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CS409 Handouts

Introduction to Database Administration

Made by Mah jabeen
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TOPIC 01

Defining Data, Information & Database

Defining Data, Information & Database

Data, Information From Data to Information

For Knowledge
For Business Intelligence
Defining Data, Information & Database

Data

Anything which is not necessarily meaningful to human being.

Raw facts/Un-processed information.

Defining Data, Information & Database

Examples of Data

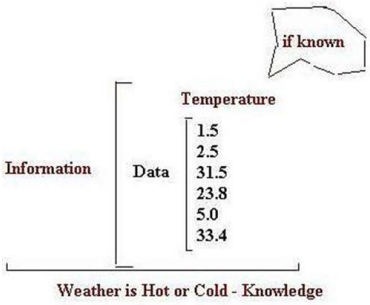
The numbers 10, 22, and 119 are data

Some one can think these are lengths and other may think room numbers

Similarly, 1.5, 2.5, 31.5, … MAY represent lengths of some iron rods
Defining Data, Information & Database

Information

Data Processed to reveal its meaning
Information is meaningful
In today's world, accurate, relevant and timely information is the key to good decision making
Good decision making is key to survival in today's competitive and global environment



Defining Data, Information & Database

Examples of Information Software Engineer designed some system

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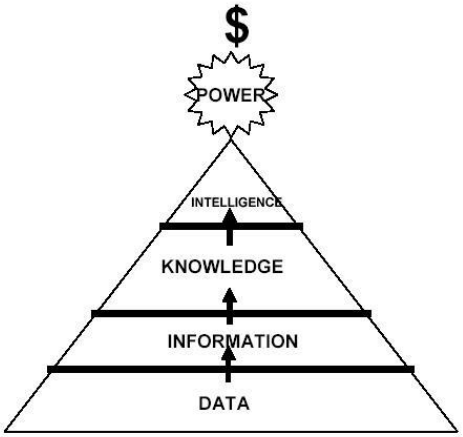
May be monthly reports are not ok
Reports are giving wrong information, etc.

This means DESIGN is not ok



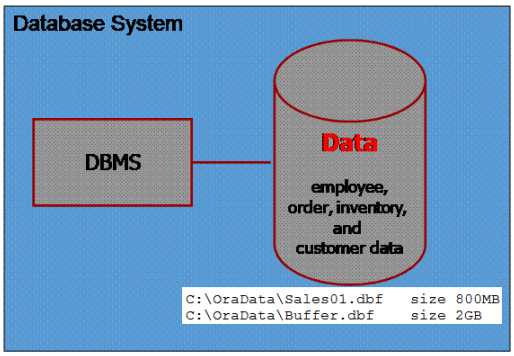
Defining Data, Information & Database

Aim of Data & Information

Defining Data, Information & Database

Who Builds Useful Information

Data Information
Defining Data, Information & Database
Database & DBMS



A database is collection of stored operational data used by application systems of some particular enterprise (C.J. Date)

TOPIC 02

Introduction to DBMS & its environment for DBA
Introduction to DBMS & its environment for DBA

DBMS, Role of DBA with Database
Examples of DBMS
Data Accessing using DBMS
Forms, Reports & Queries
DBMS Language
DBMS & its Sub Schemas
Role/ Jobs in DB Environment
Components of DBMS Environment
Interaction of DBMS with DB Files

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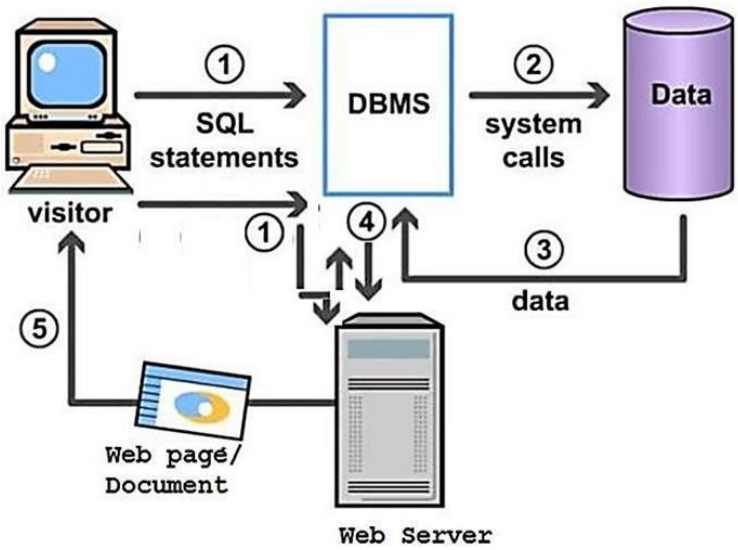
Introduction to DBMS & its environment for DBA

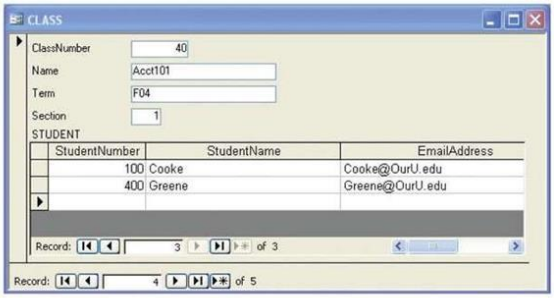
Examples of DBMS

Oracle
IBM DB2
Ingress
Teradata
MS SQL Server
MS Access
MySQL etc.



Data Accessing
using DBMS

tiers & 3-tiers Architectures



PART

Number	*PartName*	*SalesPrice*	*ROQ*	*QOH*	*CompanyName*	*City*	*Country*
1000	*Cedar Shakes*	*$22.00*	*100*	*200*			
					Bristol Systems	Machester	England
					ERS Systems	Vancouver	Canada
					Forrest Supplies	Denver	US
2000	*Garage Heater*	*$1,750.00*	*3*	*4*			
					Bristol Systems	Machester	England
					ERS Systems	Vancouver	Canada
					Kyoto Importers	Kyoto	Japan
					Forrest Supplies	Denver	US
3000	*Utility Cabinet*	*$55.00*	*7*	*3*			
					Ajax Manufacturing	Sydney	Australia

```
SQL> SELECT empno, ename, sal
  2  FROM EMP;

     EMPNO ENAME                SAL
---------- ---------- ----------
      7369 SMITH                800
      7499 ALLEN               1600
```

Introduction to DBMS & its environment for DBA
Forms, Reports & Queries

Introduction to DBMS & its environment for DBA
DBMS Language
A Software Package that enables users to define, create, maintain, and control access to the database.
Data Definition Language (DDL) Data Manipulation Language (DML) Control access (DCL): Security, integrity, concurrent access, recovery, support for data communication, etc.
Utility services (DCL)
File import/export, monitoring facilities, code generator, report writer, etc.
Support Ad Hoc queries
Database Languages are DML, DDL, DCL in SQL.
Introduction to DBMS & its environment for DBA

A software system that is used to create, maintain, and provide

Order Filing System
controlled access to user databases

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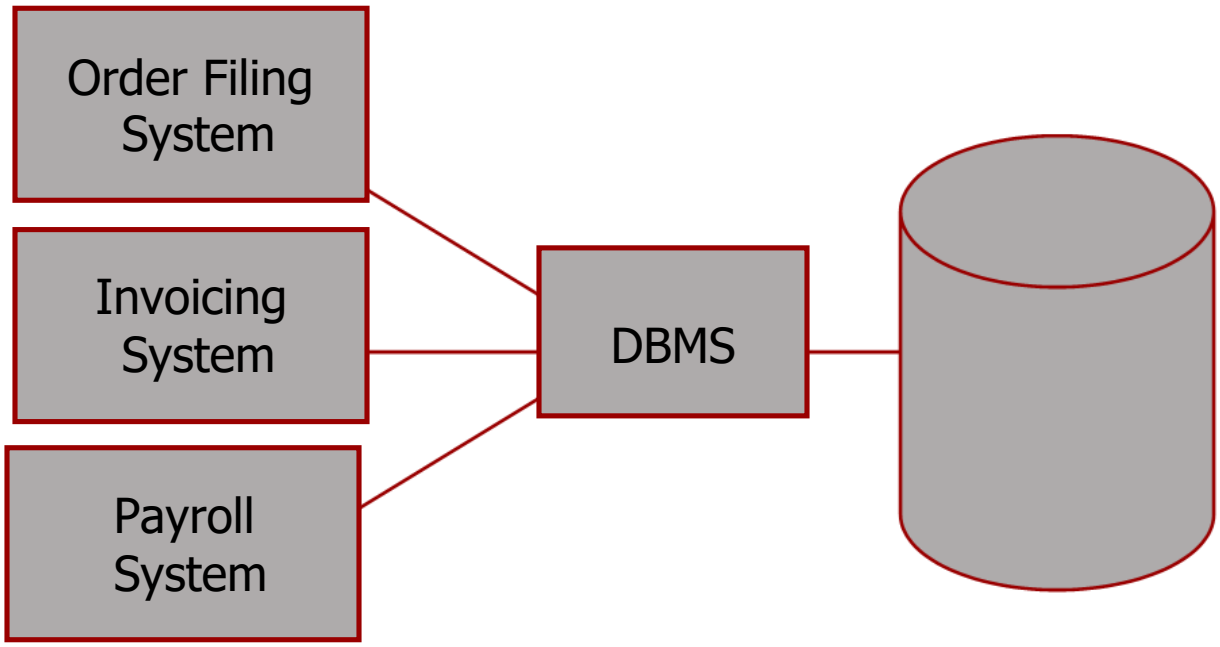
DBMS and its Sub Schemas



Contains employee, order, inventory, pricing, and customer data

DBMS manages data resources like an operating system manages hardware resources
Introduction to DBMS & its environment for DBA

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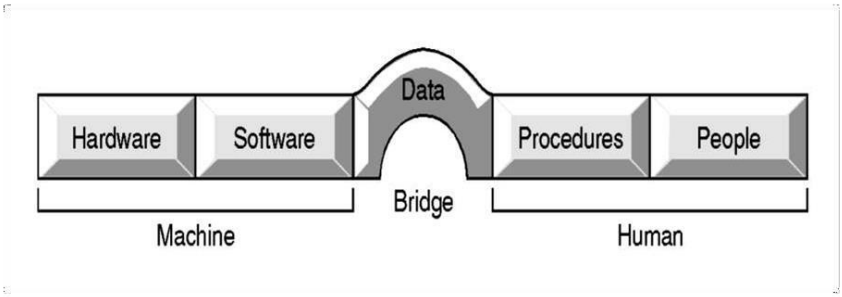
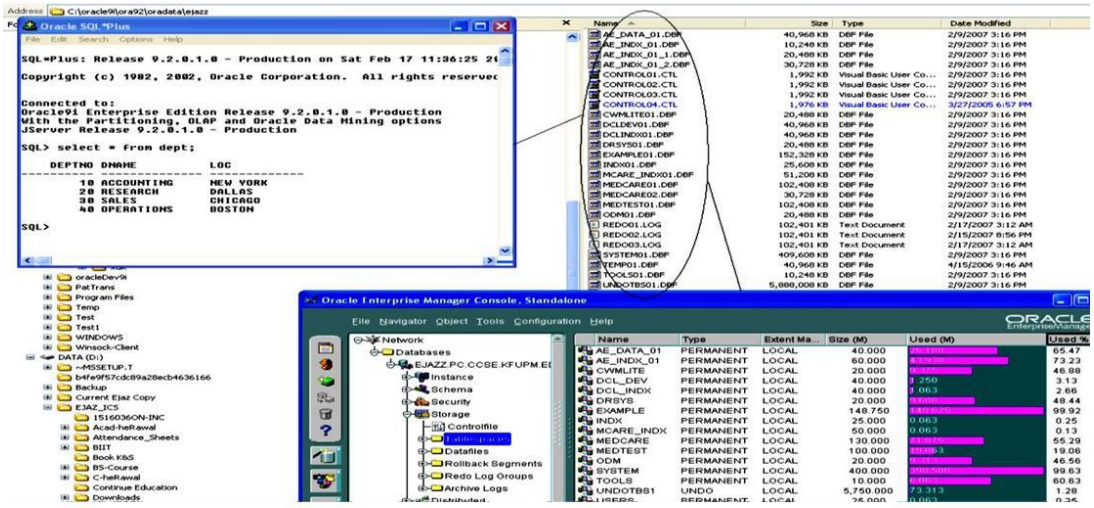
Roles/ Jobs in the Database Environment

Data Administrator (DA)
Database Administrator (DBA)
Database Designers (Logical and Physical)
Applications Programmer
Database Developer
Database Analyst
End users (Naive and sophisticated)



Introduction to DBMS & its environment for DBA

Components of DBMS Environment



Introduction to DBMS & its environment for DBA
Interaction of DBMS with DB Files
Introduction to Database Administration

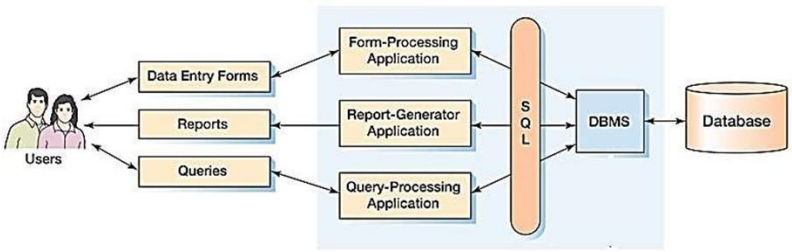
TOPIC 03

Introduction to DBMS Components & Architecture

Introduction to DBMS Components & Architecture

DBMS Components & Architecture

Interaction of users with DBMS
ANSI Spark three level architecture
Multi user DBMS Architecture
Teleprocessing
DBMS Client-Server Architecture (2- tiers)
DBMS Client-Server Architecture (3- tiers)
Alternate Client-Server Architectures
Paradigm of Database System



Introduction to DBMS Components & Architecture

Interaction of users with DBMS

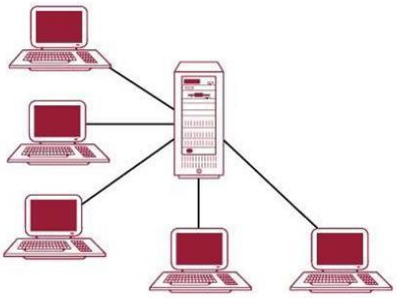
Form Processing & Report Processing Applications are build by using VB, DOT Net or PHP programming. Reports can be developed by using Crystal Reports tool.
Query Processing can be managed by using vendors SQL tool or 3rd party tools such As TOAD, SQL Developer etc.
Introduction to DBMS Components & Architecture

Multi user DBMS Architecture

Teleprocessing

File-Server

Client-Server (2-tiers, 3 tiers)



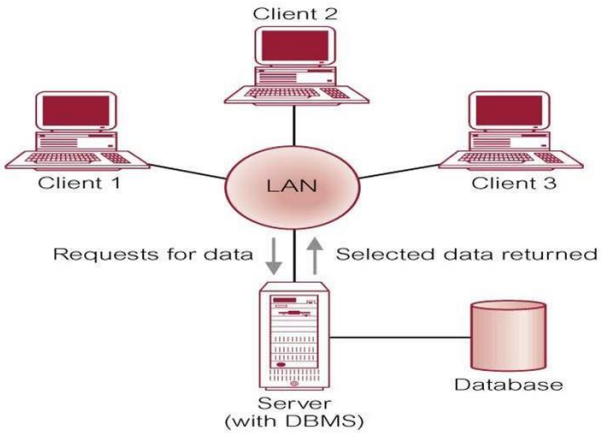
Introduction to DBMS Components & Architecture

Teleprocessing

Traditional architecture

Single mainframe with a number of terminals attached

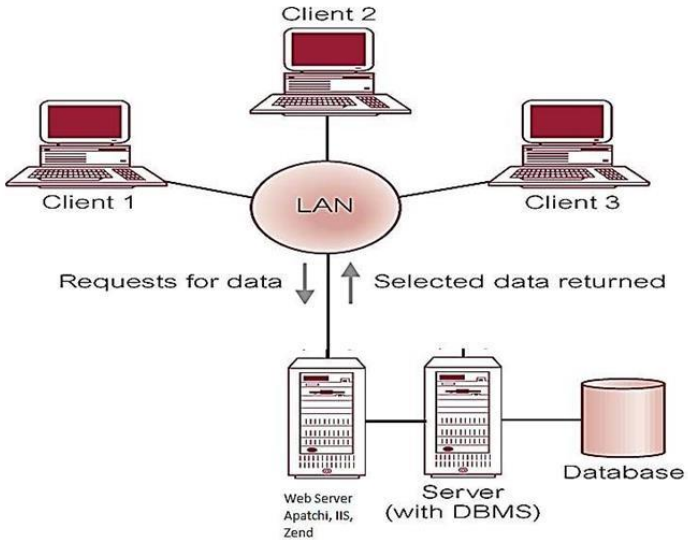
Trend is now towards downsizing



Introduction to DBMS Components & Architecture

DBMS Client-Server Architecture (2-tiers)

DB Connections can be managed by
ODBC, JDBC



Introduction to DBMS Components & Architecture

DBMS Client-Server Architecture (3-tiers)

DB Connections can be managed by using MS
ODBC, JDBC

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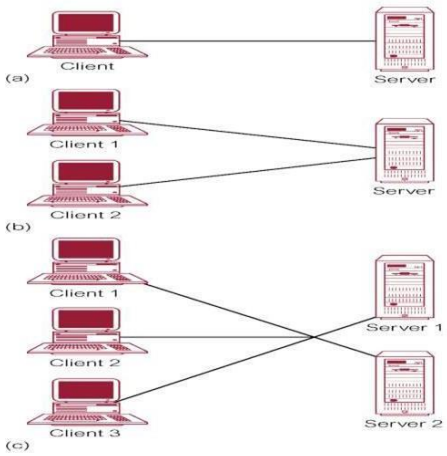

Introduction to DBMS Components & Architecture

Alternate Client-Server Architectures

Introduction to DBMS Components & Architecture

Paradigm of Database System

Logical/ Conceptual Database Design
How should the transactional data be modeled (OLTP)?
Designing the data warehouse schema (OLAP)
Query Processing
Analysis queries are hard to answer efficiently
What techniques are available to the DBMS?
Introduction to DBMS Components & Architecture

Paradigm of Database System

Physical Database Design (DBA)

How should the data be organized on disk?
What data structures should be used?
Data Mining
What use is all this data?
Which questions should we ask our data warehouse OLAP?
Data Science/Big Data
Introduction to Database Administration

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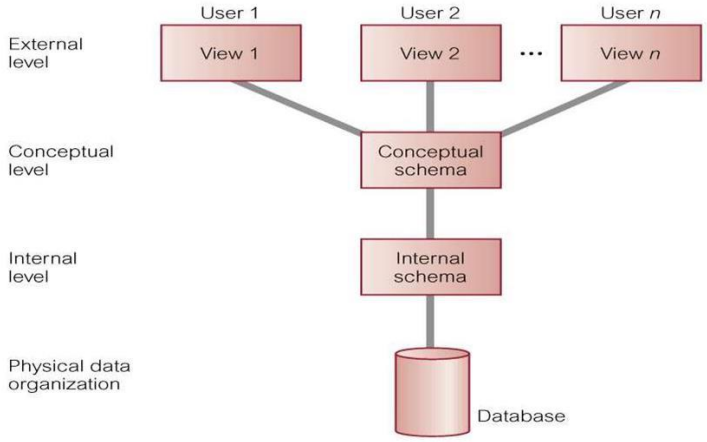
TOPIC 04

Introduction to Three Levels ANSI SPARC Architecture
Introduction to DBMS Three Levels Architecture

DBMS Three Levels Architecture

DBMS Three Levels Architecture
ANSI-SPARC Three-Level Architecture
Data Independence
Degrees of Data Abstraction
Schema & Instance
Schema Objects
Database State
Introduction to DBMS Three Levels Architecture
DBMS Three Levels Architecture
External Level
User's view of the database Describes that part of database that is relevant to a particular user
Conceptual Level
Community view of the database Describes what data is stored in database and relationships among
the data
Internal Level
Physical representation of the database on the computer
Describes how the data is stored in the database



Introduction to DBMS Three Levels Architecture

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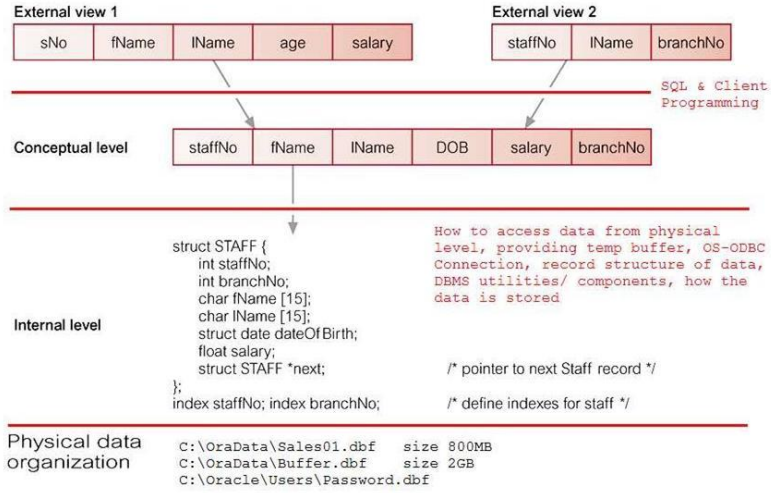
ANSI-SPARC Three-Level Architecture



Introduction to DBMS Three Levels Architecture

ANSI-SPARC Three-Levels Architecture

Introduction to DBMS Three Levels Architecture

Data Independence

Logical Data Independence
Refers to immunity of external schemas to changes in conceptual schema

Conceptual schema changes (e.g. addition/removal of entities)

Should not required changes to external schema or rewrites of application programs

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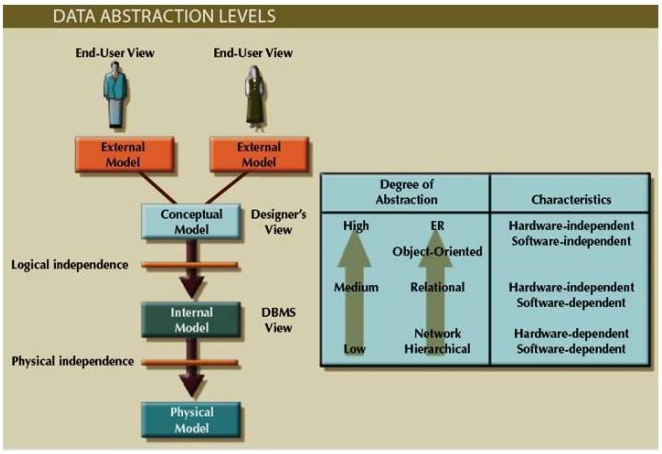
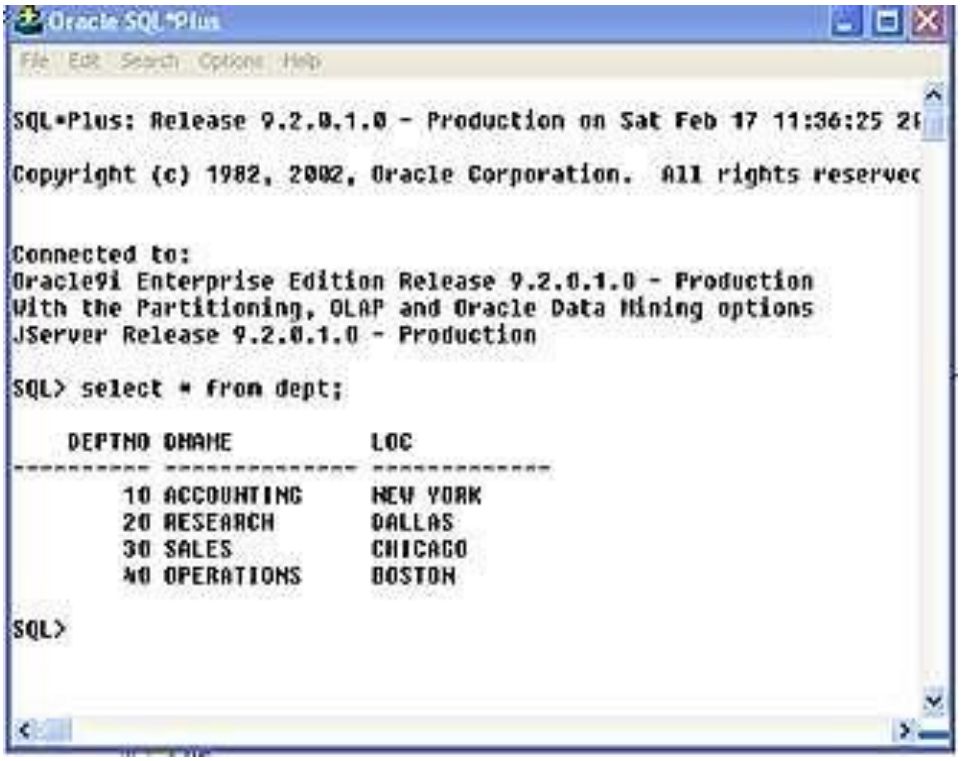


Introduction to DBMS Three Levels Architecture

Degrees of Data Abstraction

Introduction to DBMS Three Levels Architecture



Similar to types and variables in programming languages
Schema – the logical structure of the database
E.g., the database consists of information about a set of customers and accounts and the relationship between them
Analogues to type information of a variable in a program
Physical schema: database design at the physical level
Logical schema: database design at the logical level
Sub-Schema: there may be several of these at the view level, each a different view of database
Instance – the actual content of the database at a particular point in time
Analogous to the value of the variable
Schema & Instance
Introduction to DBMS Three Levels Architecture

Schema Objects
Tables
Indexes
Constraints
Sequences
Views
Clusters
Triggers
Links
Introduction to DBMS Three Levels Architecture

Schema Objects
User Defined 10.Types 11.Synonym 12.Dimensions
13.Procedural Program codes in PL/SQL, Java, C etc.

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STUDENT	Name	StudentNumber	Class	Major
	Smith	17	1	CS
	Brown	8	2	CS

COURSE	CourseName	CourseNumber	CreditHours	Department
	Intro to Computer Science	CS1310	4	CS
	Data Structures	CS3320	4	CS
	Discrete Mathematics	MATH2410	3	MATH
	Database	CS3380	3	CS

SECTION	SectionIdentifier	CourseNumber	Semester	Year	Instructor
	85	MATH2410	Fall	98	King
	92	CS1310	Fall	98	Anderson
	102	CS3320	Spring	99	Knuth
	112	MATH2410	Fall	99	Chang
	119	CS1310	Fall	99	Anderson
	135	CS3380	Fall	99	Stone

GRADE_REPORT	StudentNumber	SectionIdentifier	Grade
	17	112	B
	17	119	C
	8	85	A
	8	92	A
	8	102	B
	8	135	A

PREREQUISITE	CourseNumber	PrerequisiteNumber
	CS3380	CS3320
	CS3380	MATH2410
	CS3320	CS1310

Introduction to DBMS Three Levels Architecture
Database State
Introduction to Database Administration

TOPIC 05

Introduction to DBA Responsibilities & Tasks

Introduction to DBA Responsibilities & Tasks

DBA Roles and Responsibilities

Who is DBA?
DBA & Databases
Network Administrator
Application Developers
DBA's Tasks
DBA's Responsibilities

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Introduction to DBA Responsibilities & Tasks

Who is DBA?

A Database Administrator (DBA) is a person or a group of person who are responsible for managing all the activities related to database system.
DBA job requires a high level of expertise by a person or group of persons.
There are very rare chances that only a single person can manage all the database system activities so companies always have a group of people who take care of database system.
Introduction to DBA Responsibilities & Tasks

DBA & Databases

Each database requires at least one database administrator (DBA).
A Database system can be large and can have many users.
A database administration is sometimes not a one-person job, but a job for a group of DBAs who share responsibility.
Introduction to DBA Responsibilities & Tasks

Network Administrator

Network administrator coordinates with the DBA for database connections and other issues such as storage, OS and hardware.
Some sites have one or more network administrators. A network administrator, for example, administers Oracle networking products, such as Oracle Net Services.
Introduction to DBA Responsibilities & Tasks

Application Developers

Designing and developing the database application
Designing the database structure for an application
Estimating storage requirements for an application

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Specifying modifications of the database structure for an application
Introduction to DBA Responsibilities & Tasks

Application Developers

Relaying this information to a database administrator
Tuning the application during development
Establishing security measures for an application during development
Database Server Programming using Oracle PL/SQL
Introduction to DBA Responsibilities & Tasks

DBA's Tasks

Task 1: Evaluate the Database Server Hardware
Task 2: Install the Oracle Database Software
Task 3: Plan the Database Task 4: Create and Open the Database
Task 5: Back Up the Database Task 6: Enroll System Users
Task 7: Implement the Database Design
Introduction to DBA Responsibilities & Tasks

DBA's Tasks

Task 8: Back Up the Fully Functional Database
Task 9: Tune Database Performance Task 10: Download and Install Patches
Task 11: Roll Out to Additional Hosts
Introduction to DBA Responsibilities & Tasks

DBA's Responsibilities

Installing and upgrading the Oracle Database server and application tools
Allocating system storage and planning future storage requirements for the database system
Creating primary database storage structures (tablespaces) after application developers have designed an application
Introduction to DBA Responsibilities & Tasks

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DBA's Responsibilities

Creating primary objects (tables, views, indexes) once application developers have designed an application
Modifying the database structure, as necessary, from information given by application developers
Introduction to DBA Responsibilities & Tasks

DBA's Responsibilities

Enrolling users and maintaining system security
Ensuring compliance with Oracle license agreements
Controlling and monitoring user access to the database
Monitoring and optimizing the performance of the database
Introduction to DBA Responsibilities & Tasks

DBA's Responsibilities

Planning for backup and recovery of database information
Maintaining archived data on tape
Backing up and restoring the database
Contacting Oracle for technical support

END
Introduction to Database Administration

TOPIC 06

Overview of Physical Database Design

Overview of Physical Database Design

Physical Database Design

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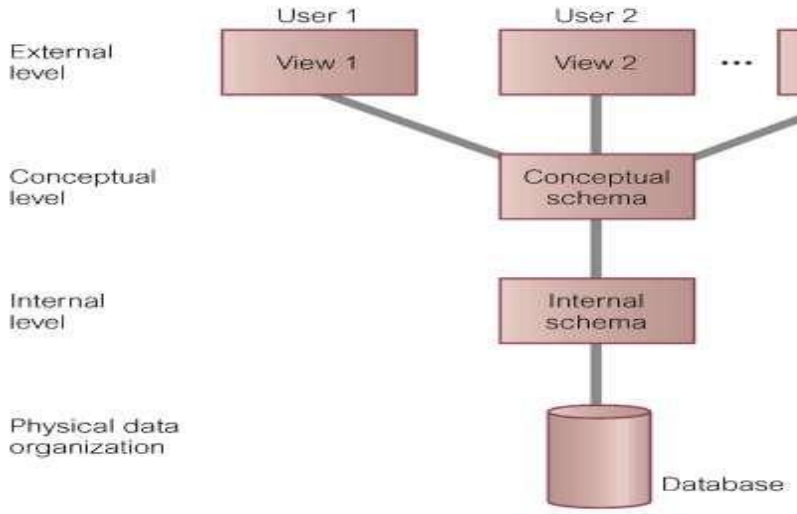
Physical level in ANSI SPARC Arch.
Purposes of Physical Database Design
Factors that influence Physical Database Design
Design decisions about Indexing
Performance & Tuning
Tuning Indexes
Overview of Physical Database Design

Physical Level in ANSI SPARC Architecture



Ref. DBA-4 (4)
Overview of Physical Database Design

Purposes

Meeting the expectations of Database Designer for the database, following are two main purposes of Physical Database Design for a DBA.
Managing Storage Structure for database or DBMS
Performance & Tuning
Overview of Physical Database Design

Factor (A): Analyzing the database queries and transactions

For each query, the following information is needed.
The files that will be accessed by the query
The attributes on which any selection conditions for the query are specified;
The attributes on which any join conditions or conditions to link multiple tables or objects for the query are specified
The attributes whose values will be retrieved by the query.
Overview of Physical Database Design

Factor (A): Analyzing the database queries and transactions

For each update transaction or operation, the following information is needed.
The files that will be updated;
The type of operation on each file
(insert, update or delete);
The attributes on which selection conditions for a delete or update operation are specified;
The attributes whose values will be changed by an update operation.
Overview of Physical Database Design

Factor (B): Frequency with Queries and Transactions

The expected frequency information, along with the attribute information collected on each query and transaction, is used to compile a cumulative list of expected frequency of use for all the queries and transactions.
It is expressed as the expected frequency of using each attribute in each file as a selection attribute or join attribute, over all the queries and transactions.
Overview of Physical Database Design

Factor (C): Time constraints of queries & transactions

Performance constraints place further priorities on the attributes that are candidates for access paths.

The selection attributes used by queries and transactions with time constraints become higher-priority candidates for primary access structure.
Overview of Physical Database Design

Factor (D): Expected frequencies of update operations

A minimum number of access paths should be specified for a file that is updated frequently.
Overview of Physical Database Design

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Factor (E): Uniqueness constraints on attributes

Access paths should be specified on all candidate key attributes

or set of attributes

that are either the primary key or constrained to be unique.
Overview of Physical Database Design

Design Decisions About Indexing

Whether to index an attribute?
What attribute or attributes to index
on?
Whether to set up a clustered index?
Whether to use a hash index over a tree index?
Whether to use dynamic hashing for the file?
Overview of Physical Database Design

Access Path & Storage

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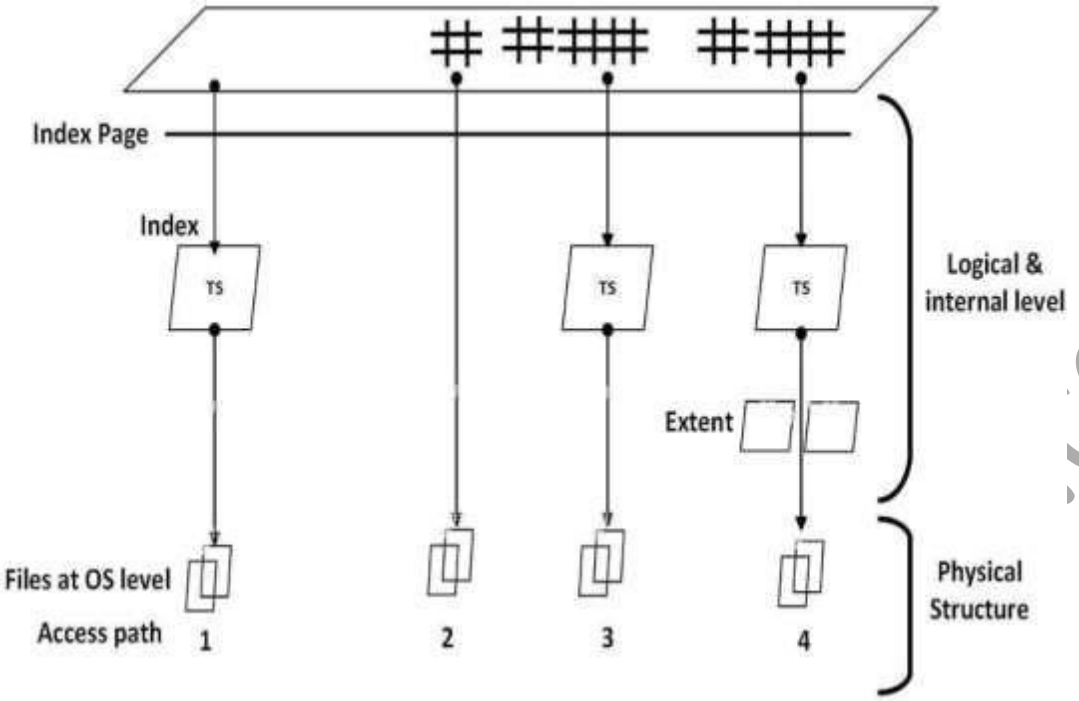

END
Introduction to Database Administration

TOPIC 07

Introduction to Database Tuning

Introduction to Database Tuning

Database Tuning

Tuning & goals
Tuning indexes
Overview of database tuning
Problems in tuning
Dynamically changes processing requirements
Changes in Database Design
Tuning queries
Introduction to Database Tuning

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Tuning & Goals Tuning:

The process of continuing to revise/adjust the physical database design by monitoring resource utilization as well as internal DBMS processing to reveal bottlenecks such as contention for the same data or devices.
Introduction to Database Tuning

Tuning & Goals Goal:

To make application run faster
To lower the response time of queries/ transactions
To improve the overall throughput of transactions
Introduction to Database Tuning

Tuning Indexes

Reasons to tuning indexes
Certain queries may take too long to run for lack of an index;
Certain indexes may not get utilized at all;
Certain indexes may be causing excessive overhead because the index is on an attribute that undergoes frequent changes
Introduction to Database Tuning

Tuning Indexes

Options to tuning indexes
Drop or/and build new indexes
Change a non-clustered index to a clustered index (and vice versa)
Rebuilding the index
Introduction to Database Tuning

Overview of Database Tuning

Statistics obtained from monitoring:
Storage statistics
I/O and device performance statistics
Query/transaction processing statistics

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Locking/logging related statistics
Index statistics
Introduction to Database Tuning

Overview of Database Tuning

Statistics internally collected in DBMSs:
Size of individual tables
Number of distinct values in a column
The number of times a particular query or transaction is submitted/executed in an interval of time
The times required for different phases of query and transaction processing
Introduction to Database Tuning

Problems in Tuning

How to avoid excessive lock contention?
How to minimize overhead of logging and unnecessary dumping of data?
How to optimize buffer size and scheduling of processes?
How to allocate resources such as disks, RAM and processes for most efficient utilization?
Introduction to Database Tuning

Dynamically Changed Processing Requirements

Need to be addressed by making changes to the conceptual schema if necessary and to reflect those changes into the logical schema and physical design.
Introduction to Database Tuning

Changes in Database Design

Existing tables may be joined (de- normalized) because certain attributes from two or more tables are frequently needed together.
For the given set of tables, there may be alternative design choices, all of which achieve 3NF or BCNF. One may be replaced by the other.
Introduction to Database Tuning

Changes in Database Design

A relation of the form R(K, A, B, C, D, …) that is in BCNF can be stored into multiple tables that are also in BCNF by replicating the key K in each table.

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Attribute(s) from one table may be repeated in another even though this creates redundancy and potential anomalies.
Apply horizontal partitioning as well as vertical partitioning if necessary.
Introduction to Database Tuning

Tuning Queries

Indications for tuning queries
A query issues too many disk accesses
The query plan shows that relevant indexes are not being used.
Introduction to Database Tuning

Tuning Queries

Typical instances for query tuning
Many query optimizers do not use indexes in the presence of arithmetic expressions, numerical comparisons of attributes of different sizes and precision, NULL comparisons, and sub-string comparisons.
Indexes are often not used for
nested queries using IN;
Introduction to Database Tuning

Tuning Queries

Some *DISTINCT*s may be redundant and can be avoided without changing the result.
Unnecessary use of temporary result tables can be avoided by collapsing multiple queries into a single query unless the temporary relation is needed for some intermediate processing.
If multiple options for join condition are possible, choose one that uses a clustering index and avoid those that contain string comparisons.
Introduction to Database Tuning

Tuning Queries

In some situations involving using of correlated queries, temporaries are useful.
The order of tables in the *FROM* clause may affect the join processing.
Some query optimizers perform worse on nested queries compared to their equivalent un-nested counterparts.
Many applications are based on views that define the data of interest to those applications.
Sometimes these views become an overkill.
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TOPIC 08

Concepts of Keys and Super keys

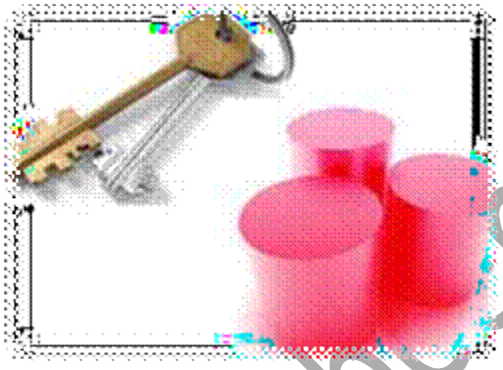
Concepts of Keys & Super Keys

Keys & Super Keys

Concepts of Keys
Super Keys
Example – 1
Example – 2
Concepts of Keys & Super Keys

Concepts of Keys

A key is a combination of one or more columns that is used to identify rows in a relation



A composite key is a key that consists of two or more columns
Concepts of Keys & Super Keys

Super Keys

A super key is a combination of columns that uniquely identifies any row within a relational database management system (RDBMS) table.

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Roll#	FirstName	LastName	Address	City	NIC#	Deptno
...						
12i-2565	...					CS
	Ali					CS
	Ali					EE
...						

{Roll#}, {Roll#, NIC#}, {NIC#}, {Roll#, FirstName, LastName}
{Roll#, FirstName, LastName, Address, City, NIC#, Deptno}
Concepts of Keys & Super Keys

Super Keys Example - 1

Roll Number	First Name	Last Name
CSU0001	Shabbir	Bhimani
CSU0002	Jain	Rao
CSU0003	Nitin	Uday

Now we have the following as super keys

Roll Number	First Name	
Roll Number	First Name	Last Name

Concepts of Keys & Super Keys

Super Keys Example - 2

Following table consists of four columns EmployeeID, Name, Job, DeptID
Examples of superkeys in this table would be
{employeeID, Name}, {employeeID, Name, job}, and
{employeeID, Name, job, departmentID}
In a real database we don't need values
for all of those columns to identify a row
Concepts of Keys & Super Keys

Super Keys Example - 2

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We only need, per our example, the set
{EmployeeID}.
This is a minimal superkey
So, employeeID is a candidate key.
EmployeeID can also
uniquely identify the tuples.

TOPIC 09

Candidate Keys with Examples
Candidate Keys with Examples

Candidate Keys

Candidate Key Definition
Example (Invoice)
Example (Bank, PTCL, NADRA)
Candidate Keys with Examples
Candidate Key Definition
A candidate key is a key that determines all of the other columns in a relation
Candidate key columns help in searching fewer duplicated or unique records.
Examples
In PRODUCT relation Prod# is a candidate key
Prod_Name is also a candidate key In ORDER_PROD
(OrderNumber, Prod#) is a candidate key
(Candidate key can be called as Alternate
Key)
Candidate Keys with Examples

Candidate Key Example Invoice (Buying Items)
Items are sold to Customers
Customer should buy Items with Invoice
Same items can be sold on many invoices
Invoice# and Item# will identifying exact record, what other columns are required
If some one tells you inv# and Qty, can you find exact product
Candidate Keys with Examples

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Candidate Key Examples
For a Bank as an Enterpise: AccountHolder (or Customer)
ACC#, Fname, Lname, DOB, CNIC#, Addr,
City, TelNo, Mobile#, DriveLic#

For PTCL: Customer (single telno holders) Consumer#, Fname, Lname, DOB, CNIC#, Addr, City, TelNo, Mobile#

END
For NADRA: Citizen (CNIC#, Fname, Lname, FatherName, DOB, OldCNIC#, PAddr, PCity, TAddr, TCity, TelNo, Mobile#)
Introduction to Database Administration

TOPIC 10

Candidate Keys with Examples
Candidate Keys with Examples

Candidate Keys Continued

Candidate Key examples
Exercises
Candidate key for search purpose
Candidate Keys with Examples

Candidate Key Examples
Example-1: Branch (branch-name, assets, branch-city)
Candidate Key: {branch-name} Example-2: Customer (cname, natid,
address, city, telno)
cname, address, city can be duplicated individually and cannot determine a record.
Candidate Keys with Examples

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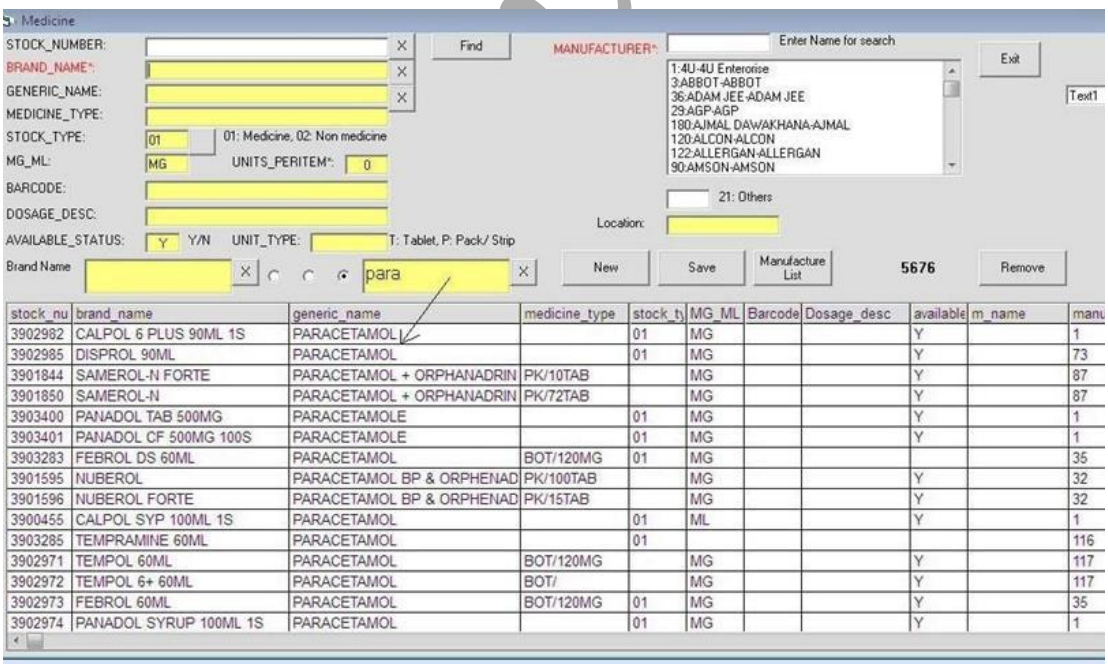
Candidate Key Examples

The following combinations distinguish customer records or tuples.
{cname, telno}, {natid}
{natid, cname}
As {natid} □ {natid, cname}, then
{natid, cname} is not candidate key and {natid} is a candidate key
Example-3: Employee(empno, name, birth_date, address, city, telno, citizenship_id)
empno, telno, citizenship_id are possible candidate keys
Candidate Keys with Examples

Exercises

Course (cid, cname, deptno) Semester (sid, syear, startdate) ClassAllocation (sid, cid, sec#, building#, room#)
Identify candidate keys in each of the above relations
Candidate Keys with Examples

Candidate Key for Search purpose



stock_nu	brand_name	generic_name	medicine_type	stock_t	MG_ML	Barcode	Dosage_desc	available	m_name	manu
3902982	CALPOL 6 PLUS 90ML 1S	PARACETAMOL		01	MG			Y		1
3902985	DISPROL 90ML	PARACETAMOL		01	MG			Y		73
3901844	SAMEROL-N FORTE	PARACETAMOL + ORPHANADRIN	PK/10TAB		MG			Y		87
3901850	SAMEROL-N	PARACETAMOL + ORPHANADRIN	PK/72TAB		MG			Y		87
3903400	PANADOL TAB 500MG	PARACETAMOLE		01	MG			Y		1
3903401	PANADOL CF 500MG 100S	PARACETAMOLE		01	MG			Y		1
3903283	FEBROL DS 60ML	PARACETAMOL	BOT/120MG	01	MG					35
3901595	NUBEROL	PARACETAMOL BP & ORPHENAD	PK/100TAB		MG			Y		32
3901596	NUBEROL FORTE	PARACETAMOL BP & ORPHENAD	PK/15TAB		MG			Y		32
3900455	CALPOL SYP 100ML 1S	PARACETAMOL		01	ML			Y		1
3903285	TEMPRAMINE 60ML	PARACETAMOL		01						116
3902971	TEMPOL 60ML	PARACETAMOL	BOT/120MG		MG			Y		117
3902972	TEMPOL 6+ 60ML	PARACETAMOL	BOT/		MG			Y		117
3902973	FEBROL 60ML	PARACETAMOL	BOT/120MG	01	MG			Y		35
3902974	PANADOL SYRUP 100ML 1S	PARACETAMOL		01	MG			Y		1

DBA can create Index on searching attributes (candidate Keys)
Introduction to Database Administration

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TOPIC 11

Primary Key
Primary Key

Primary Keys

Primary key definition
An alternate definition
Primary key examples & issues
Primary Key
Primary Key Definition
A primary key is a candidate key selected as the primary means of identifying rows in a relation:
There is one and only one primary key per relation
The primary key is NOT NULL, UNIQUE
The ideal primary key is short, numeric(alpha), indexed, fixed length and never changes
Key that has its ownership of an
Enterprise
The primary key may be a composite key
Primary Key

Primary key
An Alternate Definition

A primary key is a minimal identifier that is used to identify tuples uniquely.

This means that no subset of the primary key is sufficient to provide unique identification of tuples.
NULL values is not allowed in primary key attribute.

Example:

Primary key - Example & Issues

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STU_ID
(Practically PK must have UNIQUE, NOT NULL, INDEXO on an adribute)
STUDENT

STU_ID	NAME	CID_ID	DOB	DOB DEPTCODE

Although, candidate keys are STU_ID, CIT_ID. Organization ITSELF issues its Dwn identifier PK. PK is a property of an organization. Driving license# is a property of Ministry of Motors/ transportation, it must not be used PK in university or other organizations. It is a candidate key for other organization for search puposes,
Note: It is not recommended to create PKs for columns like Quantity, Salary, Price and column that has datatype DATE
Introduction to Database Administration

TOPIC 12

Primary Keys Examples
Primary Keys Examples

Primary Keys

Primary Key – student
Primary Key - More Examples
Primary Keys Examples
Primary key - Student

Example-1:
STUDENT(StuID, FirstName, FamilyName, DOB, …)

Example-2: Building (B#, BName, Location, Region),

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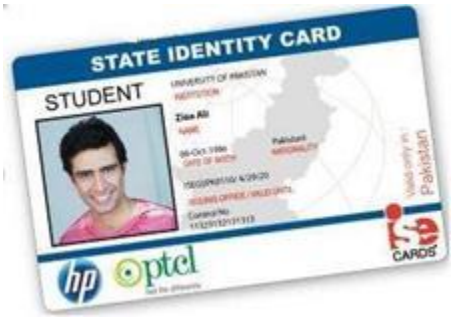

B# is a primary key. Although, BName is unique, not null but it is not short.
Primary Keys Examples
Primary key - More Examples

Example-3: Customer (cname, citizenid, address, city, telno)
This relation indicates the information about personal details. There is a chance that cname is duplicated, some may have citizenid and telno as null. This forces us to introduce new a attribute such as cust# that would be a primary key.

Customer (cust#, cname, citizenid, address, city, telno)
Primary Keys Examples

Primary key - More Examples

Example-4:
BankBranch(Branch-Name, City, TotalAsset)
What will be a PK that you will suggest?
What is a candidate key?
Which attribute is unique?
There may be many branches in one city then finalize this relation with possible constraints
Introduction to Database Administration

TOPIC 13

Primary Keys Examples
Primary Keys Examples

Primary Keys

Primary key instances

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Fixed length examples
Indexing
Primary Keys Examples
Primary key Instances

512235665 Social Security Number 610112654 (By Birth Asian, European, HomeLand)
200338900 Student ID (With Registration year)
LHR051 Product ID (with Manufacturing Loc
31266885 Bank Acc# (followed by

Branch Code)

Primary Keys Examples
Primary key Instances

Serial# starts with 1 and incremented by 1 005384 Company has many branch codes 005
007004 invoices issued from branches
Primary Keys Examples
Primary key Fixed Length

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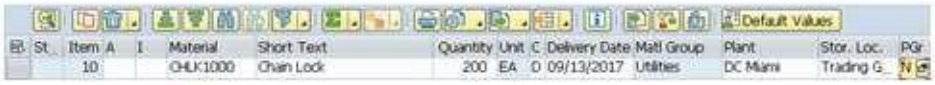
After clicking on compare your screen with the one below.



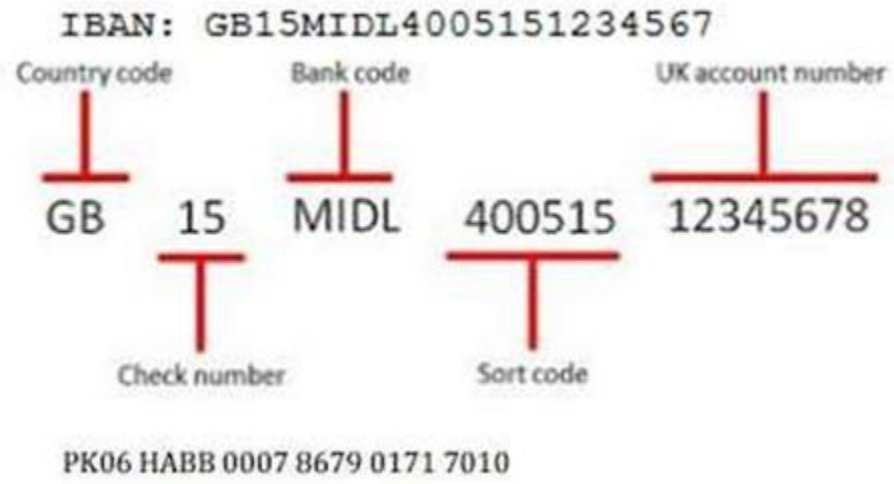
Then, click on to save your purchase requisition. The system will create a unique document number. Purchase requisition number 0010000000 created

Click on the exit icon to return to the SAP Easy Access screen

Encircled Fixed Length Key Identifiers

Primary Keys Examples

Primary key - Fixed Length



PK06 HABB 0007 8679 0171 7010

Primary Keys Examples

```
Table: PATIENT_VISIT
Index: Yes, PK
Test Query execution time:less than 1 second

Table: PATIENT_VISIT1
Index: NO
Test Query execution time:12 seconds

SQL> select count(*) Total_Records
  2  from PATIENT_VISIT;

  Total_Records
---------------
         625721

Elapsed: 00:00:00.04
```

```
SQL> select PATIENT_ID, max(PATIENT_VISITNO)
  2  from PATIENT_VISIT1
  3  where PATIENT_VISITNO = (select max(PATIENT_VISITNO)
  4     from PATIENT_VISIT1
  5     where DEPEND_SNO='0')
  6  group by PATIENT_ID
  7  having count(*)>=1;

PATIENT_ID MAX(PATIENT_VISITNO)
---------- --------------------
9999993                    1316

Elapsed: 00:00:11.54
```

```
  PRIMARY KEY ( PATIENT_ID, DEPEND_SNO, PATIENT_VISITNO )
```

Primary key - Indexing
Introduction to Database Administration

TOPIC 14

Primary Key Formats
Primary Keys Formats

Primary Keys

Primary key Indexing
Basics of indexing
Indexing on DBMS
Who will decide?
Primary Keys Formats
Basics of Indexing

Paging a key's data to access fast.
It may includes sorting from A to Z or Z to A.

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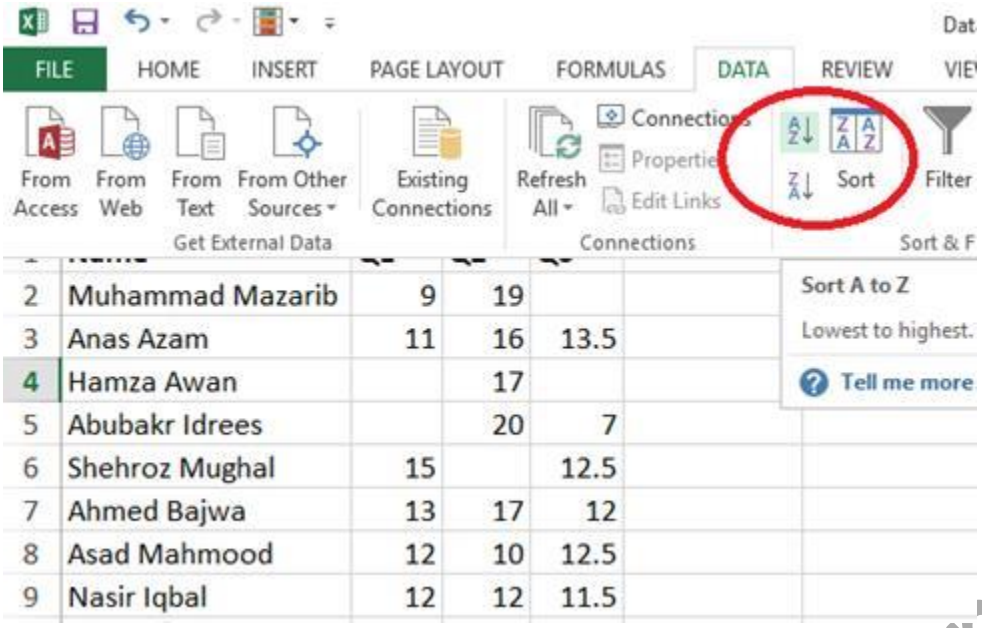

Indexing is applied on non-key columns where mostly search is required

Primary Keys Formats

Primary key – Indexing on DBMS

```
Table: PATIENT_VISIT
Index: Yes, PK
Test Query execution time:less than 1 second

Table: PATIENT_VISIT1
Index: NO
Test Query execution time:12 seconds

SQL> select count(*) Total_Records
  2  from PATIENT_VISIT;

  Total_Records
---------------
     625721

Elapsed: 00:00:00.04
```

```
SQL> select PATIENT_ID, max(PATIENT_VISITNO)
  2  from PATIENT_VISIT1
  3  where PATIENT_VISITNO = (select max(PATIENT_VISITNO)
  4     from PATIENT_VISIT1
  5     where DEPEND_SNO='0')
  6  group by PATIENT_ID
  7  having count(*)>=1;

PATIENT_ID MAX(PATIENT_VISITNO)
---------- --------------------
9999993                    1316

Elapsed: 00:00:11.54
```

```
  PRIMARY KEY ( PATIENT_ID, DEPEND_SNO, PATIENT_VISITNO )
```

Primary Keys Formats

Primary key – Who will decide?

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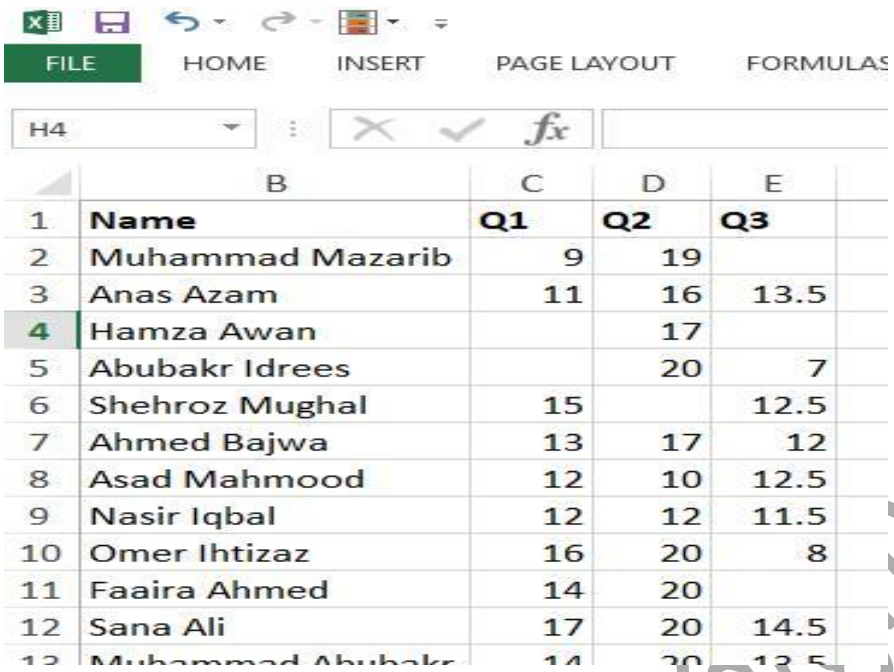

	B	C	D	E
1	**Name**	**Q1**	**Q2**	**Q3**
2	Muhammad Mazarib	9	19	
3	Anas Azam	11	16	13.5
4	Hamza Awan		17	
5	Abubakr Idrees		20	7
6	Shehroz Mughal	15		12.5
7	Ahmed Bajwa	13	17	12
8	Asad Mahmood	12	10	12.5
9	Nasir Iqbal	12	12	11.5
10	Omer Ihtizaz	16	20	8
11	Faaira Ahmed	14	20	
12	Sana Ali	17	20	14.5

Roll# is issued by some University or college Format or instance, meaningful column for PK
Introduction to Database Administration

TOPIC 15

Surrogated Keys
Surrogated Keys

Surrogated Keys

Definition
Examples
Exercises
Surrogated Keys
Surrogated Key Definition
A surrogate key as an artificial column added to a relation to serve as a primary key:
DBMS supplied
Short, numeric and never changes – an ideal primary key!
Has artificial values that are meaningless to users
Normally hidden in forms and reports
Surrogated Keys

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Example

RENTAL_PROPERTY without surrogate key:

RENTAL_PROPERTY (Street, City, State/Province, Zip/PostalCode, Country, Rental_Rate)

RENTAL_PROPERTY with surrogate key:
RENTAL_PROPERTY (PropertyID,

Street, City, State/Province, Zip/PostalCode, Country, Rental_Rate)
Surrogated Keys
Exercises

Lets solve following examples

When to put up a complaint by using phone?

ComplaintRef# is normally generated

Needs attributes?

End
Introduction to Database Administration

TOPIC 16

Surrogated Keys Examples
Surrogated Keys Examples

Surrogated Keys Examples

More Examples

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Insurance & ATM Transaction
Keys columns with order
Interesting example
Surrogated Keys Examples

More Examples

ATMTransaction
(Card#, Serial#, Amount, DrawDate)

Need more attributes

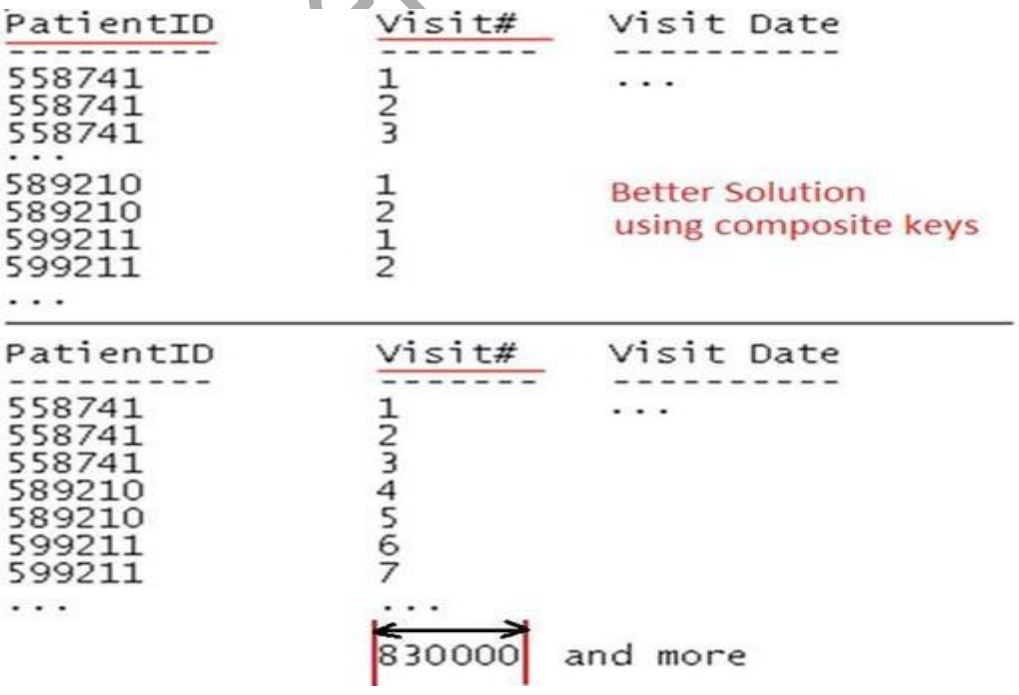
Machine#, Type, Status, LimitBalance
Surrogated Keys Examples

More Examples

InsurancePaid
(Policy#, PaidYear, PaidDate, Amount)

Need more attributes

DueDate, DueAmount, Balance, Charges
Surrogated Keys Examples
Keys with order in columns



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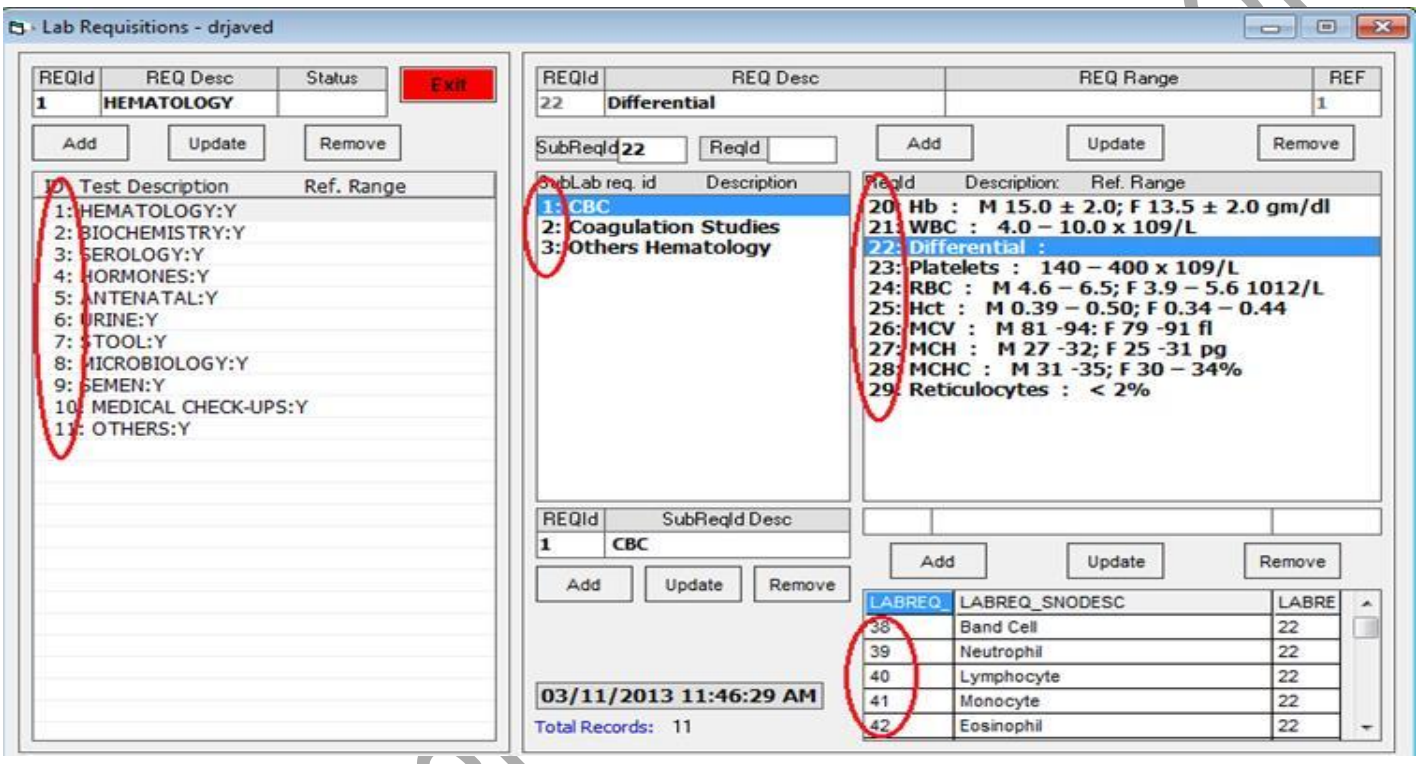
TOPIC 17

Surrogated Keys Examples
Interesting example



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Surrogated Keys Examples
Surrogated Keys Examples

Surrogated Keys

Solving example-1
Solving example-2
Surrogated Keys Examples
Solving Example-1

Let us choose

Invoice, when buying some items

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Surrogated Keys Examples
Solving Example-2
Let us discuss
We visit some wedding hall to book some event.

How staff of hall will store event's details? Which columns are required.
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TOPIC 18

Surrogated Keys Examples
Surrogated Keys Examples

Surrogated Keys

Solving example-1
Solving example-2
Comparisons of Keys
Surrogated Keys Examples

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Solving Example-1 (Saving blogs)
Surrogated Keys Examples
Solving Example-2
Let's us assume a loan of Rs. 50,000

How to decide which columns are required to fill up to keep track record of installments?
Surrogated Keys Examples

Comparisons of keys

Let us discuss

What is difference between PK & surrogated key

What is difference between PK & unique key

Give three more examples of surrogated keys from real-life.

End
Introduction to Database Administration

TOPIC 19

Foreign Keys
Foreign Keys

Foreign Keys
Definition
Example-1
Example-2
Foreign Keys
Definition
A foreign key is an attribute that refers to a primary key of same or different relation to form a link (constraint) between the relations:
A foreign key can be a single column or a composite key
The term refers to the fact that key values are *foreign* to the relation in which they appear as foreign key values
Ideally Data type, Length/ Size of FK and referring PK must be same

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Foreign Keys
Example-1

DEPARTMENT (DeptID, DepartmentName, BudgetCode, ManagerName)
EMPLOYEE (EmpNumber, EmpName, *DeptID*)

Name of FK column may be different from the name of referencing PK

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End
Foreign Keys

Example-2
CUSTOMER(CustId, Name, Address, Telno, Email)
ORDERS(Invoice#, InvType, InvDate,

CustomerId)

Does Invoice# always contain serial numbers?

Introduction to Database Administration

TOPIC 20

Foreign Keys Examples

Foreign Keys Examples

Foreign Key Examples

Relationship details
FK & Recursive Relationship
Logical link between tables

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Foreign Keys Examples

Relationship details

Deptno is a PK in DEPT table*

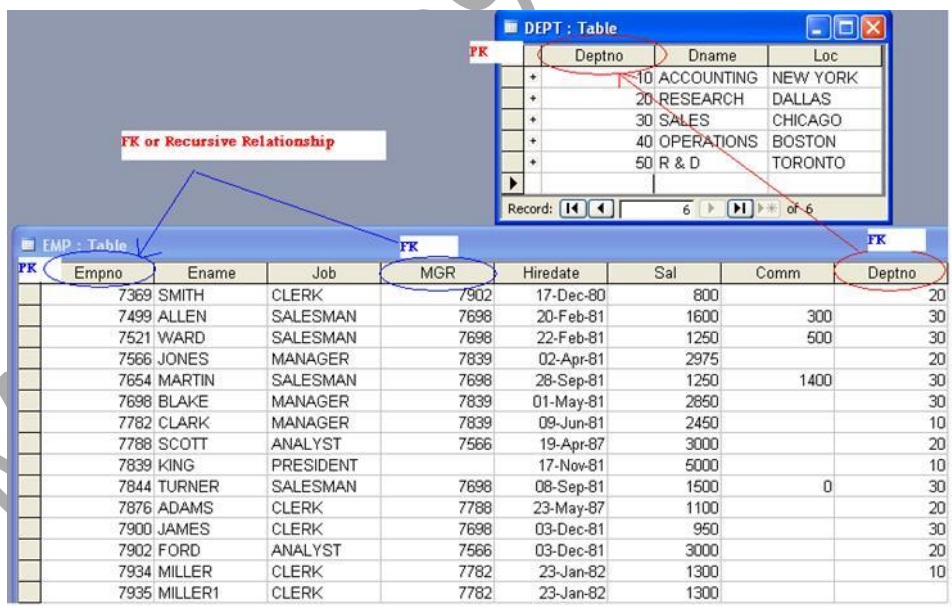
Empno is a PK in EMP table

Deptno is a FK in EMP table*

(it references to an attribute Deptno of DEPT table)

NOTE: An attribute within one relation that matches the key (Primary/same) in the same relation, is called recursive relation

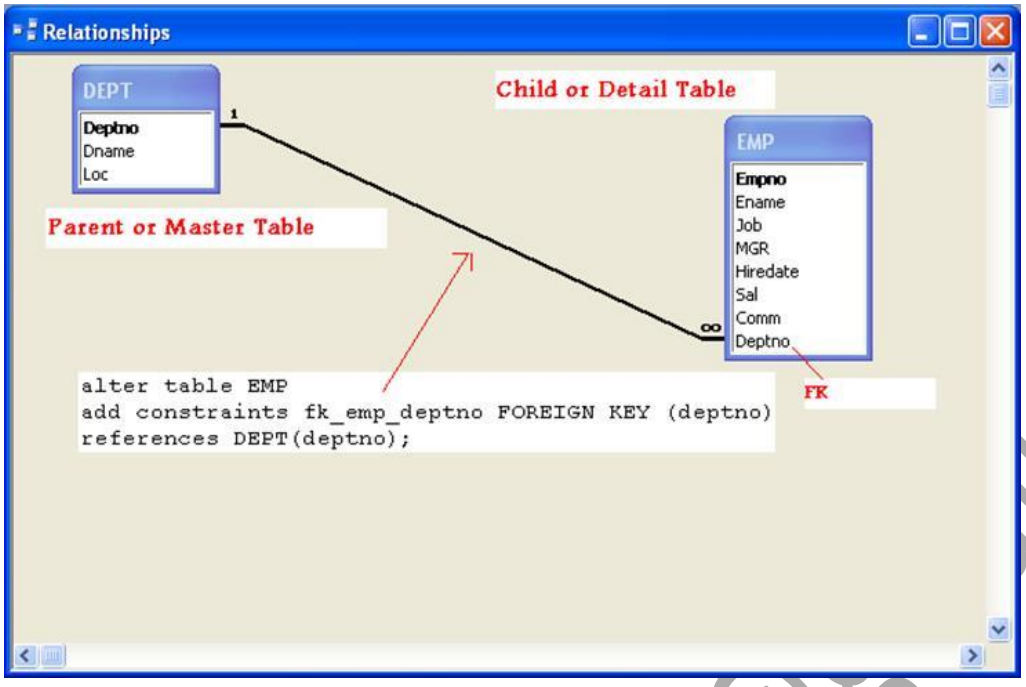
Foreign Keys Examples



FK & Recursive Relationships

Foreign Keys Examples

Logical link between tables



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TOPIC 21

Foreign Keys Examples
Foreign Keys Examples
Foreign Keys Examples

FK is a part of composite key
Logical link between tables
Recursive Relationship
Foreign Keys Examples
FK is a part of Composite keys
NOTE: PK column is underlined
ITEM (Item#, Item_Name, Department, Buyer)
ORDER_ITEM (OrderNumber, *Item#*, Quantity, Price, ExtendedPrice)

Where ORDER_ITEM.ITEM# must exist in ITEM.ITEM#
OrderNumber is an alternate name of

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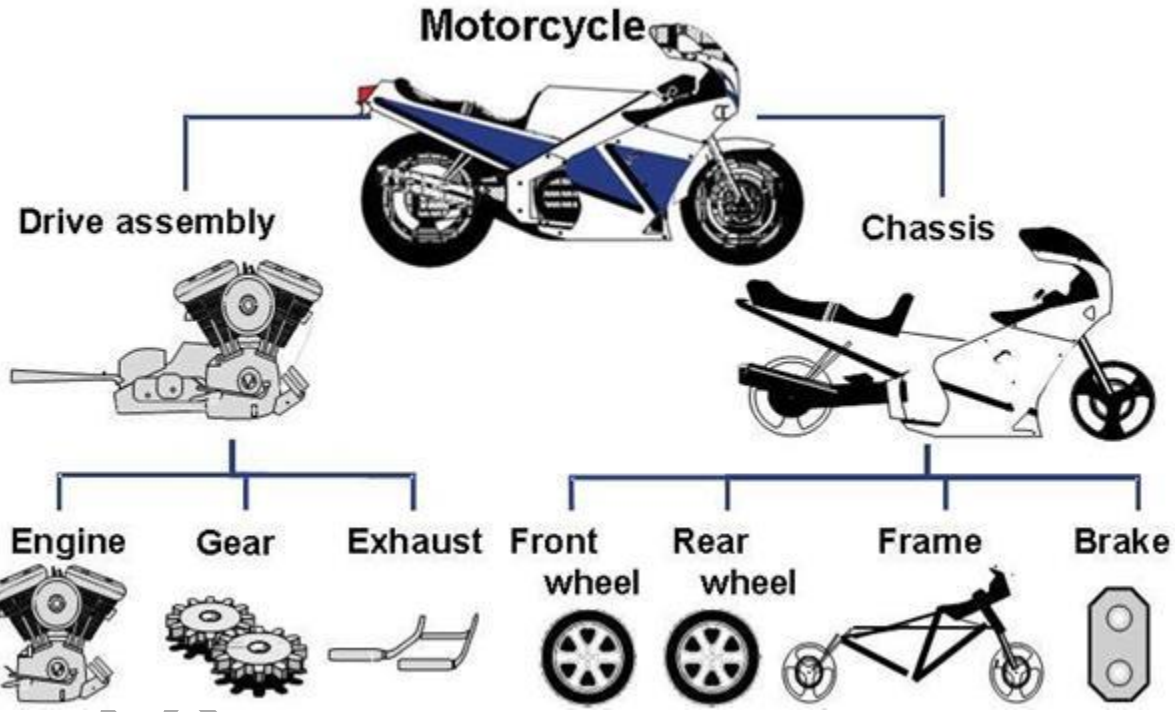
InvoiceNumber

Foreign Keys Examples

Referential Integrity Constraint

A referential integrity constraint is a statement that limits the values of the foreign key to those already existing as primary key values in the corresponding relation

Foreign Keys Examples



Recursive Relationship

Part (Part#, PName, Weight, MakeYear, Price, PType, *RefPart#*)

PType: Assembled product/ parts (e.g., Motorcycle) or single part

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TOPIC 22

Foreign Keys Examples

Foreign Keys Examples

Foreign Keys Examples

Integrity rules
Referential with cascade
Integrity Example
Foreign Keys Examples

Integrity Rules

Entity integrity

No two rows with the same primary key value
No null values in a primary key

Referential integrity

Foreign keys must match candidate key of source table
Foreign keys in some cases can be null
The database must not contain any unmatched foreign key values.
If B references A, A must exist.
Foreign Keys Examples

Referential with cascade

When we update a tuple from a table, say S, that is *referenced* by another table, say SP,
There are similar choices of *referential actions for update and delete*:
ON UPDATE CASCADE
ON UPDATE RESTRICT

There could be other choices besides these three. , e.g.,
ON UPDATE SET DEFAULT.
ON UPDATE SET NULL.

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o	NAME	STATUS	CITY

SO		
SP	P#	QTY
S2	P1	300
S2	P2	400
is	P2	200
S4	P2	200
s4	4	300
S4	as	400

P#	PNAME	COLOR	WEIGHT	CITY
P1	Nut	Red	12	London
P2	Bolt	Green	17	Paris
P3	Screw	Blue	17	Rome
P4	Screw	Red	14	London
PM	Cam	ue	2	Paris
P6	Cog	Red	lf	London

Integrity Example

81	Smith	20	London	S1	P 1	300
82	Jones	10	Paris	S 1	P2	200
83	Blake	30	Paris	SI	P3	400
84	Clark	20	London	S 1	P4	200
85	Adams	30	Athens	S 1	P5	100
					P6	100

s

TOPIC 23

Composite Keys

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Composite Keys

Composite Keys

Definition
Basic examples
Other Examples
Composite Keys

Definition of Composite Key

Combination of primary keys in a relation of selected attributes gives the concept of composite key.
Composite key is an extended form of a primary key.
All the characteristics of PK applies on Composite Keys more than one columns
Composite Keys

Basic Example of Composite Keys

During ATM Transaction, amounts can be drawn several times on one ATM Card.

We need follow the issues
How much amount will be withdrawn? When amount was drawn?
Which machine has been used? What are the types of transaction?
Card#, Amount, DrawDate, Machine#,
TransType are the attributes for transaction
Composite Keys

Other Examples of Composite Keys

Can we say Card# will be a primary key? NO Can DrawDate will be a key with Card#? NO
Then what to do? Add Surrogated key which is TransNo

ATMTransaction(Card#, TransNo, Amount, DrawDate, Machine#, TransType)

Date includes time in seconds as well.
Many transactions are managed on same date.
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TOPIC 24

Composite Keys Examples

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Composite Keys Examples

Composite Key

Preparing Dataset for Composite Keys
Hospital Related Example
What about Excluding Composite Keys?
Composite Keys Examples
Preparing Dataset for Composite Key
Card(Card#, CardHolderName, ExpiryDate, IssueDate, Acc#)

ATMTransaction(Card#, TransNo, Amount, DrawDate, Machine#, TransType)

Do we need most closed related table? What are PK and FK?
Composite Keys Examples

Hospital Related Example

PatientVisit(PatID, VisitSNO, Vdate, DocID, Diagnosis,…)

LabTest(*PatID*, *VisitSNO*, TestID, Tdate, …)

LabTest has FKs *PatID, VisitSNO,* referring to same corresponding composite keys in PatientVisit

Which lab table needs to be considered?
Composite Keys Examples
What about Excluding Composite Key?
Card(Card#, CardHolderName, ExpiryDate, IssueDate, Acc#)

ATMTransaction(ID, Card#, TransNo, Amount, DrawDate, Machine#, TransType)

Do we need most closed related table?
What is a drawback of using ID as Surrogated Key in ATMTransaction? What are PK and FK?

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TOPIC 25

Composite Keys Examples

Composite Keys Examples

Composite Keys Examples

Course offering example
Preparing datasets
Composite Keys Examples

Course Offering Example

Let's us assume, there are 1000 number of courses in a table or list.
Students want to register in courses.
Can they register by looking at 1000 courses? NO
What to do?

Offer selected courses?
Composite Keys Examples

Course Offering Example

Offering course table

CrsOffer(SemID, CrsID, Sec, InstrName, B#, R#) What to do for keys, PK or Composite Key?
CrsOffer(SemID, CrsID, Sec, InstrName, B#, R#)
CrsReg(SemID, Roll#, CrsID, Sec, TotMarks, Grade)
Composite Keys Examples

Preparing Dataset for Composite Keys

CrsOffer(SemID, CrsID, Sec, InstrName, Building#, Room#)

CrsReg(SemID, Roll#, CrsID, Sec, TotMarks, Grade)

Do we need most closed related tables?

