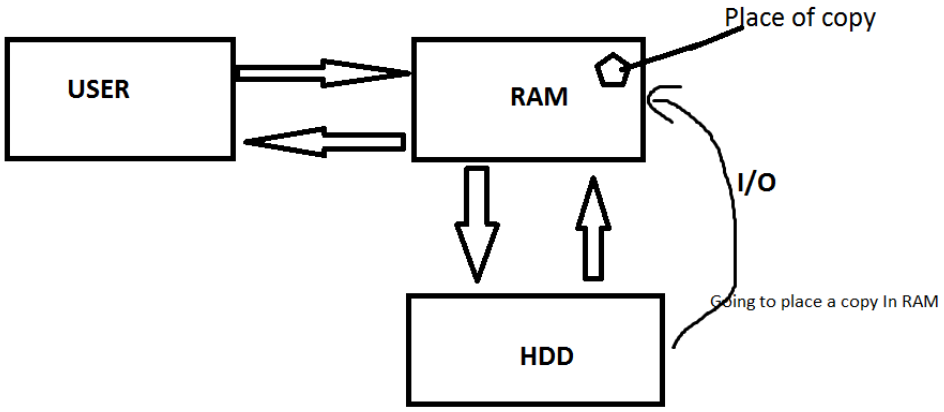
1. ***Functionality of Operating system***
2. ***Database Functionality of Oracle database***
3. ***ORACLE 11g DATABASE ARCHITECTURE***
4. ***User connectivity to the database***
5. ***Phase of sql execution***
6. ***SELECT Statement processing***
7. ***DML Statement Processing***
8. ***DDL Statement processing***
9. ***User process and server process***
10. ***Memory parameters***
11. ***Back ground process***
12. ***Basic Explanation (datafiles, control files, Redolog files & Archive Redolog files)***
13. ***Pfile and spfile.***
14. ***Database Opening Modes***
15. ***Change to archive log mode & no archive log mode***

Functionality of Operating system



When a user send a request for the information O.S will first check (Primary Search) in RAM, If the information is available It will give to the user.

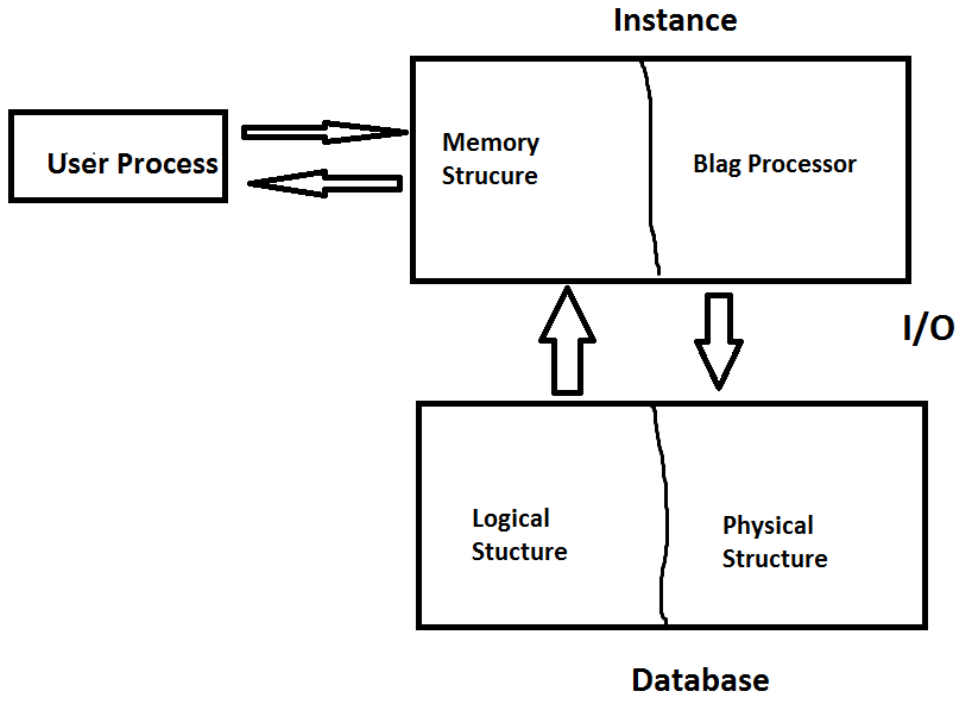
If Not a secondary search will be done a Hard disk a copy will be placed in the RAM and it will be given to the user.

