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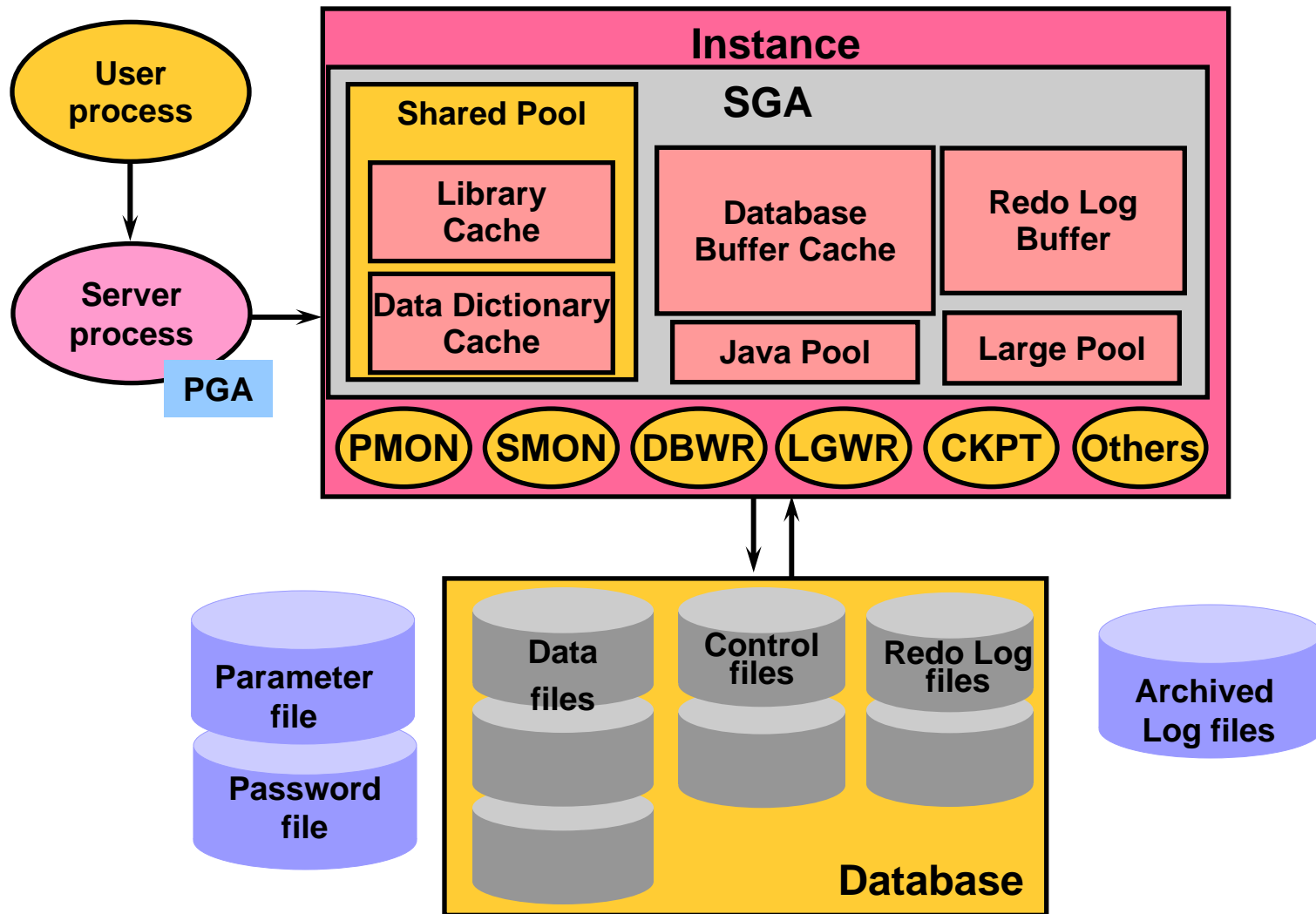
Oracle Architectural Components

Objectives

After completing this lesson, you should be able to do the following:

- **Outline the Oracle architecture and its main components**
- **List the structures involved in connecting a user to an Oracle instance**

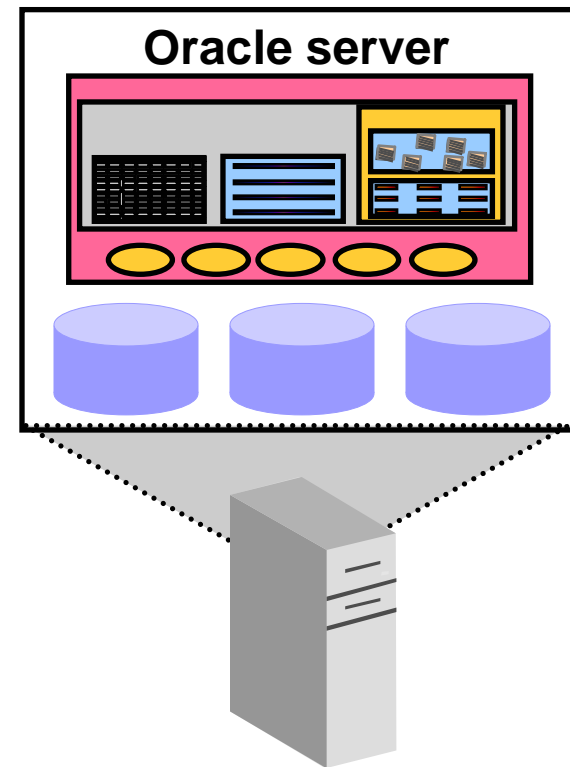
Overview of Primary Components



Oracle Server

An Oracle server:

