# Exploring the Oracle Database Architecture

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Objectives
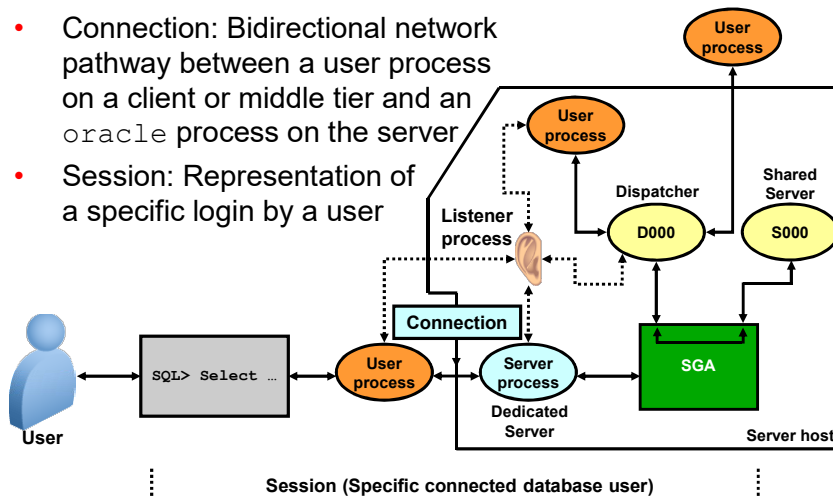
After completing this lesson, you should be able to:

- List the major architectural components of the Oracle Database server
- Explain memory structures
- Describe background processes
- Correlate logical and physical storage structures

Oracle Database Server Architecture: Overview

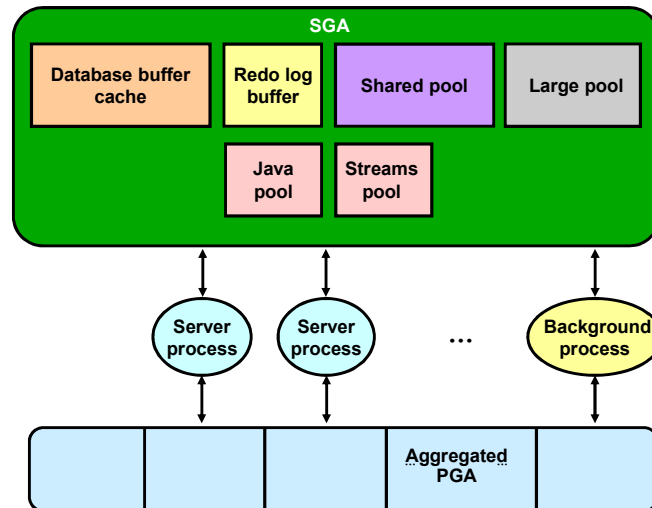**Instance**

SGA

BGP1 BGP2 BGP3 BGP*n*
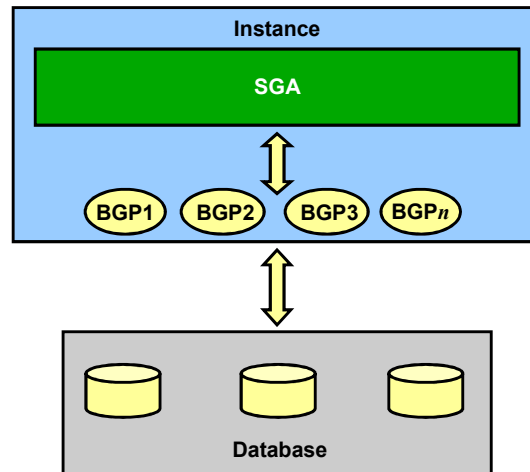
Database

Connecting to the Database Instance

- Connection: Bidirectional network pathway between a user process on a client or middle tier and an `oracle` process on the server
- Session: Representation of a specific login by a user

User process

User process

User process

Listener process

Dispatcher

Shared Server

D000

S000

Connection

SQL> Select ...