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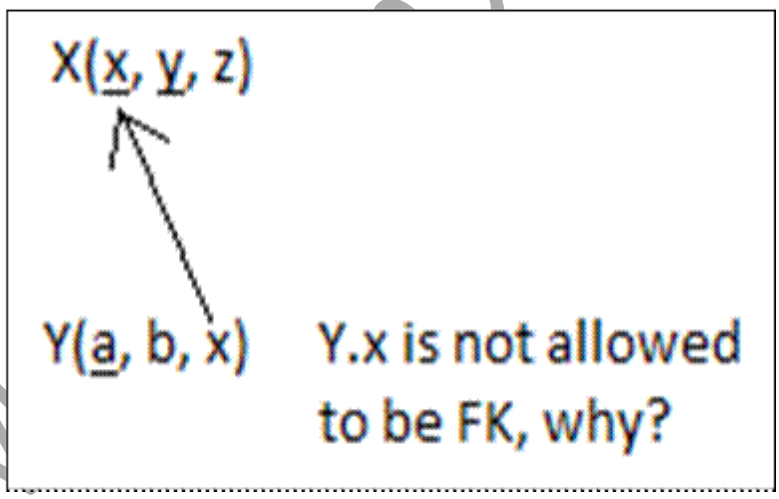
What are PK and FK?
Introduction to Database Administration

TOPIC 26

Composite Keys Examples
Composite Keys Examples

Composite Keys Examples

Meaningful learning-1
Meaningful learning-2
Wrong composite key
Indexing columns
Composite Keys Examples
Meaningful learning-1



Composite Keys Examples
Meaningful learning-2

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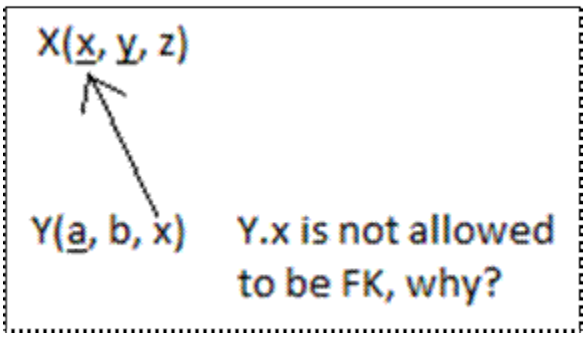
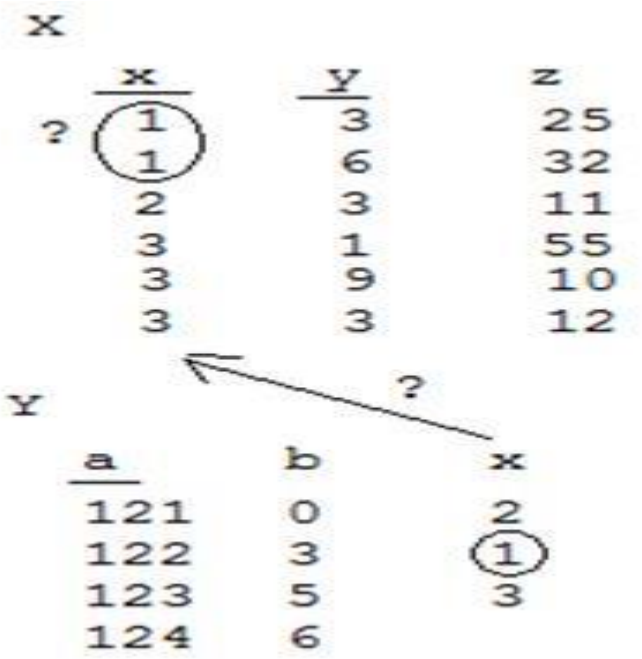


Analysis and Semantics
Evaluations



Semantics: Creating two tables with relevant data
Analysis: Y.x=1 cannot be mapped exactly with
X.x records 1, 3 or 1, 6

Evaluations: Default FK Y.x cannot be created. Trigger can be created on Y.x to make sure Y.x will be a subset of X.x. Otherwise, data can be put in Y.x which does not belong to or mapped to X.x.

Composite Keys Examples
Wrong composite key

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Do NOT make composite Key

Department

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

PK

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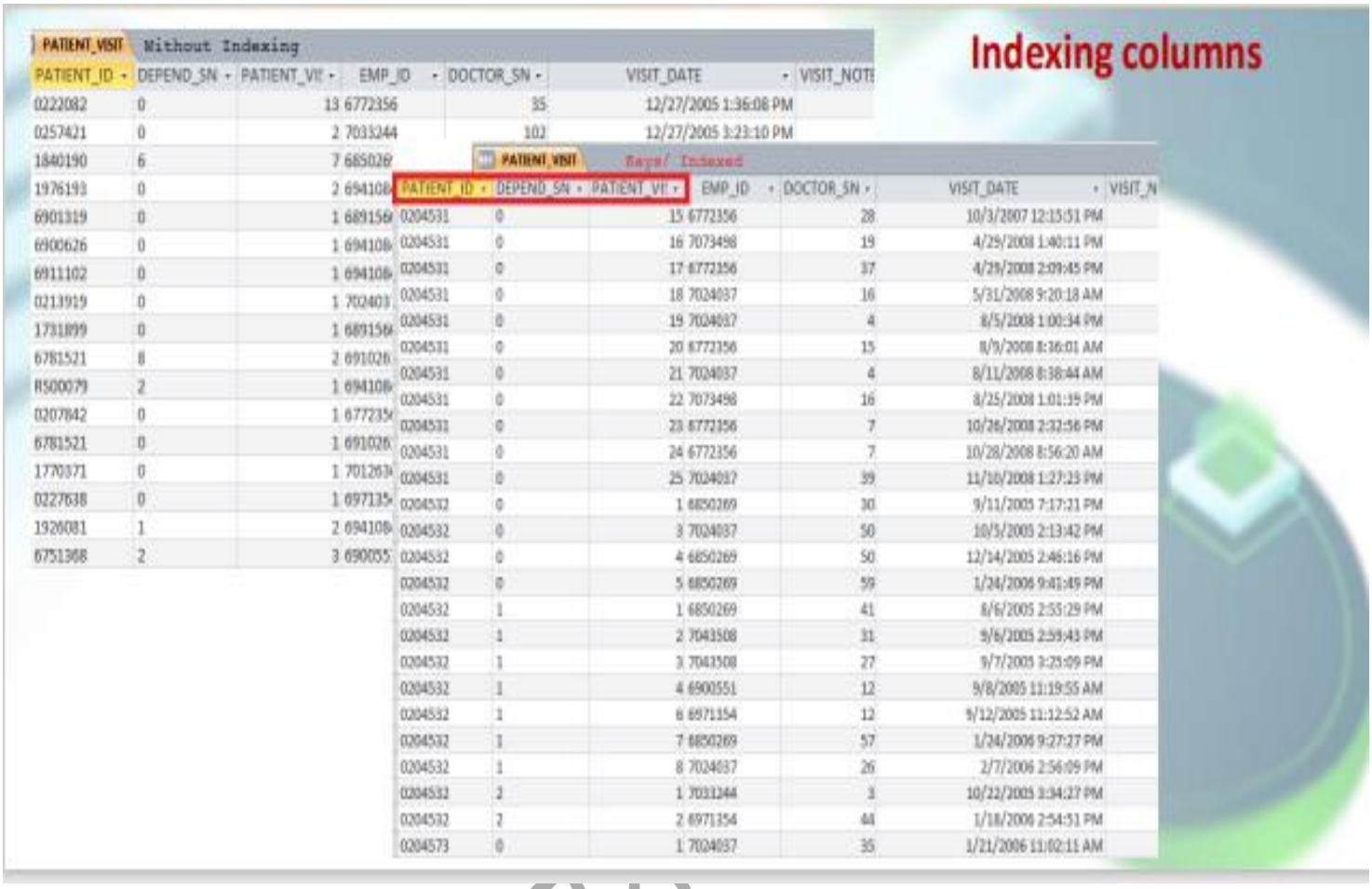

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TOPIC 27

Additional or Other Constraints

Additional or Other Constraints

Other constraints

What are additional or other constraints?
Null
Domain constraint
Additional or Other Constraints
What are additional or other constraints?
Other Constraints means additional constraints in addition to the standard constraints PK, FK, Composite Key, Surrogated key

For example, NOT NULL, CHECK, DEFAULT,
UNIQUE etc.
Additional or Other Constraints
Null

Represents a value of an attribute that is currently unknown or is no applicable for this tuple, means nothing.

Cannot compute anything with the Null
Additional or Other Constraints
Domain constraint

Specifies that the value of attribute A must be an atomic value from the domain *DOM(A).*
E.g., Width of column or Check on column.

Domain constraints must be Atomic means no two mobile numbers saved in one cell of a domain. Size of column must be appropriate.

S.	RollNo	Name	Total:	20	20	10
30	18I-0599	Saifullah Dar		16	16	8
31	18I-0645	Muzammil Shakir		15	10	7.5

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TOPIC 28

Additional Constraints using Tables

Additional Constraints using Tables

Other constraints

CHECK constraint
Unique & Default constraints
Composite unique constraints
Example of Trigger
Additional Constraints using Tables

CHECK constraints

The check clause in SQL permits domains to be restricted:
Use check clause to ensure that an hourly- wage domain allows only values greater than a specified value.
create domain *hourly-wage* numeric(5,2)
constraint *value-test* check*(value* > = 4.00)
The domain *hourly-wage* is declared to be a decimal number with 5 digits, 2 of which are after the decimal point
Additional Constraints using Tables

CHECK constraints

create table account
(branch-name Varchar(15),
acc-number Char(10) not null,
balance integer,
……)

alter table account
add constraint ck1 check (bal > 0);

alter table emp
add constraint ck1_deptno check (deptno in (10,20,30));
Additional Constraints using Tables

UNIQUE & Default constraints

create table Dependent
(empno CHAR(6),
SNO Number(2),

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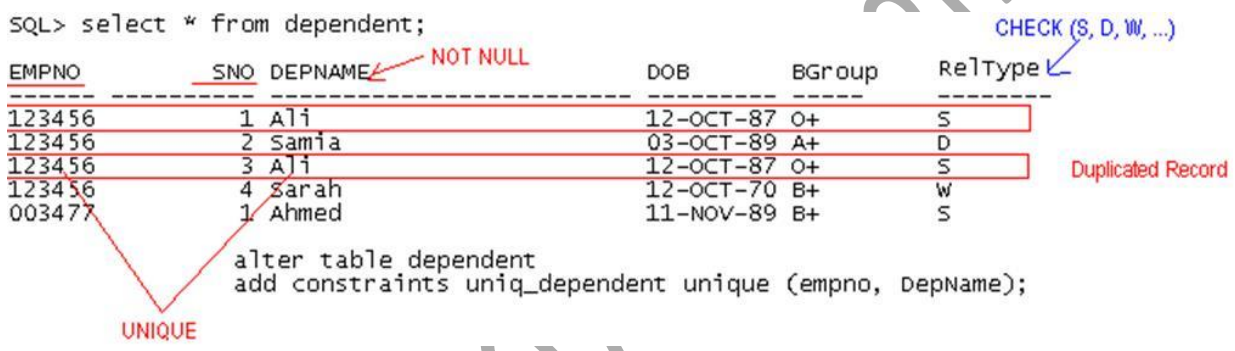
DepName varchar2(25) NOT NULL, DOB Date,
BloodGroup VARCHAR2(5),
RelType CHAR(1) Default 'W');

alter table dependent
add constraints pk_dep_empnoSNO primary key
(empno, sno);

alter table dependent
add constraints uniq_dependent unique (empno,
DepName);
Additional Constraints using Tables
Composite UNIQUE constraints



HECK (Max_Participants>=Enrolled_Participants)
CHECK (Deptno>0)
CHECK (RelType IN ('S', 'D', 'W'))
Default 'Y'
Database Triggers
Additional Constraints using Tables
Example of Trigger

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```
CREATE OR REPLACE TRIGGER display_salary_changes
BEFORE DELETE OR INSERT OR UPDATE ON EMP
FOR EACH ROW
WHEN (NEW.EMPNO > 0)
DECLARE
   sal_diff number;
BEGIN
   sal_diff := :NEW.sal  - :OLD.sal;
   dbms_output.put_line('Old salary: ' || :OLD.sal);
   dbms_output.put_line('New salary: ' || :NEW.sal);
   dbms_output.put_line('Salary difference: ' ||
sal_diff);
END;
/
```

Introduction to Database Administration

TOPIC 29

Additional Constraints using DDL Alter SQL

Additional Constraints using DDL Alter SQL

Constraints with DDL Alter SQL

PK constraint on table
FK constraint on table
Composite unique & PK constraints
Additional Constraints using DDL Alter SQL
Primary key constraint on table
create table customer
(cid char(10),
Name varchar2(100) Not null, address varchar2(100),
city varchar2(20)
);

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alter table customer
add constraints pk_cid primary key(cid);
Additional Constraints using DDL Alter SQL
Foreign key constraint on table
create table orders
(ordNo CHAR(5),
OrdType CHAR(1) not null, OrdDate Date,
TotalPrice Number(10,2), cid CHAR(10)
);
alter table orders
add constraints pk_ordNo primary key(ordNo);
alter table orders
add constraints fk_cid foreign key (cid) references customer(cid); --already created
Additional Constraints using DDL Alter SQL
Composite unique & PK constraints
create table Dependent (empno CHAR(6),
SNO Number(2),
DepName varchar2(25) NOT NULL, DOB Date,
BloodGroup VARCHAR2(5), RelType CHAR(1) Default 'W'); alter table dependent
add constraints pk_dep_empnoSNO primary key (empno, sno);
alter table dependent
add constraints uniq_dependent unique (empno, DepName);
Introduction to Database Administration

TOPIC 30

Additional Constraints using DDL Alter SQL
Additional Constraints using DDL Alter SQL

Constraints with DDL Alter SQL

Alter constraints ADD & Modify
Alter constraints using CHECK
Create table with multiple CHECK
Cascade and drop constraints
Additional Constraints using DDL Alter SQL
Alter constraints Add & Modify
Following constraints can be applied for an

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existing EMP table:

```
alter table emp modify
(sal constraint nt_null_emp_sal NOT NULL);

alter table emp
add (constraint ck1_emp check (deptno>0));
```

Additional Constraints using DDL Alter SQL

Alter constraints using CHECK

Following constraints can be applied for an existing EMP table:

```
alter table emp
add (constraint ck2_emp check (sal + NVL(comm,0)<=6000));

--Null is allowed, if column is not null alter table emp
add constraint ck1_emp check (deptno in (10,20,30));
```

Additional Constraints using DDL Alter SQL

Create table with multiple CHECK

```
create table AirTraveller (TicketNo CHAR(10), FirstName VARCHAR2(20),
FamilyName VARCHAR2(20) NOT NULL,
Nationality VARCHAR2(25), BirthDate   DATE,
FlyCode    Number,
CONSTRAINTS ch_natval CHECK (Nationality IN ('Canadian','UK','Pakistan','Bahrain')),
CONSTRAINTS ch_dob CHECK (BirthDate LIKE '[1-2][0-9][0-9][0-9]'),
CONSTRAINTS ch_flycode CHECK (FlyCode between 3 and 9));
```

Additional Constraints using DDL Alter SQL

Cascade & drop constraints

Cascade drops the FK of child table EMP emp.deptno references to dept.deptno

```
Alter table dept
drop constraint pk_deptno cascade;
```

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TOPIC 31

Keys & Constraints Revisions

Keys & Constraints Revisions

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Constraints Revisions

Standard constraints are
Super Key
Candidate Key
Primary Key (PK)
Surrogated Key
Foreign Key (FK)
Composite Key
Additional constraints are
Not Null, Check, Unique, Default, DOM Constraints using triggers
Keys & Constraints Revisions

Super Key and Candidate Key

Super Key describes concepts to find unique records, can be null & indexed

{Roll#, FullName} gives unique when FullName can be duplicated
{CNIC}, {Barcode} are also a super keys

Candidate key gives fewer records in search.
Candidate keys can be used for searching purposes
{CNIC}, {Roll#} and {MedName} are
candidate keys
Keys & Constraints Revisions

Primary Key

Gives unique record with conditions NOT NULL, UNIQUE and INDEXED

Fixed length, ownership and not frequently changed, Descriptive/ well defined key

Roll#, Empno, Item#, PatientID etc. 2019004, 16K-1005 etc.
Avoid PKs Price, Quantity, Rates
Keys & Constraints Revisions

Surrogated Key

Just like a PK but it is artificial key. Decided by the designer from set of attributes and meaningless to the user.

SerialNo or Card# with TransNo

Try to avoid Column with datatype DATE
Keys & Constraints Revisions

Foreign Key

Referencing key and also called referential integrity constraint

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Dept(DNO, Dname, Loc) Emp(Empno, Ename, Sal, DOB, DNO)

Emp.DNO is a FK references to Dept.DNO

FK is also Recursive Key!
Keys & Constraints Revisions
Composite Key
Collection of PKs in a relation

PatientVisit(PatID, VisitSNO, Vdate,
DocID, Diagnosis,…)

LabTest(*PatID*, *VisitSNO*, TestID, Tdate,
…)

Columns with red text are surrogated keys
Keys & Constraints Revisions
Additional Constraints

NOT NULL DOMAIN CHECK UNIQUE

End
DEFAULT and TRIGGER
Introduction to Database Administration

TOPIC 32

Script of Referential Integrity Constraints SQL
Script of Referential Integrity Constraints SQL

Script of Referential Integrity

Primary key with table
Primary & Foreign Key with table
Employee Prepares Order
Item Table
Sold Table & FKs
Script of Referential Integrity Constraints SQL
Primary key with Table

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Follow up all DDL in a given order of slides create table Customer
(custID CHAR(10),
CustName VARCHAR2(25) NOT NULL, Address VARCHAR2(50),
City VARCHAR2(50),
TelNo VARCHAR2(15),
Email VARCHAR2(50));

Alter table Customer
add constraint PK_Custid primary key
(CustID);
Script of Referential Integrity Constraints SQL

Primary & Foreign keys Create table Orders (InvoiceNo Varchar2(12), InvType CHAR(1),
InvDate Date NOT NULL, TotalPrice Number(6,2), CustID CHAR(8),
SalesEmpID CHAR(5));

Alter table Orders
add constraint PK_InvNo primary key (InvoiceNO);
Alter table Orders
add constraint FK_Cust_CustID foreign key (custID) references Customer(CustID);
Script of Referential Integrity Constraints SQL
Employee Prepares Order
create table Employee (EmpID CHAR(3),
EmpName VARCHAR2(25) NOT NULL, Address VARCHAR2(50),
City VARCHAR2(50),
TelNo VARCHAR2(15) UNIQUE,
Email VARCHAR2(50));
Alter table Employee
add constraint PK_EmpID primary key (EmpID);
Alter table Orders
add constraint FK_Emp_EmpID foreign key (SalesEmpID) references Employee(EmpID);
Script of Referential Integrity Constraints SQL
Item Table
Create table Item (ItemID CHAR(5),
ItemName VARCHAR2(50) NOT NULL,
PPrice NUMBER(10,2),
TotQty NUMBER(5),
Status CHAR(1)
);

Alter table Item
add constraint PK_ItemID primary key (ItemID);
Script of Referential Integrity Constraints SQL

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Sold Table & FKs Create table Sold (ItemID CHAR(5),
InvoiceNo CHAR(12),
SPrice NUMBER(10,2) Not Null,
SQty NUMBER(10,2) Not Null
);
Alter table Sold
add constraint PK_Sold primary key (ItemID, InvoiceNo); --Composite Key
Script of Referential Integrity Constraints SQL
Sold Table & FKs

Alter table Sold
add constraint FK_Sold_ItemID
foreign key (ItemID) references Item(ItemID);

Alter table Sold
add constraint FK_Sold_InvoiceNo
foreign key (InvoiceNo) references Invoice(InvoiceNo);

End
Introduction to Database Administration

TOPIC 33

Fundamentals of ER Model
Fundamentals of ER Model

Fundamentals of Entity Relationship (ER) Model

Semantic Modeling
Chen ER Model
System Development & DBA
Database Development
Conceptual Model
Conceptual Design
Fundamentals of ER Model
Semantic Modeling
A class of data models
Conveys semantic meaning
Implements databases more intelligently

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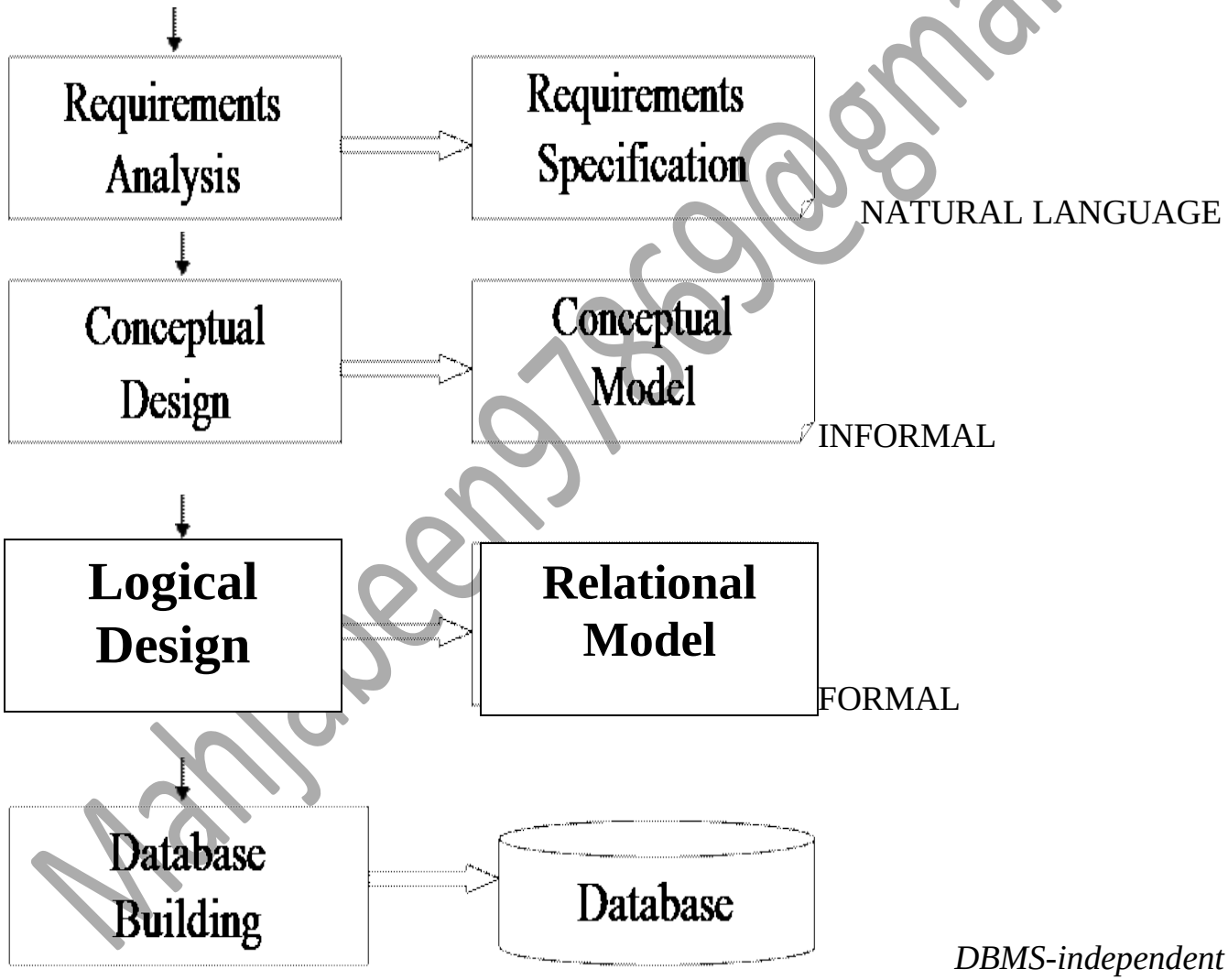
Support more sophisticated user interfaces (SQL queries, forms & reports)
Research started in 1970s and early 1980s
Other names are data modeling, E/R modeling, E-modeling
Fundamentals of ER Model
Chen ER Model
Chen in 1976 introduced the E/R model
The E/R model allows us to sketch the design of a database informally.
Designs are pictures called *entity- relationship diagrams*.
Fairly mechanical ways to convert E/R diagrams to real implementations like relational databases exist.
Fundamentals of ER Model
System Development & DBA



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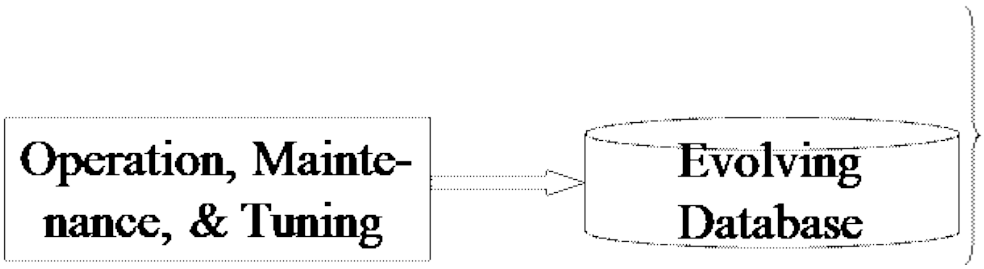

Physical/ DBA
Fundamentals of ER Model
Database Development
Requirements Analysis
Collect and Analyze the requirements of the users, e.g., Functional Specification, Prototyping.
Conceptual Design
Design a conceptual model (schema), e.g., ER model, ER Mapping.
Logical Design
Translate the ER model into a relational model (schema), DDL Scripts.
Normalization
Database Building
Build the database and write application programs for specific DBMS & S/W Appls/ Tools.
Operation, Maintenance & Tuning
Use/ Training, Installations, maintain and "tune" the database.
Fundamentals of ER Model
Conceptual Model
Highest conceptual grouping of ideas
Data tends to naturally cluster with data from the same or similar categories relevant to the organization
The major relationships between subjects have been defined

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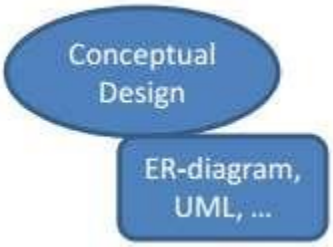
Least amount of detail
Fundamentals of ER Model
Conceptual Design



E ntity-Relationship (E R) Modeling
Entities -"things" in the real world

E.g.Car,Account,Product
Attributes – property of an entity,entity type,or

relationship type
E.g. color of a car, balance of an account, price of a product
Relationships – between entities there can be relationships, which also can have attributes

E.g. Person owns Car
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TOPIC 34

ER Diagram & Attributes Display
ER Diagram & Attributes Display

Attributes Display

For Logical Design
Symbols/ Notations
Motivational Example
Entity or Entity Type
Simple or Single Attributes
Composite Attributes
Multi valued Attributes
Derived or Stored Attributes
Complex Attributes
ER Diagram & Attributes Display
For Logical Design

Translate an ER schema into a relational schema.
Entity
Relationship
Attribute
Subtype

Normalization
To ensure you have a "good" design (Testing of your model).
ER Diagram & Attributes Display
Symbols/ Notations
Symbol Meaning

ENTITY TYPE

WEAK ENTITY TYPE

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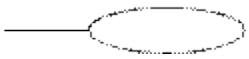
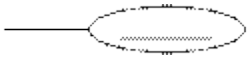
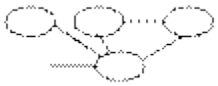
RELATIONSHIP TYPE

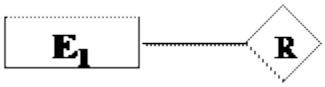


IDENTIFYING RELATIONSHIP TYPE ATTRIBUTE





KEY ATTRIBUTE MULTIVALUED ATTRIBUTE COMPOSITE ATTRIBUTE



N

R (min,max)

DERIVED ATTRIBUTE

TOTAL PARTICIPATION OF E_2 IN R

CARDINALITY RATIO 1:N FOR E_1:E_2 IN R

E

STRUCTURAL CONSTRAINT (min, max) ON PARTICIPATION OF E IN R

ER Diagram & Attributes Display

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Motivational Example

Consider building a course management system (CMS):

Students
Courses
Professors

Entities

Who takes what?
Who teaches what?

Relationships

What about Sales Items System?
ER Diagram & Attributes Display

Entity or Entity Type

An entity is an object or a concept that is identified by the enterprise as having an independent existence.
There are two types of entities:
Physical entities
Example: car, house, employee, part, supplier, building
Conceptual entities
Example: job, university course, sale, work experience, CourseReg
ER Diagram & Attributes Display

Simple or Single Attributes

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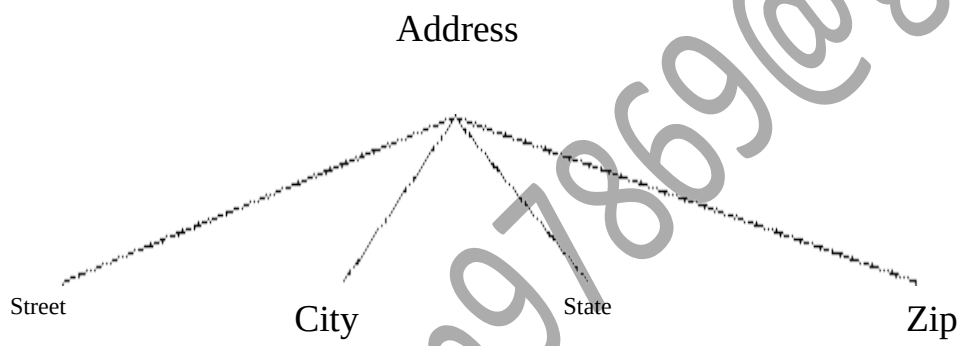
A simple attribute:
Consists of a single component with an independent existence.
Example: The Sex or Gender attribute of an EMPLOYEE entity
Example: Blood Group of a student
ER Diagram & Attributes Display
Composite Attributes

A composite attribute:
Consists of multiple components each with an independent existence.
Example: The Address attribute of an EMPLOYEE entity can be divided into Street, City, State, Zip.



ER Diagram & Attributes Display
Multivalued Attributes

An attribute that holds more than one value for a single entity.
Example: The Color attribute of a CAR entity, more than college degrees taken by students
Example: Multiple Phone numbers
ER Diagram & Attributes Display
Derived & Stored Attributes

Is an attribute that represents a value that is derived from the value of a related attribute or set of attributes not necessarily in the same entity.
Example 1: The value of the Age attribute of the EMPLOYEE entity can be derived from the today's date and the value of the employee BirthDate.
Example 2: The NumberofEmployees attribute of a DEPARTMENT entity can be derived from the EMPLOYEE table by counting the number of employees who work in that department.
ER Diagram & Attributes Display
Complex Attributes

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Is an attribute that is a nested combination of composite and multi- valued attributes in an arbitrary way.
Example: The complex attribute AddressPhone.

{AdressPhone({Phone(AreaCode, PhoneNumber)}, Address(StreetAddress(Number, Name, HouseNo), City, State, Zip))}
Note
Comma is used for separating the components
{} Represents multi-valued attributes
Introduction to Database Administration

TOPIC 35

Fundamental Notations of ER Diagram
Fundamental Notations of ER Diagram

Attributes Display

Symbol/ Notations
Entity Employee
Entity Department
Entity Project
Entities Department & Employee
Fundamental Notations of ER Diagram
Symbols/ Notations
Symbol Meaning

ENTITY TYPE

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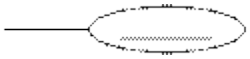
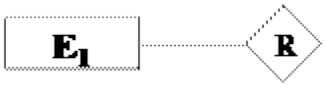
WEAK ENTITY TYPE

RELATIONSHIP TYPE

IDENTIFYING RELATIONSHIP TYPE ATTRIBUTE



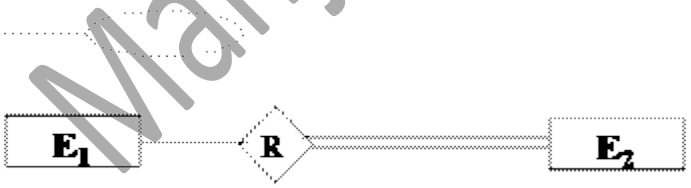
KEY ATTRIBUTE MULTIVALUED ATTRIBUTE COMPOSITE ATTRIBUTE



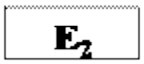
N

R (min,max)

DERIVED ATTRIBUTE



TOTAL PARTICIPATION OF E_2 IN R



CARDINALITY RATIO 1:N FOR E_1:E_2 IN R

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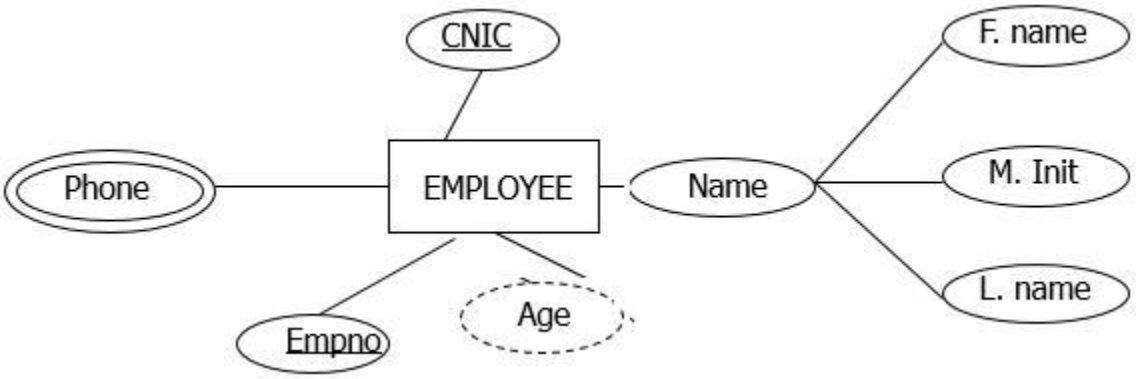
E
STRUCTURAL CONSTRAINT (min, max) ON PARTICIPATION OF E IN R
Fundamental Notations of ER Diagram

Entity Employee
Underlined are Key Identifiers
There is no PK and FK are shown in ER Diagram



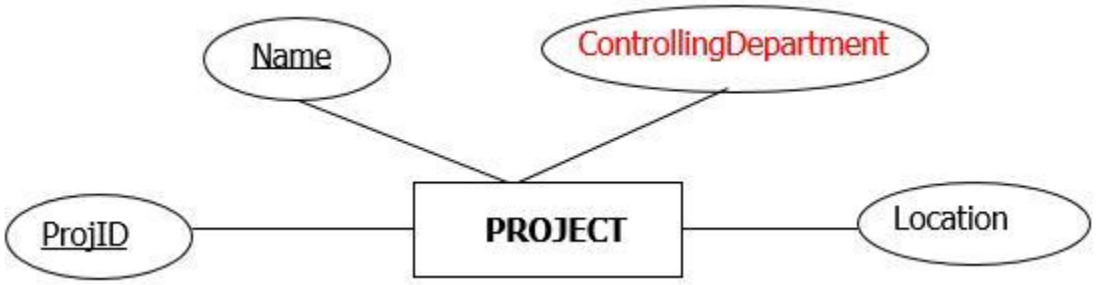
Fundamental Notations of ER Diagram
Entity Department

Underlined are Key Identifiers
There is no PK and FK are shown in ER Diagram
Double oval represents multi-valued

Fundamental Notations of ER Diagram

Entity Project
An entity type PROJECT has attributes:
ProjID (key identifier)
Name (key identifier)
DNumber (key identifier)

Location
ControllingDepartment
Budget
Start Date



End Dates
Fundamental Notations of ER Diagram
Entities Department & Employee

Consider Employees are working in departments:

Department
Employee
Manager/ Boss??

Entities

Employees are belong to Departments
Some employees are managers of department
Employee may work in more than one dept
Some are managers of other employees
Introduction to Database Administration

Relationships

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TOPIC 36

ER Diagram with Relationship one to many
ER Diagram with Relationship one to many

Attributes Display

Example-1 (1-M)
Example-2 (1-M)
Example-3 (1-M)
Example-4 (1-1)
Exercise
ER Diagram with Relationship one to many
Example-1 (one-many)

Any Employee has his/ her own department, where works in
One department has many employees or
Employee belongs to department

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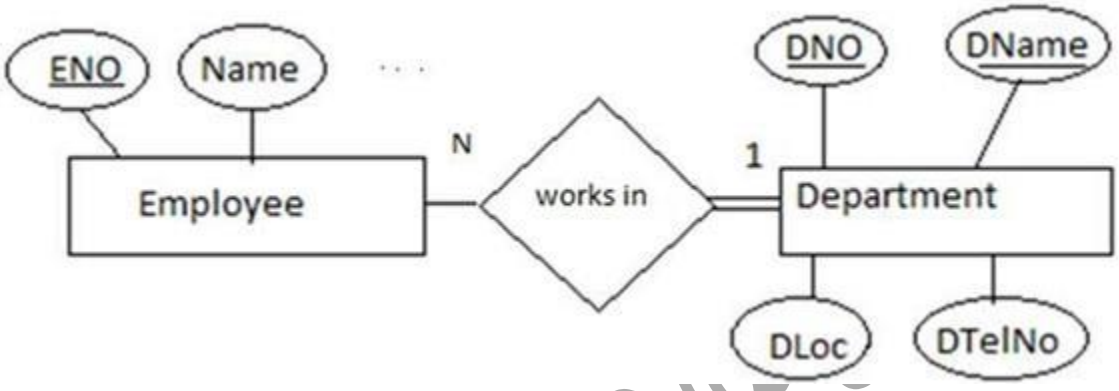
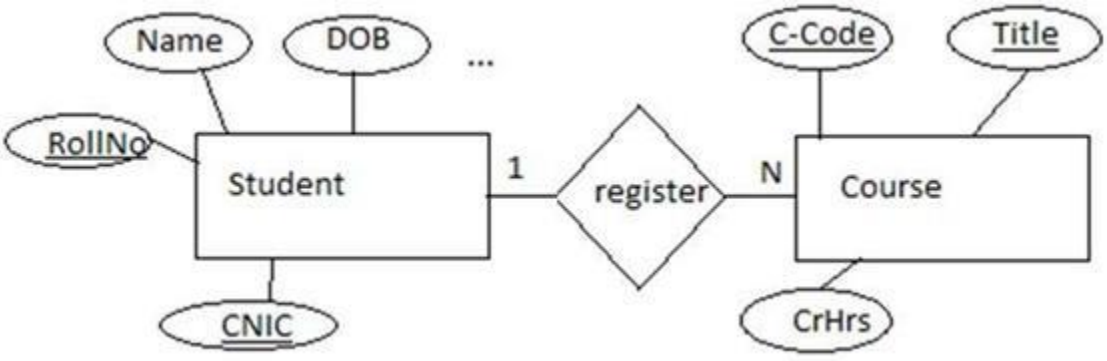
ER Diagram with Relationship one to many
Example-2 (one-many)

Any Employee has his/ her own department, where works in
Any one department has at least ONE or many employees
Employee belongs to department



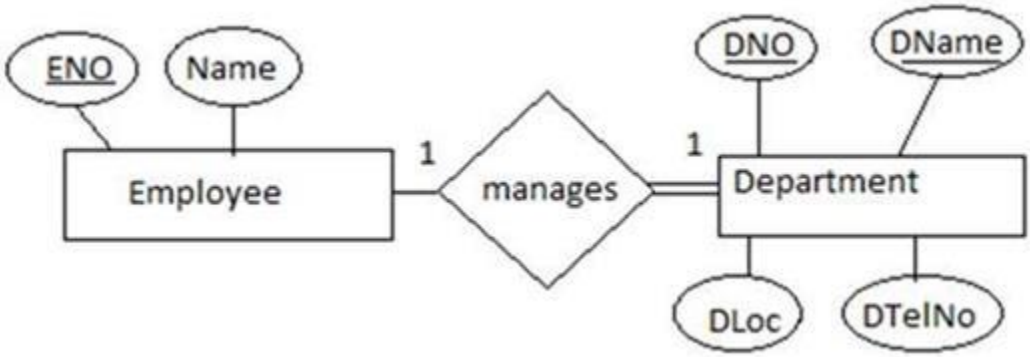
ER Diagram with Relationship one to many
Example-3 (one-many)

Below diagram is NOT correct.
Any one student can takes or registers many courses
But any one course is taken by many students



ER Diagram with Relationship one to many
Example-4 (one-one)
Some of employees will be a manager of departments.

Any one employee will be a manager of any one department but at the same time cannot be a manager of multiple departments
Any one department has one manager



as an employee.
ER Diagram with Relationship one to many
Exercise
Combining ER Diagrams of both one to one and one to many Entities are Department & Employee
Introduction to Database Administration

TOPIC 37

ER Diagram with Relationship many to many
ER Diagram with Relationship many to many

Attributes Display

Example-1 (M-N)
Example-2 (M-N)
Example-3 (M-N)
Example-4 (M-N)
Exercise
ER Diagram with Relationship many to many
Example-1 (many-many)

Any Employee has his/ her own department, where works in as full time employee. Additionally, Employee works in a Project with number of hours and rate per hour

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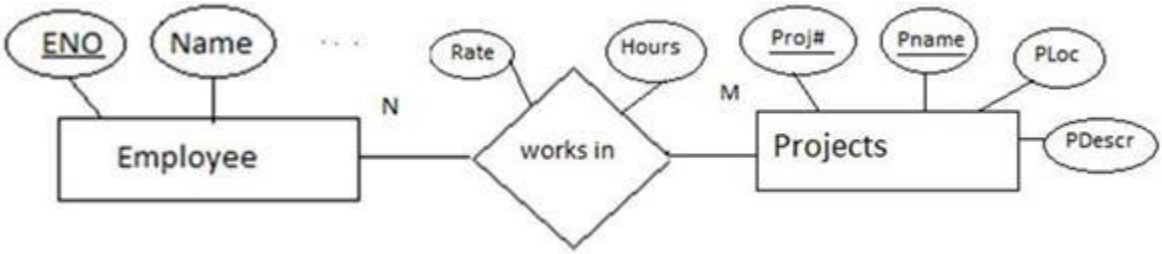
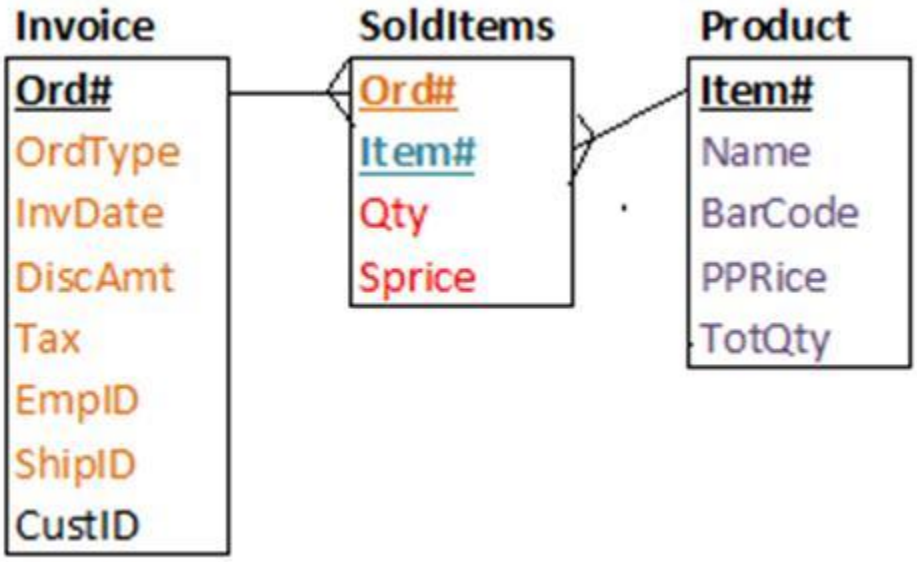


ER Diagram with Relationship many to many
Example-2 (many-many)

Customer buys items with invoice.
Any one invoice contains many products/ items and same product is sold on many invoices.

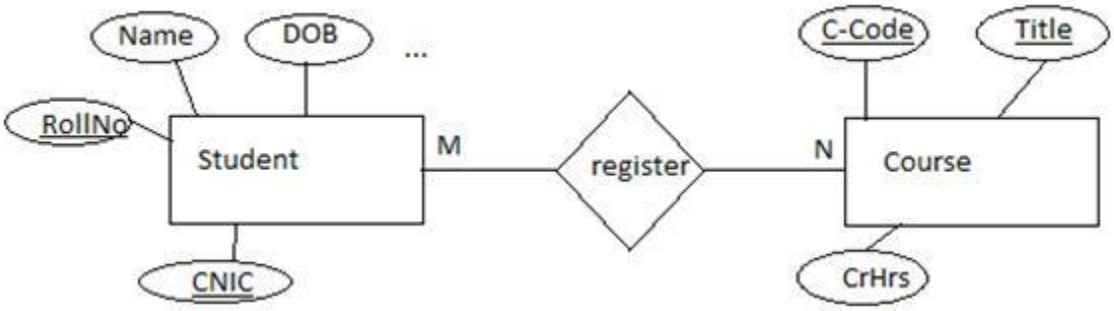


ER Diagram with Relationship many to many
Example-3 (many-many)

Every course is offered with book as its recommended and reference books.
Any book can referred in many courses.

ER Diagram with Relationship many to many
Example-4 (many-many)

Below diagram is no longer be valid if student re-enrolled in course again.
Enrollment requires semester as well.



ER Diagram with Relationship many to many
Exercise
Exercise-4 needs to be drawn with correctness, using semester entity after course offering. Such diagram is called ternary ER relationship.
Introduction to Database Administration

TOPIC 38

ER Diagram with Identifying & Weakness Relationship
ER Diagram with Identifying & Weakness Relationship

Attributes Display

Identifying & Weakness
Identifying & Identified entities
Example-1

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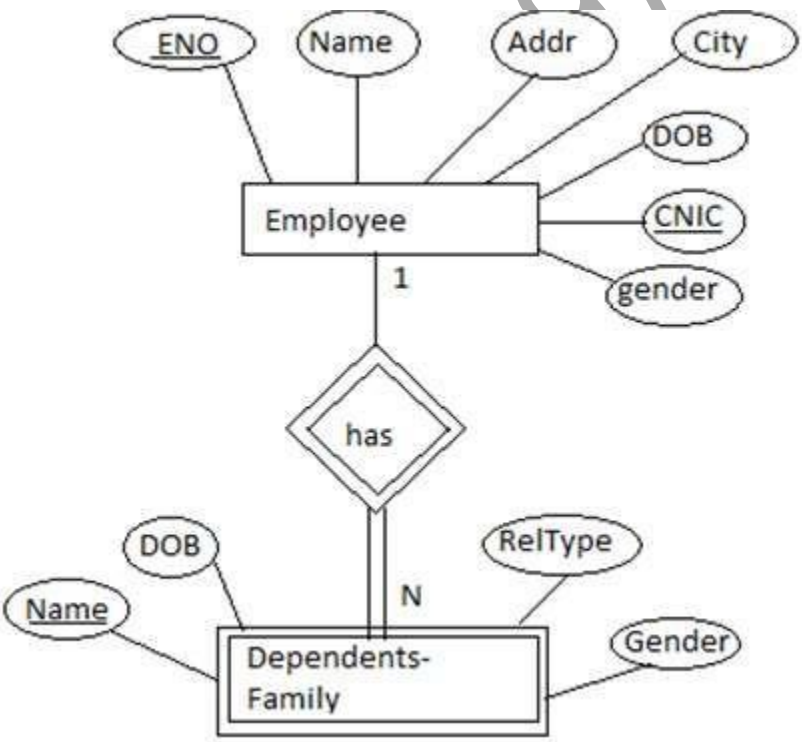
Example-2
ER Diagram with Identifying & Weakness Relationship
Identifying and weakness
An entity whose existence depends on some other entity type is called a weak entity type. Other wise it is called a strong entity type.
There is a chance of records' duplications on non-key attributes in weak entity types.
Child entity depends on other parent entity. Parent entity is identifying the child entity.
Weakness can be reduced only.
ER Diagram with Identifying & Weakness Relationship
Identifying and identified entities

All ID-Dependent (identified) entities MAY BE considered weak.
Examples are
Employee & Family Members ATM Card & Transactions, Patient and Patient visits, Patient & Issue Medicines, Loan and its Installments
ER Diagram with Identifying & Weakness Relationship
Example-1



EMPLOYEE(ENO, Name, Gender, DOB, Addr, City, CNIC)

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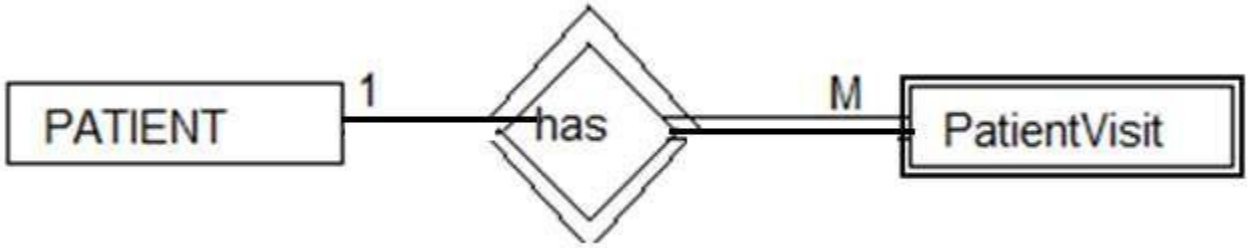
Dependent(ENO, SNO, Name, Gender, DOB, RelType)
ER Diagram with Identifying & Weakness Relationship
Exercise
Scenario: Identifying & Weak relationship



Scenario: Identifying & Strong relationship
Introduction to Database Administration

TOPIC 39

ER Diagram with Mapping
ER Diagram with Mapping

ER Diagram with Mapping

Relational Schema - Implementation Datasets
Example-1: Mapping 1-1
Example-2: Mapping 1-N
Example-3: Mapping M-N
Example-4: Mapping of Ternary Relationship
Mapping of Schema
ER Diagram with Mapping
Relational Schema – Implementation PKs, FKs are required

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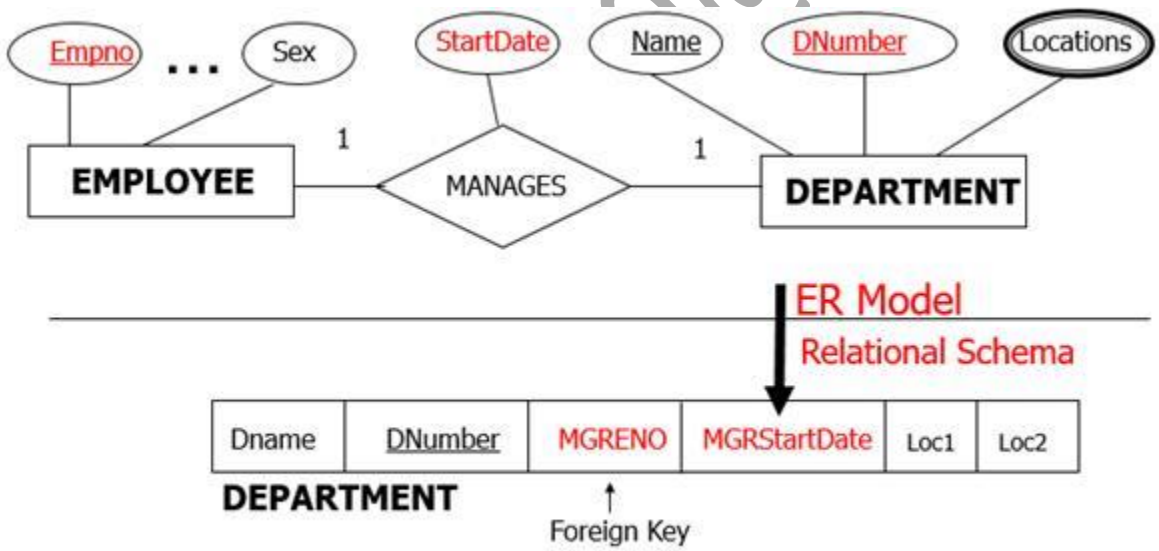
Course

CourseID	Title	CrHrs	Pre-Req
CS203	Database System	3-3-3	CS201
CS201	Data Structure	3-0-3	CS101
CS303	Software Engineering	3-0-0	

CrsOffer

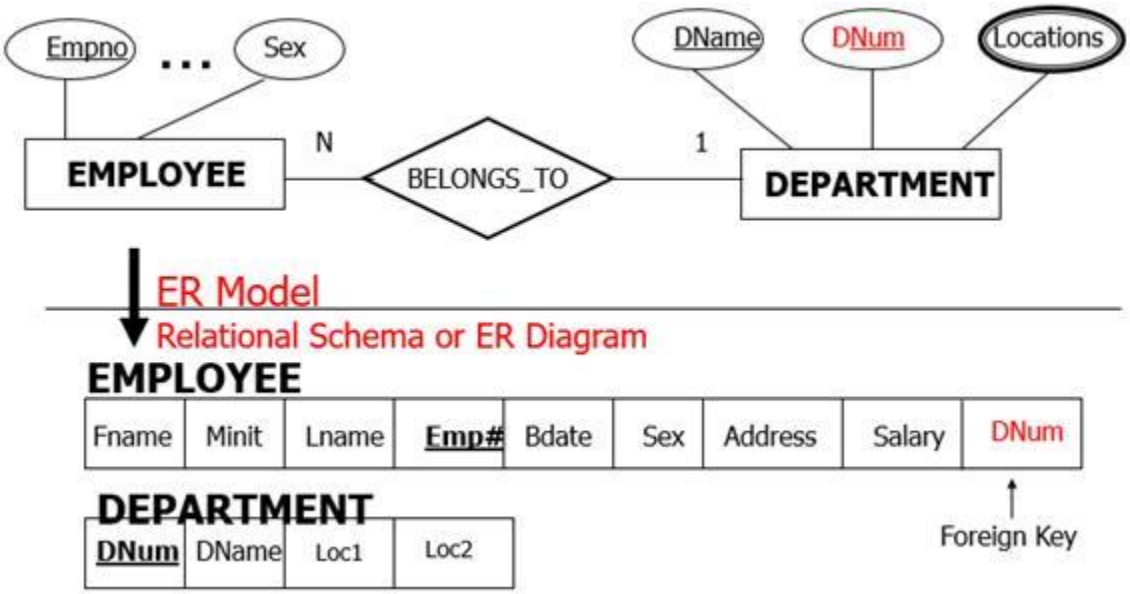
SemID	CourseID	Sec	Instr	B#	Room#	MasStu
F2018	CS201	A	Ali Hassan	2	203	40
F2018	CS201	B	Jamil	3	301	40
S2019	CS203	A	Ejaz	2	203	55
S2019	CS303	A	Jamil	1	101	50
~~S2019~~	~~CS407~~	~~A~~		~~3~~		~~40~~

Our ER gives relational schema tables similar to above … Applying Knowledge – Do able artifacts (Implementation) Each mapped table will have fewer records
Records should be referenced with the possible variations in tables
ER Diagram with Mapping
Example-1: Mapping 1-1



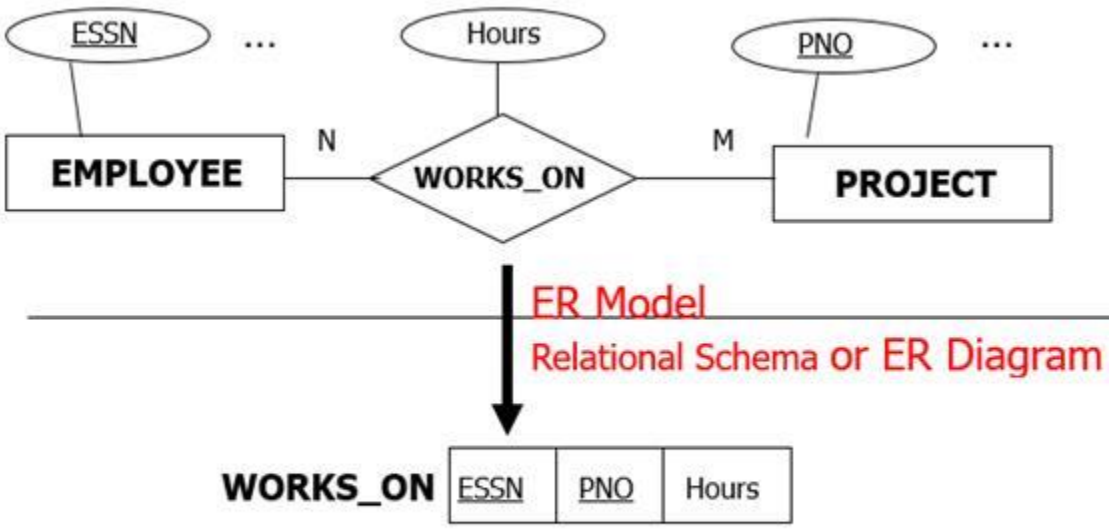
MGRSSN must be UNIQUE KEY to validate 1:1, Dname must has NOT NULL constraint

ER Diagram with Mapping
Example-2: Mapping 1-N



ER Diagram with Mapping

Example-3: Mapping M-N

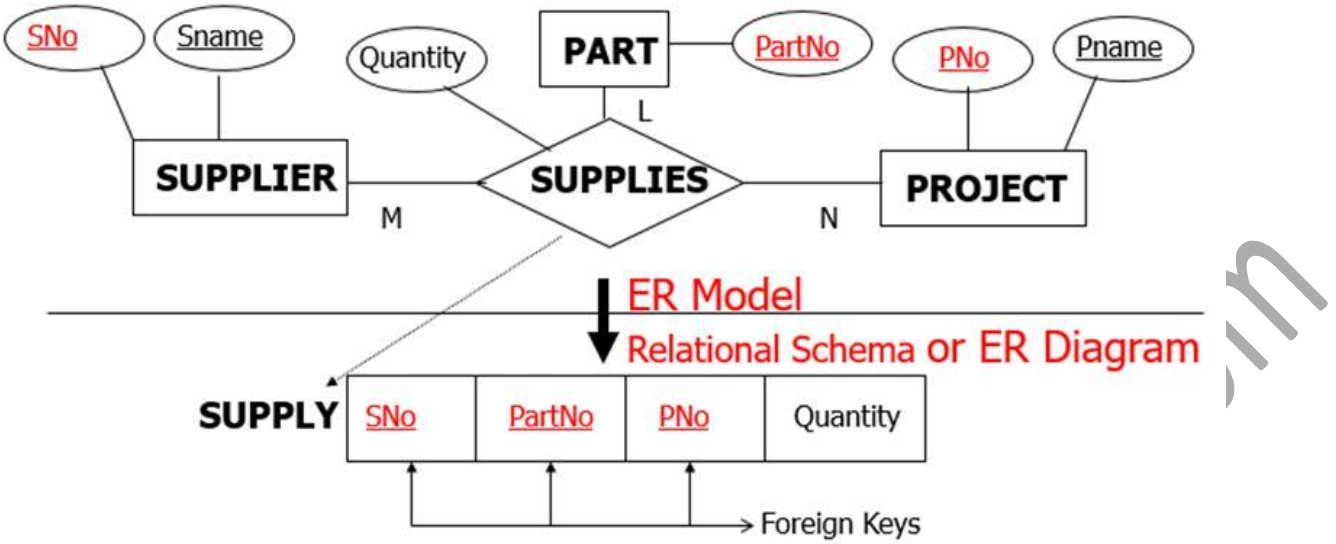


WORK_ON table requires in addition to tables EMPLOYEE and PROJECT

ESSN and PNO are the composite keys, Hours must has NOT NULL constraint

ER Diagram with Mapping

Example-4: Mapping of Ternary Relationship



Quantity must has NOT NULL constraint. Similar example can be Lecturer teaches course to students. Other example: Vehicle, Policeman, Ticket (Ticket# is a serial unique number)

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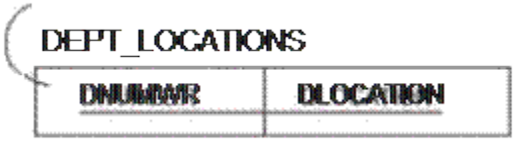
Mapping of Schema

EMPLOYEE

FNAWF: WtNlT LNAA4E SSM BDATE ADDRESS SEX SALARY PERSSN DNO

DEPARTMENT
DNAME DNUkBER MGIASN

MGRSTARTDATE



PROJECT
PNAME PLUMBER

PLOCATIO I

DNUM

WORKS ON
ESSN PNO HOI S

DEPENOENT
ESSN DEPENDENT NAME

SEX BDATE RELATIONSHIP " ,'
Introduction to Database Administration

TOPIC 40

Oracle DBMS

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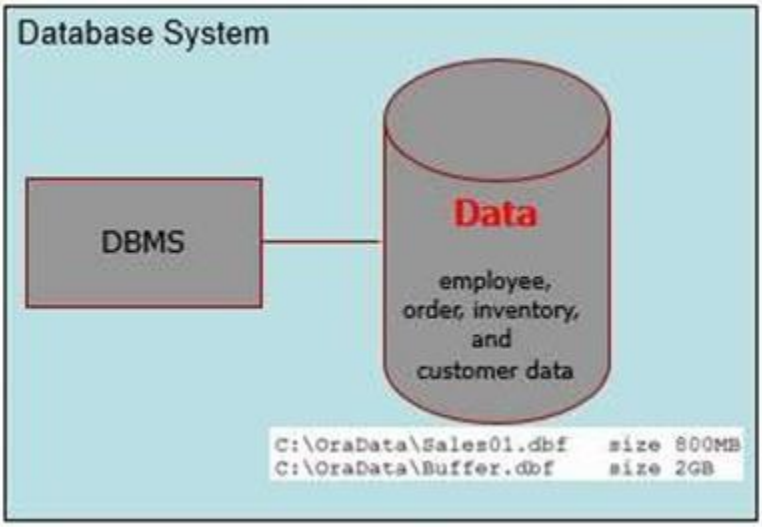

Oracle DBMS

Oracle DBMS

Definition
Relational Model
Relational DB Elements
How data is organized?
RDBMS Operations
Oracle DBMS Quick History
Oracle DBMS

Definition

Database Management System (DBMS) is a software package that controls the storage, organization, and retrieval of data, a DBMS has the following elements:
Kernal code (manages memory and storage)
Repository of metadata (data dictionary)
Query Language (accessing data)
Oracle DBMS

Relational Model

Scientist E. F. Codd defined relational model based on mathematical theory, called relational model. The relational model has the following major aspects:

Structures (Well-defined objects store or access the data)
Operations (data manipulation)

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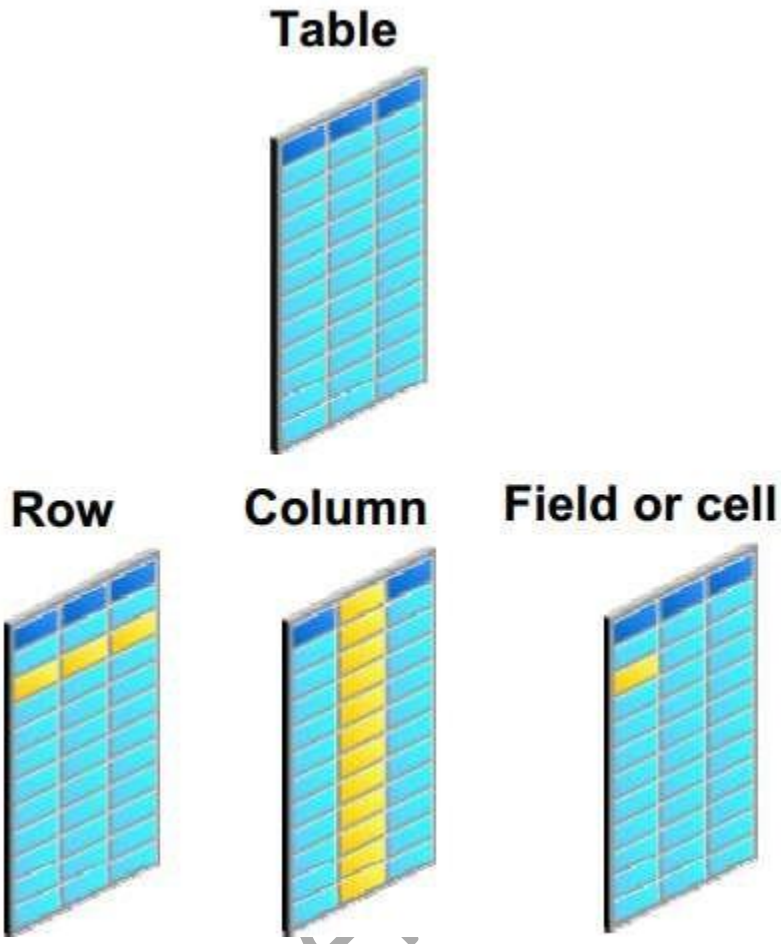
Integrity rules (constraints or restrictions)
Oracle DBMS
Relational Database Elements



Tuple Attribute Cell
Oracle DBMS
How data is organized?

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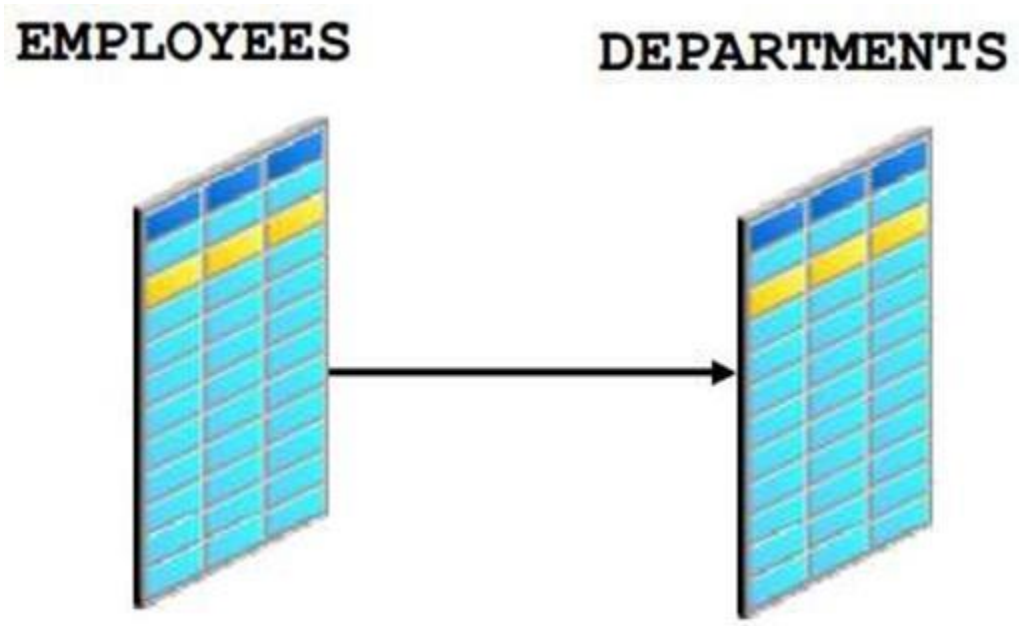

Oracle DBMS

RDBMS Operations

Logical operations

An application specifies what content is required. For example, an application requests an employee name or adds an employee record to a table. Execution of DDL in an application or schema of DBMS.

Physical operations

RDBMS determines how things should be done and carries out the operation. For example, after an application queries a table, the database may use an index to find the requested rows and read the data into memory etc. before returning result.

Both operations are independent to each other

Oracle DBMS

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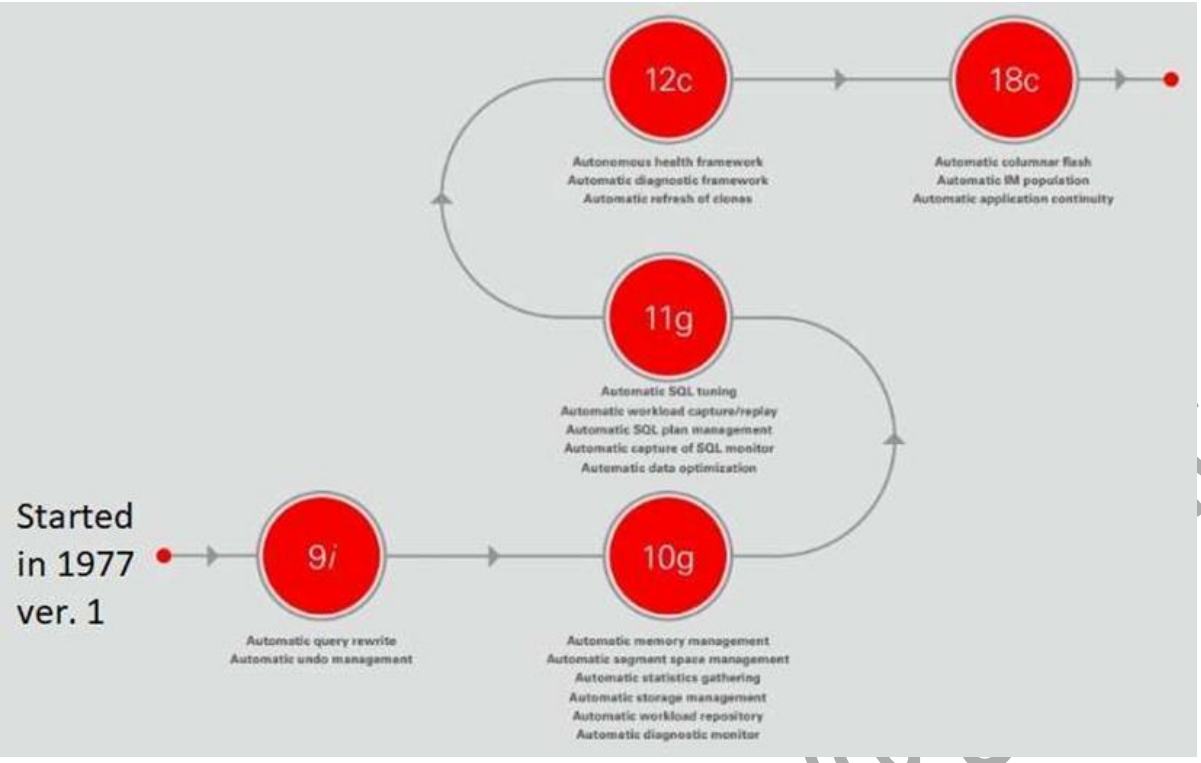

Oracle DBMS Quick History

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contact # 0321 2711298

TOPIC 41

Oracle Schema Objects & Data Access
Oracle Schema Objects & Data Access

Oracle Schema Objects & Data Access

Schema Objects
Types of Schema Objects
Tables
Indexes
Tables & Indexes in a Schema
Views, Sequences & Synonym

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Data Access
Oracle Schema Objects & Data Access

Schema Objects

Physical data storage is independent from logical data structures
Schema is a collection of data
structures, or schema objects
Schema is owned by the database user name.
Schema objects such as tables, views, indexes and sequences etc. are user- created structures that directly refer to the data (files) in the database.
BMS created objects are data dictionary views, user's roles etc.
Oracle Schema Objects & Data Access

Types of Schema Objects

Tables
Indexes
Constraints
Sequences
Views
Triggers
Sequences
Synonym
PL/SQL subprograms and packages, Java Classes etc.
Oracle Schema Objects & Data Access

Tables

Basic storage unit or schema object for storing data in structured form
Table consists rows and columns with
specific data types of columns
Maximum number of columns are 255 and unlimited number of rows or tuples in a table
Every table is uniquely identified in a schema
Integrity constraints such as NOT NULL, CHECK and PKs etc. are applied on table's columns
Oracle Schema Objects & Data Access

Indexes

An index is an optional data structure that can be created on one or more columns of a table.

Index can increase performance of data retrieval

Index can be created on searching columns

Indexes are physically and logically
independent
Oracle Schema Objects & Data Access

Tables & Indexes in a Schema

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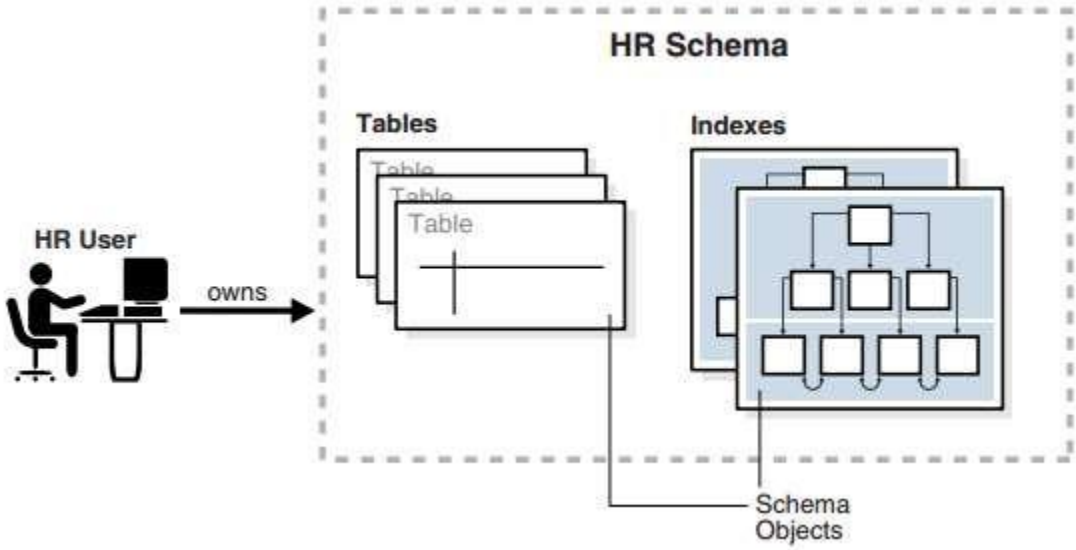

Oracle Schema Objects & Data Access

Views, Sequences & Synonym

Stored queries are called Views. Views do not keep separate data rather they extract data from tables

A Sequence is a user-created object that can be shared by multiple users. It can be ised for PK column.

A Synonym is an alias for another schema object and does not require separate storage

Oracle Schema Objects & Data Access

Data Access

Data is accessed by SQL from DBMS.

PL/SQL, Java are also used to access the data from DBMS

Data is accessed by sub languages
DML and DCL.

Data is accessed in logical schema from physical data files through internal schema. Access paths for data access may varied.

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TOPIC 42

Oracle Transaction Management

Oracle Transaction Management

Oracle Transaction Management

Transaction management
Multi-user Environment
Transactions
Example of Funds Transfer
All or Nothing Transaction
PL/SQL Transaction Example
Oracle Transaction Management

Transaction Management

Oracle Database is designed as a multiuser database. The database must ensure that multiple users can work concurrently without corrupting one another's data.
Oracle Transaction Management

Multi-user Environment

Oracle Database is designed as a multiuser database. The database must ensure that multiple users can work concurrently without corrupting one another's data.
Oracle Transaction Management

Transactions

SQL is initiated at user level (client) and it executes on Server (central Database) at a distant, may be from one city to another.

A transaction is a logical, atomic unit of work (block) that contains one or more SQL statements.
Either transaction is done (committed) or not done (rolled back). No partial execution of transaction is allowed.
Oracle Transaction Management

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Example of Funds Transfer

A transaction is a funds transfer from a saving account to a checking account. The transfer consists of the following separate operations:

Decrease the saving account
Increase the checking account
Record the transaction in the transaction journal
Oracle Transaction Management

Example of Funds Transfer

Oracle Database guarantees that all three operations succeed or fail as a unit. In case of failure, all three operations will be rolled back.
Oracle Transaction Management

All or Nothing Transactions

If you perform an atomic operation that updates several files, and if the system fails halfway through, then the files will not be consistent. In contrast, a transaction moves an Oracle Database from one consistent state to another

All or nothing, basic principle of atomic execution of a transaction
Oracle Transaction Management
PL/SQL Transactions Example

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```
BEGIN
     update emp
     set sal = 500
     where empno = 7988;

     delete from emp
     where empno = 7414;

     COMMIT;
EXCEPTION
    WHEN OTHERS THEN
    ROLLBACK;
END;
/
```

Introduction to Database Administration

TOPIC 43

Oracle Database Architecture
Oracle Database Architecture

Oracle Database Architecture

Database Architecture
Database & Instance
Oracle DB Server Architecture
Instance DB Configuration
Database Physical Storage Structure
Database Logical Storage Structure
Oracle Database Architecture

Database Architecture

A database server is the key to information management

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In general, a server reliably manages a large amount of data in a multiuser environment so that users can concurrently access the same data

A database server also prevents unauthorized access and provides efficient solutions for failure recovery.
Oracle Database Architecture

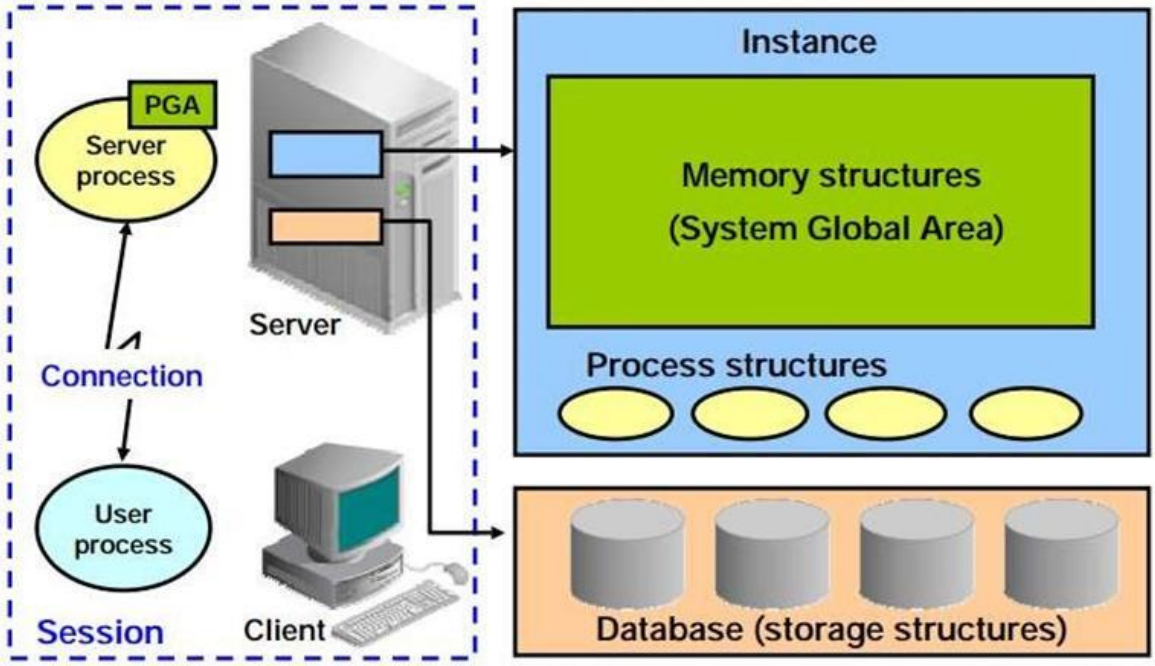
Database & Instance

A database is a set of files, located on disk, that store data. These files can exist independently of a database instance.

An instance is a set of memory structures that manage database files. The instance consists of a shared memory area, called the system global area (SGA), and a set of background processes. An instance can exist independently of database files.
Oracle Database Architecture

Database & Instance

Each client process is associated with its own server process. The server process has its own private session memory, known as the program global area (PGA).
Oracle Database Architecture



Oracle DB Server Architecture

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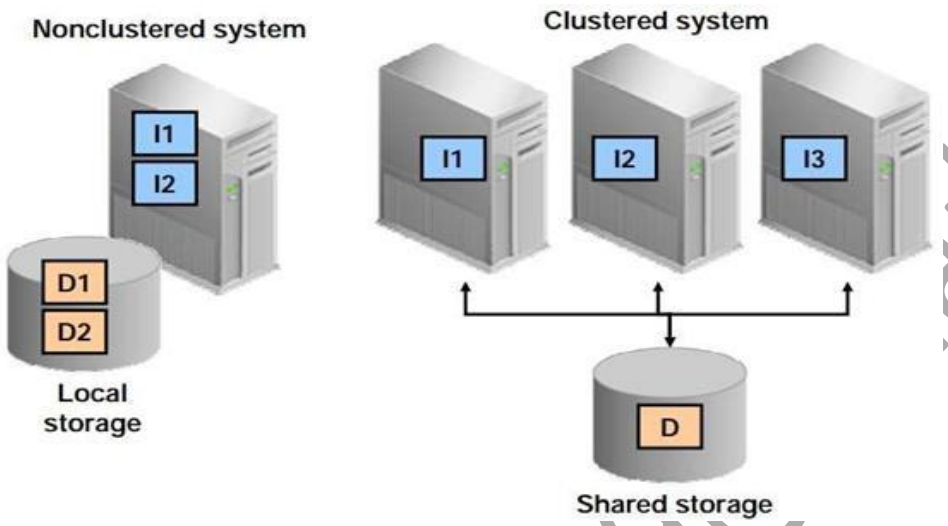
Each client process is associated with its own server process. The server process has its own private session memory, known as the program global area (PGA).