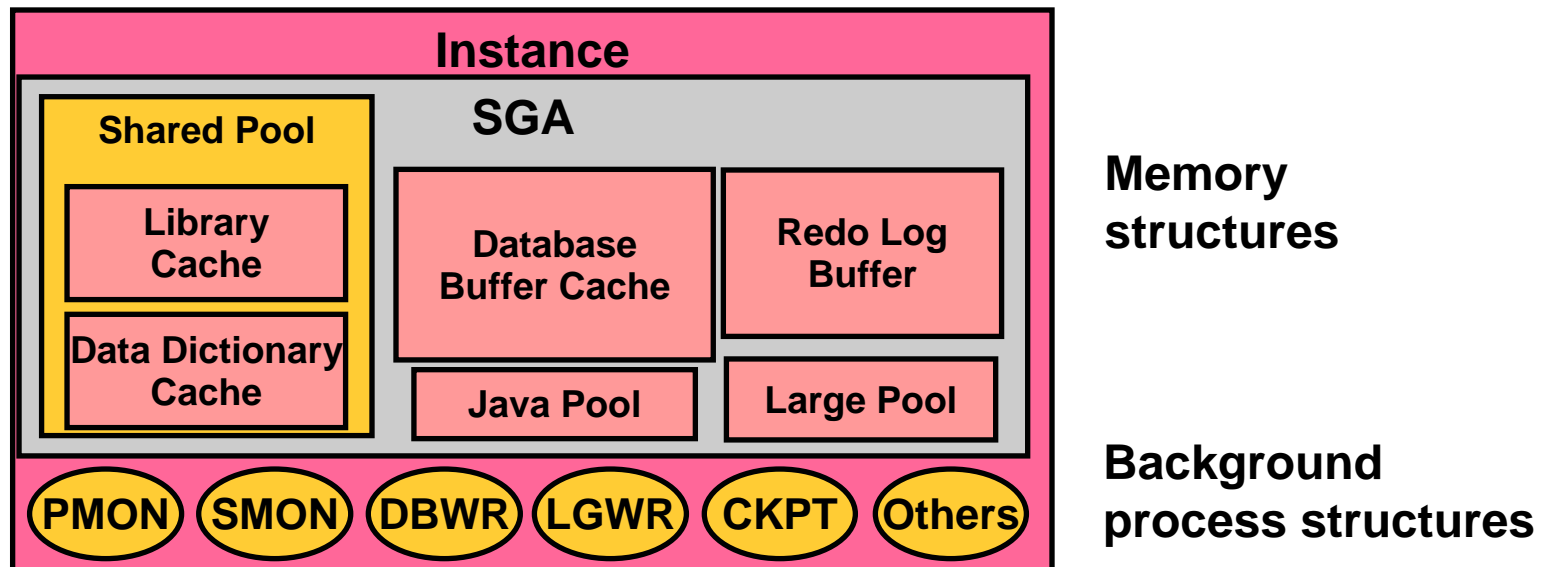
- Is a database management system that provides an open, comprehensive, integrated approach to information management
- Consists of an Oracle instance and an Oracle database



Oracle Instance

An Oracle instance:

- Is a means to access an Oracle database
- Always opens one and only one database
- Consists of memory and background process structures

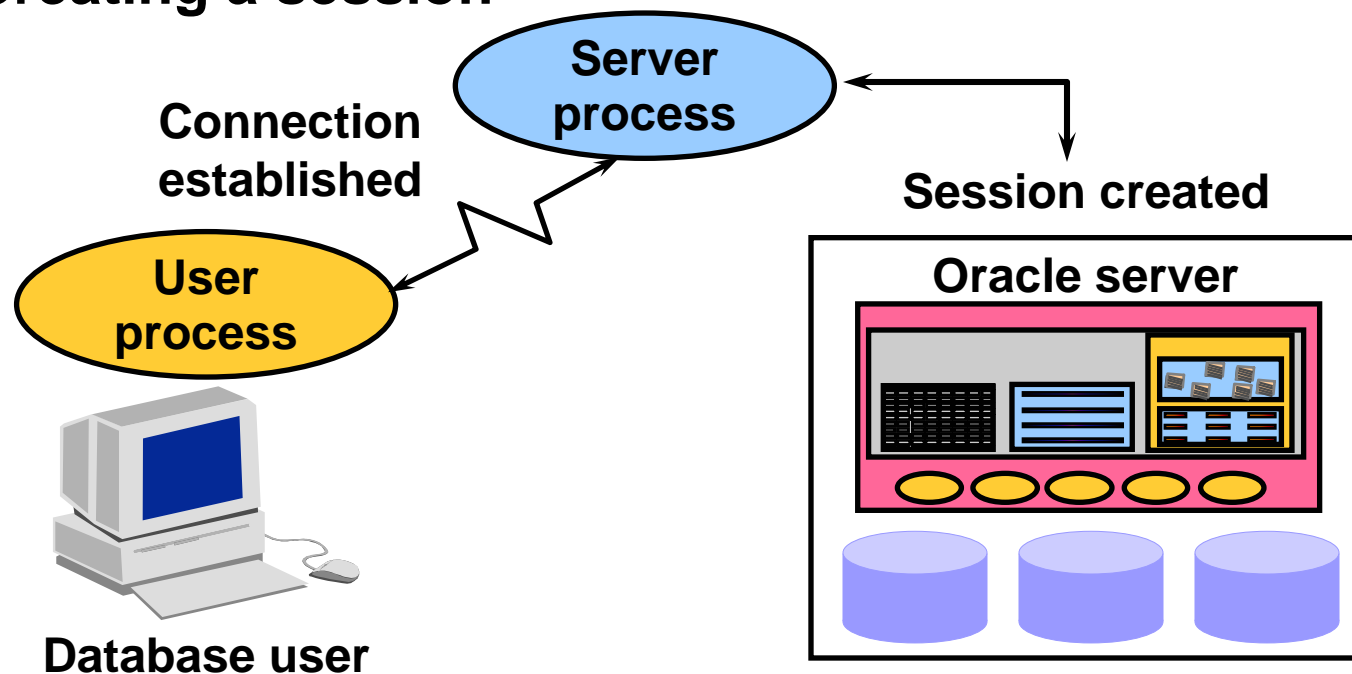


ORACLE

Establishing a Connection and Creating a Session

Connecting to an Oracle instance:

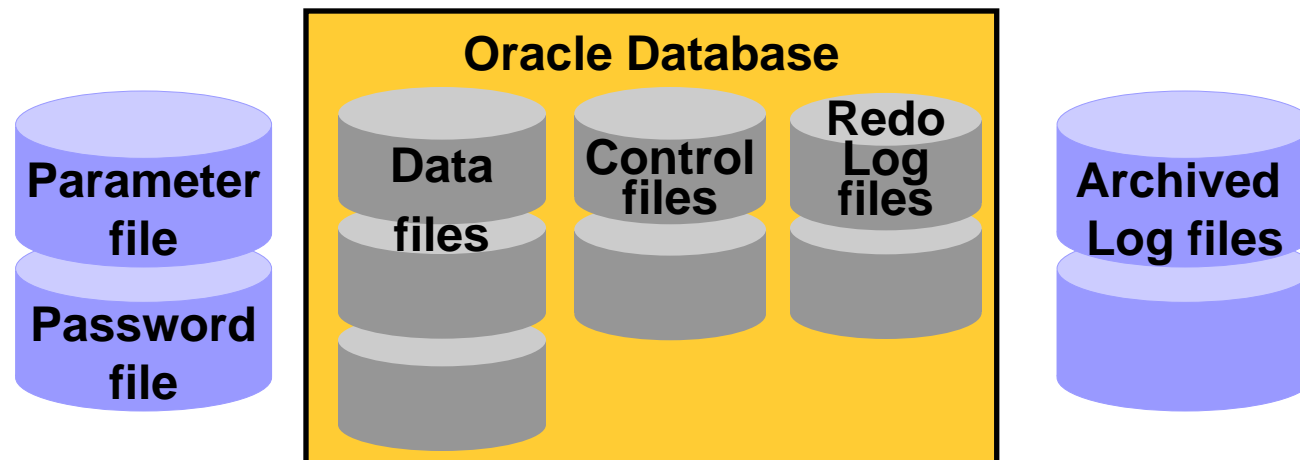
- Establishing a user connection
- Creating a session



Oracle Database

An Oracle database:

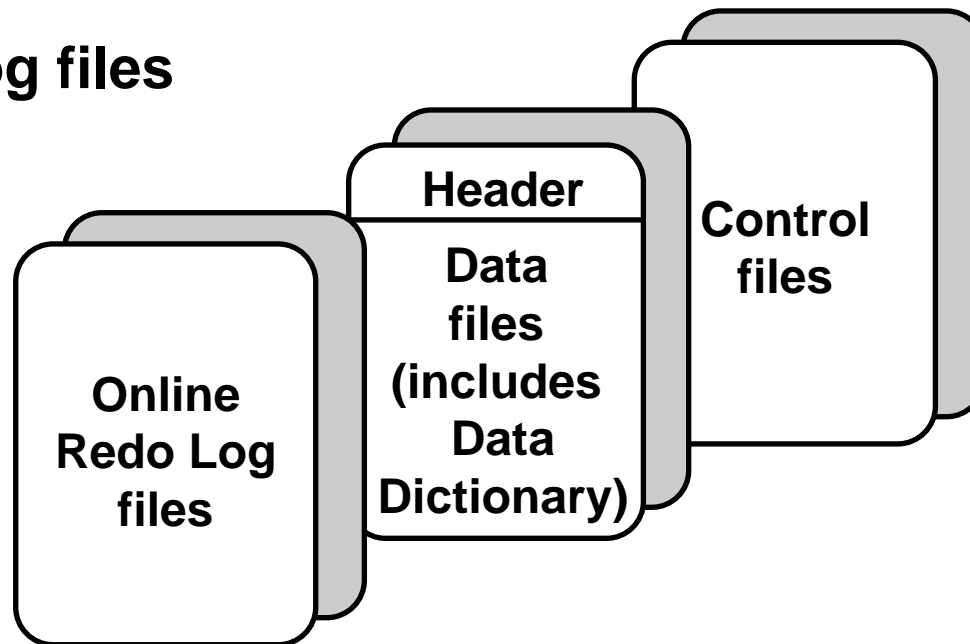
- **Is a collection of data that is treated as a unit**
- **Consists of three file types**



Physical Structure

The physical structure includes three types of files:

- Control files
- Data files
- Online redo log files



Memory Structure

Oracle's memory structure consists of two memory areas known as:

- **System Global Area (SGA):** Allocated at instance start up, and is a fundamental component of an Oracle instance
- **Program Global Area (PGA):** Allocated when the server process is started

System Global Area

- **The SGA consists of several memory structures:**
 - **Shared Pool**
 - **Database Buffer Cache**
 - **Redo Log Buffer**
 - **Other structures (for example, lock and latch management, statistical data)**
- **There are two additional memory structures that can be configured within the SGA:**
 - **Large Pool**
 - **Java Pool**

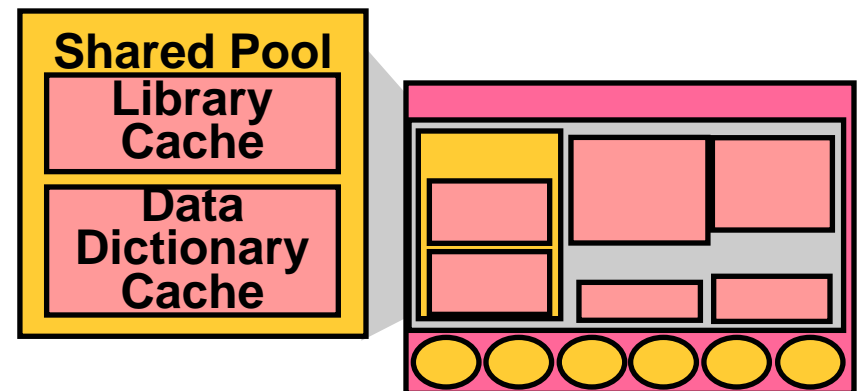
System Global Area

- Is dynamic
- Sized by the `SGA_MAX_SIZE` parameter
- Allocated and tracked in granules by SGA components
 - Contiguous virtual memory allocation
 - Granule size based on total estimated `SGA_MAX_SIZE`