User process

Server process

SGA

User

Dedicated Server

Server host

Session (Specific connected database user)

Oracle Database Memory Structures: Overview

SGA

Database buffer cache	Redo log buffer	Shared pool	Large pool

Java pool	Streams pool

Server process   Server process   ...   Background process

			Aggregated PGA	

Database Buffer Cache

- Is a part of the SGA
- Holds copies of data blocks that are read from data files
- Is shared by all concurrent processes

Server process

SGA

Database buffer cache

Data files

DBW*n*

Database writer process
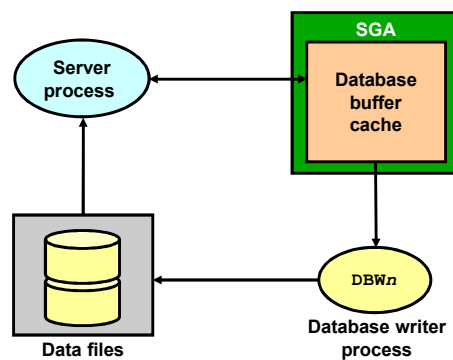
Redo Log Buffer

- Is a circular buffer in the SGA (based on the number of CPUs)
- Contains redo entries that have the information to redo changes made by operations, such as DML and DDL

SGA

Server process

Redo log buffer

LGWR

Redo log files
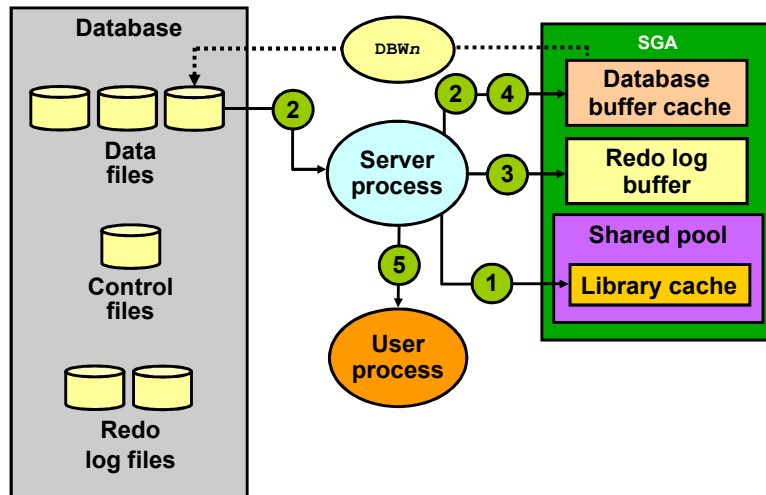
Log writer process
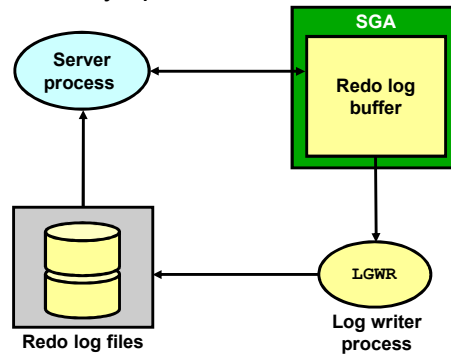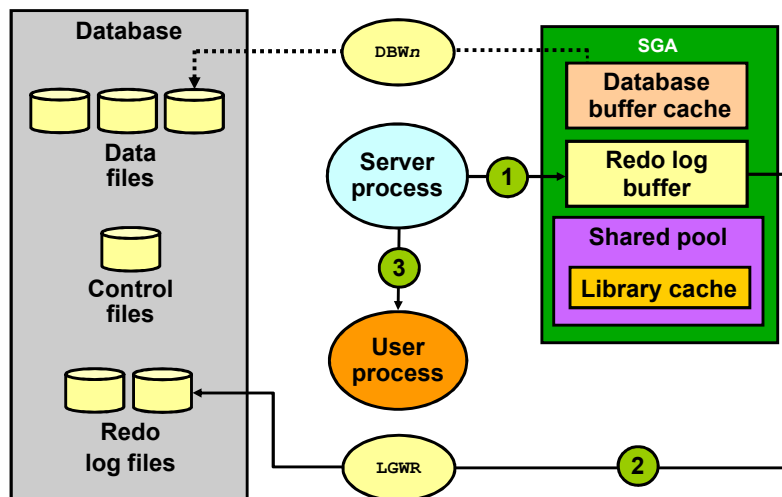
Shared Pool