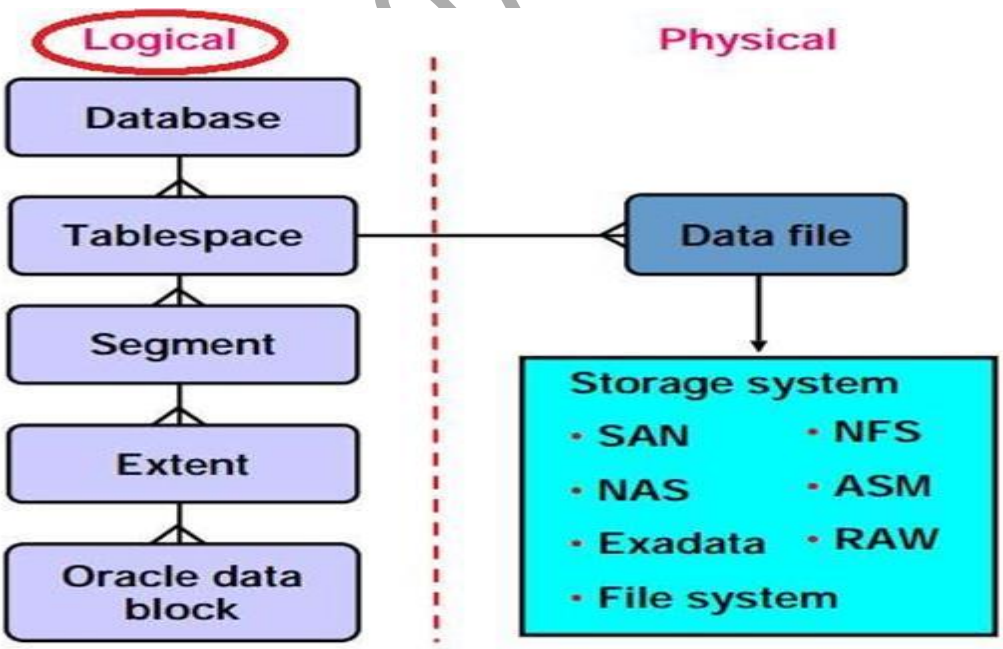
Oracle Database Architecture

Instance DB Configuration



Oracle Database Architecture

Database Logical Storage Structure



Oracle Database Architecture

Database Physical Storage Structure

TOPIC 44

Oracle11g Installation

Oracle11g Installation

Installation Steps

Installation Startup
Installation …
Login with Oracle Database Manager
OS Services
How to un-install Oracle?
Oracle11g Installation

Installation Startup

Before Installing Oracle, you must installed complete OS windows with all patches and Activations (Install Java JDK 1.5 (e.g.,

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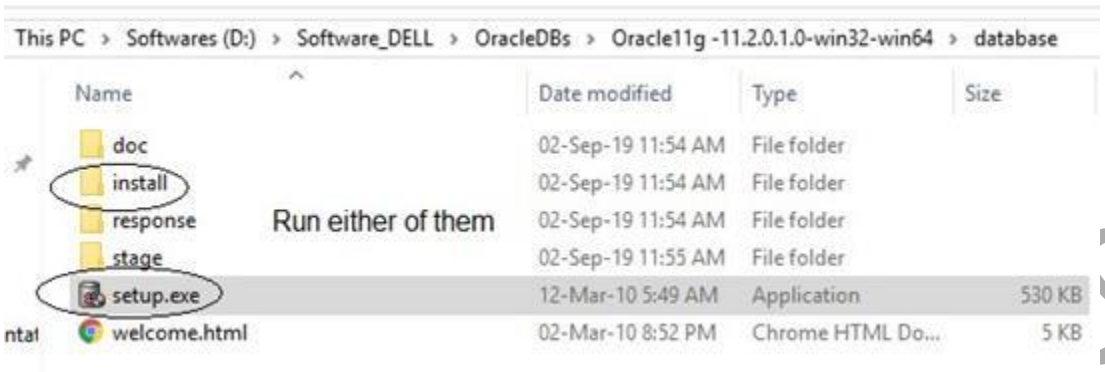
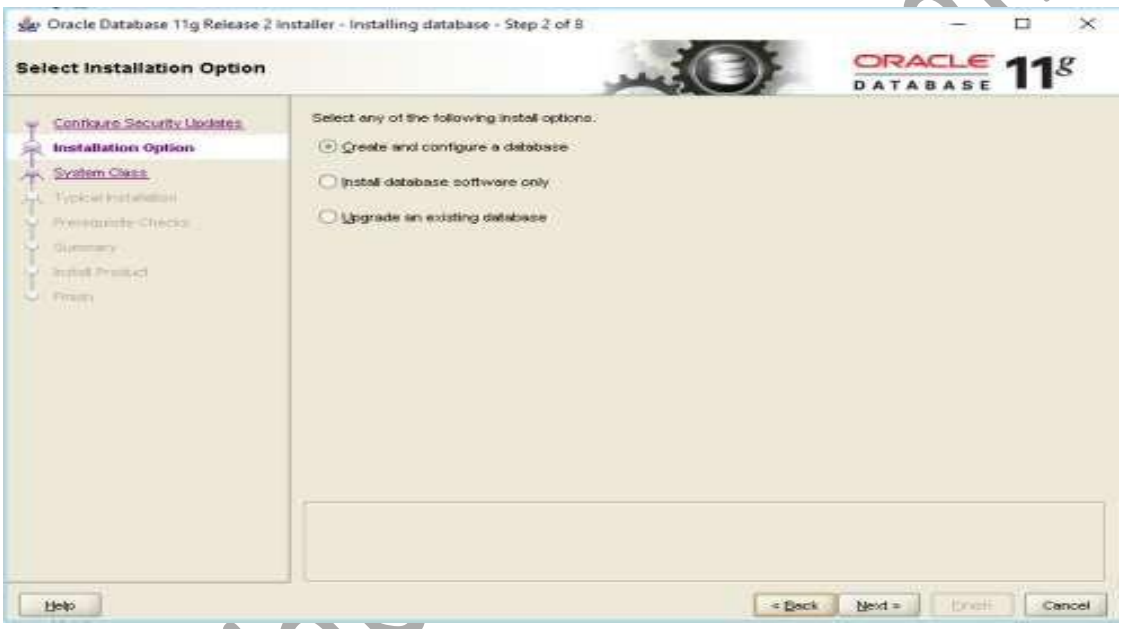
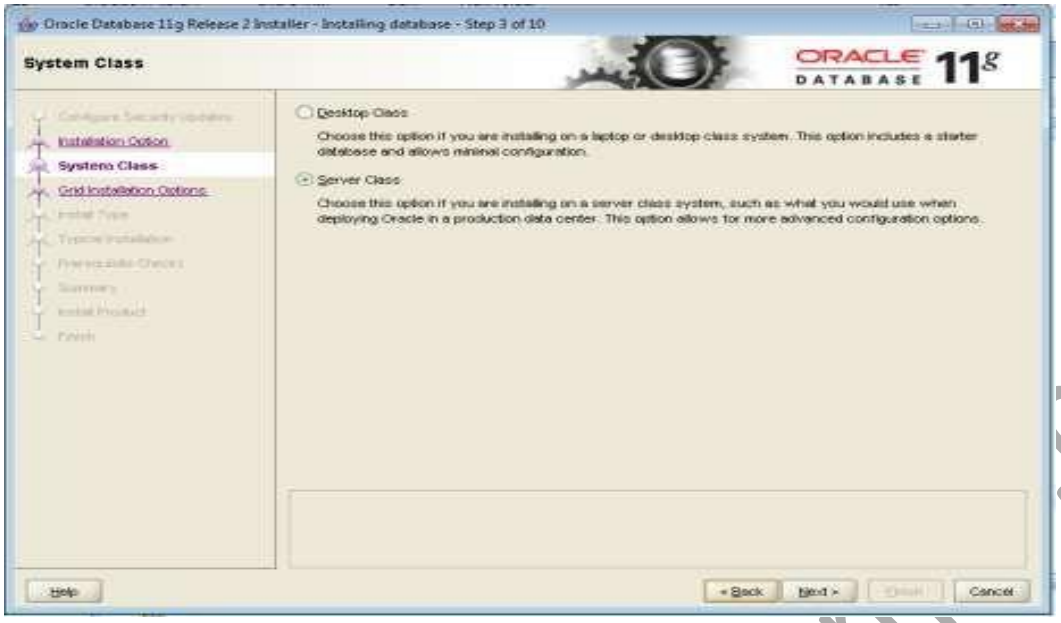
jre-1_5_0-windows-i586.exe)



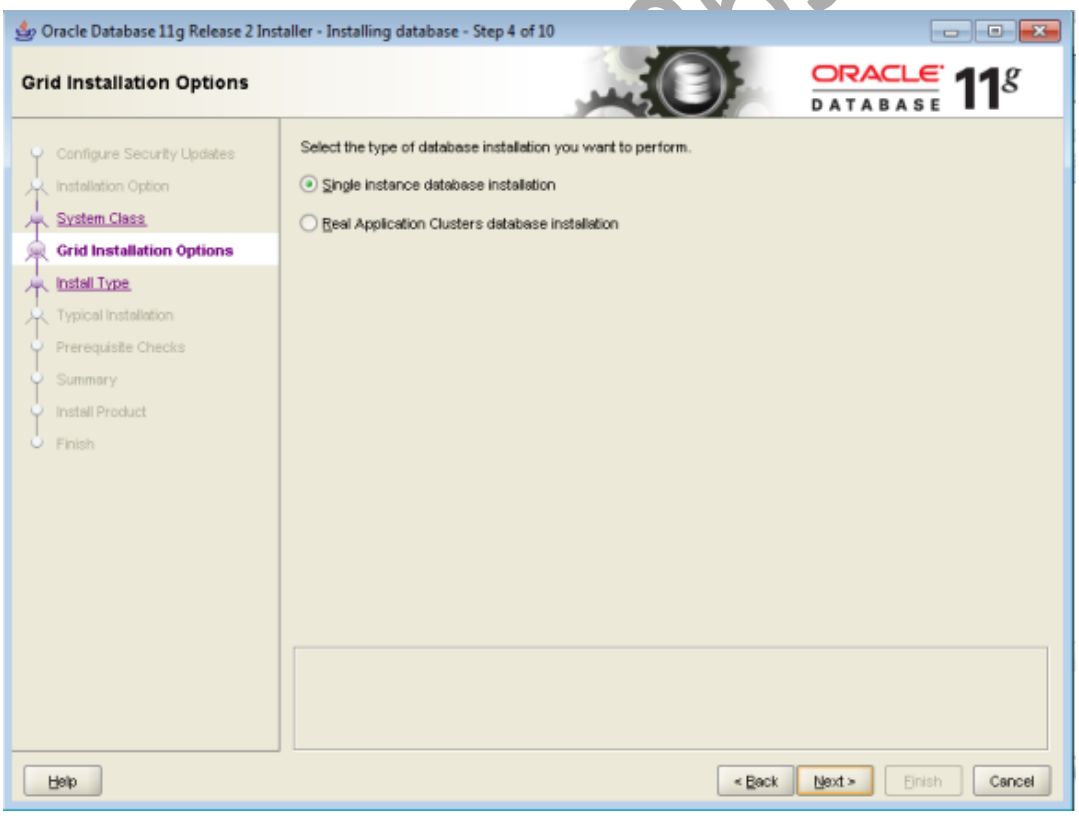
Run SETUP.EXE to start Oracle Universal Installer
Oracle11g Installation
Installation Startup

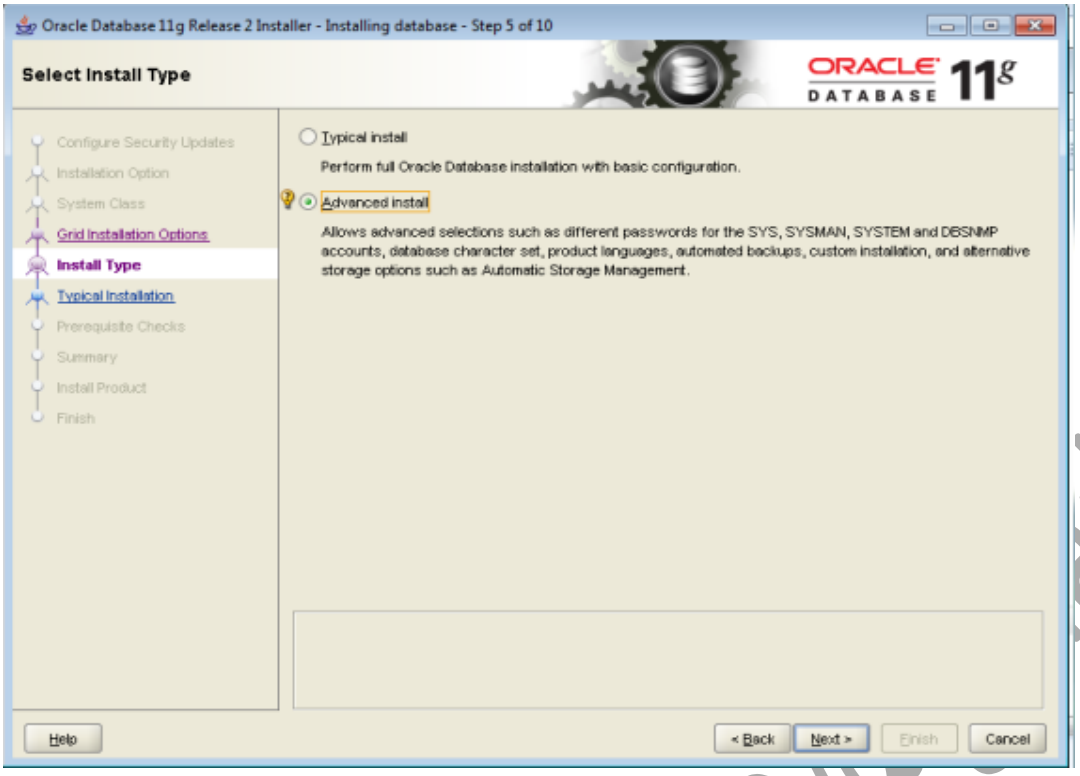


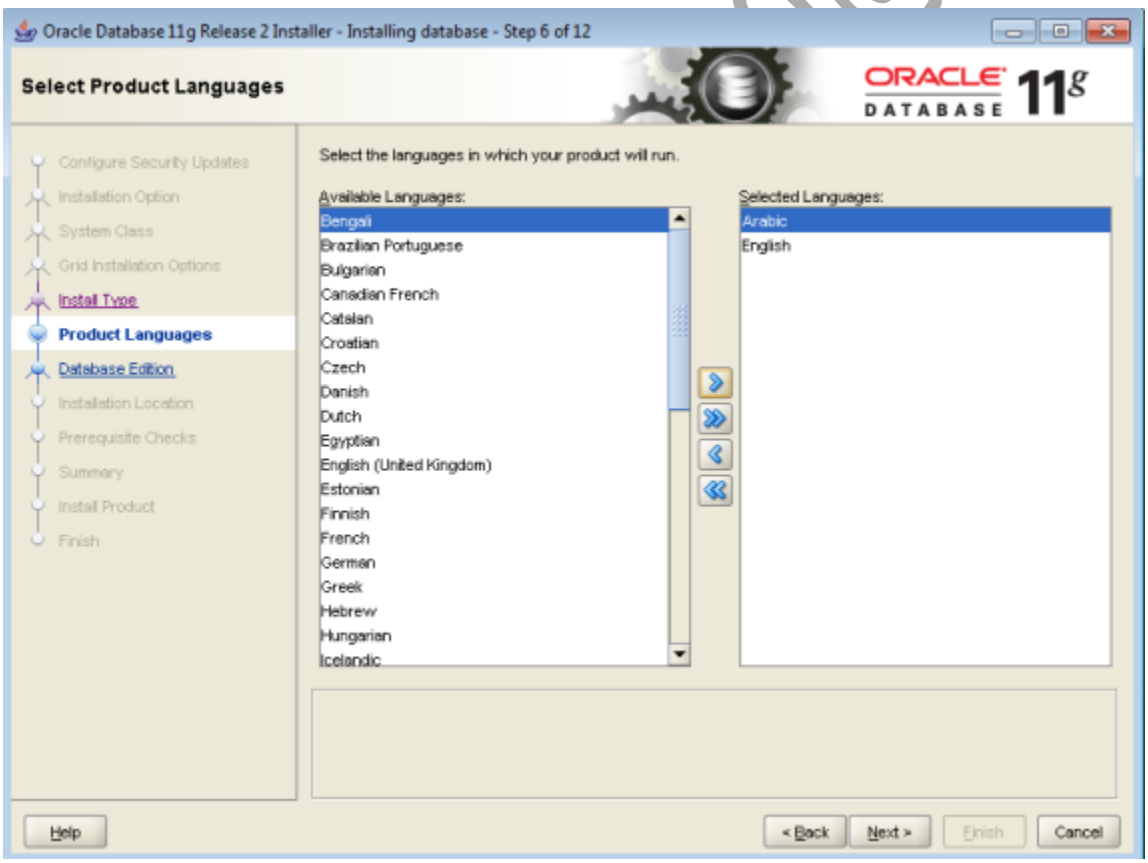
Before Installing Oracle, you must
install complete OS
windows with all patches and activations. You may get this pop up in case if you have oracle previous Installation, other proceed with next choice.
Oracle11g Installation
Installation Startup
Before Installing Oracle, you must installed
complete OS windows with all patches and activations
Run SETUP.EXE to start Oracle Universal Installer

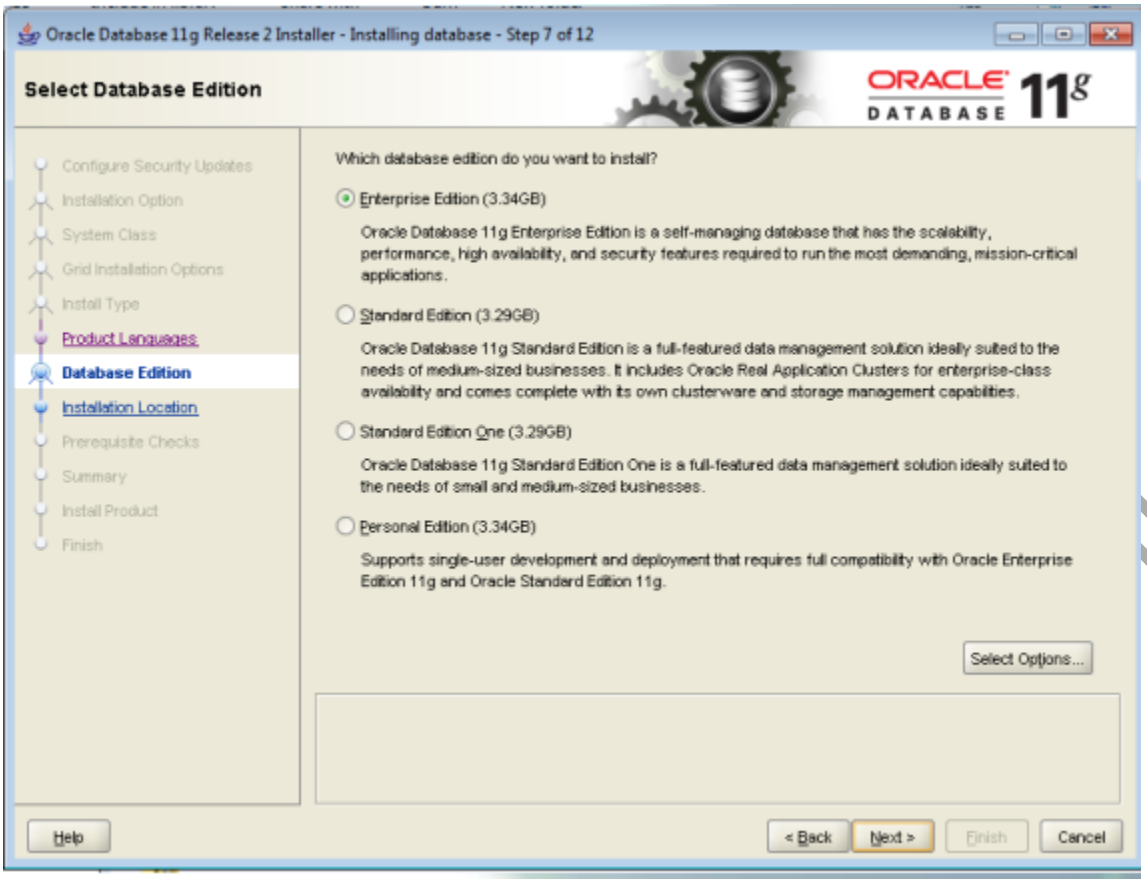


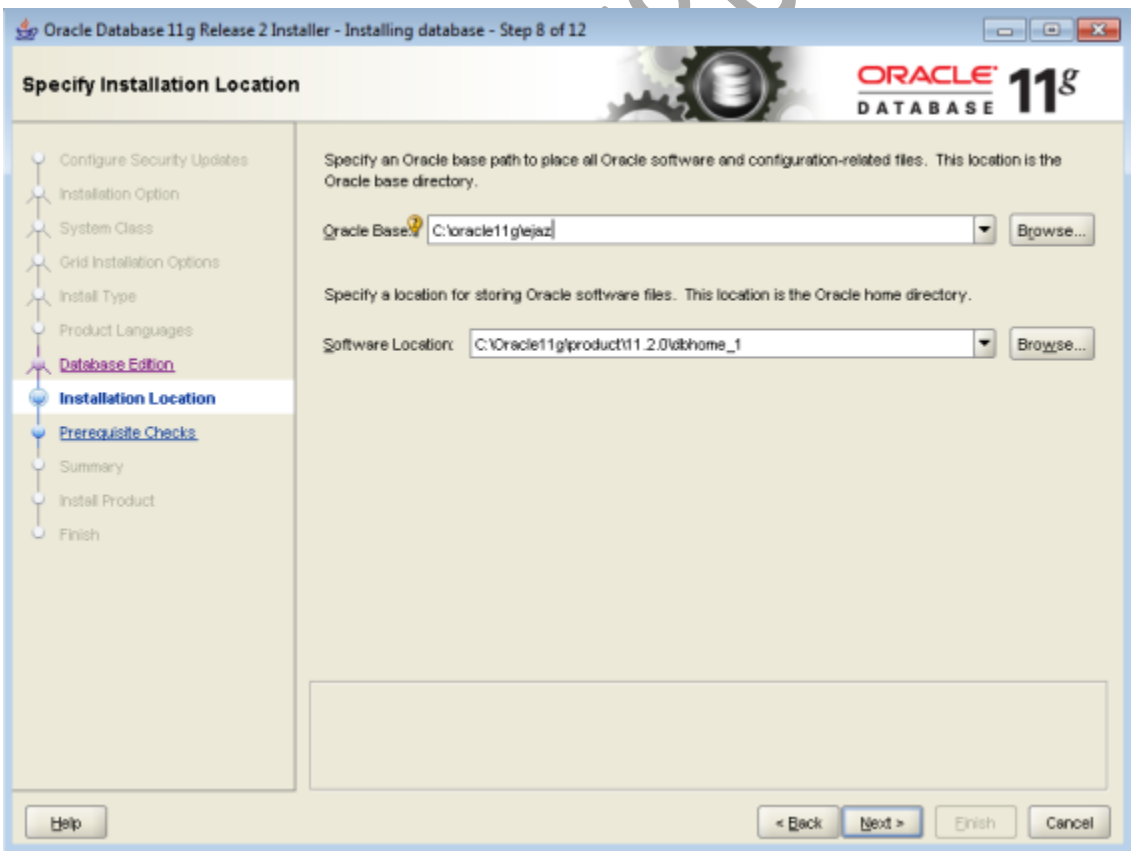
Installation

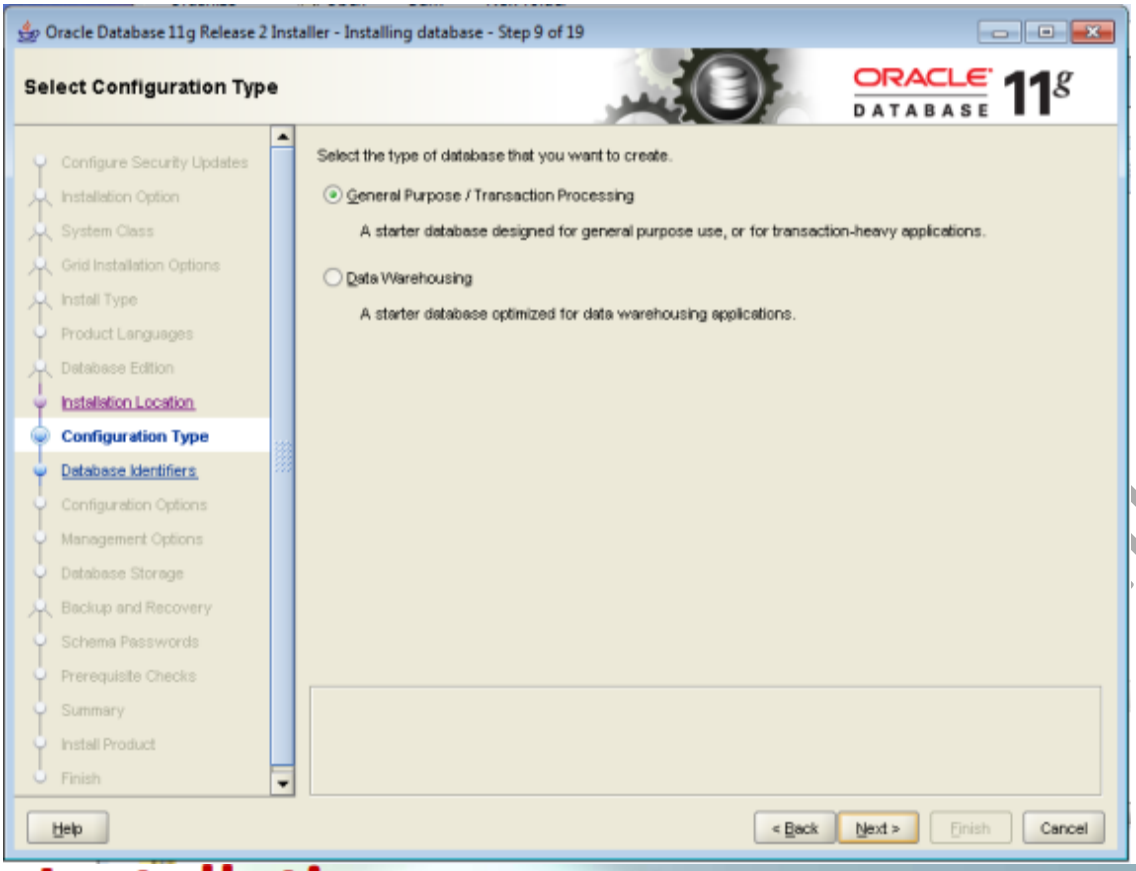



Oracle Database 11g Release 2 Installer - Installing database - Step 5 of 10
Select Install Type
ORACLE 11g DATABASE
Configure Security Updates
Installation Option
System Class
Grid Installation Options
Install Type
Typical Installation
Prerequisite Checks
Summary
Install Product
Finish
Typical install
Perform full Oracle Database installation with basic configuration.
Advanced install
Allows advanced selections such as different passwords for the SYS, SYSMAN, SYSTEM and DBSNMP accounts, database character set, product languages, automated backups, custom installation, and alternative storage options such as Automatic Storage Management.
Help
< Back
Next >
Finish
Cancel

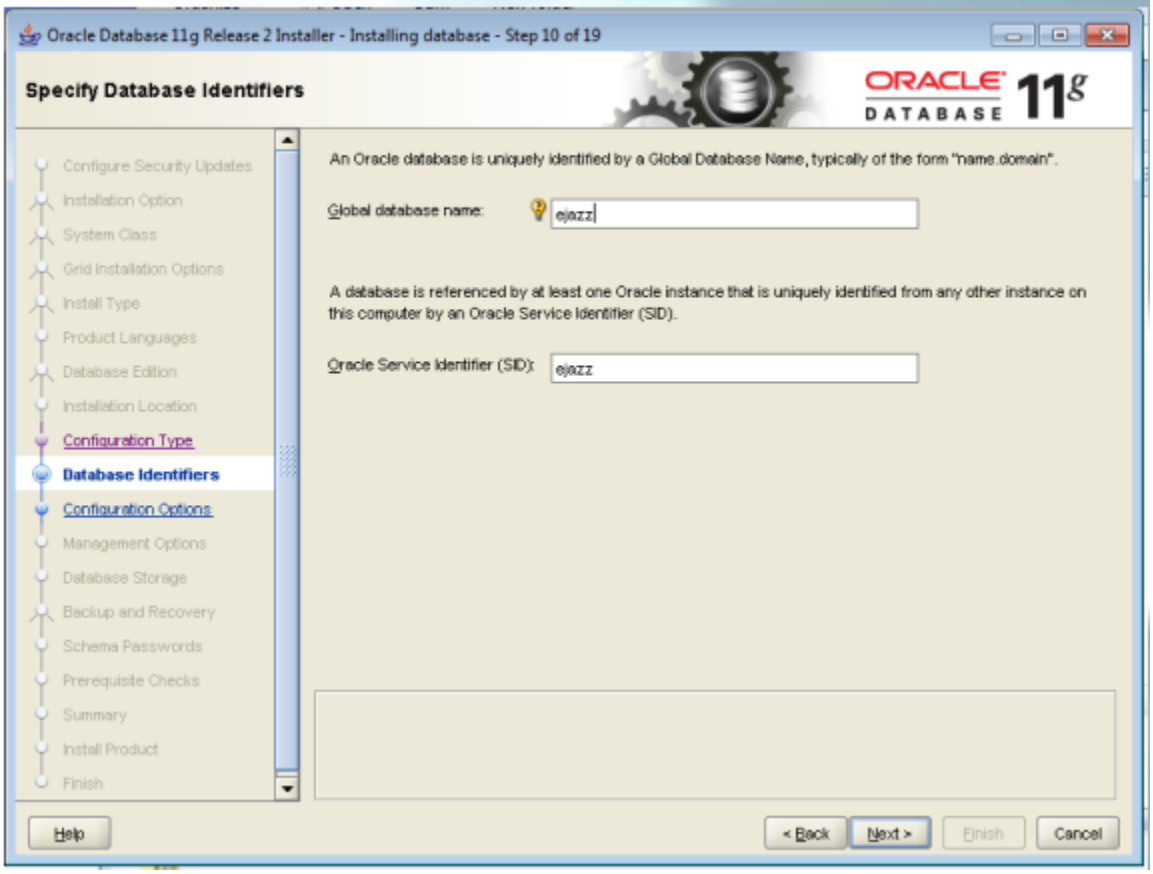

Oracle Database 11g Release 2 Installer - Installing database - Step 6 of 12
Select Product Languages
ORACLE 11g DATABASE
Configure Security Updates
Installation Option
System Class
Grid Installation Options
Install Type
Product Languages
Database Edition
Installation Location
Prerequisite Checks
Summary
Install Product
Finish
Select the languages in which your product will run.
Available Languages:
Bengali
Brazilian Portuguese
Bulgarian
Canadian French
Catalan
Croatian
Czech
Danish
Dutch
Egyptian
English (United Kingdom)
Estonian
Finnish
French
German
Greek
Hebrew
Hungarian
Icelandic
Selected Languages:
Arabic
English
Help
< Back
Next >
Finish
Cancel

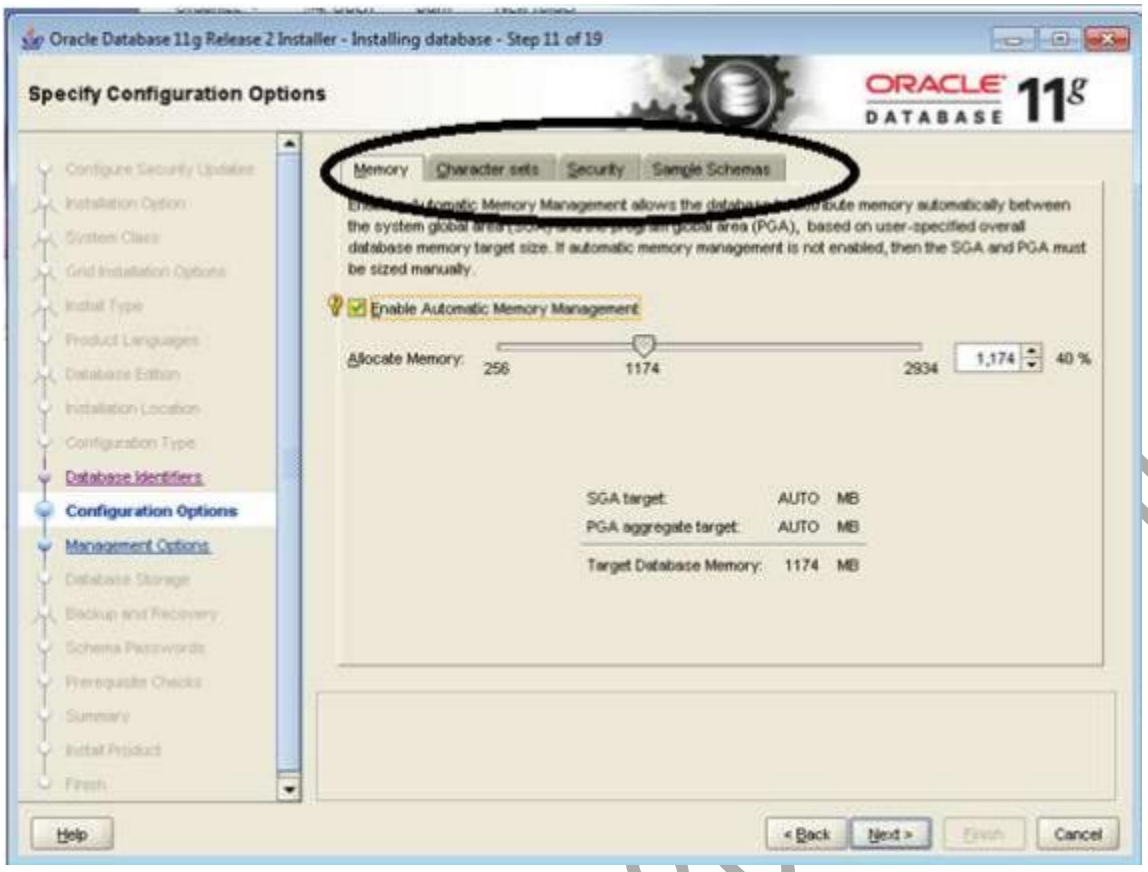

Oracle Database 11g Release 2 Installer - Installing database - Step 7 of 12
Select Database Edition
ORACLE 11g DATABASE
Configure Security Updates
Installation Option
System Class
Grid Installation Options
Install Type
Product Languages
Database Edition
Installation Location
Prerequisite Checks
Summary
Install Product
Finish
Which database edition do you want to install?
Enterprise Edition (3.34GB)
Oracle Database 11g Enterprise Edition is a self-managing database that has the scalability, performance, high availability, and security features required to run the most demanding, mission-critical applications.
Standard Edition (3.29GB)
Oracle Database 11g Standard Edition is a full-featured data management solution ideally suited to the needs of medium-sized businesses. It includes Oracle Real Application Clusters for enterprise-class availability and comes complete with its own clusterware and storage management capabilities.
Standard Edition One (3.29GB)
Oracle Database 11g Standard Edition One is a full-featured data management solution ideally suited to the needs of small and medium-sized businesses.
Personal Edition (3.34GB)
Supports single-user development and deployment that requires full compatibility with Oracle Enterprise Edition 11g and Oracle Standard Edition 11g.
Select Options...
Help
< Back
Next >
Finish
Cancel

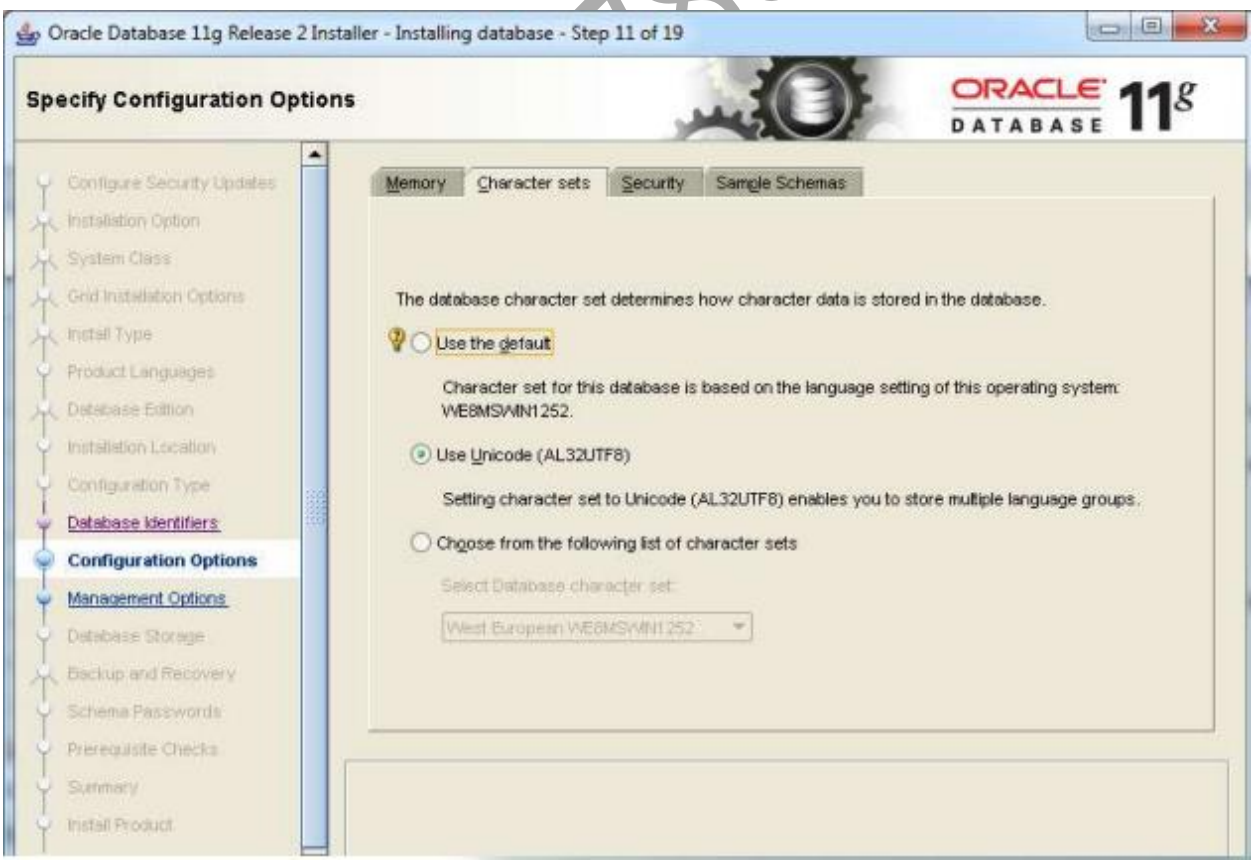

Oracle Database 11g Release 2 Installer - Installing database - Step 8 of 12
Specify Installation Location
ORACLE 11g DATABASE
Configure Security Updates
Installation Option
System Class
Grid Installation Options
Install Type
Product Languages
Database Edition
Installation Location
Prerequisite Checks
Summary
Install Product
Finish
Specify an Oracle base path to place all Oracle software and configuration-related files. This location is the Oracle base directory.
Oracle Base:
C:\oracle11g\ejaz
Browse...
Specify a location for storing Oracle software files. This location is the Oracle home directory.
Software Location:
C:\Oracle11g\product\11.2.0\dbhome_1
Browse...
Help
< Back
Next >
Finish
Cancel

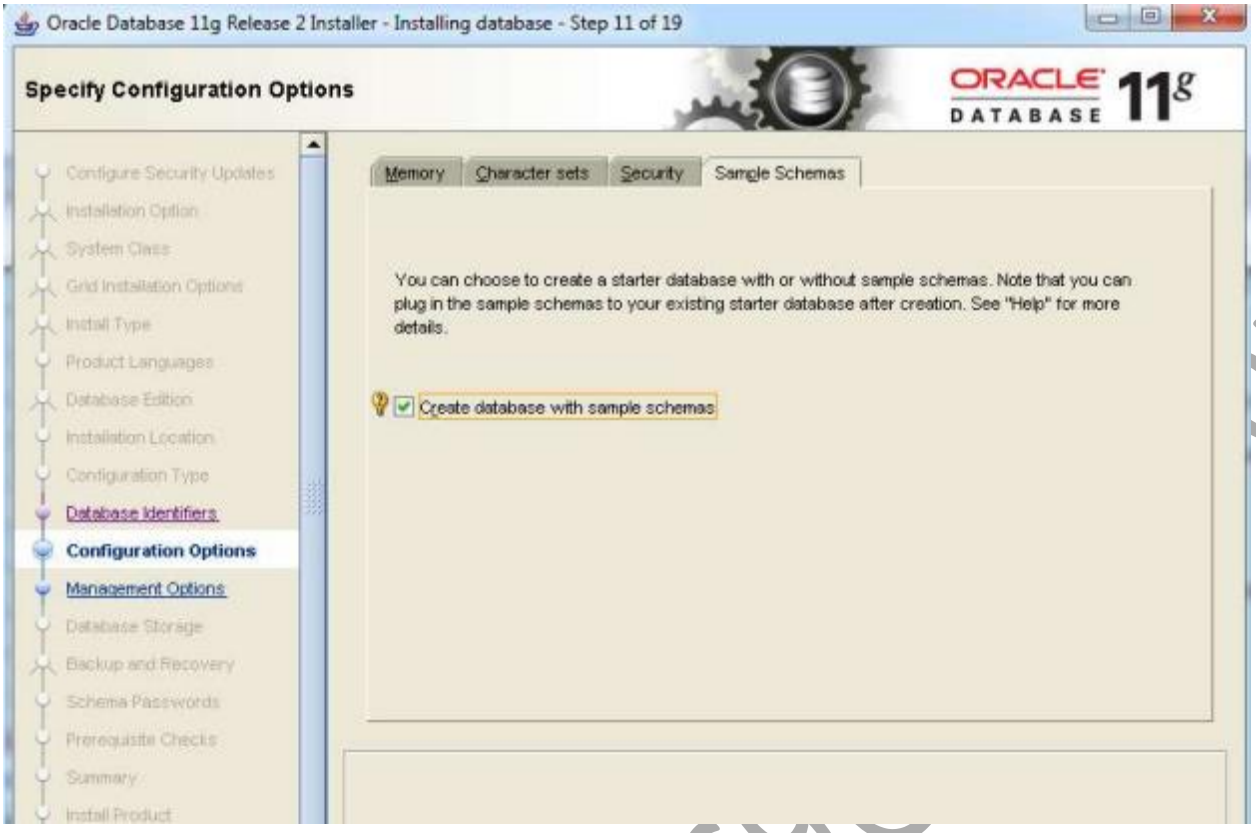


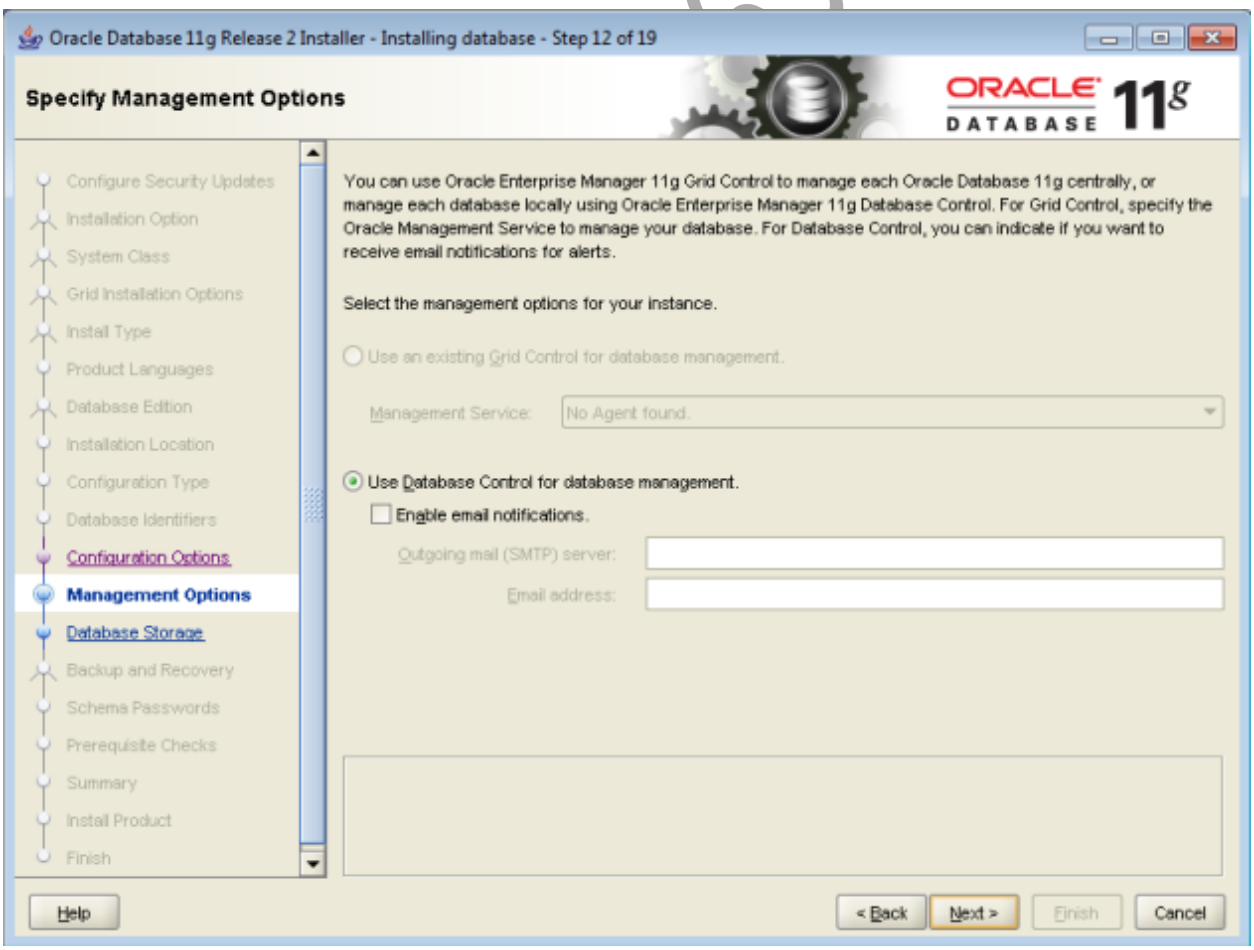
Installation

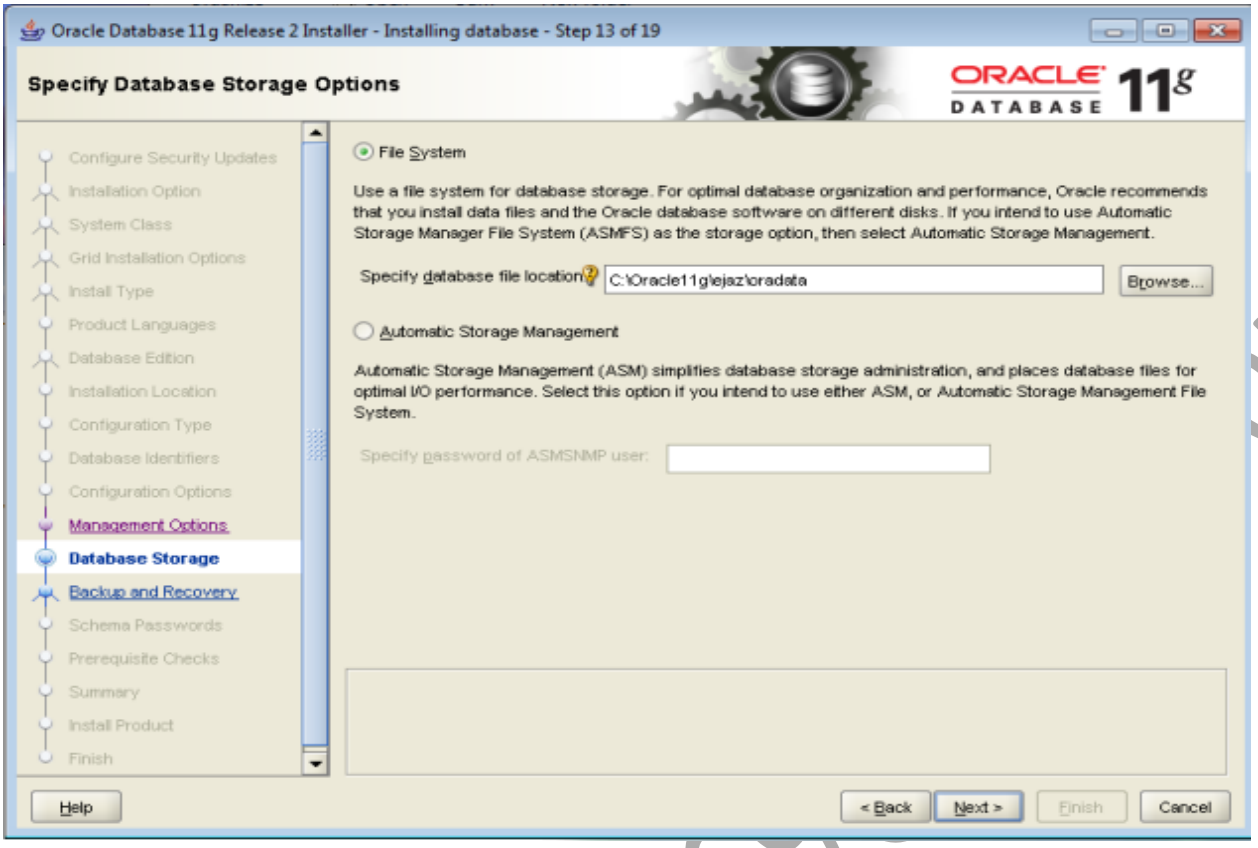


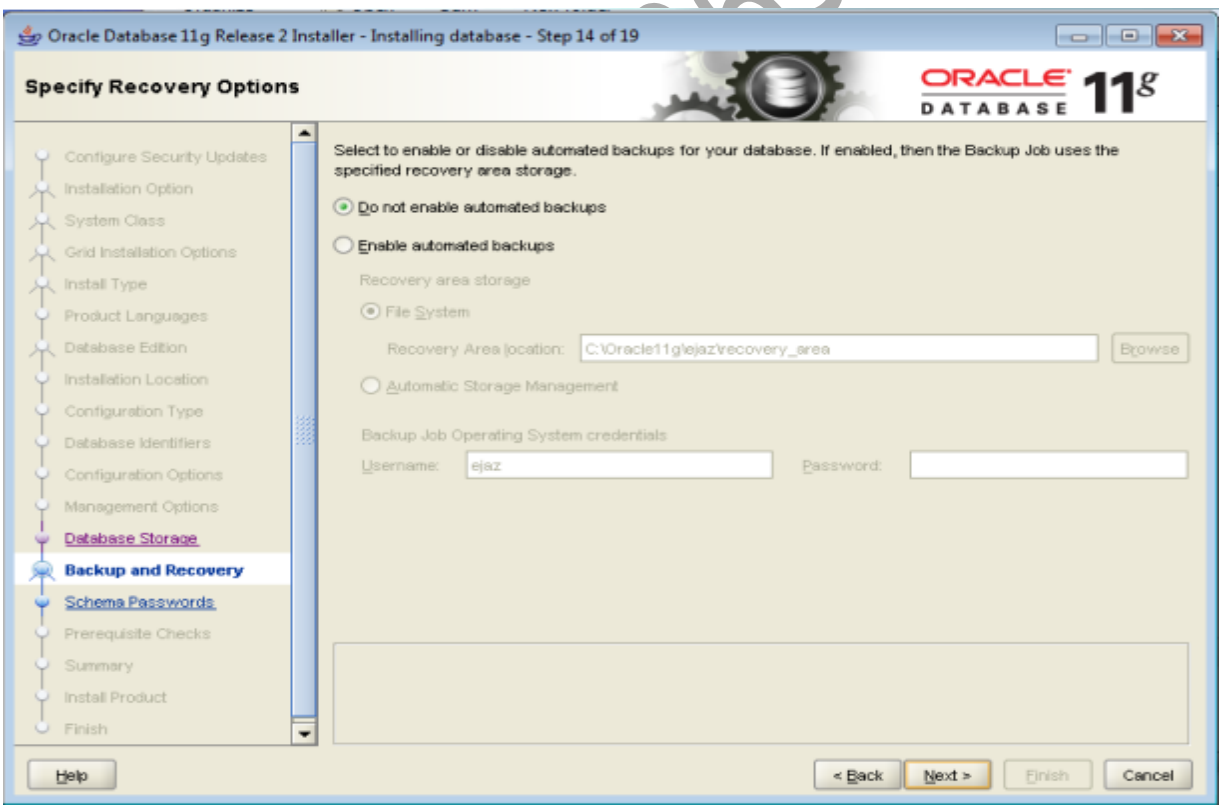

Oracle Database 11g Release 2 Installer - Installing database - Step 11 of 19
Specify Configuration Options
ORACLE 11g DATABASE
Configure Security Updates
Installation Option
System Class
Grid Installation Options
Install Type
Product Languages
Database Edition
Installation Location
Configuration Type
Database Identifiers
Configuration Options
Management Options
Database Storage
Backup and Recovery
Schema Passwords
Prerequisite Checks
Summary
Install Product
Finish
Memory
Character sets
Security
Sample Schemas
Automatic Memory Management allows the database to distribute memory automatically between the system global area (SGA) and the program global area (PGA), based on user-specified overall database memory target size. If automatic memory management is not enabled, then the SGA and PGA must be sized manually.
Enable Automatic Memory Management
Allocate Memory:
256
1174
2934
1,174
40 %
SGA target: AUTO MB
PGA aggregate target: AUTO MB
Target Database Memory: 1174 MB
Help
< Back
Next >
Finish
Cancel


Oracle Database 11g Release 2 Installer - Installing database - Step 11 of 19
Specify Configuration Options
ORACLE 11g DATABASE
Configure Security Updates
Installation Option
System Class
Grid Installation Options
Install Type
Product Languages
Database Edition
Installation Location
Configuration Type
Database Identifiers
Configuration Options
Management Options
Database Storage
Backup and Recovery
Schema Passwords
Prerequisite Checks
Summary
Install Product
Memory
Character sets
Security
Sample Schemas
The database character set determines how character data is stored in the database.
Use the default
Character set for this database is based on the language setting of this operating system: WE8MSWIN1252.
Use Unicode (AL32UTF8)
Setting character set to Unicode (AL32UTF8) enables you to store multiple language groups.
Choose from the following list of character sets
Select Database character set:
West European WE8MSWIN1252

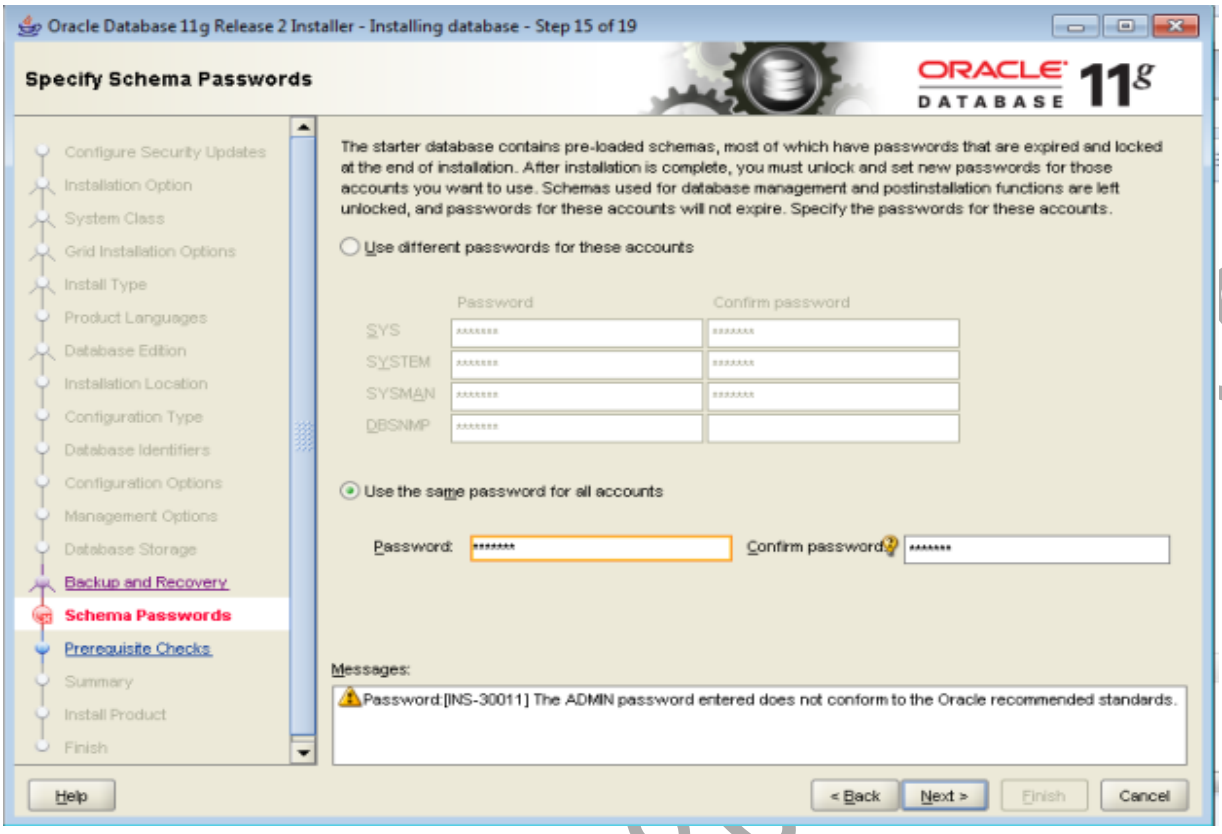

Oracle Database 11g Release 2 Installer - Installing database - Step 11 of 19
Specify Configuration Options
ORACLE 11g DATABASE
Configure Security Updates
Installation Option
System Class
Grid Installation Options
Install Type
Product Languages
Database Edition
Installation Location
Configuration Type
Database Identifiers
Configuration Options
Management Options
Database Storage
Backup and Recovery
Schema Passwords
Prerequisite Checks
Summary
Install Product
Memory
Character sets
Security
Sample Schemas
You can choose to create a starter database with or without sample schemas. Note that you can plug in the sample schemas to your existing starter database after creation. See "Help" for more details.
Create database with sample schemas


Oracle Database 11g Release 2 Installer - Installing database - Step 12 of 19
Specify Management Options
ORACLE 11g DATABASE
Configure Security Updates
Installation Option
System Class
Grid Installation Options
Install Type
Product Languages
Database Edition
Installation Location
Configuration Type
Database Identifiers
Configuration Options
Management Options
Database Storage
Backup and Recovery
Schema Passwords
Prerequisite Checks
Summary
Install Product
Finish
You can use Oracle Enterprise Manager 11g Grid Control to manage each Oracle Database 11g centrally, or manage each database locally using Oracle Enterprise Manager 11g Database Control. For Grid Control, specify the Oracle Management Service to manage your database. For Database Control, you can indicate if you want to receive email notifications for alerts.
Select the management options for your instance.
Use an existing Grid Control for database management.
Management Service:
No Agent found.
Use Database Control for database management.
Enable email notifications.
Outgoing mail (SMTP) server:
Email address:
Help
< Back
Next >
Finish
Cancel





Oracle Database 11g Release 2 Installer - Installing database - Step 15 of 19



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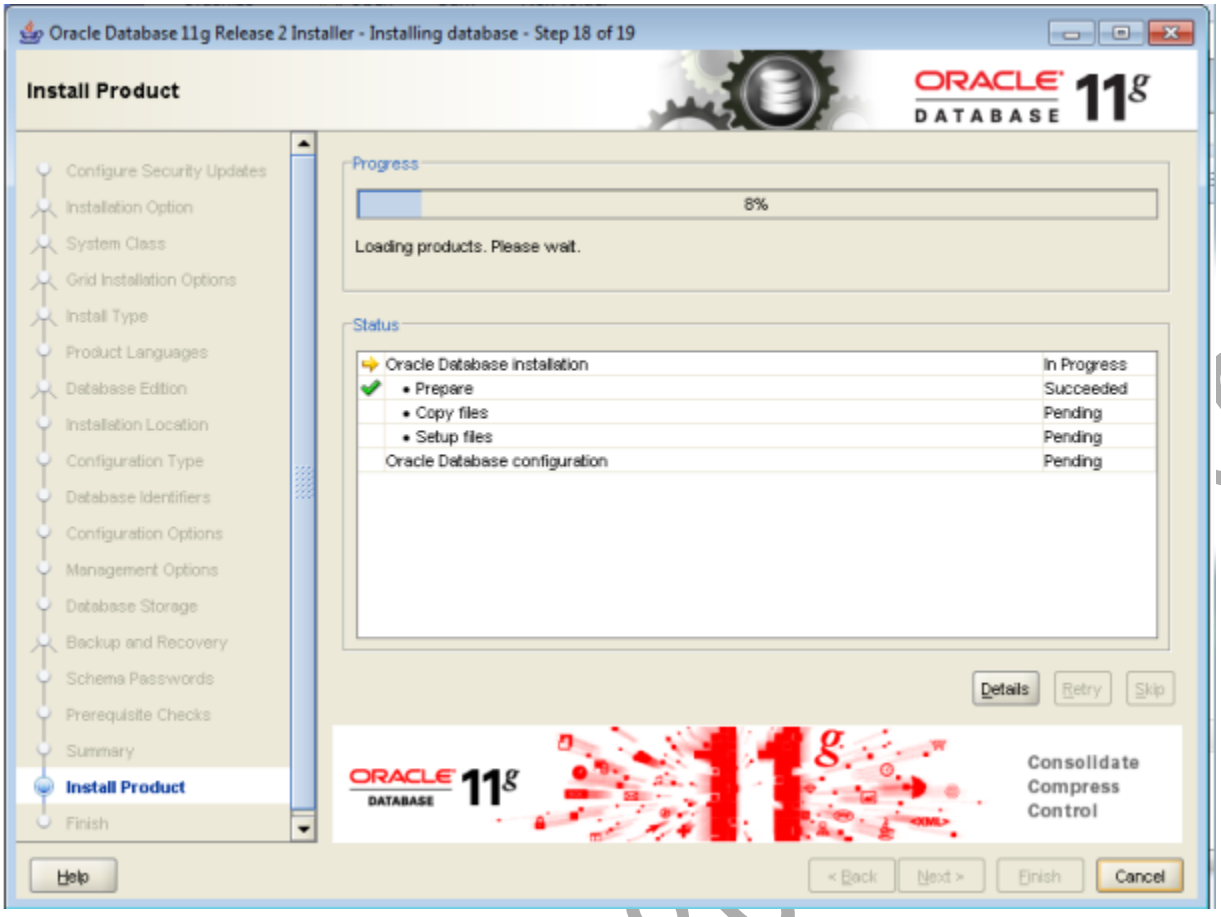
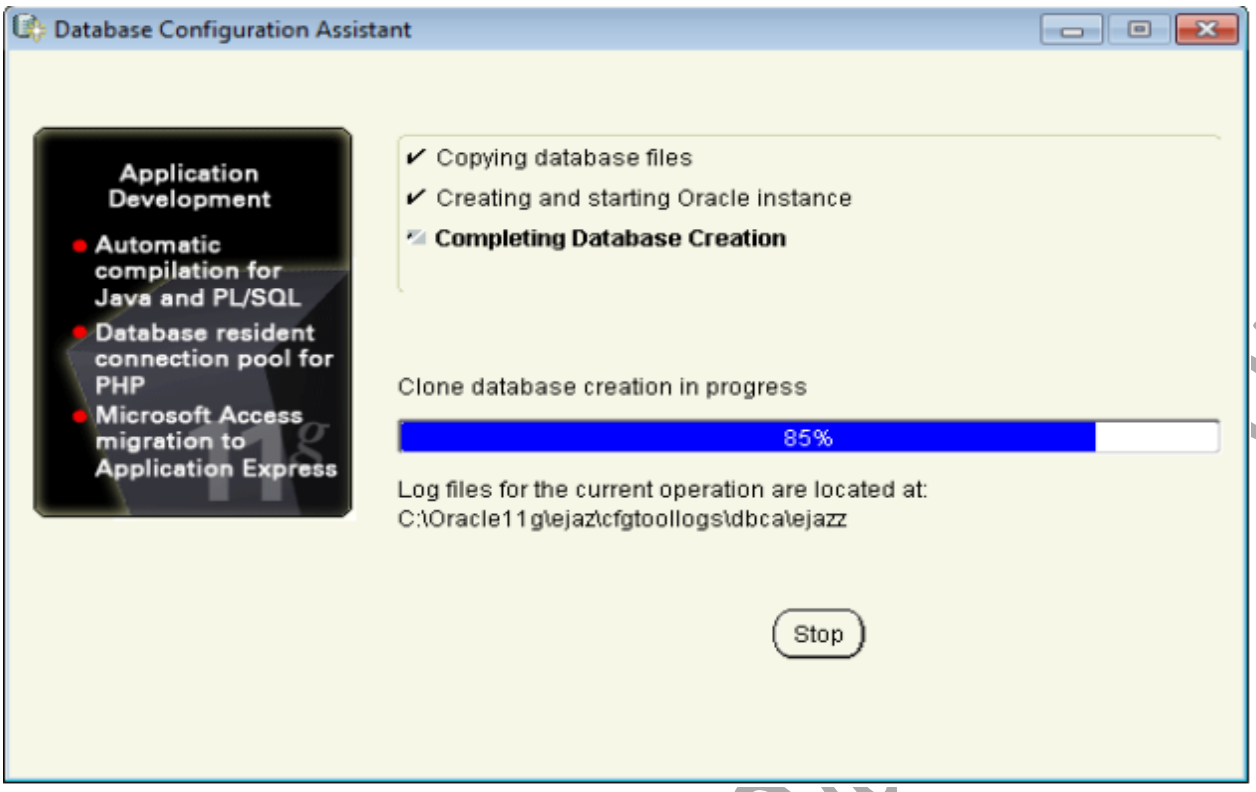


In case if any process failed, press Retry button. If NetConfig error displays then press continue

Grid Installation Options

Mahjabeen978



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Oracle11g Installation

Login with Oracle Database Manager

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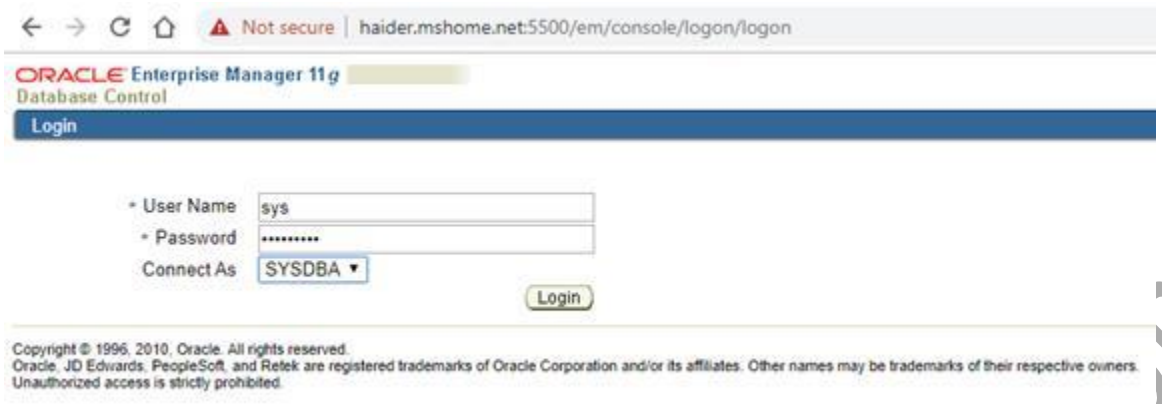


Oracle11g Installation

Installation

HOW TO LOGIN USING sys?
In User Name input box or prompt, type the following
sys / as sysdba then press enter key and type password as
password@ejazz (you will see like ******)
you can try without typing SID @ejazz
if you connection failed
Oracle11g Installation

Installation

How to unlock any user (like scott, your test user)
user: sys / as sysdba (press enter key) give password that has been set during the installation

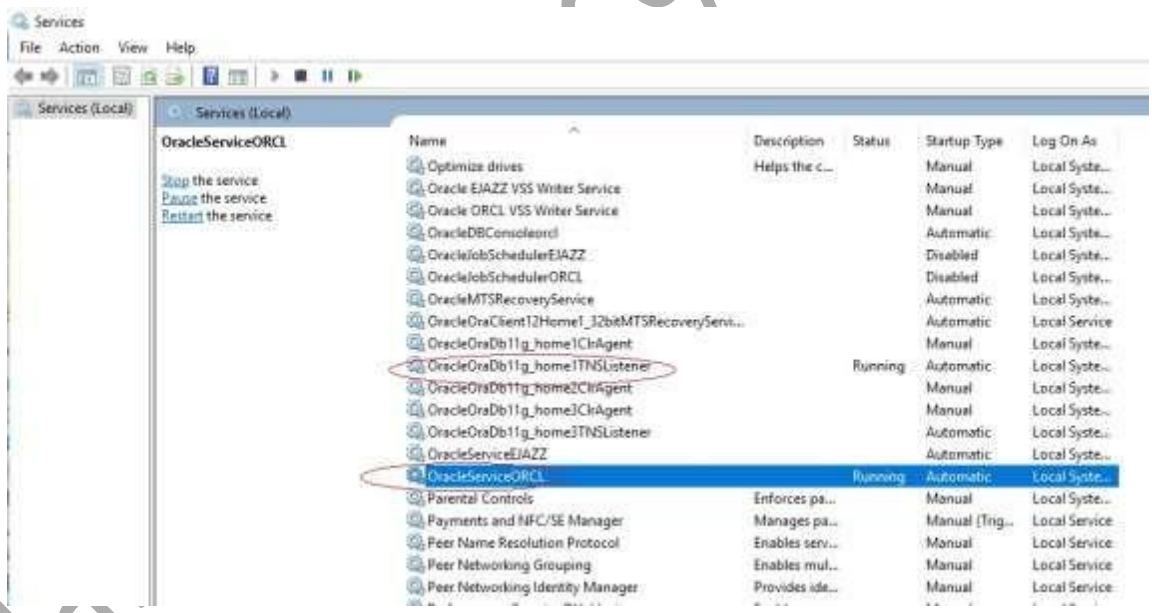
SQL>alter user scott account unlock;
Oracle11g Installation

Installation

How to change password:
SQL>Alter user st110145 identified by newpassword;

Alternatively Login:
Start SQL*Plus and log in as the SYS user, connecting
as SYSDBA:
$ORACLE_HOME/bin/sqlplus SQL> CONNECT SYS as SYSDBA
Enter password: sys_password
Oracle11g Installation

OS Services



Control Panel Admin Tools Services
Oracle11g Installation

Installation

To un-install oracle, follow press Oracle Installation Products Oracle Installer, choose oracle home and press Remove button

Once De-installation process is completed. Restart your Computer or Server, remove all oracle folders. Then install Oracle again.
Introduction to Database Administration

TOPIC 45

MS SQL Server Installation

MS SQL Server Installation

Installation Steps

Editions of MS SQL Server 2017
Installation …
Installation by Giving Password
Installation in Progress
Installation Complete
MS SQL Server Installation

Editions of MS SQL Server 2017

Enterprise: Comprehensive, high-end capacities for commanding database and business intelligence essentials.

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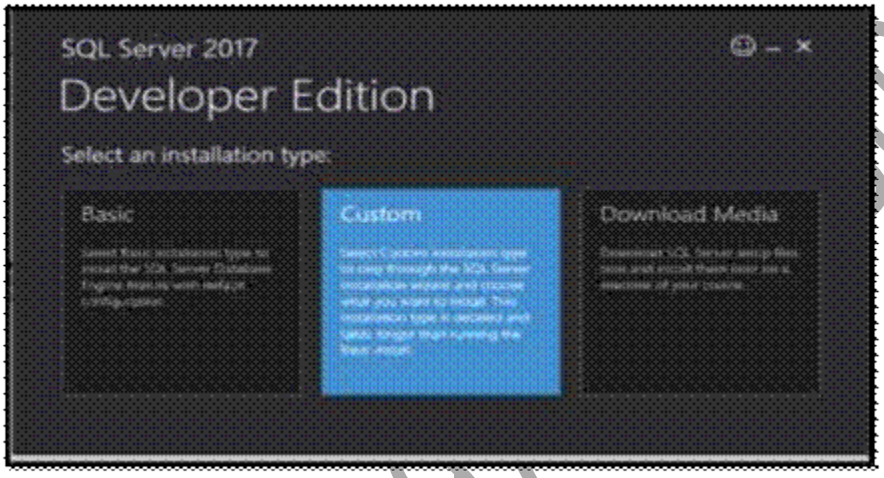
Standard: Core data management and business intelligence abilities for non-critical workloads with minimal IT support.
Express: This is a free version with limited SQL Server features.
Developer: This is a free version to build, test, and demo apps in non-production environments. All Enterprise Edition features are included.
Web: SQL Server Web edition is a low-cost version for Web features
MS SQL Server Installation

Installation …

Once SQL Server 2017 Developer edition is downloaded, double click on it to launch.



MS SQL Server Installation

Installation …

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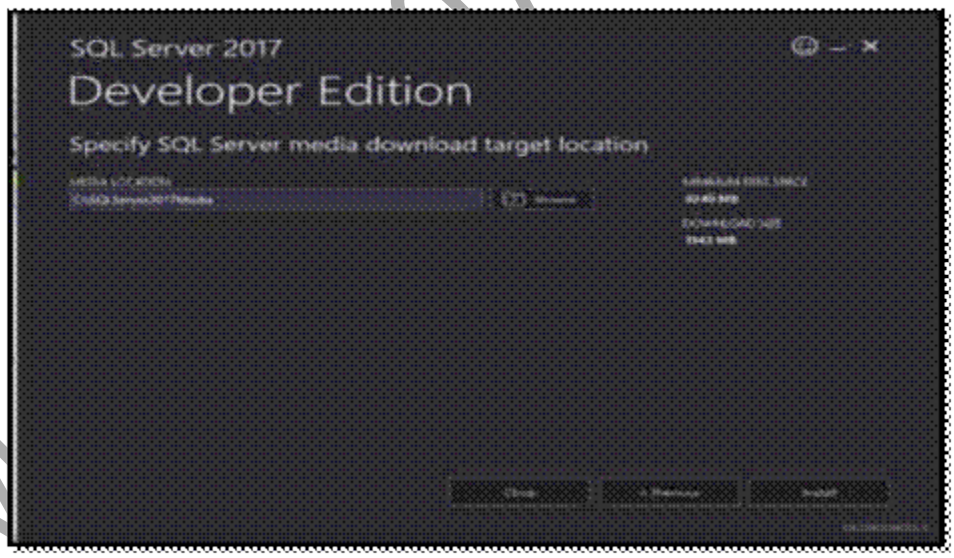
Specify the Media Location where we want to save the SQL Server media. The drive should have at minimum free space of 9240 MB in order to extract the media.
MS SQL Server Installation

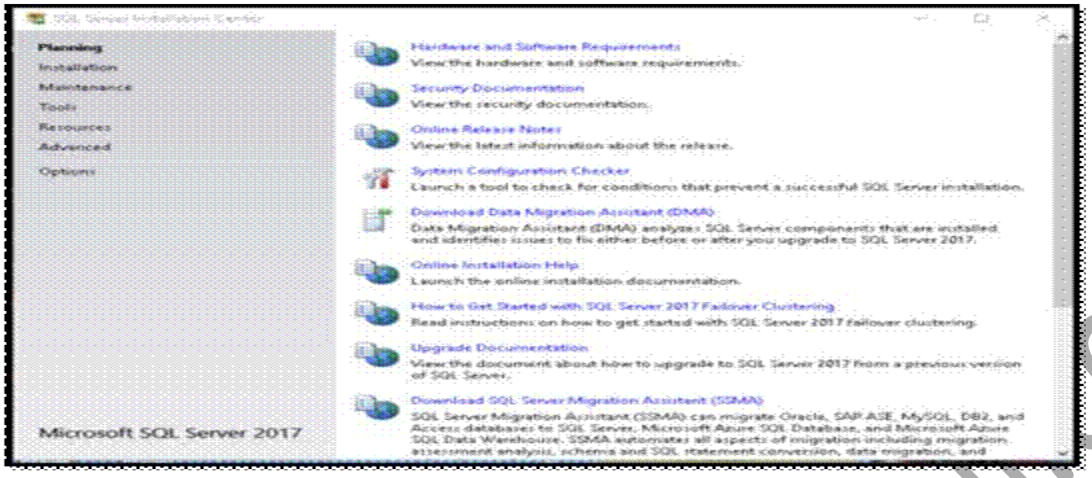
Installation …

Specify the Media Location where we want to save the SQL Server media. The drive should have at minimum free space of 9240 MB in order to extract the media.