Shared Pool

- Used to store:
 - Most recently executed SQL statements
 - Most recently used data definitions
- It consists of two key performance-related memory structures:
 - Library Cache
 - Data Dictionary Cache
- Sized by the parameter `SHARED_POOL_SIZE`

```
ALTER SYSTEM SET  
SHARED_POOL_SIZE = 64M;
```



Library Cache

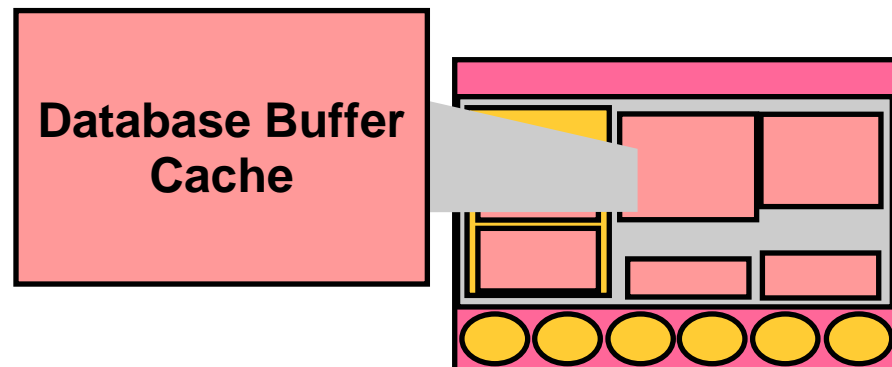
- **Stores information about the most recently used SQL and PL/SQL statements**
- **Enables the sharing of commonly used statements**
- **Is managed by a least recently used (LRU) algorithm**
- **Consists of two structures:**
 - **Shared SQL area**
 - **Shared PL/SQL area**
- **Size determined by the Shared Pool sizing**

Data Dictionary Cache

- **A collection of the most recently used definitions in the database**
- **Includes information about database files, tables, indexes, columns, users, privileges, and other database objects**
- **During the parse phase, the server process looks at the data dictionary for information to resolve object names and validate access**
- **Caching data dictionary information into memory improves response time on queries and DML**
- **Size determined by the Shared Pool sizing**

Database Buffer Cache

- Stores copies of data blocks that have been retrieved from the data files
- Enables great performance gains when you obtain and update data
- Managed through an LRU algorithm
- `DB_BLOCK_SIZE` determines primary block size



Database Buffer Cache

- **Consists of independent subcaches:**

- **DB_CACHE_SIZE**
- **DB_KEEP_CACHE_SIZE**
- **DB_RECYCLE_CACHE_SIZE**

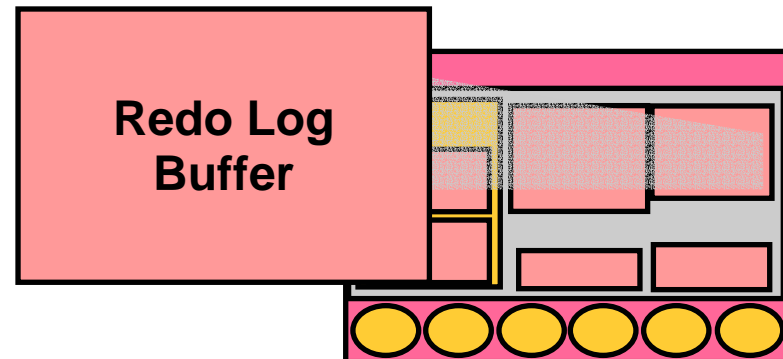
- **Can be dynamically resized**

```
ALTER SYSTEM SET DB_CACHE_SIZE = 96M;
```

- **DB_CACHE_ADVICE set to gather statistics for predicting different cache size behavior**
- **Statistics displayed by V\$DB_CACHE_ADVICE**

Redo Log Buffer

- Records all changes made to the database data blocks
- Primary purpose is recovery
- Changes recorded within are called redo entries
- Redo entries contain information to reconstruct or redo changes
- Size defined by LOG_BUFFER



Large Pool

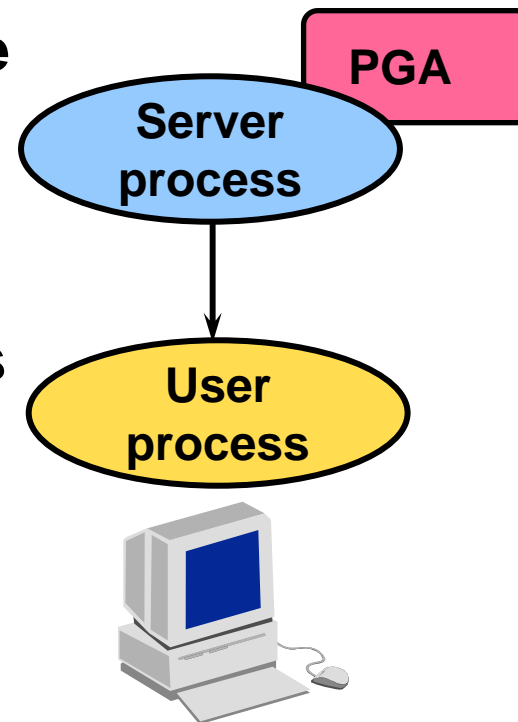
- An optional area of memory in the SGA
 - Relieves the burden placed on the Shared Pool
 - Used for:
 - Session memory (UGA) for the Shared Server
 - I/O server processes
 - Backup and restore operations or RMAN
 - Parallel execution message buffers
- `PARALLEL_AUTOMATIC_TUNING` set to `TRUE`
- Does not use an LRU list
 - Sized by `LARGE_POOL_SIZE`
 - Can be dynamically resized

Java Pool

- **Services parsing requirements for Java commands**
- **Required if installing and using Java**
- **Sized by `JAVA_POOL_SIZE` parameter**