- Is part of the SGA
- Contains:
  - Library cache
    - Shared parts of SQL and PL/SQL statements
  - Data dictionary cache
  - Result cache:
    - SQL queries
    - PL/SQL functions
  - Control structures
    - Locks

Server process

SGA

Library cache

Data dictionary cache (row cache)

Result cache

Control structures

Shared pool
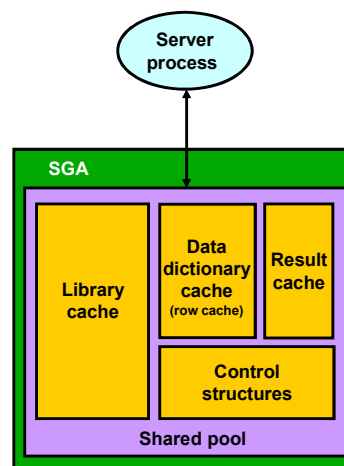
## Processing a DML Statement: Example

COMMIT Processing: Example

Large Pool

- Provides large memory allocations for:
  - Session memory for the shared server and Oracle XA interface
  - Parallel execution buffers
  - I/O server processes
  - Oracle Database backup and restore operations
- Optional pool better suited when using the following:
  - Parallel execution
  - Recovery Manager
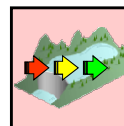 - Shared server
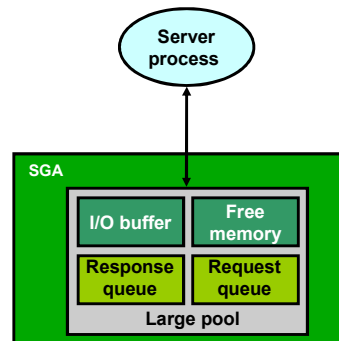
Java Pool and Streams Pool

- Java pool memory is used in server memory for all session-specific Java code and data in the JVM.
- Streams pool memory is used exclusively by Oracle Streams to:
  - Store buffered queue messages
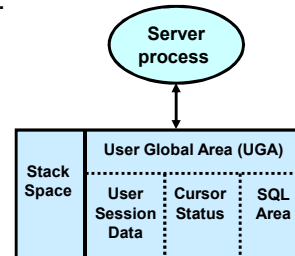 - Provide memory for Oracle Streams processes

Java pool

Streams pool

Program Global Area
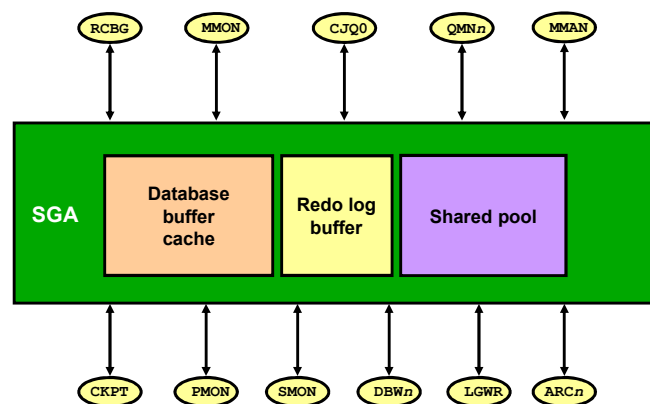
- PGA is a memory area that contains:
    - Session information
    - Cursor information
    - SQL execution work areas:
        - Sort area
        - Hash join area
        - Bitmap merge area
        - Bitmap create area
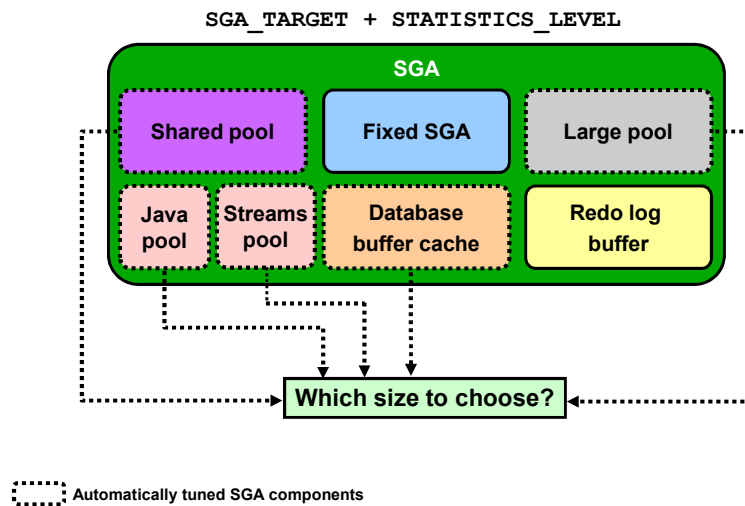- The size of the work area influences SQL performance.
- Work areas can be managed automatically or manually.