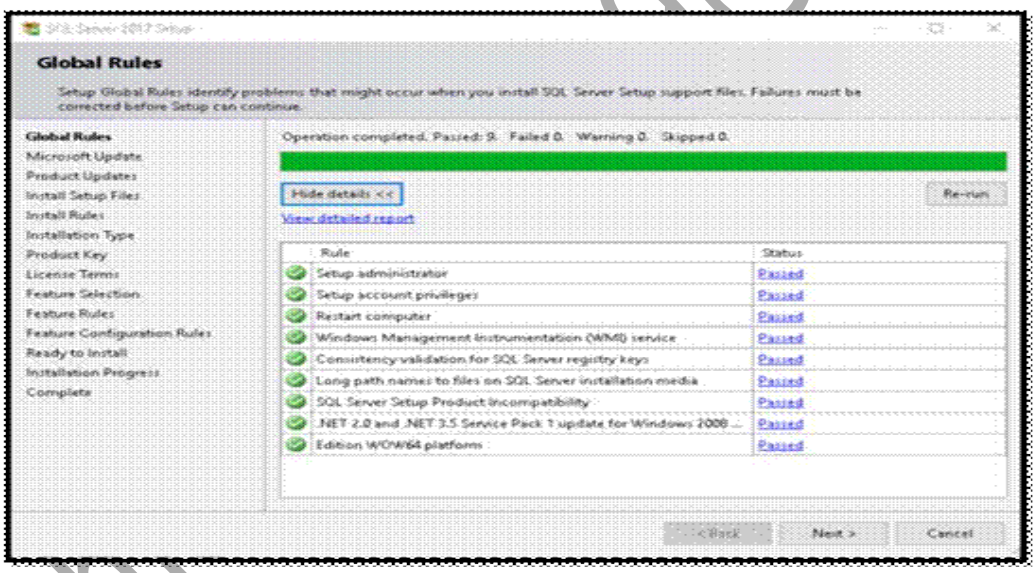
MS SQL Server Installation

Installation …

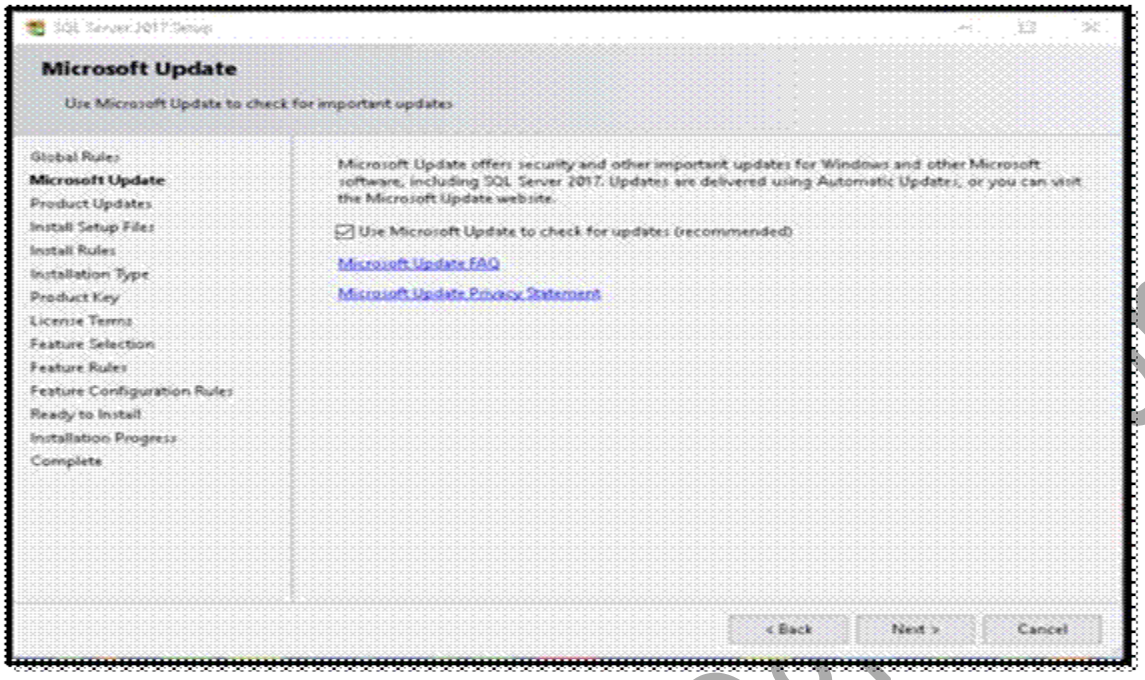


Click on New SQL Server stand-alone installation and you will get this message.
MS SQL Server Installation

Installation …



Make sure all Global rules are passed
MS SQL Server Installation
Installation …



MS SQL Server Installation

Installation …

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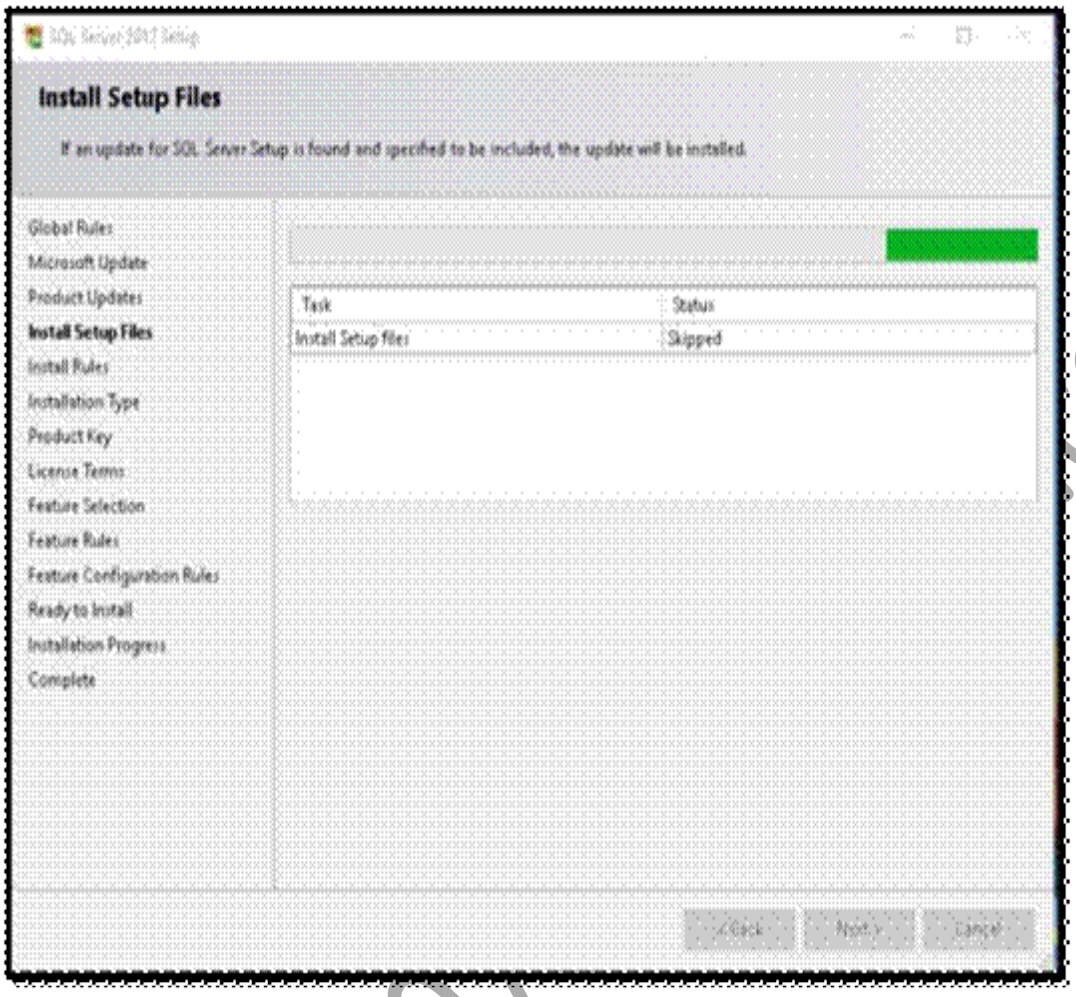

MS SQL Server Installation

Installation …

Provide product key of license

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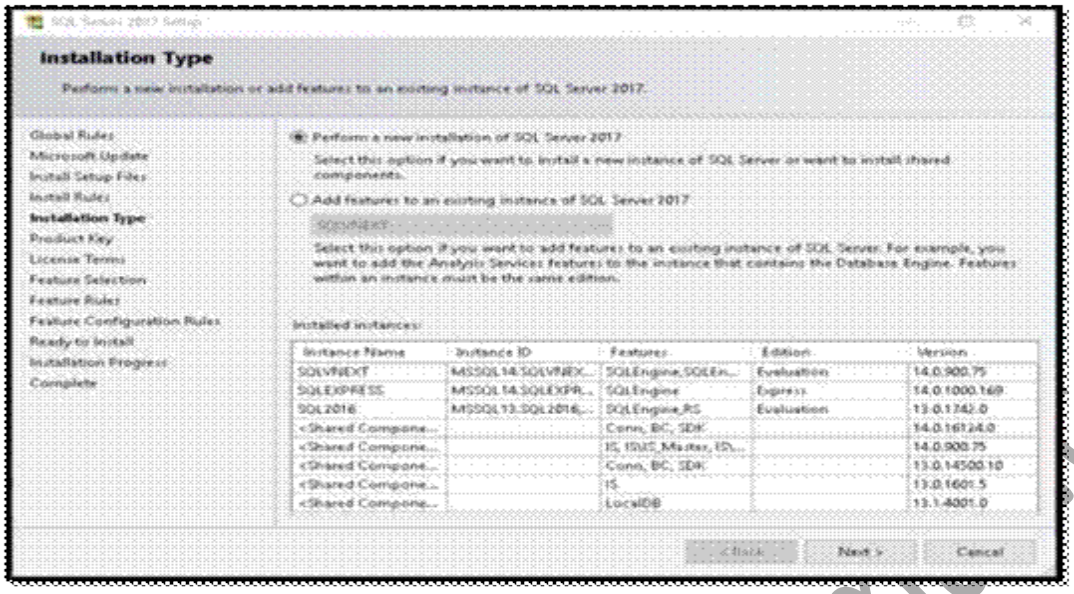
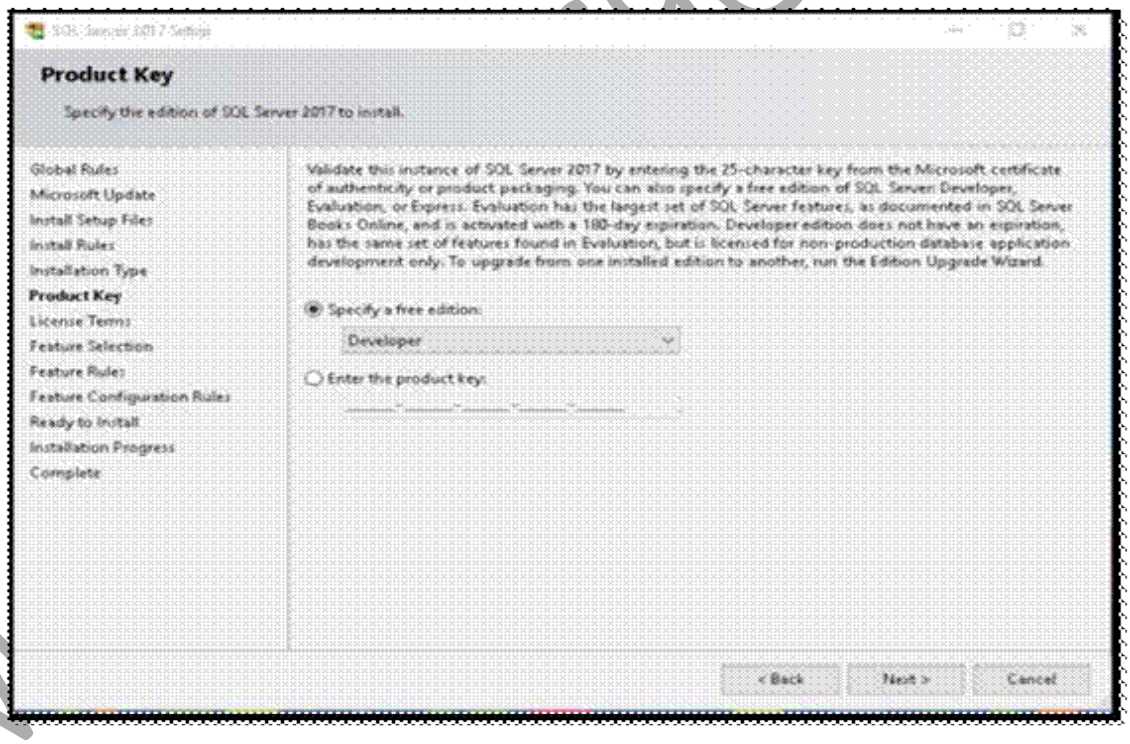
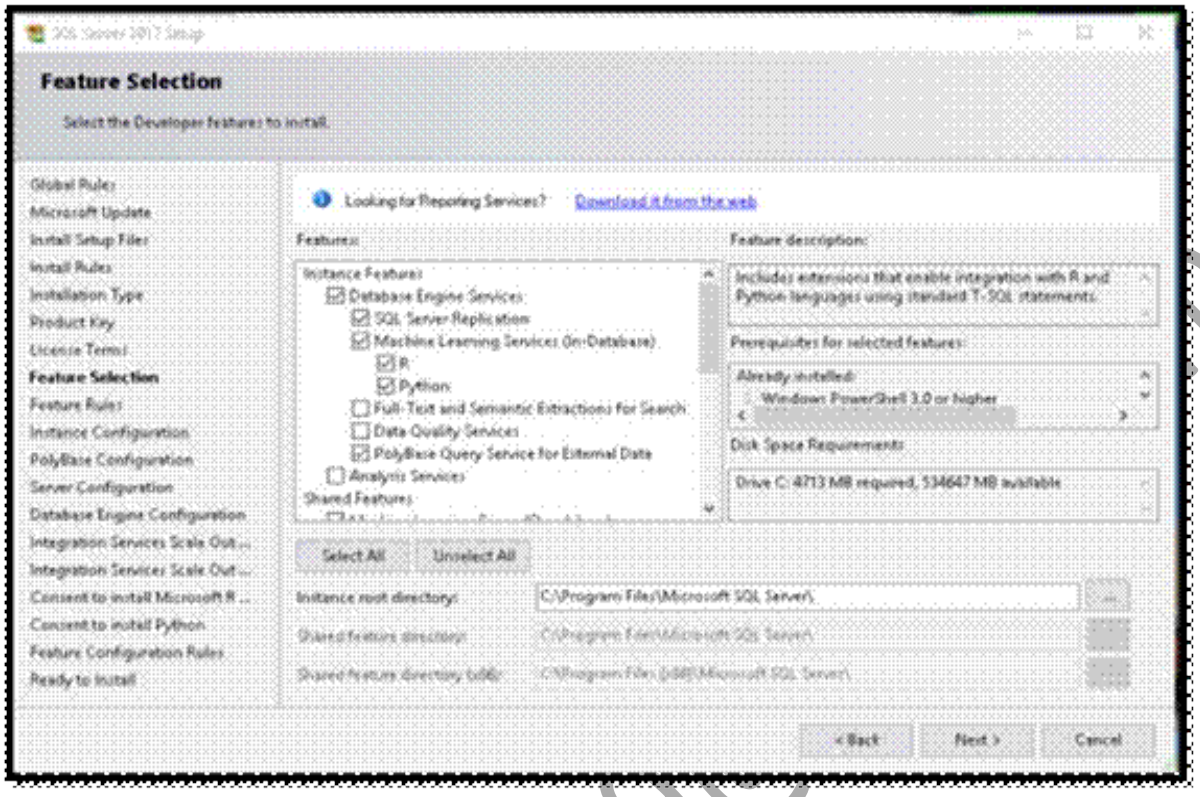


MS SQL Server Installation
Installation …

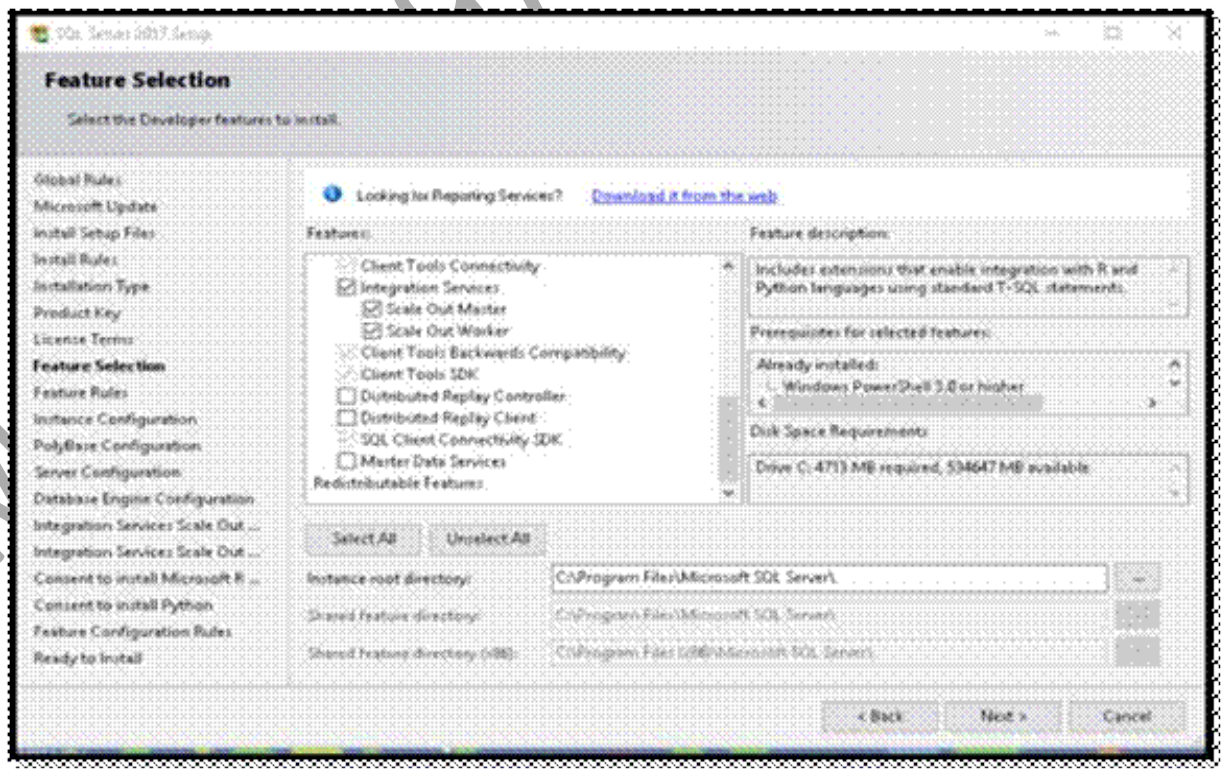


MS SQL Server Installation
Installation …

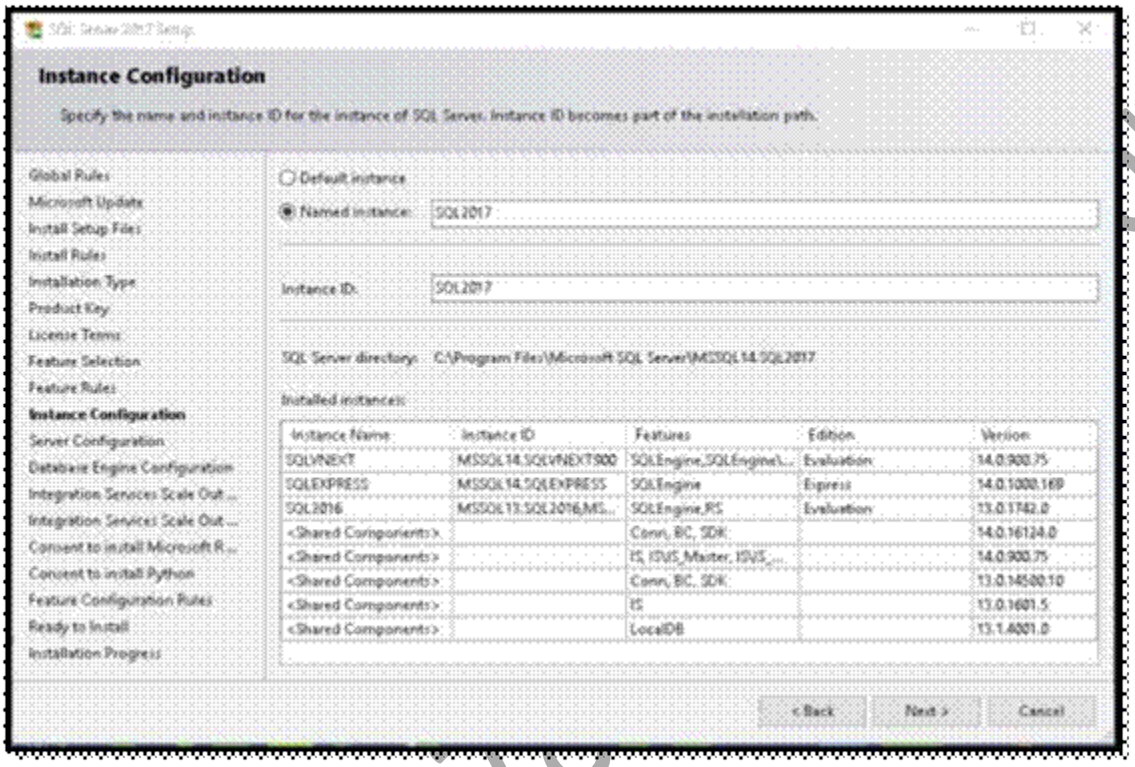


MS SQL Server Installation

Installation …



MS SQL Server Installation
Installation …



MS SQL Server Installation
Installation …

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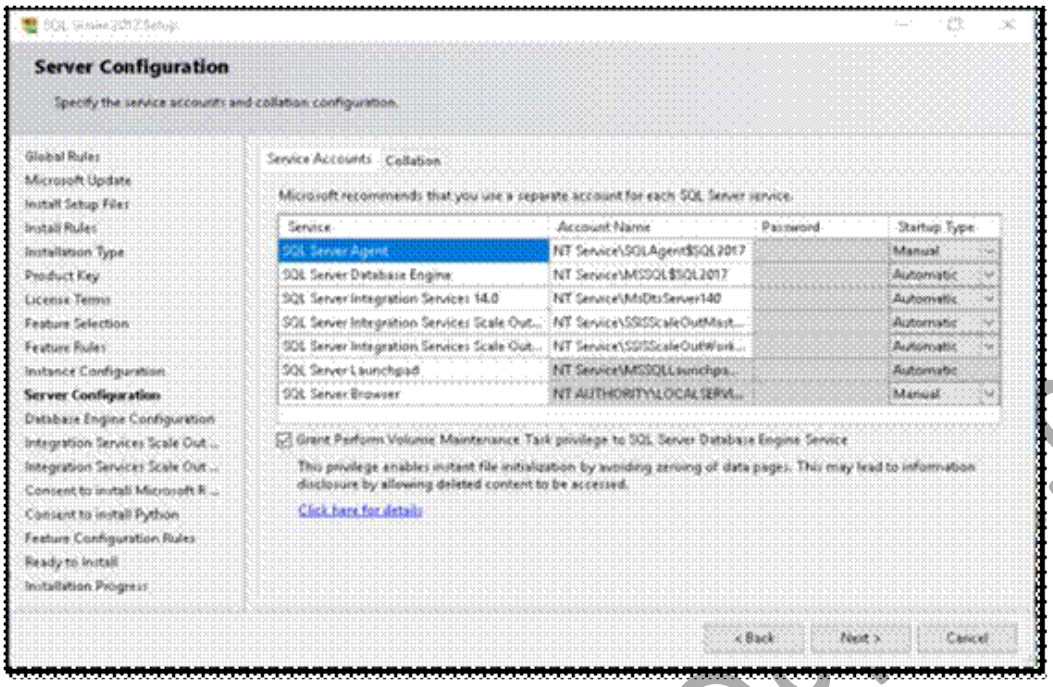
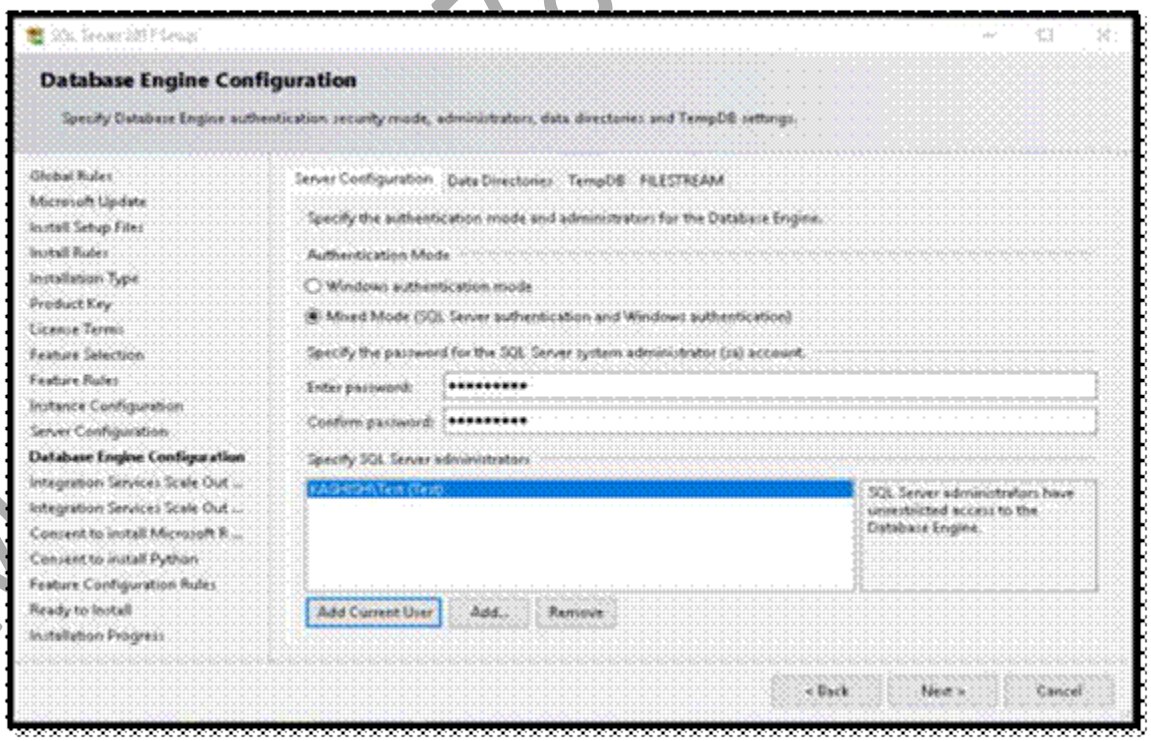


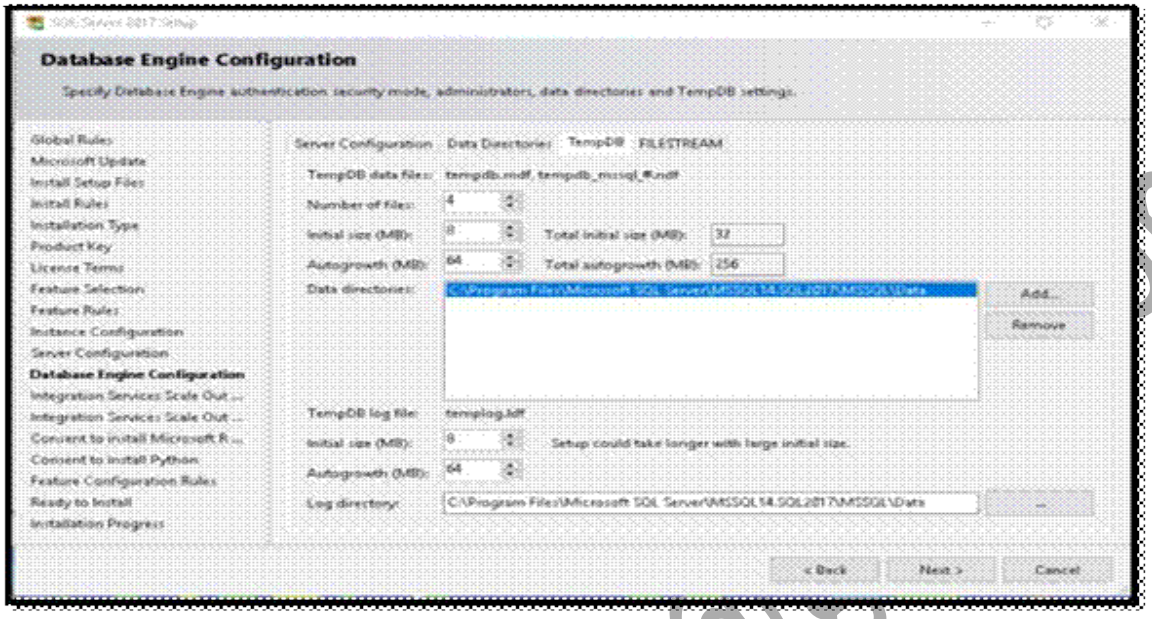
MS SQL Server Installation

Installation by Giving Password



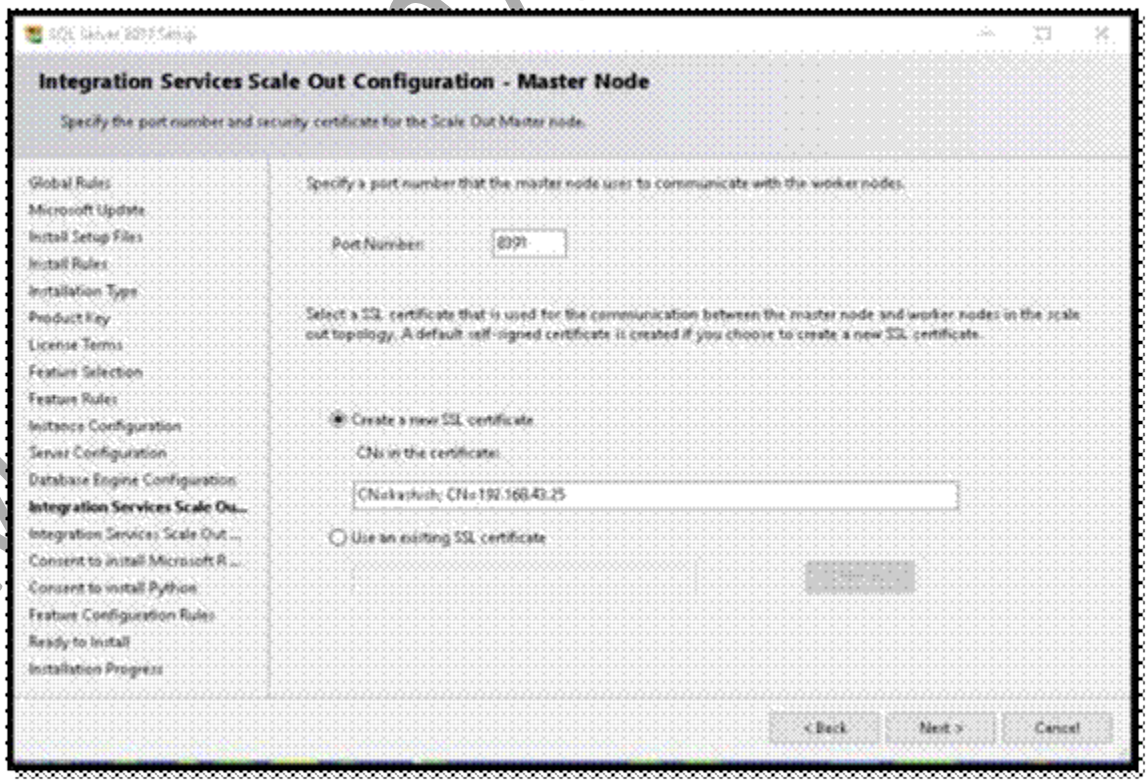
MS SQL Server Installation

Installation …



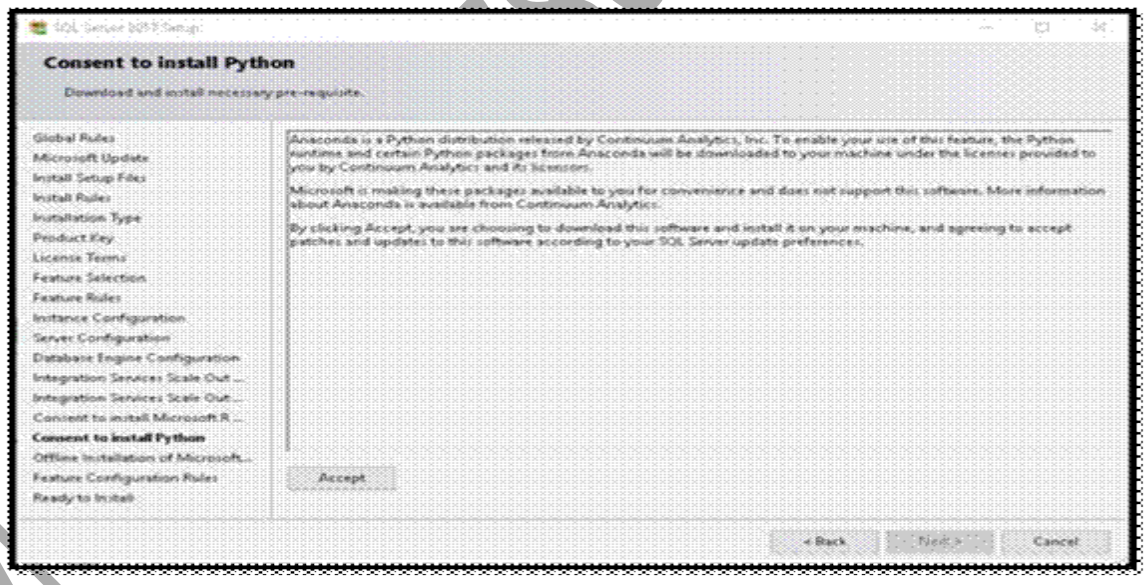
MS SQL Server Installation

Installation …

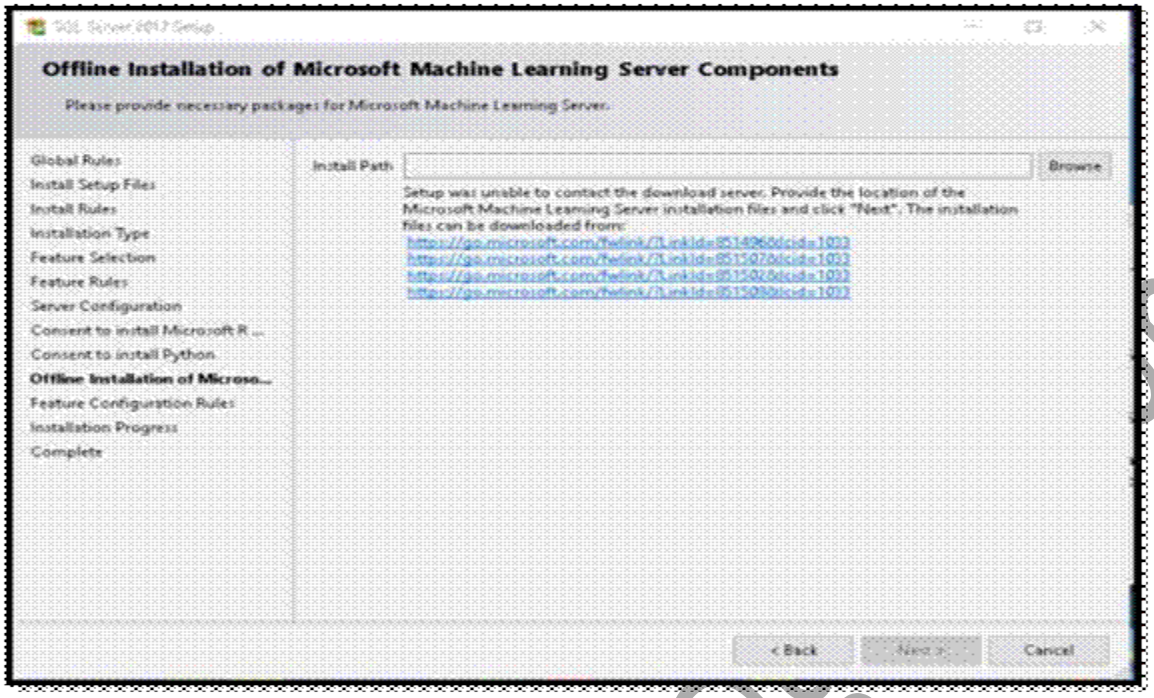


MS SQL Server Installation
Installation …

MS SQL Server Installation
Installation …

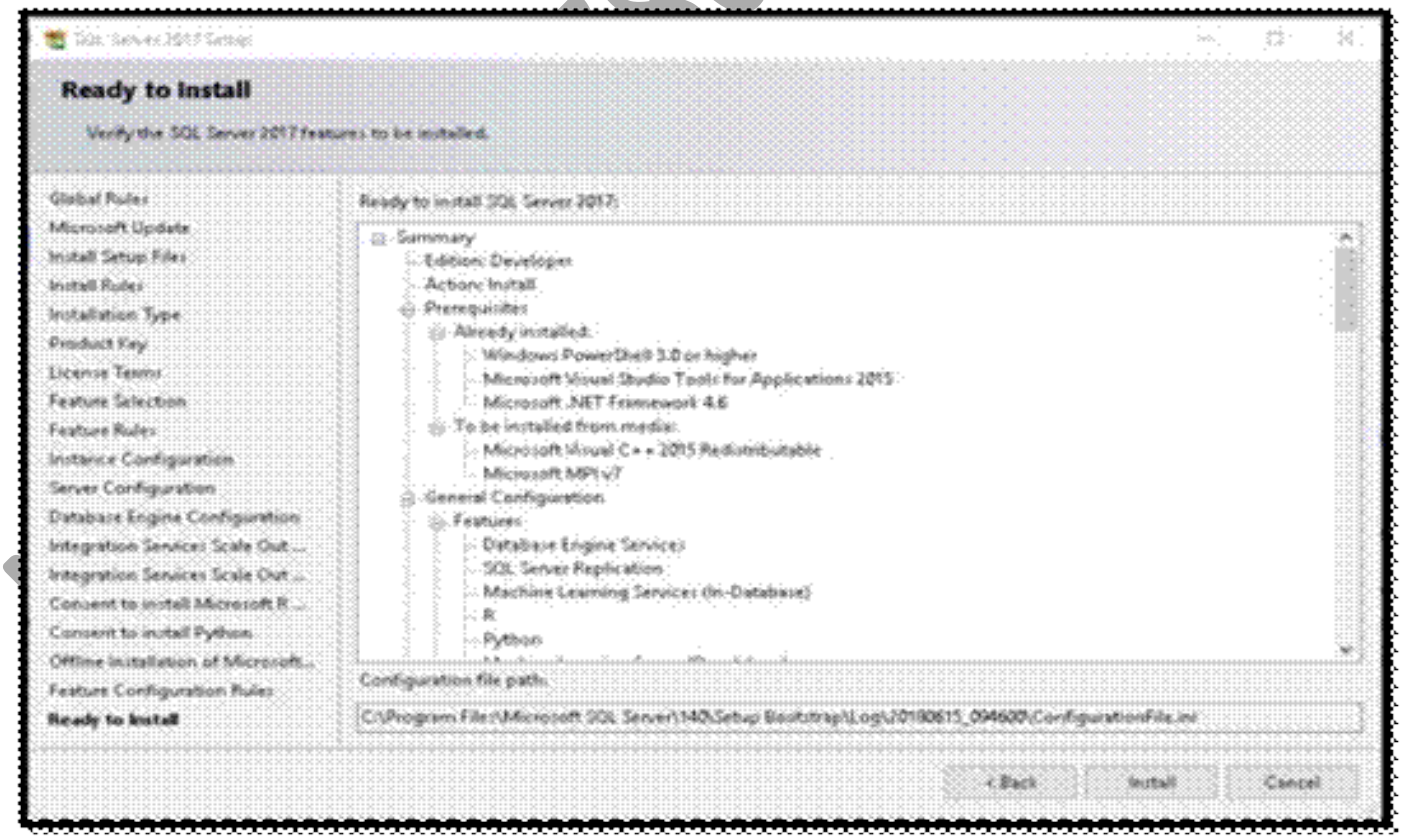


MS SQL Server Installation
Installation

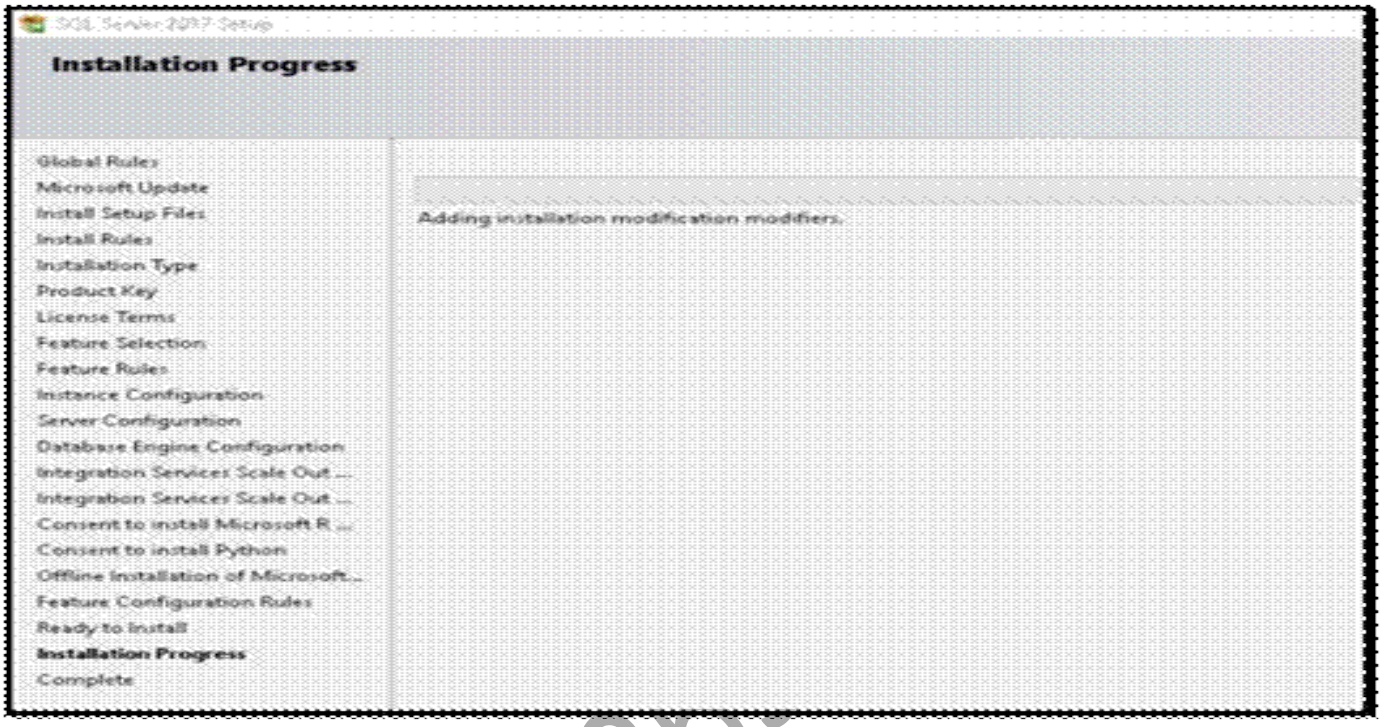


MS SQL Server Installation

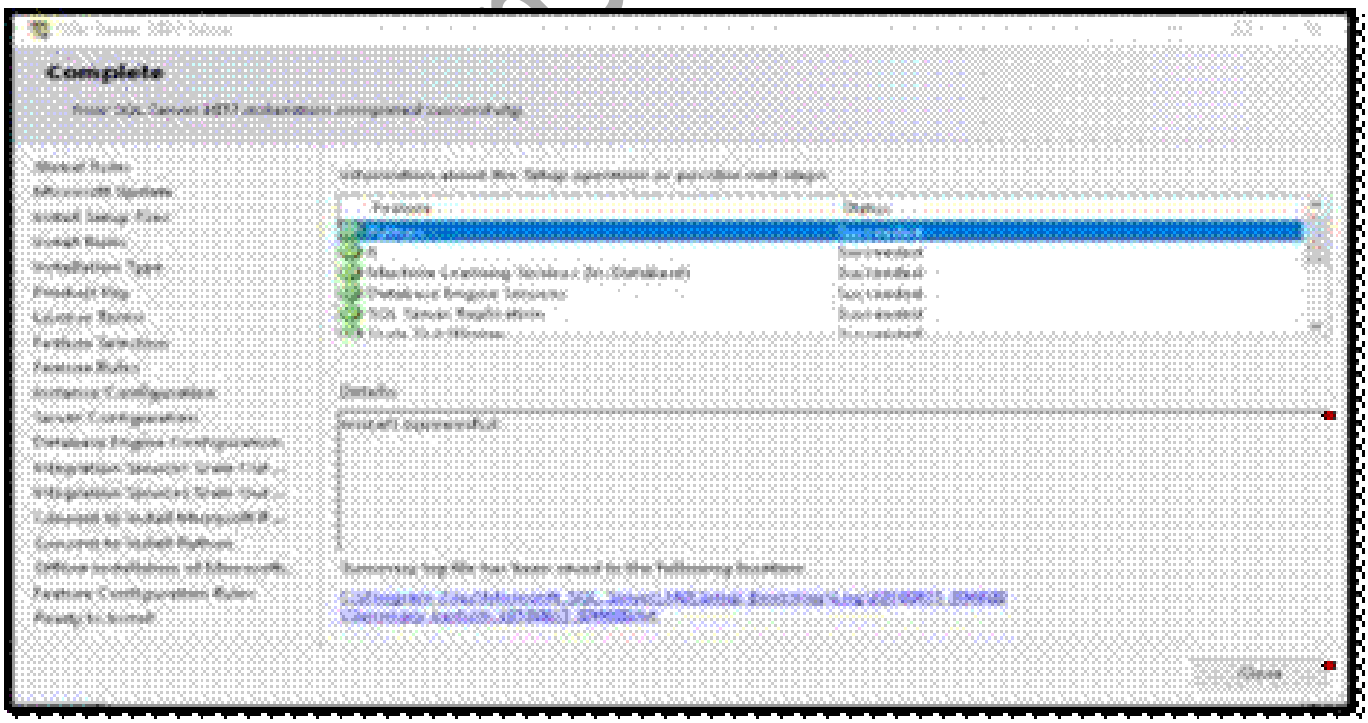
Installation



MS SQL Server Installation
Installation in Progress



MS SQL Server Installation
Installation Complete



Install SQL Server Management Studio 17.x to connect to the database server.
Download and install SQL Server Data Tools to build SQL Server relational databases, Azure SQL databases, Analysis Services (AS) data models, Integration Services (IS) packages, and Reporting Services (RS) reports.
Go through these other SQL Server 2017 tips.
Introduction to Database Administration

TOPIC 46

Oracle Configuration for Connection

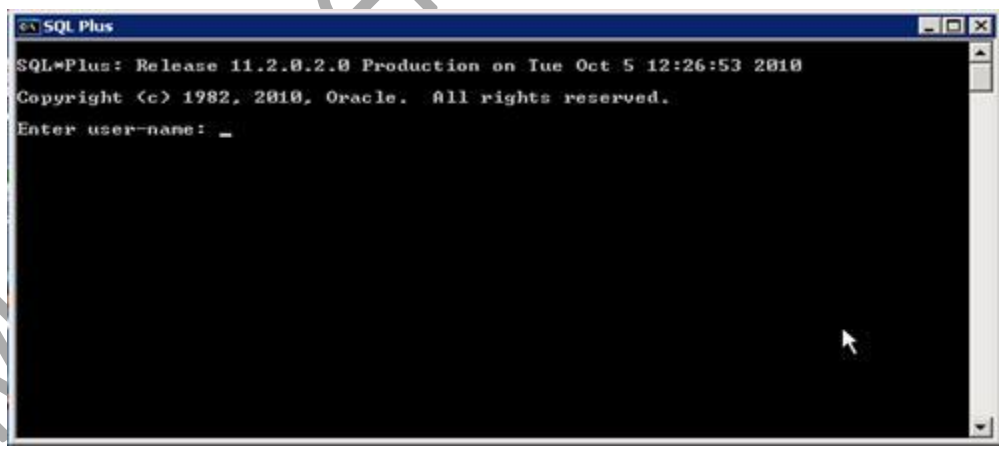
Oracle Configuration for Connection

Configuration for connection

Connect using SQL*Plus
Connect using SQL Developer
Manual Connect using tnsnames.ora
Oracle Client & Oracle Net
Oracle Configuration for Connection

Connect using SQL*Plus

Click on SQL*Plus icon and login with your user id
and password with database name (SID) that you



have given during installation.
SQL>CONNECT username @ "hostname[:port][/DBname]"
Oracle Configuration for Connection

Connect using SQL Developer

Right click Connection and choose New

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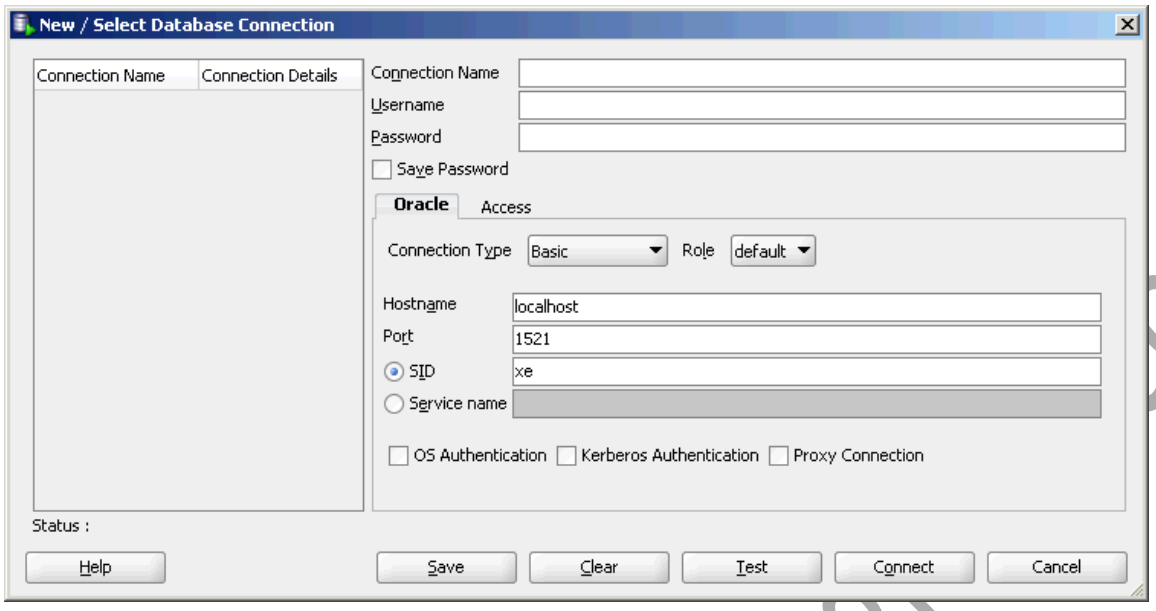
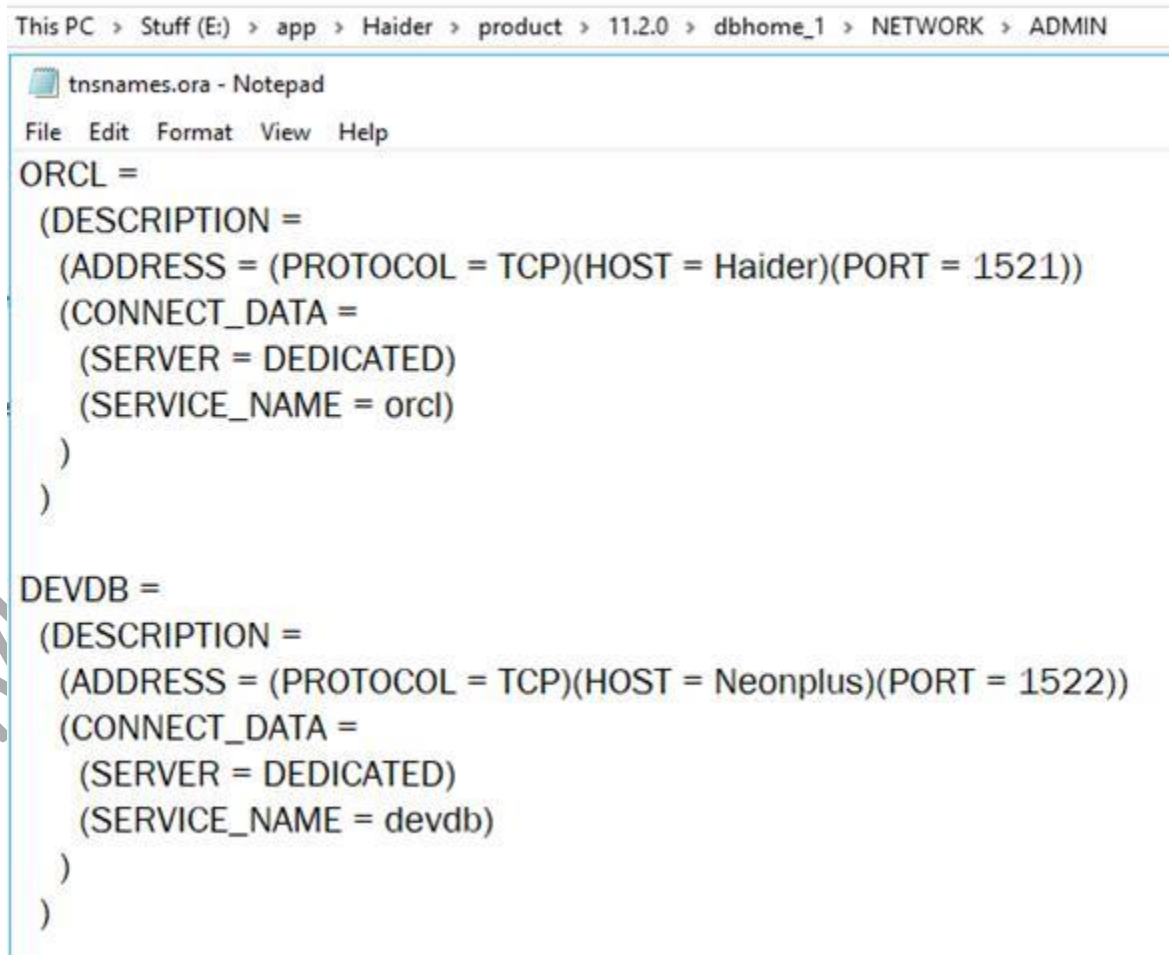
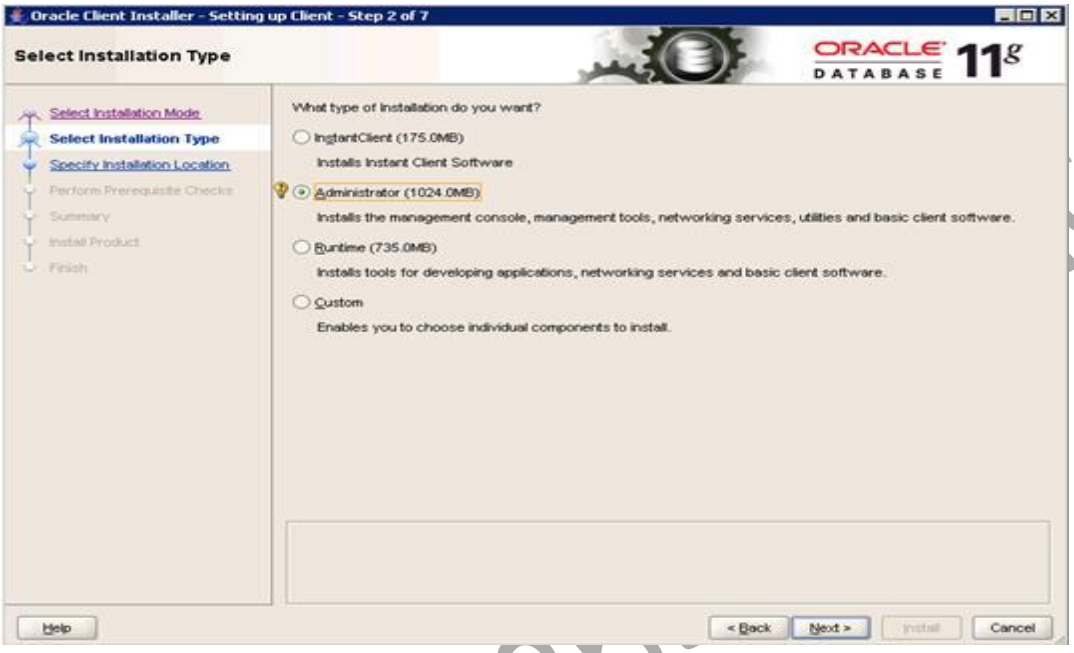


The New/Select Database Connection dialog appears
Oracle Configuration for Connection



Manual Connect using tnsname.ora file
Oracle Configuration for Connection

Oracle Client & Oracle Net



Run SETUP.EXE to start Oracle Universal Installer
Oracle Configuration for Connection
Oracle Client & Oracle Net

Oracle Configuration for Connection
Oracle Client & Oracle Net

Oracle Configuration for Connection

Oracle Client & Oracle Net

Oracle Configuration for Connection

Oracle Client & Oracle Net

Oracle Configuration for Connection

Oracle Client & Oracle Net

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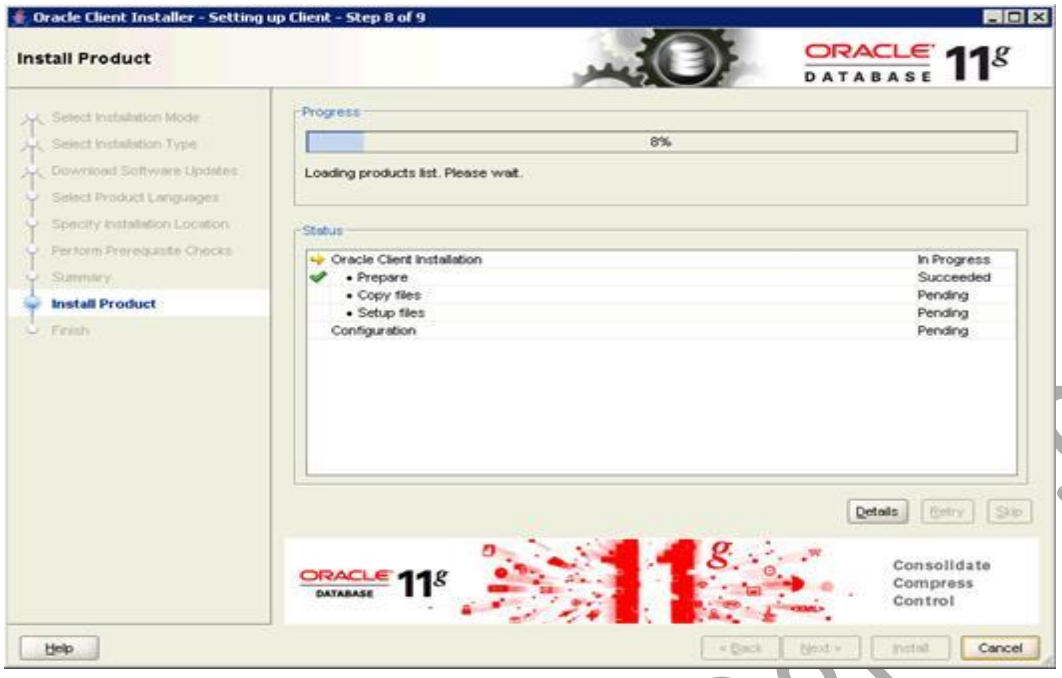
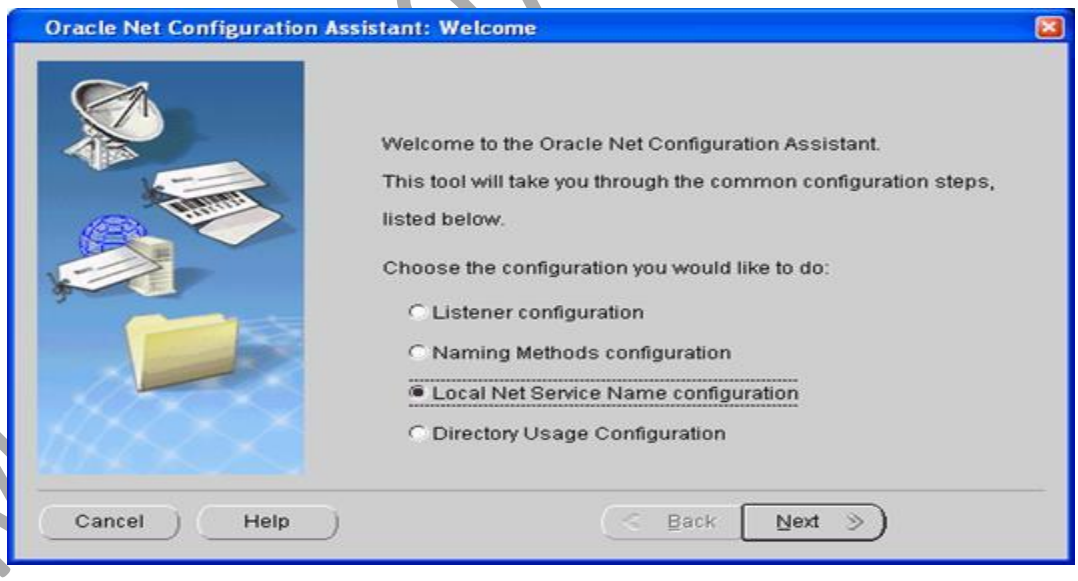
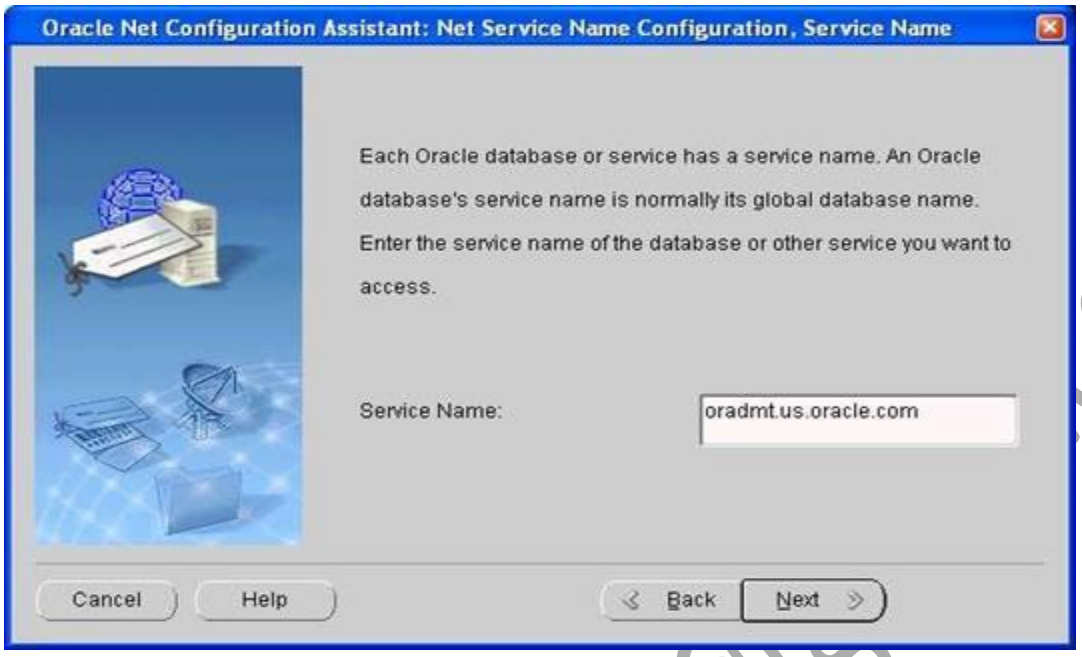


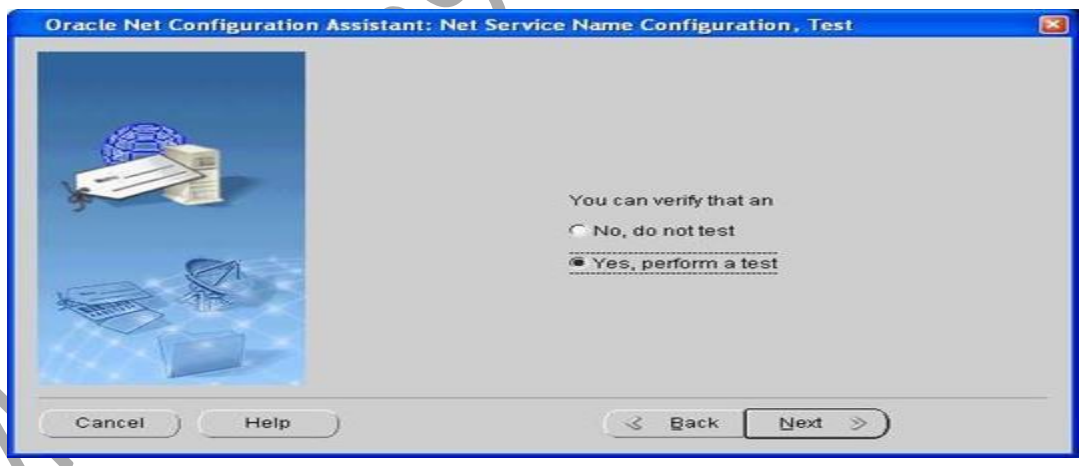
Oracle Configuration for Connection
Oracle Client & Oracle Net



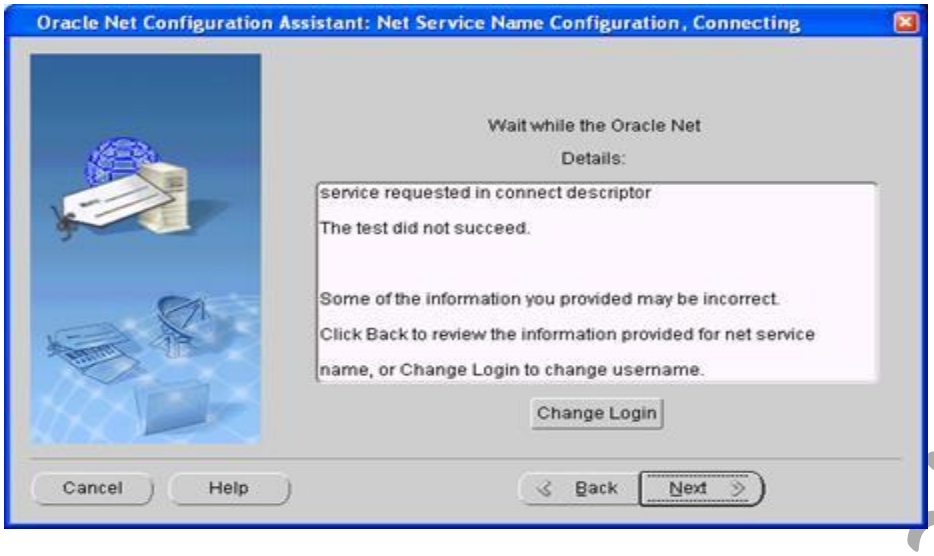
Oracle Configuration for Connection
Oracle Client & Oracle Net



Oracle Configuration for Connection
Oracle Client & Oracle Net



Oracle Configuration for Connection
Oracle Client & Oracle Net



End

Introduction to Database Administration

TOPIC 47

Oracle Data Dictionary Views

Oracle Data Dictionary Views

Data Dictionary Views (Metadata)

Metadata
Data Dictionary
Data Dictionary Contents
Data Dictionary View Sets
How to use Data Dictionary?

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Oracle Data Dictionary Views

Metadata

Repository of information (metadata) describing the data in the database.
Data about data is called Metadata Oracle metadata is managed by Data Dictionary (Read only access)

Data Dictionary is managed by using SQL

Catalogue, Repository are alternate names SQL>desc dict
Oracle Data Dictionary Views

Data Dictionary

Schema objects in the database including default values for columns and integrity constraints

Show up of amount of space or storage allocated by objects

Show up of database users, privileges and roles of users.
Oracle Data Dictionary Views

Data Dictionary Contents

Base Tables
These underlying tables store information about the database. Only Oracle database should write to and read these tables.
Views
These views decode the base table data into useful information, such as user or table names, using joins and WHERE clauses to simplify the information. These views contain the names and description of all objects in the data dictionary.
Oracle Data Dictionary Views

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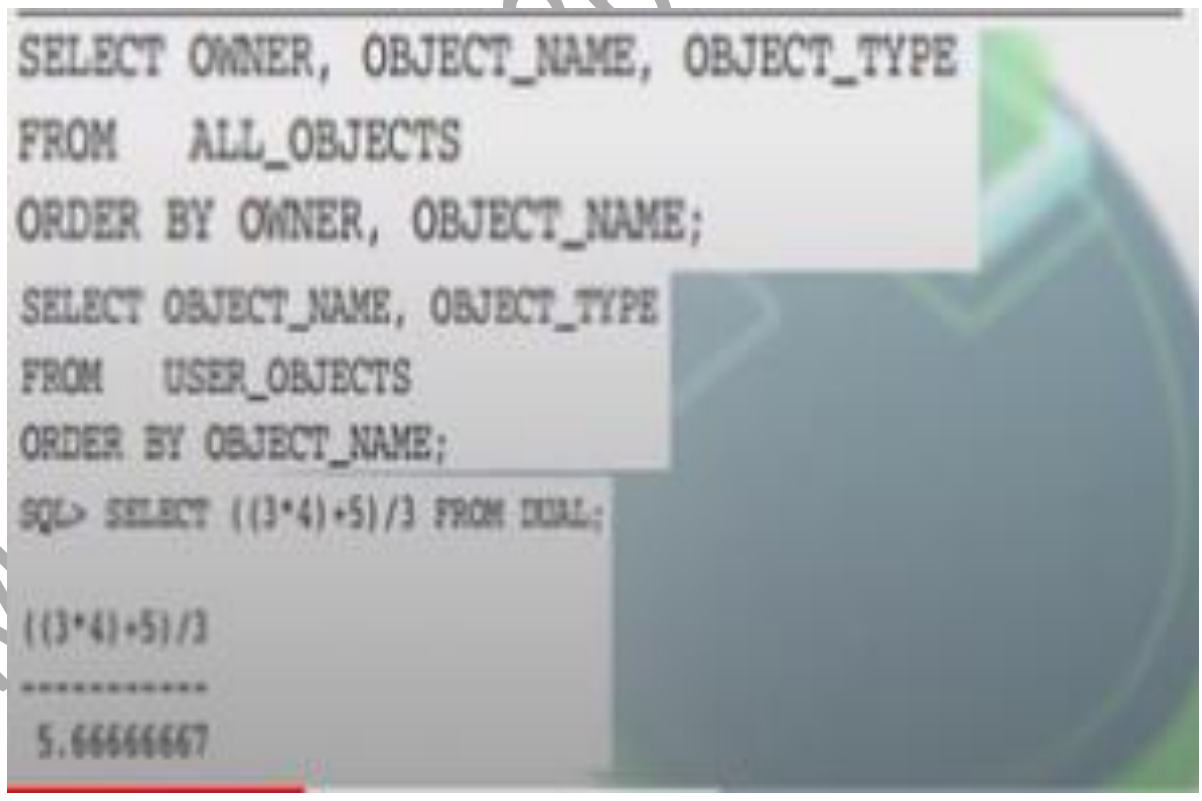
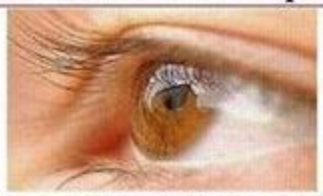
Prefix	User Access	Contents	Notes
DBA_	Database administrators	All objects	Some DBA_ views have additional columns containing information useful to the administrator.
ALL_	All users	Objects to which user has privileges	Includes objects owned by user. These views obey the current set of enabled roles.
USER_	All users	Objects owned by user	Views with the prefix USER_ usually exclude the column OWNER. This column is implied in the USER_ views to be the user issuing the query.

Data Dictionary View Sets



Oracle Data Dictionary Views

See columns of table emp and their data types



```
SQL> desc emp
 Name                                      Null?    Type
 ----------------------------------------- -------- ------------
 EMPNO                                     NOT NULL NUMBER(4)
 ENAME                                              VARCHAR2(10)
 JOB                                                VARCHAR2(9)
 MGR                                                NUMBER(4)
 HIREDATE                                           DATE
 SAL                                                NUMBER(7,2)
 COMM                                               NUMBER(7,2)
 DEPTNO                                             NUMBER(2)

SQL> select empno, hiredate, deptno, sal
  2  from emp;

     EMPNO HIREDATE      DEPTNO        SAL
---------- --------- ---------- ----------
      7369 17-DEC-80         20        800
      7499 20-FEB-81         30       1600
      7521 22-FEB-81         30       1250
      7566 02-APR-81         20       2975
      7654 28-SEP-81         30       1250
      7698 01-MAY-81         30       2850
      7782 09-JUN-81         10       2450
      7788 19-APR-87         20       3000
      7839 17-NOV-81         10       5000
      7844 08-SEP-81         30       1500
      7876 23-MAY-87         20       1100

     EMPNO HIREDATE      DEPTNO        SAL
---------- --------- ---------- ----------
      7900 03-DEC-81         30        950
      7902 03-DEC-81         20       3000
      7934 23-JAN-82         10       1300

14 rows selected.

SQL>
```

Start writing SQL by looking at above columns

How to use Data Dictionary?

Login with Sys / as sysdba SQL> desc Dict
Introduction to Database Administration

TOPIC 48

Oracle Data Dictionary Views
Oracle Data Dictionary Views

Data Dictionary Views (Metadata)

Example-1: Data Dictionary
Example-2: Data Dictionary
Dynamic Performance Views
Oracle Data Dictionary Views

Example-1: Data Dictionary

Desc dict

```
select table_name from dict
where table_name like '%CONSTRAINT%';
```

desc user_constraints
Oracle Data Dictionary Views

Example-1: Data Dictionary

To see constraints of table EMP:

```
select constraint_name, table_name,
R_constraint_name from user_constraints
where table_name='EMP';
```

Oracle Data Dictionary Views

Example-1: Data Dictionary

To see constraints of table EMP:

```
select constraint_name, table_name,
R_constraint_name from user_constraints
where table_name='EMP';
```

Oracle Data Dictionary Views

Example-2: Data Dictionary

To see the size of table EMP in KB
--login with user scott

```
select sum(bytes)/1024/1024
from dba_segments
where segment_name ='EMP';
```

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select segment_name, sum(bytes)/1024/1024 from USER_segments group by segment_name;
Oracle Data Dictionary Views

Dynamic Performance Views

These views are called dynamic performance views because they are continuously updated while a database is open and in use. The views, also sometimes called V$ views, contain
System and session parameters
Memory usage and allocation
File states (including RMAN backup files)
Oracle Data Dictionary Views

Dynamic Performance Views

Progress of jobs and tasks
SQL execution
Statistics and metrics

e.g., V$SESSION, V$DATAFILE etc.

End

Introduction to Database Administration

TOPIC 49

Memory Management & Memory Architecture Overview

Memory Management & Memory Architecture Overview

Memory & Architecture

Oracle Memory Management
Automatic Memory Management
Adjust Memory Target Manually
Enable Automatic Shared Memory
Memory Management & Memory Architecture Overview

Oracle Memory Management

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Memory management involves maintaining optimal sizes for the Oracle Database instance memory structures as demands on the database change.

The memory structures that must be managed are the system global area (SGA) and the instance program global area (instance PGA).
Memory Management & Memory Architecture Overview

Oracle Memory Management

Oracle recommends that you enable the method known as automatic memory management.
Memory Management & Memory Architecture Overview

Automatic Memory Management

You designate only the total memory size to be used by the instance, and Oracle Database dynamically exchanges memory between the SGA and the instance PGA as needed to meet processing demands.

If you prefer to exercise more direct control over the sizes of individual memory components, you can disable automatic memory management and configure the database for manual memory management
Memory Management & Memory Architecture Overview
Automatic Memory Management

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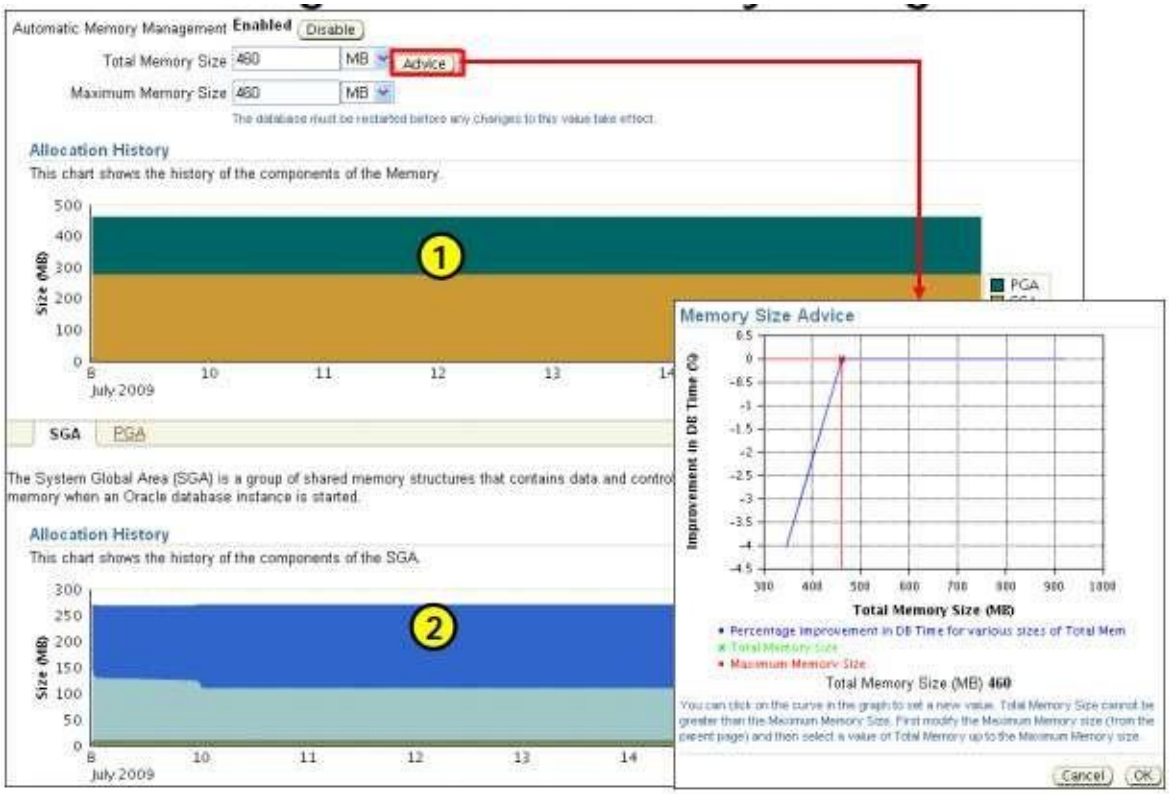
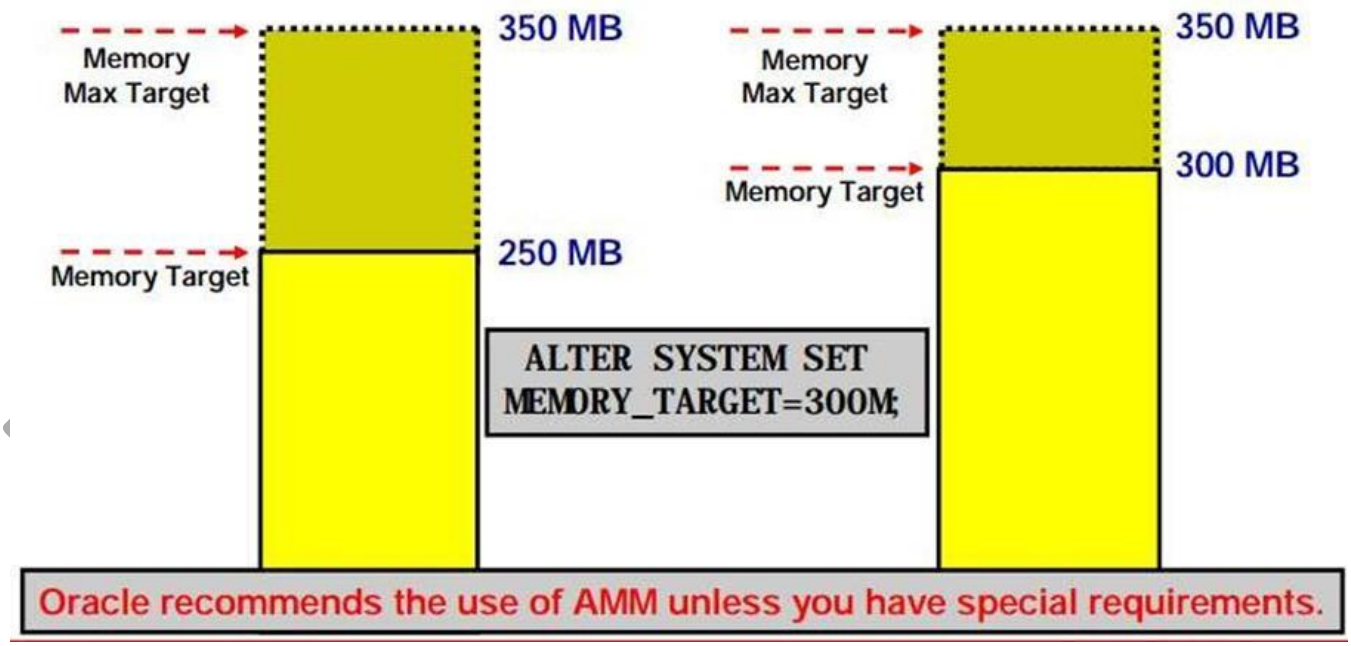


Memory Management & Memory Architecture Overview

Adjust Memory Target Manually



Memory Management & Memory Architecture Overview

Enable Automatic Shared Memory

To enable ASMM from manual shared memory management:

1. Get a value for **SGA_TARGET**:

```
SELECT ((SELECT SUM(value) FROM V$SGA) - (SELECT CURRENT_SIZE
FROM V$SGA_DYNAMIC_FREE_MEMORY)) "SGA_TARGET" FROM DUAL;
```

2. Use that value to set **SGA_TARGET**.
3. Set the values of the automatically sized SGA components to 0.

To switch to ASMM from Automatic Memory Management:

1. Set the **MEMORY_TARGET** initialization parameter to 0.
2. Set the values of the automatically sized SGA components to 0.

End
Introduction to Database Administration

TOPIC 50

Memory Management & Memory Architecture Overview

Memory Management & Memory Architecture Overview

Memory Management & Architecture

Memory Architecture Overview
Oracle Database Memory Structure
Current Sizes of SGA_TARGET and SGA_AGGREGATE_TARGET
V$MEMORY_TARGET_ADVICE provides tuning advice for the MEMORY_TARGET
V$PGASTAT
Memory Management & Memory Architecture Overview

Memory Architecture Overview

System Global Area (SGA)

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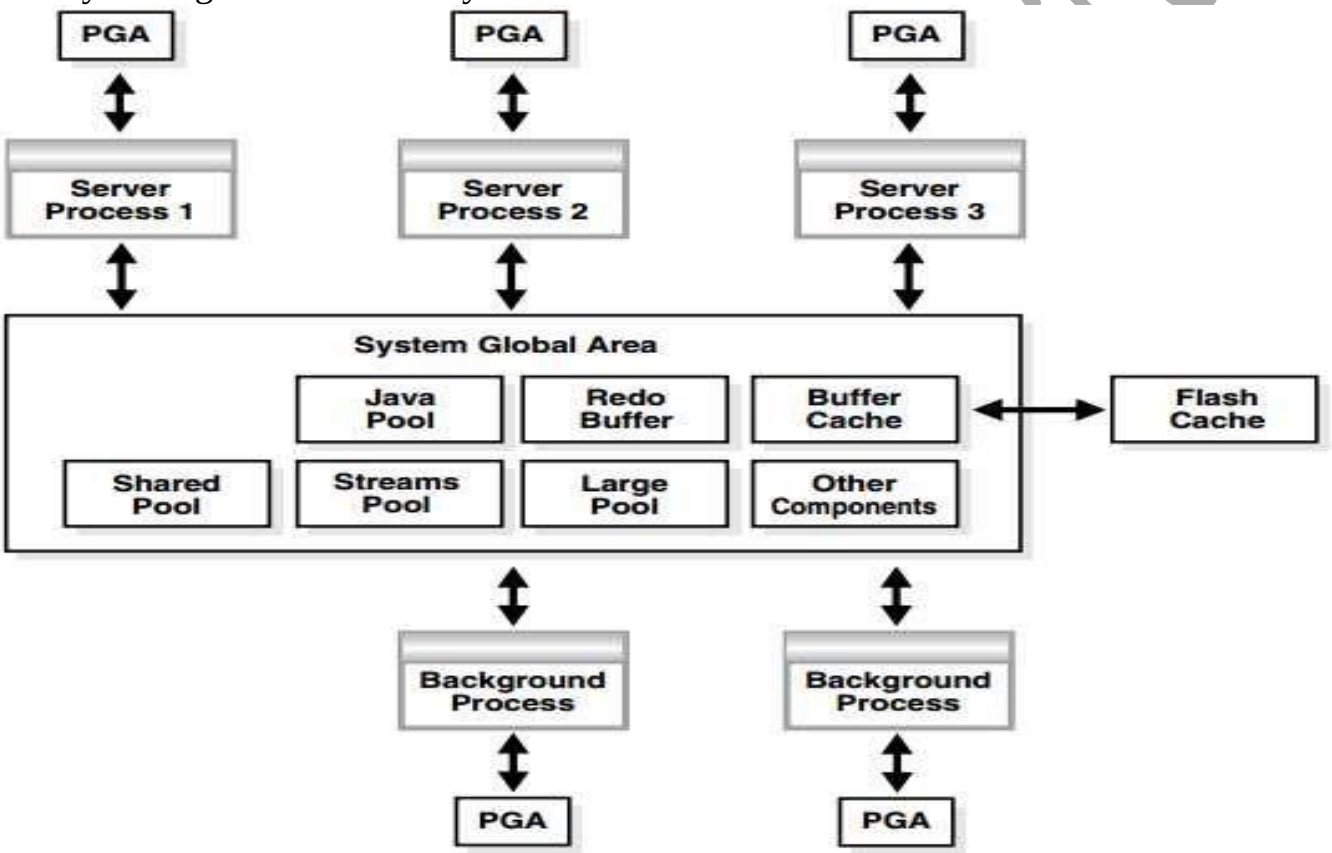
The SGA is shared by all server and background processes. Examples of data stored in the SGA include cached data blocks and shared SQL areas.
Memory Management & Memory Architecture Overview

Memory Architecture Overview

Program Global Area (PGA)
A PGA is a memory region that contains data and control information for a server process. It is non shared memory created by Oracle Database when a server process is started. Access to the PGA is exclusive to the server process. There is one PGA for each server process.
Memory Management & Memory Architecture Overview



Oracle Database Memory Structure

Memory Management & Memory Architecture Overview

Current Sizes of SGA_TARGET and SGA_AGGREGATE_TARGET

```
NAME                                 TYPE        VALUE
------------------------------------ ----------- ----------------
archive_lag_target                   integer     0
db_flashback_retention_target        integer     1440
fast_start_io_target                 integer     0
fast_start_mttr_target               integer     0
memory_max_target                    big integer 0
memory_target                        big integer 0
parallel_servers_target              integer     16
pga_aggregate_target                 big integer 90M
sga_target                           big integer 272M
```

Run the following query to determine the maximum instance PGA allocated since the database was started:

```
select value from v$pgastat where name='maximum PGA allocated';
```

Compute the maximum value between the query result from step 2b and PGA_AGGREGATE_TARGET. Add SGA_TARGET to this value.

```
memory_target = sga_target + max(pga_aggregate_target, maximum PGA
allocated)
```

SHOW PARAMETER TARGET

Memory Management & Memory Architecture Overview

V$MEMORY_TARGET_ADVICE

provides tuning advice for the MEMORY_TARGET

```
SQL>  select * from v$memory_target_advice order by memory_size;

MEMORY_SIZE MEMORY_SIZE_FACTOR ESTD_DB_TIME ESTD_DB_TIME_FACTOR    VERSION
----------- ------------------ ------------ -------------------- ----------
        180                .5          458                1.344          0
        270                .75         367               1.0761          0
        360                 1          341                    1          0
        450               1.25         335                .9817          0
        540                1.5         335                .9817          0
        630               1.75         335                .9817          0
```

Memory Management & Memory Architecture Overview

V$PGASTAT

select value from v$pgastat
where name='maximum PGA allocated'; For example, if SGA_TARGET is 272M and PGA_AGGREGATE_TARGET is 90M as
shown above, and
if the maximum PGA allocated is determined to be 120M, then MEMORY_TARGET should be at least 392M (272M + 120M).