Accessing memory to the disk is called I/O and if it increases it will degrade the performance of the system.

Note – Always second time request is faster in processing.

O.S(Operating system) will follow least Recently used algorithm [LRU] to maintain the data in the RAM.

Database Functionality of Oracle database



- The functionality of basic oracle database architecture is exactly same as O.S
- The Primary responsibilities of a DBA.
  Reduce response time
  Avoid or Reduce I/O

Oracle Database server contains two major components

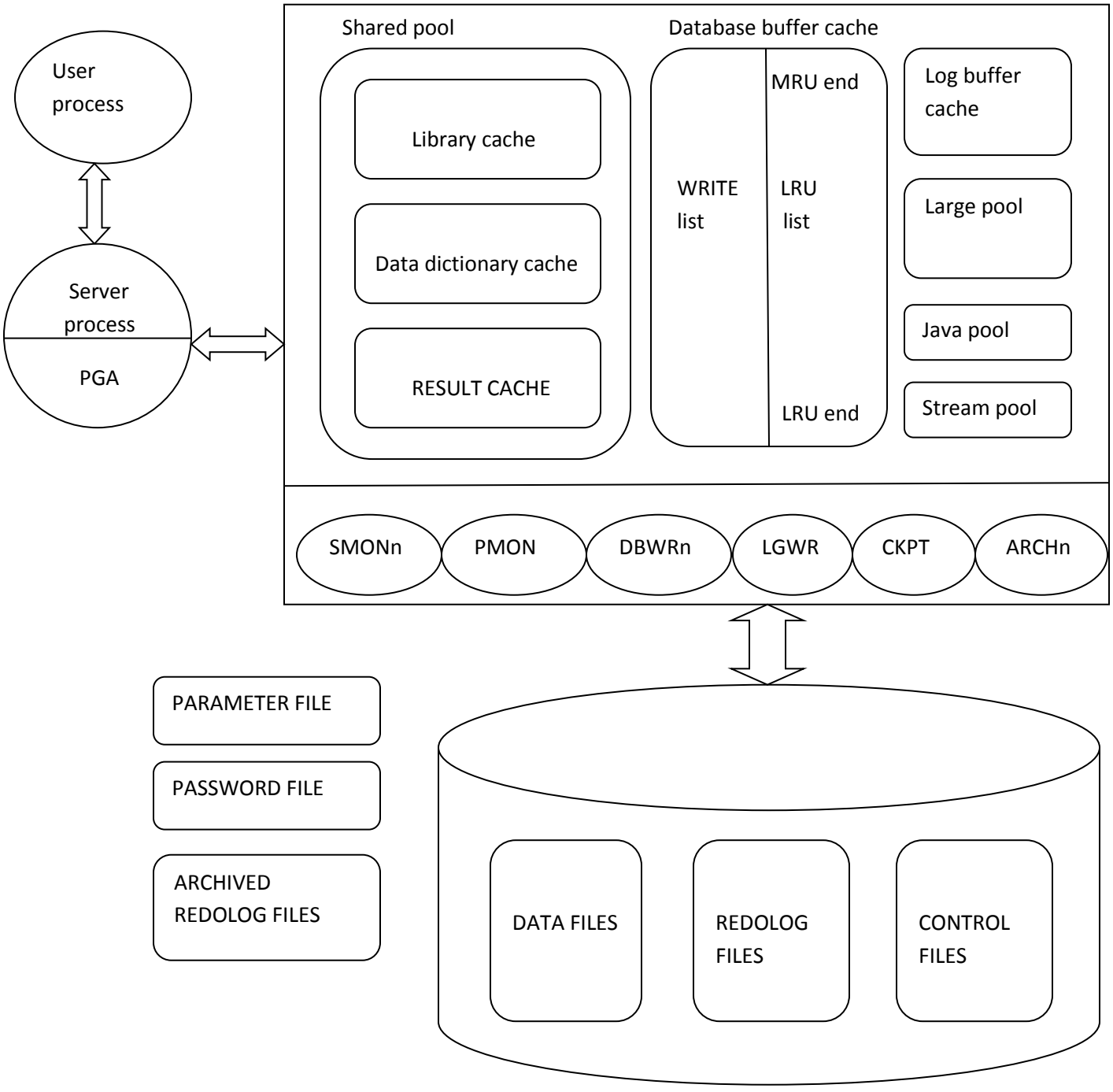
- Instance and Database

Instance - > A memory area which holds database and control information

It is a way through which users can access database.

