CSCI317 Database Performance Tuning

Transient Memory Structures of Relational Database Server

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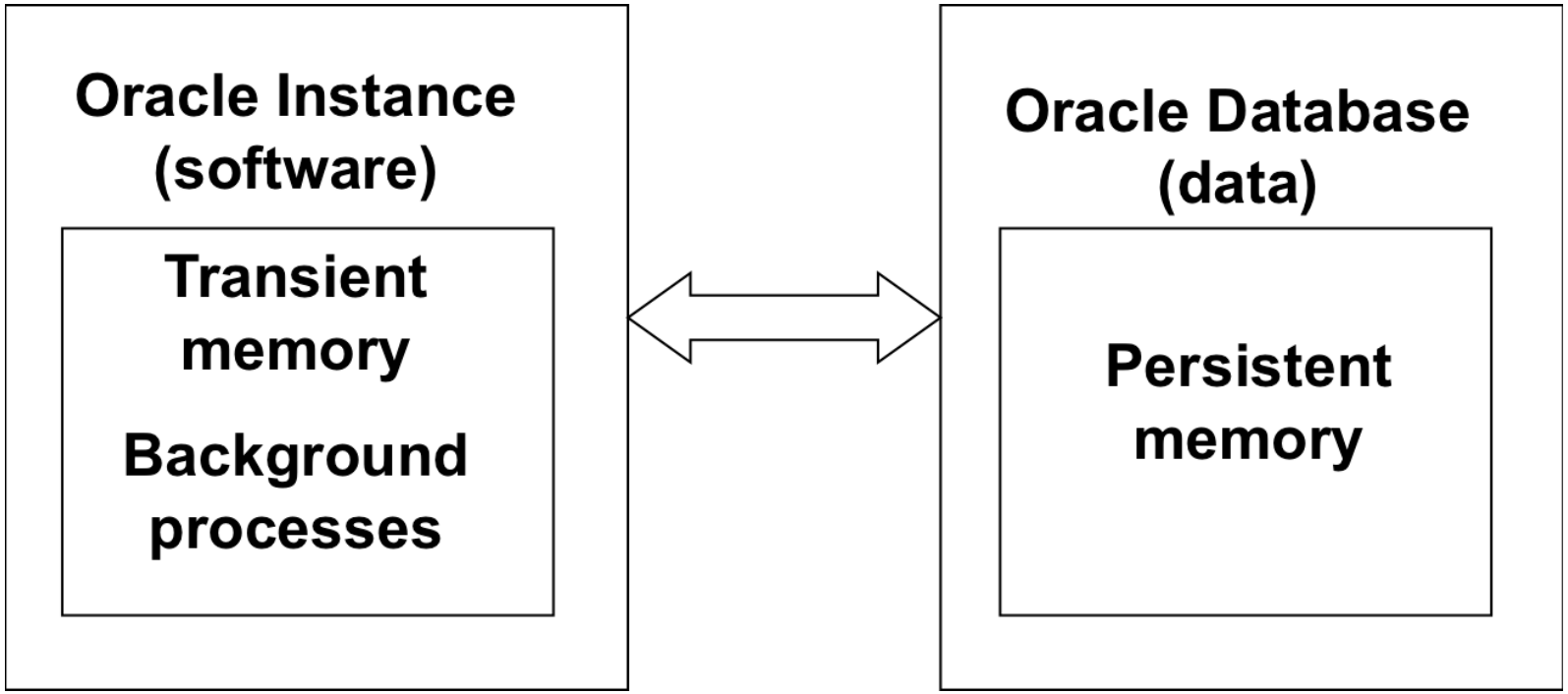
Transient Memory Structures of Relational Database Server

