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Administration for Oracle Advanced

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Goals of this presentation:

- Present some of most common issues effecting Oracle users of SDE technology as they effect Administration, Diagnostics and working with the Spatial Type.
- Provide the application steps for implementing these solutions.

Pre-requisites

- Oracle Administration Intro
- Basic knowledge of database terminology
- Working knowledge of ArcSDE Technology Basics
- Overview of working knowledge of the SDE.ST_Geometry Spatial Type in Oracle

Agenda

- Administration Topics
  - Installation, Migration and Upgrade Scenarios
  - Oracle Parameters
  - Managing Performance in 11g
  - Advanced Configurations
- Loading, Backup and Spatial Types
  - Loading Considerations
  - Export/Import/Backup Options Available
  - Leveraging the Spatial Operators
- What’s new at 10.1

Administration Topics : Migration and Upgrade

- Review Typical Scenarios
  - New Installation of Oracle 11g using Default settings vs.
  - Migration or Upgrade of Existing Geodatabase

Administration Topics : New Installation

- **New installation of Oracle 11g using Defaults.**
  - Known external Data source for loading.
  - 20 Editors, 5 Editor/Analysts
  - 10 connections in use by ArcGIS Server Website.

- **Some issues to consider**
  - Typically no baseline = use standard configuration recommendations
  - Consider architecture
    - single geodatabase or multiple geodatabases (editing vs. publishing)
  - Plan for Growth and Scalability
    - editing workflows and version architectures
    - data synchronization and replication
    - maintenance tasks and schedule

Administration Topics: Upgrade of Existing GDB

- **Migration or Upgrade of Existing Geodatabase**
  - Existing Oracle Database in place
  - Will be upgrading the Oracle then upgrading ArcSDE
  - Is it a major or minor upgrade/migration
    - Oracle 9i/ArcGIS 8.3 to 11g and 10, or
    - Oracle 10g/ArcGIS 9.2 to 11g and 10

Review Parameter Settings
open_cursors = 2000
session_cached_cursors = 50
star_transformation_enabled = false
_push_join_predicate = false
_push_join_union_view = false

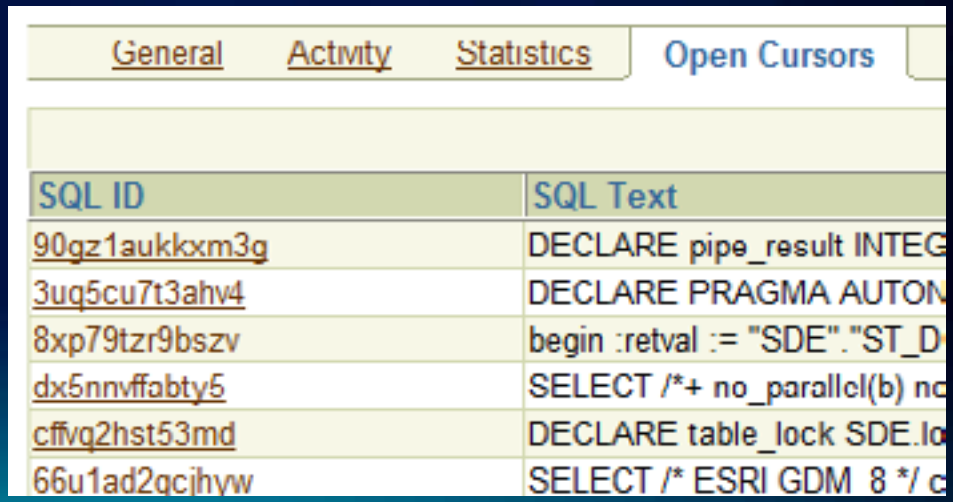
- Some Issues to consider
  - Check Oracle initialization parameters some may not apply to newer version.
  - Don't import old DBTUNE without reviewing possible new DBTUNE parameters
  - ArcGIS Server Application Server needs and impacts
  - New applications or load (number of users, new applications) changes
    - Must be carefully estimated/planned for

Administration Topics : Planning for New Configuration

- **What are some of the more advanced issues?**
  - Long Raw to BLOB
  - Geodatabase Administrative schema changes
  - Differences between Oracle versions
    - 10.2.0.3 to 10.2.0.5 (st_geometry references)
    - Oracle parameter/optimizer changes (cursor_sharing - exact vs. similar)
- **Default Oracle settings are a good starting point except:**
  - Database Cache / Memory, Max number of cursors a session can use, Data Storage
- **Estimate or measure load and storage:**
  - Need to define a sample data, MXD and operations when possible
  - Oracle Enterprise Manager (OEM), Oracle Remote Diagnostic Agent (RDA)

Setup “Basics”: Oracle Parameters

- 8K block size is optimal for most systems
- Memory: Oracle processes, PGA, and SGA (11g AMM)
  - SGA
    - Don’t swap SGA, Shared Pool – minimum 128Mb
  - PGA - 20% of memory allocated to Oracle
- Cursors
  - open_cursors = 2000 on average (or larger as there is no harm)
  - session_cached_cursors = 50+
  - cursor_sharing = exact (similar for custom applications)
- Configure for OLTP (Geodatabase and ArcSDE technology typically produce OLTP activity)



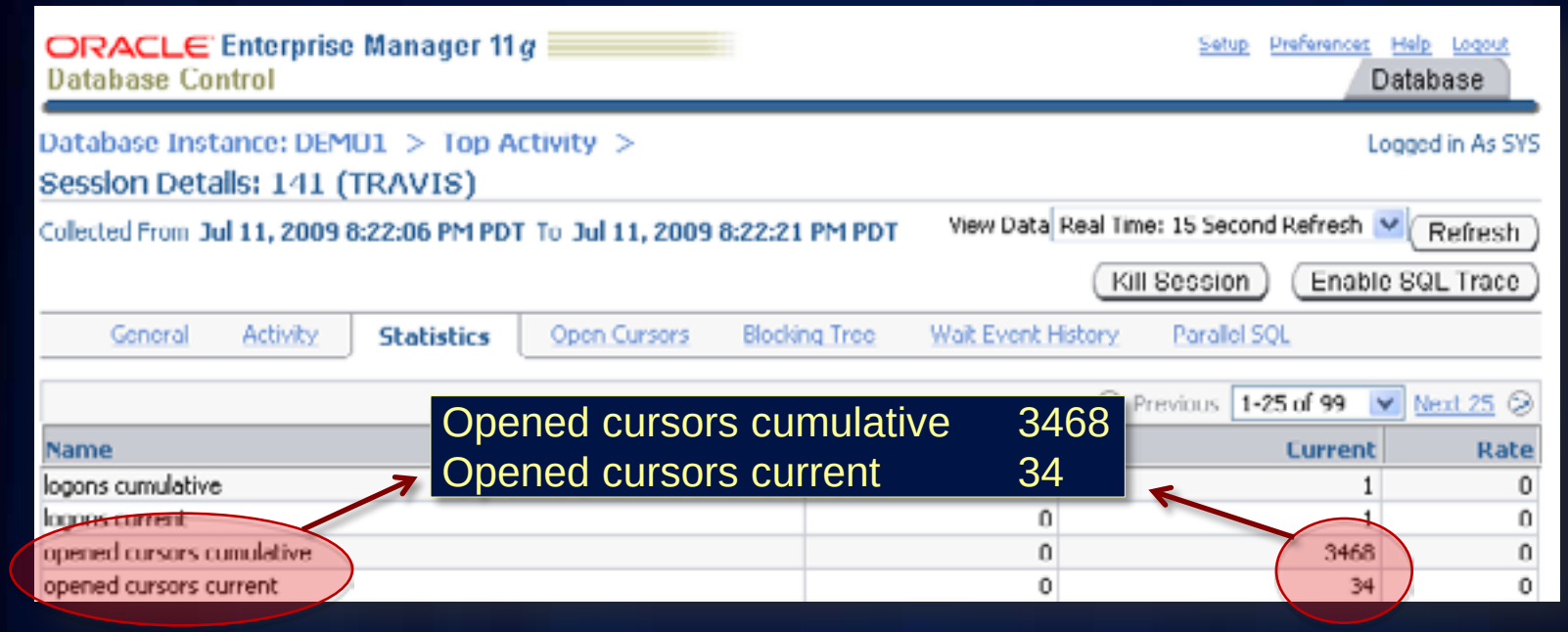
ESRI KB and Help Articles for Parameters/Upgrade

- **FAQ: What is an appropriate value for the Oracle init.ora parameter 'open_cursors'?**
  http://resources.arcgis.com/content/kbase?fa=articleShow&d=27024
- **Error: ORA-01000: maximum open cursors exceeded**
  http://resources.arcgis.com/content/kbase?fa=articleShow&d=28861
- **HowTo: Identify a cursor leak in Oracle**
  http://resources.arcgis.com/content/kbase?fa=articleShow&d=35090
- **SQL Statements using st_geometry operators experience decreased performance in Oracle 11g**
  http://resources.arcgis.com/content/kbase?fa=articleShow&d=35236
- **Oracle Parameters help topics**
  http://webhelp.esri.com/arcgisserver/9.3/java/index.htm#geodatabases/oracle_1010194088.htm

