

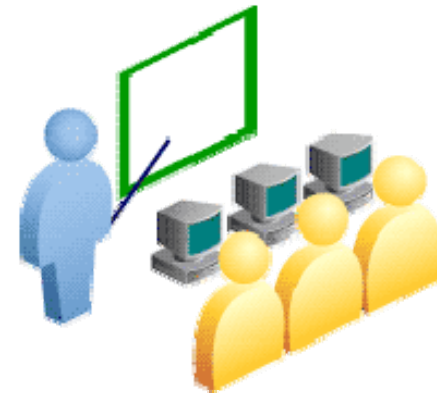
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Exploring the Oracle Database Architecture

Objectives

After completing this lesson, you should be able to:

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

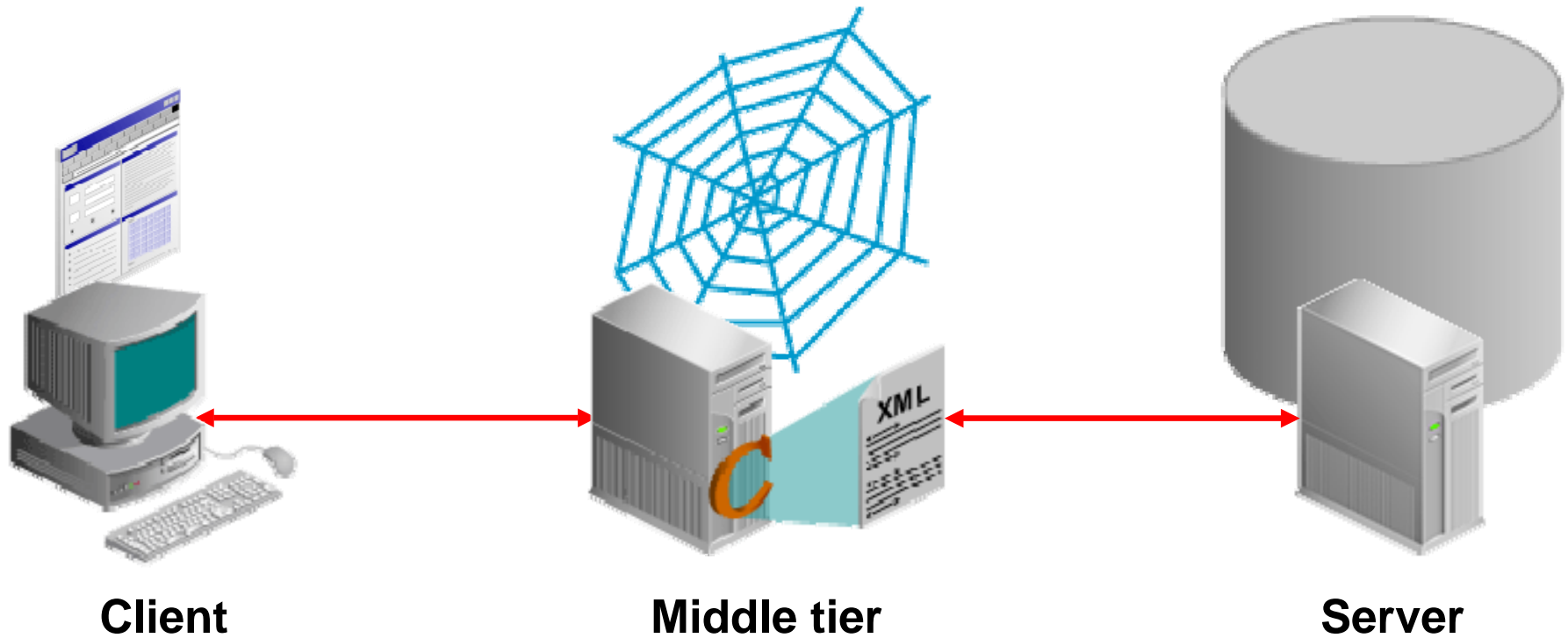


Oracle Database

The Oracle relational database management system (RDBMS) provides an open, comprehensive, integrated approach to information management