Program Global Area

- Memory reserved for each user process connecting to an Oracle database
- Allocated when a process is created
- Deallocated when the process is terminated
- Used by only one process



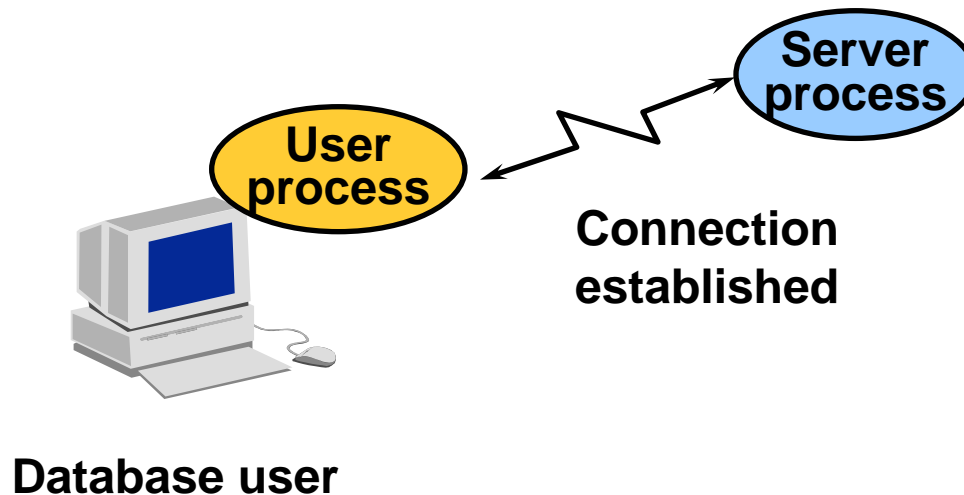
Process Structure

Oracle takes advantage of various types of processes:

- **User process:** Started at the time a database user requests connection to the Oracle server
- **Server process:** Connects to the Oracle instance and is started when a user establishes a session
- **Background processes:** Started when an Oracle instance is started

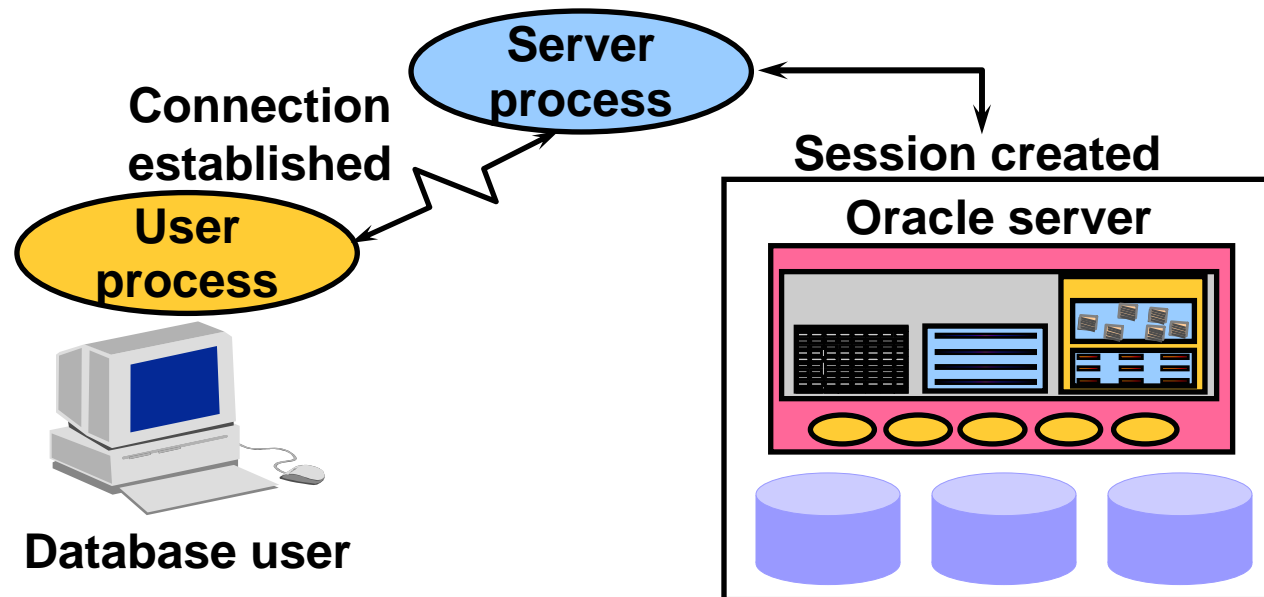
User Process

- A program that requests interaction with the Oracle server
- Must first establish a connection
- Does not interact directly with the Oracle server



Server Process

- A program that directly interacts with the Oracle server
- Fulfills calls generated and returns results
- Can be dedicated or shared server



Background Processes

Maintains and enforces relationships between physical and memory structures:

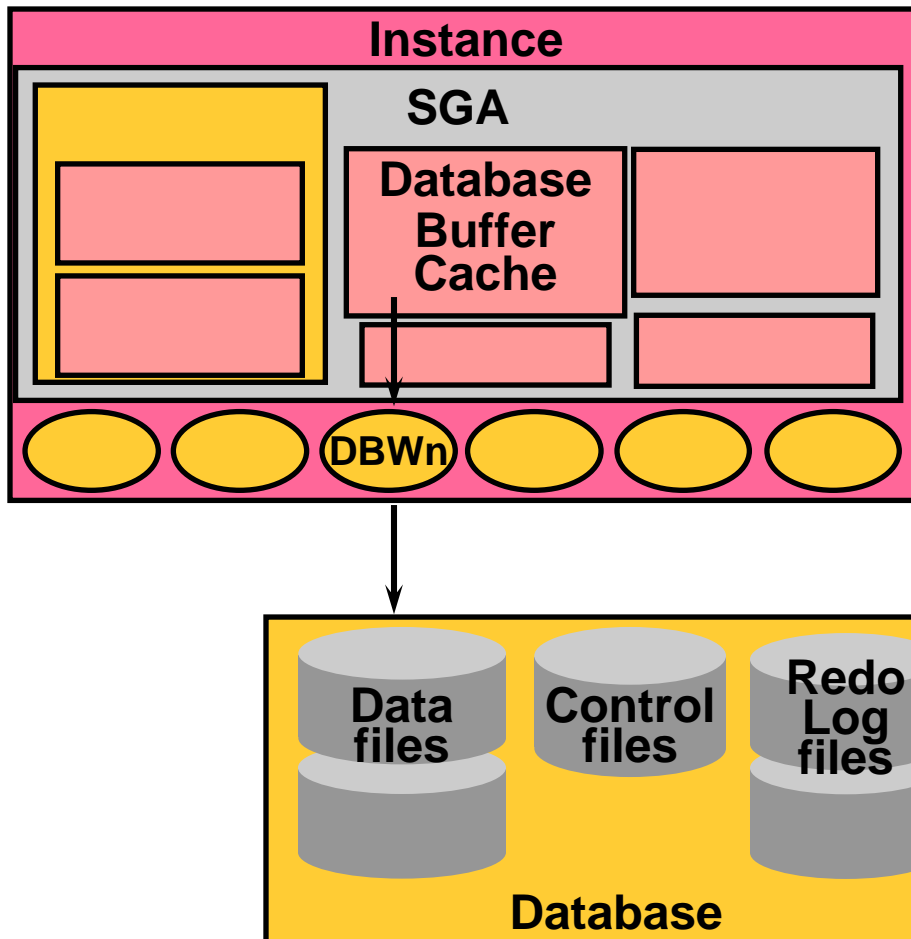
- **Mandatory background processes:**

DBWn	PMON	CKPT
LGWR	SMON	

- **Optional background processes:**

ARCn	LMDn	QMNn
CJQ0	LMON	RECO
Dnnn	LMS	Snnn
LCKn	Pnnn	

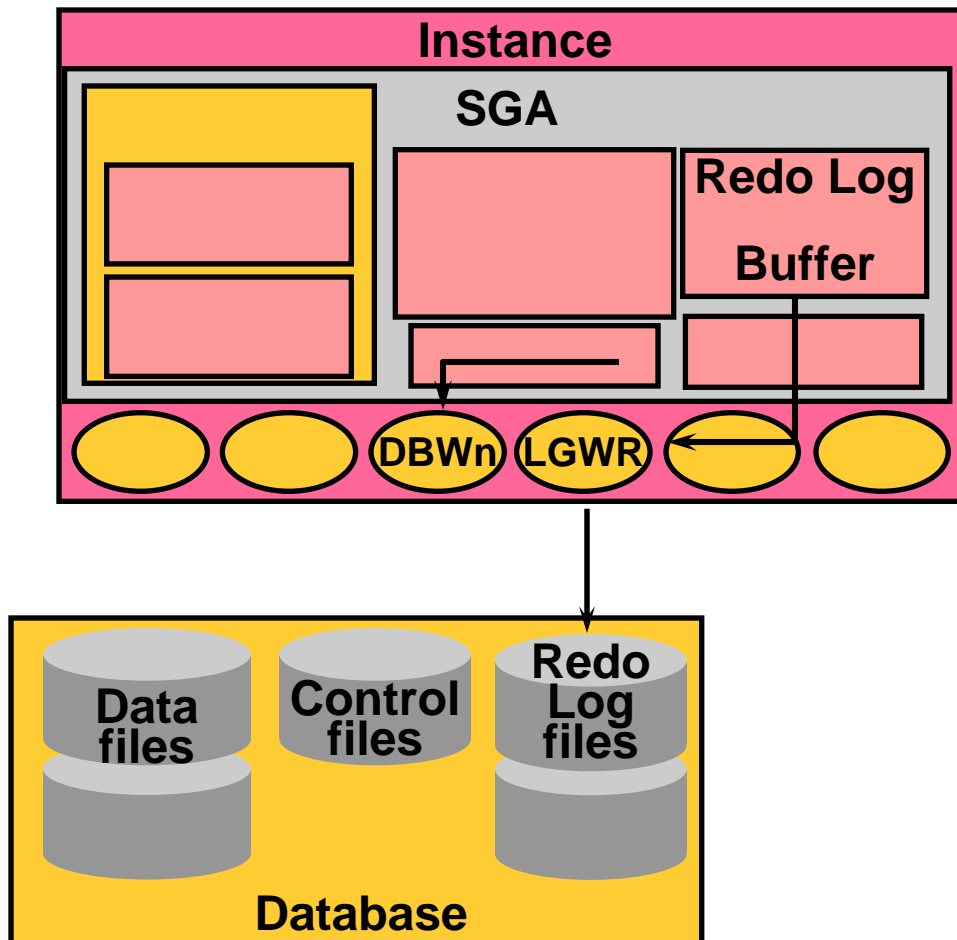
Database Writer (DBWn)



DBWn writes when:

- Checkpoint occurs
- Dirty buffers reach threshold
- There are no free buffers
- Timeout occurs
- RAC ping request is made
- Tablespace OFFLINE
- Tablespace READ ONLY
- Table DROP or TRUNCATE
- Tablespace BEGIN BACKUP

