

The Basics of Oracle Architecture

- As an oracle DBA you must be understand the concepts of the Oracle architecture clearly. It is a basic step or main point that you need before you go to manage your database.

What is an oracle Database?

- Basically, there are two main components of Oracle database — instance and database itself. An instance consists of some memory structures and the background processes, whereas a database refers to the disk resources. Figure 1 will show you the relationship.

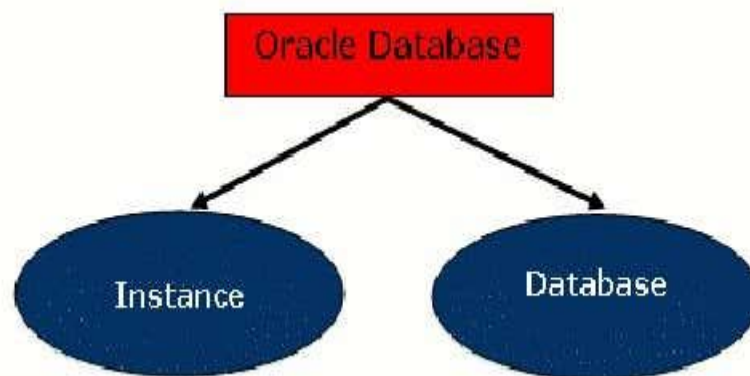


Figure 1. Two main components of Oracle database

Instance:

- The memory structures and background processes constitute an instance. The memory structure itself consists of System Global Area (SGA), Program Global Area (PGA), and an optional area —Software Area Code. In the other hand, the mandatory background processes are Database Writer (DBWn), Log Writer (LGWR), Checkpoint (CKPT), System Monitor (SMON), and Process Monitor (PMON). And another optional background processes are Archiver (ARCn), Recoverer (RECO), etc. Figure 2 will illustrate the relationship for those components on an instance.

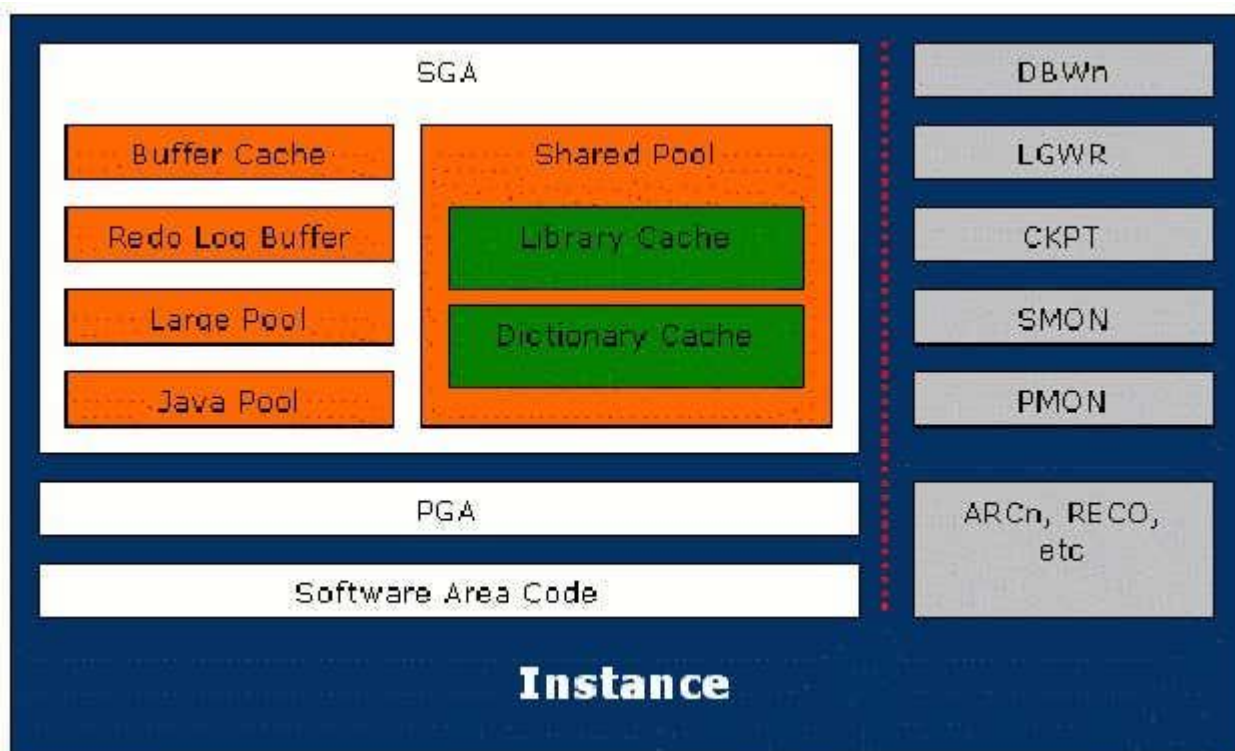


Figure 2. The instance components

System Global Area:

- SGA is the primary memory structures. When Oracle DBAs talk about memory, they usually mean the SGA. This area is broken into a few of part memory — Buffer Cache, Shared Pool, Redo Log Buffer, Large Pool, and Java Pool.

Buffer Cache:

Buffer cache is used to stores the copies of data block that retrieved from datafiles. That is, when user retrieves data from database, the data will be stored in buffer cache. Its size can be manipulated via DB_CACHE_SIZE parameter in (init.ora) initialization parameter file.

shared pool:

shared pool is broken into two small part memories — Library Cache and Dictionary Cache. The library cache is used to stores information about the commonly used SQL and PL/SQL statements; and is managed by a Least Recently Used (LRU) algorithm. It is also enables the sharing these statements among users. In the other hand, dictionary cache is used to stores information about object definitions in the database, such as columns, tables, indexes, users, privileges, etc.

The shared pool size can be set via SHARED_POOL_SIZE parameter in init.ora initialization parameter file.

REDO LOG BUFFER:

Each DML statement (insert, update, and delete) executed by users will generate the redo entry. What is a redo entry? It is an information about all data changes made by users. That redo entry is stored in redo log buffer before it is written into the redo log files. To manipulate the size of redo log buffer, you can use the LOG_BUFFER parameter in (init.ora) initialization parameter file

The Large pool:

The Large pool is an optional area of memory in the SGA. It is used to relieve the burden placed on the shared pool. It is also used for I/O processes. The large pool size can be set by LARGE_POOL_SIZE parameter in (init.ora) initialization parameter file.

The Java pool:

The Java pool is used for services parsing of the Java commands. Its size can be set by JAVA_POOL_SIZE parameter in (init.ora) initialization parameter file.

Program global area (PGA):

Although the result of SQL statement parsing is stored in library cache, but the value of binding variable will be stored in PGA. Why? Because it must be private or not be shared among users. The PGA is also used for sort area.

Software Area Code:

Software area code is a location in memory where the Oracle application software resides.

Oracle background processes:

Oracle background processes are the processes behind the scenes that work together with the memories.

DBWn:

Database writer (DBWn) process is used to write data from buffer cache into the datafiles. Historically, the database writer is named DBWR. But since some of Oracle version allows us to have more than one database writer, the name is changed to DBWn, where n value is a number 0 to 9.

LGWR:

Log writer (LGWR) process is similar to DBWn. It writes the redo entries from redo log buffer into the redo log files.

CKPT:

Checkpoint (CKPT) is a process to give a signal to DBWn to write data in the buffer cache into datafiles. It will also update datafiles and control files header when log file switch occurs

SMON:

System Monitor (SMON) process is used to recover the system crash or instance failure by applying the entries in the redo log files to the datafiles.

PMON:

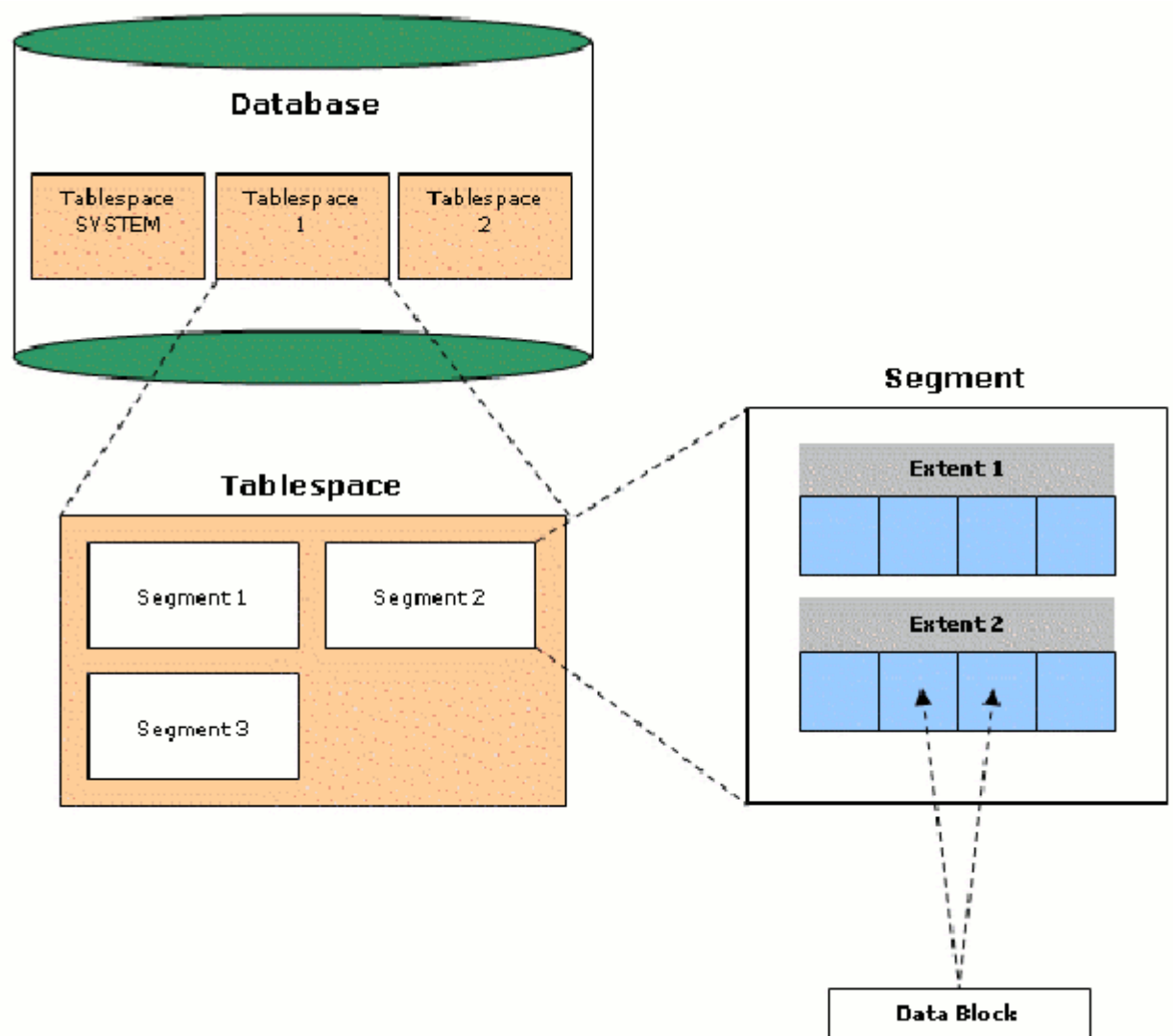
Process Monitor (PMON) process is used to clean up work after failed processes by rolling back the transactions and releasing other resources.

Database:

The database refers to disk resources, and is broken into two main structures — Logical structures and Physical structures

Logical structure:

Oracle database is divided into smaller logical units to manage, store, and retrieve data efficiently. The logical units are tablespace, segment, extent, and data block. Figure 3 will illustrate the relationships between those units



Tablespace:

A Tablespace is a grouping logical database objects. A database must have one or more tablespaces. In the Figure 3, we have three tablespaces — SYSTEM

tablespace, Tablespace 1, and Tablespace 2. Tablespace is composed by one or more datafiles.

Segment:

A Tablespace is further broken into segments. A segment is used to store same type of objects. That is, every table in the database will store into a specific segment (named Data Segment) and every index in the database will also store in its own segment (named Index Segment). The other segment types are Temporary Segment and Rollback Segment.

Extent:

A segment is further broken into extents. An extent consists of one or more data block. When the database object is enlarged, an extent will be allocated. Unlike a tablespace or a segment, an extent cannot be named.

Data Block

A data block is the smallest unit of storage in the Oracle database. The data block size is a specific number of bytes within tablespace, and it has the same number of bytes

Physical Structures

The physical structures are structures of an Oracle database (in this case the disk files) that are not directly manipulated by users. The physical structure consists of datafiles, redo log files, and control files.

Datafiles

A datafile is a file that corresponds with a tablespace. One datafile can be used by one tablespace, but one tablespace can have more than one datafiles.

Redo Log Files

Redo log files are the files that store the redo entries generated by DML statements. It can be used for recovery processes.

Control Files

Control files are used to store information about physical structure of database, such as datafiles size and location, redo log file's location, etc