Database – it is a memory area where user data will be stored permanently. Whenever user send a request the presence of information will be checked in instance. If the information is available in the instance it will be given to the user otherwise the information will be retrieved from the database and a copy will placed in instance. Accessing the information from the database will be lead to I/O which make degrade the performance of database.

ORACLE 11g DATABASE ARCHITECTURE



USer connectivity to the database -

- When a user start application user process will be created.

- This user process will be created on Clint side when ever user starts an application.

- This user process will send user information like username, password, Host sting etc... Externally ipaddress, machinname, network domain etc. Internally to the server side.

- Listener will accept the connect on the server side and will hand over this information to process monitor (PMON).

- PMON will do a primary search in a data dictionary cache for the base table. if the information is available it will do authentication . if not PMON will copy the base table from the database ti datadictionary cahe and authenticates.

- If authentication is successful. it will send an acknowledgment to user process and create server process otherwise it will send failure acknowledgement.

- Server process is the one which will do the work behalf of user process. in the memory allocated to server process is call private global area(PGA).

Base Tables -

- These are the tables which store database information.

- Usually represented with ex - user$

- Information in base table will be in encrypted format.

- DBA can access base tables, but if tries to modify it may corrupt the database.

- DBA can access information of base tables using

1. Datadictionary views (Represented with DBA_xxx which stores permanent information).

2. Dynamic performance views (Represented with v$_xxx which stores ongoing information)

Note1 - base tables will be created at the time of database creation using sql.bsq script.

Note2 - data dictionary and dynamic performance view will be created after database creation by executing catalog.sql

Note3 - Packages and procedures will be created by executing catproc.sql

(catalog.sql & catproc.sql are need to be executed manually, if we are creating the database in manual methods.).

Phases of sql exection -

- Every sql statement will undergo the following phase of execution

- This phase is composed of following sub phases.

- Syntax checking for the sql statement.

- Symantec checking that is checking the privilization (Authentication) with the help of base tables.

SELECT STATEMENT PROCESSING

- Server process will receive the statement sent by user process on server side and will handover that to library cache of shared pool
- The 1st phase of sql execution i.e Parsing will be done in library cache
- Then, OPTIMIZER (brain of oracle sql engine) will generate many execution plans, but chooses the best one based on time & cost (time – response time, cost – cpu resource utilization)
- Server process will send the parsed statement with its execution plan to PGA and 2nd phase i.e EXECUTION will be done there
- After execution, server process will start searching for the data from LRU end of LRU list and this search will continue till it founds data or reaches MRU end. If it found data, it will be given to the user. If it didn't found any data, it means data is not there in database buffer cache
- In such cases, server process will copy data from datafiles to MRU end of LRU list of database buffer cache
- From MRU end the rows pertaining to requested table will be filtered and placed in SERVER RESULT CACHE along with execution plan id and then it will be given to user (displayed on user's console)

Note : for statements issued for the second time, server process will get parsed tree and plan id from library cache and it will straightly goes to server result cache and compares the plan id. If the plan id matches, corresponding rows will be given to user. So, in this case, it is skipping all 3 phases of SQL execution by which response time is much faster than 10g database.

DML Statement Processing -

- Server process sends the request of user process to library cache for parsing and generation of execution plan. The statement will executed in PGA

Following the best execution plan

- Since DML's are changes to the database Redo entries will be generated.

Redo entry –

- A Single atomic change happened to the database it will generate Redo entry.
- Ex - if a statement is updating 1000 rows 1000 redo entries will ge generated. i.e 1000 database got modified or changed.
- Server process will copy the generated redo entries from PGA to log buffer cache.
- By taking Information from Database buffer cache server process will check for the data in LRU list of Database buffer cache.
- If data is not found server process will copy both data block and unod block to MRU end of LRU list of DBC (Database buffer cache).
- DBWR will write down the content of write list to corresponding data file.
- Before DBWR writer log writer (LGWR) will write down the contents of log buffer cache to redo log file.

- If Modified blocks are dirty blocks will be moved to right list when there reach LRU end.