Administration Topics : Capturing Metrics

- Why are the metrics important?
- Only way to understand:
  - How to configure database
  - Changes in performance or scalability for
    - Upgrades, service packs and increased usage
    - Deployment of new applications
  - Data Storage needs
- Establish a performance baseline
  - Oracle tools, ESRI tools, Other tools
- Capture organizational workflows and processes also…
  - For planning GDB Administrative maintenance workflows
  - For planning system resource requirements (peak vs. off-peak)

Capturing Metrics: Session Information



- Check Performance Metrics
- Review Statistics
- Search Sessions
- Select the Correct Session
  - sde.process_information
  - v$session, v$process

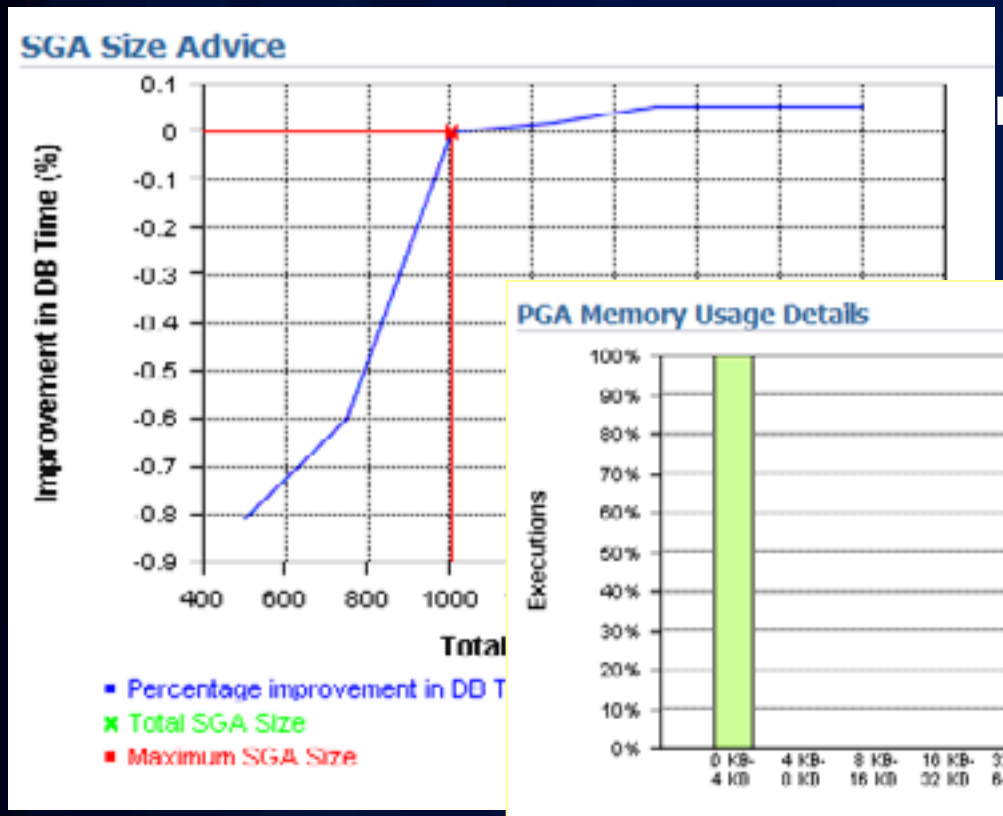
KB30394 – HowTo: Enable extended Oracle tracing for an ArcGIS connection
http://resources.arcgis.com/content/kbase?fa=articleShow&d=30394

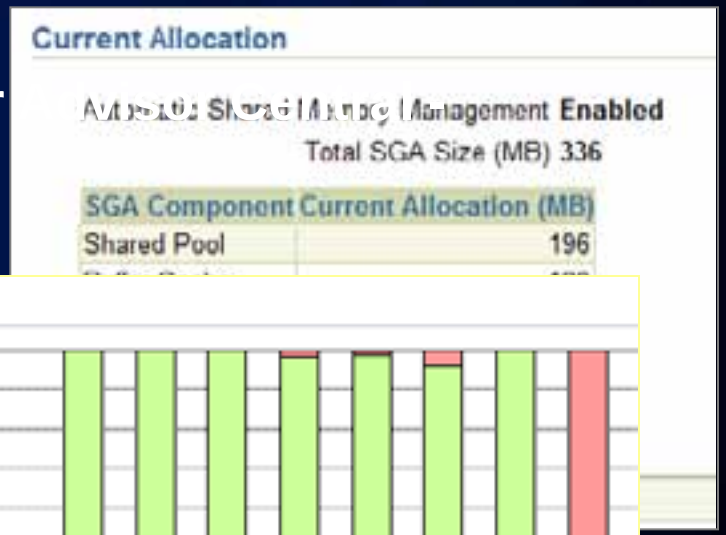
Oracle Session Statistics

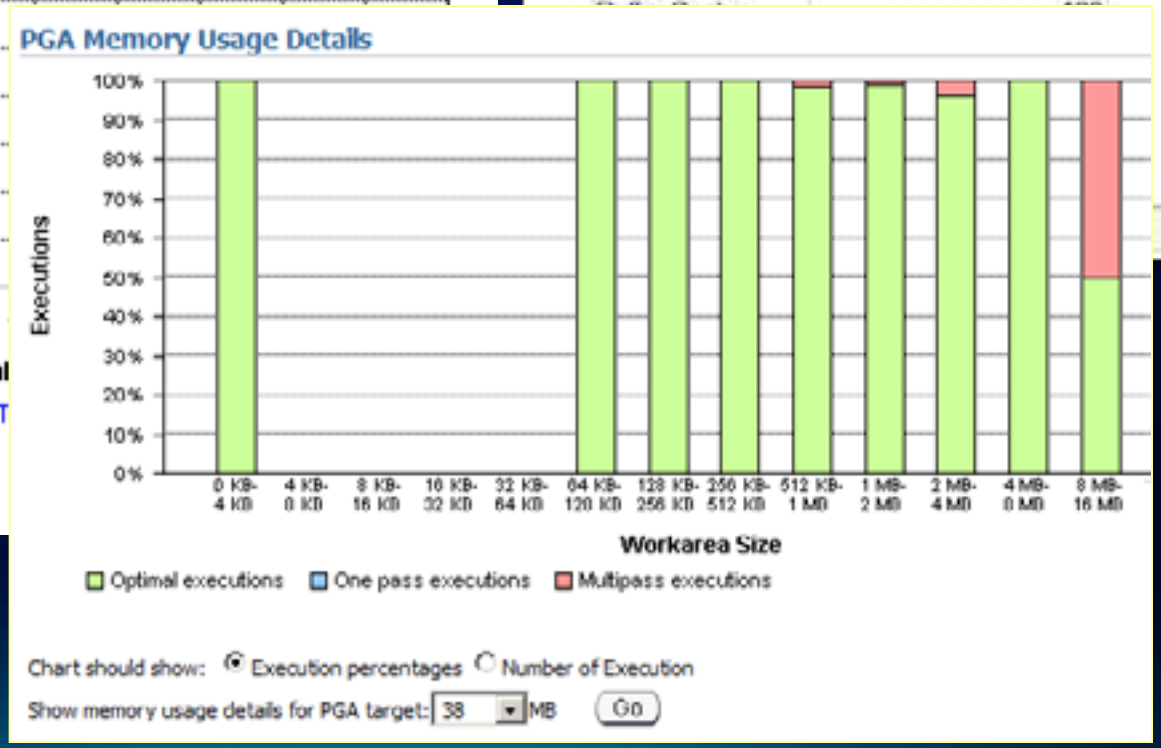
- **Tools available in 11g – Manager Session Statistics**

Name	Connection One	Connection two	Connection three	Connection four
Open cursors	34	29	29	29
Session Logical Reads	69254	45054	45049	45039
Physical Reads Total Bytes	44,687,360	1,671,168	1,679,360	1,679,360
Parse Count (Total)	1965	178	178	178
Parse Count (Hard)	196	1	1	1