Outline

Oracle system architecture



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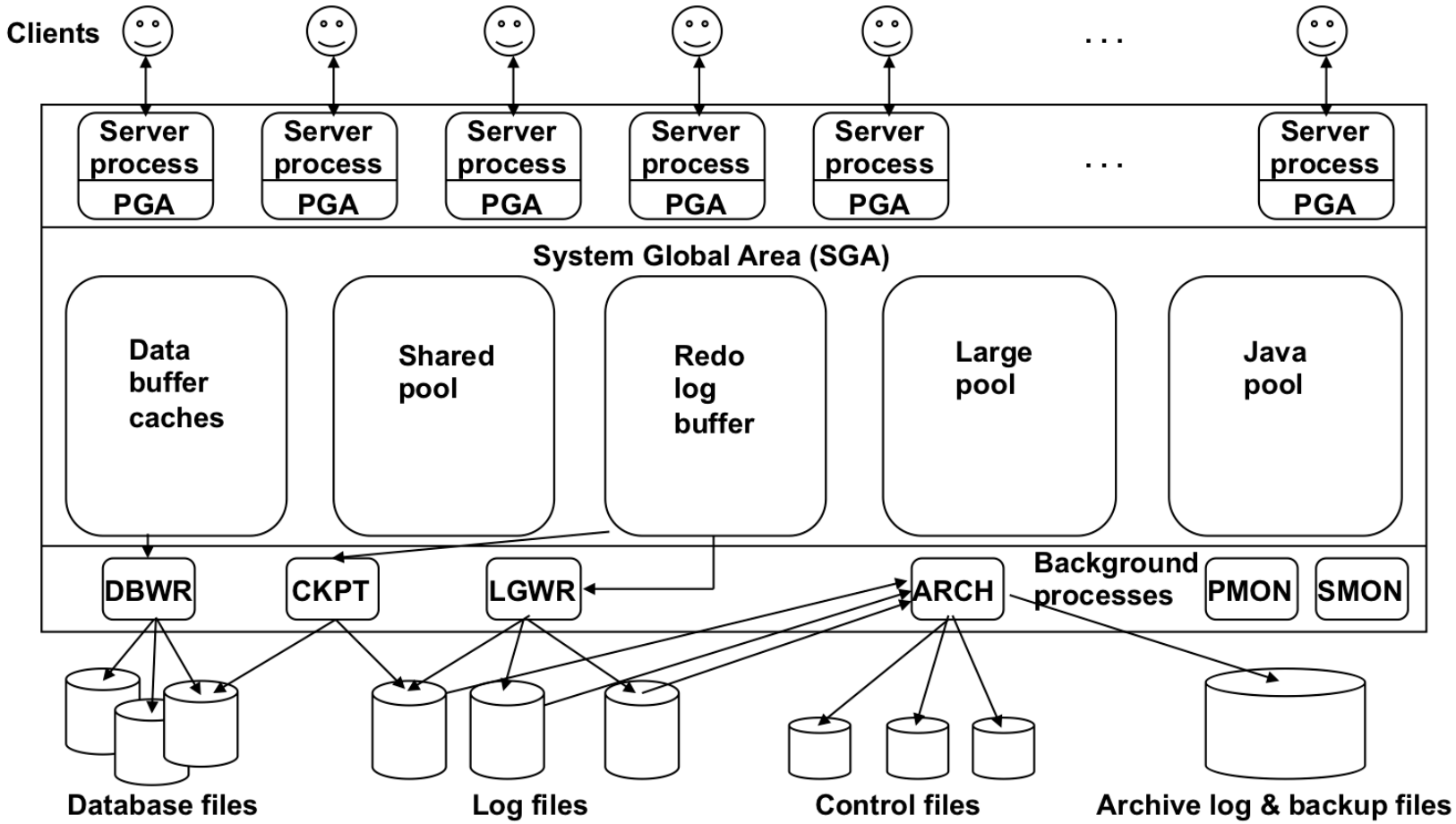