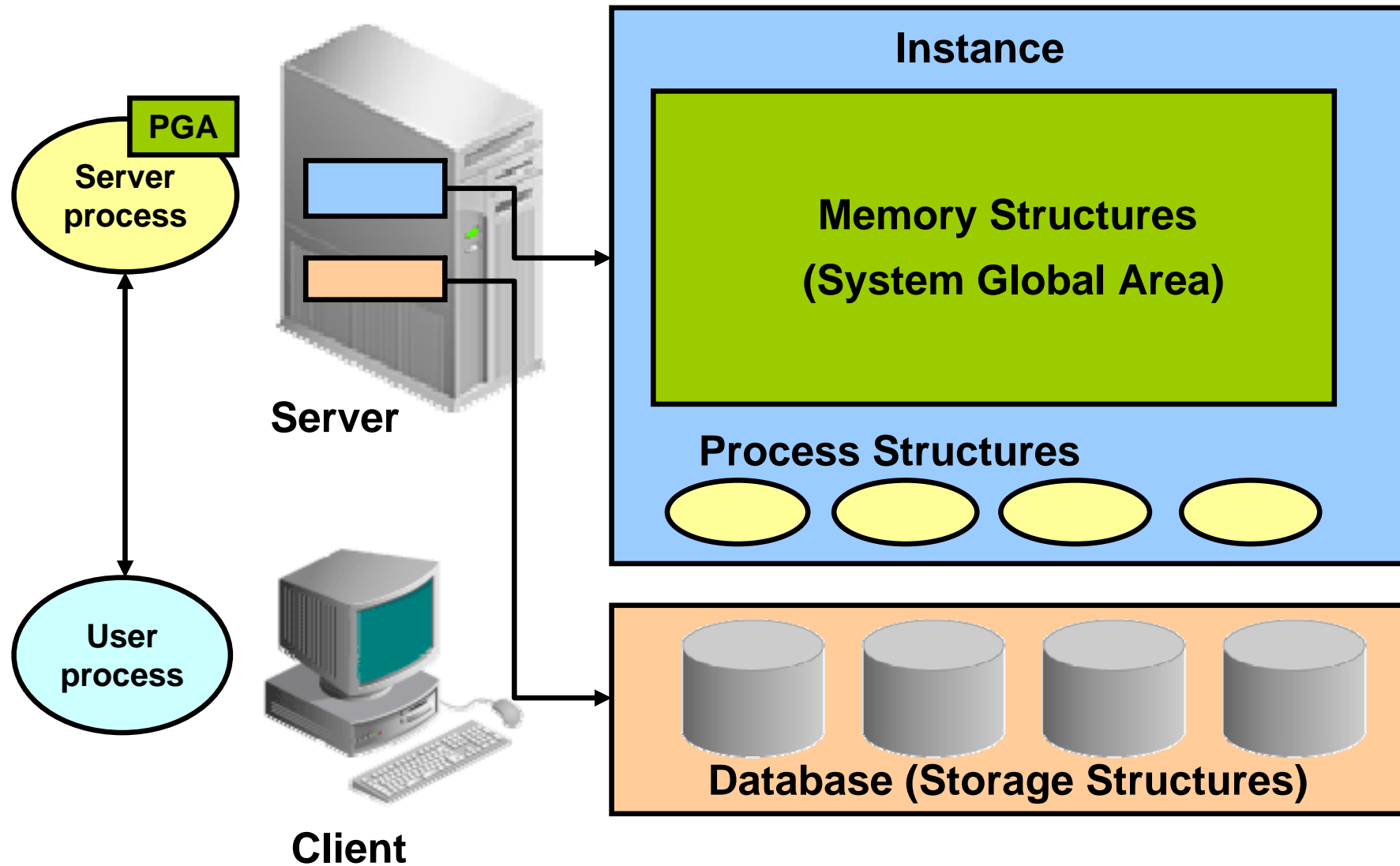


Connecting to a Server



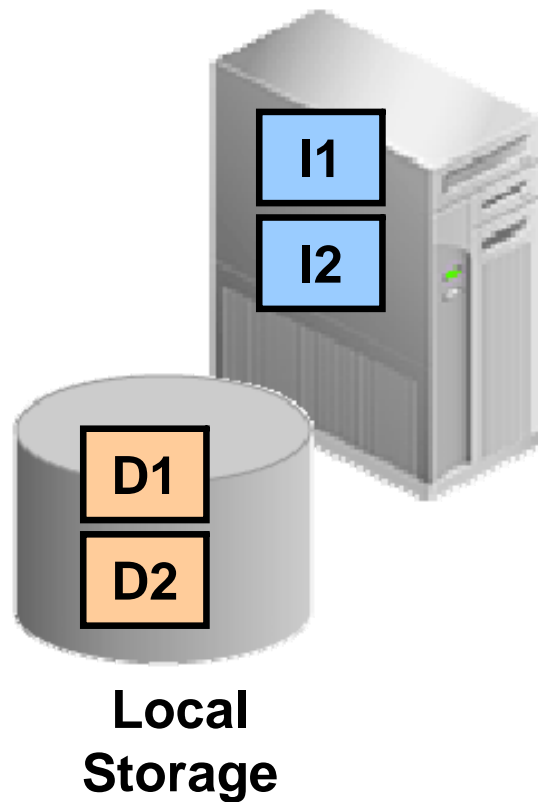
Multitier architecture shown

Oracle Database Server Architecture: Overview

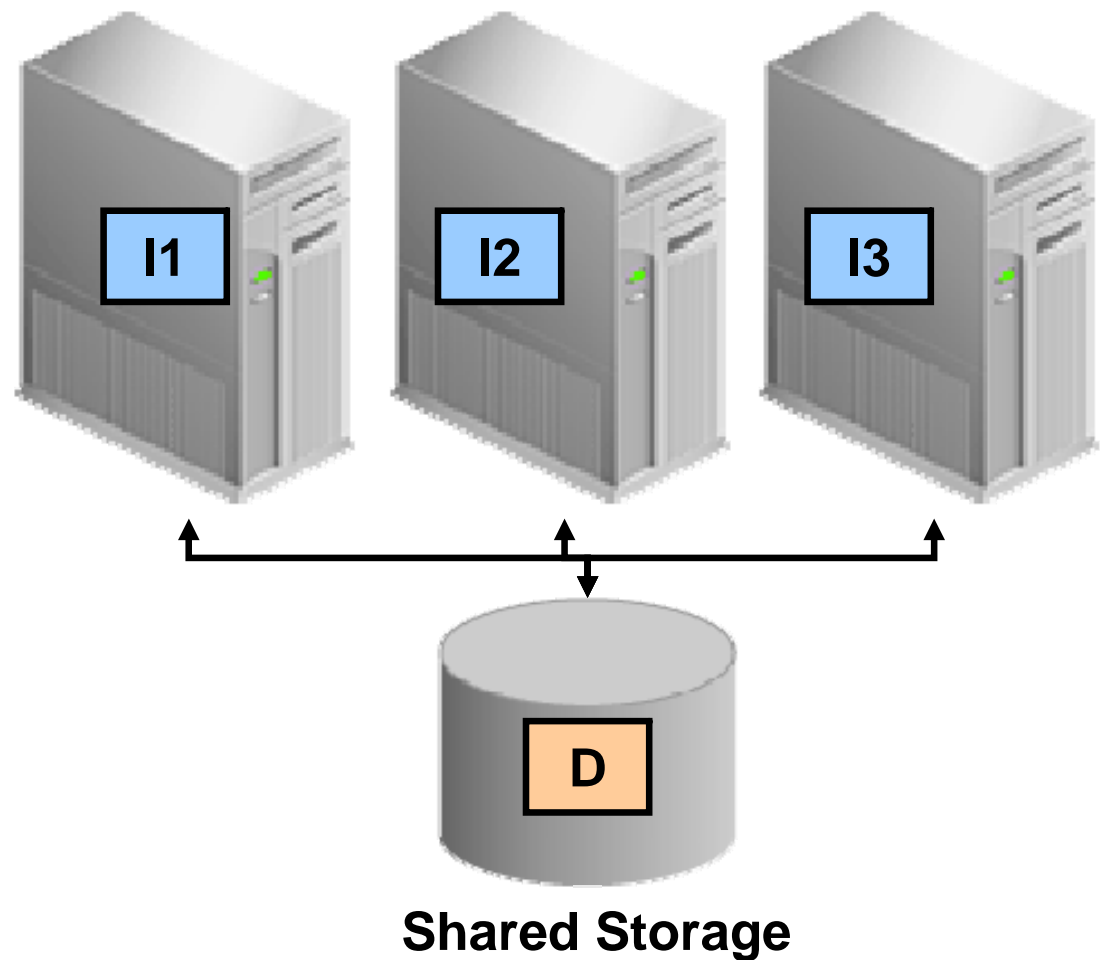


Instance: Database Configurations

Nonclustered System

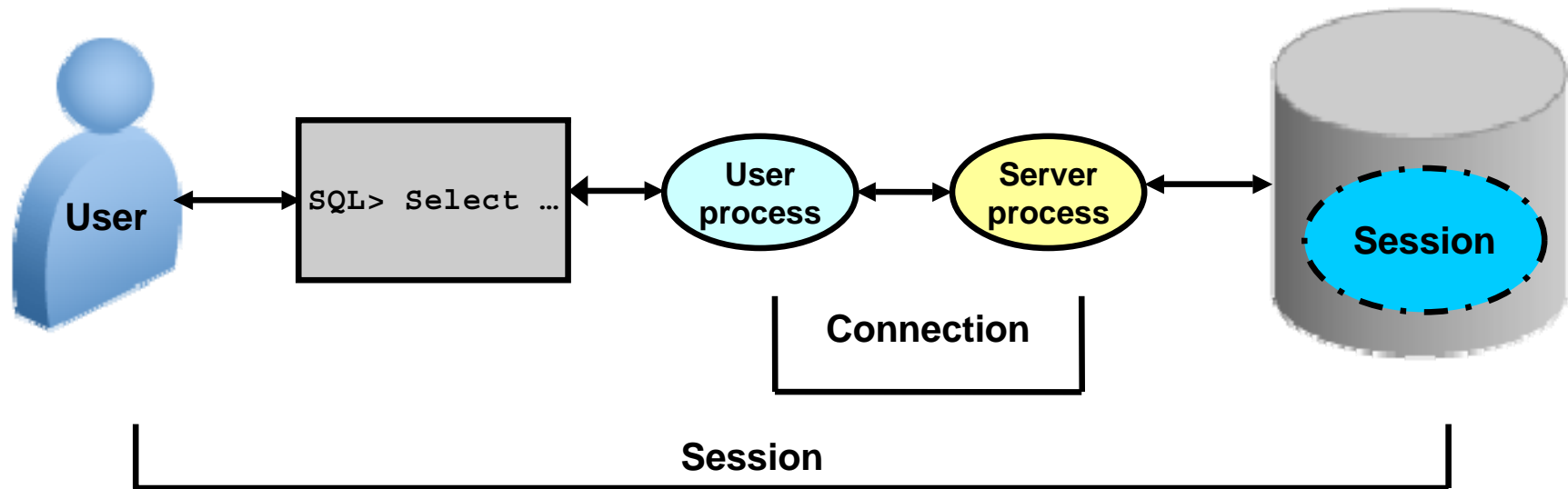


Clustered System

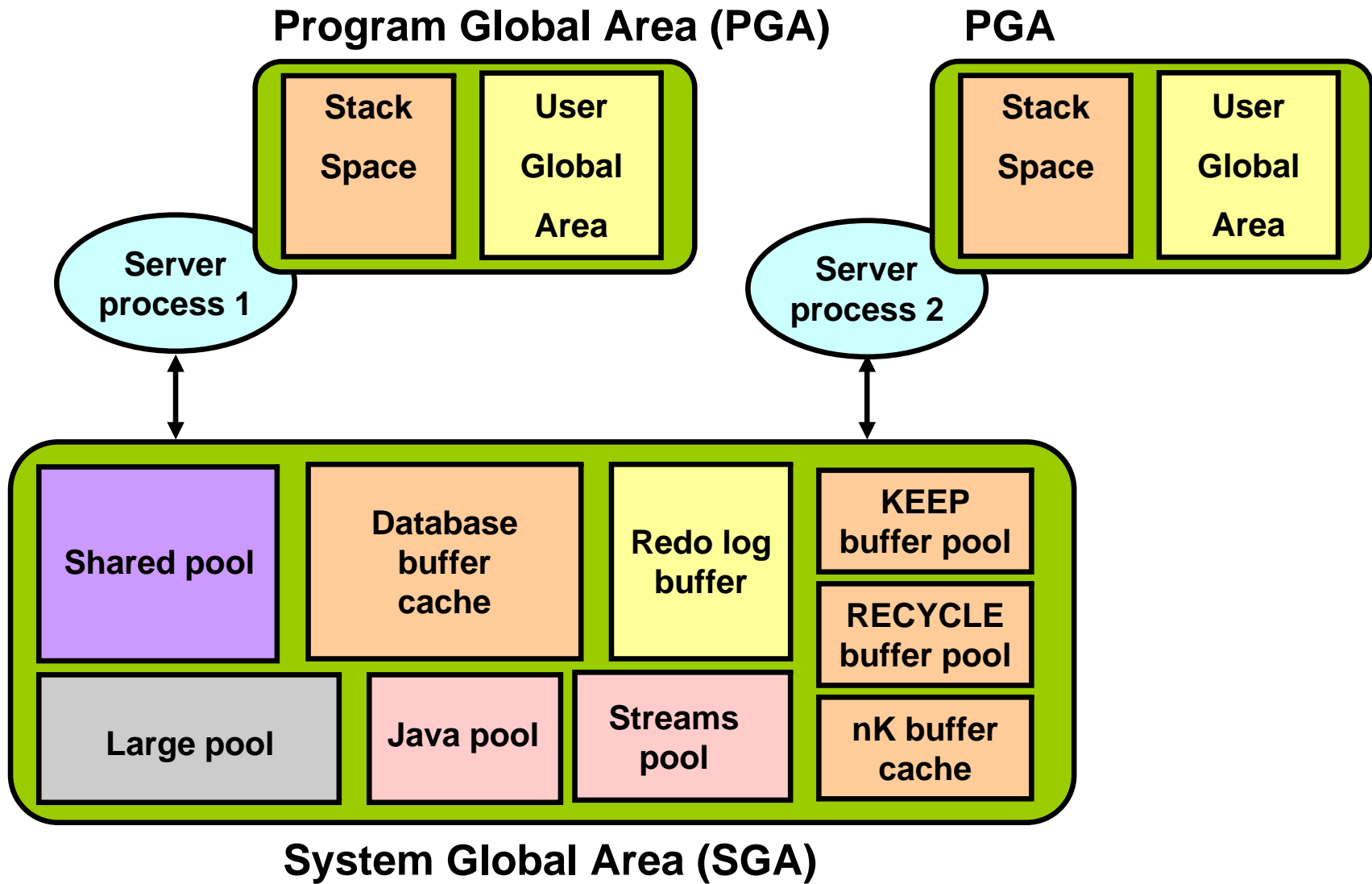


Connecting to the Database Instance

- Connection: Communication between a user process and an instance
- Session: Specific connection of a user to an instance through a user process