Note - Every block is Database buffer cache holds any of the following status.

Unused - the block this is never used.

Free - the block had been used previously but currently it is free.

Pined - the block which is currently in use.

Dirty – which blocks got modified.

DDL Statement processing -

- Server process sends the DDL statement to LC for getting parsed.

- The statement will be executed in PGA [using the best execution plan generated by optimzer] and Redo entries will be generated.

- Redo entries will be copied to log buffer cache by server process.

- Server process [After taking information from Data Dictionary cache] will search for blocks in DBC. if not found blocks will be copied to MRU end LRU list of DBC.

- The blocks which got modified to DBC are base table's blocks. After modification blocks will become dirty and will be moved to write list from where DBwriter writes to database.

User Process - it is a process which will be created on client side. Whenever application is started.

Server process - it is the process resides on server side which will do the work on behalf of user process.

Memory parameters -

PGA (Program Global Area) - It is the memory area where a user statements will be executed.. Also sorting of the statements will also be performed in PGA.

Before 9i the following are the parameters used to define the size of PGA.

work_Area_size =10m

sort_area_size = 20m,

Bitmap_work_area=10m

Hash_area_size=10m,

10g-

Pga_aggregate_target

sga_target - 5g ----------large_pool, java_pool, shared_pool,dbc_pool_size

sga_max_target - 10g

11g -

Memory_target

SGA(Shared Global Area) - it is a memory area which can be shared by all the users of database.SGA has been build with following components.

Shared pool - this has been divided into sub-components.

Library cache - it is a memory is which contains sharable parsed sql and pl/sql statements.

Data dictionary cache - it is a memory is which contains dictionary information.

Database buffer cache - it is a memory which holds a copy of user data (or) it is a memory area where server process stores data before giving to the user.

DBC can be divided as follows -

LRU list - it is a memory area which actuvally data will be placed in the from of blocks.

Write list - it is a memory area which contains dirty blocks that are ready to be written to the database.

Log Buffer cache - A memory are which holds redo entries.

Large pool - A memory are which holds RMAN backup information, if shared pool is exhausted with the memory large pool dedicates smoe memory to shared pool.

Java Pool - A memory are which will be used for the executing on processing of java application.

Stream pool - it is a memory area which will be used when oracle streams is implemented.

Note - if oracle streams is not being used don't configured stream pool. If oracle streams is not configure and if oracle streams is implemented then 10% of shared pool will be allocated to oracle streams. it is a dynamic parameter.

AUTOMATIC MEMORY MANAGEMENT

1. This is the new feature in 11g which enables DBA to manage both SGA and PGA automatically by setting MEMORY_TARGET and MEMORY_MAX_TARGET parameters.
2. MEMORY_TARGET = SGA_TARGET + PGA_AGGREGATE_TARGET
3. MEMORY_TARGET is dynamic parameter, so the value can be changed at any time, where as MEMORY_MAX_TARGET is static
4. We can check memory sufficiency and tune it by taking advice from v$MEMORY_TARGET_ADVICE

MEMORY_TARGET is a database initialization parameter (introduced in Oracle 11g) that can be used for automatic PGA and SGA memory sizing.

Parameter description:

MEMORY_TARGET

Property		**Description**
Parameter type	:	big integer
Syntax	:	MEMORY_TARGET = integer [K | M | G]
Default value	:	0
Modifiable	:	ALTER SYSTEM
Range of value	:	152 MB to MEMORY_MAX_TARGET
Basic	:	No

MEMORY_TARGET provides the following:

- A single parameter for total SGA and PGA sizes
- Automatically set the sizes of SGA components and PGA components
- Memory is transferred to where most needed
- Uses workload information
- Uses internal advisory predictions
- Can be enable by DBCA at the time of Database creation.

Note: The size of MEMORY_TARGET should less than or equal to MEMORY_MAX_TARGET.

1. *Setting MEMORY_TARGET parameter:*

```
Sql>alter system set MEMORY_TARGET='500M';

System altered.
```

2. ***Setting MEMORY_TARGET in pfile:***

[oracle@.....~]$ cd $ORACLE_HOME/dbs/

[oracle@...db_1]$vi init<sid>.ora

MEMORY_TARGET=500M

3. ***Setting MEMORY_MAX_TARGET parameter***

Sql> alter system set MEMORY_MAX_TARGET='400M' scope=Spfile;

4. ***Error:***

If MEMORY_MAX_TARGET (400M) is lesser than MEMORY_TARGET (500M) then an error occurs and it is shown below.