Introduction to Database Administration

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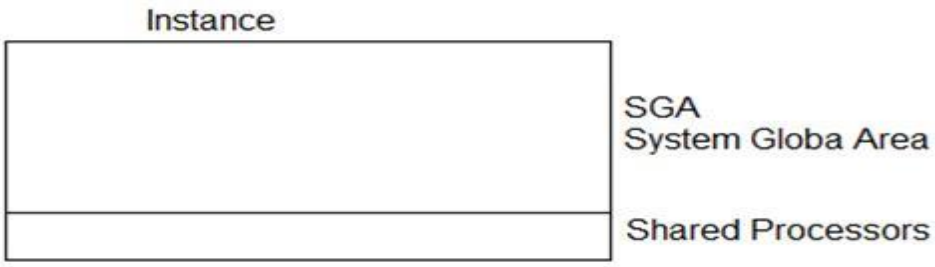
TOPIC 51

Memory Architecture Overview (SGA)
Memory Architecture Overview

Memory Management & Architecture

Instance & Database
Overview of SGA
Overview of SGA & Database
Memory Architecture Overview
Instance & Database



Memory Architecture Overview
Overview of SGA

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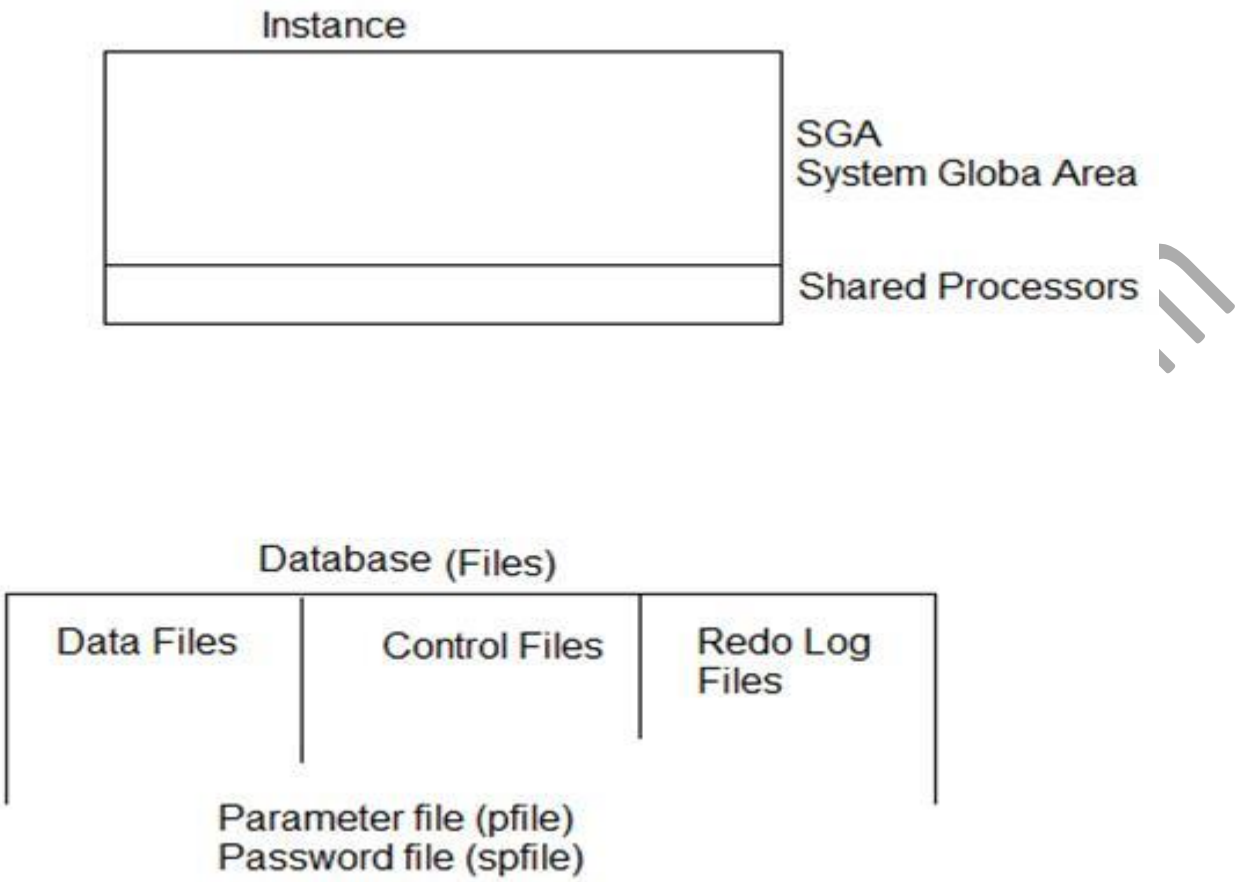

Memory Architecture Overview

Overview of SGA & Database

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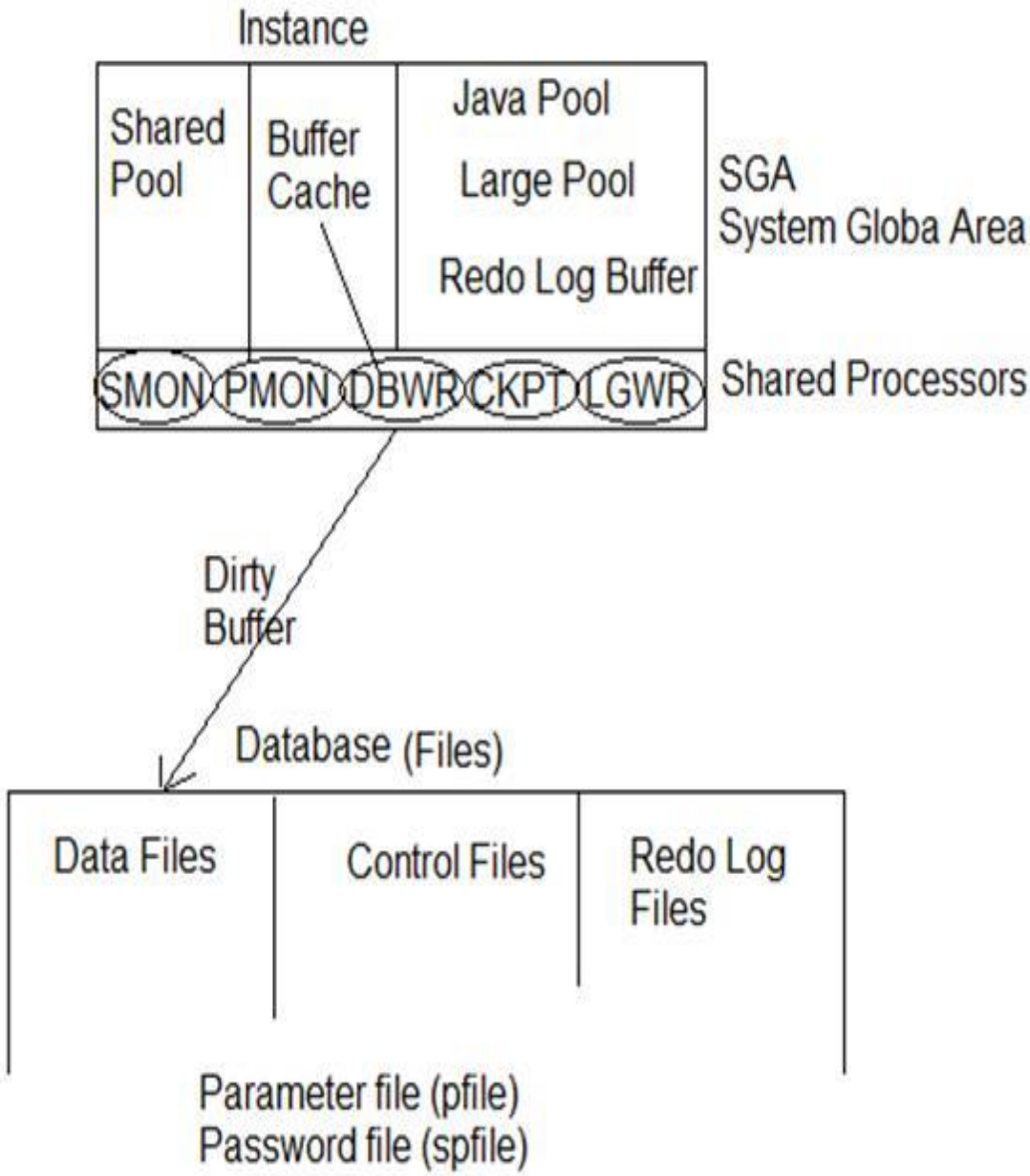
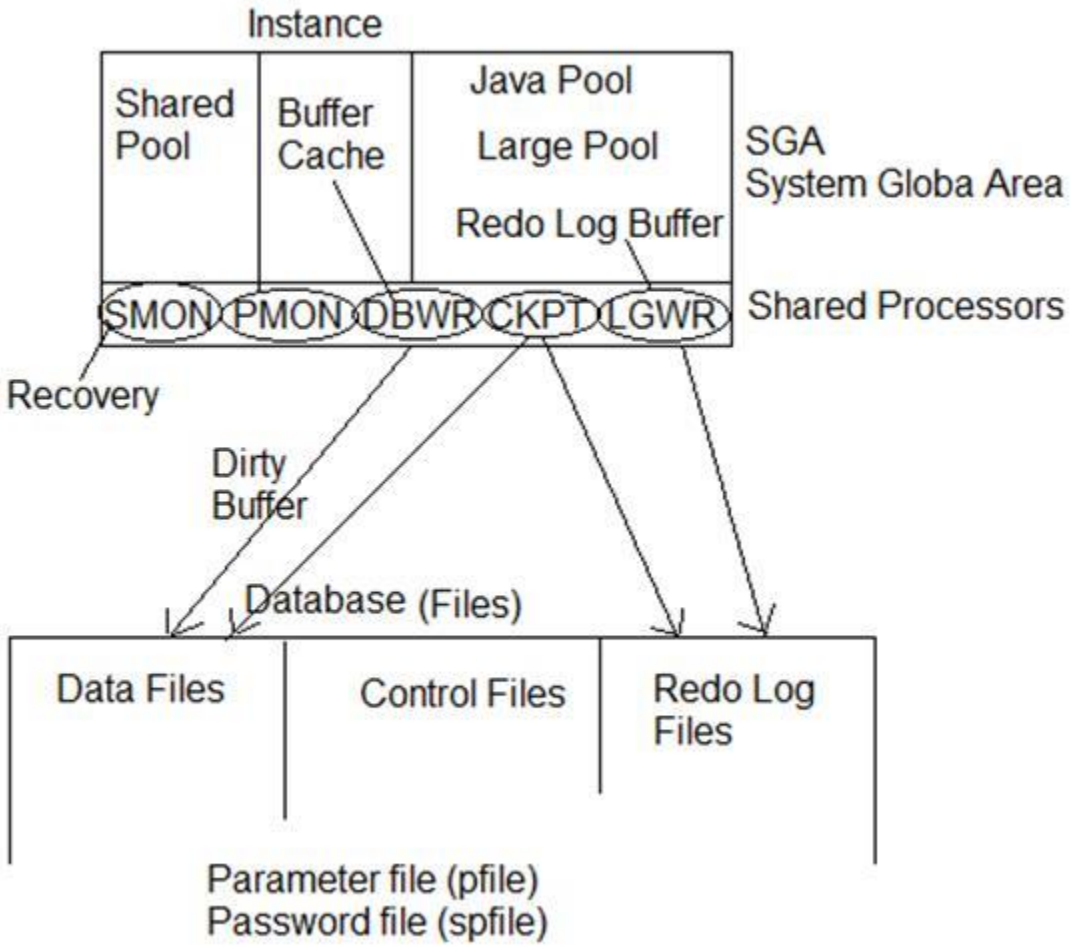


Memory Architecture Overview



Overview of SGA & Database
Introduction to Database Administration

TOPIC 52

Configuring Memory
Configuring Memory

Configuring Memory with SGA

Fundamentals of Configuration
Granules
Granule Size
SGA Memory Size
SGA_MAX_SIZE
Setting SGA Target Size

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Manual Shared Memory Management
Configuring Memory

Fundamentals of Configuration

Disable automatic memory management of SGA set target and maximum sizes for the SGA
With automatic shared memory management

The database then sets the total size of the SGA to your designated target, and dynamically tunes the sizes of many SGA components.
Configuring Memory

Fundamentals of Configuration

Set the sizes of several individual SGA components with manual shared memory management, thereby determining the overall SGA size. You then manually tune these individual SGA components on an ongoing basis.

Similarly, for the instance PGA, there is automatic/ manual PGA memory management, in which you set a target size for the instance PGA.
Configuring Memory

Granules

SGA memory components include
the shared pool (used to allocate
memory for SQL and PL/SQL execution),
the java pool (used for java objects and
other java execution memory), and
the buffer cache (used for caching disk
blocks).
Configuring Memory

Granules

All SGA components allocate and deallocate space in units of granules.

The granule size is based on the value of the SGA_MAX_SIZE initialization parameter.
Configuring Memory
Granule Size

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SGA Memory Amount	Granule Size
Less than or equal to 1 GB	4 MB
Greater than 1 GB and less than or equal to 8 GB	16 MB
Greater than 8 GB and less than or equal to 16 GB	32 MB
Greater than 16 GB and less than or equal to 32 GB	64 MB
Greater than 32 GB and less than or equal to 64 GB	128 MB
Greater than 64 GB and less than or equal to 128 GB	256 MB
Greater than 128 GB	512 MB

Using V$SGAINFO view to see the granule size that is being used by an instance
Configuring Memory

```
SQL> select name, sum(value)
  2  from v$SGA
  3  group by name;

NAME                 SUM(VALUE)
-------------------- ----------
Database Buffers      352321536
Redo Buffers            4603904
Variable Size         713032144
Fixed Size              1375792
Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             713032144 bytes
Database Buffers          352321536 bytes
Redo Buffers                4603904 bytes
Database mounted.
Database opened.
```

SGA Memory Size

Configuring Memory

SGA_MAX_SIZE

The SGA_MAX_SIZE initialization parameter specifies the maximum size of the System Global Area for the lifetime of the instance.

If you do not specify SGA_MAX_SIZE, then Oracle Database selects a default value that is the sum of all components specified or defaulted at initialization time.
Configuring Memory

Setting SGA Target Size

You enable the automatic shared memory management feature by setting the SGA_TARGET parameter to a nonzero value. This parameter sets the total size of the SGA.
It replaces the parameters that control the memory allocated for a specific set of individual components, which are now automatically and dynamically resized (tuned) as needed.
Configuring Memory
Setting SGA Target Size

SGA Component	Initialization Parameter
The shared pool	SHARED_POOL_SIZE
The large pool	LARGE_POOL_SIZE
The Java pool	JAVA_POOL_SIZE
The buffer cache	DB_CACHE_SIZE
The Streams pool	STREAMS_POOL_SIZE

Configuring Memory
Setting SGA Target Size

SGA Component	Initialization Parameter
The log buffer	LOG_BUFFER
The keep and recycle buffer caches	DB_KEEP_CACHE_SIZE DB_RECYCLE_CACHE_SIZE
Nonstandard block size buffer caches	DB_*n*K_CACHE_SIZE

In addition to setting SGA_TARGET to a nonzero value, set to zero all initialization parameters of first Table to enable full automatic tuning of the automatically sized SGA components.

Configuring Memory

Manual Shared Memory Management

SHARED_POOL_SIZE = 200M

DB_CACHE_SIZE = 500M

LARGE_POOL_SIZE=200M

Also assume the following query results:

Query	Result
SELECT SUM(value) FROM V$SGA	1200M
SELECT CURRENT_SIZE FROM V$SGA_DYNAMIC_FREE_MEMORY	208M

```
ALTER SYSTEM SET SGA_TARGET = 992M;
ALTER SYSTEM SET SHARED_POOL_SIZE = 0;
ALTER SYSTEM SET LARGE_POOL_SIZE = 0;
ALTER SYSTEM SET JAVA_POOL_SIZE = 0;
ALTER SYSTEM SET DB_CACHE_SIZE = 0;
ALTER SYSTEM SET STREAMS_POOL_SIZE = 0;
```

where 992M = 1200M minus 208M.

End

Introduction to Database Administration

TOPIC 53

Memory Related Data Dictionary Views

Memory Related Data Dictionary Views

Memory Data Dictionary Views

Memory Parameters
Memory Target & SPFILE
Tune SGA Target
PGA related Queries
Table Size
Blocks & Extents Sizes

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Database Block Size
Extent and PCT_FREE Sizes
Maximum Size of Data File
Maximum Size of Data File with Blocks
Memory Related Data Dictionary Views
Memory Parameters

```
SQL> show parameter memory

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------
hi_shared_memory_address             integer     0
memory_max_target                    big integer 1232M
memory_target                        big integer 1232M
shared_memory_address                integer     0
SQL> show memory_target
```

```
SQL> show parameter SGA

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------
lock_sga                             boolean     FALSE
pre_page_sga                         boolean     FALSE
sga_max_size                         big integer 1G
sga_target                           big integer 0
```

Memory Related Data Dictionary Views
Memory Parameters

```
SQL> show parameter target

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------
archive_lag_target                   integer     0
db_flashback_retention_target        integer     1440
fast_start_io_target                 integer     0
fast_start_mttr_target               integer     0
memory_max_target                    big integer 1232M
memory_target                        big integer 1232M
parallel_servers_target              integer     16
pga_aggregate_target                 big integer 0
sga_target                           big integer 0
SQL>
```

```
SQL> set linesize 200
SQL> select substr(name,1,10) fname, substr(value,1,100) fvalue
  2  from v$parameter
  3  where name='spfile';

FNAME      FVALUE
---------- ----------------------------------------------------------------
spfile     E:\APP\HAIDER\PRODUCT\11.2.0\DBHOME_1\DATABASE\SPFILEORCL.ORA
```

Memory Related Data Dictionary Views

Memory Target & SPFILE

create pfile='E:\app\Haider\admin\orcl\pfile
\ init.ora.862016235218' from 'E:\app\Haider\product\11.2.0\dbho me_1\dbs\init.ora';

Alter system set memory_target=1021 M scope=spfile;
Memory Related Data Dictionary Views

Memory Target & SPFILE

Alter system set SGA_TARGET=0 scope=spfile;
Alter system set PGA_AGGREGATE_TARGET=0
scope=spfile;

shutdown immediate Show parameter memory

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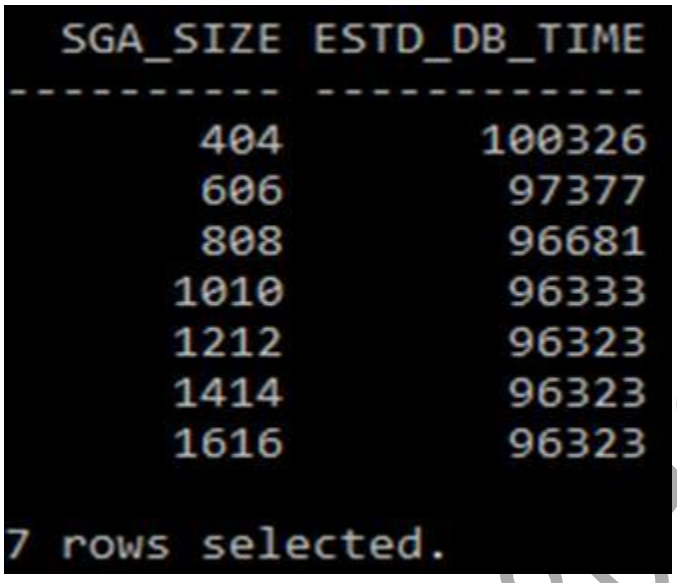
Memory Related Data Dictionary Views

Tune SGA Target

Desc V$SGA_TARGET_ADVICE



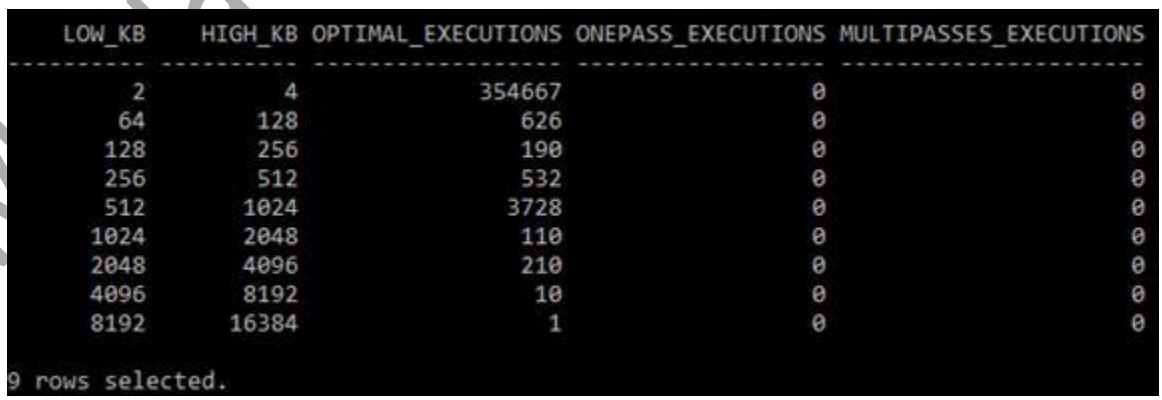
```
  SGA_SIZE ESTD_DB_TIME
---------- -------------
       404        100326
       606         97377
       808         96681
      1010         96333
      1212         96323
      1414         96323
      1616         96323

7 rows selected.
```

select sga_size,estd_db_time from V$SGA_TARGET_ADVICE;
Memory Related Data Dictionary Views

PGA related Queries

select low_optimal_size/1024 low_kb, (high_optimal_size+1)/1024 high_kb,
optimal_executions, onepass_executions, multipasses_executions
from v$sql_workarea_histogram



```
    LOW_KB    HIGH_KB OPTIMAL_EXECUTIONS ONEPASS_EXECUTIONS MULTIPASSES_EXECUTIONS
---------- ---------- ------------------ ------------------ ----------------------
         2          4             354667                  0                      0
        64        128                626                  0                      0
       128        256                190                  0                      0
       256        512                532                  0                      0
       512       1024               3728                  0                      0
      1024       2048                110                  0                      0
      2048       4096                210                  0                      0
      4096       8192                 10                  0                      0
      8192      16384                  1                  0                      0

9 rows selected.
```

where total_executions <> 0;
Memory Related Data Dictionary Views

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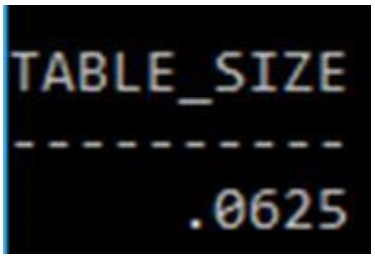
Table Size

Login with scott/tiger Desc dba_segments
select sum(bytes)/1024/1024 Table_size_MB
from dba_segments



```
TABLE_SIZE
----------
     .0625
```

where segment_name ='EMP';
Memory Related Data Dictionary Views

Blocks & Extents Sizes

select distinct tablespace_name, blocks, extents
from dba_segments;

TABLESPACE_NAME	BLOCKS	EXTENTS
WRK_NOVUS	512	4
SYSTEM	1536	27
PIND_TSDEV	24	3
PIND_TSDEV	128	1
PIND_TSDEV	512	4
WRK_NOVUS	1792	7
SYSAUX	408	5
UNDOTBS1	144	3
SYSTEM	896	22
SYSTEM	16	2
SYSAUX	112	14

Memory Related Data Dictionary Views

Database Block Size

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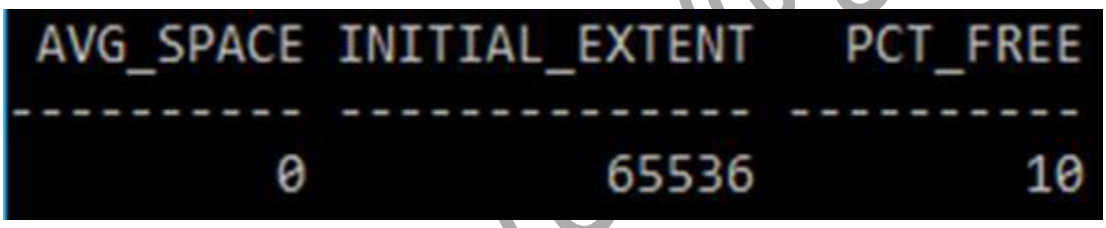
Show parameter (to see db_block_size) or
select value
from v$parameter
where name = 'db_block_size'; Value
8192

Means 8KB block size
Memory Related Data Dictionary Views

Extent and PCT_FREE Sizes

select avg_space, initial_extent, PCT_FREE from ALL_TABLES
where table_name = 'EMP';



AVG_SPACE	INITIAL_EXTENT	PCT_FREE
0	65536	10

Memory Related Data Dictionary Views

Maximum Size of Data File

How to see block size and max file size with DBA_DATA_FILES (4 Millions data blocks)

Find db block size from v$parameter 4194304 * db_block_size
Memory Related Data Dictionary Views

Maximum Size of Data File

If your db_block_size is 8kb, then your maximum datafile size is:

4194304 * 8192 = 34359738368 / 1024
/ 1024 / 1024 = 32GB.
select file_name, tablespace_name, blocks
from dba_data_files;
Memory Related Da0ta Dictionary Views

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Each Oracle datafile can contain maximum 4194303 (4 Million) data blocks.

Block Size | Maximum Datafile Size

———————————————

2k 4194303 * 2k = 8 GB

4k 4194303 * 4k = 16 GB

8k 4194303 * 8k = 32 GB

16k 4194303 * 16k = 64 GB

32k 4194303 * 32k = 128 GB

In Oracle Database 10g, BIGFILE tablespace was introduced.

(4 billion) data blocks.

Block Size | Maximum Datafile Size

———————————————

2k 4294967295 * 2k = 8 TB

4k 4294967295 * 4k = 16 TB

8k 4294967295 * 8k = 32 TB

16k 4294967295 * 16k = 64 TB

32k 4294967295 * 32k = 128 TB

Maximum Size of Data File with Blocks

End

Introduction to Database Administration

TOPIC 54

Backup using MS SQL Server

Backup using MS SQL Server

Backup using MS SQL Server

Terminologies

Failures of Database

Create a Full Backup

Create a Simple test database

Backup using MSSMS

Steps of Backup using MSSMS

Backup on non-default Location

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Backup using MS SQL Server

Terminologies

Back up [verb]
The process of creating a backup [noun] by copying data records from a SQL Server database, or log records from its transaction log.

Backup [noun]
A copy of data that can be used to restore and recover the data after a failure. Backups of a database can also be used to restore a copy the database to a new location.
Backup using MS SQL Server

Terminologies

Backup device or media
A disk or tape device to which SQL Server backups are written and from which they can be restored.
SQL Server backups can also be written to an Azure Blob storage service, and URL format is used to specify the destination and the name of the backup file
Backup using MS SQL Server

Terminologies

Full backup
A data backup that contains all the data in a specific database or set of file groups or files, and also enough log to allow for recovering that data.
Backup using MS SQL Server

Failures of Database

Media failure.
User errors, for example, dropping a table by mistake.
Hardware failures, for example, a damaged disk drive or permanent loss of a server.
Backup using MS SQL Server

Failures of Database

Natural disasters. By using SQL Server Backup to Azure Blob storage service, you can create an off-site backup in a different region than your on- premises location, to use in the event of a natural disaster affecting your
on-premises location.
Backup using MS SQL Server

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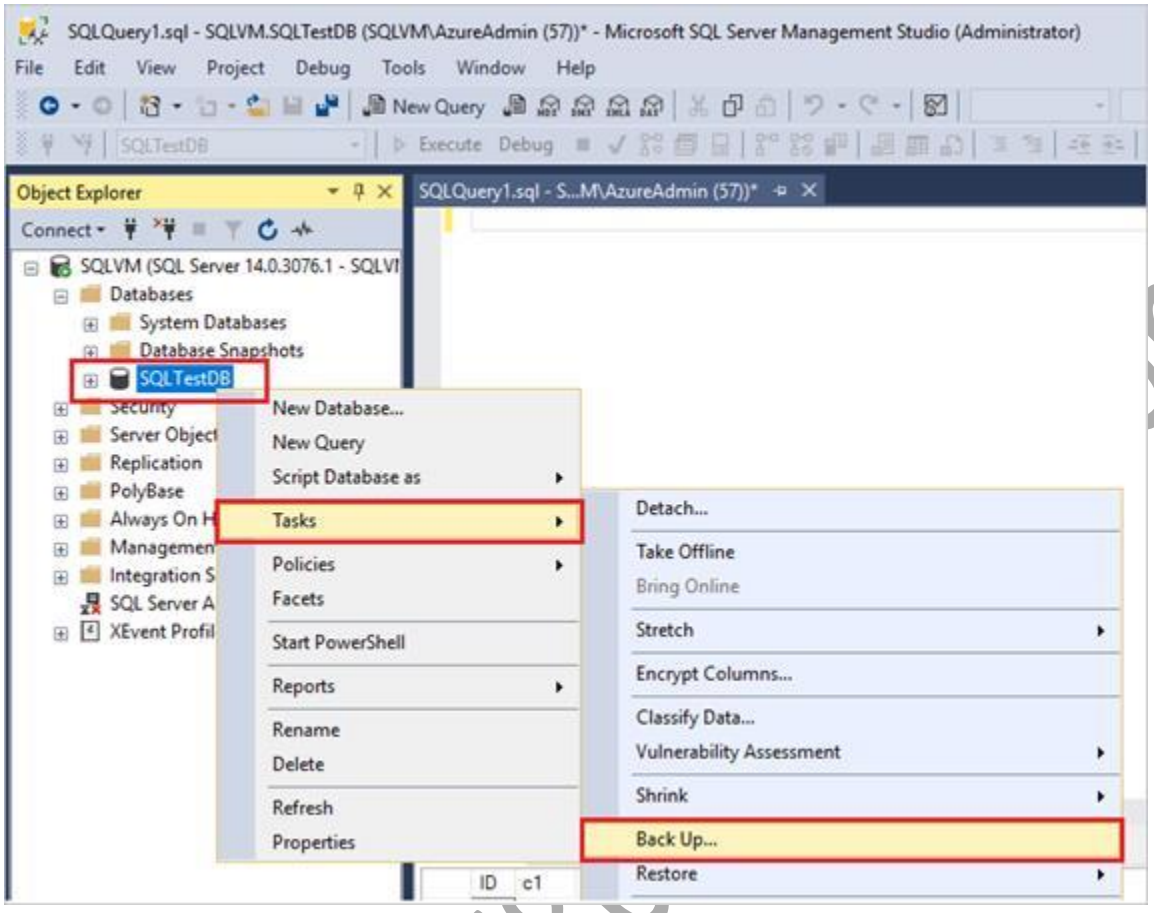
Create a Full Backup

Security
TRUSTWORTHY is set to OFF on a database backup

Permission
BACKUP DATABASE and BACKUP
LOG permissions default to members of the sysadmin fixed server role and the db_owner and db_backupoperator fixed database roles.
Backup using MS SQL Server
Create a Sample Test Database

```
USE [master]
GO

CREATE DATABASE [SQLTestDB]
GO

USE [SQLTestDB]
GO
CREATE TABLE SQLTest
   (
      ID INT NOT NULL PRIMARY KEY,
      c1 VARCHAR(100) NOT NULL,
      dt1 DATETIME NOT NULL DEFAULT getdate()
   );
GO

USE [SQLTestDB]
GO

INSERT INTO SQLTest (ID, c1) VALUES (1, 'test1')
INSERT INTO SQLTest (ID, c1) VALUES (2, 'test2')
INSERT INTO SQLTest (ID, c1) VALUES (3, 'test3')
INSERT INTO SQLTest (ID, c1) VALUES (4, 'test4')
INSERT INTO SQLTest (ID, c1) VALUES (5, 'test5')
GO

SELECT * FROM SQLTest
GO
```

Backup using MS SQL Server
Back up using MSSMS



Backup using MS SQL Server

Steps of Back up using MSSMS

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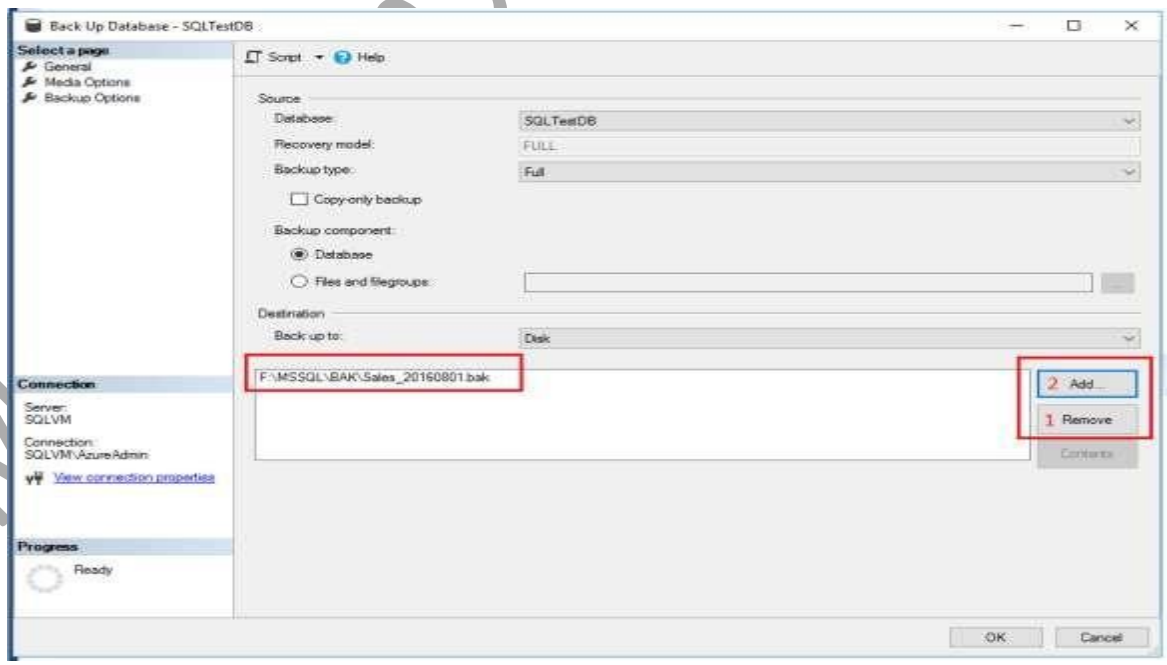
In this example, the `SQLTestDB` database will be backed up to disk at a location of your choice.

1. After connecting to the appropriate instance of the Microsoft SQL Server Database Engine, in **Object Explorer**, expand the server tree.
2. Expand **Databases**, right-click `SQLTestDB`, point to **Tasks**, and then click **Back Up...**.
3. On the **General** page in the **Destination** section select **Disk** from the **Back up to:** drop-down list.
4. Select **Remove** until all existing backup files have been removed.
5. Select **Add** and the **Select Backup Destination** dialog box will open.
6. Enter a valid path and file name in the **File name** text box and use **.bak** as the extension to simplify the classification of this file.
7. Click **OK** and then click **OK** again to initiate the backup.
8. When the backup completes successfully, click **OK** to close the SQL Server Management Studio dialog box.

Backup using MS SQL Server

Back up on non-default Location



Introduction to Database Administration

TOPIC 55

What are Control Files & Creating Control Files

Creating Control Files

Control Files

What is Control Files?
Managing Control Files
Back up Control Files
Creating Control Files
Multiplex Copying of Control Files
Creating Control Files

What is Control Files?

Control file contains
The database name
Names and locations of associated data files and redo log files
The timestamp of the database creation
The current log sequence number
Checkpoint information
Creating Control Files

Managing Control Files?

DB server writes into control file when DB is open.
DB is mounted for recovery with
control file.
More control files can be created
Creating Control Files

Back up Control Files?

Adding, dropping, or renaming datafiles

Adding or dropping a tablespace, or altering the read/write state of the tablespace

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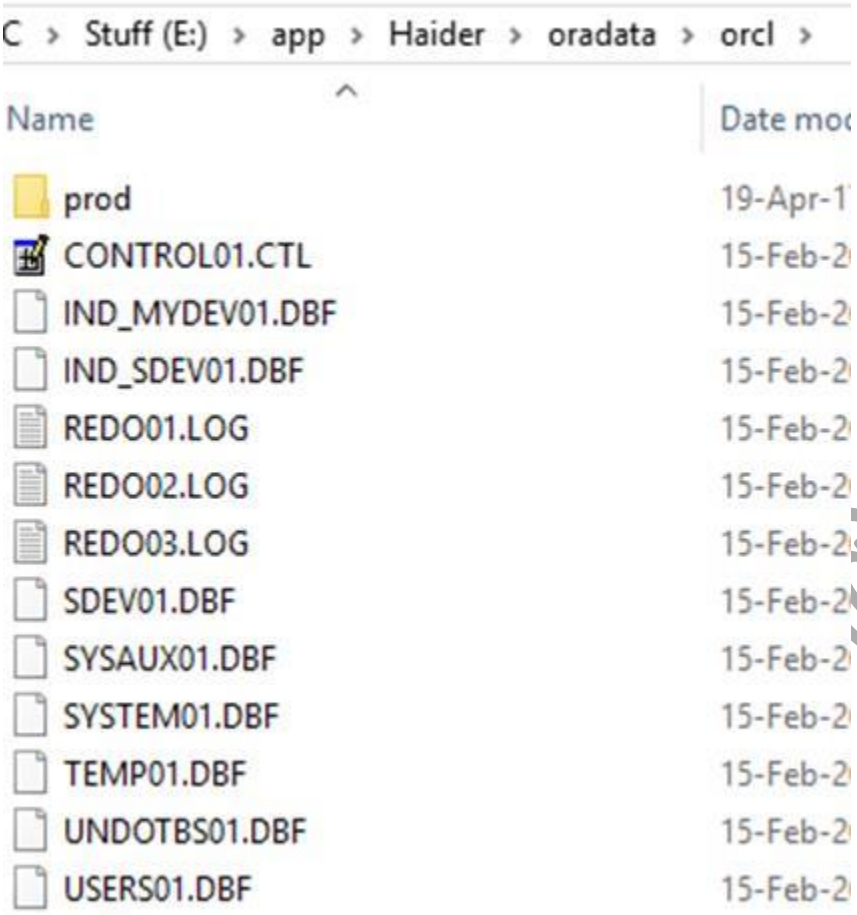
Adding or dropping redo log files or groups
Creating Control Files
Creating Control Files?



Creating Initial Control Files

Creating Additional Copies, Renaming, and Relocating Control Files

Creating New Control Files

Initial Control Files are

CONTROL_FILES =
(/u01/oracle/prod/control01.ctl,
/u02/oracle/prod/control02.ctl,
/u03/oracle/prod/control03.ctl)
Creating Control Files

Multiplex copying of Control Files

To add a multiplexed copy of the current control file or to rename a control file:

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Shut down the database.
Copy an existing control file to a new location, using operating system commands.
Edit the CONTROL_FILES parameter in the database initialization parameter file to add the new control file name, or to change the existing control filename.
Restart the database.
Introduction to Database Administration

TOPIC 56

Back up Control Files

Back up Control Files

Back up and New Control Files

When to Create Control Files?
Create Control File Statement
Data Dictionary Views for Control Files?
Using Data Dictionary Views with user sys
SQL of V$LOGFILE
SQL of V$DATAFILE
SQL of V$CONTROLFILE
SQL of V$PARAMETER
Backing up Control Files?
Steps in creating new Control Files?
Back up Control Files

When to Create Control Files?

All control files for the database have been permanently damaged and you do not have a control file backup.
You want to change the database name.
Back up Control Files

Create Control File Statement

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```
CREATE CONTROLFILE
    SET DATABASE prod
    LOGFILE GROUP 1 ('/u01/oracle/prod/redo01_01.log',
                     '/u01/oracle/prod/redo01_02.log'),
            GROUP 2 ('/u01/oracle/prod/redo02_01.log',
                     '/u01/oracle/prod/redo02_02.log'),
            GROUP 3 ('/u01/oracle/prod/redo03_01.log',
                     '/u01/oracle/prod/redo03_02.log')
    RESETLOGS
    DATAFILE '/u01/oracle/prod/system01.dbf' SIZE 3M,
             '/u01/oracle/prod/rbs01.dbs' SIZE 5M,
             '/u01/oracle/prod/users01.dbs' SIZE 5M,
             '/u01/oracle/prod/temp01.dbs' SIZE 5M
    MAXLOGFILES 50
    MAXLOGMEMBERS 3
    MAXLOGHISTORY 400
    MAXDATAFILES 200
    MAXINSTANCES 6
    ARCHIVELOG;
```

Back up Control Files

Data Dictionary Views for Control Files?

SELECT MEMBER FROM V$LOGFILE;

SELECT NAME FROM V$DATAFILE;

SELECT VALUE FROM V$PARAMETER WHERE NAME = 'control_files'

Back up Control Files

Using Data Dictionary Views with user sys

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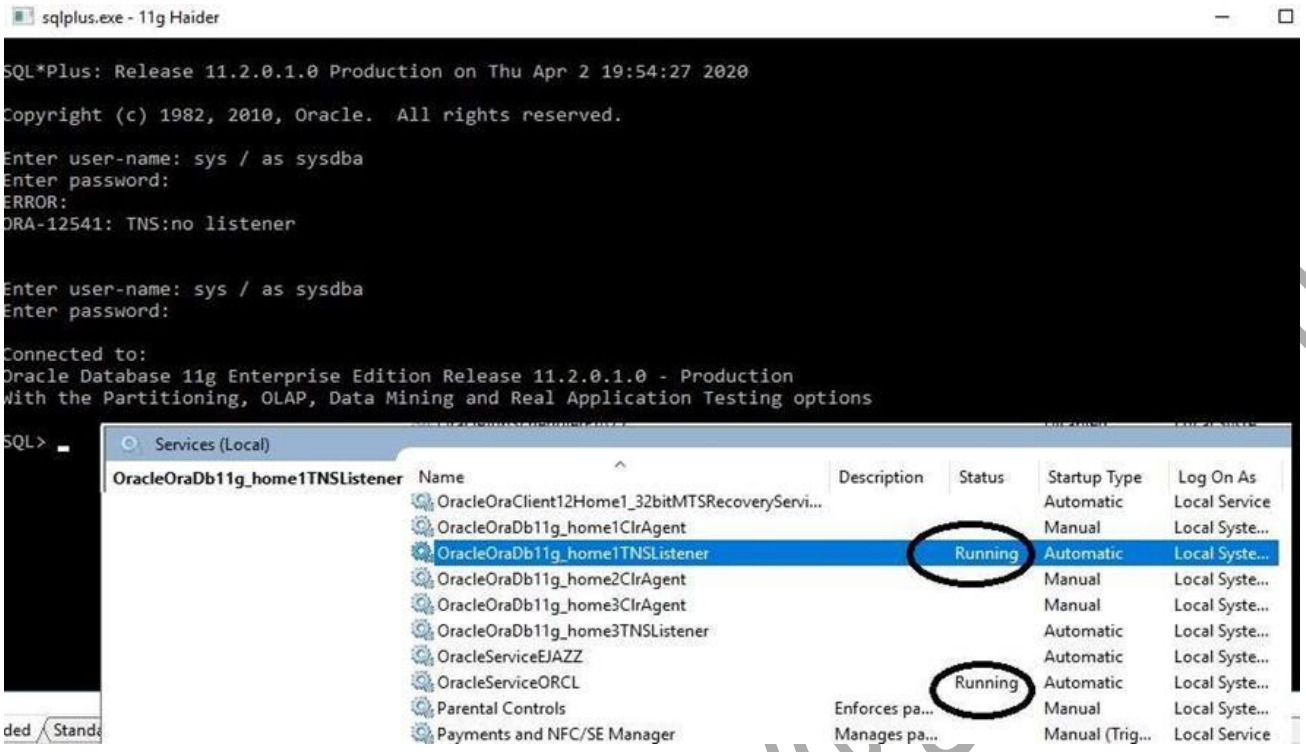
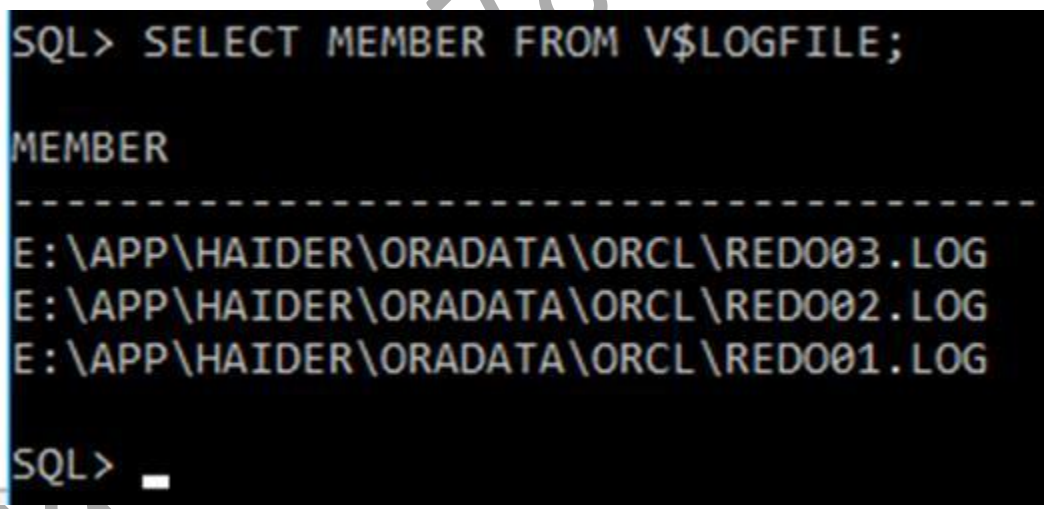


Back up Control Files
SQL of V$LOGFILE



Back up Control Files
SQL of V$DATAFILE

```
SQL> SELECT NAME FROM V$DATAFILE;

NAME
----------------------------------------------------------
E:\APP\HAIDER\ORADATA\ORCL\SYSTEM01.DBF
E:\APP\HAIDER\ORADATA\ORCL\SYSAUX01.DBF
E:\APP\HAIDER\ORADATA\ORCL\UNDOTBS01.DBF
E:\APP\HAIDER\ORADATA\ORCL\USERS01.DBF
E:\APP\HAIDER\ORADATA\ORCL\IND_MYDEV01.DBF
E:\APP\HAIDER\ORADATA\ORCL\SDEV01.DBF
E:\APP\HAIDER\ORADATA\ORCL\IND_SDEV01.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PDEV01.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PDEV02.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PDEV03.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PIND_DEV.DBF

NAME
----------------------------------------------------------
E:\APP\HAIDER\ORADATA\ORCL\PROD\PTSIMG01.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PTSIMG02.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PTSIMG03.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PTSIMG04.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PSTUCRSREG01.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PSTUCRSREG02.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PEMARKS01.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\PEMARKS02.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\TSIMG01.DBF
E:\APP\HAIDER\ORADATA\ORCL\PROD\TSIMG02.DBF
E:\APP\HAIDER\PRODUCT\11.2.0\DBHOME_1\ORADATA\NOVUS01.DBF
```

Back up Control Files

SQL of V$CONTROLFILE

With default installation, oracle contains only two control files

```
SQL> SELECT NAME FROM V$CONTROLFILE;

NAME
----------------------------------------------------------
E:\APP\HAIDER\ORADATA\ORCL\CONTROL01.CTL
E:\APP\HAIDER\FLASH_RECOVERY_AREA\ORCL\CONTROL02.CTL

SQL>
```

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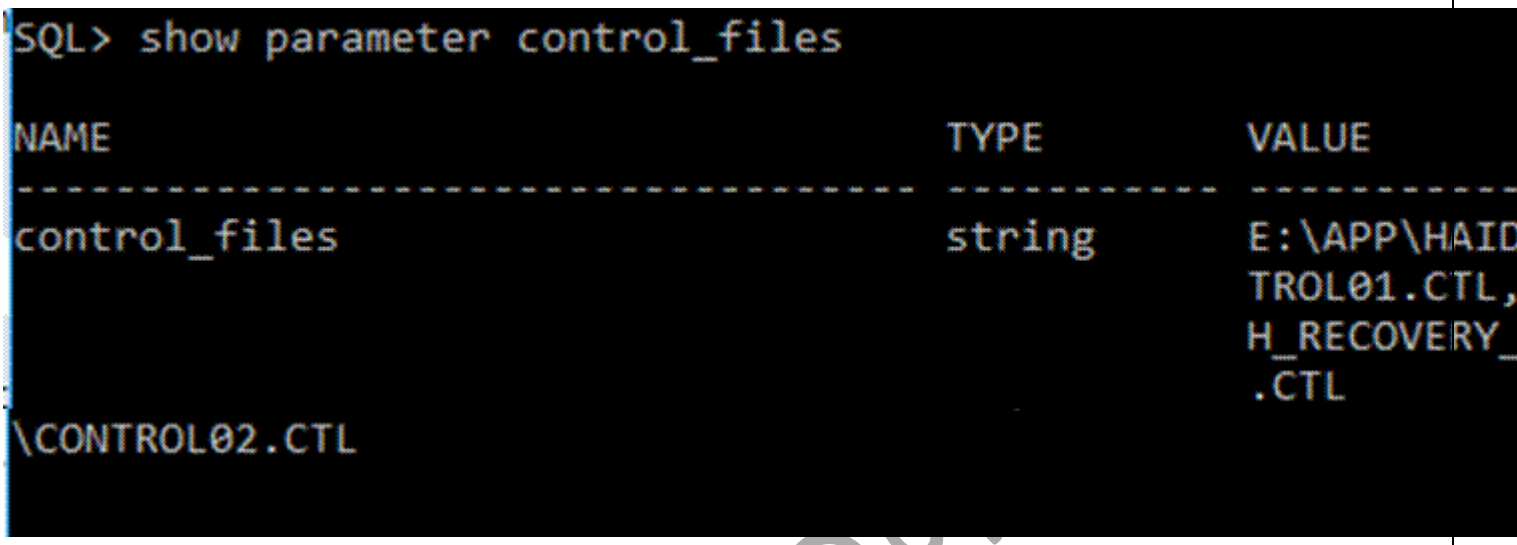
Back up Control Files
SQL of V$PARAMETER



Back up Control Files

Backing up Control Files?

Back up the control file to a binary file (duplicate of existing control file) using the following statement:
ALTER DATABASE BACKUP
CONTROLFILE TO
'/oracle/backup/control.bkp';

Produce SQL statements that can later
be used to re-create your control file: ALTER DATABASE BACKUP CONTROLFILE TO TRACE;
Back up Control Files

Steps in creating new Control Files?

Shut down the database.
If the database is open, shut down the database normally if possible. Use the IMMEDIATE or ABORT clauses only as a last resort.
Back up all data files and redo log files
of the database.
Back up Control Files

Steps in creating new Control Files?

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Start up a new instance, but do not mount or open the database: STARTUP NOMOUNT
Create a new control file for the database using the CREATE CONTROLFILE statement.
Back up Control Files

Executing steps in creating new Control Files?

login sqlplus with user: sys / as sysdba select name from v$controlfile;
Alter database backup controlfile to trace as 'E:\APP\HAIDER\ORADATA\ORCL\control.
bkp';
Back up Control Files

Executing steps in creating new Control Files?

alter system set control_files='E:\APP\HAIDER\ORADAT A\ORCL\control01.ctl',
'E:\APP\HAIDER\FLASH_RECOVERY_AR
EA\ORCL\control02.ctl', 'E:\APP\HAIDER\ORADATA\ORCL\contr ol03.ctl' scope=spfile;
shutdown immediate exit
Back up Control Files

Executing steps in creating new Control Files?

Use copy-past file in windows file explorer or use DOS command
E:\APP\HAIDER\ORADATA\ORCL>copy
control01.ctl control03.ctl
Back up Control Files

Executing steps in creating new Control Files?

sqlplus
Enter user-name: sys / as sysdba Enter password:
Connected to an idle instance.

SQL> startup
ORACLE instance started. shutdown immediate exit
Back up Control Files

Executing steps in creating new Control Files?

SQL>select name from v$controlfile; NAME
E:\APP\HAIDER\ORADATA\ORCL\CONTROL 01.CTL
E:\APP\HAIDER\FLASH_RECOVERY_AREA\ ORCL\CONTROL02.CTL
E:\APP\HAIDER\ORADATA\ORCL\CONTROL 03.CTL

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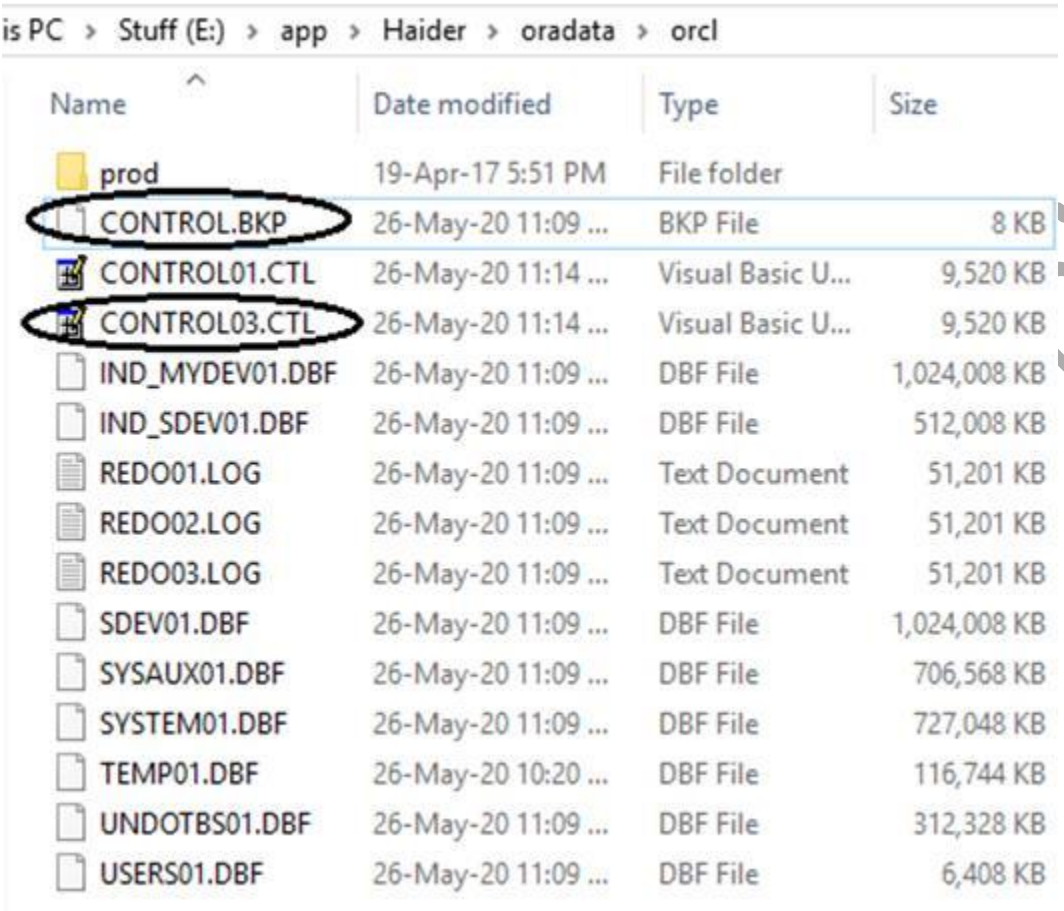
Back up Control Files
Executing steps in creating new Control Files?



Introduction to Database Administration

TOPIC 57

Trouble Shouting Control Files
Trouble Shouting Control Files

Trouble Shouting Control Files

SQL of V$CONTROLFILE
Executing steps in creating new Control Files
Steps in creating new Control Files
Executing Commands on SQL

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Executing steps in creating new Control Files
Backup Control Files using Startup Mount
Trouble Shouting Control Files

Trouble Shouting Control Files

Alter System Set Command & initialization File
Executing steps in creating new
Trouble Shouting Control Files

Trouble Shouting Control Files

Control Files using SQL
Use of Database MOUNT & NO MOUNT
Database is in normal mode (consistent database)
Executing steps in creating new Control Files
Warning for storing Control Files
Trouble Shouting Control Files

When to Create Control Files?

All control files for the database have been permanently damaged and you do not have a control file backup.
You want to change the database name.
Trouble Shouting Control Files

SQL of V$CONTROLFILE

With default installation, oracle contains
only two control files

```
SQL> SELECT NAME FROM V$CONTROLFILE;

NAME
--------------------------------------------------------------------------------
E:\APP\HAIDER\ORADATA\ORCL\CONTROL01.CTL
E:\APP\HAIDER\FLASH_RECOVERY_AREA\ORCL\CONTROL02.CTL

SQL>
```

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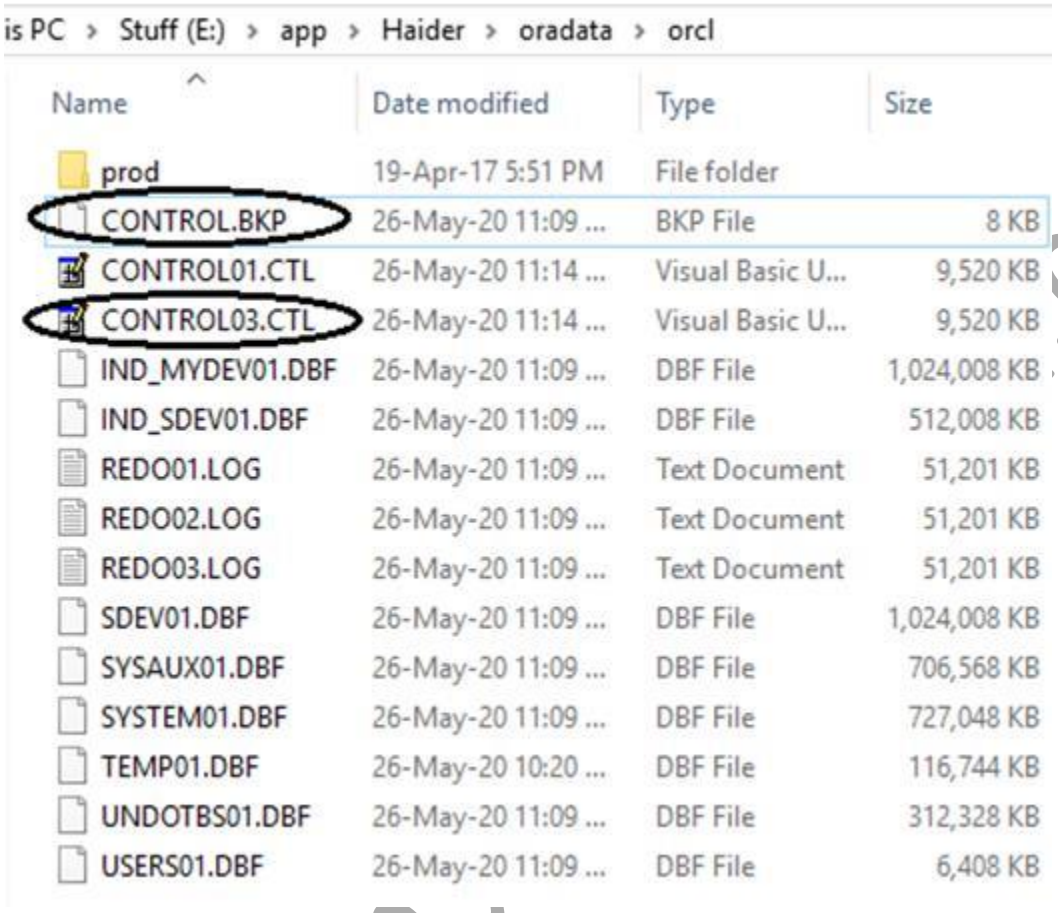
Trouble Shouting Control Files



Executing steps in creating new Control Files
Trouble Shouting Control Files

Steps in creating new Control Files

Shut down the database.
If the database is open, shut down the database normally if possible. Use the IMMEDIATE or ABORT clauses only as a last resort.
Back up all data files and redo log files of the database.
Trouble Shouting Control Files

Steps in creating new Control Files

Start up a new instance, but do not mount or open the database: STARTUP NOMOUNT

Create a new control file for the database using the CREATE CONTROLFILE statement.
Trouble Shouting Control Files

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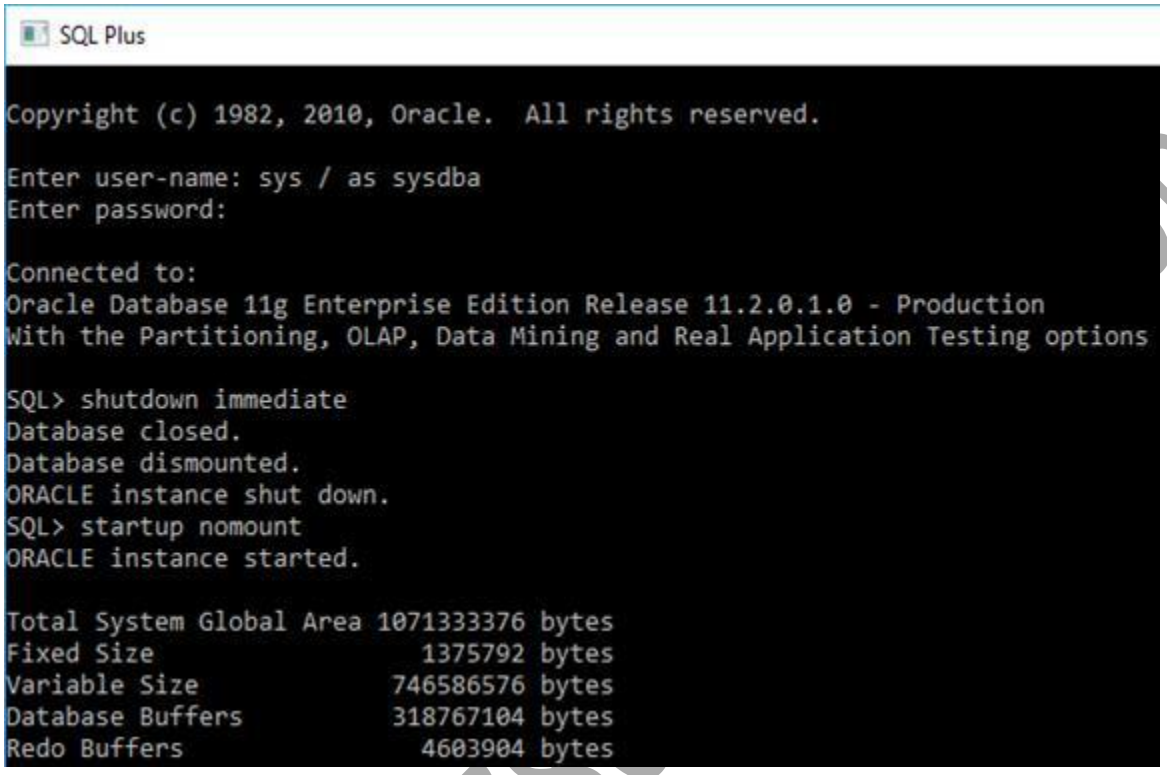
Executing Commands on SQL



Trouble Shouting Control Files

Executing steps in creating new Control Files

login sqlplus with user: sys / as sysdba select name from v$controlfile;
Alter database backup controlfile to trace as 'E:\APP\HAIDER\ORADATA\ORCL\control.b kp';
Trouble Shouting Control Files

Executing steps in creating new Control Files

Alter system set control_files='E:\APP\HAIDER\ORADAT A\ORCL\control01.ctl', 'E:\APP\HAIDER\FLASH_RECOVERY_AR EA\ORCL\control02.ctl', 'E:\APP\HAIDER\ORADATA\ORCL\contr ol03.ctl' scope=spfile;
shutdown immediate exit
Trouble Shouting Control Files

Backup Control Files using Startup Mount

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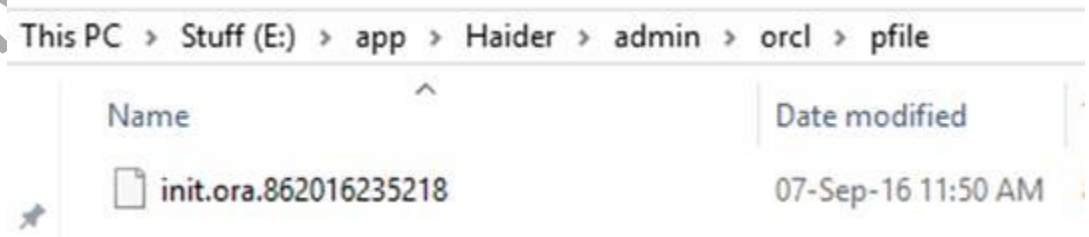
```
SQL> shutdown immediate
ORA-01507: database not mounted


ORACLE instance shut down.
SQL> startup mount
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             746586576 bytes
Database Buffers          318767104 bytes
Redo Buffers                4603904 bytes
Database mounted.
SQL> Alter database backup controlfile to trace as 'E:\APP\HAIDER\ORADATA\ORCL\control.bkp';
Alter database backup controlfile to trace as 'E:\APP\HAIDER\ORADATA\ORCL\control.bkp'
*
ERROR at line 1:
ORA-01277: file 'E:\APP\HAIDER\ORADATA\ORCL\CONTROL.BKP' already exists


SQL>
SQL> Alter database backup controlfile to trace as 'E:\APP\HAIDER\ORADATA\ORCL\control1.bkp';

Database altered.
```

Trouble Shouting Control Files

Alter System Set Command & initialization File



Trouble Shouting Control Files

Executing steps in creating new Control Files using SQL

Use copy-past file in windows file explorer or use DOS command
E:\APP\HAIDER\ORADATA\ORCL>copy
control01.ctl control03.ctl
Trouble Shouting Control Files

Executing steps in creating new Control Files using SQL

sqlplus
Enter user-name: sys / as sysdba Enter password:
Connected to an idle instance.

SQL> startup
ORACLE instance started. shutdown immediate exit
Trouble Shouting Control Files

Use of Database MOUNT & NO MOUNT

In NOMOUNT, Backup of existing control files and redo log files is required

In MOUNT, run Alter database backup …
Trouble Shouting Control Files
Database is in normal mode (consistent database)

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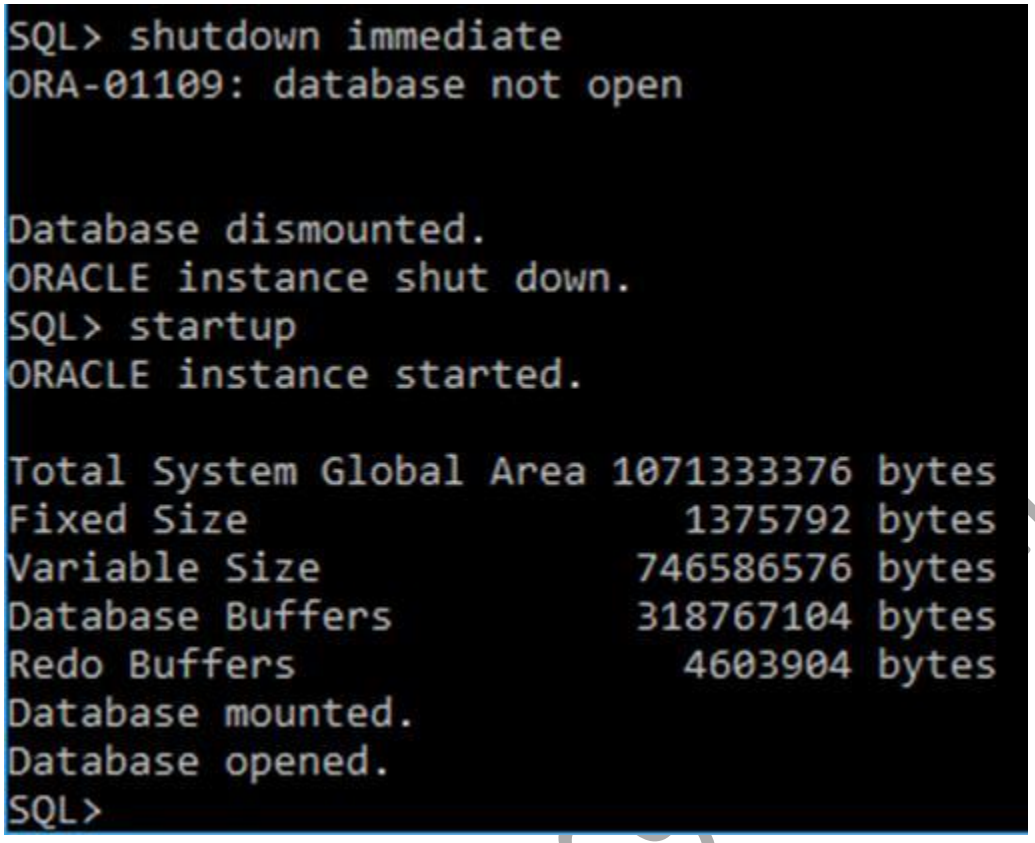

Trouble Shouting Control Files

Executing steps in creating new Control Files

SQL>select name from v$controlfile;
NAME

E:\APP\HAIDER\ORADATA\ORCL\CONTROL 01.CTL
E:\APP\HAIDER\FLASH_RECOVERY_AREA\O RCL\CONTROL02.CTL
E:\APP\HAIDER\ORADATA\ORCL\CONTROL 03.CTL
Trouble Shouting Control Files

Warning for Storing Control Files

You may want to ensure that control files are created on separate physical devices

End
Introduction to Database Administration

TOPIC 58

Recover & Dropping Control Files

Recover & Dropping Control Files

Recover & Dropping Control Files

Checking for Missing or Extra Files
Handling Errors During CREATE CONTROLFILE
ORA Error - A Sample
Different Locations of Control Files
Executing Commands on SQL
Backing up Control Files
Recover & Dropping Control Files

Recover & Dropping Control Files

Viewing Alert Log using Data Dictionary
Viewing Alert Log using Enterprise Manager
Finding Trace Files
Recovery from Permanent Media Failure
Dropping Control Files
Recover & Dropping Control Files

Checking for Missing or Extra Files

Dropped control files are still shown through data dictionary.
MISSINGnnnn is a flag in control file, gives status of file when seen by the data dictionary but actually does not exist on disk.
Recover & Dropping Control Files

Checking for Missing or Extra Files

If the actual data file corresponding to MISSINGnnnn is read-only or offline normal, then you can make the data file accessible by renaming MISSINGnnnn to the name of the actual data file.
Recover & Dropping Control Files

Checking for Missing or Extra Files

If MISSINGnnnn corresponds to a data file that was not read-only or offline normal, then you cannot use the rename operation to make the data file accessible, because the data file requires media recovery that is precluded by the results of RESETLOGS.

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Recover & Dropping Control Files

Checking for Missing or Extra Files

In this case, you must drop the tablespace containing the data file.
Conversely, if a data file listed in the control file is not present in the data dictionary, then the database removes references to it from the new control file. Refers to Alert log in any case.
Recover & Dropping Control Files

Handling Errors During CREATE CONTROLFILE

If Oracle Database sends you an error (usually error ORA-01173, ORA-01176, ORA-01177, ORA-01215, or ORA-01216)
when you attempt to mount and open the database after creating a new control file, the most likely cause is that you omitted a file from the CREATE CONTROLFILE statement or included one that should not have been listed.
Recover & Dropping Control Files

ORA Error – A Sample

Oracle Error: ORA-01173
Error Description:
Data dictionary indicates missing data file from
system tablespace

Error Cause:
Either the database has been recovered to a point in time in the future of the control file or a datafile from the system tablespace was omitted from the create control file command previously issued.
Recover & Dropping Control Files

ORA Error – A Sample

Action:
For the former problem you need to recover the database from a more recent control file. For the later problem, simply recreate the control file checking to be sure that you include all the datafiles
in the system tablespace.
Recover & Dropping Control Files

Different Locations of Control Files

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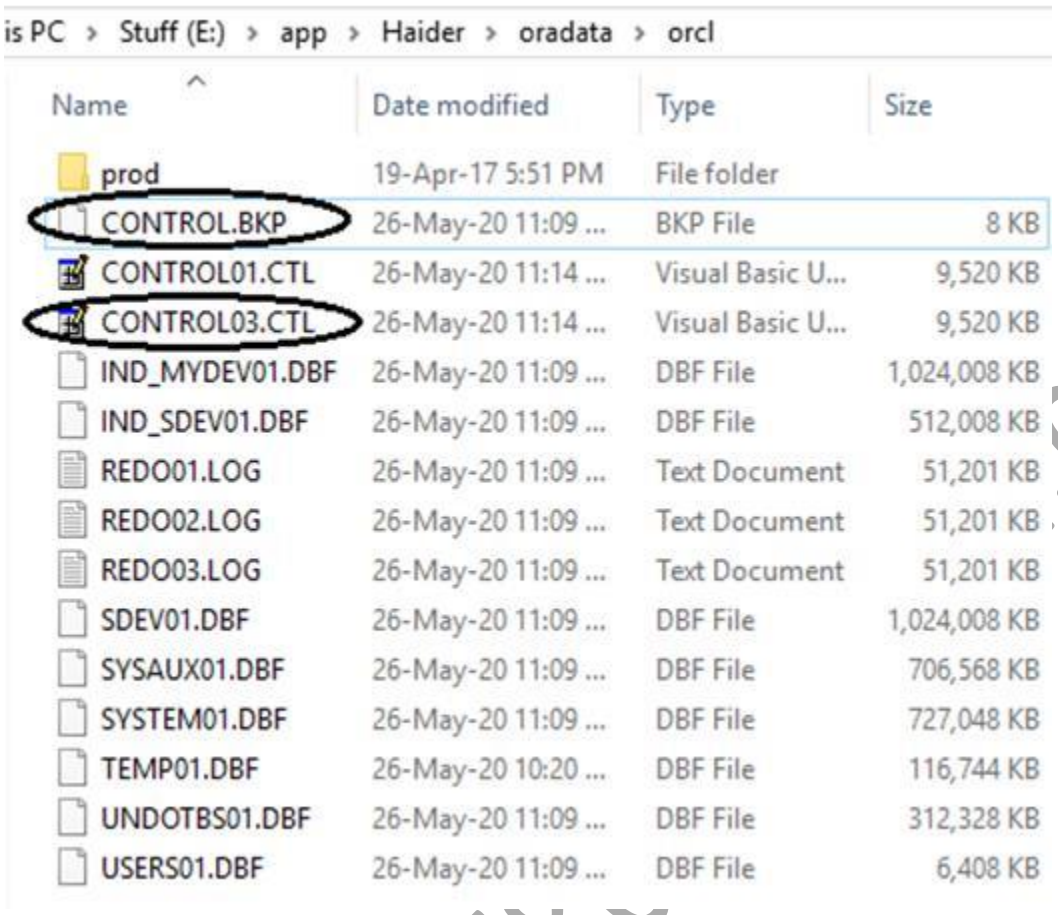
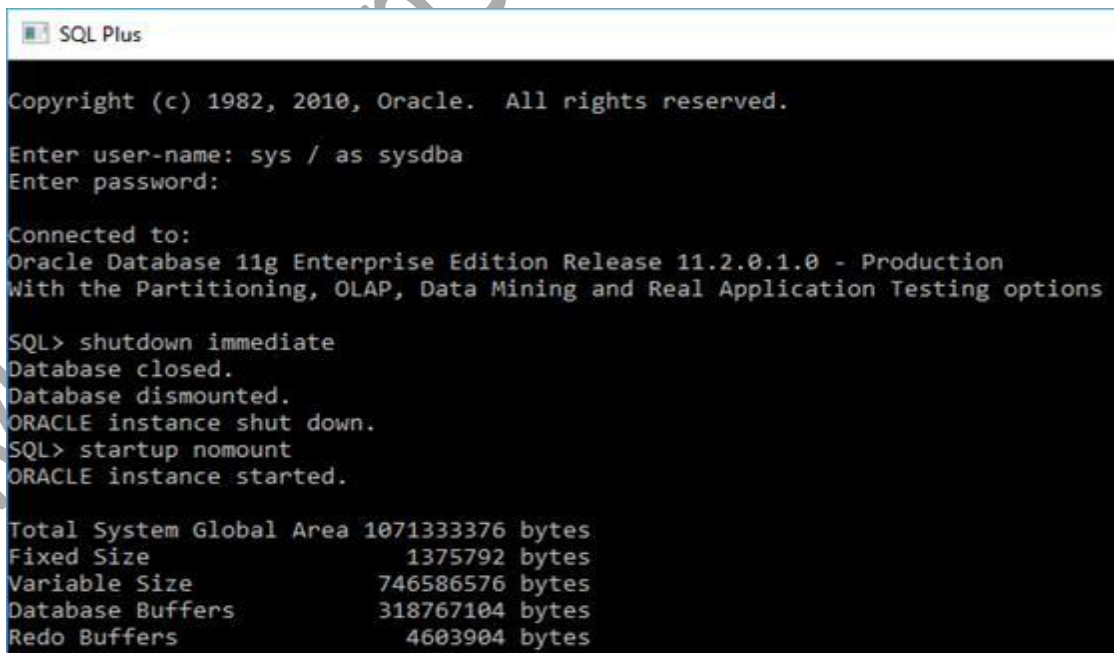


Recover & Dropping Control Files

Executing Commands on SQL



Recover & Dropping Control Files

Backing up Control Files

login sqlplus with user: sys / as sysdba select name from v$controlfile;
Alter database backup controlfile to
trace as 'E:\APP\HAIDER\ORADATA\ORCL\cont
rol.bkp';
Recover & Dropping Control Files

Backing up Control Files

Produce SQL statements that can later be used to re-create your control file:

ALTER DATABASE BACKUP CONTROLFILE TO TRACE;
Recover & Dropping Control Files

Backing up Control Files

This command writes a SQL script to a trace file where it can be captured and edited to reproduce the control file.
View the alert log to determine the name and location of the trace file.
Recover & Dropping Control Files

Viewing Alert Log using Data Dictionary

```
SQL> SELECT substr(Inst_id,1, 3),
  2  substr(name, 1, 25) Diag_name,
  3  substr(value, 1, 100) Diag_value
  4  from V$DIAG_INFO;

SUB DIAG_NAME                 DIAG_VALUE
--- ------------------------- ----------------------------------------------------------------
----------
1   Diag Enabled              TRUE
1   ADR Base                  e:\app\haider
1   ADR Home                  e:\app\haider\diag\rdbms\orcl\orcl
1   Diag Trace                e:\app\haider\diag\rdbms\orcl\orcl\trace
1   Diag Alert                e:\app\haider\diag\rdbms\orcl\orcl\alert
1   Diag Incident             e:\app\haider\diag\rdbms\orcl\orcl\incident
1   Diag Cdump                e:\app\haider\diag\rdbms\orcl\orcl\cdump
1   Health Monitor            e:\app\haider\diag\rdbms\orcl\orcl\hm
1   Default Trace File        e:\app\haider\diag\rdbms\orcl\orcl\trace\orcl_ora_25104.trc
1   Active Problem Count      0
1   Active Incident Count     0

11 rows selected.
```

Recover & Dropping Control Files

Viewing Alert Log using Enterprise Manager

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Access the Database Home page in Enterprise Manager.
Under Related Links, click Alert Log Contents.
The View Alert Log Contents page appears.
Select the number of entries to view, and then click Go
Recover & Dropping Control Files

Finding Trace Files

Trace files are stored in the Automatic Diagnostic Repository (ADR), in the trace directory under each ADR home.

To find the trace file for your current session:
SELECT VALUE FROM V$DIAG_INFO
WHERE NAME = 'Default Trace File';
Recover & Dropping Control Files

Finding Trace Files

To find all trace files for the current instance:
SELECT VALUE FROM V$DIAG_INFO
WHERE NAME = 'Diag Trace';
The path to the ADR trace directory for the current instance is returned.
Recover & Dropping Control Files

Finding Trace Files

To determine the trace file for each Oracle Database process:
SELECT PID, PROGRAM, TRACEFILE FROM V$PROCESS;

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```
SQL> SELECT VALUE FROM V$DIAG_INFO WHERE NAME = 'Diag Trace';

VALUE
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
e:\app\haider\diag\rdbms\orcl\orcl\trace
```

Recover & Dropping Control Files

Recovery from Permanent Media Failure

With the instance shut down, use an operating system command of copy
% cp /u01/oracle/prod/control01.ctl
/u04/oracle/prod/control03.ctl
Recover & Dropping Control Files

Recovery from Permanent Media Failure

Edit the CONTROL_FILES parameter in the initialization parameter file to replace the bad location with the new location:
CONTROL_FILES =
(/u01/oracle/prod/control01.ctl,
/u02/oracle/prod/control02.ctl,
/u04/oracle/prod/control03.ctl)
SQL> STARTUP
Recover & Dropping Control Files

Dropping Control Files

Database should have at least two control files at all times.

Shut down the database.
Edit the CONTROL_FILES parameter in the database initialization parameter file to delete the old control file name.
Restart the database.

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End
Introduction to Database Administration

TOPIC 59

What are Redo Log Files?

What are Redo Log Files?

Redo Log Files?

What is the Redo Log?
Redo Threads
Redo Log Contents
Writing to Redo Log Files
Active & In-active Redo Log Files
Overwriting Redo Log Files
What are Redo Log Files?

What is the Redo Log?

The most crucial structure for recovery operations is the redo log

The structure consists of two or more pre-allocated files that store all changes made to the database as they occur.
What are Redo Log Files?

What is the Redo Log?

Every instance of an Oracle Database has an associated redo log to protect the database in case of an instance failure.

Redo Log files stores all the change information for the database and are used by Oracle during Database recovery
What are Redo Log Files?

Redo Threads?

When speaking in the context of multiple database instances, the redo log for each database instance is also referred to as a redo thread.

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In typical configurations, only one database instance accesses an Oracle Database, so only one thread is present.
What are Redo Log Files?

Redo Log Contents?

Redo log files are filled with redo records or redo entry, is made up of a group of change vectors, each of which is a description of a change made to a single block in the database.
What are Redo Log Files?

Redo Log Contents?

For example, if you change a salary value in an employee table, you generate a redo record containing change vectors that describe changes to the data segment block for the table, the undo segment data block, and the transaction table of the undo segments.
Redo records are buffered in a circular fashion in the redo log buffer of the SGA.
What are Redo Log Files?

Redo Log Contents?

Redo records are written to one of the redo log files by the Log Writer (LGWR)database background process.
Whenever a transaction is committed, LGWR writes the transaction redo records from the redo log buffer of the SGA to a redo log file, and assigns a system change number (SCN) to identify the redo records for each committed transaction.
Transactions are committed when redo records are written to the disk safely.
What are Redo Log Files?

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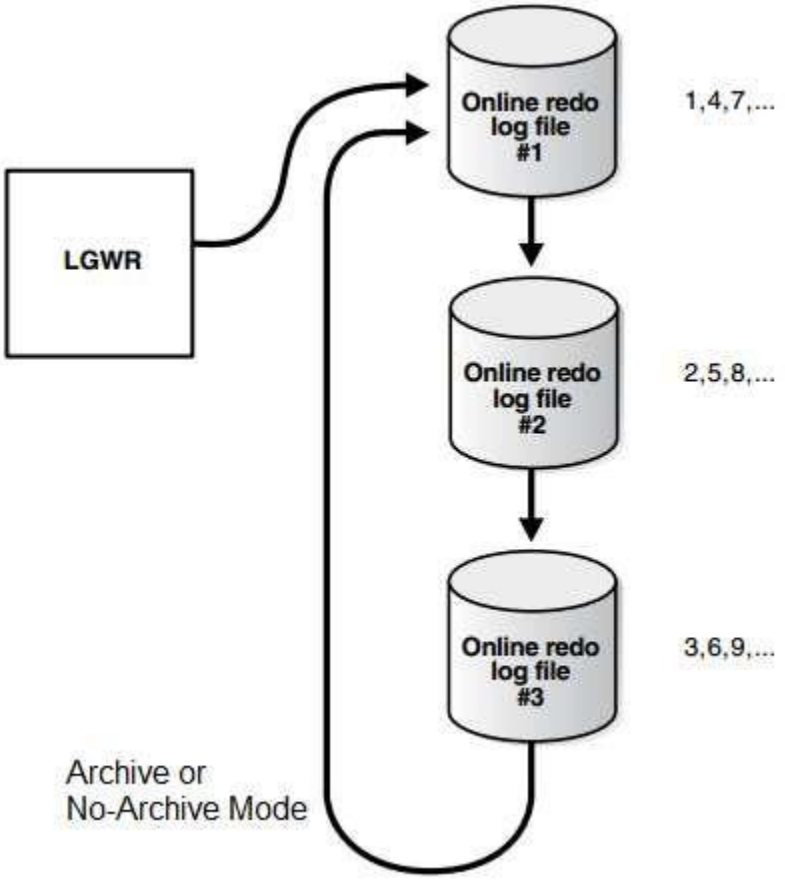

Writing to Redo Log files

LGWR writes to redo log files in a circular fashion. When the current redo log file fills, LGWR begins writing to the next available redo log file. When the last available redo log file is filled, LGWR returns to the first redo log file and writes to it, starting the cycle again.
What are Redo Log Files?

Active & In-Active Redo Log files

Oracle Database uses only one redo log file at a time to store redo records written from the redo log buffer.
The redo log file that LGWR is actively writing to is called the current redo log file.
What are Redo Log Files?

Active & In-Active Redo Log files

Redo log files that are required for instance recovery are called active redo log files.
Redo log files that are no longer required for instance recovery are called inactive redo log files.
What are Redo Log Files?

Overwriting Redo Log files

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If you have enabled archiving (the database is in ARCHIVELOG mode), then the database cannot reuse or overwrite an active online log file until one of the archiver background processes (ARCn) has archived its contents.
What are Redo Log Files?

Overwriting Redo Log files
A log switch is the point at which the database stops writing to one redo log file and begins writing to another. Normally, a log switch occurs when the current redo log file is completely filled and writing must continue to the next redo log file.