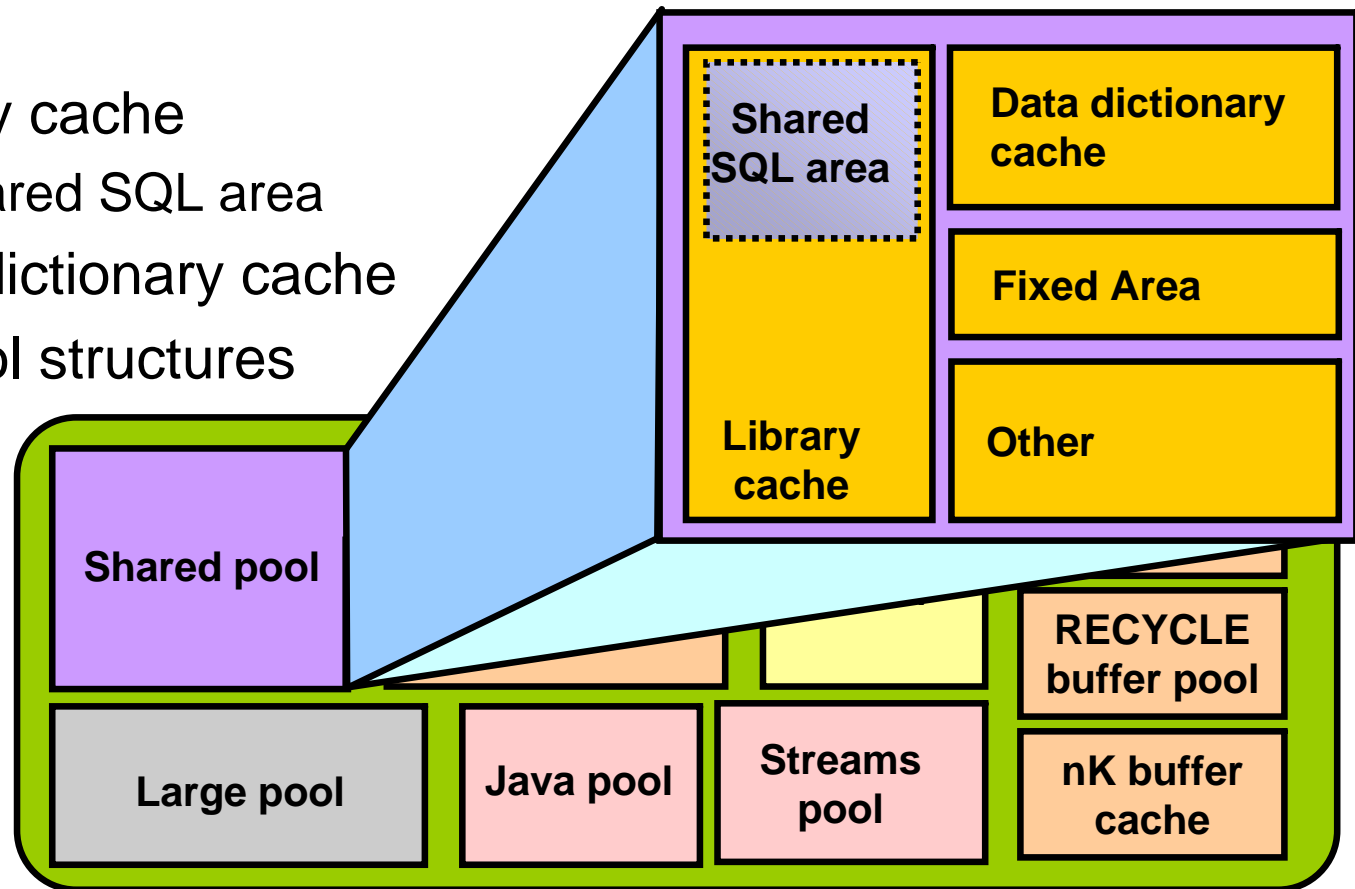


Oracle Database Memory Structures



Shared Pool

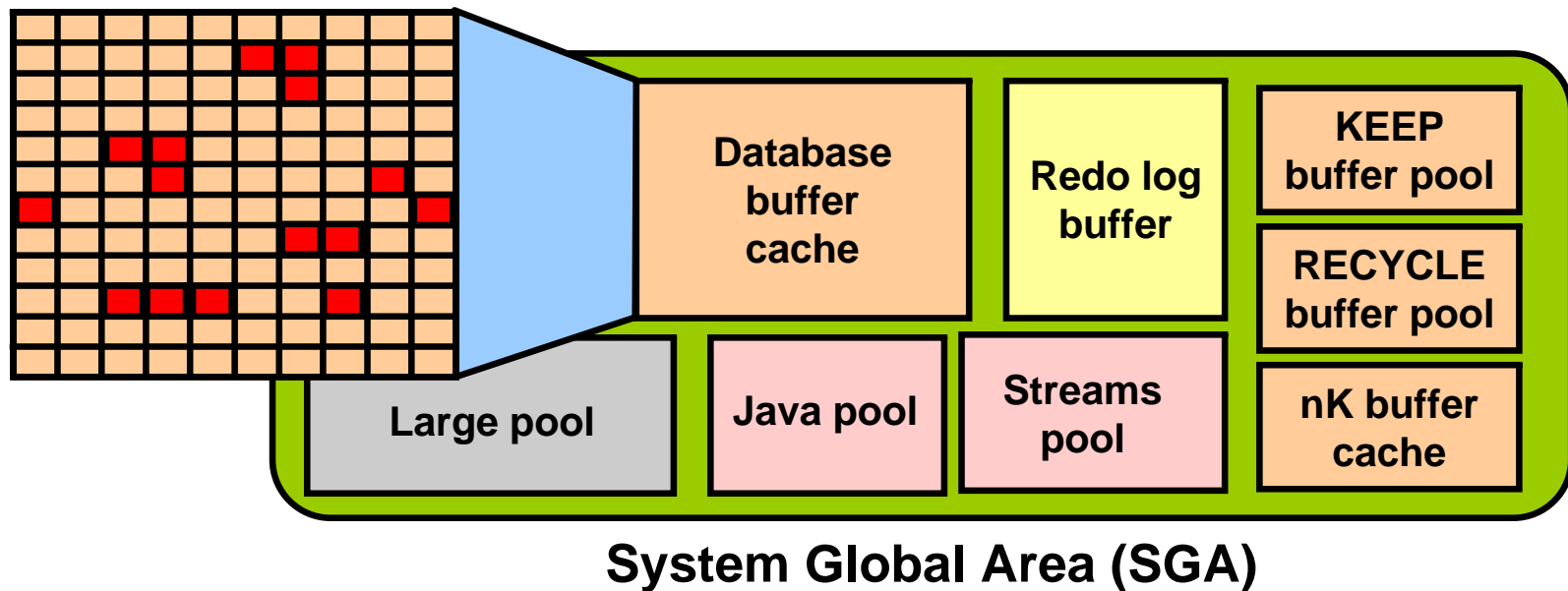
- Is a portion of the SGA
- Contains:
 - Library cache
 - Shared SQL area
 - Data dictionary cache
 - Control structures



System Global Area (SGA)

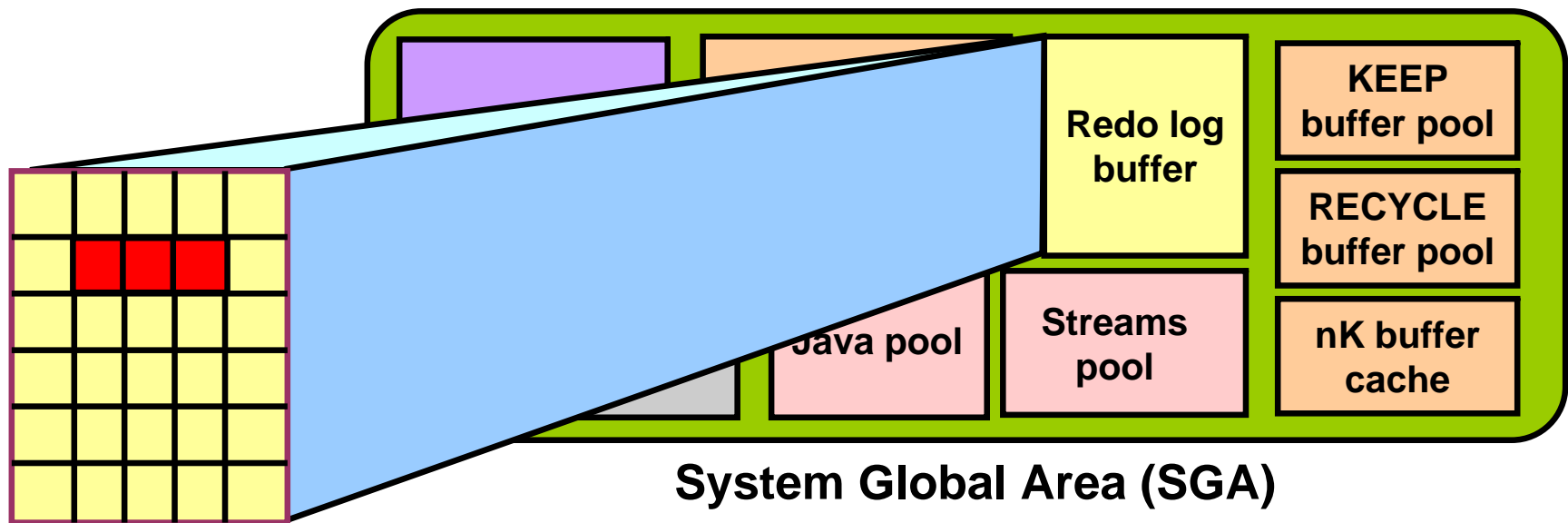
Database Buffer Cache

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



Redo Log Buffer

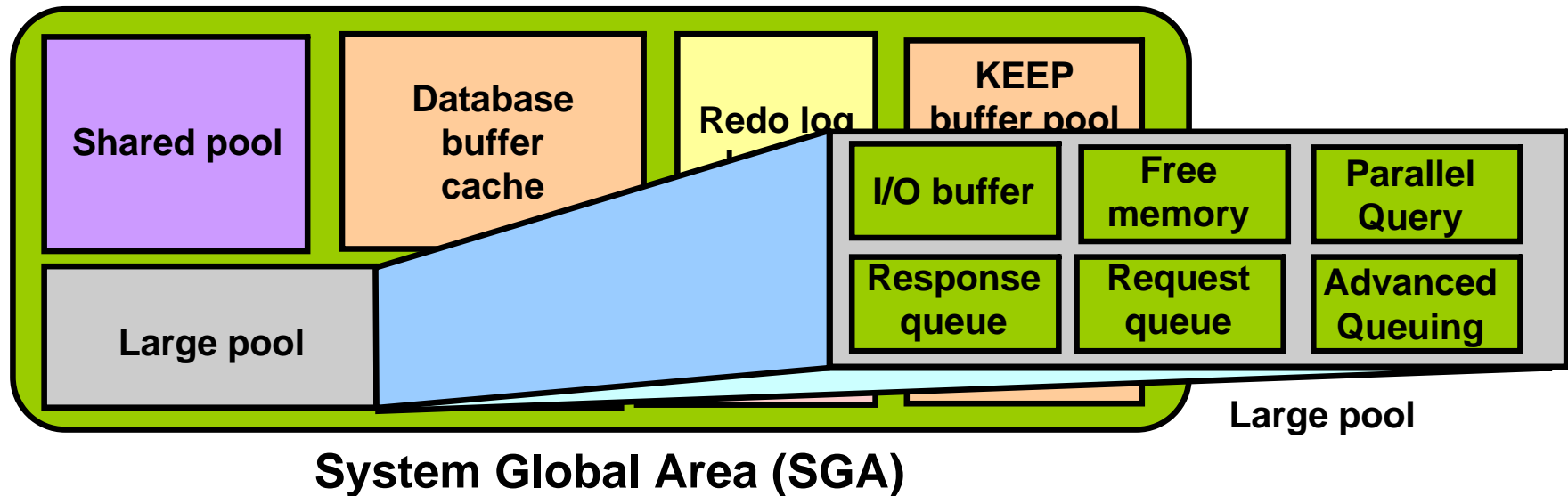
- Is a circular buffer in the SGA
- Holds information about changes made to the database
- Contains redo entries that have the information to redo changes made by operations such as DML and DDL



