

CREATING an ORACLE DATABASE

(Cap. 4)

Every running Oracle database is associated with an Oracle instance. When a database is started on a database server (regardless of the type of computer), Oracle allocates a memory area called the System Global Area (SGA) and starts one or more Oracle processes. This combination of the SGA and the Oracle processes is called an **Oracle instance**. The memory and processes of an instance manage the associated database's data efficiently and serve the one or multiple users of the database.

The Oracle database architecture includes logical and physical structures database.

A) Oracle Database - Logical Structure

The logical structure includes tablespaces, segments, extents, and data.

The Oracle server enables fine-grained control of disk space use through logical storage structures, including segments, extents, and data blocks.

A logical structure hierarchy exists as follows:

- An Oracle database contains at least one tablespace.
- A tablespace contains one or more segments.
- A segment is made up of extents.
- An extent is made up of logical blocks.
- A block is the smallest unit for read and write operations.

✓ Tablespaces

The data in an Oracle database is stored in tablespaces.

- An Oracle database can be logically grouped into smaller logical areas of space known as tablespaces.
 - A tablespace can belong to only one database at a time.
 - Each tablespace consists of one or more operating system files, which are called data files.
 - A tablespace may contain one or more segments.
 - Tablespaces can be brought online while the database is running.
 - Except for the SYSTEM tablespace or a tablespace with an active undo segment, tablespaces can be taken offline, leaving the database running.
 - Tablespaces can be switched between read/write and read-only status.
- specify that a data file should dynamically grow as objects in the tablespace grow.

✓ Segments

A segment is the space allocated for a specific logical storage structure within a tablespace.

- A tablespace may consist of one or more segments.
- A segment cannot span tablespaces; however, a segment can span multiple data files that belong to the same tablespace.
- Each segment is made up of one or more extents.

✓ Extents

Space is allocated to a segment by extents.

- One or more extents make up a segment.
- When a segment is created, it consists of at least one extent.

- As the segment grows, extents are added to the segment.
- The DBA can manually add extents to a segment.
- An extent is a set of contiguous Oracle blocks.
- An extent cannot span data files, and therefore, it must exist in one datafile.

✓ **Data Blocks**

The Oracle server manages the storage space in the data files in units called Oracle blocks or data blocks.

- At the finest level of granularity, the data in an Oracle database is stored in data blocks.
- Oracle data blocks are the smallest units of storage that the Oracle server can allocate, read, or write.
- One data block corresponds to one or more operating system blocks allocated from an existing data file.
- The standard data block size for an Oracle database is specified by the DB_BLOCK_SIZE initialization parameter when the database is created.
- The data block size should be a multiple of the operating system block size to avoid unnecessary I/O.
- The maximum data block size is dependent on the operating system.

B) Oracle Database - Physical Structure

The physical structure of the database is the set of operating system files in the database.

An Oracle database consists of three file types:

- Data files containing the actual data in the database.
- Redo log files containing a record of changes made to the database to enable recovery of the data in case of failures.
- Control files containing information necessary to maintain and verify database integrity.

✓ **Data Files**

Each tablespace in an Oracle database consists of one or more files called data files. These are physical structures that conform with the operating system on which the Oracle server is running.

- A data file can belong to only one tablespace.
- An Oracle server creates a data file for a tablespace by allocating the specified amount of disk space plus a small amount of overhead.
- The database administrator can change the size of a data file after specifying that a data file should dynamically grow as objects in the tablespace grow.

✓ **Redo log files**

Online redo log files are used in a situation such as an instance failure to recover committed data that has not been written to the data files. The online redo log files are used only for recovery.

Online Redo log files have the following characteristics:

- Record all changes made to data.
- Provide a recovery mechanism.
- Can be organized into groups.
- At least two groups required.

✓ Control File

- The control file is a small binary file necessary for the database to start and operate successfully.
- Each control file is associated with only one Oracle database.
 - Before a database is opened, the control file is read to determine whether the database is in a valid state to use.
 - A control file is updated continuously by the Oracle server during database use, so it must be available for writing whenever the database is open.
 - The information in the control file can be modified only by the Oracle server; no database administrator or end user can edit the control file.
 - If for some reason the control file is not accessible, the database does not function properly.
 - If all copies of a database's control files are lost, the database must be recovered before it can be opened.

C) Creating a Database Manually

The steps are:

- Choose a unique instance and database name
- Choose a database character set
- Set operating system variables
- Create the initialization parameter file
- Start the instance in NOMOUNT stage
- Create and execute the CREATE DATABASE command
- Run scripts to generate the data dictionary and accomplish post-creation steps
- Create additional tablespaces as needed

- ✓ Choose a unique instance and database name
- ✓ Choose a database character set

A database character set must be defined. An optional national character set can also be defined. For example:

- Character set AL32UTF16
- National character set AL16UTF16

- ✓ Set operating system variables

Four environment variables must be set: ORACLE_HOME, ORACLE_SID, PATH, LD_LIBRARY_PATH.