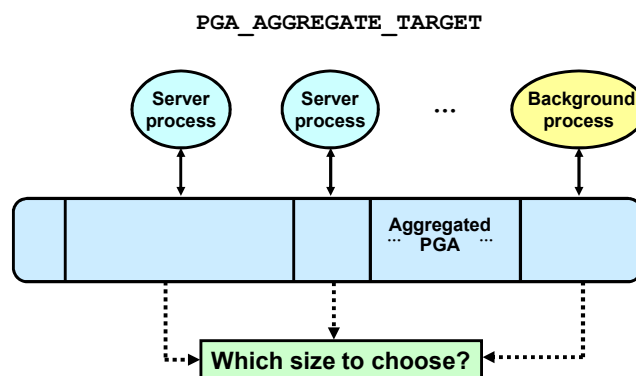| | Server process |
| Stack Space | User Global Area (UGA) |
| | User Session Data | Cursor Status | SQL Area |

Background Process

RCBG MMON CJQ0 QMN*n* MMAN

SGA | Database buffer cache | Redo log buffer | Shared pool

CKPT PMON SMON DBW*n* LGWR ARC*n*

Automatic Shared Memory Management

SGA_TARGET + STATISTICS_LEVEL

SGA

| Shared pool | Fixed SGA | Large pool |
| Java pool | Streams pool | Database buffer cache | Redo log buffer |

Which size to choose?

········· Automatically tuned SGA components

Automated SQL Execution Memory Management

PGA_AGGREGATE_TARGET

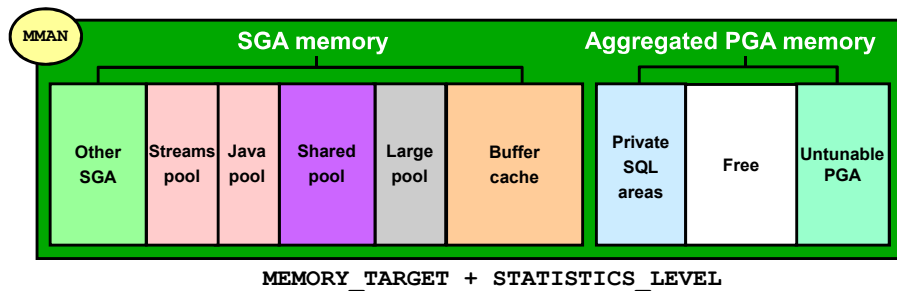Server process   Server process   ...   Background process