Large Pool

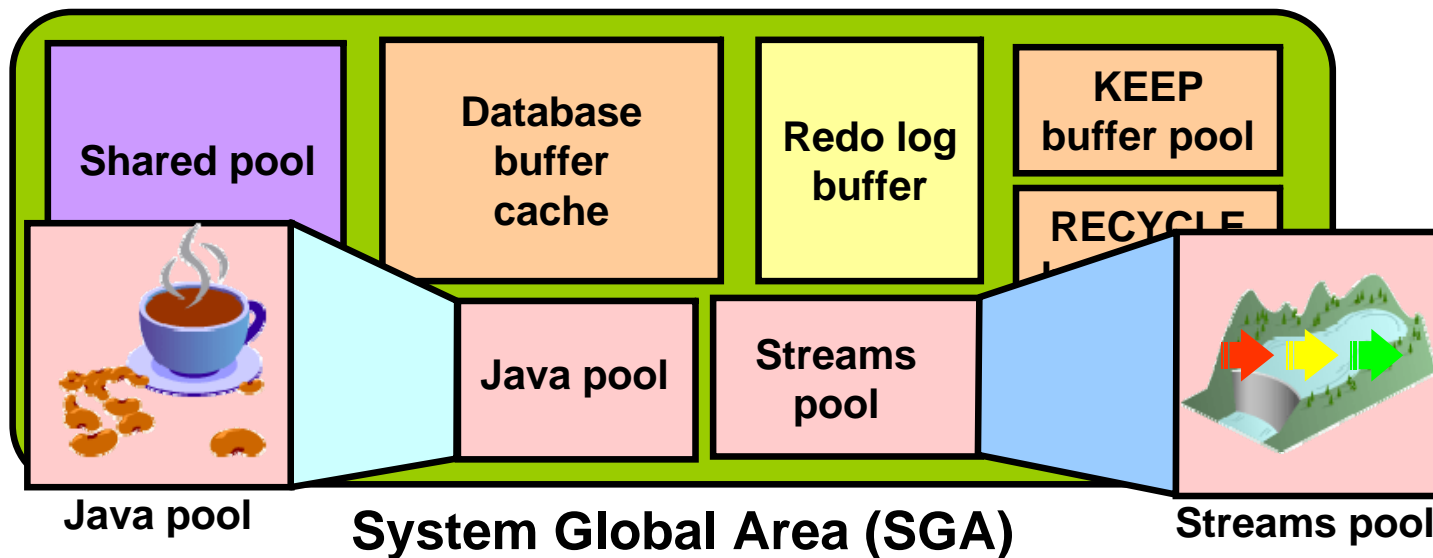
Provides large memory allocations for:

- Session memory for the shared server and the Oracle XA interface
- I/O server processes
- Oracle Database backup and restore operations

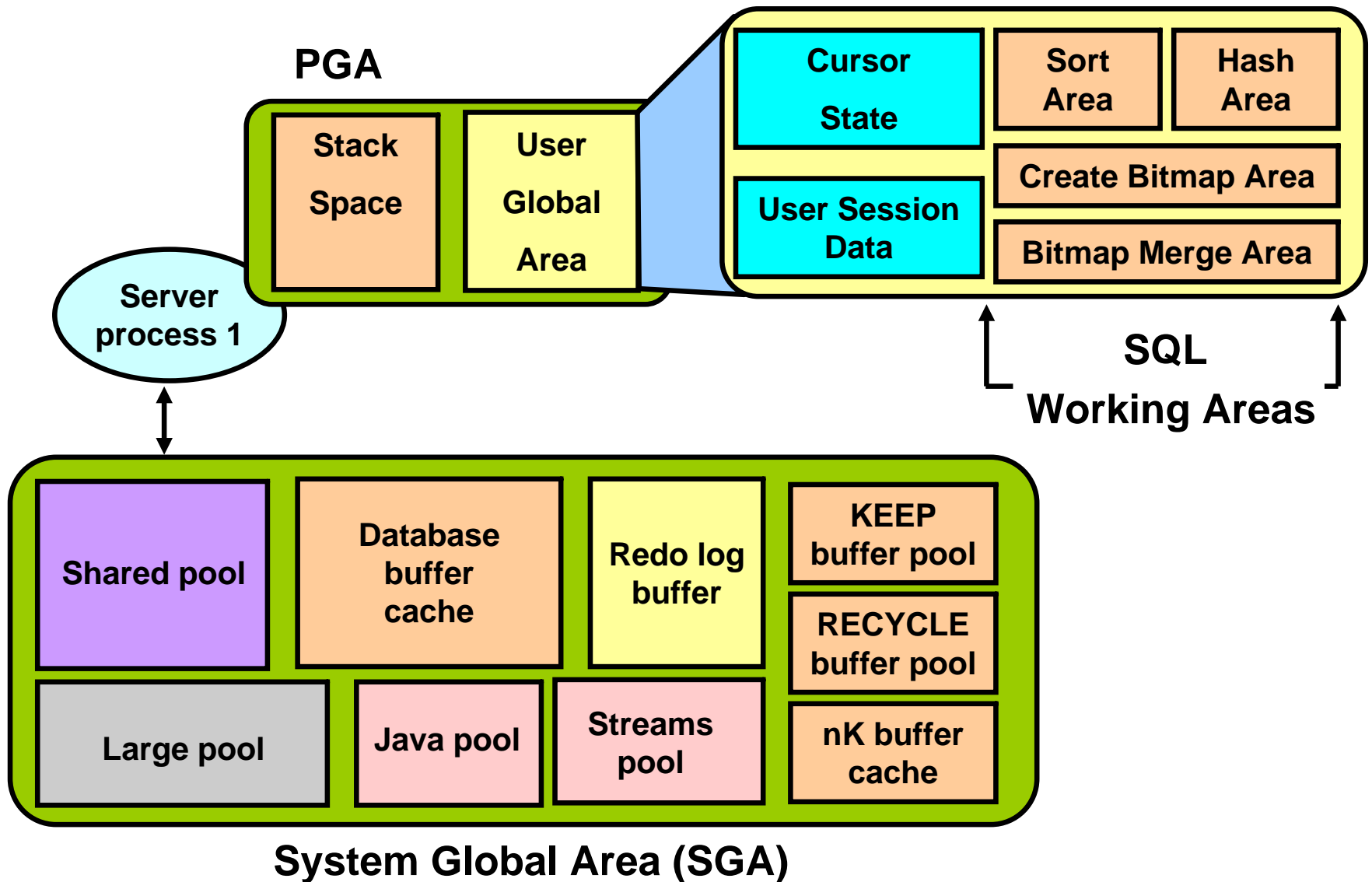


Java Pool and Streams Pool

- Java pool memory is used to store 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



Program Global Area (PGA)



Quiz

Memory region that contains data and control information for a server or background process is called:

1. Shared Pool
2. PGA
3. Buffer Cache
4. User session data

Quiz

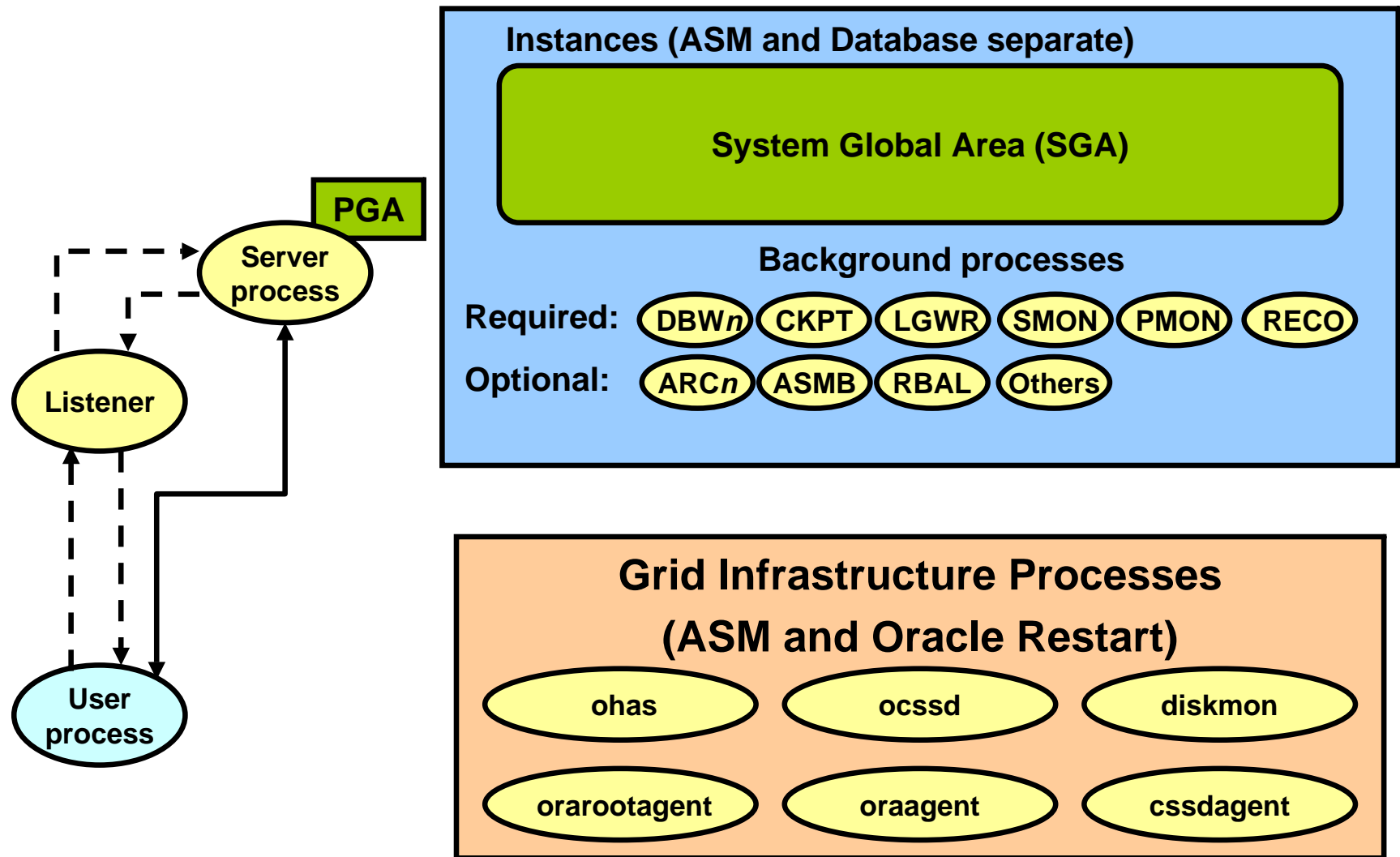
What is read into the Database Buffer Cache from the data files?

