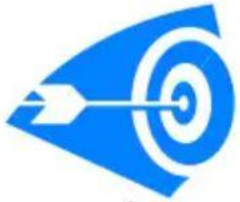
Unit 7. Database Tuning

- Tuning Application Design;
- Tuning Memory Usage; Tuning Data Access;
- Tuning Data Manipulation;
- Reducing Network Traffic;
- Using Automatic Workload Repository(AWR);
- Automatic Database Diagnostic Monitor(ADDM), Tuning SQL;
- SQL Tuning Advisor,
- Performance Tuning in a Multitenant Environment;
- Distributed Databases and Networking Tool

What is Database Tuning?



- Database tuning is a group of activities used to optimize the performance of a database.
- Goal Of Database Tuning?
  - ✓To maximize use of system resources
  - ✓To perform task as efficiently
  - ✓To work rapidly as possible

Why and when should one tune?

- Slow Physical I/O
  - -caused by poorly-configured disks
  - -caused by unnecessary physical I/O
  - -caused by poorly-tuned SQL.
- Excessive CPU usage
  - -It means that there is little idle CPU on the system
  - -caused by an inadequately-sized system,
  - -caused by untuned SQLstatements
  - -caused inefficient application programs.
- Latch Contention

  Rarely is latch contention tunable by reconfiguring the instance. Rather, latch contention usually is resolved through application changes.

Causes for low Performance

- Bad Connection Management
- Bad Use of Cursors and the Shared
- Bad SQL
- Use of Nonstandard Initialization Pa
- Getting Database I/O Wrong
- Redo Log Setup Problems
- Long Full Table Scans
- High Amounts of Recursive (SYS) SQL

Where should we do the tuning?

- **Database Design**
  - Poor system performance usually results from a *poor databas*
  - One should generally *normalize to the 3NF.*
  - Selective denormalization can provide valuable performance improvements..
- **Application Tuning:**
  - Approximately 80% of all Oracle system performance problems are *resolved by coding optimal SQL.*
- **Memory Tuning:**
  - By *Properly size* your database buffers (shared pool, buffer cache, log buffer, etc)
  - By looking at your *wait events, buffer hit ratios, system swapping and paging*, etc.
- **Disk I/O Tuning:**
  - Database files needs to be *properly sized.*
  - Also look for frequent *disk sorts, full table scans, data fragmentation*, etc.
- **Eliminate Database Contention:**
  - *Study database locks, latches and wait events* carefully and eliminate where possible.
- **Tune the Operating System:**
  - *Monitor and tune operating* system CPU, I/O and memory utilization.

Tuning Methodology:

- For best results, tune during the design phase, rather than waiting to tune after implementing your system. You can optimize performance by system tuning. This is the process of making adjustments to the way in which various system resources are used so that they correspond more closely to the overall usage patterns of the system. You can improve the overall response time of the system by locating and removing system bottlenecks.
- Two different tuning methods are:
  - Proactive Tuning While Designing and Developing Systems
  - Reactive Tuning to Improve Production Systems

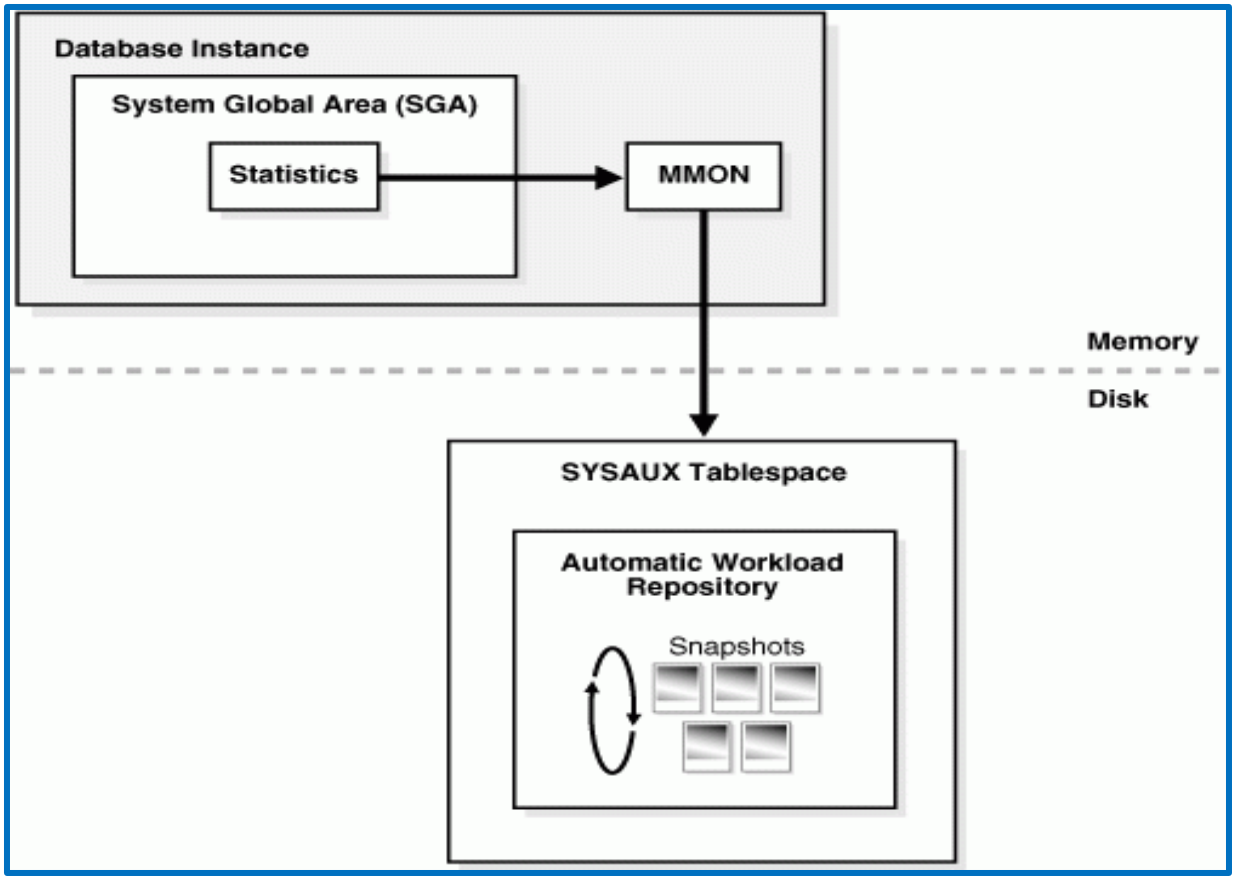
Oracle Automatic Workload Repository (AWR)