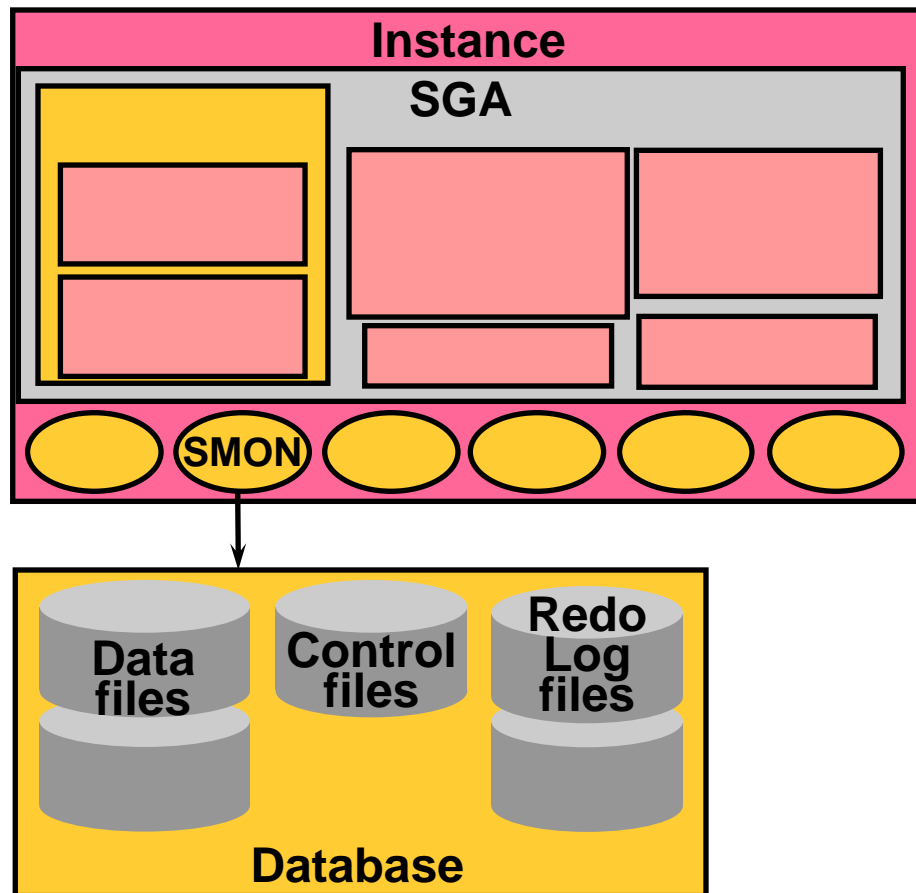
Log Writer (LGWR)



LGWR writes:

- At commit
- When one-third full
- When there is 1 MB of redo
- Every three seconds
- Before DBWn writes

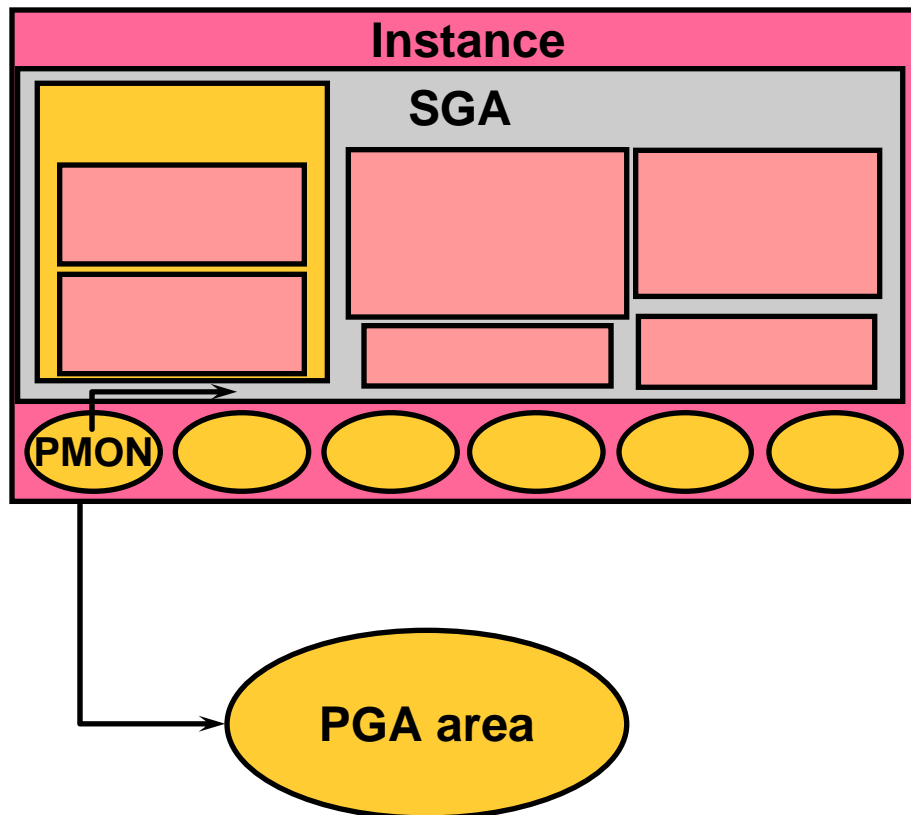
System Monitor (SMON)



Responsibilities:

- **Instance recovery**
 - Rolls forward changes in online redo log files
 - Opens database for user access
 - Rolls back uncommitted transactions
- **Coalesces free space**
- **Deallocates temporary segments**