1. Rows
2. Changes
3. Blocks
4. SQL

Process Architecture

- User process
 - Is the application or tool that connects to the Oracle database
- Database processes
 - Server process: Connects to the Oracle instance and is started when a user establishes a session
 - Background processes: Are started when an Oracle instance is started
- Daemon / Application processes
 - Networking listeners
 - Grid infrastructure daemons

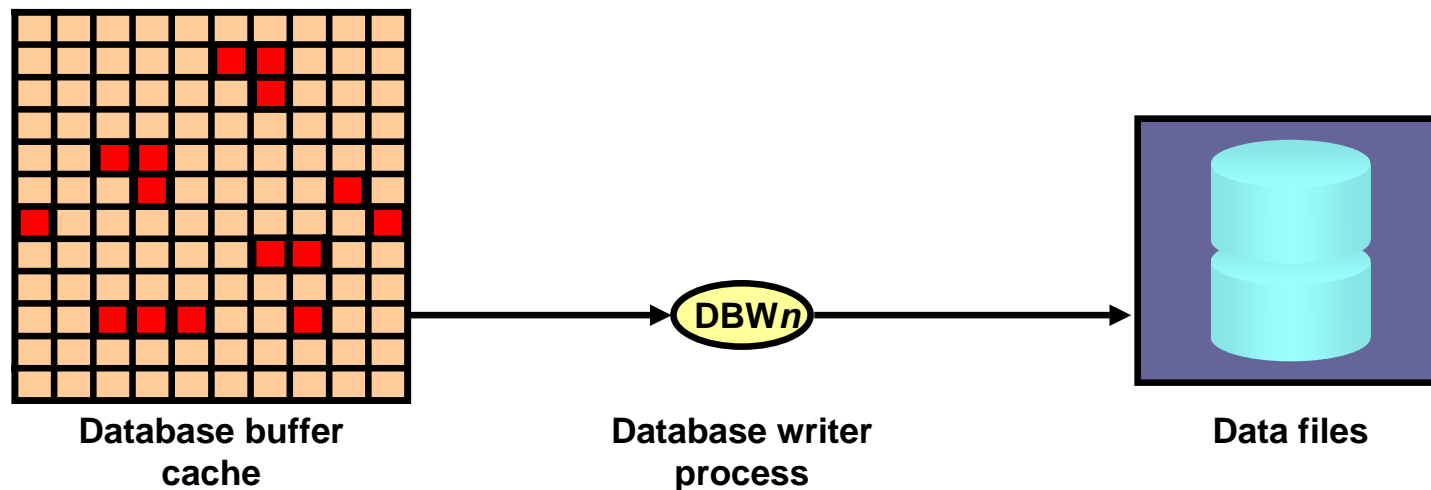
Process Structures



Database Writer Process (DBWn)

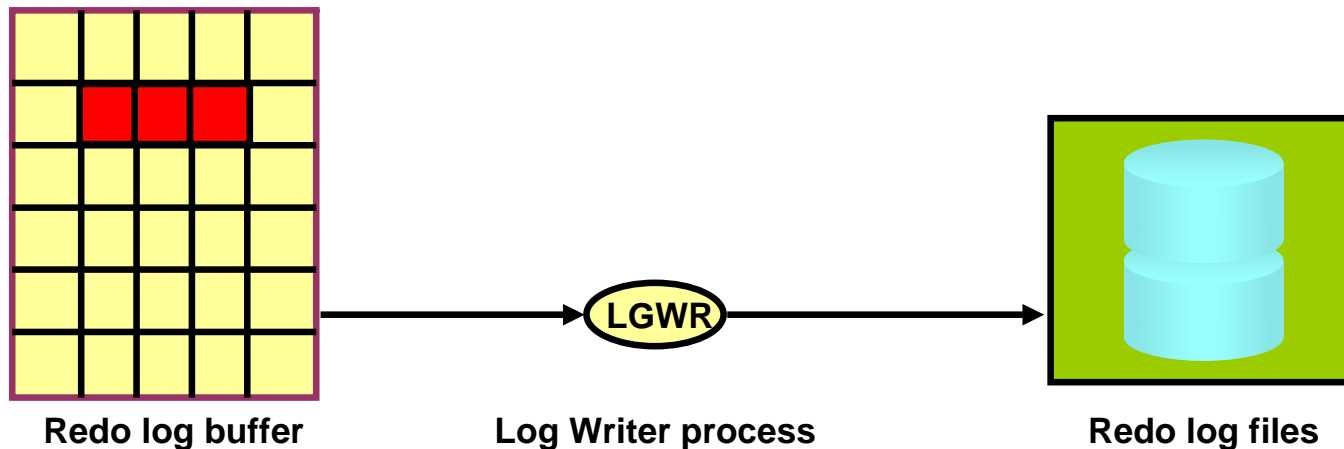
Writes modified (dirty) buffers in the database buffer cache to disk:

- Asynchronously while performing other processing
- To advance the checkpoint



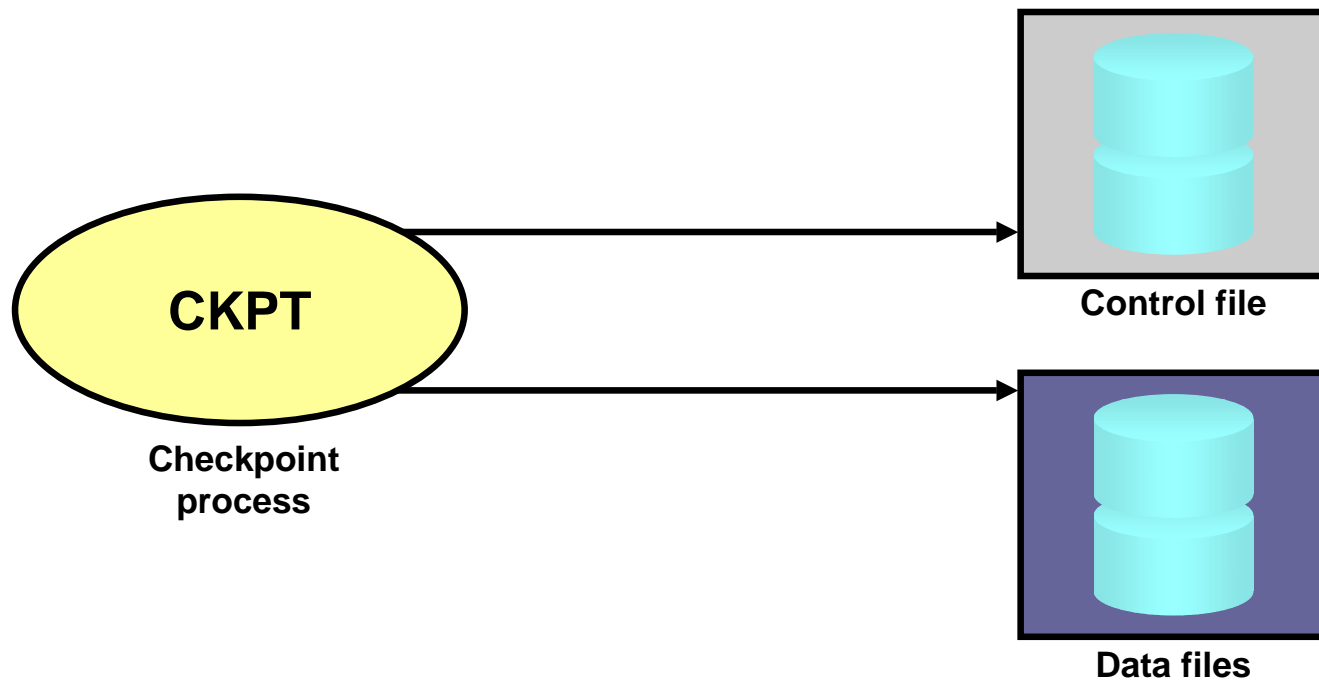
Log Writer Process (LGWR)

- Writes the redo log buffer to a redo log file on disk
- Writes:
 - When a user process commits a transaction
 - When the redo log buffer is one-third full
 - Before a DBWn process writes modified buffers to disk
 - Every 3 seconds



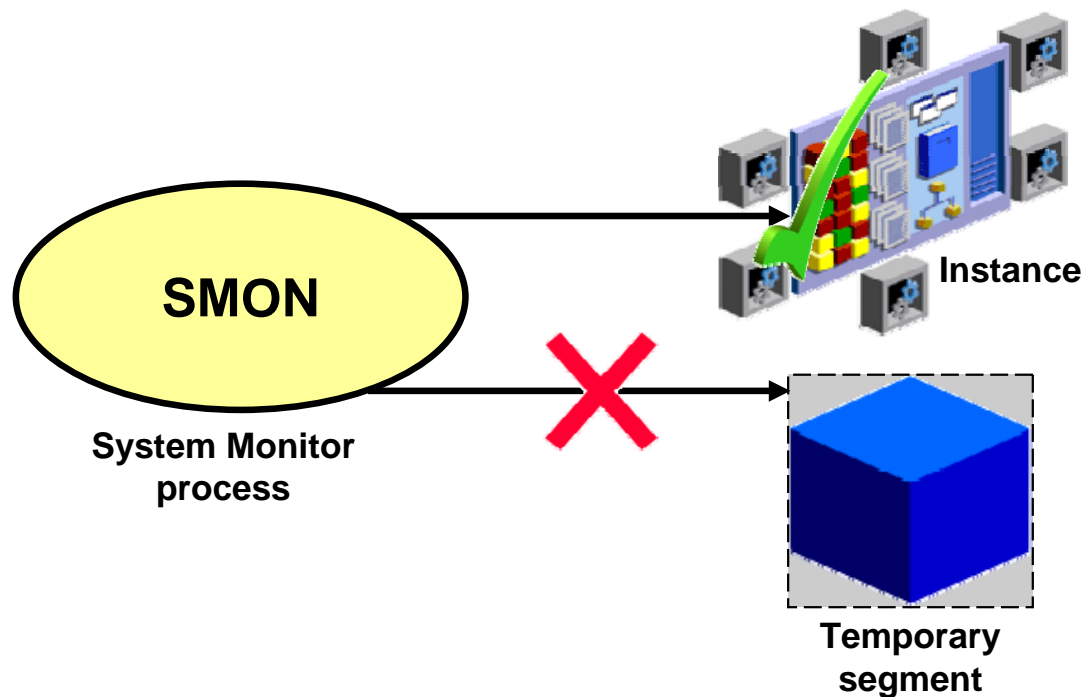
Checkpoint Process (CKPT)