ORA-00837: Specified value of MEMORY_TARGET is greater than MEMORY_MAX_TARGET.

So MEMORY_MAX_TARGET should always be a higher value than MEMORY_TARGET.

SERVER RESULT CACHE

1. It is new component introduced in 11g.
2. Usage of result cache Is dependent on parameters RESULT_CACHE_MODE and RESULT_CACHE_MAX_SIZE
3. The possible values for RESULT_CACHE_MODE is MANUAL or FORCE. When set to MANUAL, sql query should have hint /* result cache */. When using FORCE all queries will use result cache.
4. Even though after setting to FORCE, we can still avoid any query to use result cache using hint /* no result cache */
5. Oracle recommends to enable result cache only if database is hitting with lot of statements which are frequently repeated. So it must be enabled in OLTP environment
6. If we specify MEMORY_TARGET parameter, oracle will allocate 0.25% of shared pool size as result cache. If we specify SGA_TARGET (which is of 10g), result cache will be 0.5% of shared pool. If we use individual parameters (like in 9i), result cache will be of 1% size of shared pool
7. When any DML/DDL statements modify table data or structure, data in result cache will become invalid and need to be processed again

Setting the RESULT_CACHE_MODE Parameter

Whether the database caches a query result or not depends on the value of the RESULT_CACHE_MODE initialization parameter, which can take two values: MANUAL or FORCE. Here's how the two values affect result caching behavior in the database:

1. If you set the parameter to FORCE, the database will try to use the cache for all results, wherever it's possible to do so. You can, however, skip the cache by specifying NO_RESULT_CACHE hint within a query.
2. If you set the parameter to MANUAL, the database caches the results of a query only if you include the RESULT_CACHE hint in the query.

By default, the RESULT_CACHE_MODE parameter is set to MANUAL and you can change the value dynamically as shown here:

SQL> alter session set result_cache_mode=force scope=spfile;

Back Ground process -

System monitor (Smon) - > SMON will perform 2 action.

- Instance Recovery and Roll Forward

Instance Recovery -

Smon will perform instance recovery by roll forwarding the Tran's by comparing SCN b/w datafile header, control files and Redo log file.

In Roll forward smon will make sure that the commit data. if not write to data.

Roll Forward -

Comparing SCN 1,2 and 3 between redo log files and data files header. Here the latest SCN as per datafile header and control file is 3 and also scn 3 data is not completely make permanent. While instance recovery smon asks DBwriter to make the data permanent of SCN3. Whenever there is any loss of data SMON automatically performs Instance recovery when the instance is re-opened.

Find current SCN

SELECT current_scn FROM V$DATABASE;

Process Monitor (PMON) - PMON authenticates the user by using dictionary information.

Rolls back transaction's and releases locks if any, and releases the other resources.

It is also used to authenticate when user requests connection and checks whether the user has all privileges or not.

Database writer (DBWR) - Database writer writes the dirty blocks from write list of database buffer cache to data files.

Database writer will write to data files in any of the following situations.

- Whenever a log switch occur

- After log writer writes

- Whenever write list reach threshold value.

- Whenever ckpt occurs.

- Table space offline or read only or begin backup mode

- Whenever table is drop or truncate DBwriter can have up to 20 slave processes.

Log writer [LGWR] - LGWR will write the contents of log buffer cache to redolog files in any one of the following conditions.

- When commit occurs.

- When 1MB of redo is generated

- When log buffer cache is is 1/3 full

- Every 3 seconds

- Before DBwriter writes.

Check Point (check Point) - check point process will update control files and all data files header with the latest SCN (System change number)

Check point process will be initiated by check point event whenever log switch occurs.

To ensure that modified data blocks are written back to disks so that data is not lost in case of system failure. To ensure that all committed data has been written back to data files before shut down.

Data files **-** the logical structure of the database are

Table space (a group of segment)

Segment (a group of extent)

Extent (a group of data block)

Oracle data blocks (Basic unit of storage)

Table space Logical Structure -

A Table space is the logical name given a group of logical files or it is a group of segments.

A Segment is the object which stores data and which occupies memory inside the database.

