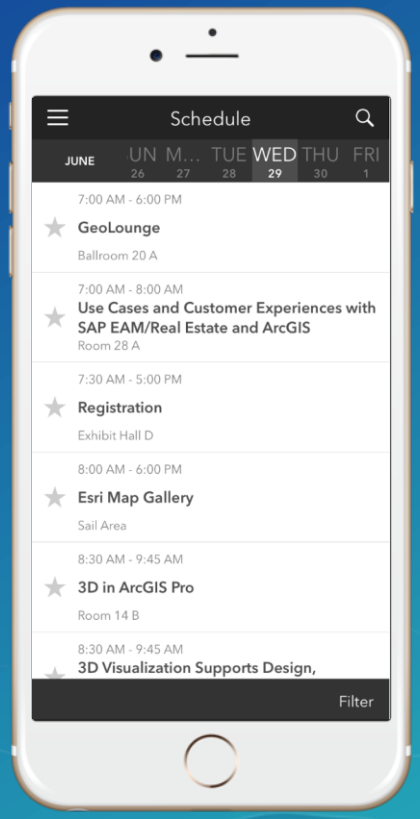
# Please take our Survey

## Your feedback allows us to help maintain high standards and to help presenters

Find your event in the Esri Events App




Find the session you want to review

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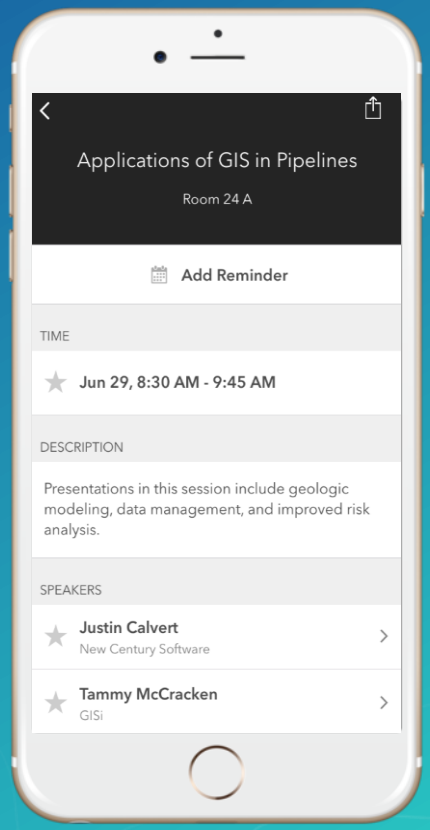
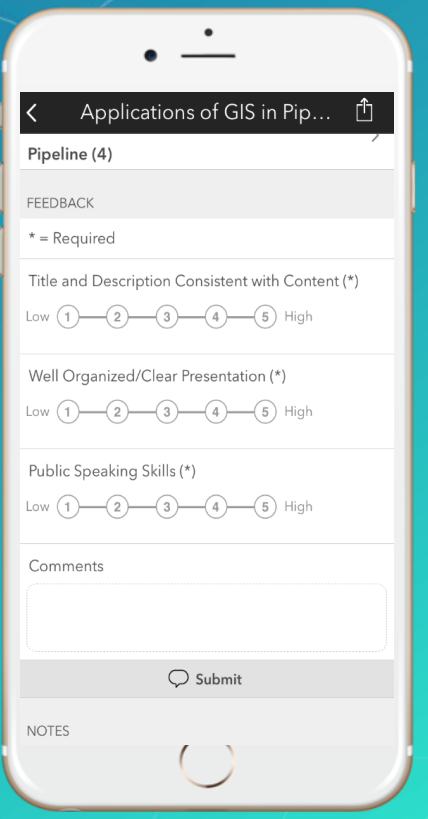



Answer survey questions and submit

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