Measuring and Monitoring Memory

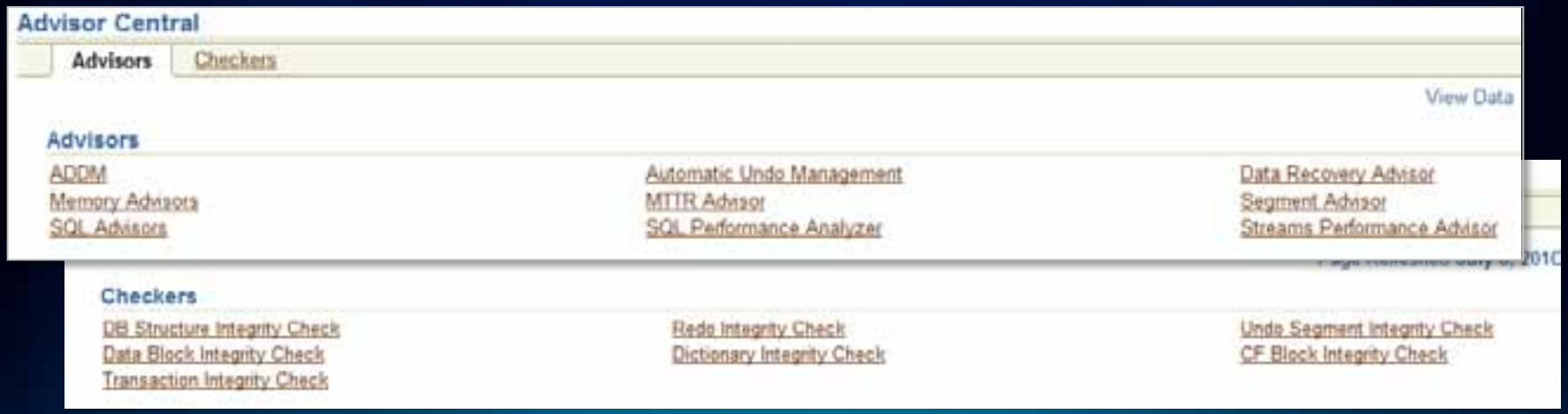






11g Advisors and Checkers - Automation

- 11g Advisors
  - ADDM, Memory, SQL, Automatic Undo, MTTR, SQL Performance, Data Recovery, Segment, Streams Performance
- 11g Checkers
  - DB Structure, Data Block, Transaction, Redo, Dictionary, Undo, CF Block – Integrity Checks



Measuring Storage Space

- **Tools available in 11g – Measure Storage of data source.**

Tablespace	Status	Size (MB)	Used (MB)	Used (%)
ENT	ONLINE	10.000	0.063	
GDB	ONLINE	10.000	0.063	
ROB	ONLINE	19,362.000	3,222.250	

Show the actual database storage

select sum(bytes) from dba_data_files – OS allocated space

select sum(bytes) from dba_segments - allocated to segments

select sum(bytes) from dba_free_space - unused segment space

- **Example shows a lot of allocated free space by truncating or coalescing segments**

```
dba_data_files : 29,245,374,464
dba_segments   : 25,579,814,912
dba_free_space : 22,187,802,624
```

Upgrade Process

- Backup, Backup, Backup!
  - It is NOT a Backup unless it has been tested to make sure it works.
- Check existing GDB for any errors or redundancies
- Clean DBMS_PIPE - Values in the database pipe can cause connection problems
- Upgrade to 10 requires use of ArcObjects GP tool
  - New Geodatabase Administrative schema changes
- “Flatten” Geodatabase <u>if possible</u>
  - reconcile, compress and drop versions and replica pairs this helps to reduce complexity during upgrade if possible, it is not required.

Installation, Migration, Upgrade Summary

- Start with recommended minimum parameters for New and monitor Existing
  - Cursors and Memory (OPEN_CURSORS, SGA, etc..)
  - Check connections parameter in server_config table via sdeconfig export/import command or sql
- Monitor usage, or ask DBA’s to monitor and adjust as necessary
- Establish a performance baseline so future growth and changes can be measured
  - OEM, mxdperfstat, Windows performance monitor, ASH

Managing Performance in 11g

- Things that must be maintained:
  - Statistics
  - Indexes

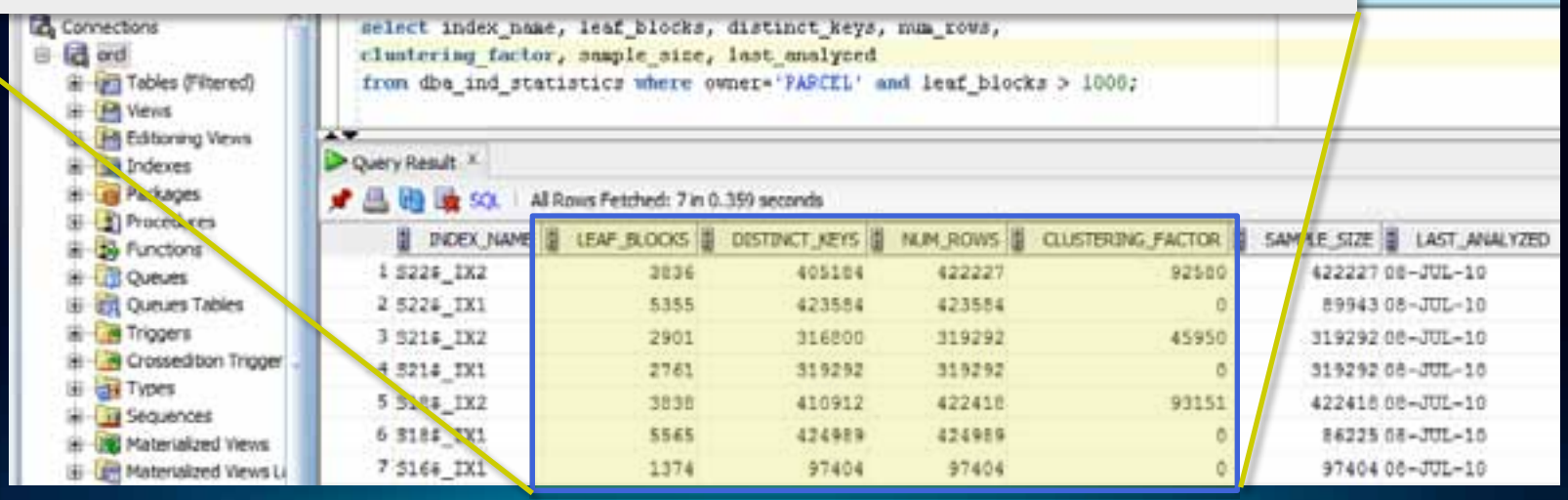
- Tools available for maintaining the Database:
  - RDBMS
  - ArcObjects

Managing Performance in 11g : Statistics

- **Table statistics**
  - The distribution and contents of rows
  - What the optimizer uses to make execution plans
- **Index statistics**
  - Information about the rows stored in IOTs, and other index metadata
- **System statistics**
  - Internal object statistics

Managing Performance: Table and Index Statistics

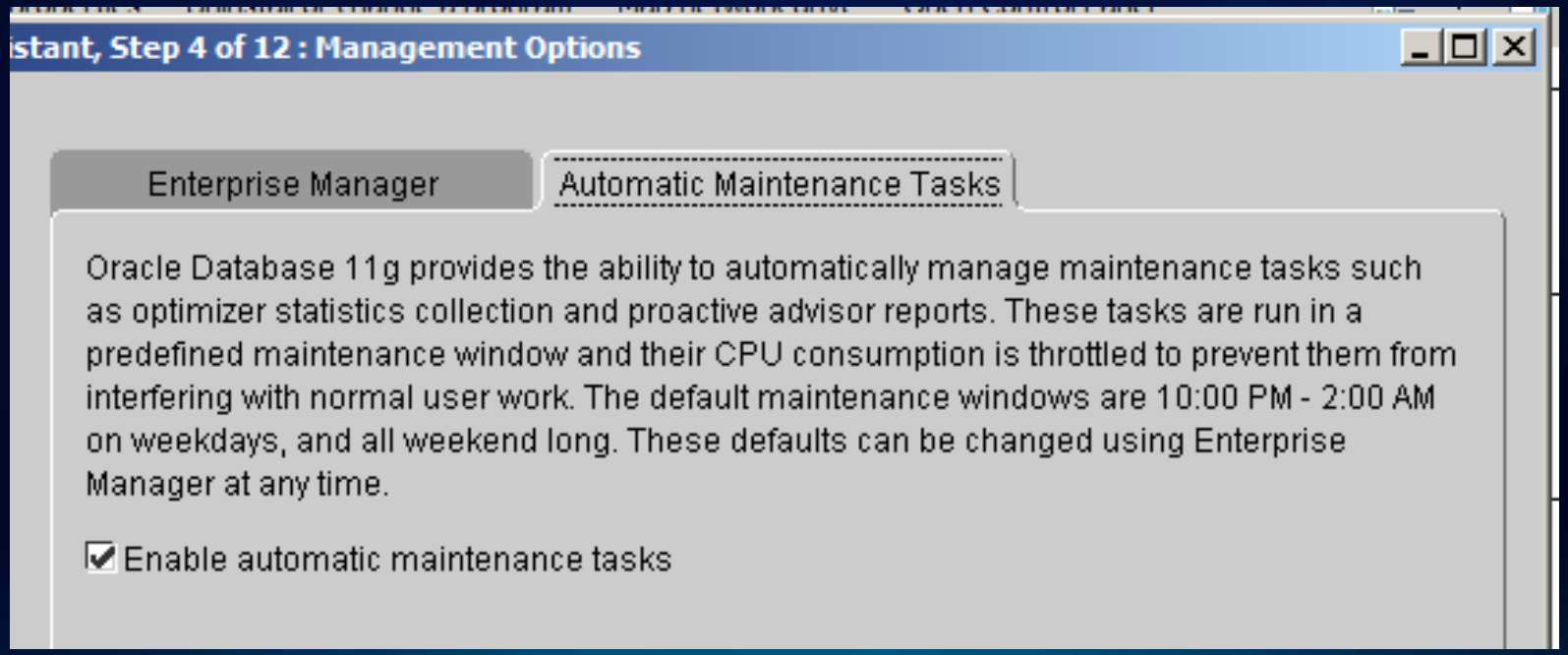
LEAF_BLOCKS	DISTINCT_KEYS	NUM_ROWS	CLUSTERING_FACTOR
3836	405184	422227	92580
5355	423584	423584	0
2901	316800	319292	45950
2761	319292	319292	0
3838	410912	422418	93151
5565	424989	424989	0
1374	97404	97404	0