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Data buffer caches

`DEFAULT` pool contains miscellaneous data blocks

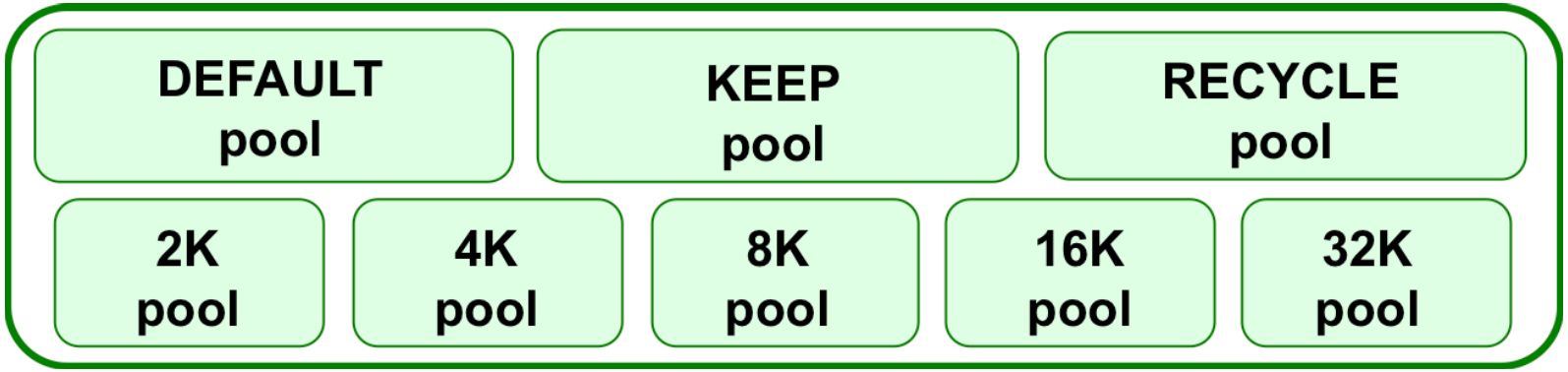
`KEEP` pool contains frequently accessed data blocks

`KEEP` pool retains data blocks

`RECYCLE` pool contains data blocks from full table scans

`RECYCLE` pool eliminates data blocks as soon as they are no longer needed

`nK` pools contain data blocks from `nK` tablespaces



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Redo log buffer

Redo log buffer is a circular buffer that contains information (redo entires) about changes made to the database by `INSERT`, `UPDATE`, `DELETE`, `CREATE`, `ALTER`, and `DROP` statements

Log writer background process writes the contents of redo log buffer into a group of mirrored redo log files

The files are cyclical such that when one is full log writer uses the next one

The first file is overwritten only after it has been checkpointed or archived

The modifications of data blocks are initially recorded in redo log buffer

Redo log buffer

Then log writer process writes the contents of redo log buffer into one of the files from a circular group of redo log files

Redo log files are used to recover the transactions when the system fails

Redo log buffer is flushed into redo log file in one of the cases:

- automatically every three seconds,
- whenever a transaction commits,
- when log writer process (`LGWR`) is is asked to switch log files,
- when redo log buffer is `1/3` full

Default size of redo log buffer is controlled by `LOG_BUFFER` parameter, it is max(`256` kbytes, (`128`*number CPUs)) the smallest size is `256`Kbytes

The systems with many concurrent transactions would benefit from a larger redo log buffer because log writer can operate on the buffer concurrently with the transactions

Long transactions writing a lot to a database benefit from a large redo log buffer

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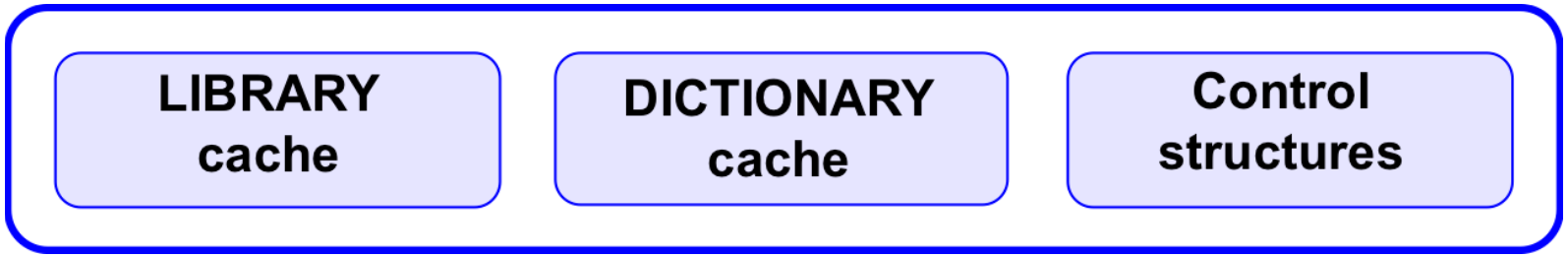
Shared pool