- The AWR is the infrastructure that provides services to Oracle Database 11*g* components to collect, maintain, and utilize statistics for problem detection and self-tuning purposes. You can view it as a data warehouse for database statistics, metrics, and so on.
- Every 60 minutes (by default) the database automatically captures statistical information from the SGA and stores it in the AWR in the form of snapshots. These snapshots are stored on the disk by a background process called Manageability Monitor (MMON). By default, snapshots are retained for eight days. You can modify both the snapshot interval and the retention intervals.
- The AWR contains hundreds of tables, all belonging to the SYSMAN schema and stored in the SYSAUX tablespace. The Oracle database does not support direct SQL access to the repository. Instead, use Enterprise Manager or the DBMS_WORKLOAD_REPOSITORY package to work with the AWR.

- **AWR Infrastructure**
- The AWR infrastructure has two major parts:
  - An in-memory statistics collection facility that is used by Oracle Database 11*g* components to collect statistics. These statistics are stored in memory for performance reasons. Statistics stored in memory are accessible through dynamic performance (V$) views.
  - The AWR snapshots that represent the persistent portion of the facility. AWR snapshots are accessible through data dictionary views and Enterprise Manager Database Control.

Statistics are stored in persistent storage for several reasons:

- The statistics need to survive instance crashes.
  - Some analyses need historical data for baseline comparisons.
  - A memory overflow can occur. When old statistics are replaced by new ones because of memory shortage, the replaced data can be stored for later use.
- The memory version of the statistics is transferred to disk on a regular basis by the MMON background process. With the AWR, the Oracle database provides a way to capture historical statistics data automatically without DBA intervention.


Database Instance
System Global Area (SGA)
Statistics
MMON
Memory
Disk
SYSAUX Tablespace
Automatic Workload Repository
Snapshots