Oracle Database assigns each redo log file a new log sequence number every time a log switch occurs and LGWR begins writing to it.
Introduction to Database Administration

TOPIC 60

Planning Redo Log Files
Planning Redo Log Files

Planning Log Files

Multiplexing Redo Log Files?
Example of Multiplexing
Legal & Illegal Multiplexed Redo Log Configuration
Placing Redo Logs on Different Locations
Adding Redo Log Files to a Group
Planning Redo Log Files

Multiplexing Redo Log Files

To protect the failure of Redo Log Files
Two or more identical copies of Redo Log Files maintained in separate locations.
Files at same location can cause I/O errors, file corruption etc.
Planning Redo Log Files

Multiplexing Redo Log Files

LGWR concurrently writes the same information to multiple identical Redo Log files
A group consists of a Redo Log file and its multiplexed copies.

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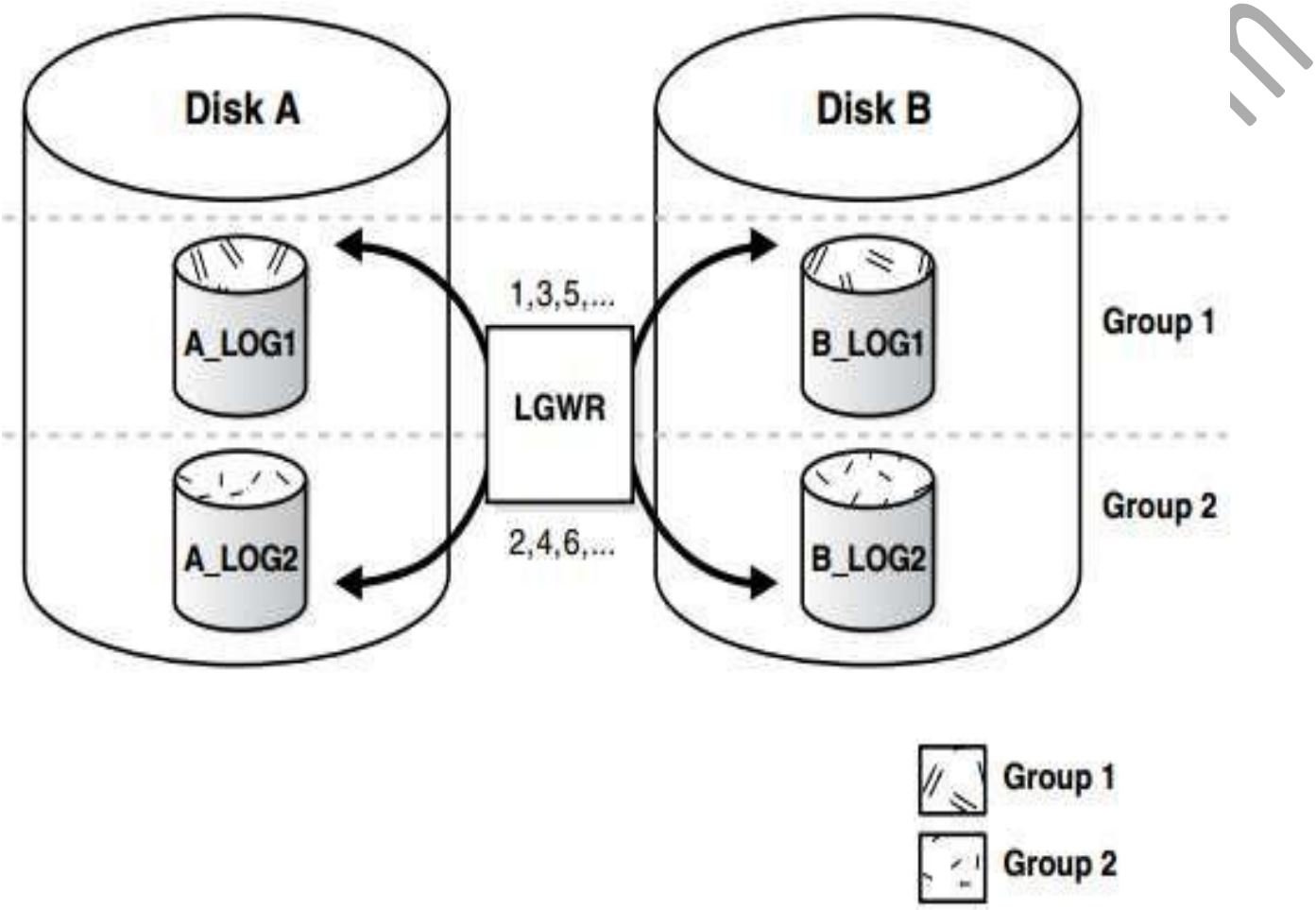
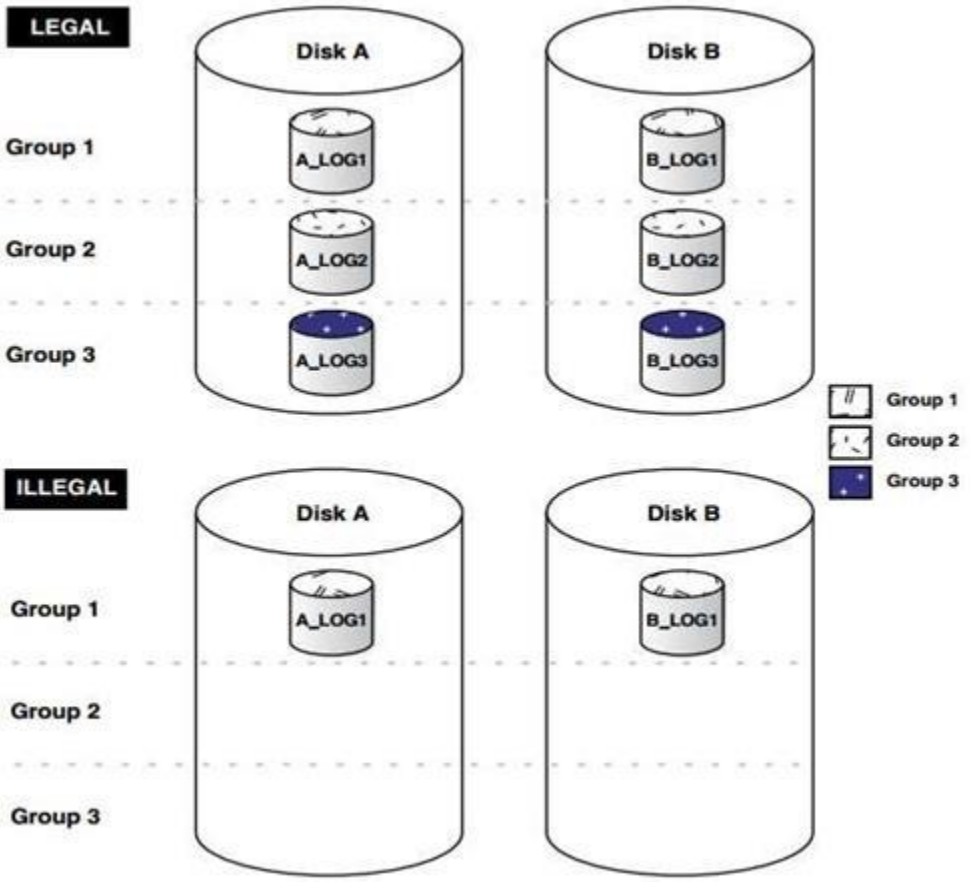
Each identical copy is said to be a member of the group. Groups can be group 1, group 2 and so on
Planning Redo Log Files

Example of Multiplexing



First LGWR writes concurrently to both A_LOG1 and B_LOG1. Then it writes concurrently to both A_LOG2and B_LOG2, and so on. LGWR never writes concurrently to members of different groups (for example, to A_LOG1and B_LOG2)
Planning Redo Log Files

Legal & Illegal Multiplexed Redo Log Configuration



Planning Redo Log Files

Placing Redo Log on Different Locations?

When setting up a multiplexed redo log, place members of a group on different physical disks. If a single disk fails, then only one member of a group becomes unavailable to LGWR and other members remain accessible to LGWR, so the instance can continue to function.
Minimum size permitted to Redo Log File
is 4MB.
Planning Redo Log Files

Planning the Block Size of Redo Log Files

```
SQL> SELECT name, value FROM v$sysstat WHERE name = 'redo wastage';

NAME                                                             VALUE
---------------------------------------------------------------- ----------
redo wastage                                                     4700476
```

Unlike the database block size, which can be between 2K and 32K, redo log files always default to a block size that is equal to the physical sector size of the disk. Historically, this has typically been 512 bytes (512B).

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Some newer high-capacity disk drives offer 4Kbyte (4K) sector sizes for both increased ECC capability and improved format efficiency.
Planning Redo Log Files

Adding Redo Log File to a Group

ALTER DATABASE orcl ADD LOGFILE GROUP 4 ('/u01/logs/orcl/redo04a.log', '/u01/logs/ orcl/redo04b.log') SIZE 100M BLOCKSIZE 512 REUSE;

```
SQL> select group#, members, BLOCKSIZE FROM V$LOG;

    GROUP#    MEMBERS  BLOCKSIZE
---------- ---------- ----------
         1          1        512
         2          1        512
         3          1        512

SQL>
```

End
Introduction to Database Administration

TOPIC 61

Creating Redo Log Files Groups

Creating Redo Log Files Groups

Creating Redo Log Files Groups & Members

Creating Redo Log Files Groups
Specify the number with a Group
Creating Redo Log Members
Alternate way of Creating Redo Log Members
Creating Redo Log Files Groups

Creating Redo Log Files Groups

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To create a new group of redo log files, use the SQL statement ALTER DATABASE with the ADD LOGFILE clause.
The following statement adds a new
group of redo logs to the database:

ALTER DATABASE ADD LOGFILE
('/oracle/dbs/log1c.rdo', '/oracle/dbs/log2c.rdo') SIZE 100M;
Creating Redo Log Files Groups

Specify the number with a Group

To a group number of redo log files, use the SQL statement ALTER DATABASE with the ADD LOGFILE clause.

ALTER DATABASE
ADD LOGFILE GROUP 10
('/oracle/dbs/log1c.rdo', '/oracle/dbs/log2c.rdo') SIZE 100M BLOCKSIZE 512;
Creating Redo Log Files Groups

Specify the number with a Group

Group number must be between 1 and MAXLOGFILES. Do not skip redo log file group, you will consume unnecessary space in the control files of the database.
Creating Redo Log Files Groups

Creating Redo Log Members

To create new redo log members for an existing group, use the SQL statement ALTER DATABASE with the ADD LOGFILE MEMBER clause. The following statement adds a new redo log member to redo log group number 2:

ALTER DATABASE
ADD LOGFILE MEMBER
'/oracle/dbs/log2b.rdo' TO GROUP 2;
Creating Redo Log Files Groups

Creating Redo Log Members

Sometimes, some members of groups dropped due to disk failure, you can add new members. Use the following SQL

ALTER DATABASE
ADD LOGFILE MEMBER

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'/oracle/dbs/log2b.rdo' TO GROUP 2;
Creating Redo Log Files Groups

Alternate way of Creating Redo Log Members

When using the ALTER DATABASE statement, you can alternatively identify the target group by specifying all of the other members of the group in the TO clause, as shown in the following example:
ALTER DATABASE ADD LOGFILE MEMBER
'/oracle/dbs/log2c.rdo'
TO ('/oracle/dbs/log2a.rdo', '/oracle/dbs/log2b.rdo');

END
Introduction to Database Administration

TOPIC 62

Relocating and Renaming
Redo Log Members
Relocating and Renaming Redo Log Members

Relocating and Renaming Redo Log Members

Reasons for Relocating Logs
Renaming Redo Log Members
What to do before Relocation?
Steps for Relocating Logs
Metadata of Redo Logs
Relocating and Renaming Redo Log Members

Reasons for Relocating Redo Log

You can use operating system commands to relocate redo logs, then use the ALTER DATABASE statement to make their new names (locations) known to the database.

This procedure is necessary, for example, if the disk currently used for some redo log files is going to be removed, or if data files and several redo log files are stored on the same disk and should be separated to reduce contention.

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Relocating and Renaming Redo Log Members

Renaming Redo Log Members

To rename redo log members, you must have the ALTER DATABASE system privilege. Additionally, you might also need operating system privileges to copy files to the desired location and privileges to open and back up the database.
Relocating and Renaming Redo Log Members

What to do before Relocations?

Before relocating your redo logs, or making any other structural changes to the database, completely BACKUP the database in case you experience problems while performing the operation. As a precaution, after renaming or relocating a set of redo log files, immediately back up the database control file.
Relocating and Renaming Redo Log Members

Steps for Relocating Redo Logs?

The log files are located on two disks: disk a and disk b.
The redo log is duplexed: one group consists of the members
/diska/logs/log1a.rdo and
/diskb/logs/log1b.rdo, and the second group consists of the members
/diska/logs/log2a.rdo and
/diskb/logs/log2b.rdo.
Relocating and Renaming Redo Log Members

Steps for Relocating Redo Logs?

The redo log files located on disk a must be relocated to disk c. The new filenames will reflect the new location: /diskc/logs/log1c.rdo and
/diskc/logs/log2c.rdo
Relocating and Renaming Redo Log Members

Metadata of Redo Logs?

The redo records have all relevant metadata for the change, including the following:
SCN and time stamp of the change
Transaction ID of the transaction that generated the change
SCN and time stamp when the transaction committed (if it committed)
Type of operation that made the change
Name and type of the modified data segment: SCN: System Change Number

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Introduction to Database Administration

TOPIC 63

Dropping Redo Log Groups & Members

Dropping Redo Log Groups & Members

Dropping Redo Log Groups & Members

Cases What to Do?
Dropping Redo Log Groups
Dropping Redo Log Members
Dropping Redo Log Groups & Members

Cases What to Do?

In some cases, you may want to drop an entire group of redo log members. For example, you want to reduce the number of groups in an instance redo log.
In a different case, you may want to drop one or more specific redo log members. For example, if a disk failure occurs, you may need to drop all the redo log files on the failed disk so that the database does not try to write to the inaccessible files.
Dropping Redo Log Groups & Members

Cases What to Do?

In other situations, particular redo log files become unnecessary. For example, a file might be stored in an inappropriate location.
Dropping Redo Log Groups & Members

Dropping Redo Log Groups?

To drop a redo log group, you must have the ALTER DATABASE system privilege. Before dropping a redo log group, consider the following restrictions and precautions:
An instance requires at least two groups of redo log files, regardless of the number of members in the groups. (A group comprises one or more members.)

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Dropping Redo Log Groups & Members

Dropping Redo Log Groups?

You can drop a redo log group only if it is inactive. If you must drop the current group, then first force a log switch to occur.
Dropping Redo Log Groups & Members

Dropping Redo Log Groups?

Make sure a redo log group is archived (if archiving is enabled) before dropping it.
To see whether this has happened, use the V$LOGview.
Dropping Redo Log Groups & Members

Dropping Redo Log Groups?

SELECT GROUP#, ARCHIVED, STATUS FROM V$LOG;
GROUP# ARC STATUS
YES ACTIVE
NO CURRENT
YES INACTIVE
YES INACTIVE
Drop a redo log group with the SQL statement ALTER DATABASE with the DROP LOGFILE clause.
Dropping Redo Log Groups & Members

Dropping Redo Log Groups?

Drop a redo log group with the SQL statement ALTER DATABASEwith the DROP LOGFILE clause.
The following statement drops redo log
group number 3:
Dropping Redo Log Groups & Members

Dropping Redo Log Groups?

ALTER DATABASE DROP LOGFILE GROUP 3;
After dropping a redo log group, ensure that the drop completed successfully, and then use the appropriate operating system command to delete the dropped redo log files.
Dropping Redo Log Groups & Members

Dropping Redo Log Members?

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Consider the following restrictions and precautions before dropping individual redo log members:
It is permissible to drop redo log files so that a multiplexed redo log becomes temporarily asymmetric. For example, if you use duplexed groups of redo log files, you can drop one member of one group, even though all other groups have two members each.
Dropping Redo Log Groups & Members

Dropping Redo Log Members?

However, you should rectify this situation immediately so that all groups have at least two members, and thereby eliminate the single point of failure possible for the redo log.
Dropping Redo Log Groups & Members

Dropping Redo Log Members?

An instance always requires at least two valid groups of redo log files, regardless of the number of members in the groups. (A group comprises one or more members.) If the member you want to drop is the last valid member of the group, you cannot drop the member until the other members become valid.
To see a redo Forcing Log Switches log file status, use the V$LOGFILE view.
Dropping Redo Log Groups & Members

Dropping Redo Log Members?

You can drop a redo log member only if it is not part of an active or current group. o drop a member of an active group, first force a log switch to occur.
Make sure the group to which a redo log member belongs is archived (if archiving is enabled) before dropping the member. To see whether this has happened, use the V$LOG view.
Dropping Redo Log Groups & Members

Dropping Redo Log Members?

To drop specific inactive redo log members, use the following statement:
ALTER DATABASE DROP LOGFILE MEMBER
'/oracle/dbs/log3c.rdo';

End
Introduction to Database Administration

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TOPIC 64

Forcing Log Switches

Between Redo Log Groups & Members

Forcing Log Switching Between Groups & Members

Forcing Log Switches

Log Switching
Log Switching – An Example
Verifying Blocks in Redo Log Files
Forcing Log Switching Between Groups & Members

Log Switching

A log switch occurs when LGWR stops writing to one redo log group and starts writing to another. By default, a log switch occurs automatically when the current redo log file group fills. You can force a log switch to make the currently active group inactive and available for redo log maintenance operations.

For example, you want to drop the currently active group, but are not able to do so until the group is inactive.
Forcing Log Switching Between Groups & Members

Log Switching

You may also want to force a log switch if the currently active group must be archived at a specific time before the members of the group are completely filled. This option is useful in configurations ith large redo log files that take a long time to fill.

The following statement forces a log switch:
ALTER SYSTEM SWITCH LOGFILE;
Forcing Log Switching Between Groups & Members

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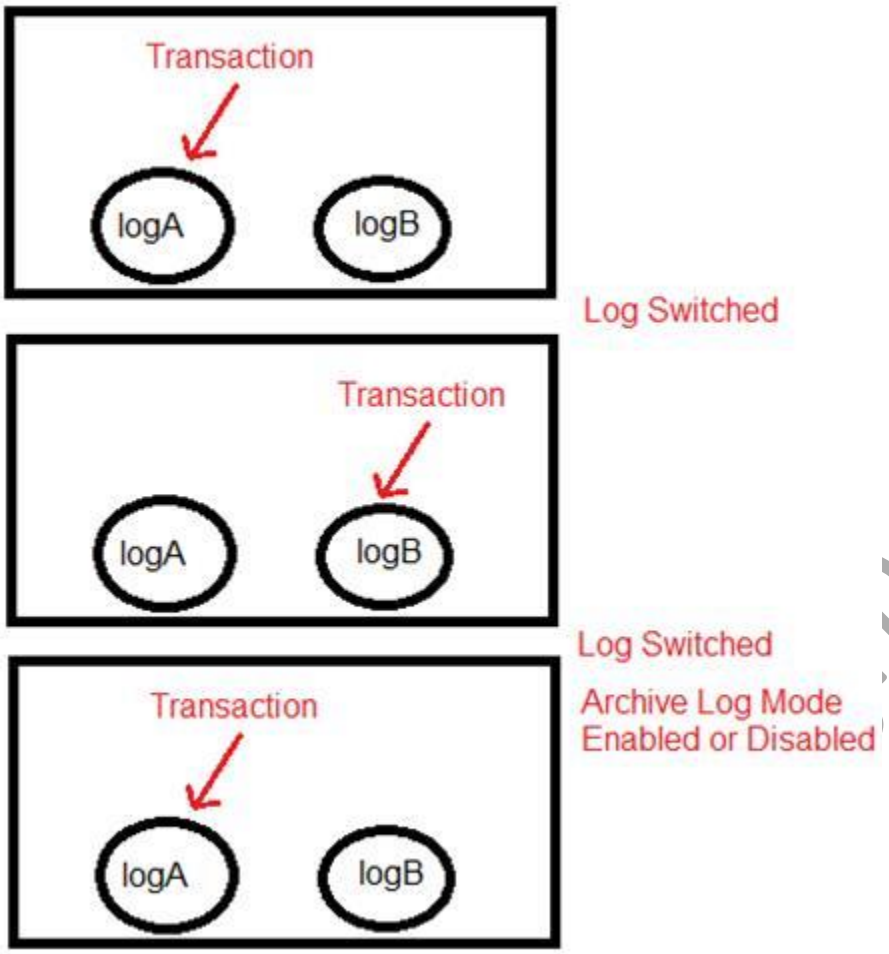

Log Switching – An Example

Forcing Log Switching Between Groups & Members

Verifying Blocks in Redo Log Files

You can configure the database to use checksums to verify blocks in the redo log files.
If you set the initialization parameter DB_BLOCK_CHECKSUM to TYPICAL(the default), the database computes a check sum for each database block when it is written to disk, including each redo log block as it is being written to the current log.
The checksum is stored header's block.
Forcing Log Switching Between Groups & Members

Verifying Blocks in Redo Log Files

Oracle Database uses the checksum to detect corruption in a redo log block.

The database verifies the redo log block when the block is read from an archived log during recovery and when it writes the block to an archive log file. An error is raised and written to the alert log if corruption is detected.
Forcing Log Switching Between Groups & Members

Verifying Blocks in Redo Log Files

If corruption is detected in a redo log block while trying to archive it, the system attempts to read the block from another member in the group.

If the block is corrupted in all members of the redo log group, then archiving cannot proceed.

The value of the DB_BLOCK_CHECKSUM parameter can be changed dynamically using the ALTER SYSTEM statement.

END
Introduction to Database Administration

TOPIC 65

Clearing Redo Log File

Clearing Redo Log File

Clearing Redo Log Files

How to clear Redo Log Files?
Error in clearing Redo Log Files
Dropping Redo Log File
Creating Redo Log File
Clearing Redo Log File

How to clear Redo Log Files?

A redo log file might become corrupted while the database is open, and ultimately stop database activity because archiving cannot continue. In this situation the ALTER DATABASE CLEAR LOGFILE statement can be used to reinitialize the file without shutting down the database.
The following statement clears the log files in redo log group number 3:
ALTER DATABASE CLEAR LOGFILE GROUP 3;
Clearing Redo Log File

How to clear Redo Log Files?

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If you clear a log file that is needed for recovery of a backup, then you can no longer recover from that backup. The database writes a message in the alert log describing the backups from which you cannot recover.
To clear an unarchived redo log that is needed to bring an offline tablespace online, use the UNRECOVERABLE DATAFILE clause in the ALTER DATABASE CLEAR LOGFILE statement.
Clearing Redo Log File

Error in clearing Redo Log Files

SQL> alter database drop logfile group 1; alter database drop logfile group 1
*
ERROR at line 1:
ORA-01624: log 1 needed for crash recovery of instance SBIP18DB (thread 1)
ORA-00312: online log 1 thread 1: '/SIBIP16/SBIP18DB/SBIP18DB/redo01.log'
Clearing Redo Log File

Error in clearing Redo Log Files

select l.group#, l.thread#, substr(f.member,1,50) f_name, l.archived,
l.status, (bytes/1024/1024) fsize from
v$log l, v$logfile f
where f.group# = l.group#

```
O# F_NAME                                           ARC STATUS    FSIZE
-- -------------------------------------------------- --- ---------------
 1 E:\APP\HAIDER\ORADATA\ORCL\REDO01.LOG               NO  INACTIVE     50
 1 E:\APP\HAIDER\ORADATA\ORCL\REDO02.LOG               NO  INACTIVE     50
 1 E:\APP\HAIDER\ORADATA\ORCL\REDO03.LOG               NO  CURRENT      50
```

order by 1,2;
Clearing Redo Log File

Error in clearing Redo Log Files

We can see the though the redolog group 1 has been archived, its status is ACTIVE.
i.e this redolog is required for crash recovery or block recovery.
So to change the status from ACTIVE to INACTIVE, switch logfile multiple times, till the status is INACTIVE.

```
# F_NAME                                           ARC STATUS    FSIZE
- -------------------------------------------------- --- ---------------
1 E:\APP\HAIDER\ORADATA\ORCL\REDO01.LOG               NO  CURRENT      50
1 E:\APP\HAIDER\ORADATA\ORCL\REDO02.LOG               NO  INACTIVE     50
1 E:\APP\HAIDER\ORADATA\ORCL\REDO03.LOG               NO  ACTIVE       50
```

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alter system switch logfile;
--for inactive status
alter database drop logfile group 2;
Clearing Redo Log File

Error in clearing Redo Log Files?

We can see the though the redolog group 1 has been archived, its status is ACTIVE.
i.e this redolog is required for crash recovery or block recovery.

```
D# F_NAME                                  ARC STATUS    FSIZE
-- --------------------------------------- --- ---------------
 1 E:\APP\HAIDER\ORADATA\ORCL\REDO01.LOG NO  ACTIVE        50
 1 E:\APP\HAIDER\ORADATA\ORCL\REDO02.LOG NO  CURRENT       50
 1 E:\APP\HAIDER\ORADATA\ORCL\REDO03.LOG NO  INACTIVE      50
```

So to change the status from ACTIVE to INACTIVE, switch logfile multiple times, till the status is INACTIVE.

alter system switch logfile;
--for inactive status
alter database drop logfile group 3;
Clearing Redo Log File

Dropping Redo Log File

```
SQL> alter database drop logfile group 3;

Database altered.

SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> startup
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             713032144 bytes
Database Buffers          352321536 bytes
Redo Buffers                4603904 bytes
Database mounted.
Database opened.
SQL>
```

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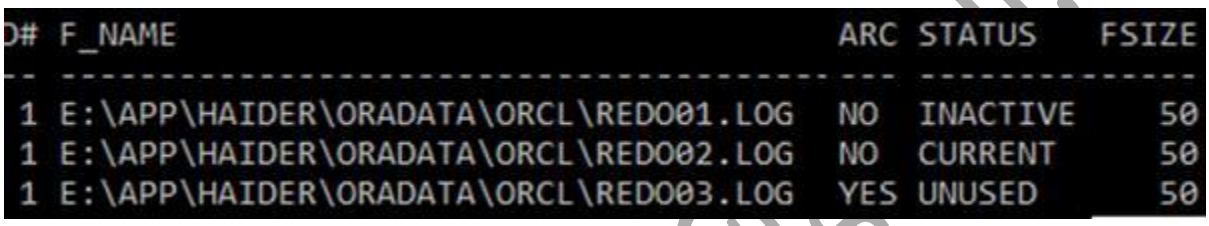
You shutdown and startup database after dropping on redo group 3. Drop REDO03.LOG from folder.
Clearing Redo Log File

Creating Redo Log File

alter database add logfile group 3 'E:\app\Haider\oradata\orcl\REDO03.log' size 50m;



D#	F_NAME	ARC	STATUS	FSIZE
1	E:\APP\HAIDER\ORADATA\ORCL\REDO01.LOG	NO	INACTIVE	50
1	E:\APP\HAIDER\ORADATA\ORCL\REDO02.LOG	NO	CURRENT	50
1	E:\APP\HAIDER\ORADATA\ORCL\REDO03.LOG	YES	UNUSED	50

Introduction to Database Administration

TOPIC 66

Metadata Views of Redo
Log File
Metadata Views of Redo Log File

Metadata View of Redo Log Files

Instance & Database Log Buffer
Significant Views?
Control File Information
Log History Information
Log of Members of Group
Log History Information
Use of Members of Group with Status
Metadata Views of Redo Log File
Instance & Database Log Buffer

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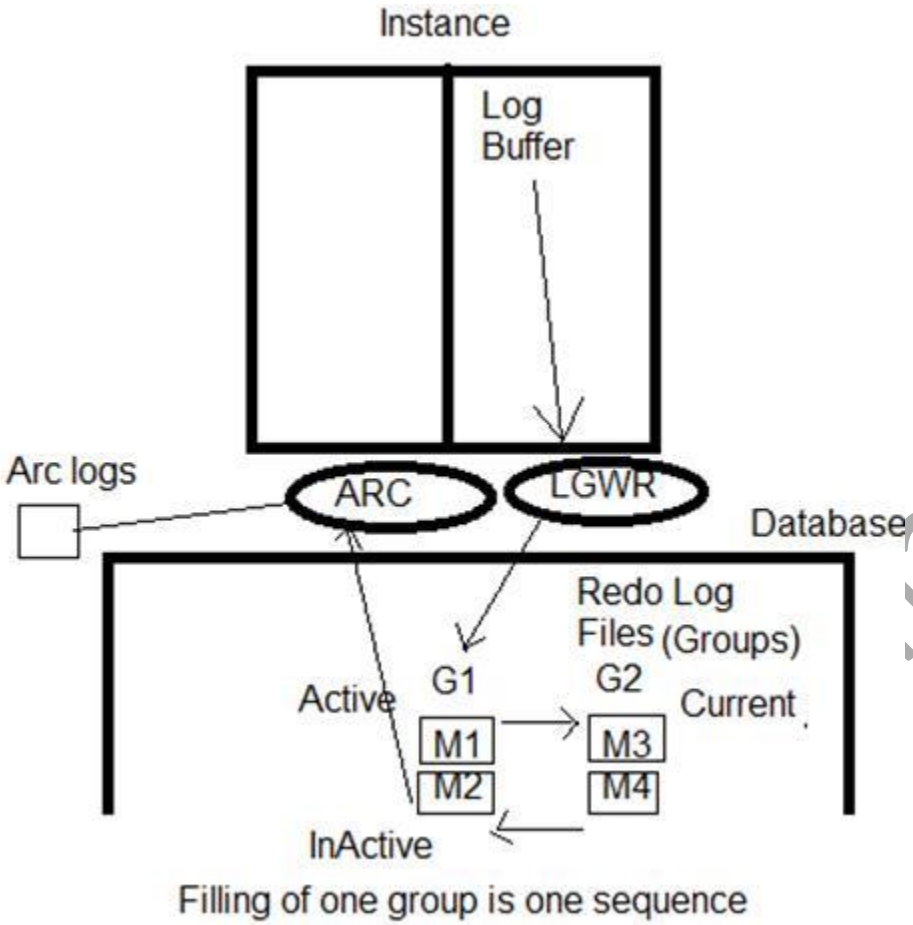

Metadata Views of Redo Log File

Significant of Views

View	Description
V$LOG	Displays the redo log file information from the control file
V$LOGFILE	Identifies redo log groups and members and member status
V$LOG_HISTORY	Contains log history information

Metadata Views of Redo Log File

Control File Information

```
SELECT * FROM V$LOG;

GROUP# THREAD#    SEQ    BYTES  MEMBERS  ARC STATUS     FIRST_CHANGE# FIRST_TIM
------ ------- ----- -------  -------  --- ---------  ------------- ---------
     1       1 10605 1048576        1  YES ACTIVE          11515628 16-APR-00
     2       1 10606 1048576        1  NO  CURRENT         11517595 16-APR-00
     3       1 10603 1048576        1  YES INACTIVE        11511666 16-APR-00
     4       1 10604 1048576        1  YES INACTIVE        11513647 16-APR-00
```

Metadata Views of Redo Log File
Members of Group

```
SELECT * FROM V$LOG;

GROUP# THREAD#    SEQ    BYTES  MEMBERS  ARC STATUS     FIRST_CHANGE# FIRST_TIM
------ ------- ----- -------  -------  --- ---------  ------------- ---------
     1       1 10605 1048576        1  YES ACTIVE          11515628 16-APR-00
     2       1 10606 1048576        1  NO  CURRENT         11517595 16-APR-00
     3       1 10603 1048576        1  YES INACTIVE        11511666 16-APR-00
     4       1 10604 1048576        1  YES INACTIVE        11513647 16-APR-00
```

Metadata Views of Redo Log File
Log History Information

```
SQL> select Stamp, Thread#, First_change#, First_time, Resetlogs_change#
  2  from  v$log_history
  3  where rownum<=10;

   STAMP   THREAD# FIRST_CHANGE# FIRST_TIM RESETLOGS_CHANGE#
--------  -------  ------------ ---------  ----------------
951399757        1      9079208 07-AUG-17            940976
951473702        1      9104778 07-AUG-17            940976
951559221        1      9132765 08-AUG-17            940976
951645623        1      9157391 09-AUG-17            940976
951732023        1      9182645 10-AUG-17            940976
952077284        1      9204703 11-AUG-17            940976
952085754        1      9217064 15-AUG-17            940976
952164052        1      9247525 15-AUG-17            940976
952303136        1      9278762 16-AUG-17            940976
952339592        1      9307368 18-AUG-17            940976
```

Metadata Views of Redo Log File

Use of member with status

```
select l.group#, l.thread#, substr(f.member,1,50) f_name, l.archived,
l.status, (bytes/1024/1024) fsize from
v$log l, v$logfile f
```

```
O# F_NAME                                          ARC STATUS    FSIZE
-- ------------------------------------------------ --- ---------------
 1 E:\APP\HAIDER\ORADATA\ORCL\REDO01.LOG           NO  INACTIVE     50
 1 E:\APP\HAIDER\ORADATA\ORCL\REDO02.LOG           NO  INACTIVE     50
 1 E:\APP\HAIDER\ORADATA\ORCL\REDO03.LOG           NO  CURRENT      50
```

```
where f.group# = l.group# order by 1,2;
```

Introduction to Database Administration

TOPIC 67

Archive & NoArchive Redo Log Files

Archive and

Archive & NoArchive of Redo Log Files

Archived Redo Log
Archived Redo Log Usage
Archived Redo Log Mode
Archived Redo Log Disabled to Enabled
Archived Redo Log Enabled to Disabled
Redo Logs Use in ARCHIVELOG Mode
Archive and NoArchive Redo Log Files

Archived Redo Log

Oracle Database lets you save filled groups of redo log files to one or more offline destinations, known collectively as the archived redo log.
The process of turning redo log files into archived redo log files is called archiving. This process is only possible if the database is running in ARCHIVELOG mode.

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You can choose automatic or manual archiving
Archive and Redo Log Files

Archived Redo Log

An archived redo log file is a copy of one of the filled members of a redo log group with log sequence number.
For example, if you are multiplexing your redo log, and if group 1 contains identical member files a_log1and b_log1, then the archiver process (ARCn) will archive one of these member files.
Archive Redo Log Files

Archived Redo Log

Should a_log1 become corrupted, then ARCn can still archive the identical b_log1. The archived redo log contains a copy of every group created since you enabled archiving.
Archive and Log Files

Archived Redo Log

When the database is running in ARCHIVELOG mode, LGWR cannot reuse and hence overwrite a redo log group until it has been archived.
The background process RCn automates archiving operations when automatic archiving is enabled. The database starts multiple archiver processes as needed to ensure that the archiving of filled redo logs does not fall behind.
Archive and

Archived Redo Log Usage

You can use archived redo logs to:
Recover a database
Update a standby database
Get information about the history of a database using the LogMiner utility
Archive Log Files

Archived Redo Log Mode

Display DB Archive Mode Disable or Enable Login with sys / as sysdba.
We will discuss archival files backup later

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```
SQL> SHOW PARAMETER DB_RECOVERY_FILE_DEST

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
db_recovery_file_dest                string      E:\app\Haider\flash_recovery_a
                                                 rea
db_recovery_file_dest_size           big integer 3852M
SQL>
```

Archive and NoArchive Redo Log Files

```
SQL> shutdown immediate
ORA-01507: database not mounted


ORACLE instance shut down.
SQL> startup mount
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             713032144 bytes
Database Buffers          352321536 bytes
Redo Buffers                4603904 bytes
Database mounted.
SQL> Alter database archivelog;

Database altered.

SQL> archive log list
Database log mode              Archive Mode
Automatic archival             Enabled
Archive destination            USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence     760
Next log sequence to archive   762
Current log sequence           762
```

```
SQL> shutdown immediate
ORA-01109: database not open


Database dismounted.
ORACLE instance shut down.
SQL> startup open
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             713032144 bytes
Database Buffers          352321536 bytes
Redo Buffers                4603904 bytes
Database mounted.
Database opened.
```

Archived Redo Log Disabled to Enabled

Using SQL sys to convert Archivelog Disabled to Enabled & Vice Versa

During recovery Oracle ask you to use
Alter database open instead of startup open
Archive and NoArchive Redo Log Files

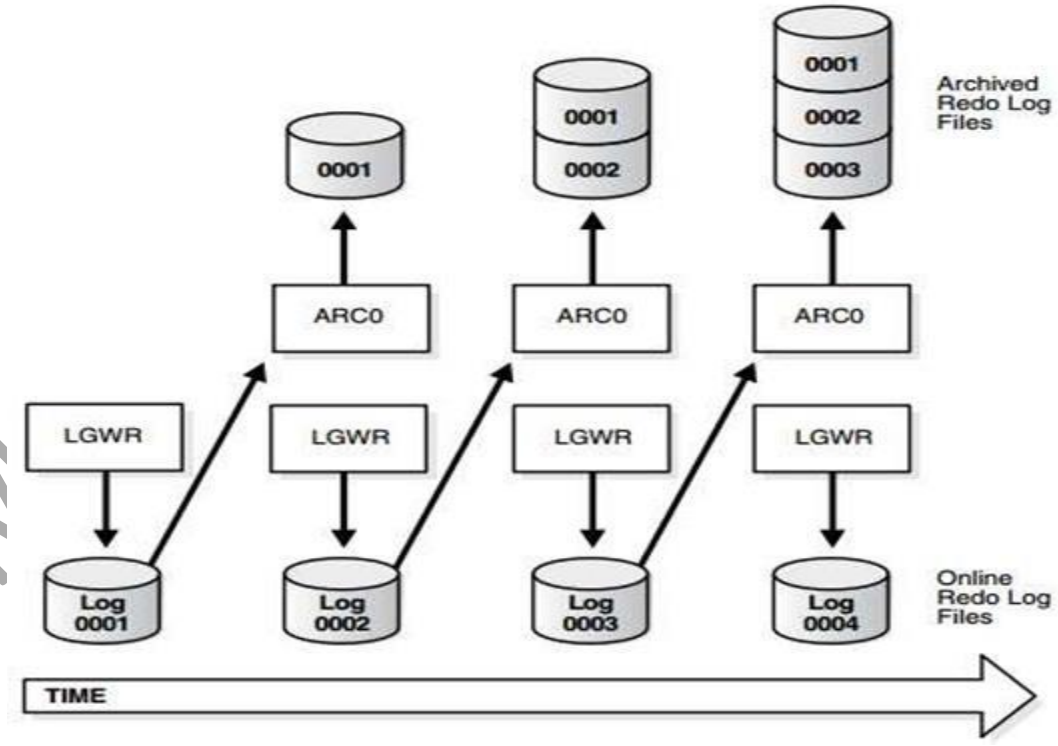
Archived Redo Log Enabled to Disabled

Mahjabeen

```
SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> startup mount
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             713032144 bytes
Database Buffers          352321536 bytes
Redo Buffers                4603904 bytes
Database mounted.
SQL> alter database noarchivelog;

Database altered.

SQL> archive log list
Database log mode              No Archive Mode
Automatic archival             Disabled
Archive destination            USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence     760
Current log sequence           762
SQL> startup open
ORA-01081: cannot start already-running ORACLE - shut it down first
SQL> shutdown immediate
ORA-01109: database not open


Database dismounted.
ORACLE instance shut down.
SQL> startup open
ORACLE instance started.
```

Archive and NoArchive Redo Log Files

Redo Logs Use in ARCHIVELOG Mode



TOPIC 68

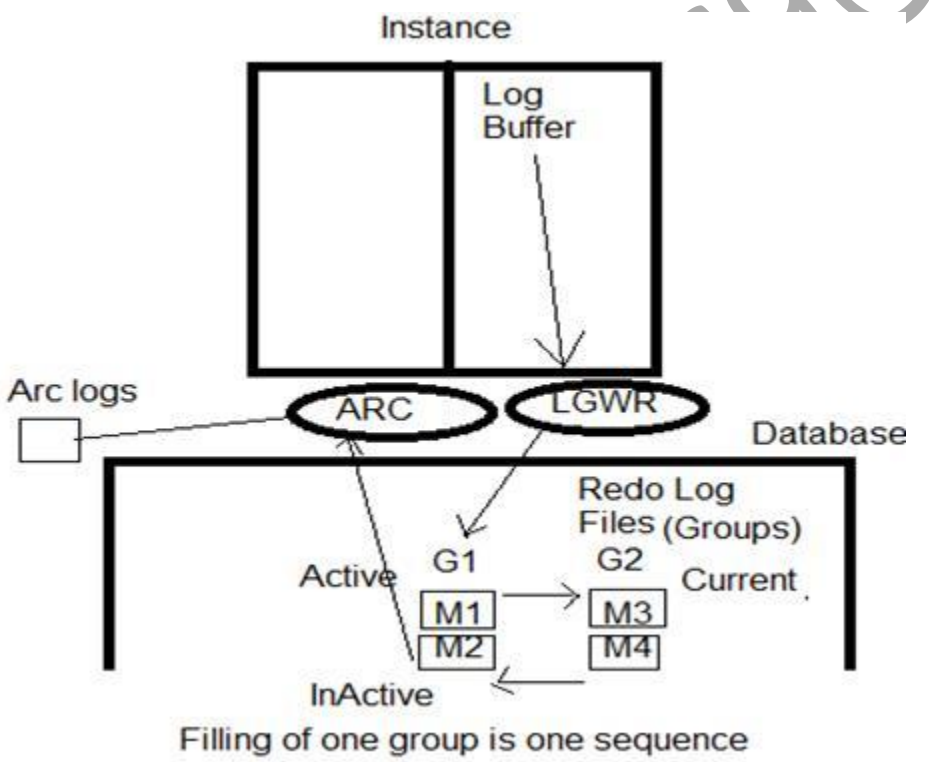
Controlling Archiving

Controlling Archiving

Controlling Archive of Redo Log

What is Oracle Archiving?
Setting the Initial Database Archiving Mode
Changing the Database Archiving Mode
Performing Manual Archiving
Adjusting the Number of Archiver Processes
Controlling Archiving

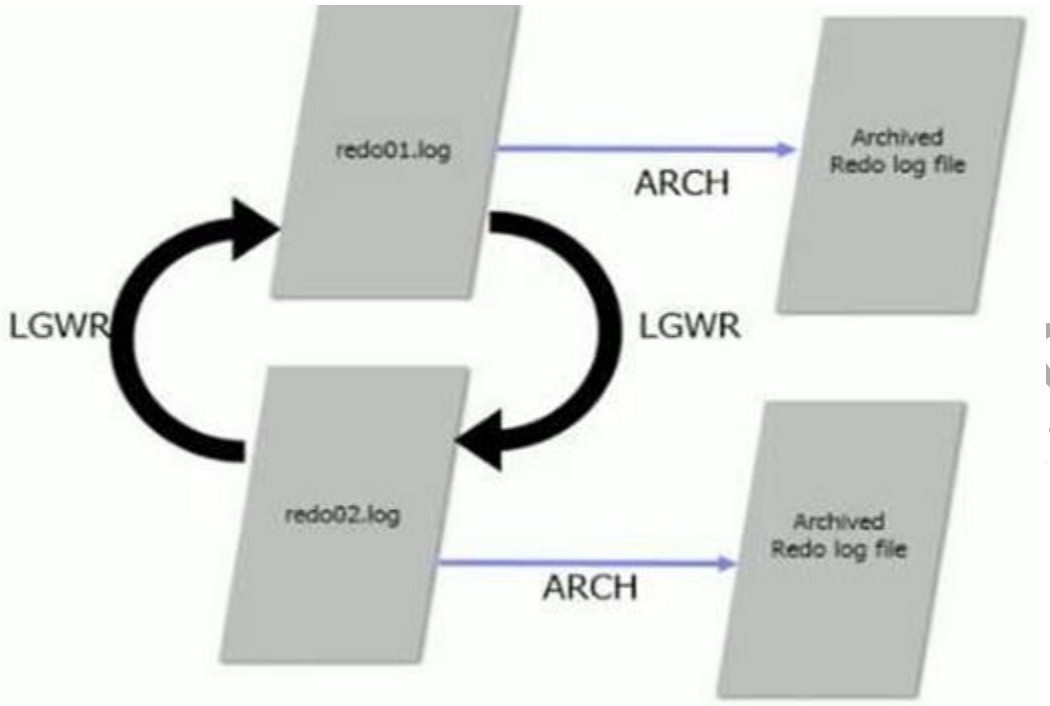
What is Oracle Archiving?



Archiving: After a switch, a copy of the Redo Log file is sent to Archive Destination
Controlling Archiving

What is Oracle Archiving?

Archiving: After a switch, a copy of the Redo Log file is sent to Archive Destination



Controlling Archiving

Setting the Initial Database Archiving Mode

Usually, you can use the default of NOARCHIVELOG mode at database creation because there is no need to archive the redo information generated by that process.
After creating the database, decide whether to change the initial archiving mode.
Controlling Archiving

Setting the Initial Database Archiving Mode

If you specify ARCHIVELOG mode, you must have initialization parameters set that specify the destinations for the archived redo log files
Controlling Archiving

Changing Archiving Mode

Start a new instance and mount, but do not open, the database.
STARTUP MOUNT
To enable or disable archiving, the database must be mounted but not open.
Controlling Archiving

Changing Archiving Mode

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Change the database archiving mode. Then open the database for normal operations.
ALTER DATABASE ARCHIVELOG; ALTER DATABASE OPEN;
Shut down the database. SHUTDOWN IMMEDIATE
Back up the database.
Controlling Archiving

Changing Archiving Mode Manual

Start a new instance and mount, but do not open, the database.
STARTUP MOUNT
Change the database archiving mode. Then open the database for normal operations.
ALTER DATABASE ARCHIVELOG MANUAL; ALTER DATABASE OPEN;
ALTER SYSTEM ARCHIVELOG ALL;
Shut down the database.
SHUTDOWN IMMEDIATE
Back up the database.
Controlling Archiving

Adjusting the Number of Archiver Processes

The LOG_ARCHIVE_MAX_PROCESSES initialization parameter specifies the number of ARCn processes that the database initially starts. The default is four processes.
To avoid any run-time overhead of starting additional ARCn processes, you can set the LOG_ARCHIVE_MAX_PROCESSES
Controlling Archiving

Adjusting the Number of Archiver Processes

Initialization parameter to specify that up
to 30 ARCn
ALTER SYSTEM SET
LOG_ARCHIVE_MAX_PROCESSES=6;

End
Introduction to Database Administration

TOPIC 69

Specifying Archive

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Destinations
Specifying Archive Destinations

Specifying Archive Destinations

Specifying Archive Destinations
Archive Destinations Status
Specifying Archive Destinations

Specifying Archive Destinations

You can choose to archive redo logs to a single destination or to multiple destinations. Destinations can be local—within the local file system or an Oracle Automatic Storage Management (Oracle ASM) disk group—or remote.
Specifying Archive Destinations

Specifying Archive Destinations

When you archive to multiple destinations, a copy of each filled redo log file is written to each destination. These redundant copies help ensure that archived logs are always available in the event of a failure at one of the destinations.
Specifying Archive Destinations

Specifying Archive Destinations

To archive to only a single destination, specify that destination using the LOG_ARCHIVE_DEST initialization parameter.
To archive to multiple destinations, you can choose to archive to two or more locations using the
Specifying Archive Destinations

Specifying Archive Destinations

LOG_ARCHIVE_DEST_n initialization parameters, or to archive only to a primary and secondary destination using the LOG_ARCHIVE_DEST and

LOG_ARCHIVE_DUPLEX_DEST initialization parameters.
Specifying Archive Destinations

Specifying Archive Destinations

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Method	Initialization Parameter	Host	Example
1	LOG_ARCHIVE_DEST_*n* where: *n* is an integer from 1 to 31. Archive destinations 1 to 10 are available for local or remote locations. Archive destinations 11 to 31 are available for remote locations only.	Local or remote	LOG_ARCHIVE_DEST_1 = 'LOCATION=/disk1/arc' LOG_ARCHIVE_DEST_2 = 'LOCATION=/disk2/arc' LOG_ARCHIVE_DEST_3 = 'SERVICE=standby1'
2	LOG_ARCHIVE_DEST and LOG_ARCHIVE_DUPLEX_DEST	Local only	LOG_ARCHIVE_DEST = '/disk1/arc' LOG_ARCHIVE_DUPLEX_DEST = '/disk2/arc'

Specifying Archive Destinations

Archive Destinations Status

Valid/Invalid: indicates whether the disk location or service name information is specified and valid
Enabled/Disabled: indicates the availability state of the location and whether the database can use the destination
Active/Inactive: indicates whether there was a problem accessing the destination

Introduction to Database Administration

TOPIC 70

Managing Archive
Destination Failure & Controlling Trace
Managing Archive Destination Failure & Controlling Trace

Managing Archive Destination Failure & Controlling Trace

Rearchiving to a Failed Destination
Controlling Trace Output
Initialization Parameter
Archived Redo Log Views

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Managing Archive Destination Failure & Controlling Trace

Rearchiving to a Failed Destination

Use the REOPEN attribute of the LOG_ARCHIVE_DEST_n parameter to specify whether and when ARCn should attempt to rearchive to a failed destination following an error. REOPEN applies to all errors, not just OPEN errors.
Managing Archive Destination Failure & Controlling Trace

Rearchiving to a Failed Destination

REOPEN=n sets the minimum number of seconds before ARCn should try to reopen a failed destination. The default value for n is 300 seconds. A value of 0 is the same as turning off the REOPEN attribute; ARCn will not attempt to archive after a failure.
If you do not specify the REOPEN keyword, ARCn will never reopen a destination following an error.
Managing Archive Destination Failure & Controlling Trace

Rearchiving to a Failed Destination

If you do not specify the REOPEN keyword, ARCn will never reopen a destination following an error.
You cannot use REOPEN to specify the number of attempts ARCn should make to reconnect and transfer archived logs. The REOPEN attempt either succeeds or fails.
You cannot use REOPEN to specify the number of attempts ARCn should make to reconnect and transfer archived logs. The REOPEN attempt
Managing Archive Destination Failure & Controlling Trace

Rearchiving to a Failed Destination

When you specify REOPEN for an OPTIONAL destination, the database can overwrite online logs if there is an error. If you specify REOPEN for a MANDATORY destination, the database stalls the production database when it cannot successfully archive.
Managing Archive Destination Failure & Controlling Trace

Rearchiving to a Failed Destination

In this situation, consider the following options:
Archive manually to the failed
destination.
Change the destination by deferring the destination, specifying the destination as optional, or changing the service.
Drop the destination.

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Managing Archive Destination Failure & Controlling Trace

Controlling Trace Output

Background processes always write to a trace file when appropriate. In the case of the archive log process, you can control the output that is generated to the trace file. You do this by setting the LOG_ARCHIVE_TRACE initialization parameter to specify a trace level.

The following values can be specified on next slide:
Managing Archive Destination Failure & Controlling Trace
Initialization Parameter

Trace Level	Meaning
0	Disable archivelog tracing. This is the default.
1	Track archival of redo log file.
2	Track archival status for each archivelog destination.
4	Track archival operational phase.
8	Track archivelog destination activity.
16	Track detailed archivelog destination activity.
32	Track archivelog destination parameter modifications.
64	Track ARC*n* process state activity.
128	Track FAL (fetch archived log) server related activities.
256	Supported in a future release.
512	Tracks asynchronous LGWR activity.
1024	RFS physical client tracking.
2048	ARC*n*/RFS heartbeat tracking.
4096	Track real-time apply
8192	Track redo apply activity (media recovery or physical standby)

Managing Archive Destination Failure & Controlling Trace

Archived Redo Log Views

Dynamic Performance View	Description
V$DATABASE	Shows if the database is in ARCHIVELOG or NOARCHIVELOG mode and if MANUAL (archiving mode) has been specified.
V$ARCHIVED_LOG	Displays historical archived log information from the control file. If you use a recovery catalog, the RC_ARCHIVED_LOG view contains similar information.
V$ARCHIVE_DEST	Describes the current instance, all archive destinations, and the current value, mode, and status of these destinations.
V$ARCHIVE_PROCESSES	Displays information about the state of the various archive processes for an instance.
V$BACKUP_REDOLOG	Contains information about any backups of archived logs. If you use a recovery catalog, the RC_BACKUP_REDOLOG contains similar information.
V$LOG	Displays all redo log groups for the database and indicates which need to be archived.
V$LOG_HISTORY	Contains log history information such as which logs have been archived and the SCN range for each archived log.

```
SELECT GROUP#, ARCHIVED
   FROM SYS.V$LOG;

GROUP#     ARC
--------   ---
         1   YES
         2   NO
```

End
Introduction to Database Administration

TOPIC 71

Database Physical Design

Database Physical Design

Physical Design

Definition & Concepts
Criteria for Physical Design
Analyzing DB Queries & Transactions
Time Constraints of Queries & Transactions
Physical DB Design Decisions
Physical Database Design for Tuning
Analyzing Database Queries & Transactions
Database Physical Design

Definition & Concepts

Physical database design is the process of choosing specific storage structures and access paths for the database files to achieve good performance for the various database applications.
Database Physical Design

Definition & Concepts

Each DBMS offers a variety of options for file organization and access path. Each DBMS includes various types of indexing, clustering of related records on disk blocks, link related records via pointers and various types of hashing/ partitions.
Database Physical Design

Definition & Concepts

For example, Oracle gives the concept of partitions as TableSpaces & MS SQL Server provides concept of sub databases
Database Physical Design

Criteria for Physical Design

Response Time: Elapse time between submitting a database transaction for execution and receiving a response. Response time is also influenced by factors not under control of DBMS, factors are communication, scheduling and operating system etc.
Database Physical Design

Criteria for Physical Design

Space Utilization: An amount of storage space used by the database files and their access path structure on disk including indexes.

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Transaction Throughput: Average number of transactions processed per minute. It is measured at peak conditions on the system
Database Physical Design

Analyzing DB Queries & Transactions

The files that will be accessed by the query.
Whether the selection condition is an equality, inequality, or a range condition.
The attributes whose values will be retrieved by the query.
The attributes on which any selection conditions for the queries are specified.
Database Physical Design

Analyzing DB Queries & Transactions

The attributes on which any join conditions or conditions to link multiple tables or objects for the query are specified.
The files that will be modified.
The attributes on which selection conditions for a delete or update is specified.
Database Physical Design

Time Constraints of Queries & Transactions

Some queries and transactions may
stringent performance constraints.
For example, a transaction may have the constraint that it should terminate within 5 seconds on 95 percent of the occasions when it is invoked than it would never take more than 20 seconds.
The type of operations on each file (insert, delete and update)
Database Physical Design

Physical DB Design Decisions

Design decisions about indexing: Attributes that are joint on equality, inequality or range conditions.
Whether to index an attribute.
What attribute(s) to index on. (Composite keys or one of attributes in key and other is non-key)
Database Physical Design

Physical DB Design Decisions

Whether to set up a Clustered index.
Whether to use hash index over tree index.
Whether to use dynamic hashing for the file (files are very volatiles).

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Apply de-normalization: separate the logically related attributes into tables to minimize redundancy.
Database Physical Design

Physical Database Design for Tuning

Size of individual tables
Number of distinct values in a column
Time of query submission and its execution
Storage statistics: Partitions, index space and buffer pool
I/O & performance statistics: Total read/write activity
Database Physical Design

Physical Database Design for Tuning

Locking/ logging related statistics: Rates of issuing different types of locks, transaction throughput rates, and log records activity
Index statistics: Number of levels in an index, number of non-contiguous leaf pages.
Database Physical Design

Analyzing Database Queries & Transactions

The files that will be accessed by the query
The attributes on which any selection condition (WHERE) for the query are specified
The attributes on which any join conditions are specified
Database Physical Design

Analyzing Database Queries & Transactions

The attributes whose values will retrieved by the queries
The files that will be updated
Type of operations on files (INSERT, DELETE, UPDATE)
The attributes whose values will be changed by an update operation

Introduction to Database Administration

TOPIC 72

Defining Tablespace, Types

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& Data Files
Defining

Tablespace & Data Files

Definition & Concepts
Benefits of using Multiple Tablespaces
Assigning Tablespace Quotas to Users
Types of Tablespaces
Defining & Data Files

Definition & Concepts

An Oracle database consists of one or more logical storage units called tablespaces, which collectively store all of the database's data.

For example, Enterprise's data tablespace, temporary tablespace, index tablespace etc.
Defining & Data Files

Definition & Concepts

Tablespaces (Logical Level)
Can belong to only one database at a
time
Consists of one or more data files
Are further divided into logical units of storage

Data Files (Physical Level)
Can belong to only one tablespace and one database
Are a repository for schema object data
& Data Files

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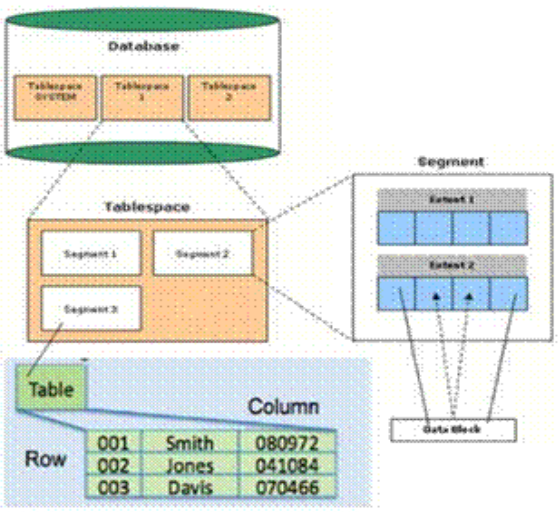
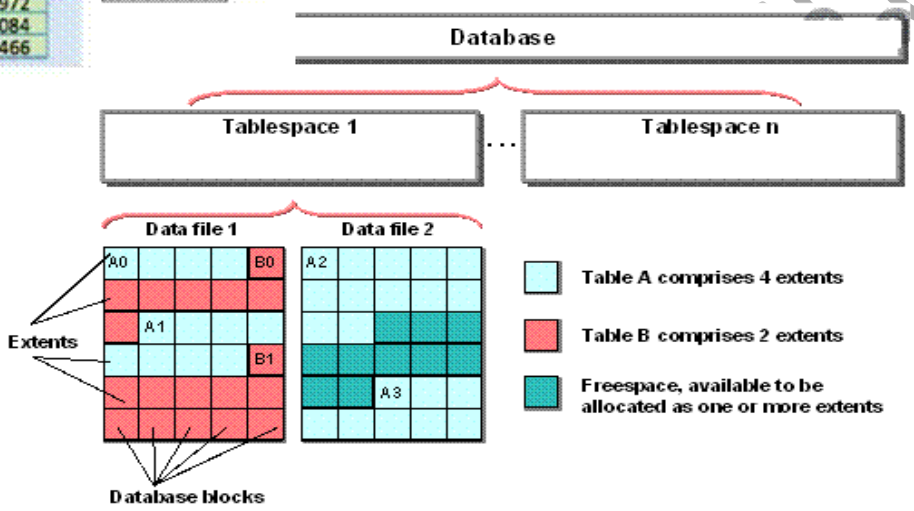
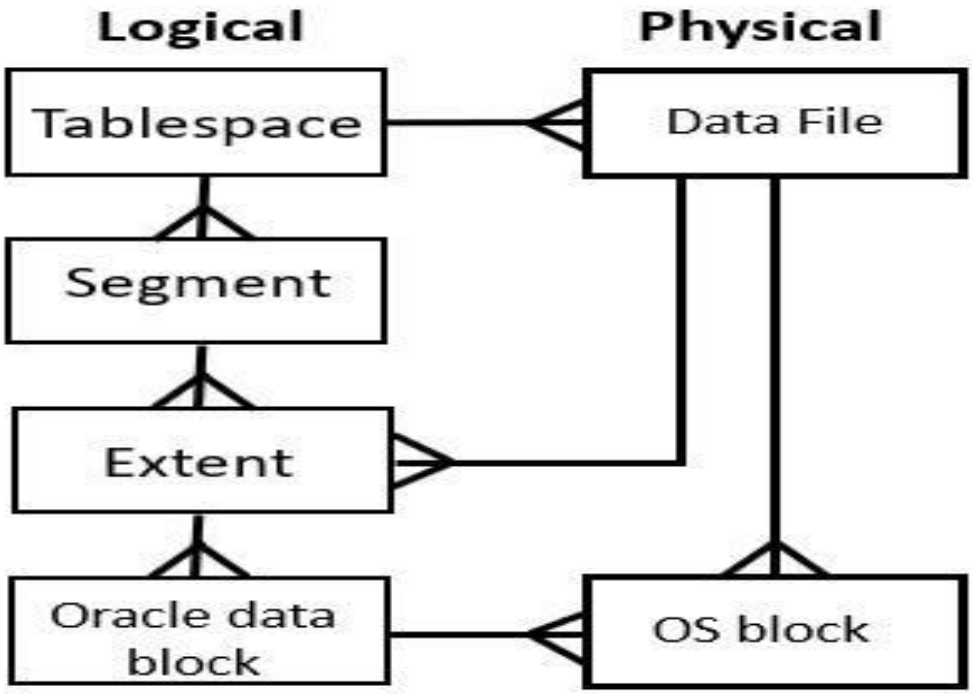
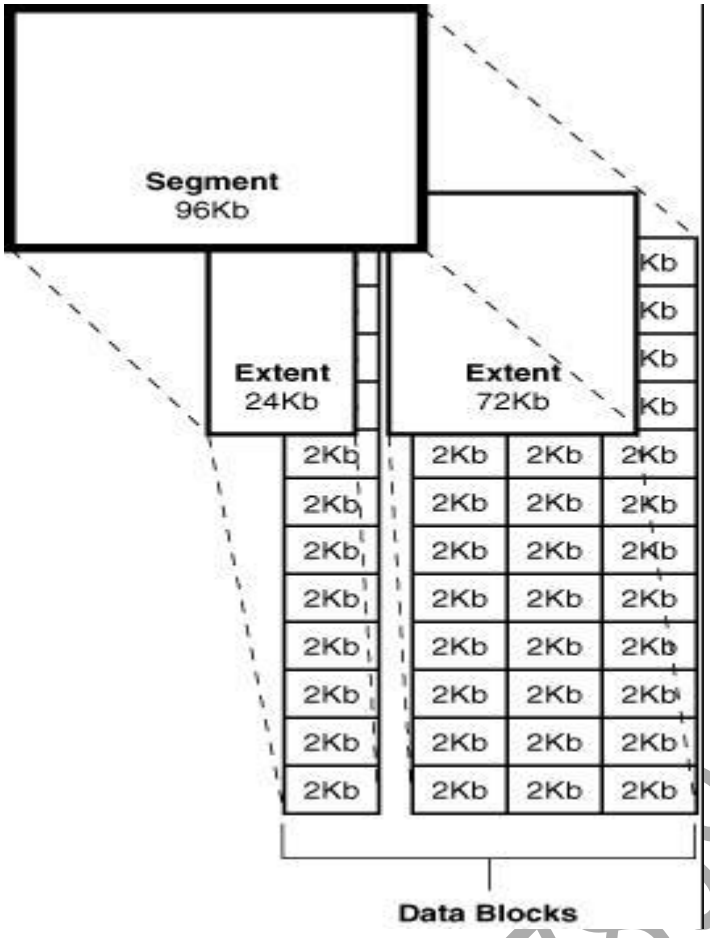


An extent is a logical unit of database storage space allocation made up of a number of contiguous data blocks. One or more extents in turn make up a segment. When the existing space in a segment is completely used, Oracle allocates a new extent for the segment.



Tablespaces & Extents





Defining & Data Files

Benefits of using Multiple Tablespaces

Separate user data from data dictionary data to reduce I/O contention.
Separate data of one application from the data of another to prevent multiple applications for offline purpose.
Store the data files of different tablespaces on different disk drives to reduce I/O contention.
Take individual tablespaces offline while others remain online, providing better overall availability.
& Data Files

Benefits of using Multiple Tablespaces

Optimizing tablespace use by reserving a tablespace for a particular type of database use, such as high update activity, read-only activity, or temporary segment storage.
Back up individual tablespaces.

Note: Some operating system can affect the number of tablespaces that can simultaneously online.

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Defining Tablespace, Types & Data Files

Assigning Tablespace Quotas to Users

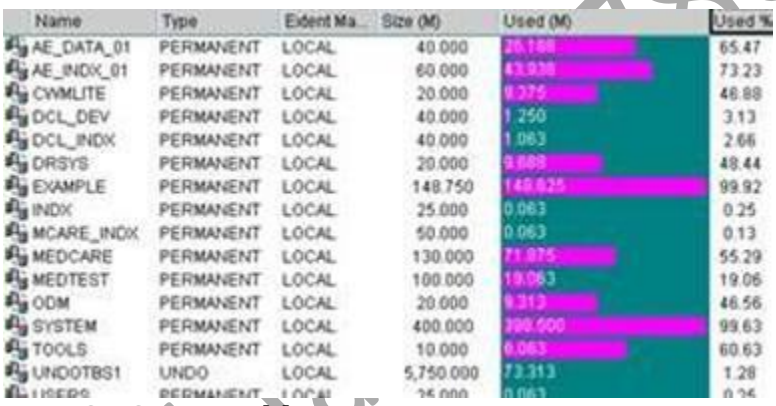
Grant to users who will be creating tables, clusters, materialized views, indexes, and other objects the privilege to create the object and a quota(space allowance or limit) in the tablespace intended to hold the object segment.
Defining Tablespace, Types & Data Files

Assigning Tablespace Quotas to Users

For PL/SQL objects such as packages, procedures, and functions, users only need the privileges to create the objects. No explicit tablespace quota is required to create these PL/SQL objects
Defining Tablespace, Types & Data Files

Types of Tablespaces

SYSTEM tablespace
Created with the database
Contains the data dictionary
Contains the SYSTEM undo segment



Name	Type	Extent Ma...	Size (M)	Used (M)	Used %
AE_DATA_01	PERMANENT	LOCAL	40.000	26.188	65.47
AE_INDX_01	PERMANENT	LOCAL	60.000	43.938	73.23
CWMLITE	PERMANENT	LOCAL	20.000	9.375	46.88
DCL_DEV	PERMANENT	LOCAL	40.000	1.250	3.13
DCL_INDX	PERMANENT	LOCAL	40.000	1.063	2.66
DRSYS	PERMANENT	LOCAL	20.000	9.688	48.44
EXAMPLE	PERMANENT	LOCAL	148.750	148.625	99.92
INDX	PERMANENT	LOCAL	25.000	0.063	0.25
MCARE_INDX	PERMANENT	LOCAL	50.000	0.063	0.13
MEDCARE	PERMANENT	LOCAL	130.000	71.875	55.29
MEDTEST	PERMANENT	LOCAL	100.000	19.063	19.06
ODM	PERMANENT	LOCAL	20.000	9.313	46.56
SYSTEM	PERMANENT	LOCAL	400.000	398.500	99.63
TOOLS	PERMANENT	LOCAL	10.000	6.063	60.63
UNDOTBS1	UNDO	LOCAL	5,750.000	73.313	1.28

Non-SYSTEM tablespace
Separate segments
Eases space administration
Controls amount of space of a user

Introduction to Database Administration

TOPIC 73

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Creating Tablespaces
Creating Tablespaces

Creating Tablespaces

Creating Tablespace Syntax
Creating Tablespace using SQL
How a user uses Tablespace?
Space Management in Tablespace
Locally-Managed Tablespaces
Dictionary-Managed Tablespaces
Create UNDO Tablespace
Create Temporary Tablespace
Creating a default Temporary Tablespace
Restrictions
Creating Tablespaces
Creating Tablespace Syntax

```
CREATE TABLESPACE tablespace
    [DATAFILE clause]
    [MINIMUM EXTENT integer[K|M]]
    [BLOCKSIZE integer [K]]
    [LOGGING|NOLOGGING]
    [DEFAULT storage_clause ]
    [ONLINE|OFFLINE]
    [PERMANENT|TEMPORARY]
    [extent_management_clause]
    [segment_management_clause]
```

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Oracle Internal &

Creating Tablespaces

Creating Tablespace using SQL

Windows Platform: CREATE TABLESPACE WORK
datafile 'C:\Oracle11g\ordata\wrk01.dbf' size 500M online;

Unix/ Linux Platform: CREATE TABLESPACE WORK
datafile '/u01/ordata/wrk01.dbf' size 500M online;
Creating Tablespaces

How a user uses Tablespace?

Create user ejaz identified by pwd default tablespace WORK temporary tablespace TEMP;

--Assigning default roles to user(owner)
Grant connect, resource to ejaz;

Grant create table to ejaz; Grant create view to ejaz;
Creating Tablespaces

Space Management in Tablespace

Tablespaces allocate space in extents. Tablespaces can be created to use one of the following two different methods of keeping track of free and used space:

Locally managed tablespaces: The extents are managed within the tablespace via bitmaps. Each bit in the bitmap corresponds to a block or a group of blocks.
Creating Tablespaces

Space Management in Tablespace

When an extent is allocated or freed for reuse, the Oracle server changes the bitmap values to show the new status of the blocks. Locally managed is the default beginning Oracle.

Dictionary-managed tablespaces: The extents are managed by the data dictionary. The Oracle server updates the appropriate tables in the data dictionary whenever an extent is allocated or deallocated.
Creating Tablespaces

Locally-Managed Tablespaces

Reduced contention on data dictionary tables
No undo generated when space allocation or deallocation occurs
No coalescing required

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CREATE TABLESPACE userdata datafile 'C:\Ora11g\ordata\usr01.dbf' size 500M
EXTENT MANAGEMENT LOCAL UNIFORM SIZE 128K;
Creating Tablespaces

Dictionary-Managed Tablespaces

Extents are managed in the data dictionary
Each segment stored in the tablespace can have a different storage clause.
No coalescing required

CREATE TABLESPACE userdata datafile 'C:\Ora11g\ordata\usr01.dbf' size 500M EXTENT MANAGEMENT DICTIONARY DEFAULT STORAGE (Initial 1M NEXT 1M PCTINCREASE 0);
Creating Tablespaces

Create UNDO Tablespace

Used to store undo segments
Cannot contain any other objects
Extents are locally managed
Can only use the DATAFILE and EXTENT MANAGEMENT Clause

CREATE UNDO TABLESPACE undo01
datafile 'C:\Oracle11g\ordata\undo01.dbf' size 40M;
Creating Tablespaces

Create Temporary Tablespace

Used for sort operations
Can be shared by multiple users
Cannot contain any permanent objects
Locally managed extents recommended

CREATE Temporary TABLESPACE temp1 datafile 'C:\Oracle11g\ordata\temp101.dbf' size 20M
EXTENT MANAGEMENT LOCAL UNIFORM SIZE 4M;

Creating a default Temporary Tablespace

After database creation: ALTER DATABASE
DEFAULT TEMPORARY TABLESPACE

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default_temp1;

To see default temporary tablespace, use
Select property_name from database_properties;
Creating Tablespaces

Restrictions

Default temporary tablespace cannot be:

Dropped until after a new default is
made available
Taken offline
Alter to a permanent tablespace

End
Introduction to Database Administration

TOPIC 74

Specifying Non Standard Block Sizes for Tablespaces

Specifying Non Standard Block Sizes for Tablespaces

Block Sizes for Tablespaces

Bigfile Tablespaces
Creating Bigfile Tablespaces
VIEWS for Bigfile Tablespaces
Non Standard Block Sizes for Tablespaces
Creating Non Standard Tablespaces
Specifying Non Standard Block Sizes for Tablespaces

Bigfile Tablespaces

A bigfile tablespace is a tablespace with a single, but potentially very large (up to 4G blocks) data file. Traditional small file tablespaces, in contrast, can contain multiple data files, but the files cannot be as large.

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Specifying Non Standard Block Sizes for Tablespaces

Bigfile Tablespaces

The benefits of bigfile tablespaces are as follows:
A bigfile tablespace with 8K blocks can contain a 32 terabyte data file. A bigfile tablespace with 32K blocks can contain 128 terabyte data file. The maximum number of data files in an Oracle Database is limited (usually to 64K files). Therefore, bigfile tablespaces can significantly enhance the storage capacity of an Oracle DB
Specifying Non Standard Block Sizes for Tablespaces

Bigfile Tablespaces

Bigfile tablespaces can reduce the number of data files needed for a database. An additional benefit is that the DB_FILES initialization parameter and MAXDATAFILES parameter of the CREATE DATABASE and CREATE CONTROLFILE statements can be adjusted to reduce the amount of SGA space required for data file information and the size of the control file.
Specifying Non Standard Block Sizes for Tablespaces

Bigfile Tablespaces

Bigfile tablespaces simplify database management by providing data file transparency. SQL syntax for the ALTER TABLESPACE statement lets you perform operations on tablespaces, rather than the underlying individual data files.
Specifying Non Standard Block Sizes for Tablespaces

Creating Bigfile Tablespaces

```
CREATE BIGFILE TABLESPACE bigtbs
DATAFILE '/u02/oracle/data/bigtbs01.dbf'
SIZE 50G
...
```

You can specify SIZE in kilobytes (K), megabytes (M),gigabytes (G), or terabytes (T).

If the default tablespace type was set to BIGFILE at database creation then bigfile tablespace will be created by default.
Specifying Non Standard Block Sizes for Tablespaces

VIEWS for Bigfile Tablespaces

DBA_TABLESPACES
USER_TABLESPACES

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V$TABLESPACE
Specifying Non Standard Block Sizes for Tablespaces

Non Standard Block Sizes for Tablespaces

You can create tablespaces with block sizes different from the standard database block size, which is specified by the DB_BLOCK_SIZE initialization parameter. This feature lets you transport tablespaces with unlike block sizes between databases.
Specifying Non Standard Block Sizes for Tablespaces

Non Standard Block Sizes for Tablespaces

Use the BLOCKSIZE clause of the CREATE TABLESPACE statement to create a tablespace with a block size different from the database standard block size. In order for the BLOCKSIZE clause to succeed, you must have already set the DB_CACHE_SIZE and at least one DB_nK_CACHE_SIZE initialization parameter.
Specifying Non Standard Block Sizes for Tablespaces

Non Standard Block Sizes for Tablespaces

Further, and the integer you specify in the BLOCKSIZE clause must correspond with the setting of one DB_nK_CACHE_SIZE parameter setting. Although redundant, specifying a BLOCK SIZE equal to the standard block size, as specified by the DB_BLOCK_SIZE initialization parameter, is allowed.
Specifying Non Standard Block Sizes for Tablespaces

Creating Non Standard Tablespaces

```
CREATE TABLESPACE lmtbsb DATAFILE
'/u02/oracle/data/lmtbsb01.dbf' SIZE 50M
EXTENT MANAGEMENT LOCAL UNIFORM SIZE 128K BLOCKSIZE 8K;
```

End
Introduction to Database Administration

TOPIC 75

Altering Tablespaces

Altering Tablespaces

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Altering Tablespaces

Altering Tablespaces Availability
Taking Tablespaces Offline
Tablespaces cannot Offline
Altering Tablespace SQL
Owner of Tablespace
Making Tablespace Readonly
Dictionary View for use of Altering Tablespace
Wait for Altering Tablespace to Readonly
Altering Tablespaces

Altering Tablespaces Availability

Before you can make a tablespace read- only, the following conditions must be met

You can take an online tablespace offline so that it is temporarily unavailable for genera use. The rest of the database remains open and available for users to access data.
Altering Tablespaces

Altering Tablespaces Availability

Conversely, you can bring an offline tablespace online to make the schema objects within the tablespace available to database users.
The database must be open to alter the availability of a tablespace.
Altering Tablespaces

Taking Tablespaces Offline

To make a portion of the database unavailable while allowing normal access to the remainder of the database
To perform an offline tablespace backup (even though a tablespace can be backed up while online and in use)
Altering Tablespaces

Taking Tablespaces Offline

To make an application and its group of tables temporarily unavailable while updating or maintaining the application
To rename or relocate tablespace data files

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Altering Tablespaces

Tablespaces cannot Offline

SYSTEM
The undo tablespace
Temporary tablespaces
Altering Tablespaces

Altering Tablespace SQL

Here are sample examples ALTER TABLESPACE users OFFLINE; ALTER TABLESPACE users ONLINE;
ALTER TABLESPACE work
add datafile 'C:\oracle11g\oradata\wrk02.dbf' size 500M;
Altering Tablespaces

Owner of Tablespace

Following SQL statement assigns tablespace to a particular user:

CREATE USER meduser Identified by pwd
default tablespace WORK temporary tablespace TEMP;
Altering Tablespaces

Making Tablespace Read only

The tablespace must be online. This is necessary to ensure that there is no undo information that must be applied to the tablespace.
The tablespace cannot be the active undo tablespace or SYSTEM tablespace.
Altering Tablespaces

Making Tablespace Read only

The tablespace must not currently be involved in an online backup, because the end of a backup updates the header file of all data files in the tablespace.
The tablespace cannot be a temporary tablespace.
Altering Tablespaces

Dictionary View for use of Altering Tablespace

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```
SELECT SQL_TEXT, SADDR
    FROM V$SQLAREA,V$SESSION
    WHERE V$SQLAREA.ADDRESS = V$SESSION.SQL_ADDRESS
        AND SQL_TEXT LIKE 'alter tablespace%';

SQL_TEXT                                  SADDR
----------------------------------------- --------
alter tablespace tbs1 read only           80034AF0
```

Altering Tablespaces

Dictionary View for use of Altering Tablespace

```
SELECT SES_ADDR, START_SCNB
    FROM V$TRANSACTION
    ORDER BY START_SCNB;

SES_ADDR START_SCNB
-------- ----------
800352A0       3621   --> waiting on this txn
80035A50       3623   --> waiting on this txn
80034AF0       3628   --> this is the ALTER TABLESPACE statement
80037910       3629   --> don't care about this txn
```

End
Introduction to Database Administration

TOPIC 76

Readonly & Online Status

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of Tablespaces
Readonly & Online Status of Tablespaces

Readonly & Online Status of Tablespaces

Steps to Create Readonly Tablespaces
SQL Alter Tablespace Command
Delaying the opening of Data Files
Side Effect of Delaying the opening of Data Files
Important Issues of Delaying the opening of Data Files
Readonly & Online Status of Tablespaces

Steps to Create Readonly Tablespaces

Create a writable tablespace on another device. Create the objects that belong in the tablespace and insert your data.
Alter the tablespace to make it read- only.
Copy the data files of the tablespace onto the WORM device. Use operating system commands to copy the files.
Take the tablespace offline.
Readonly & Online Status of Tablespaces

Steps to Create Readonly Tablespaces

Rename the data files to coincide with the names of the data files you copied onto your WORM device. Use ALTER TABLESPACE with the RENAME DATAFILE clause.
Renaming the data files changes their names in the control file.
Bring the tablespace back online.
Readonly & Online Status of Tablespaces

SQL Alter Tablespace Command

ALTER TABLESPACE userdata READ ONLY;

Causes a checkpoint
Data available only for read operations
Objects can be dropped from tablespace
Readonly & Online Status of Tablespaces

SQL Alter Tablespace Command

RMAN>

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SQL 'ALTER TABLESPACE hr READ ONLY'; CONVERT TABLESPACE hr
TO PLATFORM 'Solaris[tm] OE (64-bit)' FORMAT
'/tmp/transport_to_solaris/%U';; We will discuss RMAN later.
Readonly & Online Status of Tablespaces

Delaying the opening of Data Files

When substantial portions of a very large database are stored in read- only tablespaces that are located on slow-access devices or hierarchical storage, you should consider setting the READ_ONLY_OPEN_DELAYED initialization parameter to TRUE.
Readonly & Online Status of Tablespaces

Delaying the opening of Data Files

This speeds certain operations, primarily opening the database, by causing data files in read-only tablespaces to be accessed for the first time only when an attempt is made to read data stored within them.
Readonly & Online Status of Tablespaces

Side Effect of Delaying the opening of Data Files

Setting READ_ONLY_OPEN_DELAYED=TRUE has
the following side-effects
A missing or bad read-only file is not detected at open time. It is only discovered when there is an attempt to access it.
Readonly & Online Status of Tablespaces

Side Effect of Delaying the opening of Data Files

ALTER SYSTEM CHECK DATAFILESdoes not check read- only files.
ALTER TABLESPACE...ONLINE and ALTER DATABASE DATAFILE...ONLINE do not check read-only files. They are checked only upon the first access.
Readonly & Online Status of Tablespaces

Side Effect of Delaying the opening of Data Files

V$RECOVER_FILE, V$BACKUP, and V$DATAFILE_HEADER do not access read-only files.
Read-only files are indicated in the results list with the error "DELAYED OPEN", with zeroes for the values of other columns.
Readonly & Online Status of Tablespaces

Side Effect of Delaying the opening of Data Files

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V$DATAFILE does not access read- only files. Read-only files have a size of "0" listed.
V$RECOVERY_LOG does not access read-only files. Logs they could need for recovery are not added to the list.
Readonly & Online Status of Tablespaces

Side Effect of Delaying the opening of Data Files

ALTER DATABASE NOARCHIVELOG does not access read-only files. It proceeds even if there is a read-only file that requires recovery.
Readonly & Online Status of Tablespaces

Important Issues of Delaying the opening of Data Files

RECOVER DATABASE and ALTER DATABASE OPEN RESETLOGS continue to access all read-only data files regardless of the parameter value. To avoid accessing read-only files for these operations, take those files offline.
Readonly & Online Status of Tablespaces

Important Issues of Delaying the opening of Data Files

If a backup control file is used, the read-only status of some files may be inaccurate. This can cause some of these operations to return unexpected results. Care should be taken in this situation.