- Records checkpoint information in
 - Control file
 - Each data file header



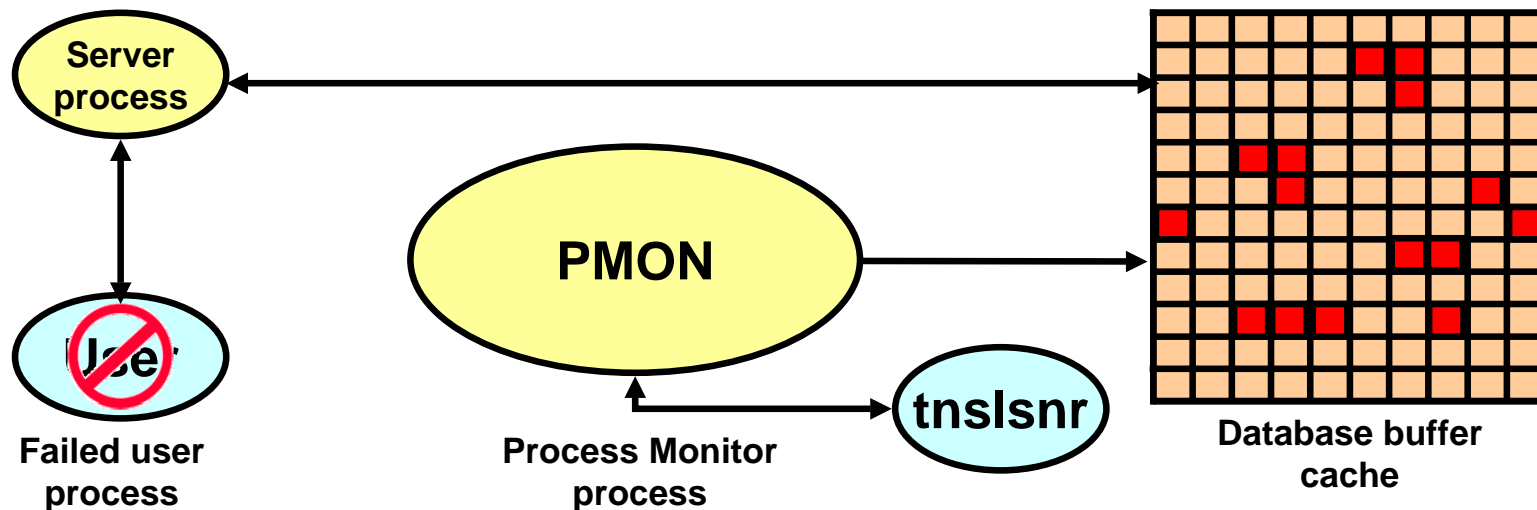
System Monitor Process (SMON)

- Performs recovery at instance startup
- Cleans up unused temporary segments



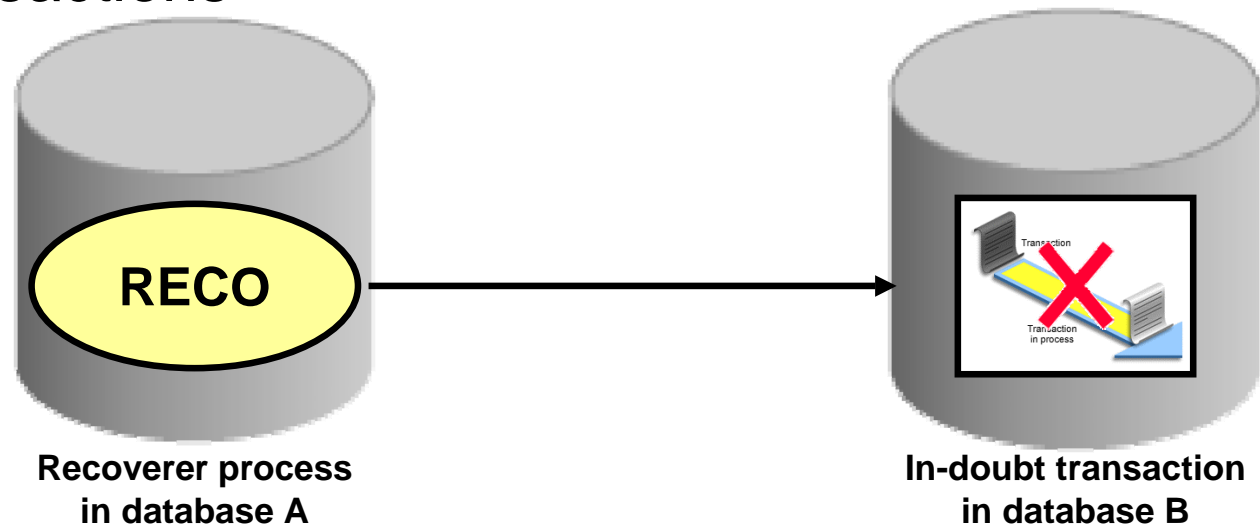
Process Monitor Process (PMON)

- Performs process recovery when a user process fails
 - Cleans up the database buffer cache
 - Frees resources that are used by the user process
- Monitors sessions for idle session timeout
- Dynamically registers database services with listeners



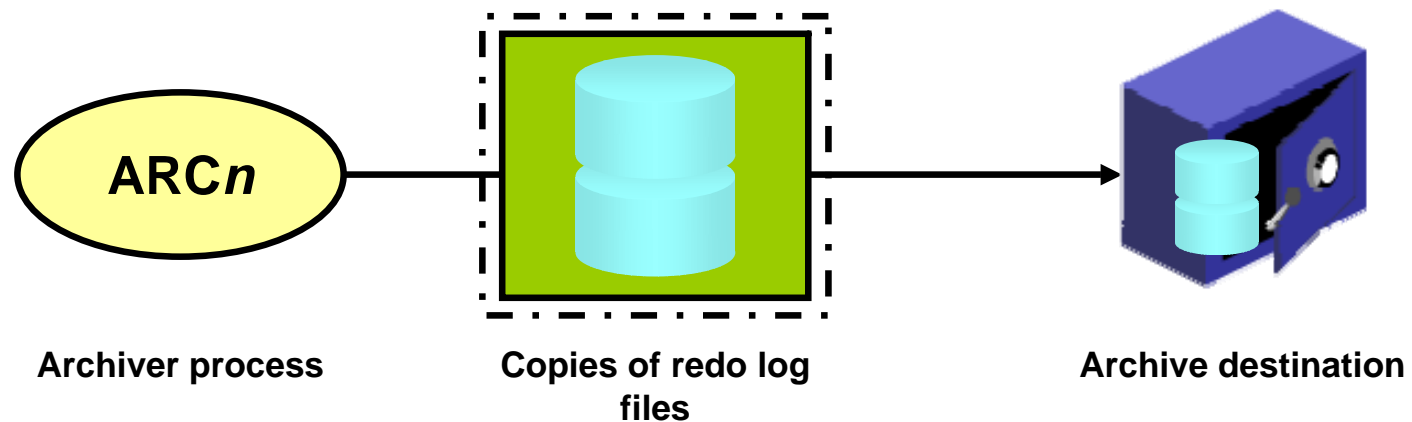
Recoverer Process

- Used with the distributed database configuration
- Automatically connects to other databases involved in in-doubt distributed transactions
- Automatically resolves all in-doubt transactions
- Removes any rows that correspond to in-doubt transactions



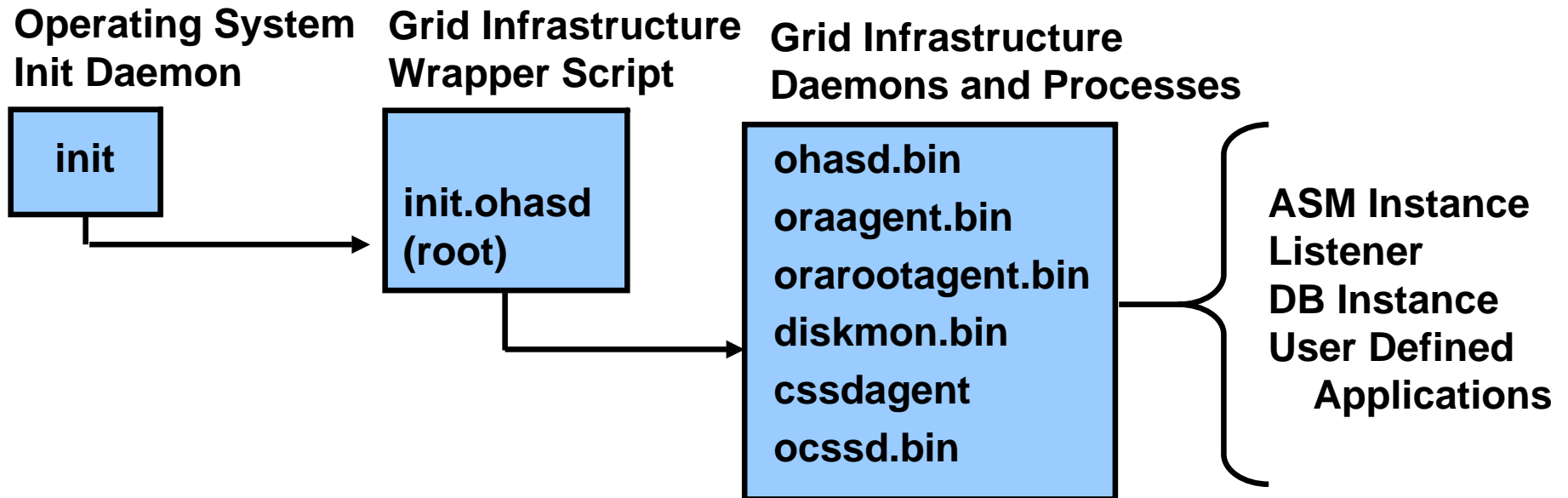
Archiver Processes (ARCn)

- Copy redo log files to a designated storage device after a log switch has occurred
- Can collect transaction redo data and transmit that data to standby destinations



Process Startup Sequence

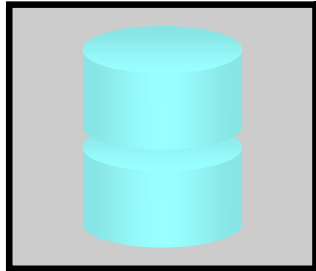
- Oracle Grid Infrastructure is started by the OS init daemon.