`LIBRARY` cache contains the parse trees and the execution plans for `SQL` statements, `PL/SQL` procedures and packages and control structures such as locks and library cache handles

`DICTIONARY` cache contains a collection of data dictionary relational tables containing information about the structures of the database

`LRU` strategy is used to control allocation and deallocation of memory in shared pool



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Large pool and Java pool

Large pool cache contains session memory for the shared server and XA interface (transactions that interact with more than one database), I/O server processes, backup and restore operations, and parallel execution message buffer

Large pool is used to store large memory allocations

Large large pool is strongly recommended when using multithreaded server

Java pool consists of transient memory used by the local `Java Virtual Machine`

Java pool is needed only with `Java` stored procedures,

`Java Beans`, or other options included in `Jserver` option of the system

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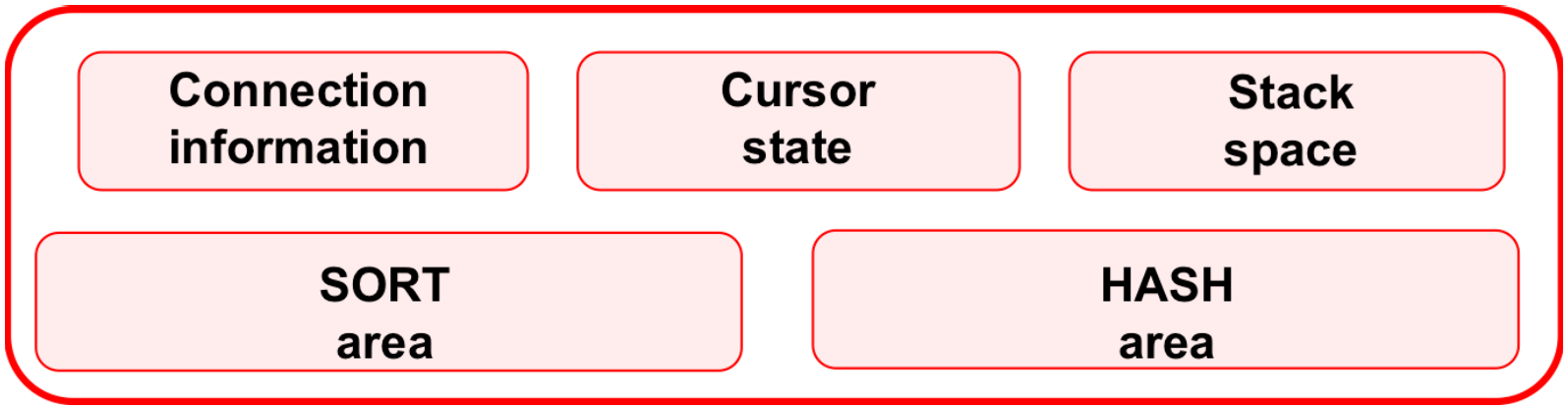
Process Global Area

Process Global Area (PGA) is a transient memory area that contains data and control information for a server process

Process Global Area consist of private SQL area (bind information and run-time memory structures), cursor areas, stack space, session memory, and SQL work areas (sorting, hashing, operations on bitmaps)