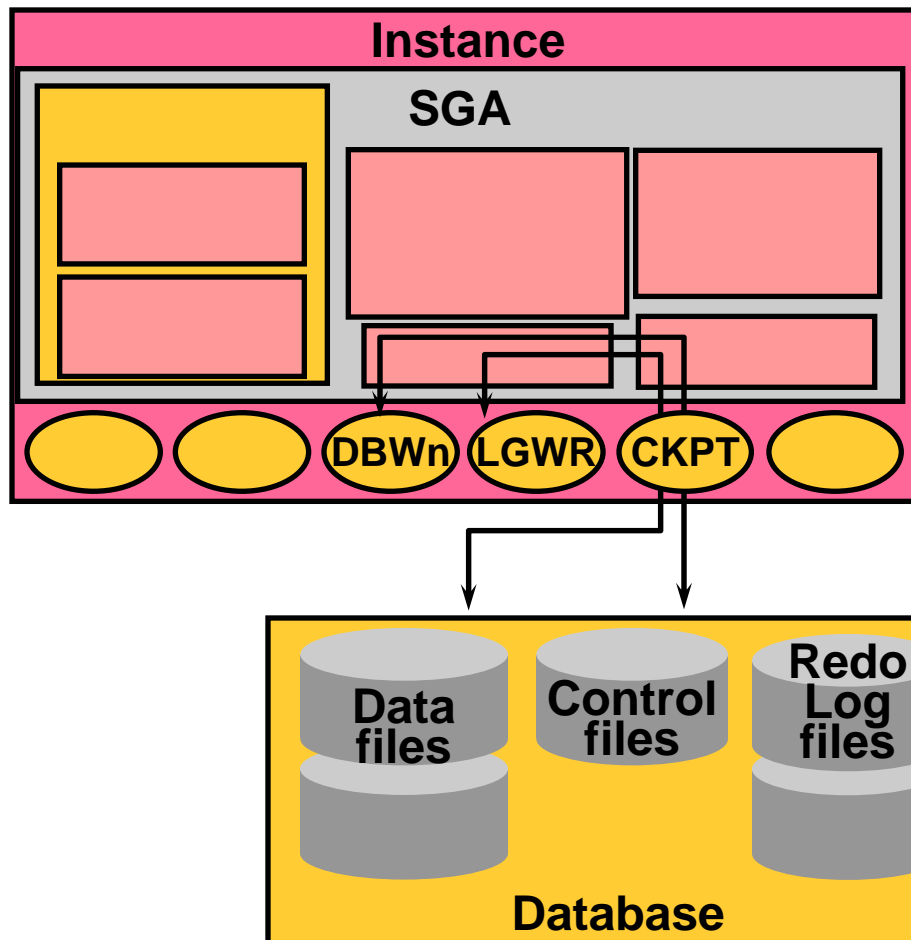
Process Monitor (PMON)



Cleans up after failed processes by:

- Rolling back the transaction
- Releasing locks
- Releasing other resources
- Restarting dead dispatchers

Checkpoint (CKPT)

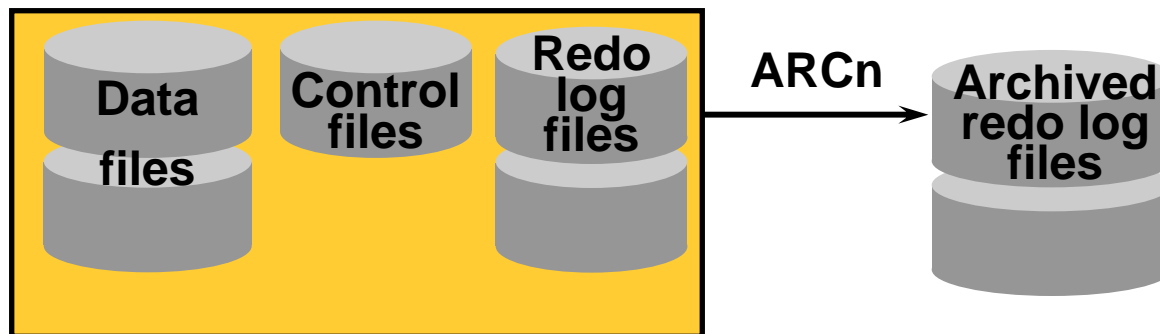


Responsible for:

- Signaling DBWn at checkpoints
- Updating datafile headers with checkpoint information
- Updating control files with checkpoint information

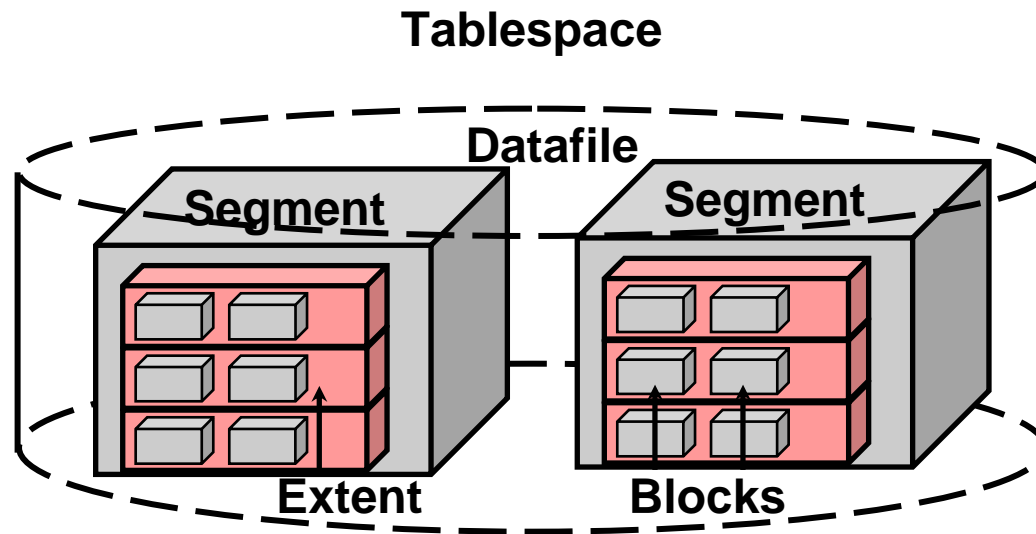
Archiver (ARCn)

- Optional background process
- Automatically archives online redo log files when ARCHIVELOG mode is set
- Preserves the record of all changes made to the database



Logical Structure

- Dictates how the physical space of a database is used
- Hierarchy consisting of tablespaces, segments, extents, and blocks



Processing SQL Statements

- **Connect to an instance using:**
 - User process
 - Server process
- **The Oracle server components that are used depend on the type of SQL statement:**
 - Queries return rows
 - DML statements log changes
 - Commit ensures transaction recovery
- **Some Oracle server components do not participate in SQL statement processing.**

Summary

In this lesson, you should have learned how to:

- **Explain database files: data files, control files, online redo log files**
- **Explain SGA memory structures: Database Buffer Cache, Shared Pool, and Redo Log Buffer**
- **Explain primary background processes: DBWn, LGWR, CKPT, PMON, SMON**
- **Explain the use of the optional background process ARCn**
- **Identify optional and conditional background processes**
- **Explain logical hierarchy**

Practice 1 Overview

This practice covers the following topics:

- **Reviewing architectural components**
- **Identifying structures involved in connecting a user to an Oracle instance**