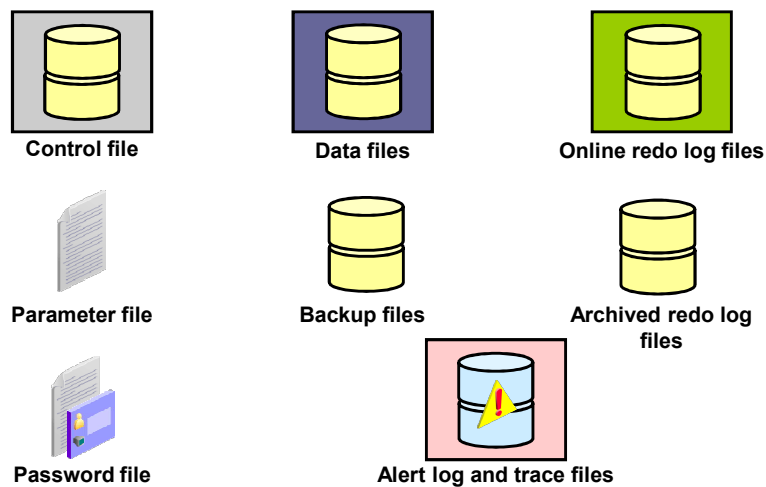Aggregated PGA

Which size to choose?
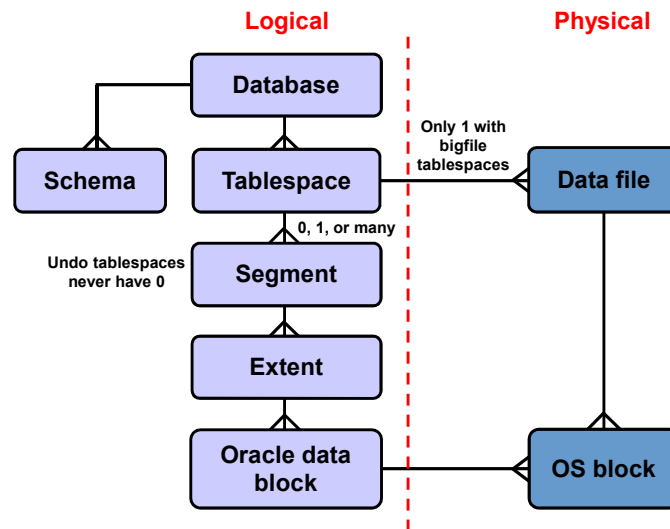
Automatic Memory Management

- Sizing of each memory component is vital for SQL execution performance.
- It is difficult to manually size each component.
- Automatic memory management automates memory allocation of each SGA component and aggregated PGA.

MMAN	SGA memory						Aggregated PGA memory		
	Other SGA	Streams pool	Java pool	Shared pool	Large pool	Buffer cache	Private SQL areas	Free	Untunable PGA

MEMORY_TARGET + STATISTICS_LEVEL

Database Storage Architecture

Control file

Data files

Online redo log files

Parameter file

Backup files

Archived redo log files

Password file

Alert log and trace files

Logical and Physical Database Structures

Logical   **Physical**

Database

Schema   **Tablespace**   Only 1 with bigfile tablespaces   **Data file**

0, 1, or many

Undo tablespaces never have 0   **Segment**

Extent

Oracle data block   **OS block**

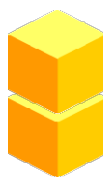## Segments, Extents, and Blocks

- Segments exist in a tablespace.
- Segments are collections of extents.
- Extents are collections of data blocks.
- Data blocks are mapped to disk blocks.
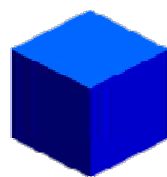
Segment   Extents   Data blocks   Disk blocks

SYSTEM and SYSAUX Tablespaces

- The SYSTEM and SYSAUX tablespaces are mandatory tablespaces that are created at the time of database creation. They must be online.
- The SYSTEM tablespace is used for core functionality (for example, data dictionary tables).
- The auxiliary SYSAUX tablespace is used for additional database components (such as the Enterprise Manager Repository).

Quiz

The first time an Oracle Database server process requires a particular piece of data, it searches for the data in the:
  a. Database buffer cache
  b. PGA
  c. Redo log buffer
  d. Shared pool

Quiz

Which of the following is not a database logical structure?

a. Tablespace
b. Data file
c. Schema
d. Segment

Quiz

The SYSAUX tablespace is used for core functionality, and the SYSTEM tablespace is used for additional database components, such as the Enterprise Manager Repository.

a. True
b. False

Summary

In this lesson, you should have learned how to:

- List the major architectural components of the Oracle Database server
- Explain memory structures
- Describe background processes
- Correlate logical and physical storage structures