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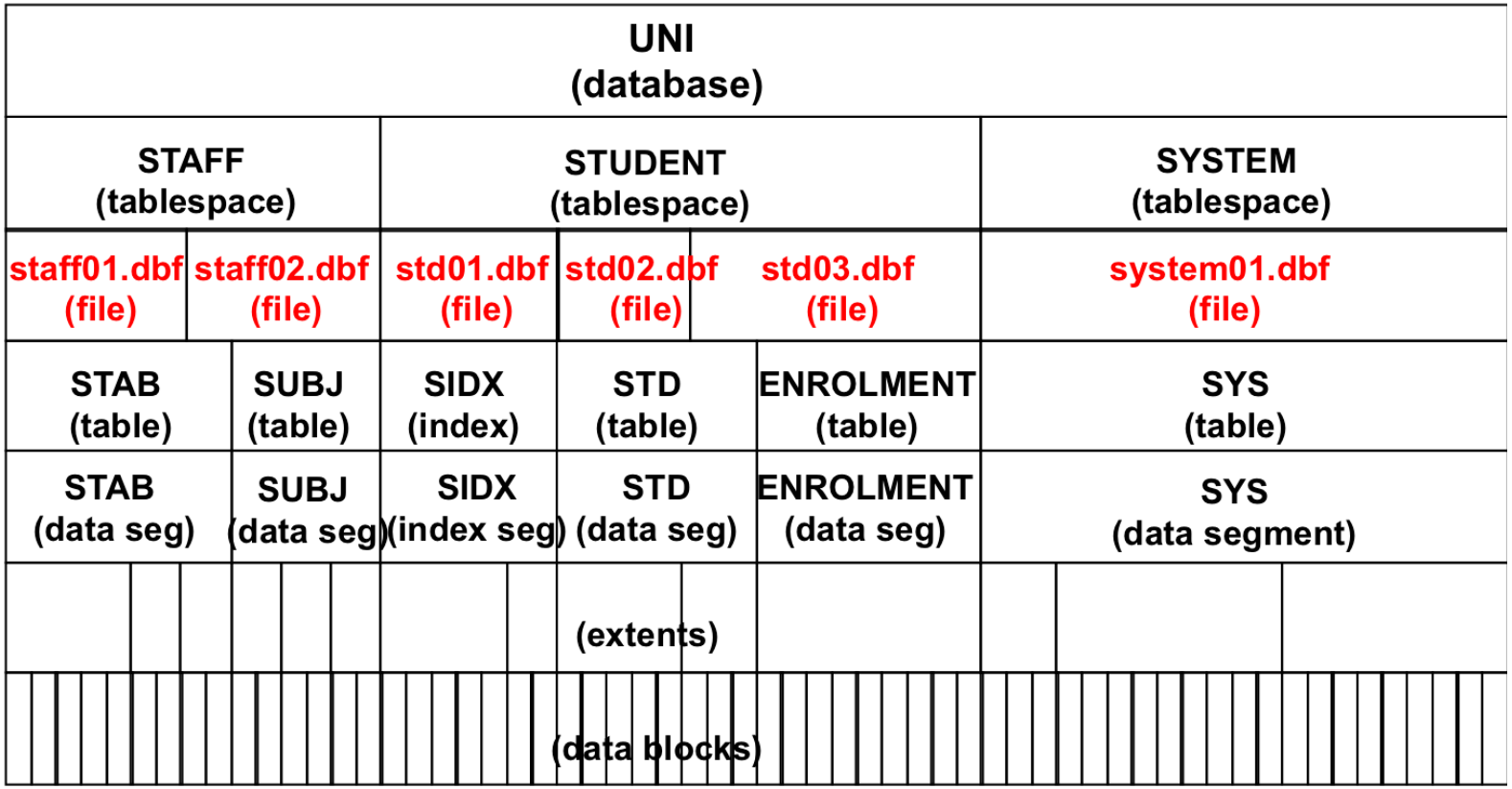
Database files



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File system mechanisms

Operating system file systems: these are the files that appear in a file system of a given operating system

Raw partitions: these are very big sections of persistent storage without any sort of file system on it

Raw partitions are not buffered - all I/O is direct without any buffering from operating system

Automatic Storage Management (ASM): ASM is a file system exclusively designed for a database

Automatic Storage Management stores data in file system organized in a different way from operating system file system

Clustered file system: it is a traditional file system that is shared by many nodes (computers) in a clustered environment

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Parameter files

Parameter files tell the system where to find control files, trace files, and what are the initial values of certain system parameters, for example `DB_NAME`, `SGA_MAX_SIZE`, `SORT_AREA_SIZE`, etc

A name of server parameter file (`SPFILE`) is `spfile<ORACLE_SID>.ora`

A legacy parameter file has a name `init<ORACLE_SID>.ora`

A sample contents of `init<ORACLE_SID>.ora`

server parameter file

```
db_block_size=8192
db_cache_size=100M
open_cursors=100
background_dump_dest= /packages/csoracle/u02/app/oracle/admin/csci/bdump
core_dump_dest=/packages/csoracle/u02/app/oracle/admin/csci/cdump
timed_statistics=TRUE
user_dump_dest=/packages/csoracle/u02/app/oracle/admin/csci/udump
```