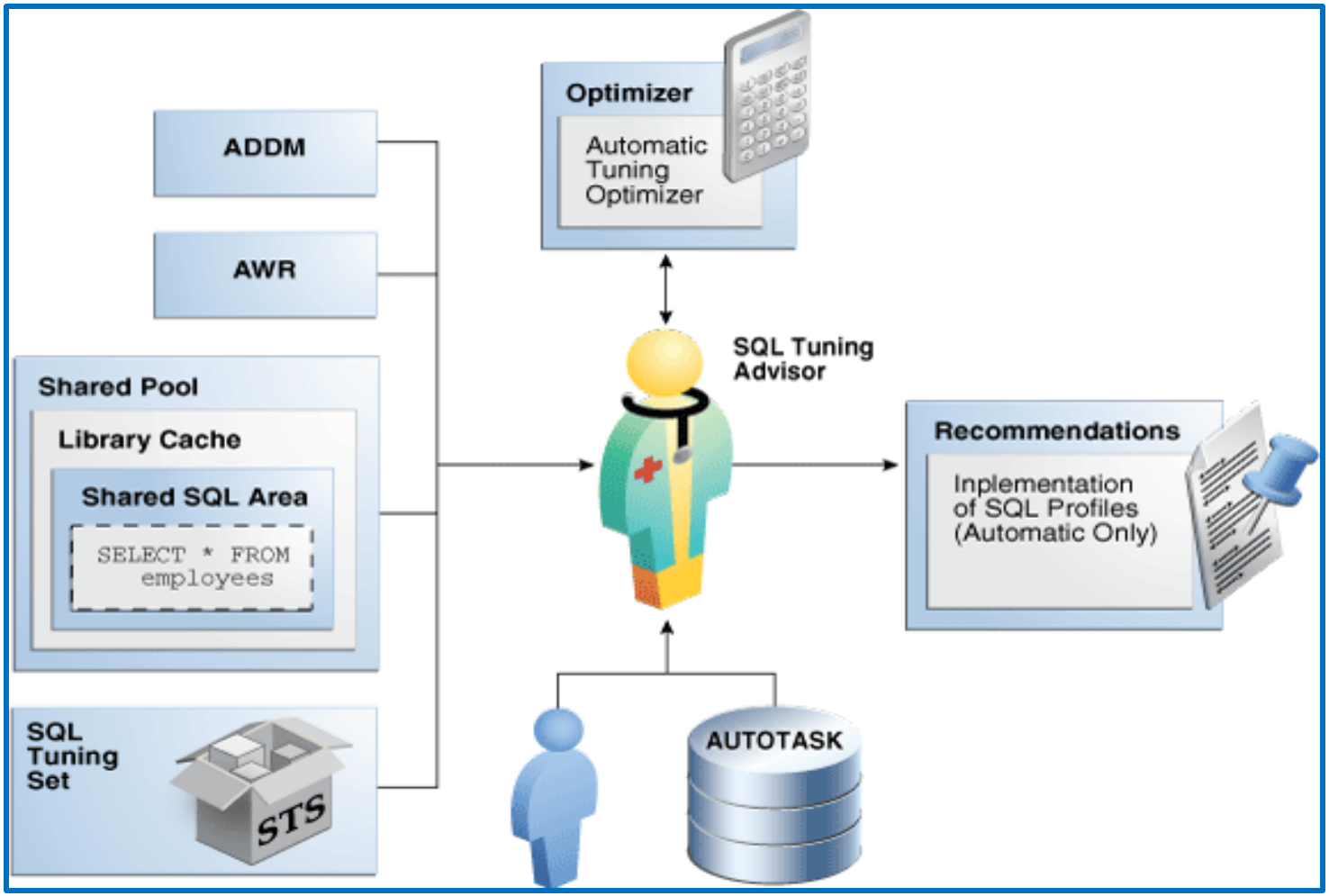
- The **Automatic Database Diagnostic Monitor (ADDM)** is a self-diagnostic engine built into Oracle Database. ADDM examines and analyzes data captured in the Automatic Workload Repository (AWR) to determine possible performance problems in Oracle Database. ADDM then locates the root causes of the performance problems, provides recommendations for correcting them, and quantifies the expected benefits. ADDM also identifies areas of the database for informational purposes where no action is necessary.
- An ADDM analysis is performed after each AWR snapshot (every hour by default), and the results are saved in the database, which can then be viewed using Oracle Enterprise Manager.

- The ADDM analysis is performed from the top down, first identifying symptoms and then refining the analysis to reach the root causes of performance problems. ADDM uses the DB time statistic to identify performance problems. DB time is the cumulative time spent by the database in processing user requests, including both wait time and CPU time of all user sessions that are not idle. The goal of tuning the performance of a database is to reduce the DB time of the system for a given workload. By reducing DB time, the database is able to support more user requests using the same resources. System resources that are using a significant portion of DB time are reported as problem areas by ADDM, and they are sorted in descending order by the amount of related DB time spent.

In addition to diagnosing performance problems, **ADDM** recommends possible solutions. When appropriate, ADDM recommends multiple solutions from which you can choose. ADDM recommendations include:

- Hardware changes
  - Adding CPUs or changing the I/O subsystem configuration
- Database configuration
  - Changing initialization parameter settings
- Schema changes
  - Hash partitioning a table or index, or using automatic segment-space management (ASSM)
- Application changes
  - Using the cache option for sequences or using bind variables
- Using other advisors
  - Running the SQL Tuning Advisor on high-load SQL statements or running the Segment Advisor on hot objects

- **SQL Tuning Advisor** is SQL diagnostic software in the Oracle Database Tuning Pack. You can submit one or more SQL statements as input to the advisor and receive advice or recommendations for how to tune the statements, along with a rationale and expected benefit.


ADDM
AWR
Shared Pool
Library Cache
Shared SQL Area
SELECT * FROM employees
SQL Tuning Set
STS
Optimizer
Automatic Tuning Optimizer
SQL Tuning Advisor
AUTOTASK
Recommendations
Inplementation of SQL Profiles (Automatic Only)

SQL Tuning Advisor Architecture

- **Automatic Tuning Optimizer** is the central tool used by SQL Tuning Advisor. The advisor can receive SQL statements as input from multiple sources, analyze these statements using the optimizer, and then make recommendations.
- Invoking Automatic Tuning Optimizer for every hard parse consumes significant time and resources. Tuning mode is meant for complex and high-load SQL statements that significantly affect database performance.
- Manageability advisors such as SQL tuning advisor use a common infrastructure called the advisor framework. This framework provides a common schema and interface for storing task objects. An advisor schema is a set of tables to store the data from advisors. SQL Tuning Advisor receives tuning input, and then writes to the advisor schemas by means of the advisor framework. SQL Tuning Advisor reads data from advisor schema when it produces its reports.

Thank You