The following are the memory types of segment.

Table segment

Index segment

Temp segment

Undo segment

An extent small memory is allocated to a segment (or) it is a group of oracle data blocks.

Oracle data block is the basic unit of memory allocated to the table space.

- From 10g the following are the mandatory table spaces for some other functionality of database.

System - which contain base tables.

Sysayx - contains base tables for reporting perpous.

Temp - contains nothing but used for sorting.

Undo - contains before images of the transactions useful for rollback or recovery.

Note - we cannot drop or rename, modify system or sysaux tablespaces. but we can do the same for any other table space.

Data dictionary view -

These views will give permanent information of the database and they will be in the format of dba_xxx (like dba_users, dba_tables)

Select * from dba_users.

Redo Log files.

- It is a file which consists redo entries written by log writer.

- It overcome file size problems oracle maintains 2 redolog files which can be used in a cycle process.

- switching between redolog files is called logswitch.

- Whenever a logswitch occurs checkpoint event will trigger checkpoint process and dbwriter also starts working.

Control files -

- Which tell us where the data files and other relevant information about their state.

Control file contains critical database information like

Latest SCN & RMAN backup information

All the data files names and locations and their size

All redo log files locations names and sizes database name and the creation date.

Log sequence number

Archive log mode (or) no archive log mode etc...

Archive redolog Files (ARCH) - Archive redolog files are a copy of online redolog files and they are useful for recovery purpose. When the database is in archive log mode, whenever a logswitch occurs, Archival process copies the content of online redologfile to archive redolog files.

Note - By default database will be in no archive log mode.

Password file - it is a file used for authentication for the user connectivity as sysdba from a remote machine. Password file will be in the format of pwdsid.ora

Password file will not used when a user is connecting by sitting on the server.

Syntax - $orapwd file=pwdsid.ora password=ora123 entries=5

Orapwd is a utility to create password file.

File - name of the password file

Password - the new password the should be assign.

Entries - up to how many users can connect using this password file.

Password file location - $ORACLE_HOME/dbs

Parameter file (pfile) - it is a file which defines the characteristics of the database.

Parameter file or pfile is will be in the format of initsid.ora

Ex- if the instance is dev then the pfile name should be initdev.ora

Note - a sample init.ora will created when the installed oracle software. This is the reason dba's will called pfile is init.ora file.

If the file is lost we can recreate using the content of alert log file.

Spfile (server parameter pfile) - since pfile is a text file and can be edited (modified) oracle introduce a secured file called spfile. This will be in binary format.

Spfile should not modified and should reside on server side only

It will be in the format spfileSID.ora (spfiledev.ora)

Note - At any moment we can create spfile from pfile and vice versa.

Spfile scopes -

Whenever a parameter in pfile or spfile need to be modified. This can be done at sql prompt using alter system set.

We can have 3 scopes for modifying a parameters.

sql> alter system set <parameter> scope=<"scopes">

Scopes - memory, spfile, both

Memory - when scope=memory new value will be assigned [the value will be change] and after restarting the database new value will be unassigned.

Spfile - when scope=spfile oracle will register the value and it will implement after restarting the database

Both - when scope=both the value will be changed immediately and will be made permanent even after restarting the database.

Database Opening Modes-

Startup Phase -

Startup nomount;

Alter database mount;

Alter database open; (or)

Startup;

Note - the database can be started without shutdown command using

sql> startup force; - > shutdown + startup

- Oracle database operates in three phases which making it available to the user.

Nomount - Oracle instance will start using parameter pfile or spfile.

Mount - this phase is for maintenance activity and requires control file to be available in the corresponding locations. The control file path will known to oracle by checking the parameter. Control_ files either in spfile or pfile.

Open - the phase represents that database is available for user actions. Oracle will check for data files and redolog files in the corresponding locations before operating the database. The locations of data files and redologfiles are available in control files.

Restrict - this phase will allow users with restricted session privilege to connect to the database.

Force - this option is used to startup the database when instance is aborted (Instance crash).

A database can shutdown in any one of the modes.

Modes	**New users**	**New tax's Transaction**	**waiting for existing Transaction to complete**	**waiting for session close**
Normal	No	Yes	yes	Yes
Transactional	No	No	yes	Yes
Immediate	No	No	yes	No
abort	No	No	No	No