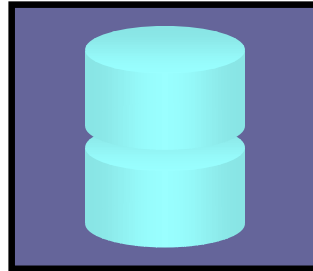
- Oracle Grid Infrastructure installation modifies the `/etc/inittab` file to ensure startup every time machine is started in corresponding run level.

```
# cat /etc/inittab
..
h1:35:respawn:/etc/init.d/init.ohasd run >/dev/null 2>&1 </dev/null
```

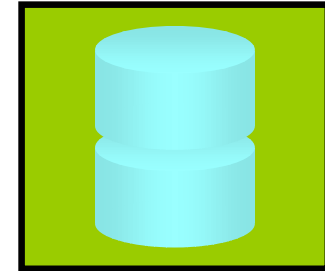
Database Storage Architecture



Control files



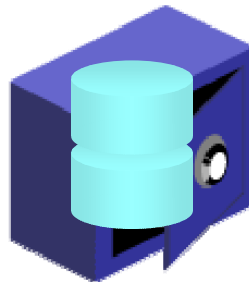
Data files



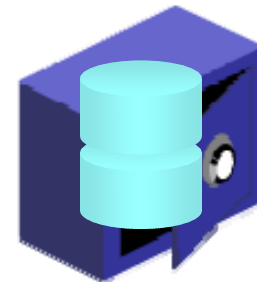
Online redo log files



Parameter file



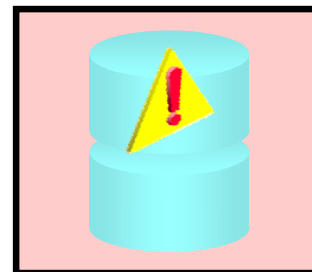
Backup files



Archived redo log files

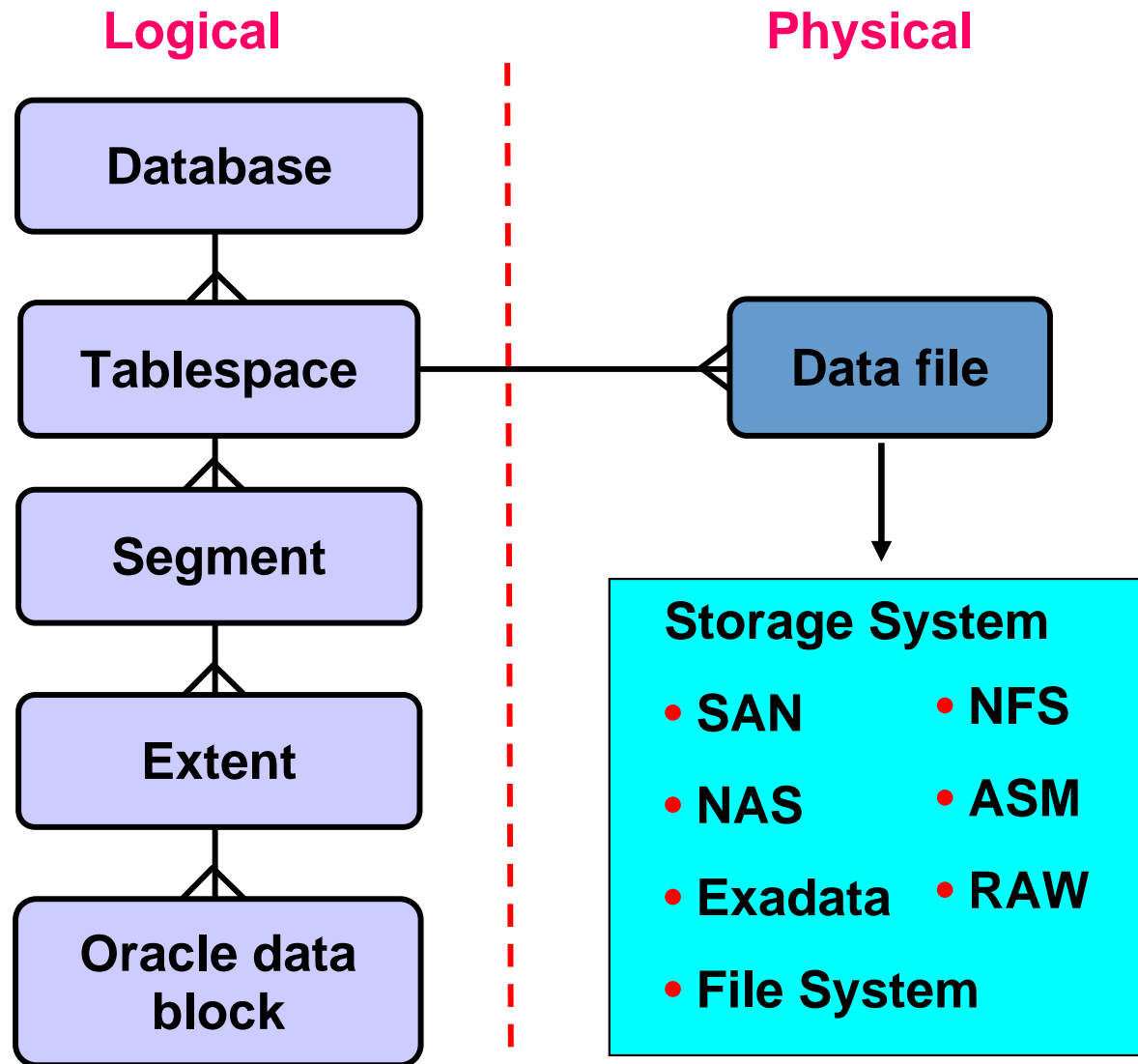


Password file



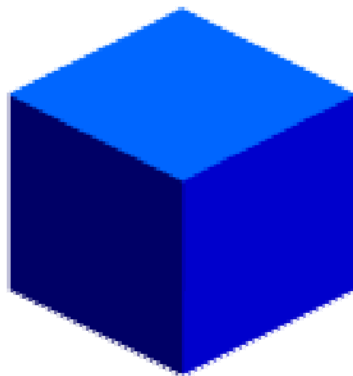
Alert log and trace files

Logical and Physical Database Structures



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

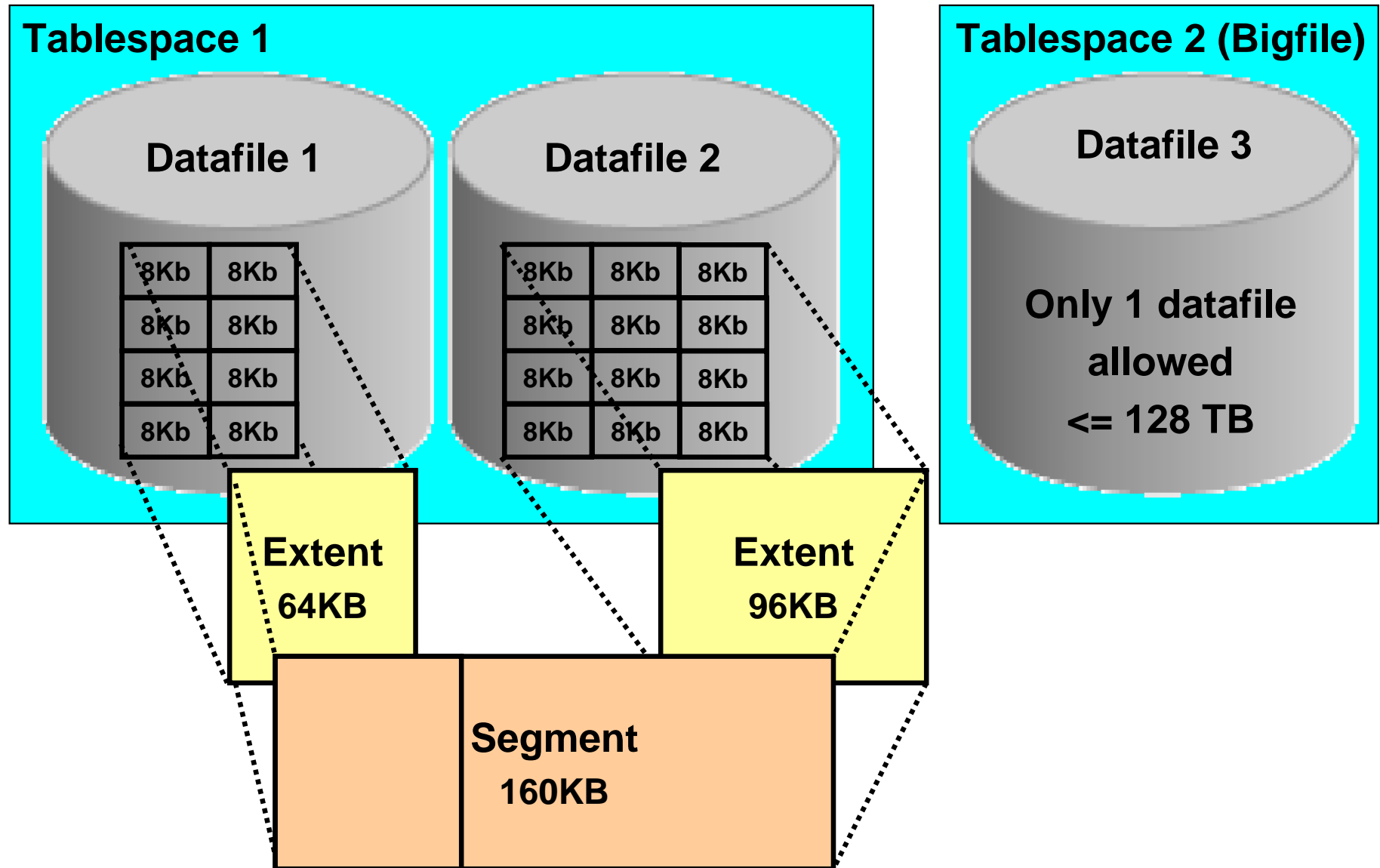


**Data
blocks**



**Disk blocks
(File System
Storage)**

Tablespaces and Data Files

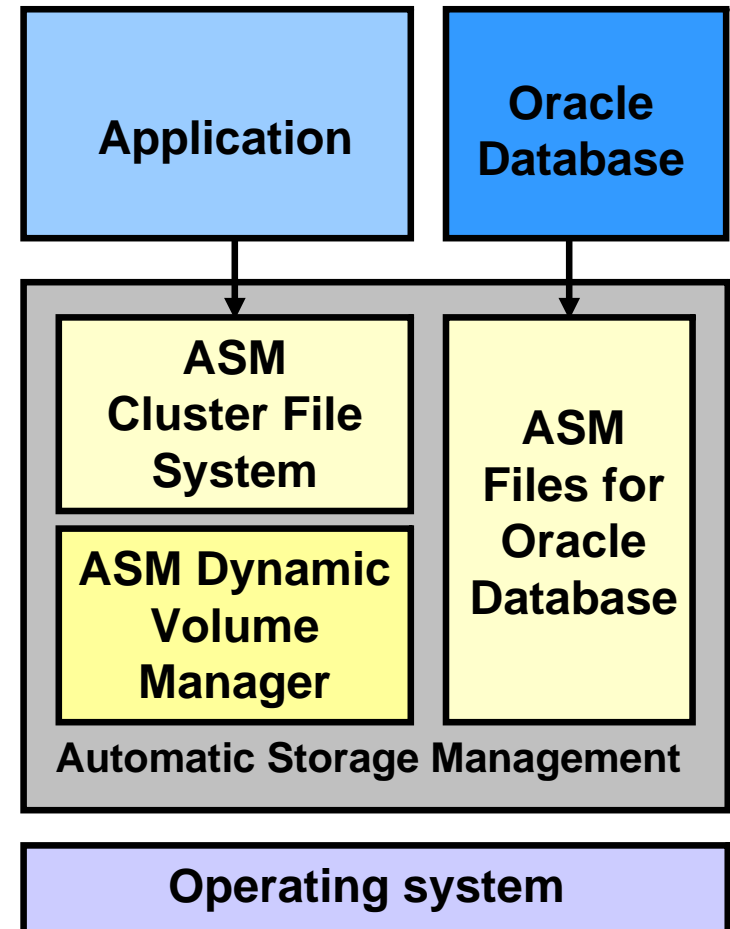


SYSTEM and SYSAUX Tablespaces

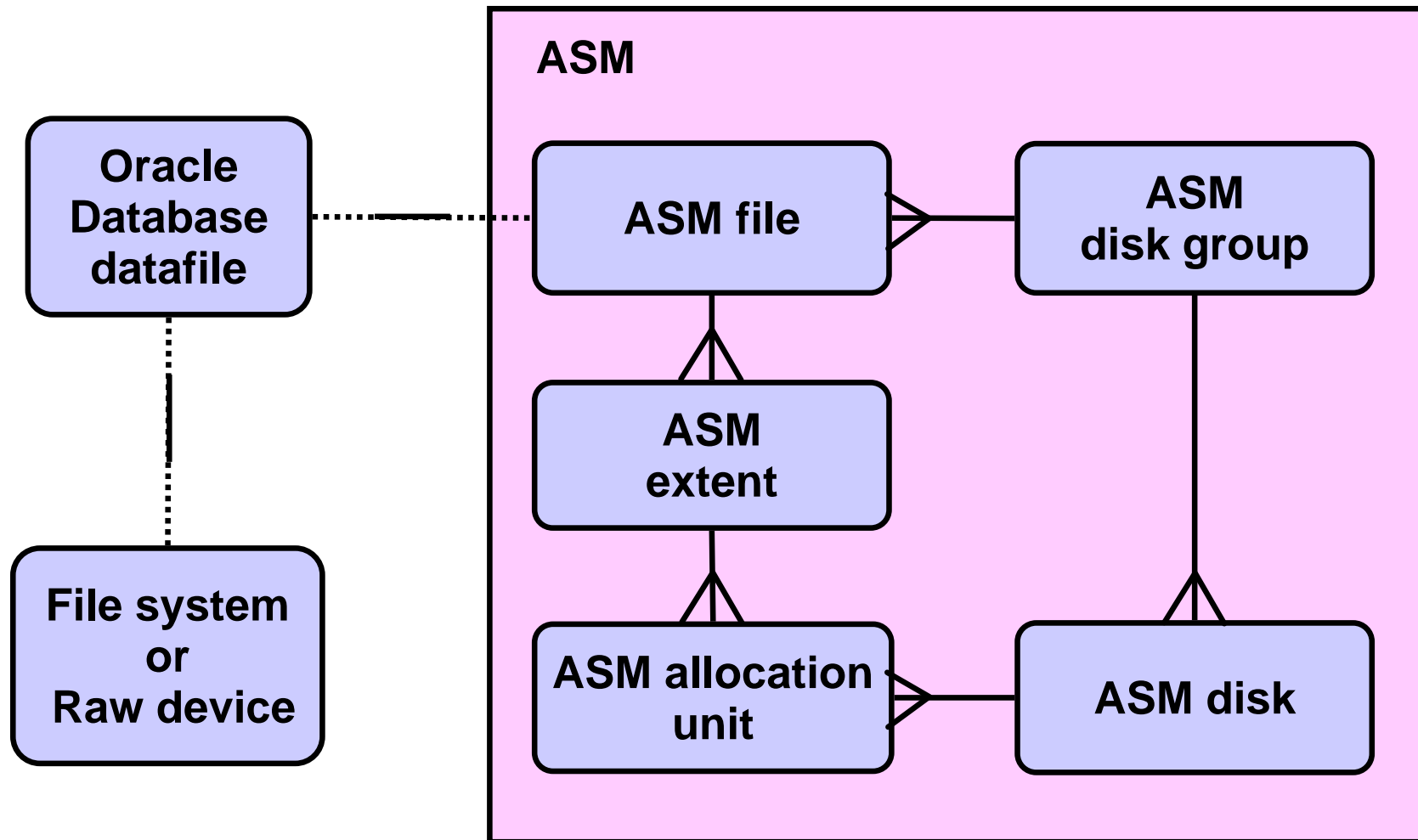
- The SYSTEM and SYSAUX tablespaces are mandatory tablespaces that are created at the time of database creation. They must be online.
- The SYSTEM tablespace is used for core functionality (for example, data dictionary tables).