Oracle 11g – Automatic Maintenance

Optimizer Statistics Collection – statistics collection
Segment Advisor – segment reorganization
SQL Tuning Advisor – attempts to tune high-load SQL

- **Tasks Automated at 11g**

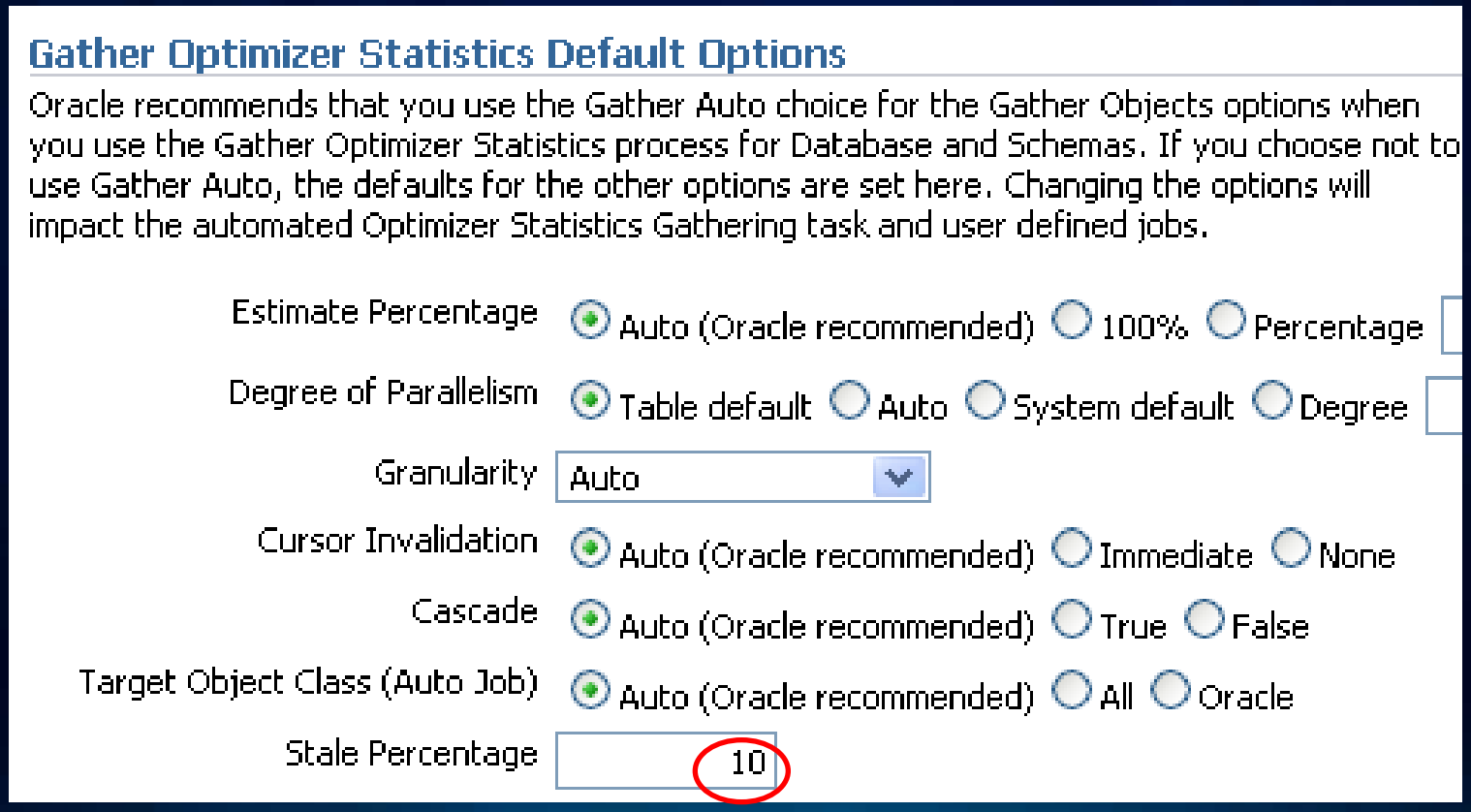


Managing Performance in 11g : Statistics

- Oracle automatic statistics gathering 10g vs. 11g
- Utilize optimizer_dynamic_sampling (KB32005)
  http://resources.arcgis.com/content/kbase?fa=articleShow&d=32005
- Other options
  - ArcCatalog and GP Tools
  - sdetable –o update_dbms_stats –t roads –m estimate
- Temporary Tablespace - increase size for compute
  - consider increasing the size of your temporary table space to compute statistics rather than estimate them because it provides more accurate statistics for the optimizer.

11g Auto Statistics Gathering

- **Setting Stale Percentage**



Other Configuration Tips

- D-Table indexes
  - need to be checked for errors and redundancy in the _IDX (KB31081) and _PK (KB24925) indexes
- A-Table Index
  - Performance gains by altering the Adds table indexes (KB32184)
- Cache the lobs
  - Most lobs can be cached to reduce trips to disk ST(KB33428), Network(34485), Raster(35521)
- Index rebuild
  - Sweeper Indexes need to be rebuilt to reduce their number of blocks (KJ35409)
- ST_GEOMETRY Spatial index shrink
  - Reduce the number of blocks used by the spatial index (KB33341)
- Re-gather Stats
  - Do not build stats on the logfile tables
    Note: Scripts to perform these tasks are included at the end of slide deck

Advanced Configuration Topics

- Some not formally supported – must test
- External Authentication – Direct Connect
  - OS Authentication
  - Advanced Security
  - Encryption
  - Must use Direct Connect
- Oracle RAC – clusters
  - Must use Direct Connect
- Oracle DataGuard – replication
  - Physical – “stand by”
  - Logical

Oracle RAC

- Use Direct Connect architecture
- Extproc configuration for ST_Geometry spatial type
  - Windows ST_ShapeLib.dll is dependent on dlls found in the Visual C++ Redistribution Package.
  - Installed by SDE setup program automatically, or can be installed using redistribution package
- Cursors
  - Cursors don’t failover, reconnect either must be done or takes place depending upon application and configuration.

Oracle Dataguard

- Physical – standby database – commonly used
- Logical – RDBMS replication - rare in Geodatabase configurations
  - Users can connect to “standby” database, but should be treated as “read-only”.
  - Not supported, and configuration complex due to SQL exclusion required.

Multiple Geodatabase Configuration

- Multiple Geodatabase for Different Tasks
  - At least two Geodatabases should be present typically – production and test
  - Other reasons for multiple geodatabases
    - Editing and publishing (web)
    - Production and test/development
    - Different application needs
  - Methods for configuring multiple Geodatabases in Oracle
    - Multiple instances on same server
    - Multiple instances on different servers
    - Project/Schema Geodatabase