End
Introduction to Database Administration

TOPIC 77

Altering & Maintaining Tablespaces

Altering & Maintaining Tablespaces

Maintaining Tablespaces

Altering a Locally Managed Tablespace
Add a bigfile Tablespace
Altering a Locally Managed Temporary Tablespace

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Shrinking a Locally Managed Temporary Tablespace
Altering & Maintaining Tablespaces

Altering a Locally Managed Tablespace

You cannot alter a locally managed tablespace to a locally managed temporary tablespace, nor can you change its method of segment space management. Coalescing free extents is unnecessary for locally managed tablespaces. However, you can use the ALTER TABLESPACE statement on locally managed tablespaces for some operations, including the following:
Altering & Maintaining Tablespaces

Altering a Locally Managed Tablespace

Adding a data file. For example: ALTER TABLESPACE lmtbsb
ADD DATAFILE
'/u02/oracle/data/lmtbsb02.dbf' SIZE 1M;
Altering & Maintaining Tablespaces

Altering a Locally Managed Tablespace

Altering tablespace availability (ONLINE/OFFLINE).
Making a tablespace read-only or read/write
Renaming a data file, or enabling or disabling the autoextension of the size of a data file in the tablespace.
Altering & Maintaining Tablespaces

Add a bigfile Tablespace

Two clauses of the ALTER TABLESPACE statement support data file transparency when you are using bigfile tablespaces:
RESIZE: The RESIZE clause lets you resize the single data file in a bigfile tablespace to an absolute size, without referring to the data file. For example: ALTER TABLESPACE bigtbs RESIZE 80G;
AUTOEXTEND(used outside of the ADD DATAFILE clause):
Altering & Maintaining Tablespaces

Add a bigfile Tablespace

With a bigfile tablespace, you can use the AUTOEXTEND clause outside of the ADD DATAFILEclause.
For example:
ALTER TABLESPACE bigtbs AUTOEXTEND ON NEXT 20G;

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An error is raised if you specify an ADD DATAFILE clause for a bigfile tablespace.
Altering & Maintaining Tablespaces

Altering a Locally Managed Temporary Tablespace

You can use ALTER TABLESPACE to add a temp file, take a temp file offline, or bring temp file online, as illustrated in the following examples:

ALTER TABLESPACE lmtemp ADD TEMPFILE
'/u02/oracle/data/lmtemp02.dbf' SIZE 18M REUSE;
Altering & Maintaining Tablespaces

Altering a Locally Managed Temporary Tablespace

ALTER TABLESPACE lmtemp TEMPFILE OFFLINE;

ALTER TABLESPACE lmtemp TEMPFILE ONLINE;
Altering & Maintaining Tablespaces

Altering a Locally Managed Temporary Tablespace

The ALTER DATABASE statement can be used to alter temp files.
The following statements take offline and bring online temp files. They behave identically to the last two ALTER TABLESPACE statements in the previous example.
Altering & Maintaining Tablespaces

Altering a Locally Managed Temporary Tablespace

ALTER DATABASE TEMPFILE
'/u02/oracle/data/lmtemp02.dbf' OFFLINE;
ALTER DATABASE TEMPFILE
'/u02/oracle/data/lmtemp02.dbf' ONLINE;
Altering & Maintaining Tablespaces

Altering a Locally Managed Temporary Tablespace

The following statement resizes a temp file:
ALTER DATABASE TEMPFILE
'/u02/oracle/data/lmtemp02.dbf' RESIZE 18M;
Altering & Maintaining Tablespaces

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Altering a Locally Managed Temporary Tablespace

The following statement drops a temp file and deletes its operating system file:
ALTER DATABASE TEMPFILE
'/u02/oracle/data/lmtemp02.dbf' DROP INCLUDING DATAFILES;

The tablespace to which this temp file belonged remains. A message is written to the alert log for the temp file that was deleted.
Altering & Maintaining Tablespaces

Shrinking a Locally Managed Temporary Tablespace

Large sort operations performed by the database may result in a temporary tablespace growing and occupying a considerable amount of disk space. After the sort operation completes, the extra space is not released; it is just marked as free and available for reuse.
Altering & Maintaining Tablespaces

Shrinking a Locally Managed Temporary Tablespace

Therefore, a single large sort operation might result in a large amount of allocated temporary space that remains unused after the sort operation is complete.
For this reason, the database enables you to shrink locally managed temporary tablespaces and release unused space.
Altering & Maintaining Tablespaces

Shrinking a Locally Managed Temporary Tablespace

ALTER TABLESPACE lmtemp1 SHRINK SPACE KEEP 20M;
The following example shrinks the temp file lmtemp02.dbf of the locally managed temporary tablespace lmtmp2.

ALTER TABLESPACE lmtemp2 SHRINK TEMPFILE
'/u02/oracle/data/lmtemp02.dbf'

Introduction to Database Administration

TOPIC 78

Renaming & Dropping

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Tablespaces
Renaming & Dropping Tablespaces

Renaming & Dropping Tablespaces

Renaming Tablespaces
Affects of Renaming Tablespaces
Dropping Tablespaces
Dropping Tablespaces - Example
Segments in a Tablespace
Renaming & Dropping Tablespaces

Renaming Tablespaces

Using the RENAME TO clause of the ALTER TABLESPACE, you can rename a permanent or temporary tablespace. For example, the following statement renames the users tablespace:

ALTER TABLESPACE users RENAME TO
usersts;
Renaming & Dropping Tablespaces

Renaming Tablespaces

When you rename a tablespace the database updates all references to the tablespace name in the data dictionary, control file, and (online) data file headers.

To confirm use DBA_USERS.
Renaming & Dropping Tablespaces

Affects of Renaming Tablespaces

The COMPATIBLE parameter must be set to 10.0.0 or higher.
If the tablespace being renamed is the SYSTEM tablespace or the SYSAUX tablespace, then it will not be renamed.
If any data file or the tablespace is offline then the tablespace is not renamed.
Renaming & Dropping Tablespaces

Affects of Renaming Tablespaces

If the tablespace is read only, then data file headers are not updated. This should not be regarded as corruption; instead, it causes a message to be written to the alert log indicating that data file headers have not been renamed. The data dictionary and control file are updated.

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Renaming & Dropping Tablespaces

Affects of Renaming Tablespaces

If the tablespace is the default temporary tablespace, then the corresponding entry in the database properties table is updated and the DATABASE_PROPERTIES view shows the new name.
Renaming & Dropping Tablespaces

Affects of Renaming Tablespaces

If the tablespace is an undo tablespace and if the following conditions are met, then the tablespace name is changed to the new tablespace name in the server parameter file (SPFILE).
The server parameter file was used to start up the database.
The tablespace name is specified as the UNDO_TABLESPACE for any instance.
Renaming & Dropping Tablespaces

Dropping Tablespaces

You can drop a tablespace and its contents (the segments contained in the tablespace) from the database if the tablespace and its contents are no longer required. You must have the DROP TABLESPACE system privilege to drop a tablespace.
Renaming & Dropping Tablespaces

Dropping Tablespaces

When you drop a tablespace, the file pointers in the control file of the associated database are removed. You can optionally direct Oracle Database to delete the operating system files (data files) that constituted the dropped tablespace.
Off line tablespace before dropping it.
Renaming & Dropping Tablespaces

Dropping Tablespaces

You cannot drop a tablespace that contains any active segments.
For example, if a table in the tablespace is currently being used or the tablespace contains undo data needed to roll back uncommitted transactions, you cannot drop the tablespace.
Renaming & Dropping Tablespaces

Dropping Tablespaces

To drop a tablespace, use the DROP TABLESPACE statement. The following statements drops the users tablespace, including the segments in the tablespace:

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Alter tablespace users offline; DROP TABLESPACE users INCLUDING CONTENTS;
Renaming & Dropping Tablespaces

Dropping Tablespaces

To delete the data files associated with a tablespace at the same time that the tablespace is dropped, use the INCLUDING CONTENTS AND DATAFILES
clause. The
following statement drops the users tablespace and its associated data files:

DROP TABLESPACE users INCLUDING CONTENTS AND DATAFILES;
Renaming & Dropping Tablespaces

Dropping Tablespaces - Example

create tablespace test
datafile 'E:\app\Haider\oradata\tst01.dbf'
size 100M; Tablespace created.
create user usr1 identified by xyz default tablespace test temporary tablespace temp;

grant connect, resource to usr1; grant create table to usr1;
Renaming & Dropping Tablespaces

Dropping Tablespaces - Example

alter tablespace test offline;

shutdown immediate startup open

DROP TABLESPACE test including contents;
Renaming & Dropping Tablespaces

Dropping Tablespaces - Example

conn usr1/xyz
SQL> create table AA
2 (id number); create table
*
ERROR at line 1:
ORA-00959: tablespace 'TEST' does not exist
Renaming & Dropping Tablespaces
Segments in a Tablespace

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```
SQL> set linesize 200;
SQL> select segment_name, segment_type
  2  from dba_segments
  3  where tablespace_name='WRK_NOVUS';

SEGMENT_NAME                                SEGMENT_TYPE
------------------------------------------- --------------
PATIENT                                     TABLE
PATIENT_VISIT                               TABLE
PK_EMP_ID                                   INDEX
PK_PATVISIT_PAT_VSNO                        INDEX
IX_PATVISIT_PID_VDATE                       INDEX
IX_PATVISIT_PID_DPNSNO                      INDEX
IX_PATVISIT_EMPID_VDATE                     INDEX
IX_PATIENT_VISIT_CREATE_DATE                INDEX

8 rows selected.
```

End
Introduction to Database Administration

TOPIC 79

Managing SYSAUX Tablespaces

Managing SYSAUX Tablespaces

SYSAUX Tablespaces

- Introduction
- Monitoring Occupants
- Benefits of using SYSAUX Tablespace
- Controlling the Size of the SYSAUX Tablespace - Guidelines

Managing SYSAUX Tablespaces

Introduction

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- The SYSAUX tablespace was installed as an auxiliary tablespace to the SYSTEM tablespace when you created your database.
- Some database components that formerly created and used separate tablespaces now occupy the SYSAUX tablespace.
- SYSAUX tablespace is used to reduce the load managed by SYSTEM tablespace.

Managing SYSAUX Tablespaces

Introduction

- If the SYSAUX tablespace becomes unavailable, core database functionality will remain operational.
- The database features that use the SYSAUX tablespace could fail, or function with limited capability.
- SYSTEM tablespace will continue running for the users to work on if some problem occurs in SYSAUX tablespace.

Managing SYSAUX Tablespaces

Introduction

- SYSAUX tablespace mainly used for performance and comparison purposes

Managing SYSAUX Tablespaces

Monitoring Occupants

You can monitor the occupants of the SYSAUX tablespace using the V$SYSAUX_OCCUPANTS view. This view lists the following information about the occupants of the SYSAUX tablespace:

- Name of the occupant
- Occupant description
- Schema name
- Move procedure
- Current space usage

Managing SYSAUX Tablespaces

Monitoring Occupants

Another major occupant of the SYSAUX tablespace is the embedded Oracle Enterprise Manager repository. This repository is used by Oracle Enterprise Manager Database Control to store its metadata. The size of this repository depends on database activity and on configuration-related information stored in the repository.

Managing SYSAUX Tablespaces

Benefits of using SYSAUX Tablespace

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The SYSAUX tablespace is always created
at database creation.
The SYSAUX tablespace serves as an auxiliary tablespace to the SYSTEM tablespace. Because it is the default tablespace for many Oracle Database features and products that previously required their own tablespaces, it reduces the number of tablespaces required by the database. It also reduces the load on the SYSTEM tablespace.
Managing SYSAUX Tablespaces

Controlling the Size of the SYSAUX Tablespace

The SYSAUX tablespace is occupied by several database components, and its total size is governed by the space consumed by those components.
The space consumed by the components, in turn, depends on which features or functionality are being used and on the nature of the database workload.
Managing SYSAUX Tablespaces

Controlling the Size of the SYSAUX Tablespace - Guidelines

Parameter/Recommendation	Small	Medium	Large
Number of CPUs	2	8	32
Number of concurrently active sessions	10	20	100
Number of user objects: tables and indexes	500	5,000	50,000
Estimated SYSAUX size at steady state with default configuration	500 MB	2 GB	5 GB

End
Introduction to Database Administration

TOPIC 80

Repairing Tablespaces

Repairing Tablespaces

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Repairing Tablespaces

Repairing Locally Managed Tablespace
Diagnosing using DBMS_SPACE_ADMIN package
Scenario-1
Scenario-2

Scenario-3
Scenario-4
Scenario-5
Repairing Tablespaces

Repairing Locally Managed Tablespace

DROP_EMPTY_SEGMENTS	Drops segments from empty tables or table partitions and dependent objects
MATERIALIZE_DEFERRED_SEGMENTS	Materializes segments for tables and table partitions with deferred segment creation and their dependent objects.
SEGMENT_CORRUPT	Marks the segment corrupt or valid so that appropriate error recovery can be done
SEGMENT_DROP_CORRUPT	Drops a segment currently marked corrupt (without reclaiming space)

Oracle Database includes the DBMS_SPACE_ADMIN package, which is a collection of aids for diagnosing and repairing problems in locally managed tablespaces.

Following are the some of DBMS_SPACE_ADMIN Package Procedures
Repairing Tablespaces

Diagnosing using DBMS_SPACE_ADMIN package

The following scenarios describe typical situations in which you can use the DBMS_SPACE_ADMIN package to diagnose and resolve problems.

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Note: Some of these procedures can result in lost and unrecoverable data if not used properly. You should work with Oracle Support Services if you have doubts about these procedures.
Repairing Tablespaces

Scenario-1

Fixing Bitmap When Allocated Blocks are Marked Free out these procedures.
The TABLESPACE_VERIFY procedure discovers that a segment has allocated blocks that are marked free in the bitmap, but no overlap between segments is reported.
In this scenario, perform the following tasks:
Call the SEGMENT_DUMP procedure to dump the ranges that the administrator allocated to the segment.
For each range, call the TABLESPACE_FIX_BITMAPS procedure with the TABLESPACE_EXTENT_MAKE_USED option to mark the space as used.
Call TABLESPACE_REBUILD_QUOTAS to rebuild quotas.
Repairing Tablespaces

Scenario-2

Dropping a corrupted segment:
In this scenario, perform the following tasks:
Call the SEGMENT_VERIFY procedure with the SEGMENT_VERIFY_EXTENTS_GLOBAL option. If no overlaps are reported, then proceed with steps 2 through 5.
Call the SEGMENT_DUMP procedure to dump the DBA ranges allocated to the segment.
For each range, call TABLESPACE_FIX_BITMAPS with the TABLESPACE_EXTENT_MAKE_FREE option to mark the space as free.
Call SEGMENT_DROP_CORRUPT to drop the SEG$ entry.
Call TABLESPACE_REBUILD_QUOTAS to rebuild quotas
Repairing Tablespaces

Scenario-3

Fixing Bitmap Where Overlap is Reported:
The TABLESPACE_VERIFY procedure reports some overlapping. Some of the real data must be sacrificed based on previous internal errors. After choosing the object to be sacrificed, in this case say, table t1, perform the following tasks:
Make a list of all objects that t1 overlaps.
Drop table t1. If necessary, follow up by calling the SEGMENT_DROP_CORRUPT procedure.
Call the SEGMENT_VERIFY procedure on all objects that t1overlapped. If necessary, call the TABLESPACE_FIX_BITMAPS procedure to mark appropriate bitmap blocks as used.
Rerun the TABLESPACE_VERIFY procedure to verify that the problem is resolved
Repairing Tablespaces

Scenario-4

Correcting Media Corruption of Bitmap Blocks A set of bitmap blocks has media corruption.

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In this scenario, perform the following tasks:
Call the TABLESPACE_REBUILD_BITMAPSprocedure, either on all
bitmap blocks, or on a single block if only one is corrupt.
Call the TABLESPACE_REBUILD_QUOTAS procedure to rebuild quotas.
Call the TABLESPACE_VERIFY procedure to verify that the bitmaps are consistent.
Repairing Tablespaces

Scenario-5

Assume that the database block size is 2K and the existing extent sizes in tablespace tbs_1 are 10, 50, and 10,000 blocks (used, used, and free). The MINIMUM EXTENT value is 20K (10 blocks). Allow the system to choose the bitmap allocation unit. The value of 10 blocks is chosen, because it is the highest common denominator and does not exceed MINIMUM EXTENT.

The statement to convert tbs_1 to a locally managed tablespace is as follows: EXEC DBMS_SPACE_ADMIN.TABLESPACE_MIGRATE_TO_LOCAL ('tbs_1');
If you choose to specify an allocation unit size, it must be a factor of the unit
size calculated by the system.

Introduction to Database Administration

TOPIC 81

Migrating the System Tablespace

Migrating the System Tablespaces

Migrating the System Tablespace

Introduction
Other tablespaces
Pre-requisites of migration
Command for migration
Importing and exporting data of tablespaces
Migrating the System Tablespaces

Introduction

What is SYSTEM tablespace
It is required when database is created and when database is getting start using.

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Pre bundled code and data dictionary-managed tablespace.
It contains System Objects, your objects and Users/ Privileges.
It contains AWR: Automatic Workload Repository
Migrating the System Tablespaces

Other Tablespaces

Following tablespaces are required with the SYSTEM tablespace
UNDO TS
User ability to rollback
old values of DML changes
Read Consistency of Data
Temporary TS
contents are temp stored in TS
order by, distinct, Index --> PGA is active
Kind rough work area
Migrating the System Tablespaces

Other Tablespaces

USERS TS
Create users, which users will use which TS information
Migrating the System Tablespaces

Pre-requisites of Migration

Before performing the migration the following conditions must be met:
The database has a default temporary tablespace that is not SYSTEM.
There are no rollback segments in the dictionary-managed tablespace.
There is at least one online rollback segment in a locally managed tablespace, or if using automatic undo management, an undo tablespace is online.
Migrating the System Tablespaces

Pre-requisites of Migration

All tablespaces other than the tablespace containing the undo space (that is, the tablespace containing the rollback segment or the undo tablespace) are in read- only mode.
The SYSAUX tablespace is offline.
The system is in restricted mode.
There is a cold backup of the database.
Migrating the System Tablespaces

Command for Migration

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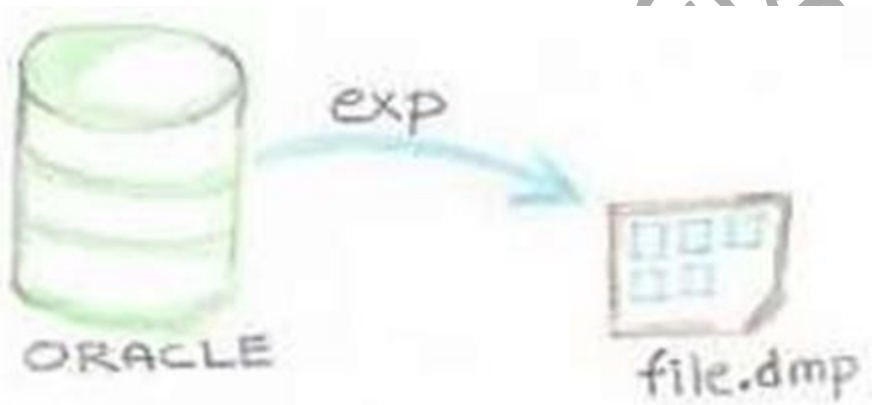
The following statement performs the migration:

SQL> EXECUTE
DBMS_SPACE_ADMIN.TABLESPACE_MIGRATE
_TO_LOCAL('SYSTEM');
Migrating the System Tablespaces

Importing & Exporting Data of Tablespaces

Use following command of export on source database

C:\>exp usr/pwd file=c:\test\f1.dmp



Migrating the System Tablespaces

Importing & Exporting Data of Tablespaces

Following are two tablespaces of source database. We will create sure same tablespaces in the target tablespace.

```
Create tablespace MedCare Datafile
    'D:\oracle9i\ora92\oradata\MCare01.dbf' Size 150M online
    MINIMUM EXTENT 64K
    DEFAULT STORAGE (INITIAL 64K NEXT 64K);

CREATE TABLESPACE MCare_indx
DATAFILE 'D:\oracle9i\ora92\oradata\MCare_indx01.dbf' SIZE 100M
MINIMUM EXTENT 64K
DEFAULT STORAGE (INITIAL 64K NEXT 64K);
```

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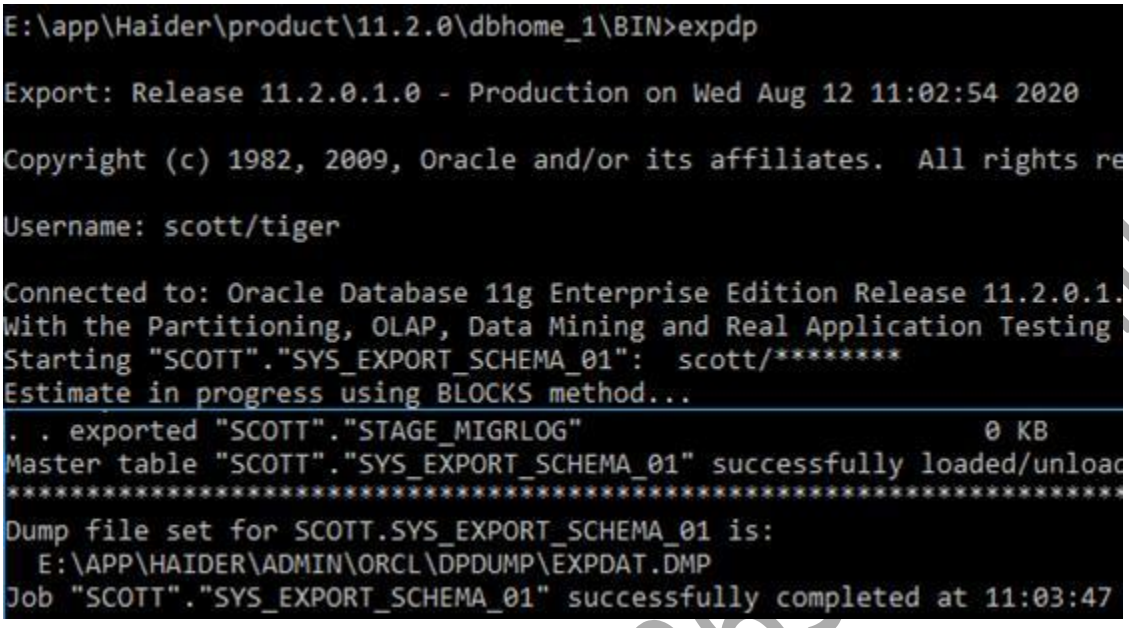
Use following command of import on target database
C:\>exp usr/pwd file=c:\test\f1.dmp
Migrating the System Tablespaces

Importing & Exporting Data of Tablespaces



Alternatively, use export/ import data pump command. For example,

End
Introduction to Database Administration

TOPIC 82

Creating Alternate TEMP Tablespace

Creating Alternate TEMP Tablespace

Creating Alternate TEMP Tablespace

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What is Temporary Tablespace?
Creating TEMP Tablespace
Verifying TEMP Tablespace
Create Temporary Tablespace Group
Temporary Tablespace Files
Creating Alternate TEMP Tablespace

What is TEMP Tablespace?

What is SYSTEM tablespace
It is required when database is created and when database is getting start using.
Creating Alternate TEMP Tablespace

Creating TEMP Tablespace

Create a new tablespace and then drop an existing temp tablespace

```
CREATE
    TEMPORARY TABLESPACE "TEMP_DEFAULT2" TEMPFILE
    'D:\ORACLE9I\ORA92\ORADATA\MEDCARE\TEMP_DEFAULT2.DBF' SIZE
    1000M EXTENT MANAGEMENT LOCAL UNIFORM SIZE 1M;

ALTER DATABASE DEFAULT TEMPORARY TABLESPACE "TEMP_DEFAULT2";
```

Creating Alternate TEMP Tablespace

Creating TEMP Tablespace

shutdown and startup database,
run complicated query to see whether new tablespace getting filled or not

see file alert.log for more details

To check default tablespace is created or DONE or NOT:

select * from database_properties;
Creating Alternate TEMP Tablespace

Creating TEMP Tablespace

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Tablespace must be empty before dropping off

Drop tablespace temp
including contents and datafiles;

Shutdown and startup database again

Drop related files from folder like TEMP01.DBF
Creating Alternate TEMP Tablespace
Verifying TEMP Tablespace

```
SQL> select property_name from database_properties;

PROPERTY_NAME
------------------------------
DICT.BASE
DEFAULT_TEMP_TABLESPACE
DEFAULT_PERMANENT_TABLESPACE
DEFAULT_EDITION
Flashback Timestamp TimeZone
TDE_MASTER_KEY_ID
DST_UPGRADE_STATE
DST_PRIMARY_TT_VERSION
DST_SECONDARY_TT_VERSION
DEFAULT_TBS_TYPE
NLS_LANGUAGE
```

Creating Alternate TEMP Tablespace

Create Temporary Tablespace Group

Temporary Tablespace Groups allow an Oracle database to write to multiple temp tablespaces simultaneously.

A user is assigned to a group of temp tablespaces instead of a single temporary tablespace

It allows a single SQL operation to use multiple Temporary Tablespaces for sorting
Creating Alternate TEMP Tablespace

Create Temporary Tablespace Group

Create Temporary Tablespace temp1 tempfile 'C:\Oracle\Oradata\temp01.dbf' size 50M

```
SQL> select *
  2  from database_properties
  3  where property_name like '%TABLESPACE%';

PROPERTY_NAME
------------------------------
PROPERTY_VALUE
--------------------------------------------------
--------------------------------------------------
DESCRIPTION
--------------------------------------------------
--------------------------------------------------
DEFAULT_TEMP_TABLESPACE
TEMP
Name of default temporary tablespace

DEFAULT_PERMANENT_TABLESPACE
USERS
Name of default permanent tablespace
```

tablespace group tempgroup1;
Creating Alternate TEMP Tablespace

Temporary Tablespace Files

Using data dictionary view;

```
SQL> select tablespace_name
  2  from dba_temp_files;

TABLESPACE_NAME
------------------------------
TEMP
```

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End
Introduction to Database Administration

TOPIC 83

Viewing Tablespace using Data Dictionary Views

Viewing Tablespaces using Data Dictionary Views

Data Dictionary Views of Tablespace

Dictionary Views of Tablespaces
V$Tablespaces
DBA_DATA_FILES
DBA_TEMP_FILES
Finding Used Size of Tablespaces
Finding Free Space of Tablespaces
Viewing Tablespaces using Data Dictionary Views

Dictionary Views of Tablespaces

Use Dictionary to display views:

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```
SQL> select table_name
  2  from dict
  3  where table_name like '%TABLESPACE%';

TABLE_NAME
------------------------------
DBA_FILE_GROUP_TABLESPACES
DBA_HIST_TABLESPACE_STAT
DBA_TABLESPACES
DBA_TABLESPACE_GROUPS
DBA_TABLESPACE_THRESHOLDS
DBA_TABLESPACE_USAGE_METRICS
USER_FILE_GROUP_TABLESPACES
USER_TABLESPACES
ALL_FILE_GROUP_TABLESPACES
V$TABLESPACE
GV$ENCRYPTED_TABLESPACES

TABLE_NAME
------------------------------
V$ENCRYPTED_TABLESPACES
GV$TABLESPACE

13 rows selected.
```

Viewing Tablespaces using Data Dictionary Views

V$Tablespaces

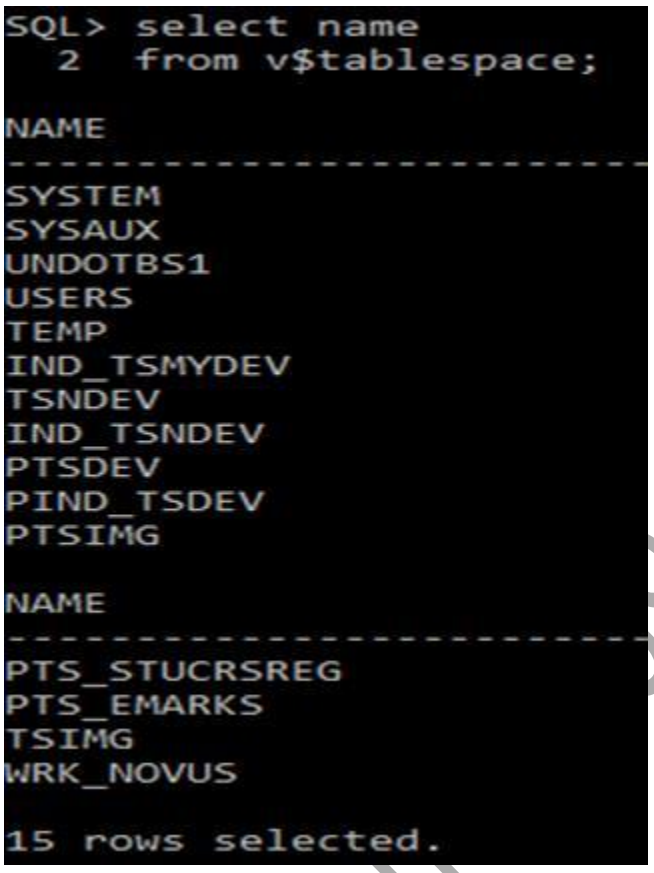
To display columns of V$Tablespaces:

```
SQL> set linesize60
SQL> desc v$tablespace
 Name                          Null?    Type
 ----------------------------- -------- -------------
 TS#                                    NUMBER
 NAME                                   VARCHAR2(30)
 INCLUDED_IN_DATABASE_BACKUP            VARCHAR2(3)
 BIGFILE                                VARCHAR2(3)
 FLASHBACK_ON                           VARCHAR2(3)
 ENCRYPT_IN_BACKUP                      VARCHAR2(3)
```

Viewing Tablespaces using Data Dictionary Views

V$Tablespaces

Select column name V$Tablespaces:



```
SQL> select name
  2  from v$tablespace;

NAME
------------------------------
SYSTEM
SYSAUX
UNDOTBS1
USERS
TEMP
IND_TSMYDEV
TSNDEV
IND_TSNDEV
PTSDEV
PIND_TSDEV
PTSIMG

NAME
------------------------------
PTS_STUCRSREG
PTS_EMARKS
TSIMG
WRK_NOVUS

15 rows selected.
```

Viewing Tablespaces using Data Dictionary Views

DBA_DATA_FILES

Display name and data file size in MB:

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```
SQL> select tablespace_name, file_name,
  2  bytes/1024/1024 size_MB
  3  from dba_data_files
  4  where tablespace_name='&tablespace_name';
Enter value for tablespace_name: WRK_NOVUS
old   4: where tablespace_name='&tablespace_name'
new   4: where tablespace_name='WRK_NOVUS'

TABLESPACE_NAME
------------------------------
FILE_NAME
--------------------------------------------------------------------------------
   SIZE_MB
----------
WRK_NOVUS
E:\APP\HAIDER\PRODUCT\11.2.0\DBHOME_1\ORADATA\NOVUS01.DBF
       800
```

Viewing Tablespaces using Data Dictionary Views

DBA_TEMP_FILES

Display name and data file size in MB:

```
SQL> select file_name,
  2  bytes/1024/1024 size_MB
  3  from dba_temp_files;

FILE_NAME
----------------------------------------------------
   SIZE_MB
----------
E:\APP\HAIDER\ORADATA\ORCL\TEMP01.DBF
       114
```

TEMP01.DBF 13-Aug-20... DBF File 116,744 KB

Viewing Tablespaces using Data Dictionary Views

Finding Used Data Size of Tablespaces

```
SQL> SELECT TABLESPACE_NAME,
  2     ROUND(SUM(BYTES)/(1024*1024), 2)||' MB' AS USED_SIZE
  3     FROM DBA_SEGMENTS
  4     --WHERE TABLESPACE_NAME='EDRDBA'
  5     GROUP BY TABLESPACE_NAME;

TABLESPACE_NAME                USED_SIZE
------------------------------ ------------------------------
PIND_TSDEV                     197.31 MB
SYSAUX                         648.5 MB
TSIMG                          1120.5 MB
UNDOTBS1                       21.69 MB
TSNDEV                         643.56 MB
PTS_EMARKS                     48 MB
WRK_NOVUS                      703.75 MB
USERS                          4.19 MB
SYSTEM                         707.63 MB
PTSDEV                         364.63 MB
PTSIMG                         62 MB

TABLESPACE_NAME                USED_SIZE
------------------------------ ------------------------------
PTS_STUCRSREG                  480 MB
IND_TSNDEV                     .06 MB

13 rows selected.
```

Using data dictionary view DBA_SEGMENTS :
Viewing Tablespaces using Data Dictionary Views

Finding Free Space of Tablespaces

```
SQL>    SELECT TABLESPACE_NAME,
  2     ROUND(SUM(BYTES)/(1024*1024), 2)||' MB' AS FREE_SIZE
  3     FROM DBA_FREE_SPACE
  4     GROUP BY TABLESPACE_NAME;

TABLESPACE_NAME                FREE_SIZE
------------------------------ ------------------------------
IND_TSMYDEV                    999 MB
PIND_TSDEV                     301.75 MB
SYSAUX                         50.5 MB
UNDOTBS1                       282.31 MB
TSIMG                          925.5 MB
TSNDEV                         531.44 MB
PTS_EMARKS                     1950 MB
WRK_NOVUS                      367.25 MB
USERS                          3.56 MB
SYSTEM                         1.38 MB
IND_TSNDEV                     498.94 MB

TABLESPACE_NAME                FREE_SIZE
------------------------------ ------------------------------
PTSDEV                         2704.5 MB
PTSIMG                         4030 MB
PTS_STUCRSREG                  1518 MB

14 rows selected.
```

Using data dictionary view DBA_FREE_SPACE

End
Introduction to Database Administration

TOPIC 84

Logical Storage Structure & Hierarchy

Logical Storage Structure & Hierarchy

Logical Storage Structure & Hierarchy

Physical & Logical Database
Tablespace
Database Block
Database Block, Extents and Segments
Database Block, Extents and Segments within Database
Logical Storage Structure & Hierarchy

Physical & Logical Database

Physical Database
Control Files
Redo Log Files
Data Files
Logical Database
Tablespace
Segments
Extents
DB Blocks
Logical Storage Structure & Hierarchy

Physical & Logical Database

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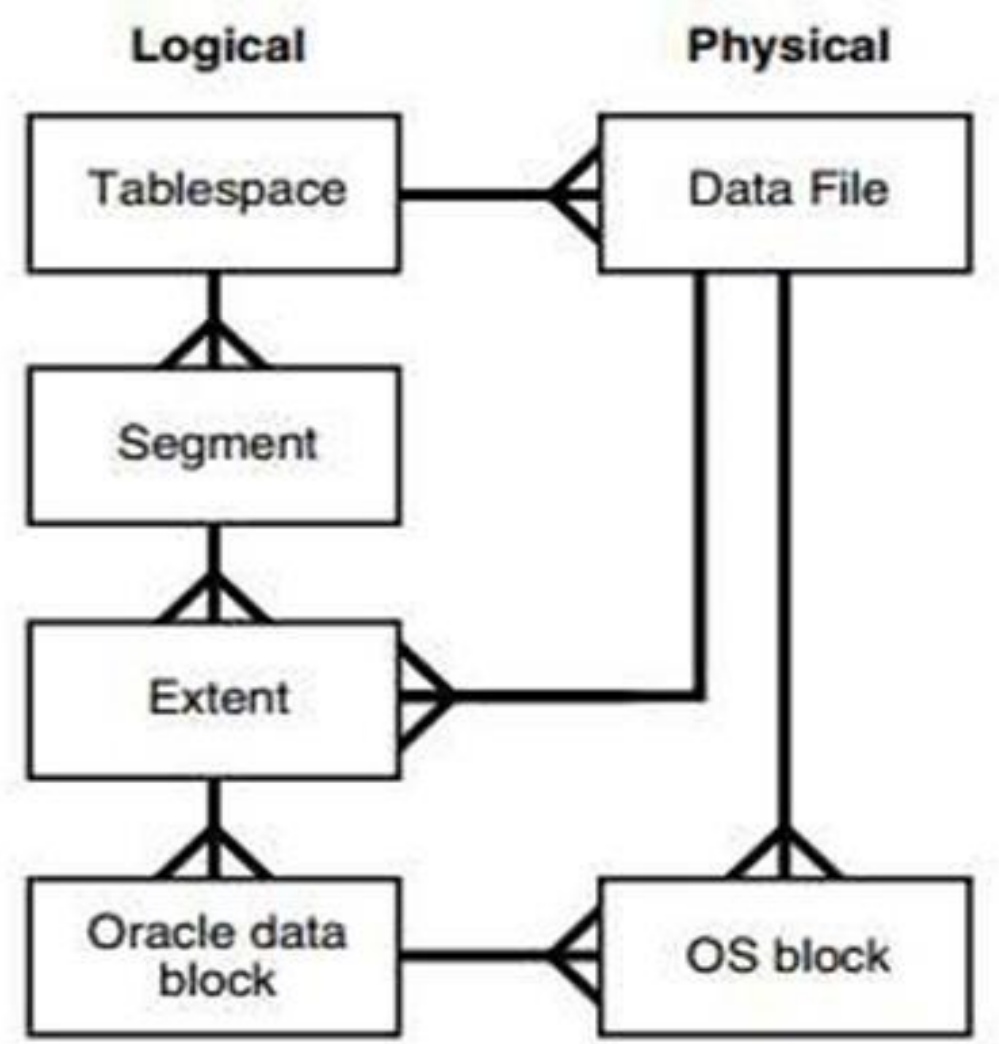


Logical Storage Structure & Hierarchy

Tablespace

Tablespace stores space logically to create logical objects such as Tables, Indexes and other objects.

Tablespace's physically space stored in associated files.
Logical Storage Structure & Hierarchy

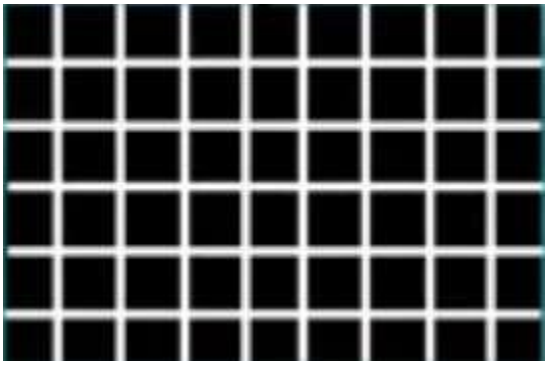
Database Block

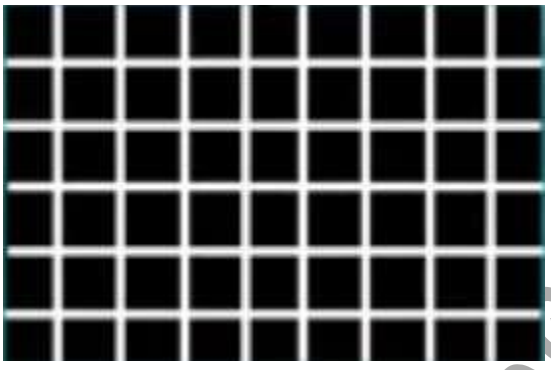
Logical minimum storage unit is called database block.

Its size is decided during database creation.

5 default sizes: 2K, 4K, 8K, 16K, 32K (K: Kilobytes)
Logical Storage Structure & Hierarchy

Database Block, Extents and Segments
Data Files



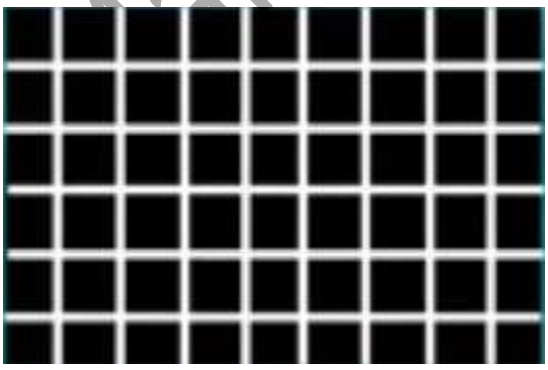


Database blocks

Database Blocks

OS Blocks
Logical Storage Structure & Hierarchy

Database Block, Extents and Segments



Data Files

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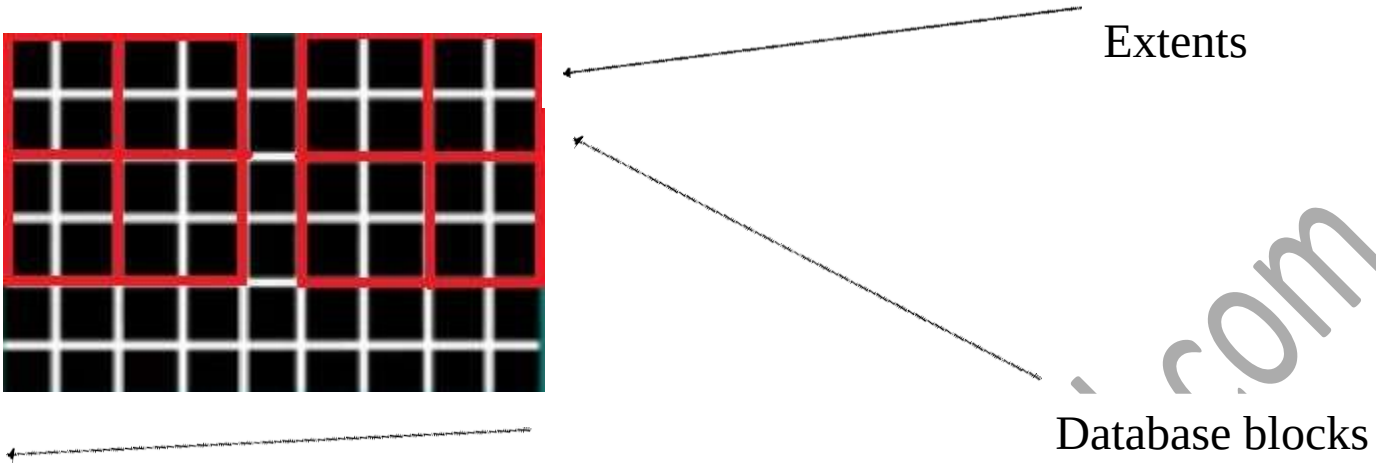
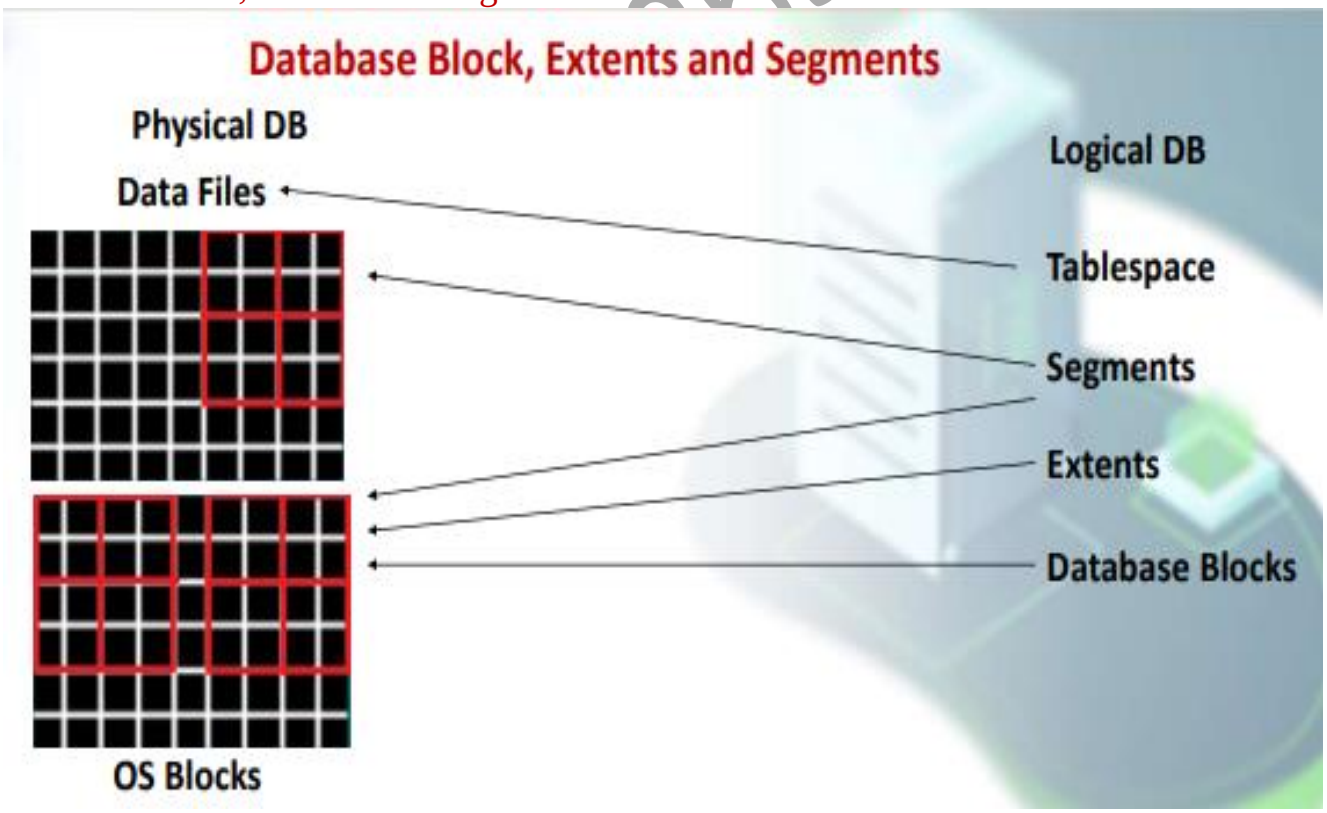


Extents Database Blocks

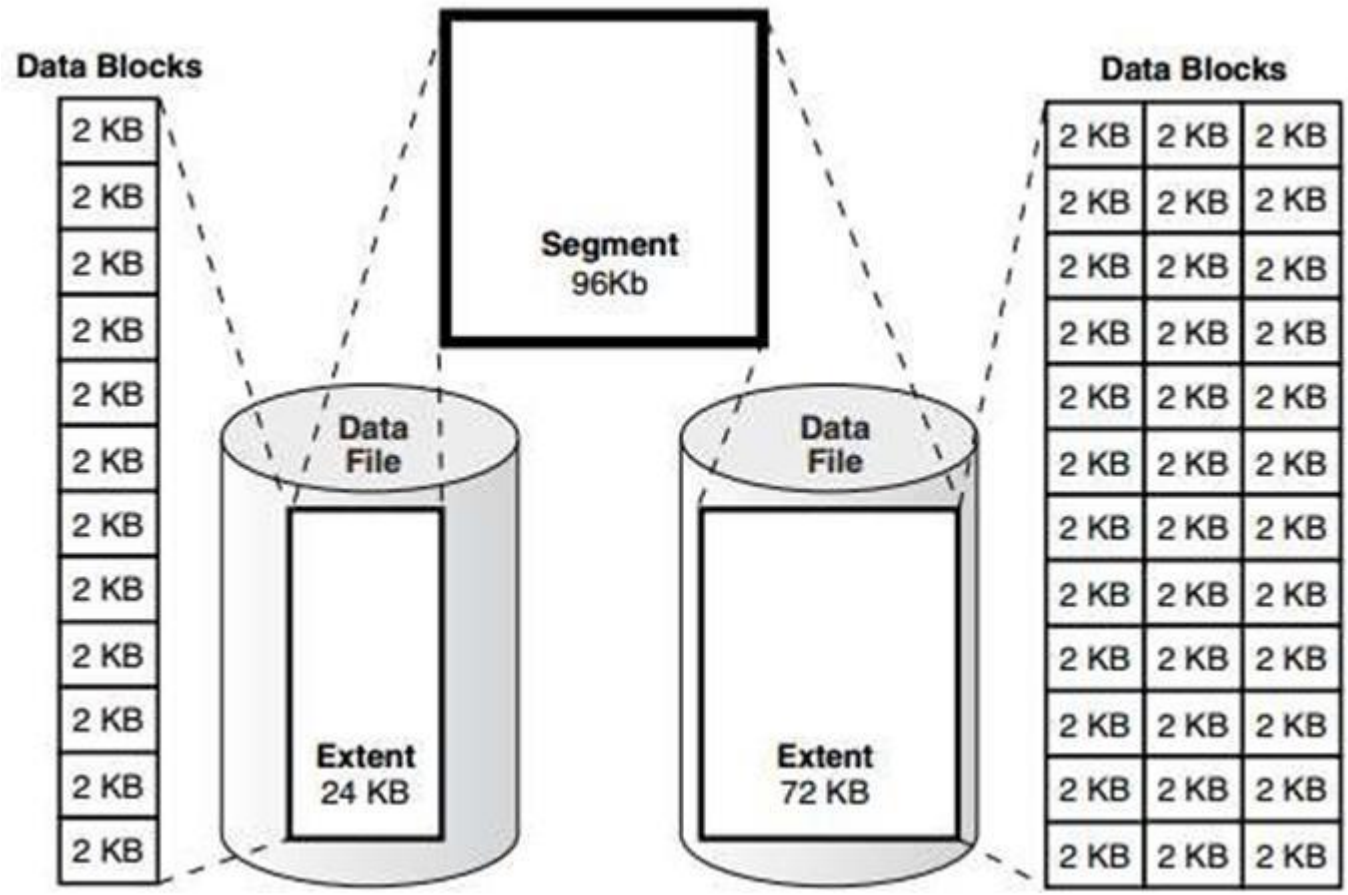
OS Blocks
Logical Storage Structure & Hierarchy

Database Block, Extents and Segments



Database Block, Extents and Segments within Database

At the finest level of granularity, Oracle Database stores data in data blocks.
One logical data block corresponds to a specific number of bytes of physical disk space. Block sizes can be 2 KB, 4KB or more.
Data block is the smallest unit of storage that Oracle Database can use or allocate.
Logical Storage Structure & Hierarchy
Database Block, Extents and Segments within Database



Introduction to Database Administration

TOPIC 85

Overview of Data Blocks
Overview of Data Blocks

Overview of Database Blocks

What is Data Block?
Data Blocks & OS Blocks
Interaction of Data Blocks & OS Blocks
Database Block Size
Data Block Format
Row Format
RowID Pseudocolumn
Overview of Data Blocks

What is Data Block?

Oracle Database manages the logical storage space in the data files of a database in units called data blocks, also called Oracle blocks or pages. A data block is the minimum unit of database I/O.
Overview of Data Blocks

Data Blocks & OS Blocks

At the physical level, database data is stored in disk files made up of operating system blocks. An operating system block is the minimum unit of data that the operating system can read or write.
In contrast, an Oracle block is a logical storage structure whose size and structure are not known to the operating system.
Overview of Data Blocks

Data Blocks & OS Blocks

Figure shows that operating system blocks may differ in size from data blocks. The database requests data in multiples of data blocks, not operating system blocks.

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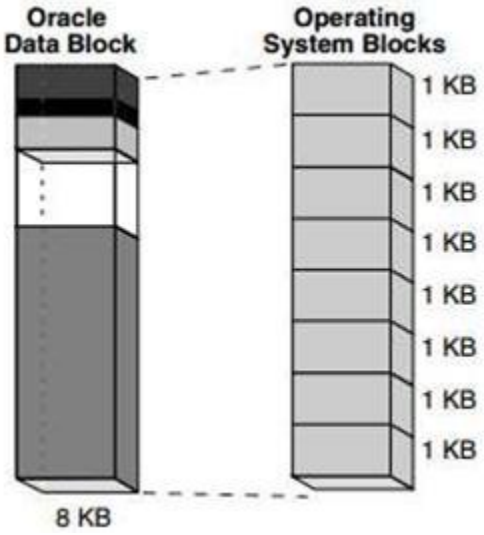

Overview of Data Blocks

Interaction of Data Blocks & OS Blocks

When the database requests a data block, the operating system translates this operation into a requests for data in permanent storage. The logical separation of data blocks from operating system blocks has the following implications:
Applications do not need to determine the physical addresses of data on disk.
Database data can be striped or mirrored on multiple physical disks.
Overview of Data Blocks

Database Block Size

Every database has a database block size. The DB_BLOCK_SIZE initialization parameter sets the data block size for a database when it is created.
The size is set for the SYSTEM and SYSAUX tablespaces and is the default for all other tablespaces.
The database block size cannot be changed except by re-creating the database.
Overview of Data Blocks

Database Block Size

If DB_BLOCK_SIZE is not set, then the default data block size is operating system-specific.
The standard data block size for a database is4 KB or 8 KB.

If the size differs for data blocks and operating system blocks, then the data block size must be a multiple of the operating system block size
Overview of Data Blocks

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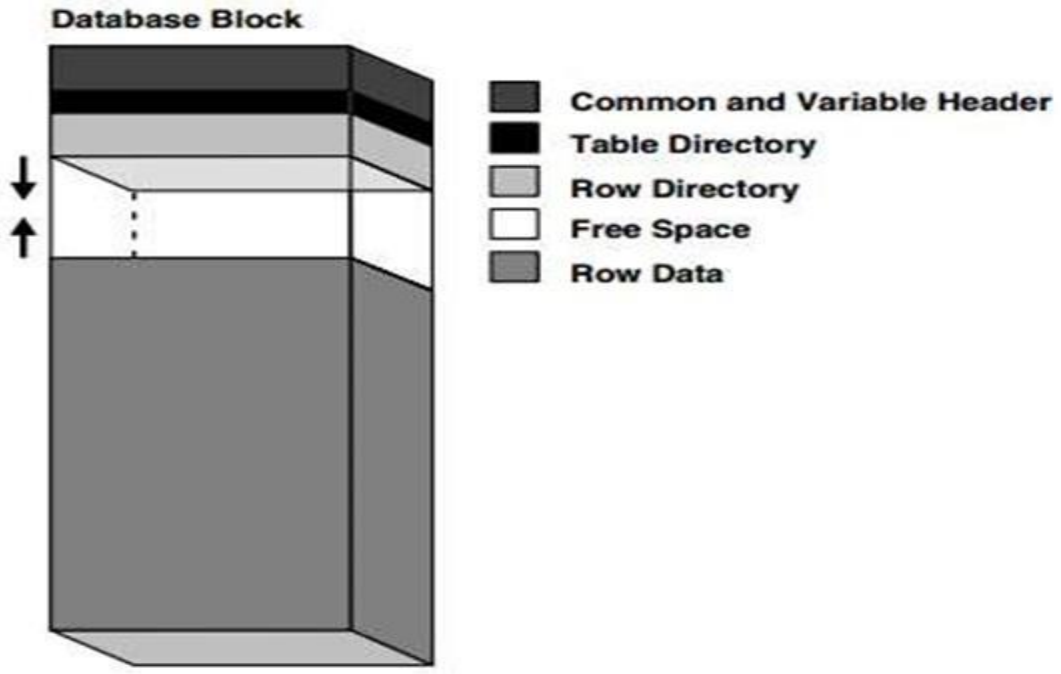
Database Block Size

You can create individual tablespaces whose block size differs from the DB_BLOCK_SIZE setting.

A nonstandard block size can be useful when moving a transportable tablespace to a different platform.
Overview of Data Blocks
Data Block Format



Every data block has a format or internal structure that enables the database to track the data and free space in the block. This format is similar whether the data block contains table, index, or table cluste data
Overview of Data Blocks
Row Format

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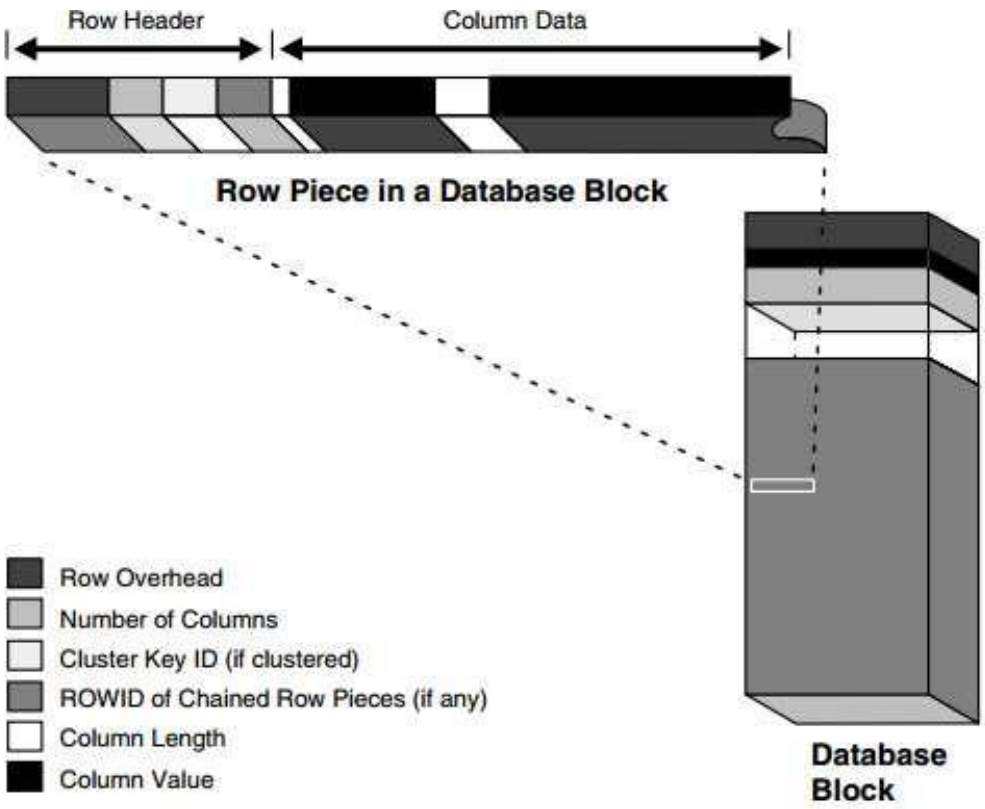


The row data part of the block contains the actual data, such as table rows or index key entries. Just as every data block has an internal format, every row has a row format that enables the database to track the data in the row.

Overview of Data Blocks

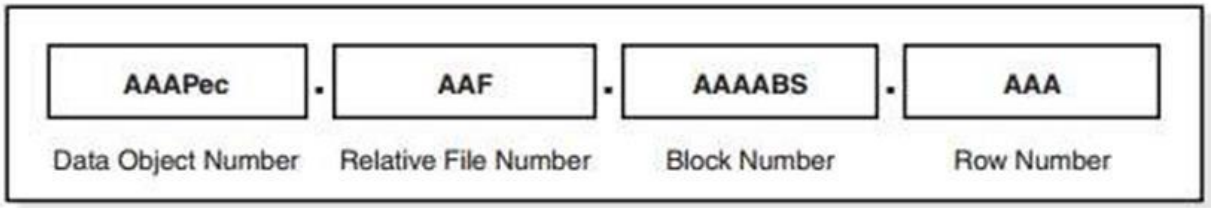
RowID Pseudocolumn

```
SQL> SELECT ROWID FROM employees WHERE employee_id = 100;

ROWID
------------------
AAAPecAAFAAAABSAAA
```

Figure 12–8 illustrates the format of an extended rowid.

Figure 12–8 ROWID Format



Queries the ROWID pseudocolumn to show the extended rowid of the row in the employee stable for employee 100

Introduction to Database Administration

TOPIC 86

Percentage of Free Space in Blocks (PCTFREE)

Percentage of Free Space in Blocks

Percentage of Free Space Blocks

What is Free Space in Data Block?
Data Blocks & OS Blocks
Percentage of Free Space in Data Blocks
PCTFREE Space in Data Block
Optimizing of Free Space
Reuse of Index Space
Row Migration
Percentage of Free Space in Blocks

What is Free Space in Data Block?

As the database fills a data block from the bottom up, the amount of free space between the row data and the block header decreases. This free space can also shrink during updates, as when changing a trailing null to a non-null value.

The database manages free space in the data block to optimize performance and avoid wasted space (Tuning Feature).
Percentage of Free Space in Blocks

Data Blocks & OS Blocks

At the physical level, database data is stored in disk files made up of operating system blocks. An operating system block is the minimum unit of data that the operating system can read or write.
In contrast, an Oracle block is a logical storage structure whose size and structure are not known to the operating system.
Percentage of Free Space in Blocks

Percentage of Free Space in Data Blocks

The PCTFREE storage parameter is essential to how the database manages free space. This SQL parameter sets the minimum percentage of a data block reserved as free space for updates to existing rows.

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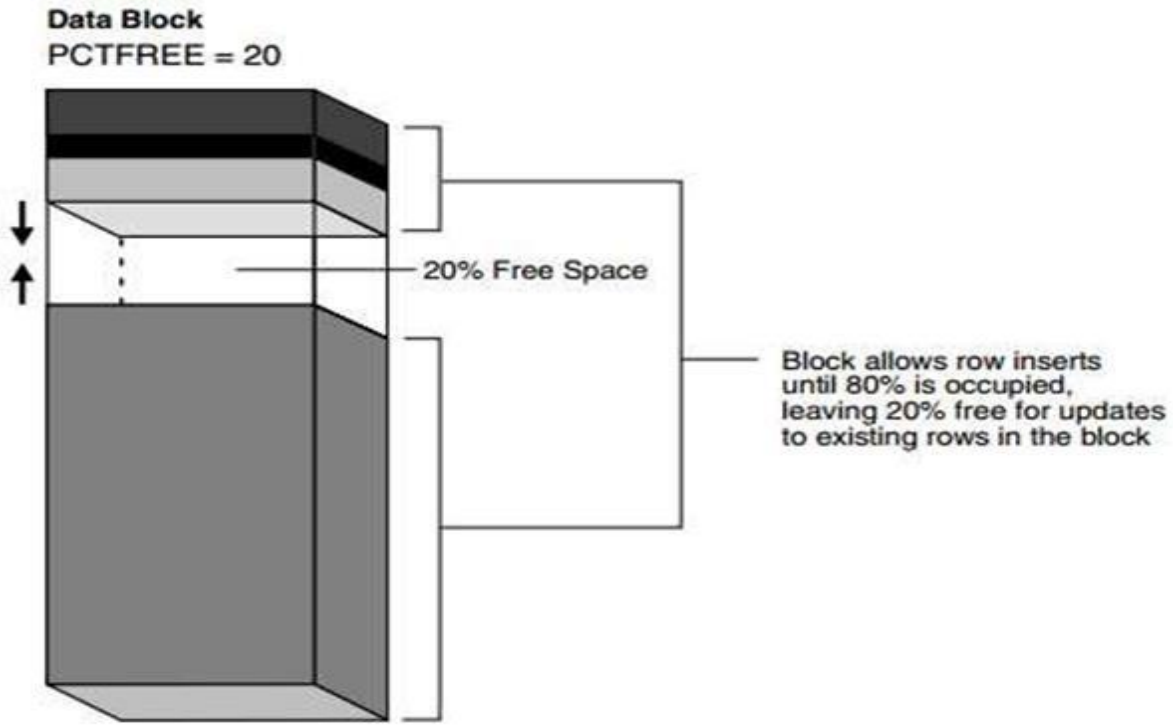
PCTFREE is important for preventing row migration and avoiding wasted space.
Percentage of Free Space in Blocks



PCTFREE Space in Data Block

CREATE TABLESPACE userdata datafile 'C:\Ora11g\ordata\usr01.dbf' size 500M
EXTENT MANAGEMENT DICTIONARY
DEFAULT STORAGE
(Initial 1M NEXT 1M PCTINCREASE 0);

PCTFREE parameter does not applied on LOB Datatypes
Percentage of Free Space in Blocks

Optimizing of Free Space

While the percentage of free space cannot be less than PCTFREE, the amount of free space can be greater. For example, a PCTFREE setting of 20% prevents the total amount of free space from dropping to 5% of the block, but permits 50% of the block to be free space.
Percentage of Free Space in Blocks

Optimizing of Free Space

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The following SQL statements can increase free space:
DELETE statements
UPDATE statements that either update existing values to smaller values or increase existing values and force a row to migrate
INSERT statements on a table that uses OLTP compression. If inserts fill a block with data, then the database invokes block compression, which may result in the block having more free space.
Percentage of Free Space in Blocks

Optimizing of Free Space

The space released is available for INSERT under the following conditions:
If the INSERT statement is in the same transaction and after the statement that frees space, then the statement can use the space.
If the INSERT statement is in a separate transaction from the statement that frees space (perhaps run by another user), then the statement can use the space made available only after the other transaction commits and only if the space is needed.
Percentage of Free Space in Blocks

Reuse of Index Space

The database can reuse space within an index block.
For example, if you insert a value into a column and delete it, and if an index exists on this column, then the database can reuse the index slot when a row requires it
Percentage of Free Space in Blocks

Row Migration

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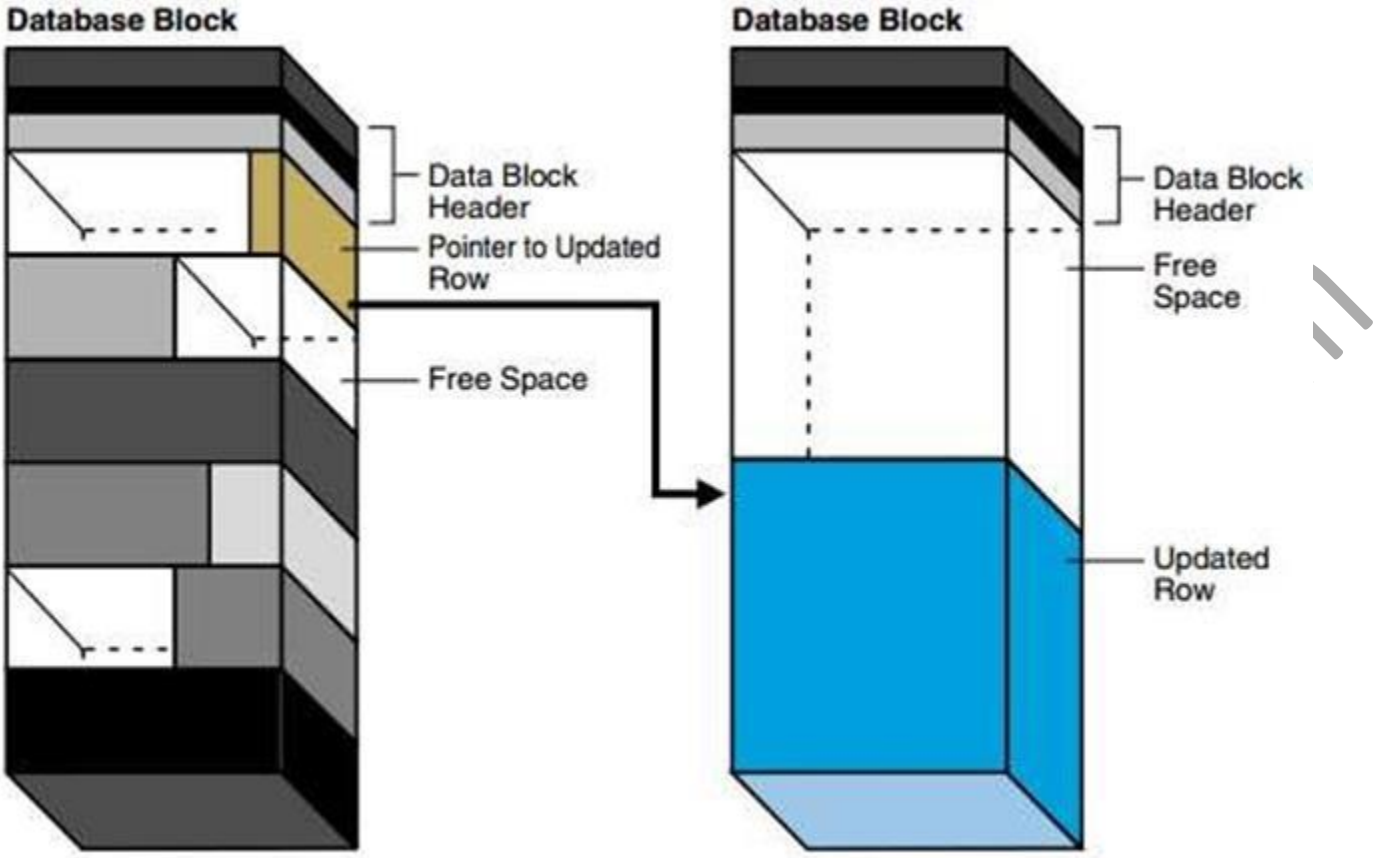

The left block contains a row that is updated so that the row is now too large for the block. The database moves the entire row to the right block and leaves a pointer to the migrated row in the left block

Introduction to Database Administration

TOPIC 87

Overview of Extents

Overview of Extents

Overview of Extents

What is Extent?
Incremental Extents of Segment
Deallocation of Extents
Manually Deallocate Space

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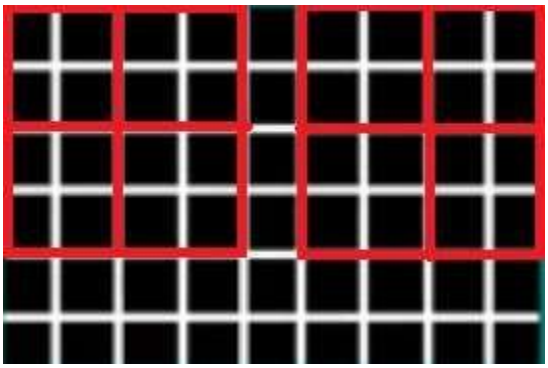
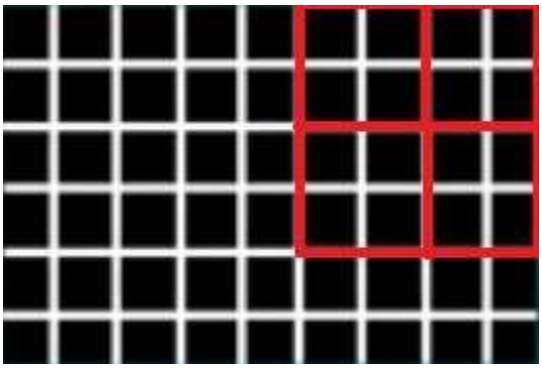
Sample SQL DDL using Extent
Overview of Extents

What is Extent?





An extent is a logical unit of database storage space allocation made up of contiguous data blocks. Data blocks in an extent are logically contiguous but can be physically spread out on disk because of RAID striping and file system implementations. Data Files
Overview of Extents

What is Extent?

An extent is a logical unit of database storage space allocation made up of contiguous data blocks. Data blocks in an extent are logically contiguous but can be physically spread out on disk because of RAID striping and file system implementations.
Overview of Extents

What is Extents?

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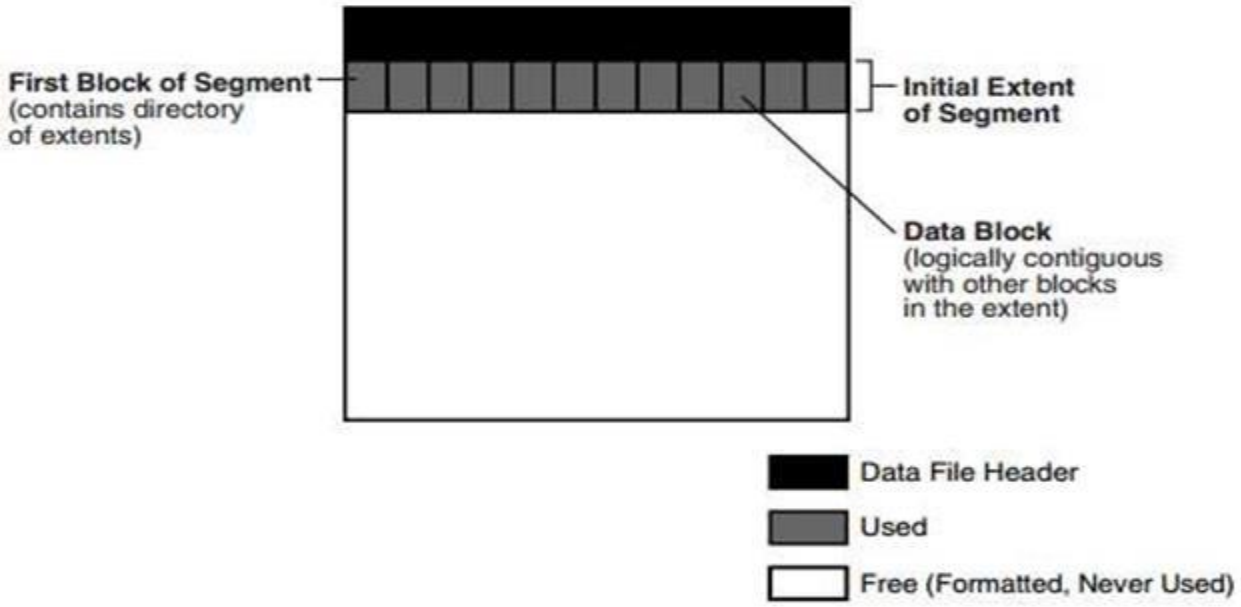
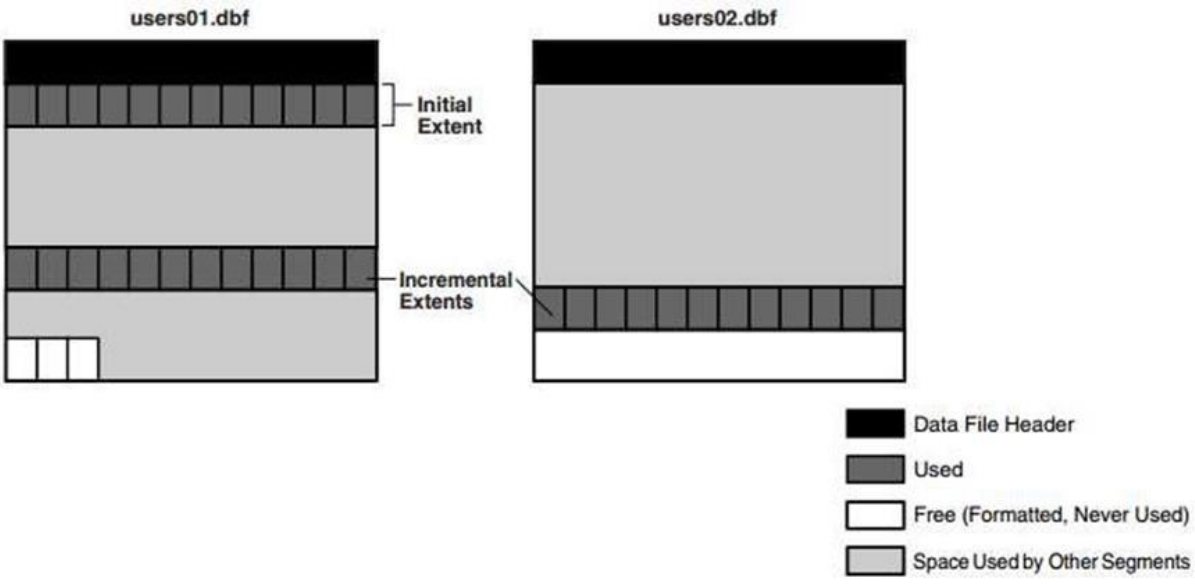


By default, the database allocates an initial extent for a data segment when the segment is created. An extent is always contained in one data file.
Although no data has been added to the segment, the data blocks in the initial extent are reserved for this segment exclusively.
The first data block of every segment contains a directory of the extents in the segment.
Figure shows the initial extent in a segment in a data file that previously contained no data.
Overview of Extents

Incremental Extents of Segment



Overview of Extents

Deallocation of Extents

In general, the extents of a user segment do not return to the tablespace unless you drop the object using a DROP command.
In Oracle Database 11g Release 2, you can also drop the segment using the DBMS_SPACE_ADMIN package.

For example, if you delete all rows in a table, then the database does not reclaim the data blocks for use by other objects in the tablespace.
Overview of Extents

Manually Deallocate Space

Following techniques can deallocate extents
You can use an online segment shrink to reclaim fragmented space in a segment. Segment shrink is an online, in-place operation.
You can move the data of a non partitioned table or table partition into a new segment, and optionally into a different tablespace for which you have quota.
Overview of Extents

Manually Deallocate Space

You can rebuild or coalesce the index
You can truncate a table or table cluster, which removes all rows. By default, Oracle Database deallocates all space used by the removed rows except that specified by the MINEXTENTS storage parameter.
You can deallocate unused space, which frees the unused space at the high water mark end of the database segment and makes the space available for other segments in the tablespace
Overview of Extents

Sample SQL DDL using Extent

```
CREATE TABLESPACE MCare_indx
DATAFILE 'D:\oracle11g\ora11g\oradata\MCare_indx01.dbf'
SIZE 100M
MINIMUM EXTENT 64K
DEFAULT STORAGE (INITIAL 64K NEXT 64K);
```

Introduction to Database Administration

TOPIC 88

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Overview of Segments

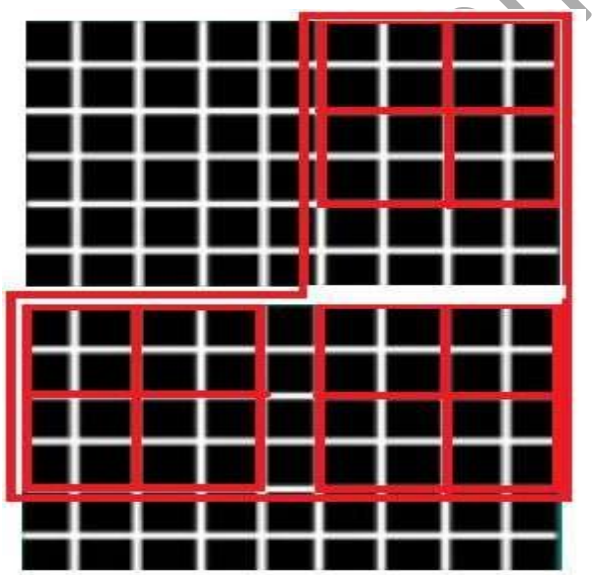
Overview of Segments

Overview of Segments

What is Segment?
Segment & Data Files
User Segments
User Segments Creation
Creation of Multiple Segments
SQL DDL for Segments under Tablespace
Temporary Segments
UNDO Segments
Tablespace with Segments
Overview of Segments

What is Segment?

A segment is a set of extents that contains all the data for a logical storage structure within a tablespace. For example, Oracle Database allocates one or more extents to form the data segment for a table. The database also allocates one or more extents to form the index segment for a table implementations.
Overview of Segments



Segment & Data Files

Data Files

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For example, Patient table consists of three segments from two data files
Overview of Segments

User Segments

A single data segment in a database stores the data for one user object. There are different types of segments. Examples of user segments include:
Table, table partition, or table cluster
LOB or LOB partition
Index or index partition
Each non partitioned object and object partition is stored in its own segment. For example, if an index has five partitions, then five segments contain the index data.
Overview of Segments

User Segments Creation

By default, the database uses deferred segment creation to update only database metadata when creating tables and indexes.
When a user inserts the first row into a table or partition, the database creates segments for the table or partition, its LOB columns, and its indexes.
Deferred segment creation enables you to avoid using database resources unnecessarily.
Overview of Segments

User Segments Creation

For example, installation of an application can create thousands of objects, on consuming significant disk space. Many of these objects may never be used.

You can use the DBMS_SPACE_ADMIN package to manage segments for empty objects.
Overview of Segments
Creation of Multiple Segments

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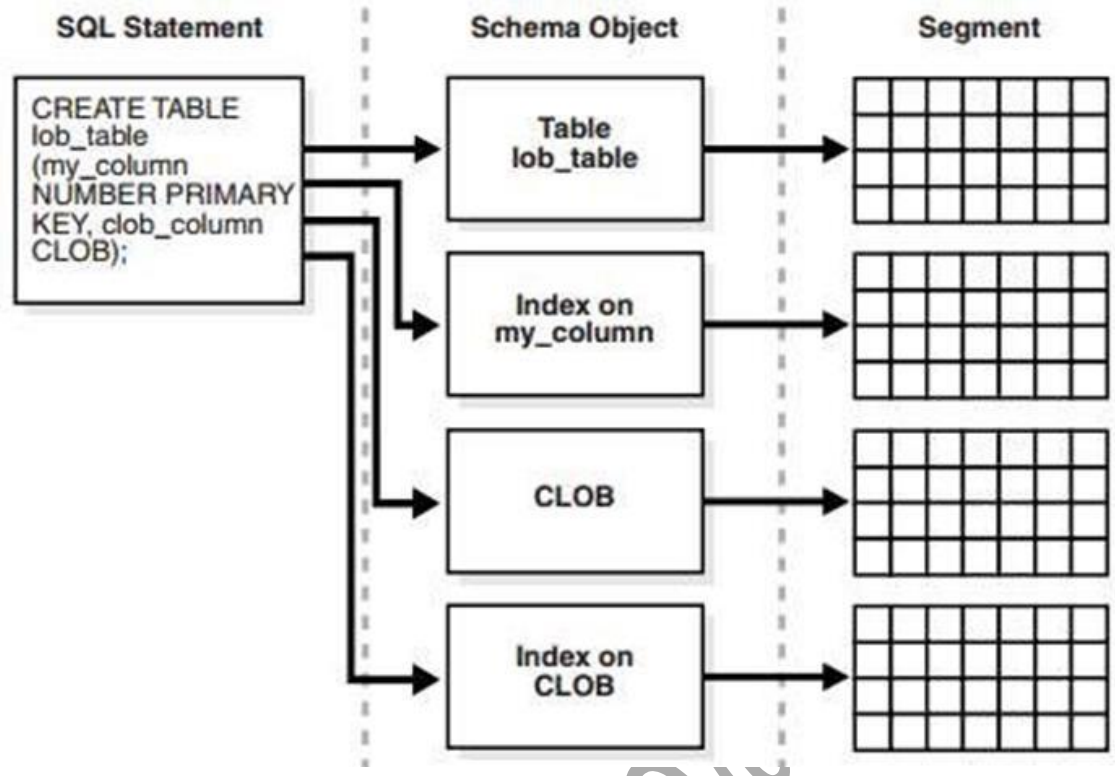

Overview of Segments

SQL DDL for Segments under Tablespace

CREATE TABLE PATIENT_HISTORY (PATIENT_ID CHAR (007),
DEPEND_SNO VARCHAR2 (002), ALLERGY_DESC VARCHAR2 (250) NOT NULL,
HISTORY_DESC LONG
) tablespace MCare;

ALTER TABLE PATIENT_HISTORY
ADD constraint PK_PATHIST_ID PRIMARY KEY (PATIENT_ID,DEPEND_SNO) USING INDEX TABLESPACE MCare_indx;

Overview of Segments

Temporary Segments

When processing a query, Oracle Database often requires temporary workspace for intermediate stages of SQL statement execution.

Typical operations that may require a temporary segment include sorting, hashing, and merging bitmaps. While creating an index, Oracle Database also places index segments into temporary segments and then converts them into permanent segments when the index is complete

Overview of Segments

UNDO Segments

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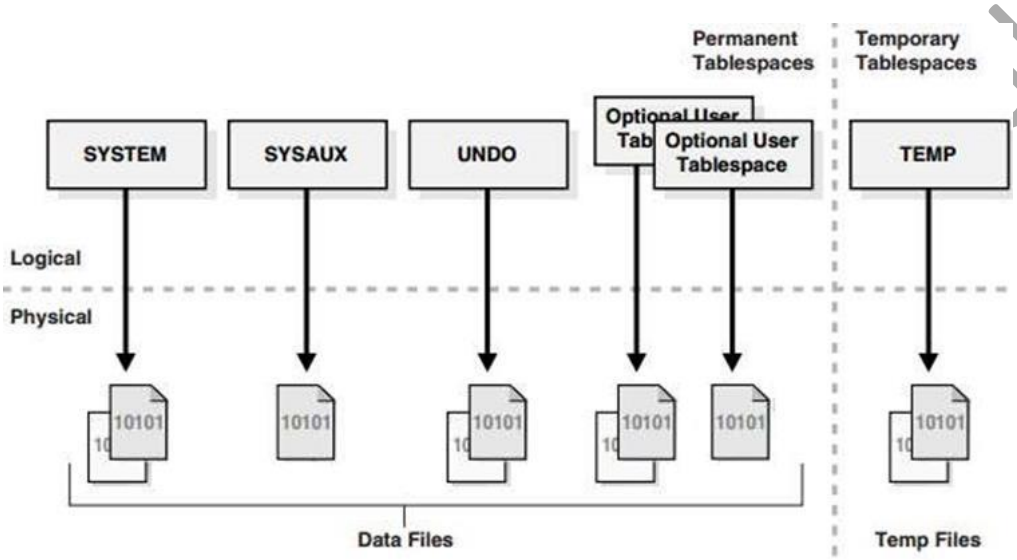
Oracle Database maintains records of the actions of transactions, collectively known as undo data.
Oracle Database uses undo to do the following:
Roll back an active transaction
Recover a terminated transaction
Provide read consistency
Perform some logical flashback operations
Overview of Segments

Tablespace with Segments

A tablespace is a logical storage container for segments. Segments are database objects,



such as tables and indexes, that consume storage space. At the physical level, a tablespace stores data in one Or more data files or temp files.
Introduction to Database Administration

TOPIC 89

Creating Schema Objects Tables, Views

Creating Schema Objects, Tables and Views

Overview of Segments

Introduction to Schema Objects
User & Schema Objects
Schema Objects Types
Overview of Views

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Use of Views
SQL to Create View
View of Base Table
Creating Schema Objects, Tables and Views

Introduction to Schema Objects

A database schema is a logical container for data structures, called schema objects.

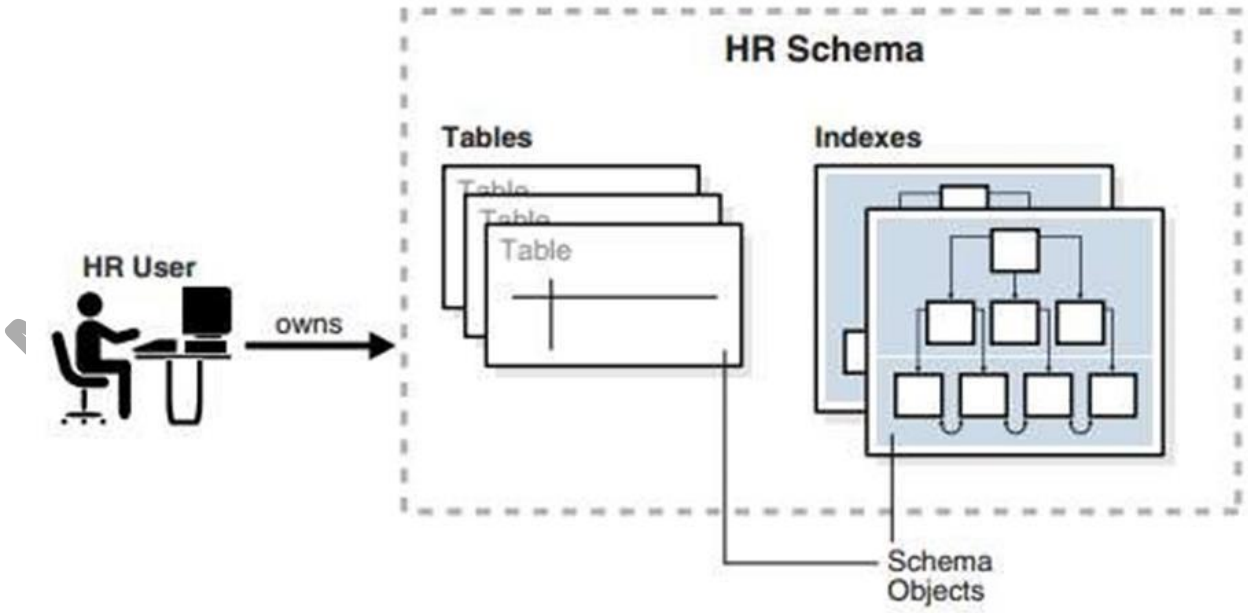
Examples of schema objects are tables, views, sequences and indexes etc.

Schema objects are created and
manipulated with SQL
Creating Schema Objects, Tables and Views

Introduction to Schema Objects

A database user has a password and various database privileges. Each user owns a single schema, which has the same name as the user.
The schema contains the data for the user owning the schema. For example, the hr user owns the hr schema, which contains schema objects such as the employees table.
In a production database, the schema owner usually represents a database application rather than a person.
Creating Schema Objects, Tables and Views

User & Schema Objects



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Creating Schema Objects, Tables and Views

Schema Objects Types

Tables
Storing data in rows of tables
Indexes
Indexes are schema objects that contains an entry for each indexed row of the table or table cluster and provide direct, fast access to rows.
Partitions
Partitions are pieces of large tables and indexes.
Creating Schema Objects, Tables and Views

Schema Objects Types

Partitions
Partitions are pieces of large tables and indexes.
Views
Views are customized presentations of data in one or more tables or other views.
Sequences
A sequence is a user-created object that can be shared by multiple users to generate integers.
Creating Schema Objects, Tables and Views

Schema Objects Types

Dimensions
A dimension defines a parent-child relationship between pairs of column sets, where all the columns of a column set must come from the same table.
Synonyms
A synonym is an alias for another schema object.
PL/SQL Programs
Procedural server programming
Creating Schema Objects, Tables and Views

Overview of Views

A view is a logical representation of one or more tables.
In essence, a view is a stored query.
A view derives its data from the tables on which it is based, called base tables.
Base tables can be tables or other

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views.
All operations performed on a view actually affect the base tables.
You can use views in most places where tables are used.
Creating Schema Objects, Tables and Views

Use of Views

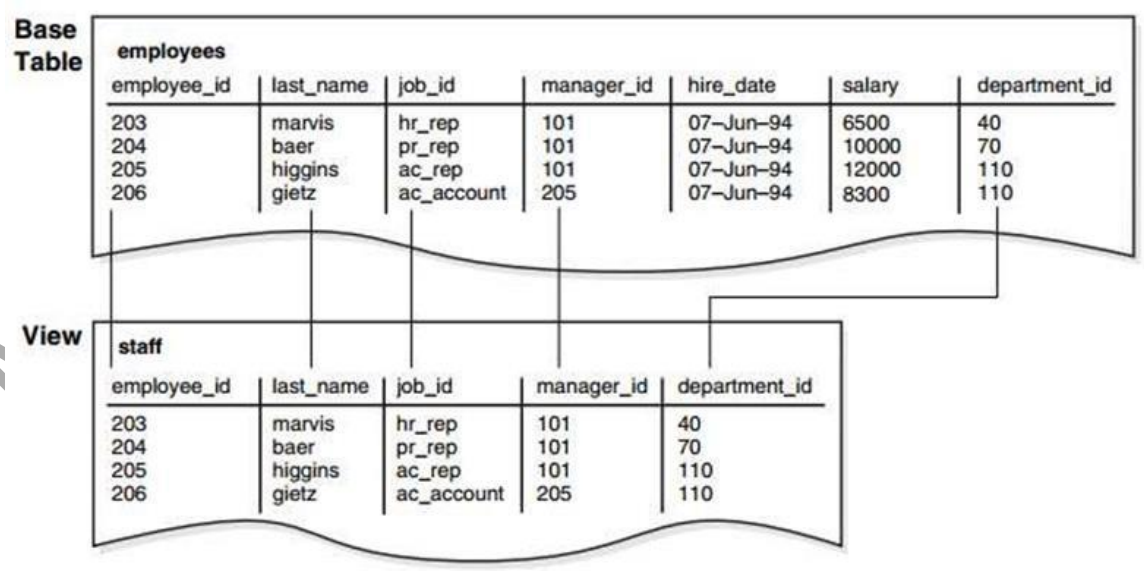
Provide an additional level of table security by restricting access to a predetermined set of rows or columns of a table
Hide data complexity
Present the data in a different perspective from that of the base table For example, the columns of a view can be renamed without affecting the tables on which the view is based.
Isolate applications from changes in definitions of base tables used.
Creating Schema Objects, Tables and Views

SQL to Create View