- The auxiliary SYSAUX tablespace is used for additional database components (such as the Enterprise Manager Repository).
- The SYSTEM and SYSAUX tablespaces are not recommended to be used to store application's data.

Automatic Storage Management

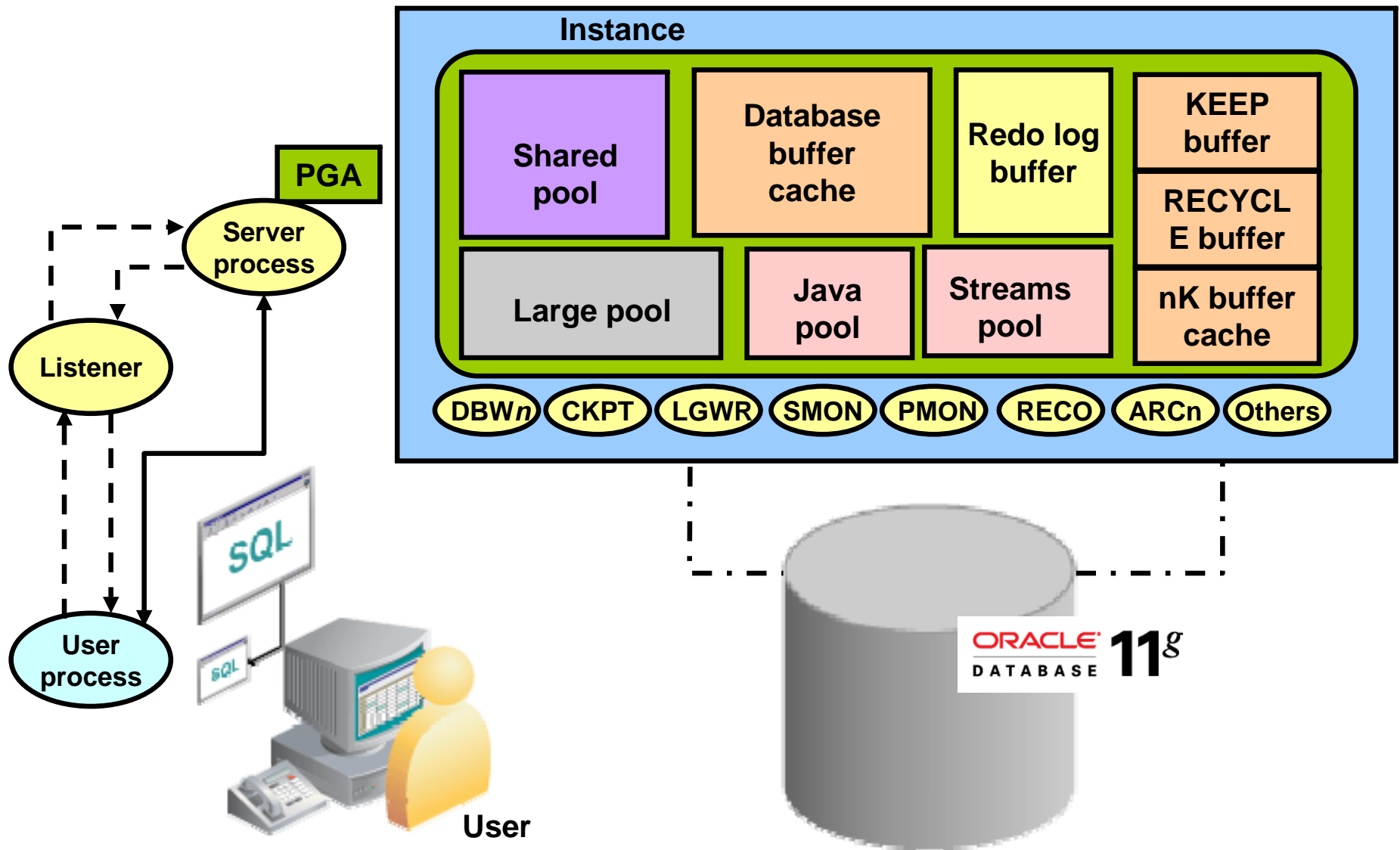
- Is a portable and high-performance cluster file system
- Manages Oracle database files
- Manages application files with ASM Cluster File System (ACFS)
- Spreads data across disks to balance load
- Mirrors data in case of failures
- Solves storage-management challenges



ASM Storage Components



Interacting with an Oracle Database: Memory, Processes and Storage



Quiz

The Process Monitor process (PMON):

1. Performs recovery at instance startup
2. Performs process recovery when a user process fails
3. Automatically resolves all in-doubt transactions
4. Writes the redo log buffer to a redo log file

Quiz

ASM Files are accessed by which types of instances?

1. RDBMS Instances only
2. ASM Instances only
3. Both RDBMS and ASM Instances

Summary

In this lesson, you should have learned how to:

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

Practice 1: Overview

This is a paper practice with questions about:

- Database architecture
- Memory
- Processes
- File structures