Choosing Multiple Geodatabase Configuration

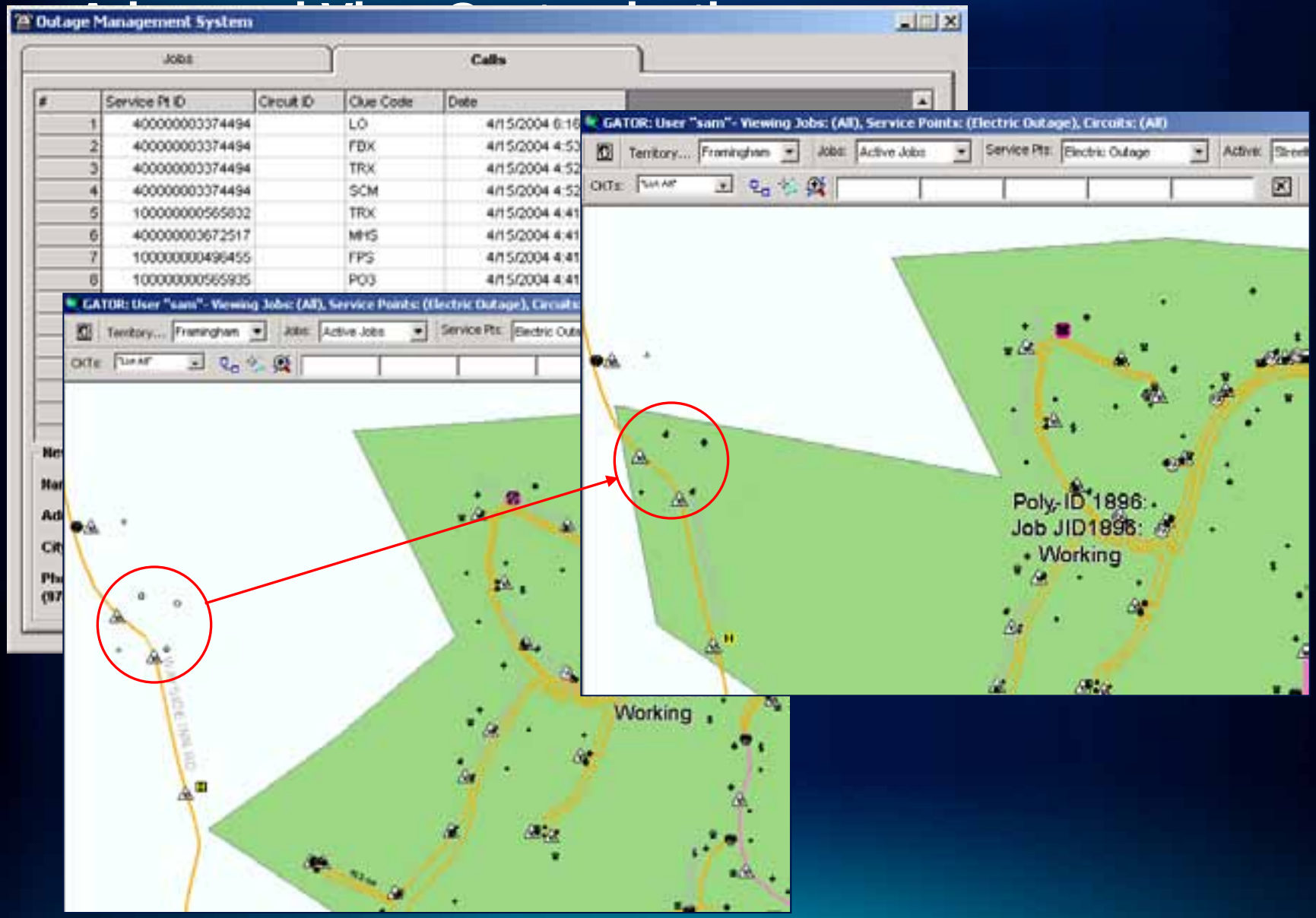
- Oracle configuration needs
  - Archive log mode /Bulk data loading
  - Custom applications (cursor_sharing – similar)
- Scenarios
  - Major configuration differences required by application workflows
    - Multiple Oracle instances (multiple geodatabases)
  - DBA's want to manage only a single instance <u>AND</u> no major configuration differences for applications
    - project/schema geodatabase

Views, Spatial Views and Types

- **Spatial Functions can be used in Spatial Views**
  - **Can provide “dynamic” feature classes on map**

```
CREATE VIEW san_berdoo_quakes_v AS SELECT a.objectid,
a.location, b.name FROM quakes4 a, st_counties b WHERE
b.name = 'San Bernardino' AND
sde.st_intersects(a.location,b.boundary);
```

- **Also Materialized Views**
- **May require registration with ArcSDE and Geodatabase**
  - **Depending upon creation method used**
    - sdetable –o create_view vs. SQL
  - **Depending upon intended use**
    - Display in arcmap or for sql query only, Query Layer (10.x)


Outage Management System
Jobs
Calls
| Service Pt ID | Circuit ID | Clue Code | Date
1 | 400000003374494 | | LO | 4/15/2004 6:16
2 | 400000003374494 | | FDX | 4/15/2004 4:53
3 | 400000003374494 | | TRX | 4/15/2004 4:52
4 | 400000003374494 | | SCM | 4/15/2004 4:52
5 | 100000000565832 | | TRX | 4/15/2004 4:41
6 | 400000003672517 | | MHS | 4/15/2004 4:41
7 | 100000000496455 | | FPS | 4/15/2004 4:41
8 | 100000000565935 | | PO3 | 4/15/2004 4:41
GATOR: User "sam" - Viewing Jobs: (All), Service Points: (Electric Outage), Circuits: (All)
Territory... Framingham
Jobs: Active Jobs
Service Pts: Electric Outage
Poly ID 1896
Job JID1896
Working
Working

Advanced View Customization

```
select /* FIRST_ROWS */ service_point_id, shape, ckt_id, job_id, poly_id,
prev_energ_poly_id, lock_status, xfr_tag, point_type, account_priority,
customer_count, replace_flag, clue_cd, pri_call_type, priority, topcall, symbol
From (select g.*, gc.clue_cd, m.pri_call_type,
ROW_NUMBER() OVER (PARTITION BY g.service_point_id ORDER BY m.priority)
topcall, m.priority, m.symbol
from gator_service_points g, gator_calls gc, master_lut m
Where g.service_point_id = gc.service_pt_id And CASE when g.job_id is null then
0 else 1 end = m.assign
And gc.clue_cd = m.clue and g.account_priority = m.accnt and
(CASE  When ROUND((sysdate - gc.last_chng_datetime) * 1440) = 0 then '0'
When ROUND((sysdate - gc.last_chng_datetime) * 1440) > 0 and
ROUND((sysdate - gc.last_chng_datetime) * 1440) <= 120 then '120'
When ROUND((sysdate - gc.last_chng_datetime) * 1440) > 120 and
ROUND((sysdate - gc.last_chng_datetime) * 1440) <= 240 then '240'
When ROUND((sysdate - gc.last_chng_datetime) * 1440) > 240 then '241'
Else '9999‘ End) = m.age_class) where topcall = 1 and pri_call_type IN
('PF','LD','LO')
```

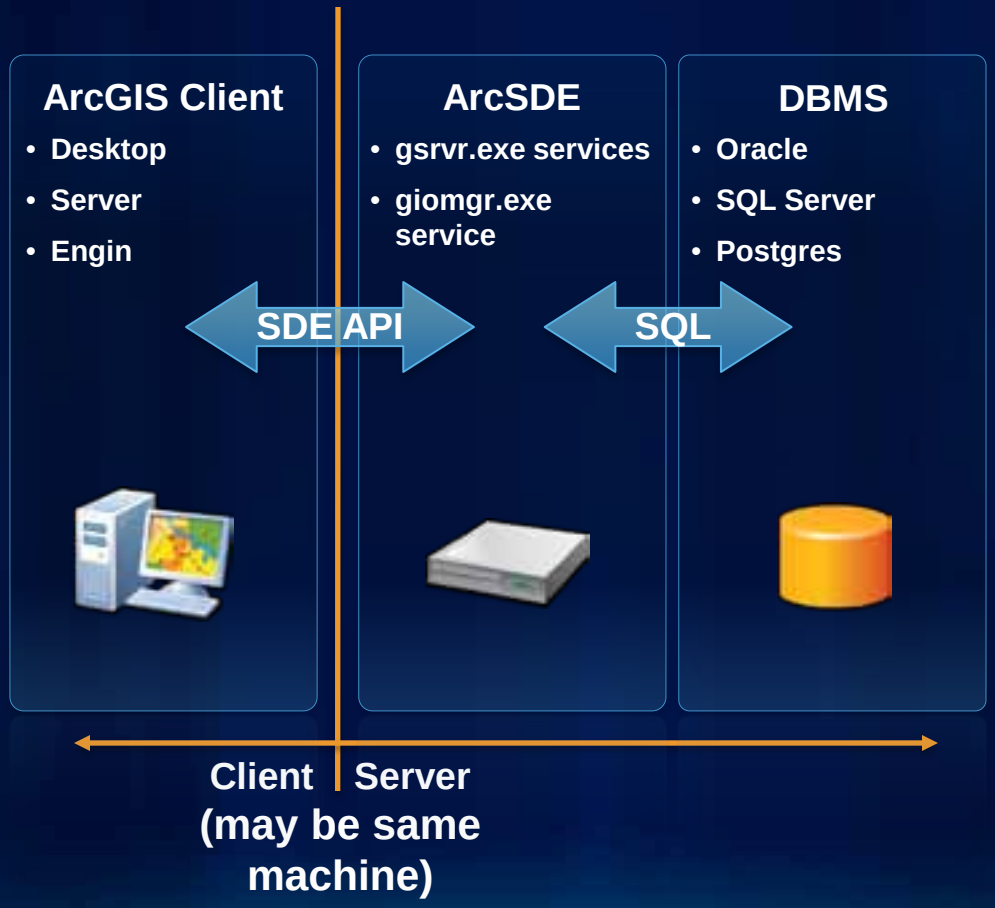
Agenda

- Administration Topics
  - Scenario 1: New Setup with 11g
  - Scenario 2: Upgrading to 11g from 9i/10g
  - Managing Performance in 11g
  - Advanced Configurations
- Loading, Backup and Spatial Types
  - Loading Considerations
  - Export/Import/Backup Options Available
  - Leveraging the Spatial Operators
- What’s new at 10.1