- ORACLE_HOME - the top directory in which the Oracle9i server is installed.
- ORACLE_SID - a user-definable name assigned to an instance of a database. Used to distinguish different database instances running on one machine
- PATH - defines the directories the operating system search to find executables.
- LD_LIBRARY_PATH - defines the directories in which required library files are stored.

✓ **Create the initialization parameter file**

The initialization parameter file is created using the sample init.ora file installed during the installation process.

- Copy the sample init.ora and name it initSID.ora.
- Make modifications to the file specific to the needs of the database you will be creating.
- If an SPFILE is to be used, the PFILE must be created first.

✓ **Start the instance in NOMOUNT**

- Connect as user SYS with SYSDBA privilege.
- The database must be placed in the NOMOUNT state in order to create a database.

✓ **Create and execute the CREATE DATABASE command**

- Create an SQL script that contains the CREATE DATABASE command.
- Connect to SQL*Plus as the SYS user with the SYSDBA privilege.
- With the database in NOMOUNT state, execute the script.
- The CREATE DATABASE command will be dramatically simplified if the database being created is to use Oracle Managed Files (OMF) to manage the operating system files.

✓ **Run scripts**

- Two scripts **catalog.sql** and **catproc.sql** must be run after the database is created:
 - catalog.sql - creates the views on the base tables and on the dynamic performance views, and their synonyms.
 - catproc.sql - creates the packages and procedures required to use PL/SQL. In addition, it creates several of the PL/SQL packages that are used to extend RDBMS functionality. This script also creates additional packages views for alerts, pipes, logminer, large objects, objects, queuing, replication, and other built-in options.
- Both scripts must be run as the user SYS with SYSDBA privilege.
- Before executing the scripts the database must be placed in the OPEN state.

✓ **Create additional tablespaces**

You should create any additional tablespaces required to meet your database needs.

Examples:

```
SQL> connect sys as sysdba
```

```
SQL> startup nomount
```

ORACLE instance started.

Total System Global Area 21790532 bytes
Fixed Size 278340 bytes
Variable Size 16777216 bytes
Database Buffers 4194304 bytes
Redo Buffers 540672 bytes

1)

```
SQL> CREATE DATABASE UBD1
LOGFILE
GROUP 1 ('$HOME/ORADATA/u03/log_01_01_db01.rdo') SIZE 1M,
GROUP 2 ('$HOME/ORADATA/u03/log_02_01_db01.rdo') SIZE 1M
DATAFILE '$HOME/ORADATA/u01/system_01_db01.dbf' SIZE 1M
AUTOEXTEND ON NEXT 5M MAXSIZE 150M
DEFAULT TEMPORARY TABLESPACE temp
TEMPFILE '$HOME/ORADATA/u02/temp_01_db01.dbf' SIZE 1M 5
AUTOEXTEND ON NEXT 5M MAXSIZE 1M
CHARACTER SET WE8ISO8859P1
NATIONAL CHARACTER SET AL16UTF16
/
```

2)

```
SQL> CREATE DATABASE UBD2
USER SYS IDENTIFIED BY ORACLE
USER SYSTEM IDENTIFIED BY MANAGER
CONTROLFILE REUSE
LOGFILE
GROUP 1 ('E:/student/redo01.log') SIZE 100M,
GROUP 2 ('E:/student/redo02.log') SIZE 100M,
GROUP 3 ('E:/student/redo03.log') SIZE 100M
MAXLOGFILES 5
MAXLOGMEMBERS 5
MAXLOGHISTORY 1
MAXDATAFILES 100
MAXINSTANCES 1
ARCHIVELOG
FORCE LOGGING
CHARACTER SET US7ASCII
NATIONAL CHARACTER SET AL16UTF16
/
```

3)
SQL> CREATE DATABASE UBD3
LOGFILE
GROUP 1 ('/\$HOME/ORADATA/u01/redo01.log') SIZE 100M,
GROUP 2 ('/\$HOME/ORADATA/u02/redo02.log') SIZE 100M,
MAXLOGFILES 5
MAXLOGMEMBERS 5
MAXLOGHISTORY 1
MAXDATAFILES 100
MAXINSTANCES 1
DATAFILE '/\$HOME/ORADATA/u01/system01.dbf' SIZE 325M
UNDO TABLESPACE undotbs
DATAFILE '/\$HOME/ORADATA/u02/undotbs01.dbf' SIZE 200
DEFAULT TEMPORARY TABLESPACE temp
TEMPFILE '/\$HOME/ORADATA/u03/temp01.dbf' SIZE 4M
CHARACTER SET US7ASCII
/