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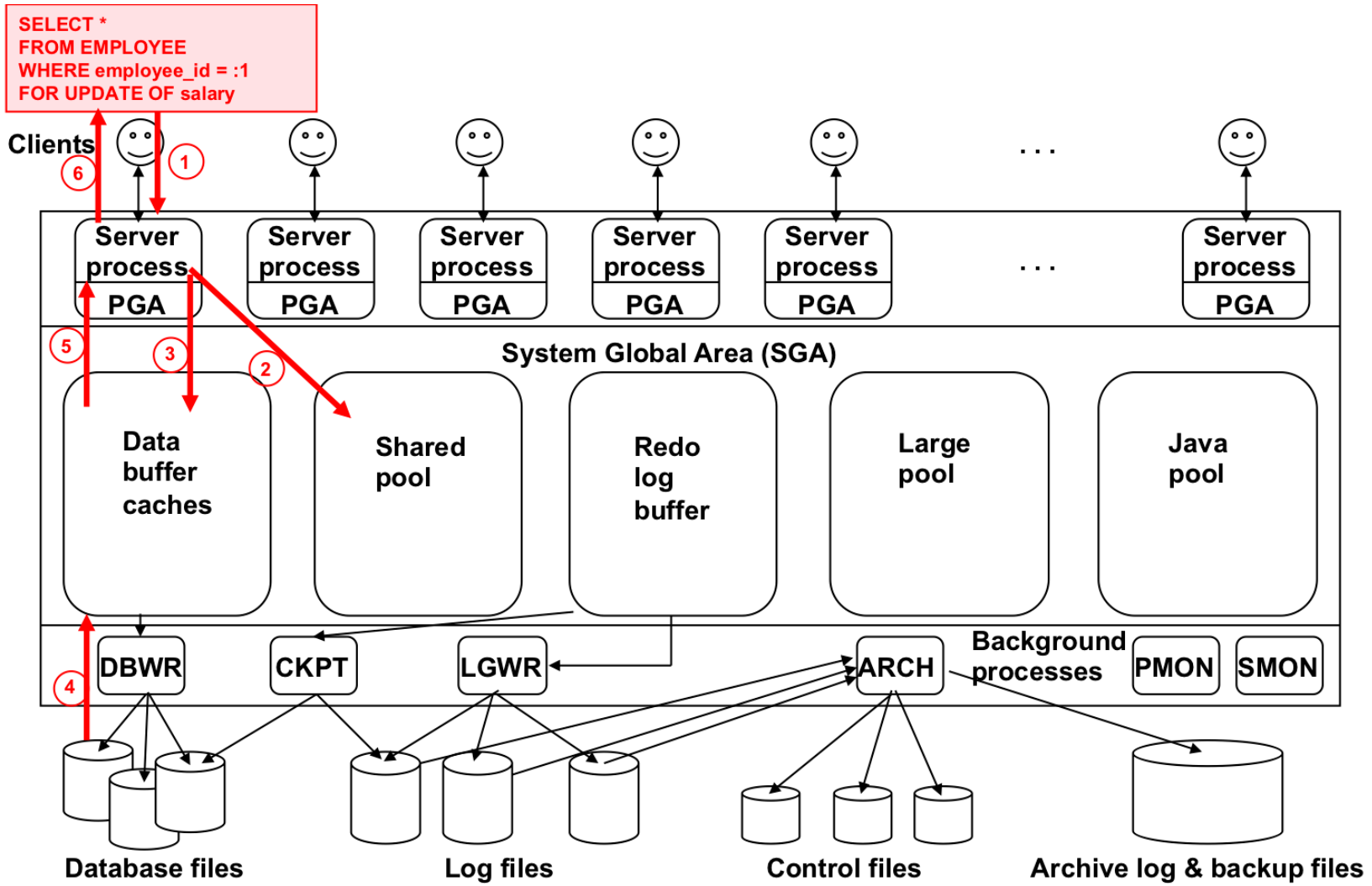
Oracle process flows