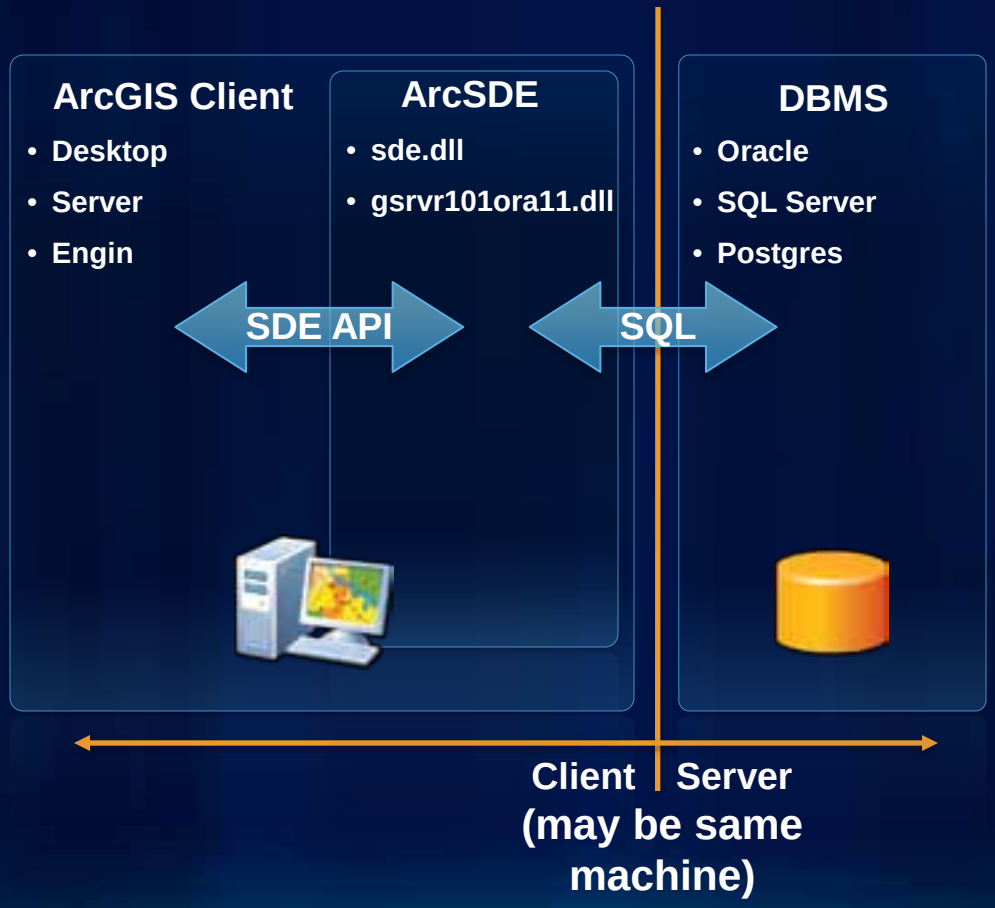
Connection Type Review

- Two types
  - Direct connection (2 Tier)
    - Connection directly from client to server
    - Requires database client installation on all desktop clients
  - Application connection (3 Tier)
    - Connection from client application to ArcSDE service
    - Does no require database client installation on desktop clients

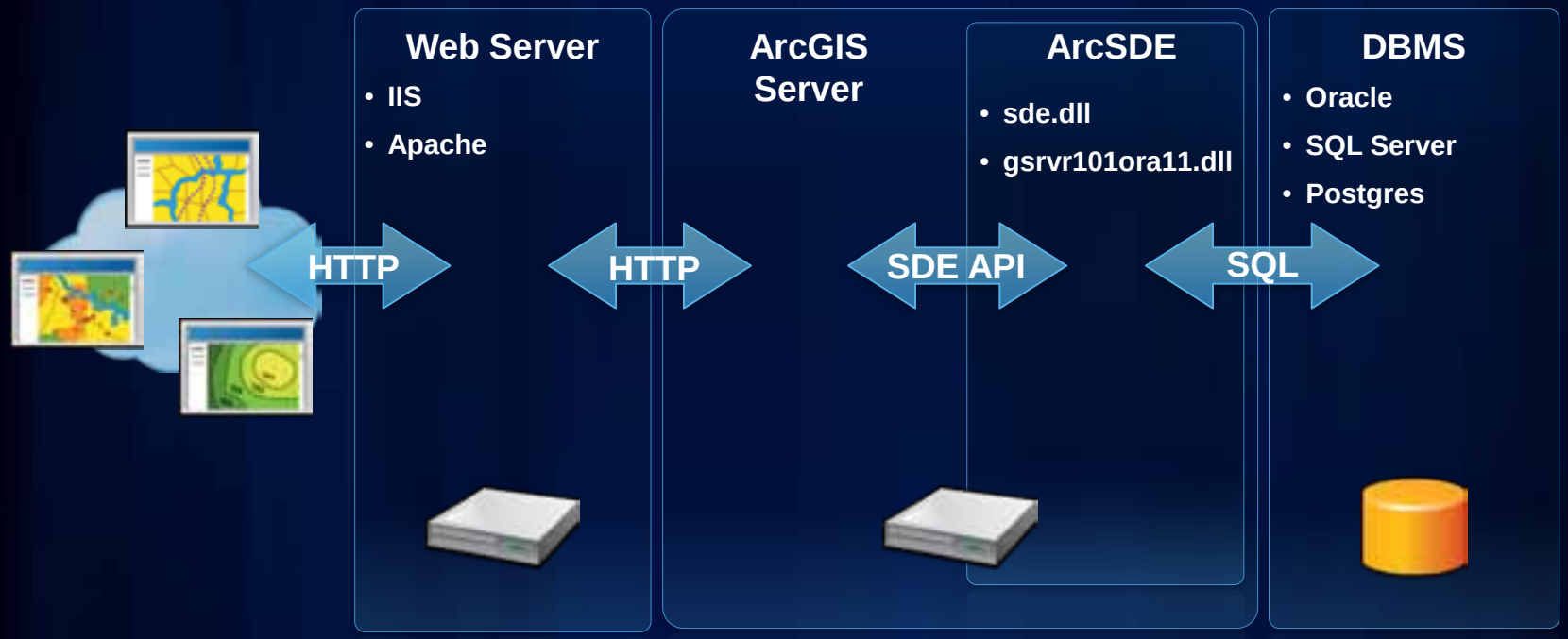
Application Connection – ArcSDE Technology



Direct Connection – ArcSDE Technology



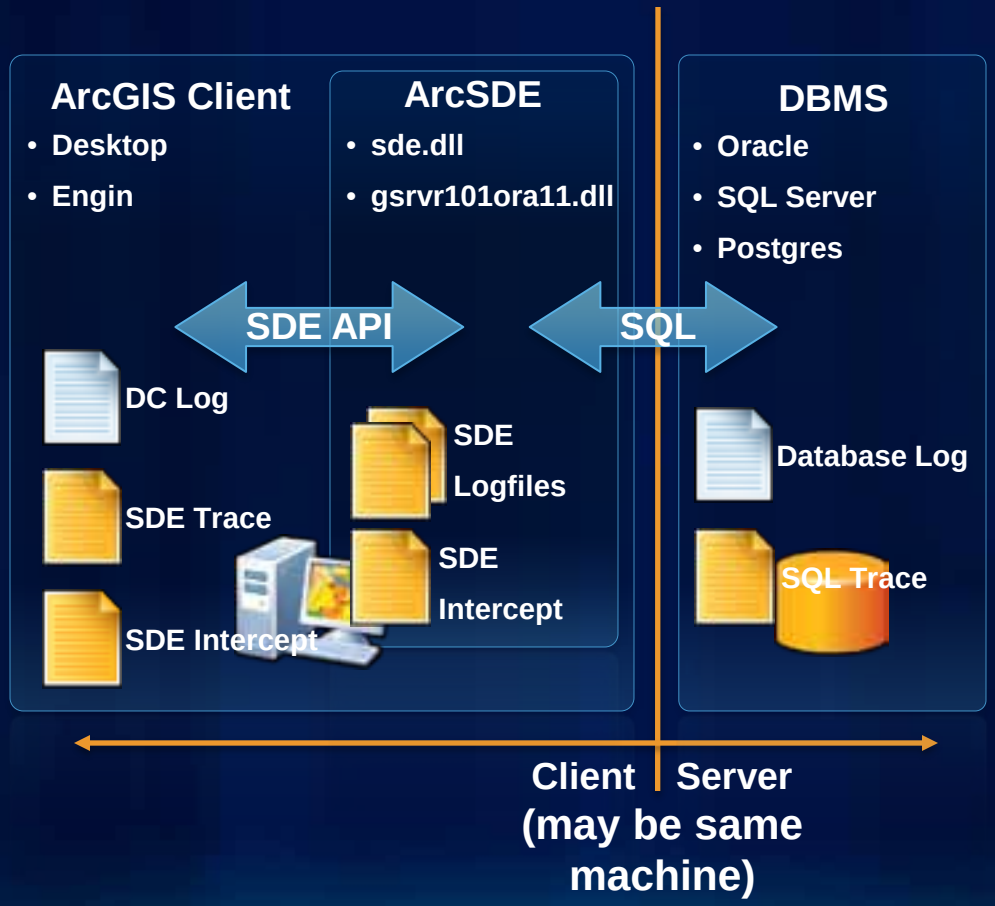
Direct Connection – ArcSDE Technology



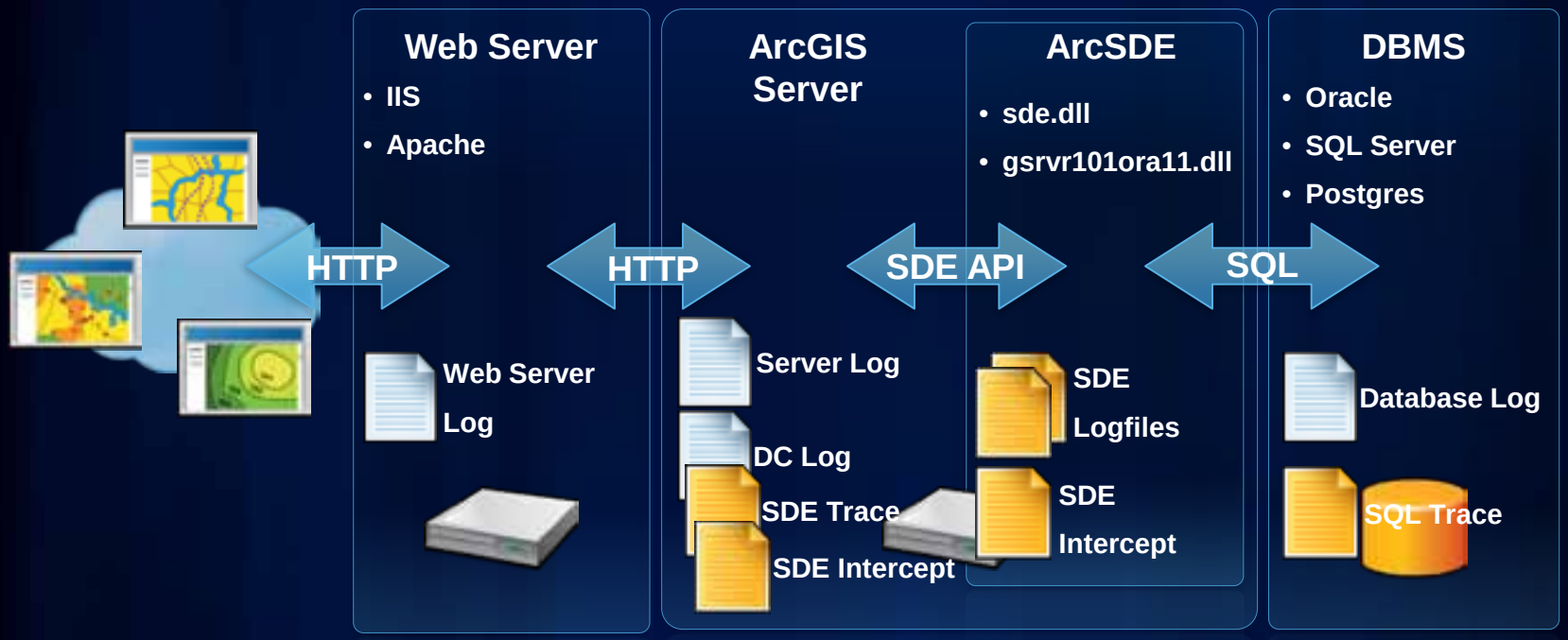
Diagnostic tools

- System tools
  - Windows, use task manager and event viewer
- Tools available from ESRI
  - SDE logfiles in the %SDEHOME%/etc folder
  - SDE Intercept, SDE Trace, set as environment variables
  - DC log files
  - Server Logs
- Tools available from Oracle
  - Alert log, SQL tracing

Direct Connection: Logging



Direct Connection – ArcSDE Technology



SDE Logfiles

- **Three types**
  - **giomgr_<service>.log**
    - giomgr process information, startup/shutdown, connections
  - **sde_<service>.log**
    - gsrvr process information, event, errors
    - Setting %SDEVERBOSE% to true increase the amount of information logged, but slows performance
  - **sde_setup.log**
    - Information about the setup process
- To enable for direct connections, set **%SDEHOME%**, or check the user **%TEMP%** directory

SDE DC Log

- Information that is similar to the sde_<service>.log file.
  - This file is only present during direct connections
- This file will automatically be generated and placed in the %SDEHOME%/etc or %TEMP% directories.

SDE Trace

- This logfile lists all the calls that are made to the ArcSDE client API.
- Not all of these calls result in a round trip to the server
- To enable set %SDETRACELOC% to the path name. Files are named %SDETRACELOC%.001, %SDETRACELOC%.002…

SDE Intercept

- A list of all calls between the SDE client and the SDE sever.
  - If using DC, will have two files that mirror each other.
- To enable set:
  - %SDEINTERCEPT% to the required values
    - set SDEINTERCEPT=cwrfT
  - %SDEINTERCEPTLOC% to the path name
    - Files are named %SDEINTERCEPTLOC%.001, %SDEINTERCEPTLOC%.002…

Oracle DBMS Log

- **Oracle Alert Log,**
  - "The Alert file is a log file that records information about internal errors and administrative activities, such as backups." **http://download.oracle.com/docs/cd/E11882_01/server.112/e17766/intro.htm#i10817**
- **Automatically enabled, location can be found by issuing the following SQL**
  -
```
SQL> select value from v$parameter where name
= 'background_dump_dest'
```

Oracle SQL Trace

- Description of every SQL statement that was executed per session
  - Very useful in analysis of slow running queries and operations, TKProf results much more readable
- Activate by altering session
  - As DBA user, tracing a different session:
    - ```
      SQL> DBMS_SYSYEM.SET_ENV(<session id>, <session serial>, 10046, 12, ‘’)
      ```
  - Tracing the current session, additional privileges required:
    - ```
      SQL> alter session set events '10046 trace name context forever, level 12'
      ```

Bulk Loading Considerations

- Exception to the rule
  - Versioning
    - Do a reconcile and post of the version to default before you load
    - Highly recommended that you do a compress before the load
    - No other editing during a load
  - Indexes
    - Bulk loads are faster without indexes
    - Put feature classes in load only mode (drop indexes) before loading
    - Do not forget to take them out again of load only mode (recreate indexes)

Why to export/import using RDBMS tools?

- **Copying non-versioned data without GDB functionality**
- **Copying the complete database to a test instance**

- **Logical Rules:**

	Target has SDE – without GDB functionality	Target Has SDE – with GDB functionality	Target Doesn't have SDE
Source Has SDE	Use database tools	Use GDB replication	Use database tools

What to Export?

- No GDB functionality : SDE.ST_GEOMETRY and SDO_GEOMETRY data, or tables without spatial data, with no GDB functionality (Domains, Relationship Classes, Feature Dataset)
  - Only need to export the table
  - Drop SDE.ST_Geometry spatial prior to export
- GDB functionality need the SDE schema.
  - The User, all related data and SDE schema
  - May be easier to export entire Oracle Instance

How to export?

- Data pump (Oracle), SDEExport (ArcSDE)
  - Oracle tools, work well with ST_Geometry starting at 9.3
- Simple data only. Advanced object types have to be exported using the ArcGIS, GP tools, python or ArcObjects.
- KB34342 Index: Working with ST_Geometry and Oracle export/import

Data pump setup

```
D:\>mkdir D:\CMDWork\DATAPUMP_DIR
```

```
SQL> create directory "DATAPUMP_DIR" As
'D:\CMDWork\DATAPUMP_DIR';

SQL> grant read on Directory "DATAPUMP_DIR" to
sde_user;

SQL> grant write on Directory "DATAPUMP_DIR" to
sde_user;
```

Export Examples

- Oracle datapump

```
D:\>expdp gdb/*** DIRECTORY=DATAPUMP_DIR
DUMPFILE=UC2009_country.dmp tables=(COUNTRY)
```

- SDE Export

```
D:\>sdeexport -o create -l country,shape -u gdb -p ***
-f D:\CMDWork\UC2009\SDEExportCountry.exp
```

Import Examples

- Oracle datapump

```
D:>impdp gdb/*** DIRECTORY=DATAPUMP_DIR
 DUMPFILE=UC2009_country.dm
```

```
D:>sdelayer -o register -l country,shape -u gdb -p *** -
 e nac+ -P HIGH -t ST_GEOMETRY -C Objectid,sde
```

- SDE Import

```
D:>sdeimport -o create -l country,shape -u gdb -p ***
-f D:\CMDWork\UC2009\SDEExportCountry.exp
```

Backup Options

- Backup all schemas, including SDE
- Make sure you test your recovery scripts/backups before you need to use them.