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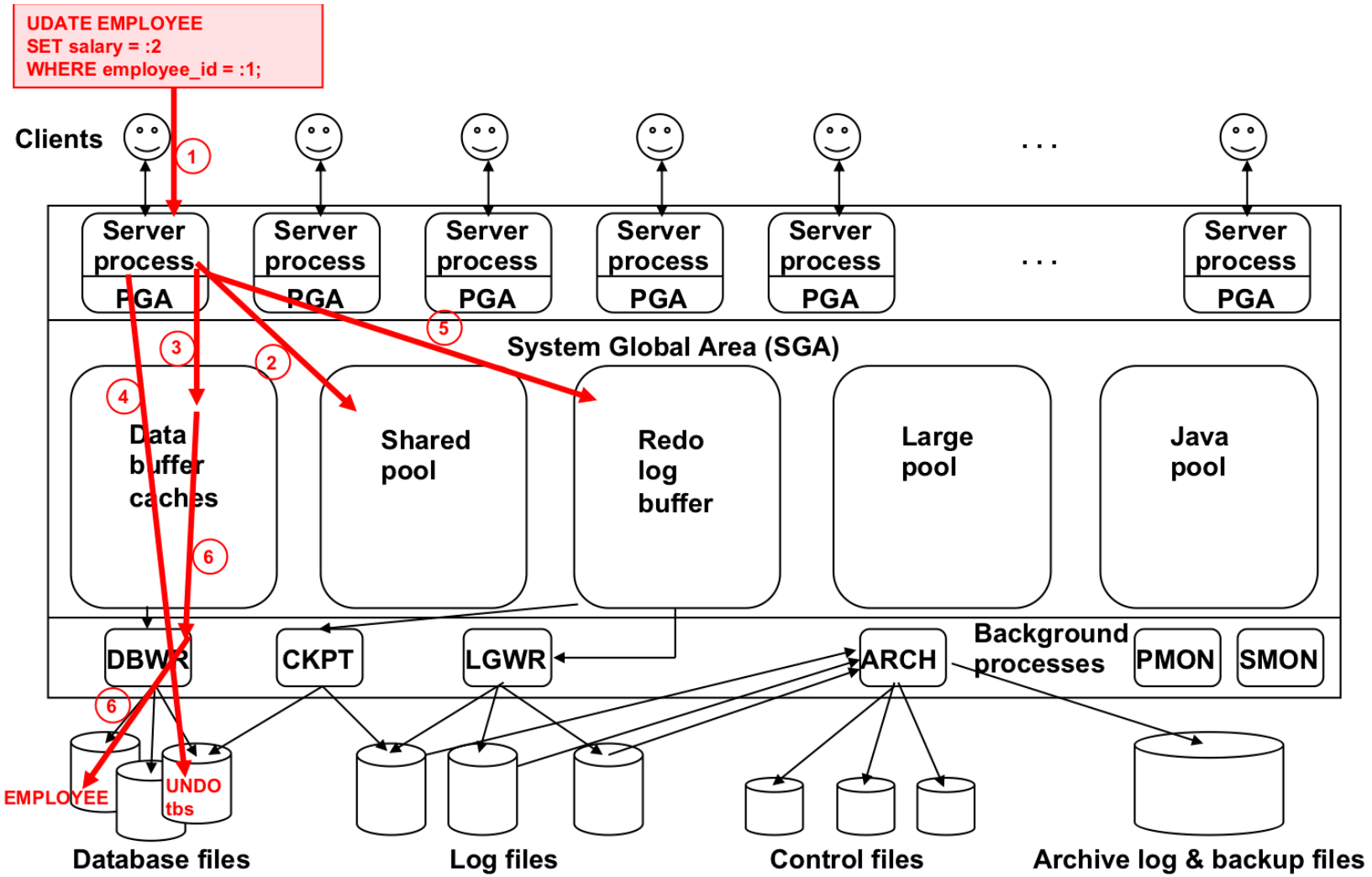