- On restore, may have to complie SDE schema packages.
  - DBMS_UTILLiTY.COMPILE_SCHEMA(‘SDE’)

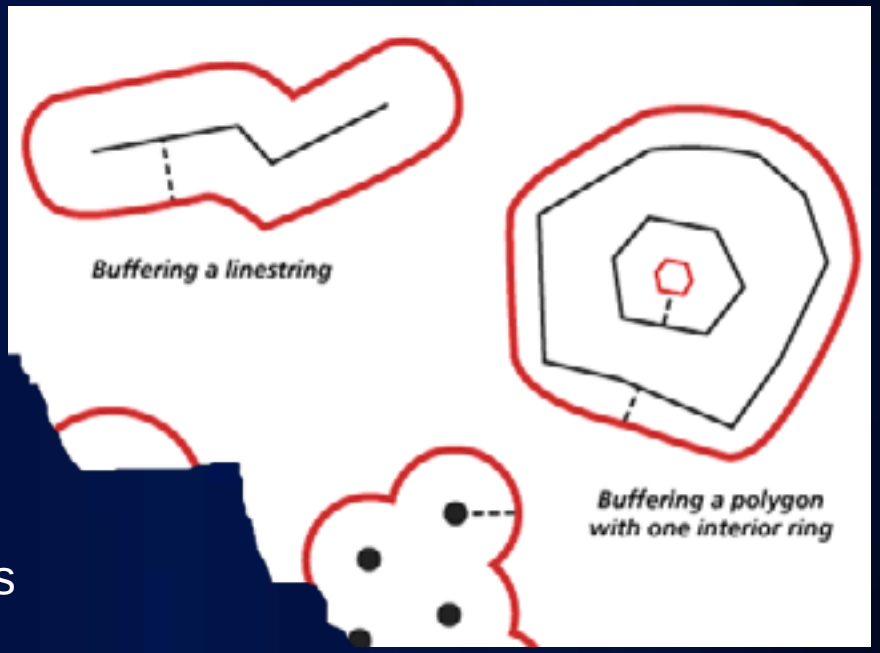
Note: It is worthwhile to backup dbinit file and dbtune settings whenever they change.

Leveraging Spatial Operators

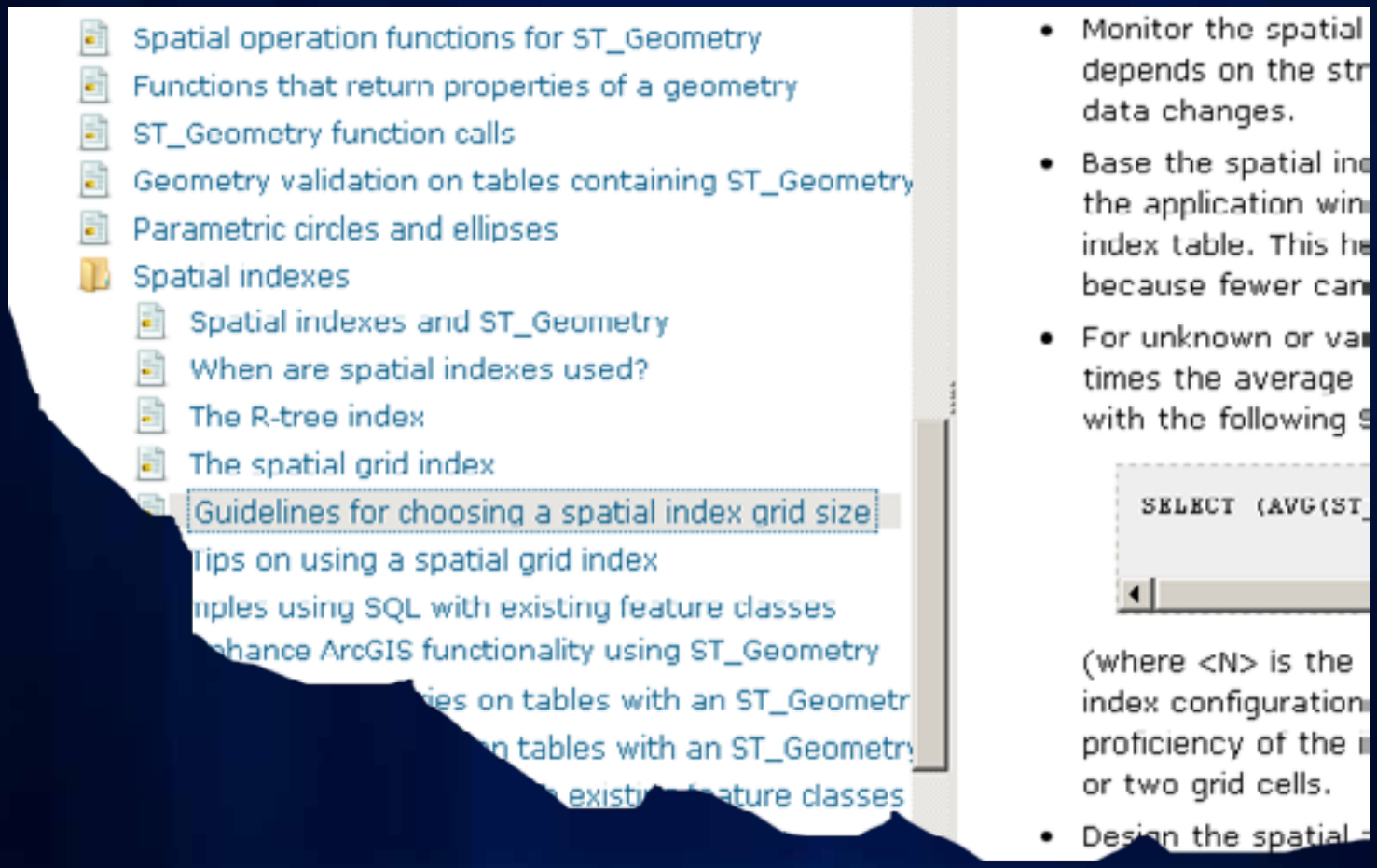
- Eases integration
  - The geodatabase can create spatial type data
  - The geodatabase can consume spatial type data
- Enhances your efficiency
  - Leverage processing power of the DBMS
- Adheres to standards
  - Industry standard SQL access
  - Simple features
  - Standard Functions
  - Well-known interchange formats

Spatial Types and Functions

- **Creation of Features**
  - through SQL
- **Analysis**
  - Buffering Geometry
  - Convex Hull
  - Difference of Geometries
  - Intersection of Geometries
  - Symmetric Differences
  - Union
  - Minimum Distance
  - Aggregates
- **Feature Information**



ST_Geometry Help and KB articles



Agenda

- Administration Topics
  - Scenario 1: New Setup with 11g
  - Scenario 2: Upgrading to 11g from 9i/10g
  - Managing Performance in 11g
  - Advanced Configurations
- Architectures, Loading and Spatial Types
  - Connection Architectures and Diagnostics
  - Loading Considerations, Export/Import and Backup
  - Leveraging the Spatial Type
- What’s new at 10.1

What’s new at 10.1

- Stand alone SDE.ST_Geometry install
  - Implementing a static list of common spatial references
- Connection to none Geodatabase Oracle instance
  - Connect and query simple features from a SDE.ST_Gometry or SDO_Geometry layer for read only access
  - Ability to copy a feature class to database
- Geodatabase/Database administration tools
  - Version hierarchy, permissions, locking and statistics all exposed through ArcCatalog

Related Documentation Resources

- Geodatabase Resource Center
  - http://resources.esri.com/geodatabase/
- Inside the Geodatabase Blog
  - www.esri.com/geodatabaseblog
- ArcGIS Desktop Help topics
  - Registering tables to be used by ArcGIS Desktop
  - Enhancing ArcGIS functionality using spatial types
  - Using multiversioned views

Other Sessions

Technical Workshops

- Managing Distributed Data with Geodatabase Replication
  - Tuesday 3:15pm Room 6D
  - Thursday 10:15am Room 4
- Editing Strategies for Enterprise Geodatabses
  - Thursday 10:15am Room 5A/B

Demo Theatre Presentations

- Using Oracle Trace to Troubleshoot
  - Wednesday 11:30am Geodatabase Management Demo Theatre
  - Thursday 11:30am Geodatabase Management Demo Theatre
- Using SQL with your Geodatabase
  - Thursday 10:30am Geodatabase Management Demo Theatre

Other Sessions

Technical Workshop 20 Minute

- Database Security Tips
  - Thursday 10:15am Room 23B
- Troubleshooting Performance Issues with Enterprise Geodatabases
  - Thursday 10:40am Room 24A
- Upgrading to ArcGIS 10.0 Geodatabases
  - Thursday 1:30pm 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

Questions?

- ***Please fill out the evaluation***
  - **http://www.esri.com/sessioneval**
- ***Thank you for attending***