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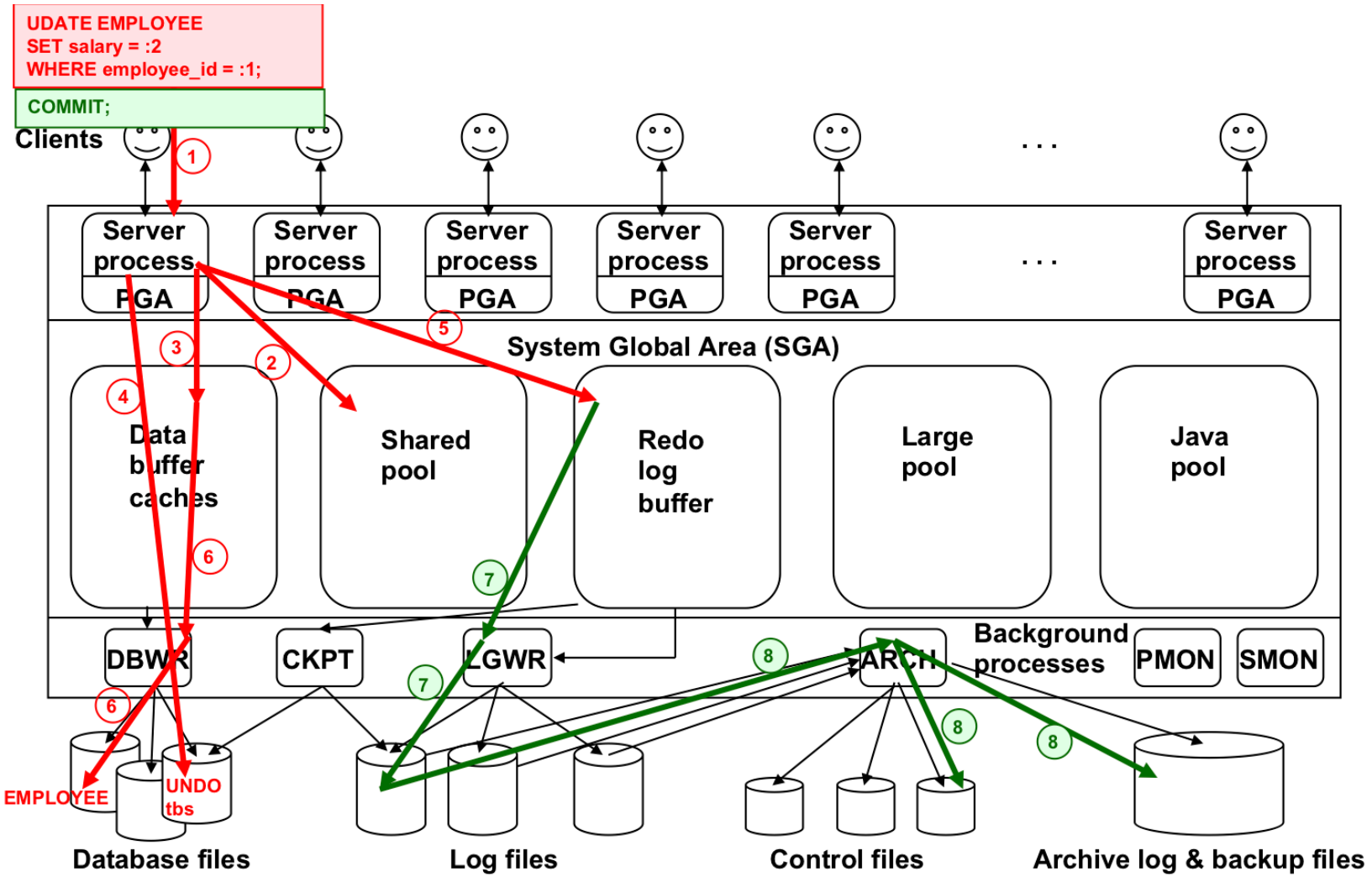

References

T. Kyte Expert Oracle Database Architecture 9i, 10g, and 11g Programming techniques and Solutions, Apress 2011, chapters 2, 3, 4

G. Harrison Oracle Performance Survival Guide, Prentice Hall, 2010, chapter 2