```
CREATE VIEW staff AS
SELECT employee_id, last_name, job_id,
manager_id, department_id FROM employees;
```

Creating Schema Objects, Tables and Views

View of Base Table



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TOPIC 90

Analyzing Tables, Indexes & Clusters

Analyzing Tables, Indexes & Clusters

Analyzing Tables, Indexes & Clusters

Overview of Table Clusters
Cluster Key
Overview of Indexed Clusters
DDL for Indexed Clusters
Overview of Indexes
Composite Indexes
Analyzing Tables, Indexes & Clusters

Overview of Table Clusters

A table cluster is a group of tables that share common columns and store related data in the same blocks. When tables are clustered, a single data block can contain rows from multiple tables.

For example, a block can store rows from both the employees and Departments tables rather than from only a single table.
Analyzing Tables, Indexes & Clusters

Cluster Key

The cluster key is the column or columns that the clustered tables have in common.
For example, the employees and departments tables share the department_id column.
You specify the cluster key when creating the table cluster and when creating every table added to the table cluster.
Analyzing Tables, Indexes & Clusters

Cluster Key Value

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The cluster key value is the value of the cluster key columns for a particular set of rows. All data that contains the same cluster key value, such as department_id=20, is physically stored together. Each cluster key value is stored only once in the cluster and the cluster index, no matter how many rows of different tables contain the value
Analyzing Tables, Indexes & Clusters

Overview of Indexed Clusters

An indexed cluster is a table cluster that uses an index to locate data. The cluster index is a B-tree index on the cluster key. A cluster index must be created before any rows can be inserted into clustered tables
Analyzing Tables, Indexes & Clusters

DDL for Indexed Clusters

```
CREATE CLUSTER emp_dept_cluster (department_id NUMBER(4))
SIZE 512;

CREATE INDEX idx_emp_dept_cluster ON
CLUSTER emp_dept_cluster;
```

Analyzing Tables, Indexes & Clusters

DDL for Indexed Clusters

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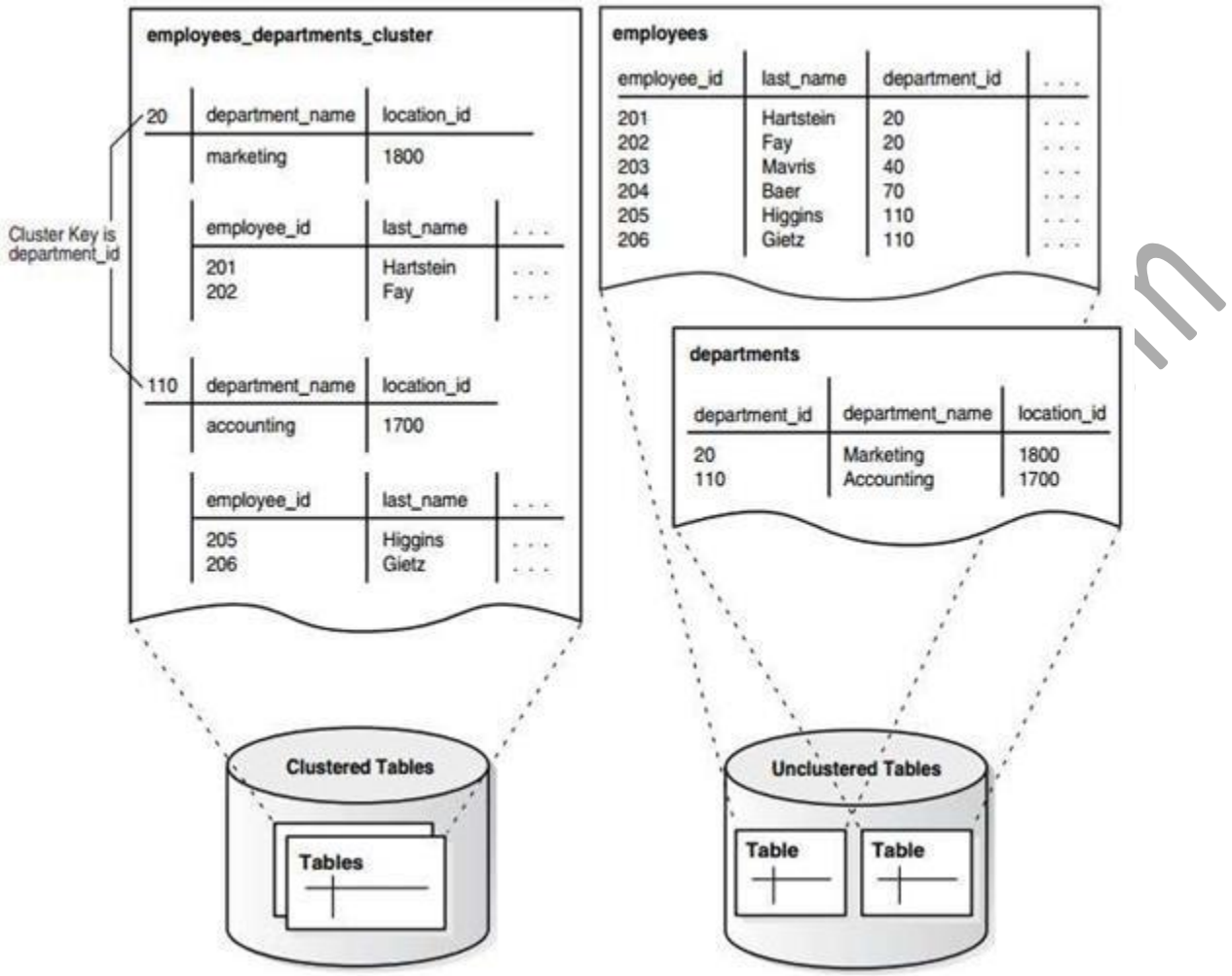

Analyzing Tables, Indexes & Clusters

Overview of Indexes

An index is an optional structure, associated with a table or table cluster, that can sometimes speed data access. By creating an index on one or more columns of a table, you gain the ability in some cases to retrieve a small set of randomly distributed rows from the table.

Indexes are one of many means of
reducing disk I/O.
Analyzing Tables, Indexes & Clusters

Composite Indexes

An index is an optional structure, associated with a table or table cluster, that can sometimes speed data access. By creating an index on one or more columns of a table, you gain the ability in some cases to retrieve a small set of randomly distributed rows from the table.

Indexes are one of many means of
reducing disk I/O.
Analyzing Tables, Indexes & Clusters

Composite Indexes

A composite index, also called a concatenated index, is an index on multiple columns in a table. Columns in a composite index should appear in the order that makes the most sense for the queries that will retrieve data and need not be adjacent in the table.

CREATE INDEX employees_ix
ON employees (last_name, job_id, salary);
Introduction to Database Administration

TOPIC 91

Managing Integrity Constraints-1

Managing Integrity Constraints-1

Integrity Constraints

Data Integrity
Techniques for Data Integrity
Advantages of Integrity Constraints
Types of Integrity Constraints
Managing Integrity Constraints-1

Data Integrity

Business rules specify conditions and relationships that must always be true or must always be false. For example, each company defines its own policies about salaries, employee numbers, inventory tracking, and so on.

It is important that data maintain data integrity, which is adherence to these rules, as determined by the database administrator or application developer.
Managing Integrity Constraints-1

Techniques for Data Integrity

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Following are possible options:
Enforcing business rules with triggered
stored database procedures
Using stored procedures to completely
control access to data
Enforcing business rules in the code of a
database application
Using Oracle Database integrity constraints, which are rules defined at the column or object level that restrict values in the database
Managing Integrity Constraints-1

Advantages of Integrity Constraints

An integrity constraint is a schema object that is created and dropped using SQL.

Advantages of integrity constraints over alternatives for enforcing data integrity include:

Declarative ease
Centralized rules
Flexibility when loading data
Managing Integrity Constraints-1

Advantages of Integrity Constraints

Declarative ease
Because you define integrity
constraints using SQL DDL statements.
Centralized rules
Integrity constraints are defined for tables and are stored in the data dictionary
Flexibility when loading data
You can disable integrity constraints temporarily to avoid performance overhead when loading large amounts of data.
Managing Integrity Constraints-1

Types of Integrity Constraints

Oracle Database enables you to apply constraints both at the table and column level. A constraint specified as part of the definition of a column or attribute is called an inline specification.

NOT NULL UNIQUE CHECK DEFAULT
PK/ FK: Standard Integrity Constraints
Introduction to Database Administration

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TOPIC 92

Managing Integrity Constraints-2

Managing Integrity Constraints-2

Integrity Constraints

NOT NULL Constraint
UNIQUE Constraint
CHECK Constraint
DEFAULT Constraint
FK CASCADE Constraints
FK CASCADE Constraints – Example
Trigger's Constraint
ENABLE/ DISABLE or Drop Constraints
Managing Integrity Constraints-2

NOT NULL Constraint

A NOT NULL constraint requires that a column of a table contain no null values. A null is the absence of a value. By default, all columns in a table allow nulls.
By default, FK is NULL.

Create table Student(
(RollNo CHAR(10),
FullName VARCHAR2(50) NOT NULL,
…..);
Managing Integrity Constraints-2

UNIQUE Constraint

A unique key (Null able) constraint requires that every value in a column or set of columns be unique. No rows of a table may have duplicate values in a column (the unique key) or set of columns (the composite unique key) with a unique key constraint.

Create table Medicine((ItemNo CHAR(10),
Name VARCHAR2(50) NOT NULL UNIQUE,
…..);

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Managing Integrity Constraints-2

CHECK Constraint

A check constraint on a column or set of columns requires that a specified condition be true or unknown for every row. If DML results in the condition of the constraint evaluating to false, then the SQL statement is rolled back.

Alter table Medicine
Add constraint chk_medType CHECK (MedType IN ('S','P'));
Managing Integrity Constraints-2

DEFAULT Constraint

A default constraint on a column requires that a specified value be true when null value is entered.

Create table Medicine((ItemNo CHAR(10),
Name VARCHAR2(50) NOT NULL,
Status CHAR(1) default 'Y‘,
…..);
Managing Integrity Constraints-2

FK CASCADE Constraints

CASCADE is applied with INSERT, DELETE or UPDATE.
For example, a foreign key with cascade delete means that if a record in the parent table is deleted, then the corresponding records in the child table will automatically be deleted. This is called a cascade delete in Oracle.
Managing Integrity Constraints-2

FK CASCADE Constraints - Example

CREATE TABLE supplier
(supplier_id numeric(10) not null, supplier_name varchar2(50) not null, contact_name varchar2(50),
CONSTRAINT supplier_pk PRIMARY KEY (supplier_id));

CREATE TABLE products
(product_id numeric(10) not null,
supplier_id numeric(10) not null,
CONSTRAINT fk_supplier FOREIGN KEY (supplier_id)
REFERENCES supplier(supplier_id) ON DELETE CASCADE);
Managing Integrity Constraints-2

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Trigger's Constraints

CREATE TRIGGER cascade_del_stu_record
BEFORE DELETE ON STUDENT FOR EACH ROW
BEGIN
DELETE FROM RECORD
WHERE RECORD.SID = :OLD.SID;
END;
Managing Integrity Constraints-2

Trigger's Constraints

CREATE TRIGGER cascade_del_stu_record BEFORE DELETE ON STUDENT
FOR EACH ROW BEGIN
DELETE FROM RECORD
WHERE RECORD.SID = :OLD.SID;
END;
Managing Integrity Constraints-2

ENABLE/ DISABLE or Drop Constraints

Existing constraints on table can be

Enabled
Disabled
Dropped
For example,
Alter table Invoice
DROP constraint fk_custid;
Introduction to Database Administration

TOPIC 93

Schema Objects, Queries & Views

Schema Objects, Queries & Views

Schema Objects

How a Schema is Created?

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How a Schema is Implemented?
Simple & Complex Views
Creating Tables
Creating Sequence or AutoNumber
Data Dictionary for Tables & Views
Schema Objects, Queries & Views

How a Schema is Created

We have studied that DBA has to create default Tablespace and assign temporary Tablespace with storage in terms of data files.
Create first user (owner of schema) with grants such as rights and privileges.
We will cover schema objects Tables
and Views.
Ref. DBA-73
Schema Objects, Queries & Views

How a Schema is Implemented?

A view is a logical representation of a table or combination of tables.
In essence, a view is a stored query.
A view derives its data from the tables
on which it is based.
These tables are called base tables. Base tables might in turn be actual tables or might be views themselves.
All operations performed on a view actually affect the base table of the view.
Schema Objects, Queries & Views

How a Schema is Implemented?

You can use views in almost the same way as tables. You can query, update, insert into, and delete from views, just as you can standard tables.
Views can provide a different representation (such as subsets or supersets) of the data that resides within other tables and views.
Views can be Simple or Complex
Views can be used for security purposes
View does not contain its own data
Schema Objects, Queries & Views

Simple & Complex Views

CREATE VIEW sales_staff AS SELECT empno, ename, deptno FROM emp
WHERE deptno = 10;

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CREATE VIEW sales_staff AS
SELECT job, count(*) FROM emp
WHERE deptno = 10 Group by job;
Schema Objects, Queries & Views

Simple & Complex Views

CREATE OR REPLACE VIEW division1_staff AS
SELECT ename, empno, job, dname FROM emp, dept
WHERE emp.deptno IN (10, 30) AND emp.deptno = dept.deptno;

Insert, delete and update operations for
base tables are applied on simple views.
Schema Objects, Queries & Views

Creating Tables

CREATE TABLE dept (
deptno NUMBER(4) PRIMARY KEY,
dname VARCHAR2(14), loc VARCHAR2(13));

CREATE TABLE emp (
empno NUMBER(4) PRIMARY KEY, ename VARCHAR2(10),
…
deptno NUMBER(2);
…
Schema Objects, Queries & Views

Creating Sequence or AutoNumber

CREATE SEQUENCE emp_sequence INCREMENT BY 1
START WITH 1 NOMAXVALUE NOCYCLE CACHE 10;
Schema Objects, Queries & Views

Data Dictionary for Tables & Views

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```
SELECT COLUMN_NAME, UPDATABLE
      FROM USER_UPDATABLE_COLUMNS
      WHERE TABLE_NAME = 'EMP_DEPT';

COLUMN_NAME                    UPD
------------------------------ ---
EMPNO                          YES
ENAME                          YES
DEPTNO                         YES
SAL                            YES
DNAME                          NO
LOC                            NO
```

SELECT COLUMN_NAME, UPDATABLE FROM USER_UPDATABLE_COLUMNS
WHERE TABLE_NAME = 'EMP_DEPT';

End
Introduction to Database Administration

TOPIC 94

Creating Tables & Alter Tables

Creating Tables & Alter Tables

Creating & Alter Tables

What is a Table?
Design Table Guidelines
Heap-Organized Table
Clustered Table
Indexed-Organized Table
Partitioned Table
Storage Location of a Table
Alter Table
Tables with Segment Creation
Creating Tables & Alter Tables

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What is a Table?

Tables are the basic unit of data storage in an Oracle Database. Data is stored in rows and columns. You define a table with a table name, such as employees, and a set of columns.
You give each column a column name, such as emp_id, last_name, and job_id; a data type, such as VARCHAR2, DATE, or NUMBER; and a width. The width can be predetermined by the data type, as in DATE.
Creating Tables & Alter Tables

What is a Table?

If columns are of the NUMBER data type, define precision and scale instead of width. A row is a collection of column information corresponding to a single record.
You can specify rules for each column of a table. These rules are called integrity constraints. One example is a NOT NULL integrity constraint. This constraint forces the column to contain a value in every row.
Some column types, such as LOBs, varrays, and nested tables, are stored in their own segments. LOBs and varrays are stored in LOB segments, while nested tables are stored in storage tables.
Creating Tables & Alter Tables

Design Table Guidelines

Use descriptive names for tables, columns, indexes, and clusters.
Be consistent in abbreviations and in the use of singular and plural forms of table names and columns.
Document the meaning of each table and its columns with the COMMENT command.
Normalize each table.
Creating Tables & Alter Tables

Design Table Guidelines

Select the appropriate datatype for each column. Consider whether your applications would benefit from adding one or more virtual columns to some tables.
Define columns that allow nulls last, to
conserve storage space.
Cluster tables whenever appropriate, to conserve storage space and optimize performance of SQL statements.
Creating Tables & Alter Tables

Heap-Organized Table

This is the basic, general purpose type of table which is the primary subject of this chapter. Its data (heap).

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Creating Tables & Alter Tables

Clustered Table

A clustered table is a table that is part of a cluster. A cluster is a group of tables that share the same data blocks because they share common columns and are often used together
Creating Tables & Alter Tables

Indexed-Organized Table

Unlike an ordinary (heap-organized) table, data for an index-organized table is stored in a B-tree index structure in a primary key sorted manner.
Besides storing the primary key column values of an index-organized table row, each index entry in the B-tree stores the non key column values as well
Creating Tables & Alter Tables

Partitioned Table

Partitioned tables enable your data to be broken down into smaller, more manageable pieces called partitions, or even subpartitions. Each partition can have separate physical attributes, such as compression enabled or disabled, type of compression, physical storage settings, and tablespace, thus providing a structure that can be better tuned for availability and performance.
Creating Tables & Alter Tables

Partitioned Table

In addition, each partition can be managed individually, which can simplify and reduce the time required for backup and administration.
Creating Tables & Alter Tables

Storage Location of a Table

It is advisable to specify the TABLESPACE clause in a CREATE TABLE statement to identify the tablespace that is to store the new table.
For partitioned tables, you can optionally identify the tablespace that is to store each partition.
Ensure that you have the appropriate privileges and quota on any tablespaces that you use.
If you do not specify a tablespace in a CREATE TABLE statement, the table is created in your default tablespace.
Creating Tables & Alter Tables

Alter Table

Alter table command applies when table is already exist in a schema.

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We can add constraints, columns and modifications operations on table using Alter table DDL statements.
Creating Tables & Alter Tables
Tables with Segment Creation

```
CREATE TABLE part_time_employees (
    empno NUMBER(8),
    name VARCHAR2(30),
    hourly_rate NUMBER (7,2)
    )
    SEGMENT CREATION DEFERRED;

CREATE TABLE hourly_employees (
    empno NUMBER(8),
    name VARCHAR2(30),
    hourly_rate NUMBER (7,2)
    )
   SEGMENT CREATION IMMEDIATE
   PARTITION BY RANGE(empno)
    (PARTITION empno_to_100 VALUES LESS THAN (100),
    PARTITION empno_to_200 VALUES LESS THAN (200));
```

```
SELECT segment_name, partition_name FROM user_segments;

SEGMENT_NAME         PARTITION_NAME
-------------------- ------------------------------
HOURLY_EMPLOYEES     EMPNO_TO_100
HOURLY_EMPLOYEES     EMPNO_TO_200
```

Introduction to Database Administration

TOPIC 95

DDL Script Writing-1
DDL Script Writing-1

Script Writing

What is a Script?
A Sample DDL in a Script?
Creating Temporary Tables
Table with TEMP Tablespace
Bulk Data Load in a Table

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Alter Table
Index with Tablespace
DDL Partition Table
DDL Script Writing-1

What is a Script?

Normally writing or generating DDL commands to create/ alter tables, views, constraints and storages etc., in an order in plain text using Notepad or text files
Mostly scripts contain structure of tables. Sometimes, DML commands are also put in scripts as per management requirement.
Scripts can be with Create, Alter and
Drop Tables
DDL Script Writing-1

A Sample DDL in a Script

```
CREATE TABLE hr.admin_emp (
        empno       NUMBER(5) PRIMARY KEY,
        ename       VARCHAR2(15) NOT NULL,
        ssn         NUMBER(9) ENCRYPT USING 'AES256',
        job         VARCHAR2(10),
        mgr         NUMBER(5),
        hiredate    DATE DEFAULT (sysdate),
        photo       BLOB,
        sal         NUMBER(7,2),
        hrly_rate   NUMBER(7,2) GENERATED ALWAYS AS (sal/2080),
        comm        NUMBER(7,2),
        deptno      NUMBER(3) NOT NULL
                    CONSTRAINT admin_dept_fkey REFERENCES hr.departments
                    (department_id))
   TABLESPACE admin_tbs
   STORAGE ( INITIAL 50K);

COMMENT ON TABLE hr.admin_emp IS 'Enhanced employee table';
```

DDL Script Writing-1

Creating Temporary Tables

Temporary tables are useful in applications where a result set is to be buffered (temporarily persisted), perhaps because it is constructed by running multiple DML operations.
For example, consider the following:

```
CREATE GLOBAL TEMPORARY TABLE admin_work_area
        (startdate DATE,
         enddate DATE,
         class CHAR(20))
       ON COMMIT DELETE ROWS;
```

DDL Script Writing-1

Table with TEMP Tablespace

```
CREATE TEMPORARY TABLESPACE tbs_t1
    TEMPFILE 'tbs_t1.f' SIZE 50m REUSE AUTOEXTEND ON
    MAXSIZE UNLIMITED
    EXTENT MANAGEMENT LOCAL UNIFORM SIZE 64K;

CREATE GLOBAL TEMPORARY TABLE admin_work_area
        (startdate DATE,
         enddate DATE,
         class CHAR(20))
       ON COMMIT DELETE ROWS
       TABLESPACE tbs_t1;
```

DDL Script Writing-1

Bulk Data Load in a Table

```
FORALL i IN 1..numrecords
  INSERT /*+ APPEND_VALUES */ INTO orderdata
  VALUES(ordernum(i), custid(i), orderdate(i),shipmode(i), paymentid(i));
COMMIT;
```

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Alter Table

ecezt4n‹aa<e 0 I
ADD ṭbmus NBfB8R (7,3));
DDL Script Writing-1

Index with Tablespace

CREATE INDEX int_sales_index ON int_salestable
(s_saledate, s_productid, s_custid) TABLESPACE tbs_low_freq;
DDL Script Writing-1

DDL Partition Table

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```
CREATE TABLE salestable
(s_productid NUMBER,
s_saledate DATE,
s_custid NUMBER,
s_totalprice NUMBER)
TABLESPACE users
PARTITION BY RANGE(s_saledate)
(PARTITION sal03q1 VALUES LESS THAN (TO_DATE('01-APR-2003
PARTITION sal03q2 VALUES LESS THAN (TO_DATE('01-JUL-2003'
PARTITION sal03q3 VALUES LESS THAN (TO_DATE('01-OCT-2003'
PARTITION sal03q4 VALUES LESS THAN (TO_DATE('01-JAN-2004'
```


TOPIC 96

DDL Script Writing-2

DDL Script Writing-2

Script Writing

Writing Script using Notepad
Tables in an Order
Drop Tables in an Order
Other Schema Objects
DDL Script Writing-2

Writing Script using Notepad

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Script is a plain text structure of schema

Tables in an Order

```
create table Customer
(custID          CHAR(10),
CustName         VARCHAR2(25) NOT NULL,
Address          VARCHAR2(50),
City             VARCHAR2(50),
TelNo            VARCHAR2(15),
Email            VARCHAR2(50) UNIQUE)
tablespace TS_Sales;

Alter table Customer
add constraint PK_Custid primary key (CustID);
```

create table Customer (oustID CMAR(10).
CustName VARCHARZ(25) NOT NULL.
Address VARCHAR2(50)

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City VARCHAR2(50).
TelNo VARCHAR2(15).
Email VARCHAR2(S0) UNIQUE)
tablespace T8_8ales:
Alter table Customer
add constraint PK_Custid primary key (CustID):

Tables in an Order

```
Create table Orders
(InvoiceNo      CHAR(12),
InvType         CHAR(1),
InvDate         Date NOT NULL,
TotalPrice      Number(6,2),
SalesEmpID      CHAR(5),
CustID          CHAR(8))
tablespace TS_Sales;

Alter table Orders
add constraint PK_InvNo primary key (InvoiceNO)
USING INDEX TABLESPACE Sale_indx;

Alter table Orders
add constraint FK_Cust_CustID foreign key (custID)
references Customer(CustID);
```

Create table Orders
(InvoiceNo CHAR(12).
InvType CHAR(1).
InvDate Date NOT NULL. alPr Number(6.2).
SalesEmpID CHAR(S).
CustID CHAR(8))
tablespace TS_Bales:
lter table Orders
dd constraint PK InvNo primary key (Invoiced0) RING INDEX TABLESPACE Male indx;
lter table Orders
adds non I ra i nd FKYCussI Cu c I D fore i gn key (ous I I D)
ze Le senses CuzrI omes (CuST I D) :

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Tables in an Order

```
create table Employee
(EmpID          CHAR(3),
EmpName         VARCHAR2(25) NOT NULL,
Address         VARCHAR2(50),
City            VARCHAR2(50),
TelNo           VARCHAR2(15),
Email           VARCHAR2(50) UNIQUE)
tablespace TS_Sales;

Alter table Employee
add constraint PK_EmpID primary key (EmpID)
USING INDEX TABLESPACE Sale_indx;

Alter table Orders
add constraint FK_Emp_EmpID foreign key (SalesEmpID)
references Employee(EmpID)
USING INDEX TABLESPACE Sale_indx;
```

create table Employee (EmpID CHAR(3).
EmpName VARCHAR2(25) NOT NULL.
ddr VARCHAR2(50).
VARCMAR250).
elNo VARCHAR?(1S).
Email VARCHAR2(S0) UNIQUE)
tablespace TS_Sales:
lter table Employee
dd oonst ra i nd PK Emp I D primary key (Einp I D) 8 ING INDEX TABLE 8PACE 8a l e i ndx ;

lter table Orders
add constraint FK_Emp_EmpID fore gn key (8a1esEmpID)
re f eres n we Einp I oyee (Einp I D)
8 ING INDEX TABLE 8PACE 8a I e i ndx :
DDL Script Writing-2

Tables in an Order

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```
Create table Item
(ItemID          CHAR(5),
ItemName         VARCHAr2(50) NOT NULL,
PPrice           NUMBER(10,2),
TotQty           NUMBER(5),
Status           CHAR(1))
tablespace TS_Stock;

Alter table Item
add constraint PK_ItemID primary key (ItemID)
USING INDEX TABLESPACE Sale_indx;
```

Tables in an Order

```
Create table Sold
(
ItemID          CHAR(5),
InvoiceNo       CHAR(12),
SPrice          NUMBER(10,2) Not Null,
SQty            NUMBER(10,2) Not Null)
tablespace TS_ItemSold;

Alter table Sold
add constraint PK_Sold primary key (ItemID, InvoiceNo)
USING INDEX TABLESPACE Sold_indx;

Alter table Sold
add constraint FK_Sold_ItemID foreign key (ItemID)
references Item(ItemID);

Alter table Sold
add constraint FK_Sold_InvoiceNo foreign key (InvoiceNo)
references Invoice(InvoiceNo);
```

Create table Sold
ItemID CHAR(5).
InvoiceNo CHAR(1Z).
5Price NUMBER(10.2) Not Null.
SQty NUMBER(10*2) Not Null) tablespace TB_ItemBold:

Alter table Sold
add constraint PK_5old primary key (ItemID. InvoiceNo)
USING INDEX TABLESPACE Sold_indx:

Alter table Bold

add constraint FK_Bold_ItemID Foreign key (ItemID) references Item(ItemID);

Alter table Sold
cadd onoI ra i nd FKp8o 1 del nvo i ceNo f ore i gn key (I nvo i ceNo)
re f erenoes I nvn i we (I nvo1 redo) :
DDL Script Writing-2

Drop Tables in an Order

```
Drop table Sold;
Drop table employee;
Drop table orders;
Drop table customer;
Drop table Item;
```

DDL Script Writing-2

Other Schema Objects
Script may contains other objects such as Views
Sequences
Synonym
PL/SQL Triggers & Code
DML for sample data

End
Introduction to Database Administration

TOPIC 97

Drop Tables & Recycle Bin

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Drop Tables & Recycle Bin

Overview of Segments

Drop Tables
Drop Tables Precautions
Drop Tables Commands
What is the Recycle Bin?
Object Naming in Recycle Bin
Enable & Disable the Recycle Bin
Purging is the Recycle Bin
Data Dictionary Views for Recycle Bin
Drop Tables & Recycle Bin

Drop Tables

To drop a table that you no longer need, use the DROP TABLE statement. The table must be contained in your schema or you must have the DROP ANY TABLE system privilege.
Drop Tables & Recycle Bin

Drop Tables Precautions

Dropping a table removes the table definition from the data dictionary. All rows of the table are no longer accessible.
All indexes and triggers associated with a table are dropped.
All views and PL/SQL program units dependent on a dropped table remain, yet become invalid (not usable).
All synonyms for a dropped table
remain, but return an error when used.
Drop Tables & Recycle Bin

Drop Tables Precautions

All extents allocated for a table that is dropped are returned to the free space of the tablespace and can be used by any other object requiring new extents or new objects. All rows corresponding to a clustered table are deleted from the blocks of the cluster
Drop Tables & Recycle Bin

Drop Tables Commands

DROP TABLE hr.int_admin_emp;

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If the table to be dropped contains any primary or unique keys referenced by foreign keys of other tables and you intend to drop the FOREIGN KEY constraints of the child tables, then include the CASCADE clause in the DROP TABLE statement

DROP TABLE hr.admin_emp CASCADE
CONSTRAINTS;

Drop Tables & Recycle Bin

Drop Tables Commands

If you should want to immediately release the space associated with the table at the time you issue the DROP TABLE statement, include the PURGE clause as shown in the following statement:

DROP TABLE hr.admin_emp PURGE;

Drop Tables & Recycle Bin

What is the Recycle Bin?

The recycle bin is actually a data dictionary table containing information about dropped objects.
Dropped tables and any associated objects such as indexes, constraints, nested tables, and the likes are not removed and still occupy space.
They continue to count against user space quotas, until specifically purged from the recycle bin.

SELECT * FROM RECYCLEBIN;

Drop Tables & Recycle Bin

Object Naming in Recycle Bin

```
SQL> select * from tab;

TNAME                          TABTYPE  CLUSTERID
------------------------------ ------- ----------
BIN$hlLPRYaURGeQBtlLS4/DHg==$0 TABLE
BIN$pgI7NTBnRKSh+170M90xHg==$0 TABLE
BLOBS                          TABLE
BONUS                          TABLE
```

The renaming convention is as follows: BIN$unique_id$version
unique_id is a 26-character globally unique identifier for this object, which makes the recycle bin name unique across all databases
Version is a version number assigned by the database

Drop Tables & Recycle Bin

Enable & Disable the Recycle Bin

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To disable the recycle bin:

1. Issue one of the following statements:

```
ALTER SESSION SET recyclebin = OFF;

ALTER SYSTEM SET recyclebin = OFF SCOPE = SPFILE;
```

2. If you used ALTER SYSTEM, restart the database.

To enable the recycle bin:

1. Issue one of the following statements:

```
ALTER SESSION SET recyclebin = ON;

ALTER SYSTEM SET recyclebin = ON SCOPE = SPFILE;
```

2. If you used ALTER SYSTEM, restart the database.

Drop Tables & Recycle Bin

Purging is the Recycle Bin

If you decide that you are never going to restore an item from the recycle bin, you can use the PURGE statement to remove the items and their associated objects from the recycle bin and release their storage space.

PURGE TABLE "BIN$jsleilx392mk2=293$0";
PURGE TABLESPACE example; PURGE RECYCLEBIN;
Drop Tables & Recycle Bin
Data Dictionary Views for Recycle Bin

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```
SELECT object_name, original_name FROM dba_recyclebin
   WHERE owner = 'HR';

OBJECT_NAME                    ORIGINAL_NAME
------------------------------ --------------------------------
BIN$yrMKlZaLMhfgNAgAIMenRA==$0 EMPLOYEES
```

You can also view the contents of the recycle bin using the SQL*Plus command SHOW RECYCLEBIN.

```
SQL> show recyclebin

ORIGINAL NAME    RECYCLEBIN NAME                OBJECT TYPE  DROP TIME
---------------- ------------------------------ ------------ -------------------
EMPLOYEES        BIN$yrMKlZaVMhfgNAgAIMenRA==$0 TABLE        2003-10-27:14:00:19
```

Introduction to Database Administration

TOPIC 98

Indexed Organized Tables

Indexed Organized Tables

Overview of Segments

Drop Tables
Indexed Organized Tables

Drop Tables

To drop a table that you no longer need, use the DROP TABLE statement. The table must be contained in your schema or you must have the DROP ANY TABLE system privilege.
Introduction to Database Administration

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Data Dictionary Views for Tables

Data Dictionary Views for Tables

Integrity Constraints

Three Types of Views
Displaying Views for Tables
Size of a Table
Displaying Table's Constraints
Displaying Table's Columns Details
Data Dictionary Views for Tables

What is an index?

Indexes are optional structures associated with table and clusters that allow SQL queries to execute more quickly against a table

Index helps you locate information faster than if there were no index, an oracle database index provides a faster access path to table data. You can use indexes without rewriting any queries. Your results are the same, but you see them more quickly.

Independency of an index

Indexes are logically and physically independent of the data in the associated table. Being independent structure, they require storage space.You can create and drop an index without affecting the base tables, database application or other indexes.

The database automatically maintains indexes when you insert, update and delete rows of the associated table.If you drop an index all applications

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continue to work, access to previously indexed data might be slower.

Data load & index usage

Data is often inserted or loaded into a table using either a SQL * loader or an import utility. It is more efficient to create an index for a table after inserting orloading the data.

If you create one or more indexes before loading data, the database then must update every index as each row is inserted.

Index with segments & Tablespace

- The amount for each user is determined by the initialization parameter SORT_AREA_SIZE.
- The database also swaps sort information to and from temporary segments that are only allocated during the index creation in the user's temporary tablespace.

Suitable Columns for Indexing

- Values are relatively unique in the column.
- There is a wide range of values (good for regular indexes).
- There is a small range of values (good for bitmap indexes).
- The column contains many nulls, but queries often select all rows having a value.

Indexing Limit on Table

- A table can have any number of indexes. However, the more indexes there are, the more overhead is incurred as the table is modified Specifically, when rows are inserted or deleted, all indexes on the table must be updated as well.
- Also, when a column is updated, all indexes that contain the column must be updated.

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Creating Indexes

To create an index in your own schema, at least one of the following conditions must be true:

- The table or cluster to be indexed is in your own schema.
- You have INDEX privilege on the table to be indexed.
- You have CREATE ANY INDEX system privilege.

CREATE INDEX emp_ename ON emp(ename);

CREATE INDEX emp_ename ON emp(ename) TABLESPACE users STORAGE (INITIAL 20K NEXT 2010;

TOPIC 99

Data Dictionary Views for Tables
Three Types of Views

There are three types of Views to manage Tables related information:

DBA_
ALL_
USER_
Data Dictionary Views for Tables

Displaying Views for Tables

SQL statement to display Tables related Views:

Select Table_name From Dict
Where Table_name like '%TAB%‘;

You can use following choices for more views:
Table_name like '%COL%' Table_name like '%EXTERNAL%‘ Table_name like '%CONSTRAINT%'

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Size of a Table

To find size of table in MB

select sum(bytes)/1024/1024 SizeMB from dba_segments
where segment_name ='EMP';
Data Dictionary Views for Tables

Displaying Table's Constraints

```
select u.constraint_name, u.CONSTRAINT_TYPE, substr(c.column_name,1,30) col_name
from user_constraints u, USER_CONS_COLUMNS c
where u.table_name='EMP'
and u.CONSTRAINT_TYPE = 'P'
and (u.table_name=c.table_name
and c.constraint_name=u.constraint_name);


CONSTRAINT_NAME                C COL_NAME
------------------------------ - ------------------------------
PK_EMP                         P EMPNO
```

Data Dictionary Views for Tables

Displaying Table's Columns Details

Column information, such as name, data type, length, precision, scale, and default data values can be listed using one of the views ending with the _COLUMNS suffix. For example, the following query lists all of the default column values for the emp and dept tables:

SELECT TABLE_NAME, COLUMN_NAME, DATA_TYPE, DATA_LENGTH, LAST_ANALYZED FROM DBA_TAB_COLUMNS

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TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	LAST_ANALYZED
COUNTRIES	COUNTRY_ID	CHAR	2	05-FEB-03
COUNTRIES	COUNTRY_NAME	VARCHAR2	40	05-FEB-03
COUNTRIES	REGION_ID	NUMBER	22	05-FEB-03
DEPARTMENTS	DEPARTMENT_ID	NUMBER	22	05-FEB-03

WHERE OWNER = 'HR' ORDER BY TABLE_NAME;
Introduction to Database Administration

TOPIC 100

Creating & Altering an Index

Creating & Altering an Index

Creating & Altering Index

Altering Indexes
Creating Indexes
Creating & Alter Indexes
Rebuild Index
Making Index Visible/ Invisible
Making Index Useable
Creating & Altering an Index

Altering Indexes

To alter an index, your schema must contain the index or you must have the ALTER ANY INDEX system privilege. With the ALTER INDEX statement, you can:
Rebuild or coalesce an existing index
Deallocate unused space or allocate a new extent Specify parallel execution (or not) and alter the degree of parallelism
Alter storage parameters or physical attributes Specify LOGGING or NOLOGGING
Creating & Altering an Index

Creating Indexes

Enable or disable key compression

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Mark the index unusable
Make the index invisible
Rename the index
Start or stop the monitoring of index usage
Creating & Altering an Index

Creating Indexes

```
CREATE INDEX emp_ename ON emp(ename)
TABLESPACE users
STORAGE (INITIAL 20K NEXT 20k);

CREATE UNIQUE INDEX
dept_unique_index ON dept (dname) TABLESPACE indx;
```

Creating & Altering an Index

Creating & Alter Indexes

```
CREATE TABLE emp (
empno NUMBER(5) PRIMARY KEY, age    INTEGER)
ENABLE PRIMARY KEY
USING INDEX TABLESPACE Work_Indx;

ALTER INDEX emp_ename STORAGE (NEXT 40);
```

Creating & Altering an Index

Rebuild Index

You have the option of rebuilding the index online. Rebuilding online enables you to update base tables at the same time that you are rebuilding.
The following statement rebuilds the emp_name index online:

```
ALTER INDEX emp_name REBUILD ONLINE;
```

Creating & Altering an Index

Making Index Visible/ Invisible

An invisible index is ignored by the optimizer unless you explicitly set the OPTIMIZER_USE_INVISIBLE_INDEXES
initialization parameter to TRUE at the session or system level. Making an index invisible is an alternative to making it unusable or dropping it.

```
ALTER INDEX index INVISIBLE; ALTER INDEX index VISIBLE;
```

Creating & Altering an Index

Making Index Visible/ Invisible

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An invisible index is ignored by the optimizer unless you explicitly set the OPTIMIZER_USE_INVISIBLE_INDEXES
initialization parameter to TRUE at the session or system level. Making an index invisible is an alternative to making it unusable or dropping it.

ALTER INDEX *index* INVISIBLE; ALTER INDEX *index* VISIBLE;
Creating & Altering an Index
Making Index Useable
Query the data dictionary to determine whether an
existing index or index partition is usable or unusable.

SELECT INDEX_NAME AS "INDEX OR PART NAME", STATUS, SEGMENT_CREATED
FROM USER_INDEXES

INDEX OR PART NAME	STATUS	SEG
I_EMP_ENAME	N/A	N/A
JHIST_EMP_ID_ST_DATE_PK	VALID	YES
JHIST_JOB_IX	VALID	YES
JHIST_EMPLOYEE_IX	VALID	YES
JHIST_DEPARTMENT_IX	VALID	YES
EMP_EMAIL_UK	VALID	NO

.
UNION ALL
SELECT PARTITION_NAME AS "INDEX OR PART NAME",
STATUS, SEGMENT_CREATED FROM USER_IND_PARTITIONS;
Introduction to Database Administration

TOPIC 101

Recycle Bin
Recycle Bin

Schema Recycle Bin

What is the Recycle Bin?
What is the Recycle Bin?
Object Naming the Recycle Bin
Recycle Bin Tables

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Enable or Disable Recycle Bin
Purging Objects in the Recycle Bin
Restoring Objects From Recycle Bin
Enable or Disable Recycle Bin
Recycle Bin

What is the Recycle Bin?

The recycle bin is actually a data dictionary table containing information about dropped objects. Dropped tables and any associated objects such as indexes, constraints, nested tables, and the likes are not removed and still occupy space.
Recycle Bin

What is the Recycle Bin?

They continue to count against user space quotas, until specifically purged from the recycle bin or the unlikely situation where they must be purged by the database because of tablespace space constraints.
Each user can be thought of as having his own recycle bin, because, unless a user has the SYSDBA privilege.

SELECT * FROM RECYCLEBIN;
Recycle Bin

Object Naming the Recycle Bin

When a dropped table is moved to the recycle bin, the table and its associated objects are given system-generated names. This is necessary to avoid name conflicts that may arise if multiple tables have the same name. circumstances are:
A user drops a table, re-creates it with the same name, then drops it again.
Two users have tables with the same name, and both users drop their tables.

BIN$*unique_id*$*version*
Recycle Bin

Recycle Bin Tables

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```
SQL> select * from tab;

TNAME                          TABTYPE  CLUSTERID
------------------------------ ------- ----------
BIN$hqQXpmBGSHeVHay6wPyUlQ==$0 TABLE
BIN$n4XwANZSS3mT8l+SHf6gGA==$0 TABLE
BONUS                          TABLE
DEPT                           TABLE
EMP                            TABLE
SALGRADE                       TABLE

6 rows selected.
```

Recycle Bin

Enable or Disable Recycle Bin

To disable the recycle bin:

1. Issue one of the following statements:

```
ALTER SESSION SET recyclebin = OFF;

ALTER SYSTEM SET recyclebin = OFF SCOPE = SPFILE;
```

2. If you used ALTER SYSTEM, restart the database.

To enable the recycle bin:

1. Issue one of the following statements:

```
ALTER SESSION SET recyclebin = ON;

ALTER SYSTEM SET recyclebin = ON SCOPE = SPFILE;
```

2. If you used ALTER SYSTEM, restart the database.

Ref. DBA E25494 Oracle11g.pdf pp. 20-58
Recycle Bin

Purging Objects in the Recycle Bin

If you decide that you are never going to restore an item from the recycle bin, you can use the PURGE statement to remove the items and their associated objects from the recycle bin and release their storage space. You need the same privileges as if you were dropping the item.

PURGE TABLE "BIN$jsleilx392mk2=293$0"; PURGE TABLESPACE example;
PURGE TABLESPACE example USER oe;
Recycle Bin

Restoring Objects From Recycle Bin

The following example restores int_admin_emp table and assigns to it a new name:

FLASHBACK TABLE int_admin_emp TO BEFORE DROP
RENAME TO
int2_admin_emp;
Recycle Bin
Enable or Disable Recycle Bin

```
SELECT object_name, original_name FROM dba_recyclebin
   WHERE owner = 'HR';

OBJECT_NAME                    ORIGINAL_NAME
------------------------------ --------------------------------
BIN$yrMKlZaLMhfgNAgAIMenRA==$0 EMPLOYEES
```

You can also view the contents of the recycle bin using the SQL*Plus command SHOW RECYCLEBIN.

```
SQL> show recyclebin

ORIGINAL NAME    RECYCLEBIN NAME                OBJECT TYPE  DROP TIME
---------------- ------------------------------ ------------ -------------------
EMPLOYEES        BIN$yrMKlZaVMhfgNAgAIMenRA==$0 TABLE        2003-10-27:14:00:19
```

Ref. DBA E25494 Oracle11g.pdf pp. 20-59
Introduction to Database Administration

TOPIC 102

Dropping Index

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Dropping Index

Dropping Index

Dropping Index
Reasons for Dropping Index
Extents for Index
SQL for Dropping Index
When not to Drop Index
Dropping Index

Dropping Index

To drop an index, the index must be contained in your schema, or you must have the DROP ANY INDEX system privilege.
Dropping Index

Reasons for Dropping Index

Some reasons for dropping an index include:
The index is no longer required.
The index is not providing anticipated performance improvements for queries issued against the associated table. For example, the table might be very small, or there might be many rows in the table but very few index entries.
Dropping Index

Reasons for Dropping Index

Applications do not use the index to query the data.
The index has become invalid and must be dropped before being rebuilt.
The index has become too fragmented and must be dropped before being rebuilt.
Dropping Index

Extents for Index

When you drop an index, all extents of the index segment are returned to the containing tablespace and become available for other objects in the tablespace.
Dropping Index

SQL for Dropping Index

The following statement drops the emp_ename index:

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DROP INDEX emp_ename;
Dropping Index

When not to Drop Index

You cannot drop only the index associated with an enabled UNIQUE key or PRIMARY KEY constraint. To drop a constraints associated index, you must disable or drop the constraint itself.

End
Introduction to Database Administration

TOPIC 103

Data Dictionary Views for Index
Data Dictionary Views for Index

Data Dictionary Views

Three Types of Views
Displaying Views for Indexes
Display Index Name
Displaying Index on Table's Column
Displaying Index's Columns Details
Data Dictionary Views for Index

Three Types of Views

There are three types of Views to manage Index related information:

DBA_ ALL_ USER_
Data Dictionary Views for Index

Displaying Views for Indexes

SQL statement to display Indexes related Views:

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Select Table_name
From Dict
Where Table_name like '%IND%';

You can use following views as well:
INDEX_STATS INDEX_HISTOGRAM V$OBJECT_USAGE
Data Dictionary Views for Index

Display Index Name

To find table which contains Index

```
SQL> set linesize100
SQL> select index_name, index_type, Table_name
  2  from user_indexes
  3  where Table_name = 'EMP';

INDEX_NAME                     INDEX_TYPE                  TABLE_NAME
------------------------------ --------------------------- -----------
PK_EMP                         NORMAL                      EMP
```

Data Dictionary Views for Index

Displaying Index on Table's Column

```
SQL> select i.index_name, i.index_type, substr(c.column_name, 1, 20) col_name
  2  from user_indexes i, user_ind_columns c
  3  where i.Table_name = 'EMP'
  4  and i.table_name=c.table_name;

INDEX_NAME                     INDEX_TYPE                  COL_NAME
------------------------------ --------------------------- --------------------
PK_EMP                         NORMAL                      EMPNO
```

Data Dictionary Views for Index
Displaying Index's Columns Details

create index ind_name on EMP(ename);

select i.index_name, i.index_type, substr(c.column_name, 1, 20) col_name

from user_indexes i, user_ind_columns c where i.Table_name = 'EMP'
and i.table_name=c.table_name

INDEX_NAME	INDEX_TYPE	COL_NAME
IND_NAME	NORMAL	ENAME
PK_EMP	NORMAL	EMPNO

and i.index_name=c.index_name;
Introduction to Database Administration

TOPIC 104

Defining Clusters

Defining Clusters

Clusters

What is a Cluster?
Cluster Key
Choosing Appropriate Tables for Cluster
Appropriate Column for Cluster
Defining Clusters

What is a Cluster?

A cluster provides an optional method of storing table data. A cluster is made up of a group of tables that share the same data blocks. The tables are grouped together because they share common columns and are often used together.
For example, the
emp and dept table share the deptno column. When you cluster the emp and dept tables, Oracle stores all rows for each department from both the emp and dept tables in the same data blocks.
Defining Clusters

What is a Cluster?

A cluster provides an optional method of storing table data. A cluster is made up of a group of tables that share the same data blocks. The tables are grouped together because they share common columns and are often used together.
For example, the

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emp and dept table share the deptno column. When you cluster the emp and dept tables, Oracle stores all rows for each department from both the emp and dept tables in the same data blocks.
Defining Clusters

Cluster Key

The cluster key is the column, or group of columns, that the clustered tables have in common. You specify the columns of the cluster key when creating the cluster.

You subsequently specify the same columns when creating every table added to the cluster. Each cluster key value is stored only once each in the cluster and the cluster index, no matter how many rows of different tables contain the value.
Defining Clusters

Cluster Key

After creating a cluster, you can create tables in the cluster. However, before any rows can be inserted into the clustered tables, a cluster index must be created.

Using clusters does not affect the creation of additional indexes on the clustered tables; they can be created and dropped as usual.
Defining Clusters

Choosing Appropriate Tables for Cluster

Use clusters for tables for which the
following conditions are true:
The tables are primarily queried--that is, tables that are *not* predominantly inserted into or updated.
Records from the tables are frequently queried together or joined.
Defining Clusters

Appropriate Column for Cluster

Choose cluster key columns carefully. If multiple columns are used in queries that join the tables, make the cluster key a composite key.
In general, the characteristics that indicate a good cluster index are the same as those for any index.

End
Introduction to Database Administration

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TOPIC 105

Create & Alter Clusters

Create & Alter Clusters

Create & Alter Clusters

Creating a Cluster
SQL DDL Command for Cluster
Creating a Table in a Cluster
Creating Cluster using SQL
Altering Clusters
Dropping Clusters
Create & Alter Clusters

Creating a Cluster

To create a cluster in your schema, you must have the CREATE CLUSTER system privilege and a quota for the tablespace intended to contain the cluster or the UNLIMITED TABLESPACE system privilege.

To create a cluster in another user's schema you must have the CREATE ANY CLUSTER system privilege, and the owner must have a quota for the tablespace intended to contain the cluster or the UNLIMITED TABLESPACE system privilege.
Create & Alter Clusters

SQL DDL Command for Cluster

CREATE CLUSTER emp_dept (deptno NUMBER(3))
SIZE 600
TABLESPACE users
STORAGE (INITIAL 200K NEXT 300K MINEXTENTS 2 PCTINCREASE 33);
Create & Alter Clusters

Creating a Table in a Cluster

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To create a table in a cluster, you must have either the CREATE TABLE or CREATE ANY TABLE system privilege. You do not need a tablespace quota or the UNLIMITED TABLESPACE system privilege to create a table in a cluster.
Create & Alter Clusters

Creating Cluster using SQL

CREATE TABLE emp (
empno NUMBER(5) PRIMARY KEY,
ename VARCHAR2(15) NOT NULL,
. . .
deptno NUMBER(3) REFERENCES dept) CLUSTER emp_dept (deptno);

CREATE TABLE dept (
deptno NUMBER(3) PRIMARY KEY, . . .)
CLUSTER emp_dept (deptno);
Create & Alter Clusters

Altering Clusters

To alter a cluster, your schema must contain the cluster or you must have the ALTER ANY CLUSTER system privilege. You can alter an existing cluster to change the following settings:
Physical attributes (INITRANS and
storage characteristics)
The average amount of space required to store all the rows for a cluster key value (SIZE)
The default degree of parallelism
Create & Alter Clusters

Altering Clusters

To alter a cluster, your schema must contain the cluster or you must have the ALTER ANY CLUSTER system privilege. You can alter an existing cluster to change the following settings:
Physical attributes (INITRANS and
storage characteristics)
The average amount of space required to store all the rows for a cluster key value (SIZE)
The default degree of parallelism
Create & Alter Clusters

Dropping Clusters

To alter a cluster, your schema must contain the cluster or you must have the ALTER ANY CLUSTER system privilege. You can alter an existing cluster to change the following settings:
Physical attributes (INITRANS and

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storage characteristics)
The average amount of space required to store all the rows for a cluster key value (SIZE)
The default degree of parallelism
Create & Alter Clusters

Dropping Clusters

DROP CLUSTER emp_dept INCLUDING TABLES;

DROP CLUSTER emp_dept INCLUDING
TABLES CASCADE CONSTRAINTS;

End
Introduction to Database Administration

TOPIC 106

Data Dictionary Views for Clusters

Data Dictionary Views for Clusters

Data Dictionary Views

Three Types of Views
Displaying Views for Clusters
Display Cluster's Details
Displaying Cluster on Table's Column
Data Dictionary Views for Clusters

Three Types of Views

There are three types of Views to manage Cluster related information:

DBA_ ALL_ USER_
Data Dictionary Views for Clusters

Displaying Views for Clusters

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SQL statement to display Indexes related Views:

```
Select Table_name
From Dict
Where Table_name like '%CLU%';
```

You can use following views as well: DBA_CLU_COLUMNS USER_CLU_COLUMNS
Data Dictionary Views for Clusters

Display Cluster's Details

To find cluster's information

```
SQL> conn sys / as sysdba
Enter password:
Connected.
SQL> select cluster_name, Tablespace_name, cache
  2  from user_clusters;

CLUSTER_NAME                   TABLESPACE_NAME                CACHE
------------------------------ ------------------------------ -----
C_USER#                        SYSTEM                             N
C_TS#                          SYSTEM                             N
C_TOID_VERSION#                SYSTEM                             N
C_RG#                          SYSTEM                             N
C_OBJ#_INTCOL#                 SYSTEM                             N
C_OBJ#                         SYSTEM                             N
C_MLOG#                        SYSTEM                             N
C_FILE#_BLOCK#                 SYSTEM                             N
C_COBJ#                        SYSTEM                             N
SMON_SCN_TO_TIME_AUX           SYSAUX                             N

10 rows selected.
```

Data Dictionary Views for Clusters

Displaying Cluster on Table's Column

```
SQL> select c.cluster_name, c.Tablespace_name, c.cluster_name, cc.clu_column_name
  2  from user_clusters c, user_clu_columns cc
  3  where c.cluster_name=cc.cluster_name;

CLUSTER_NAME                   TABLESPACE_NAME                CLUSTER_NAME                   CLU_COLUMN_NAME
------------------------------ ------------------------------ ------------------------------ ---------------
---
C_COBJ#                        SYSTEM                         C_COBJ#                        OBJ#
C_COBJ#                        SYSTEM                         C_COBJ#                        OBJ#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 SEGFILE#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 SEGBLOCK#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 TS#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 SEGFILE#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 SEGBLOCK#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 TS#
```

Introduction to Database Administration

TOPIC 107

Defining Hash Clusters

Defining Hash Clusters

Hash Clusters

What is a Hash Cluster?
Finding Rows in Index or Cluster?
Situation where useful Hashing
Creating Hash Clusters
Querying Hash Clusters
Defining Hash Clusters

What is a Hash Cluster?

Storing a table in a hash cluster is an optional way to improve the performance of data retrieval. A hash cluster provides an alternative to a non-clustered table with an index or an index cluster. With an indexed table or index cluster, Oracle Database locates the rows in a table using key values that the database stores in a separate index.
Defining Hash Clusters

What is a Hash Cluster?

To use hashing, you create a hash cluster and load tables into it. The database physically stores the rows of a table in a hash cluster and retrieves them according to the results of a hash function.
Oracle Database uses a hash function to generate a distribution of numeric values, called hash values, that are based on specific cluster key values.
Defining Hash Clusters

What is a Hash Cluster?

The key of a hash cluster, like the key of an index cluster, can be a single column or composite key (multiple column key).
To find or store a row in a hash cluster, the database applies the hash function to the cluster key value of the row.

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The resulting hash value corresponds to a data block in the cluster, which the database then reads or writes on behalf of the issued statement.
Defining Hash Clusters

Finding Rows in Index or Cluster?

One or more I/Os to find or store the key value in the index
Another I/O to read or write the row in the table or cluster
Defining Hash Clusters

Situation where useful Hashing

Most queries are equality queries on the cluster key:

SELECT ... WHERE cluster_key = ...;

In such cases, the cluster key in the equality condition is hashed, and the corresponding hash key is usually found with a single read. In comparison, for an indexed table the key value must first be found in the index, and then the row is read from the table (another read).
Defining Hash Clusters

Situation where useful Hashing

The tables in the hash cluster are primarily static in size so that you can determine the number of rows and amount of space required for the tables in the cluster. If tables in a hash cluster require more space than the initial allocation for the cluster, performance degradation can be substantial because overflow blocks are required.
Defining Hash Clusters

Creating Hash Clusters

```
CREATE CLUSTER trial_cluster ( trialno NUMBER(5,0) )
TABLESPACE users STORAGE ( INITIAL 250K
NEXT 50K MINEXTENTS 1
MAXEXTENTS 3
PCTINCREASE 0 )
HASH IS trialno HASHKEYS 150;
```
Defining Hash Clusters

Creating Hash Clusters

The following statement creates the trial table in the trial_cluster hash cluster:

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```
CREATE TABLE trial (
trialno NUMBER(5,0) PRIMARY KEY,
...
)
CLUSTER trial_cluster (trialno);
```

Defining Hash Clusters

Querying Hash Clusters

```
TELEPHONE_NUMBER CALL_TIMESTAMP CALL_DURATION OTHER_INFO
---------------- -------------- ------------- --------------------------
      6505551212              0             9 misc info
      6505551212              1            17 misc info
      6505551212              2             5 misc info
      6505551212              3            90 misc info

Execution Plan
----------------------------------------------------------
Plan hash value: 2118876266

-------------------------------------------------------------------------
| Id  | Operation         | Name        | Rows  | Bytes | Cost (%CPU)|
-------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |             |     1 |    56 |     0   (0)|
|*  1 |  TABLE ACCESS HASH| CALL_DETAIL |     1 |    56 |            |
-------------------------------------------------------------------------
```

Introduction to Database Administration

TOPIC 108

Creating & Altering Hash Clusters

Creating & Altering Hash Clusters

Creating & Altering Hash Clusters

Creating Hash Clusters
Querying Hash Clusters

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Estimating Hash Clusters Size
Altering Hash Clusters
Dropping Hash Clusters
Creating & Altering Hash Clusters

Creating Hash Clusters

```
CREATE CLUSTER trial_cluster ( trialno NUMBER(5,0) )
TABLESPACE users STORAGE ( INITIAL 250K
NEXT 50K MINEXTENTS 1
MAXEXTENTS 3
PCTINCREASE 0 )
HASH IS trialno HASHKEYS 150;
```

Creating & Altering Hash Clusters

Creating Hash Clusters

The following statement creates the trial table in the trial_cluster hash cluster:

```
CREATE TABLE trial (
trialno NUMBER(5,0) PRIMARY KEY,
...
)
CLUSTER trial_cluster (trialno);
```

Creating & Altering Hash Clusters

Querying Hash Clusters

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```
TELEPHONE_NUMBER CALL_TIMESTAMP CALL_DURATION OTHER_INFO
---------------- -------------- ------------- --------------------------
      6505551212              0             9 misc info
      6505551212              1            17 misc info
      6505551212              2             5 misc info
      6505551212              3            90 misc info

Execution Plan
----------------------------------------------------------
Plan hash value: 2118876266

-------------------------------------------------------------------------------
| Id  | Operation          | Name        | Rows  | Bytes | Cost (%CPU)|
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |             |     1 |    56 |     0   (0)|
|*  1 |  TABLE ACCESS HASH| CALL_DETAIL |     1 |    56 |            |
-------------------------------------------------------------------------------
```

Creating & Altering Hash Clusters

Estimating Hash Clusters Size

Example:
STORAGE (INITIAL 100K
NEXT 150K MINEXTENTS 1
PCTINCREASE 0)
SIZE 1500
HASHKEYS 100

In this example, only one hash key can be assigned for each data block. Therefore, the initial space required for the hash cluster is at least 100*2K or 200K.
Creating & Altering Hash Clusters

Altering Hash Clusters

You can alter a hash cluster with the ALTER CLUSTER statement:
ALTER CLUSTER emp_dept . . . ;
The implications for altering a hash cluster are identical to those for altering an index cluster, described in. However, the SIZE, HASHKEYS, "Altering Clusters" on page 22- 6 and HASH IS parameters cannot be specified in an ALTER CLUSTER statement. To change these parameters, you must re- create the cluster, then copy the data from the original cluster.
Creating & Altering Hash Clusters

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Dropping Hash Clusters

You can drop a hash cluster using the DROP CLUSTER statement:

DROP CLUSTER emp_dept;

A table in a hash cluster is dropped using the DROP TABLE statement. The implications of dropping hash clusters and tables in hash clusters are the same as those for dropping index clusters.

Introduction to Database Administration

TOPIC 109

Data Dictionary Views for Hash Clusters

Data Dictionary Views for Hash Clusters

Data Dictionary Views

Three Types of Views
Displaying Views for Hash Clusters
Display Hash or just Cluster's Details
Displaying Cluster on Table's Column
Data Dictionary Views for Hash Clusters

Three Types of Views

There are three types of Views to manage Hash Cluster related information:

DBA_ ALL_ USER_
Data Dictionary Views for Hash Clusters

Displaying Views for Hash Clusters

SQL statement to display Indexes related Views:

Select Table_name From Dict
Where Table_name like '%SYN%';

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You can use following views as well: DBA_UPDATABLE_COLUMNS ALL_UPDATABLE_COLUMNS USER_UPDATABLE_COLUMNS
Data Dictionary Views for Hash Clusters

Display Hash or just Cluster's Details

To find cluster's information

```
SQL> conn sys / as sysdba
Enter password:
Connected.
SQL> select cluster_name, Tablespace_name, cache
  2  from user_clusters;

CLUSTER_NAME                   TABLESPACE_NAME                CACHE
------------------------------ ------------------------------ -----
C_USER#                        SYSTEM                             N
C_TS#                          SYSTEM                             N
C_TOID_VERSION#                SYSTEM                             N
C_RG#                          SYSTEM                             N
C_OBJ#_INTCOL#                 SYSTEM                             N
C_OBJ#                         SYSTEM                             N
C_MLOG#                        SYSTEM                             N
C_FILE#_BLOCK#                 SYSTEM                             N
C_COBJ#                        SYSTEM                             N
SMON_SCN_TO_TIME_AUX           SYSAUX                             N

10 rows selected.
```

Data Dictionary Views for Hash Clusters

Displaying Cluster on Table's Column

```
SQL> select c.cluster_name, c.Tablespace_name, c.cluster_name, cc.clu_column_name
  2  from user_clusters c, user_clu_columns cc
  3  where c.cluster_name=cc.cluster_name;

CLUSTER_NAME                   TABLESPACE_NAME                CLUSTER_NAME                   CLU_COLUMN_NAME
------------------------------ ------------------------------ ------------------------------ ---------------
---
C_COBJ#                        SYSTEM                         C_COBJ#                        OBJ#
C_COBJ#                        SYSTEM                         C_COBJ#                        OBJ#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 SEGFILE#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 SEGBLOCK#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 TS#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 SEGFILE#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 SEGBLOCK#
C_FILE#_BLOCK#                 SYSTEM                         C_FILE#_BLOCK#                 TS#
```

Introduction to Database Administration

TOPIC 110

Defining & Managing Views

Defining & Managing Views

Defining & Managing Views

How a Schema is Created?
How a Schema is Implemented?
Simple & Complex Views
SQL Practices on Views
Defining & Managing Views

How a Schema is Created?

We have studied that DBA has to create default Tablespace and assign temporary Tablespace with storage in terms of data files.
Create first user (owner of schema) with grants such as rights and privileges.
We will cover schema objects Tables
and Views.
Ref. DBA-73
Defining & Managing Views

How a Schema is Implemented?

A view is a logical representation of a table or combination of tables.
In essence, a view is a stored query.
A view derives its data from the tables
on which it is based.
These tables are called base tables. Base tables might in turn be actual tables or might be views themselves.
All operations performed on a view actually affect the base table of the view.
Defining & Managing Views

How a Schema is Implemented?

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You can use views in almost the same way as tables. You can query, update, insert into, and delete from views, just as you can standard tables.
Views can provide a different representation (such as subsets or supersets) of the data that resides within other tables and views.
Views can be Simple or Complex
Views can be used for security purposes
View does not contain its own data
Defining & Managing Views

Simple & Complex Views

CREATE VIEW sales_staff AS SELECT empno, ename, deptno FROM emp
WHERE deptno = 10;

CREATE VIEW sales_staff AS
SELECT job, count(*) FROM emp
WHERE deptno = 10 Group by job;
Defining & Managing Views

SQL Practices on Views

We can apply Insert, delete and update operations on simple views. for base tables

End
Introduction to Database Administration

TOPIC 111

Updating a Join View
Updating a Join View

Updating a Join View

Introduction
Rules for Updating Join Views
Example-1 of a Join View
Example-2 of a Join View
Data Dictionary View for Join Views

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Updating a Join View

Introduction

An updatable join view (also referred to as a modifiable join view) is a view that contains multiple tables in the top-level FROM clause of the SELECT statement, and is not restricted by the WITH READ ONLY clause.
Updating a Join View

Rules for Updating Join Views

The rules for updatable join views are shown in the following table. Views

Rule	Description
General Rule	Any `INSERT`, `UPDATE`, or `DELETE` operation on a join view can modify only one underlying base table at a time.
`UPDATE` Rule	All updatable columns of a join view must map to columns of a **key-preserved table**. See "Key-Preserved Tables" on page 24-7 for a discussion of key-preserved tables. If the view is defined with the `WITH CHECK OPTION` clause, then all join columns and all columns of repeated tables are not updatable.
`DELETE` Rule	Rows from a join view can be deleted as long as there is exactly one key-preserved table in the join. The key preserved table can be repeated in the `FROM` clause. If the view is defined with the `WITH CHECK OPTION` clause and the key preserved table is repeated, then the rows cannot be deleted from the view.
`INSERT` Rule	An `INSERT` statement must not explicitly or implicitly refer to the columns of a **non-key-preserved table**. If the join view is defined with the `WITH CHECK OPTION` clause, `INSERT` statements are not permitted.

that meet these criteria are said to be inherently updatable.

DBA E25494 Oracle11g.pdf pp. 24-6
Updating a Join View

Example-1 of a Join View

```
CREATE VIEW emp_dept AS
SELECT emp.empno, emp.ename, emp.deptno, emp.sal, dept.dname, dept.loc FROM emp,
dept
WHERE emp.deptno = dept.deptno
AND
```

dept.loc IN ('DALLAS', 'NEW YORK', 'BOSTON');

EMPNO	ENAME	DEPTNO	DNAME	LOC
7782	CLARK	10	ACCOUNTING	NEW YORK
7839	KING	10	ACCOUNTING	NEW YORK
7934	MILLER	10	ACCOUNTING	NEW YORK
7369	SMITH	20	RESEARCH	DALLAS
7876	ADAMS	20	RESEARCH	DALLAS

Updating a Join View
Example-1 of a Join View

CREATE VIEW emp_dept AS
SELECT emp.empno, emp.ename, emp.deptno, emp.sal, dept.dname, dept.loc FROM emp, dept
WHERE emp.deptno = dept.deptno
AND

```
UPDATE emp_dept
      SET sal = sal * 1.10
      WHERE deptno = 10;
```

dept.loc IN ('DALLAS', 'NEW YORK', 'BOSTON');

```
UPDATE emp_dept
     SET deptno = 10
     WHERE ename = 'SMITH';
ORA-01779 cannot modify a column
```

```
UPDATE emp_dept
     SET loc = 'BOSTON'
     WHERE ename = 'SMITH';
ORA-01779 cannot modify a column which mapsto a non key-preserved table
```

Updating a Join View
Example-2 of a Join View

CREATE VIEW emp_mgr AS

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```
SELECT e1.ename, e2.ename mname FROM emp e1, emp e2
WHERE e1.mgr = e2.empno
WITH CHECK OPTION;
```

Following statement works successfully:

```
INSERT INTO emp_dept (ename, empno, deptno)
VALUES ('KURODA', 9010, 40);
```

Updating a Join View

Example-2 of a Join View

The following INSERT statements would fail with an error (ORA-01776 cannot modify more than one base table through a join view):

```
INSERT INTO emp_dept (ename, empno, deptno)
VALUES ('KURODA', 9010, 77); --FK value not found in department table

INSERT INTO emp_dept (empno, ename, loc)
VALUES (9010, 'KURODA', 'BOSTON'); --cannot insert data in two tables
```

Updating a Join View

Data Dictionary View for Join Views

If you are in doubt whether a view is modifiable, then you can select from the USER_UPDATABLE_COLUMNS view to see if it is. For example:

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```
SELECT owner, table_name, column_name, updatable FROM USER_UPDAT
     WHERE TABLE_NAME = 'EMP_DEPT_VIEW';
```

This returns output similar to the following:

```
OWNER        TABLE_NAME      COLUMN_NAM      UPD
----------   ----------      ----------      ---
SCOTT        EMP_DEPT_V      EMPNO           NO
SCOTT        EMP_DEPT_V      ENAME           NO
SCOTT        EMP_DEPT_V      DEPTNO          NO
SCOTT        EMP_DEPT_V      DNAME           NO
SCOTT        EMP_DEPT_V      LOC             NO
5 rows selected.
```


TOPIC 112

Create Sequences

Create Sequences

Create Sequences

An Overview
Sequence Characteristics
Sequence Example-1
Concurrent Access to Sequence
Sequence Syntax
Sequence Example-2
Data Dictionary Views for Sequence
Create Sequences

An Overview

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A sequence (Autonumber) is a schema object from which multiple users can generate unique integers. A sequence generator provides a highly scalable and well-performing method to generate surrogate keys for a number data type.
Create Sequences

Sequence Characteristics

A sequence definition indicates general information, such as the following:
The name of the sequence
Whether the sequence ascends or descends The interval between numbers
Whether the database should cache sets of generated sequence numbers in memory
Whether the sequence should cycle
when a limit is reached
Create Sequences

Sequence Example-1

CREATE SEQUENCE customers_seq START WITH 1000
INCREMENT BY 1 NOCACHE NOCYCLE;
Create Sequences

Concurrent Access to Sequence

The same sequence generator can generate numbers for multiple tables. In this way, the database can generate primary keys automatically and coordinate keys across multiple rows or tables.
For example, a sequence can generate primary keys for an orders table and a customers table.
Create Sequences

Sequence Syntax

CREATE SEQUENCE user.sequence_name [INCREMENT BY interval]
[START WITH first_number]
[MAXVALUE max_value | NOMAXVALUE] [MINVALUE min_value | NOMINVALUE]
[CYCLE | NOCYCLE]
[CACHE cache_size | NOCACHE] [ORDER | NOORDER];
Create Sequences

Sequence Example-2

CREATE SEQUENCE id_seq INCREMENT BY 10
START WITH 10
MINVALUE 10

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MAXVALUE 100 CYCLE
CACHE 2;
To get the next value of the sequence, you
use the NEXTVAL pseudo-column:

SELECT id_seq.NEXTVAL FROM dual;
Create Sequences

Sequence Example-2

INSERT INTO tasks(id, title) VALUES(seq.NEXTVAL, 'Create Sequence in Oracle');

SELECT id_seq.NEXTVAL FROM dual;
Create Sequences

Data Dictionary Views for Sequence

USER_SEQUENCES ALL_SEQUENCES SEQ

End
Introduction to Database Administration

TOPIC 113

Alter & Drop Sequences

Alter & Drop Sequences

Alter & Drop Sequences

An Overview
NEXTVAL & CURRVAL
Caching Sequence Number
Dropping Sequences
Alter & Drop Sequences

An Overview

To alter a sequence, your schema must contain the sequence, you must have the ALTER object privilege on the sequence, or you must have the ALTER ANY SEQUENCE system privilege.

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You can alter a sequence to change any of the parameters that define how it generates sequence numbers except the sequence starting number. To change the starting point of a sequence, drop the sequence and then re-create it.
Alter & Drop Sequences

An Overview

Alter a sequence using the ALTER SEQUENCE statement. For example, the following statement alters the emp_seq:

```
ALTER SEQUENCE emp_seq
INCREMENT BY 10
MAXVALUE 10000 CYCLE
CACHE 20;
```

Alter & Drop Sequences

NEXTVAL & CURRVAL

CURRVAL and NEXTVAL cannot be used in the following places:
A subquery
A view query or materialized view query
A SELECT statement with the DISTINCT operator
A SELECT statement with a GROUP BY or ORDER BY clause
Alter & Drop Sequences

NEXTVAL & CURRVAL

A SELECT statement that is combined with another SELECT statement with the UNION, INTERSECT, or MINUS set operator
The WHERE clause of a SELECT
statement
The condition of a CHECK constraint
Alter & Drop Sequences

Caching Sequence Number

Follow these guidelines for fast access to all sequence numbers:
Be sure the sequence cache can hold all the sequences used concurrently by your applications.
Increase the number of values for each sequence held in the sequence cache.
Alter & Drop Sequences

Dropping Sequences

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You can drop any sequence in your schema. To drop a sequence in another schema, you must have the DROP ANY SEQUENCE system privilege. If a sequence is no longer required, you can drop the sequence using the DROP SEQUENCE statement.
Alter & Drop Sequences

Dropping Sequences
For example, the following statement
drops the order_seq sequence: DROP SEQUENCE order_seq;
When a sequence is dropped, its definition is removed from the data dictionary. Any synonyms for the sequence remain, but return an error when referenced.

Introduction to Database Administration

TOPIC 114

Defining Synonyms
Defining Synonyms

Defining Sequences

An Overview
Public & Private Synonyms
Securable Synonyms
DDL Create Synonyms
Select script for all Tables
Defining Synonyms

An Overview

A synonym is an alias for a schema object.
Synonyms can provide a level of security by masking the name and owner of an object and by providing location transparency for remote objects of a distributed database.
Also, they are convenient to use and reduce the complexity of SQL statements for database users.
Defining Synonyms

An Overview

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Synonyms allow underlying objects to be renamed or moved, where only the synonym must be redefined and applications based on the synonym continue to function without modification.
User u1 can access table of user scott as Select * from scott.emp;
But we want u1 uses statement as Select * from emp;
User scott should create emp synonym with the same name
Defining Synonyms

Public & Private Synonyms

You can create both public and private synonyms.
A public synonym is owned by the special user group named PUBLIC and is accessible to every user in a database.
A private synonym is contained in the schema of a specific user and available only to the user and to grantees for the underlying object.
Defining Synonyms

Securable Synonyms

Synonyms themselves are not securable. When you grant object privileges on a synonym, you are really granting privileges on the underlying object, and the synonym is acting only as an alias for the object in the GRANT statement.
Defining Synonyms

Securable Synonyms

To create a private synonym in your own schema, you must have the CREATE SYNONYM privilege.

To create a private synonym in another user's schema, you must have the CREATE ANY SYNONYM privilege.

To create a public synonym, you must have the CREATE PUBLIC SYNONYM system privilege.
Defining Synonyms

DDL Create Synonyms

Following sample DDL command is required to create public synonym:

```
CREATE PUBLIC SYNONYM public_emp
FOR ejaz.emp
```

Creating synonym inside same user’s schema

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create synonym syn_emp for scott.emp;
Defining Synonyms
Select Script for all Tables

select 'create synonym '||tname||' for u1.'||tname||';'
from tab;

```
'CREATESYNONYM'||TNAME||'FORU1.'||TNAME||';'
--------------------------------------------------
create synonym BONUS for u1.BONUS;
create synonym DEPT for u1.DEPT;
create synonym DUMMY for u1.DUMMY;
create synonym EMP for u1.EMP;
create synonym PROJASSIGN for u1.PROJASSIGN;
create synonym PROJECT for u1.PROJECT;
create synonym SALGRADE for u1.SALGRADE;

7 rows selected.

SQL>
```

Introduction to Database Administration

TOPIC 115

Create & Drop Synonyms
Create & Drop Synonyms

Create & Drop Sequences

Specifying Schema
FOR Clause
Create Synonym for Objects
Create Synonym Examples
Accessing Synonym
Drop Synonym
Synonym Syntax

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Create & Drop Synonyms

Specifying Schema

Specify the schema to contain the synonym. If you omit schema, then Oracle Database creates the synonym in your own schema. You cannot specify a schema for the synonym if you have specified PUBLIC.
Create & Drop Synonyms

FOR Clause

Specify the object for which the synonym is created. The schema object for which you are creating the synonym can be of the following types:

Table or object table
View or object view
Sequence
Stored procedure, function, or package
Materialized view
Java class schema object
User-defined object type & Synonym
Create & Drop Synonyms

Create Synonym for Objects

Specify the object for which the synonym is created. The schema object for which you are creating the synonym can be of the following types:

Table or object table
View or object view
Sequence
Stored procedure, function, or package
Materialized view
Java class schema object
User-defined object type & Synonym
Create & Drop Synonyms

Create Synonym Examples

To define the synonym offices for the table locations in the schema hr, issue the following statement:

CREATE SYNONYM offices FOR hr.locations;

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Create & Drop Synonyms

Create Synonym Examples

To create a PUBLIC synonym for the emp table in the schema hr on the remote database, you could issue the following statement:

CREATE PUBLIC SYNONYM emp_table
FOR hr.emp@remote.us.oracle.com;
Create & Drop Synonyms

Accessing Synonym

If the user hr's schema does not contain an object named customers, and if hr has select permission on oe.customers, then hr can access the customers table in oe's schema by using the public synonym customers:

SELECT COUNT(*) FROM customers;
Create & Drop Synonyms

Drop Synonym

Following commands can be used to drop synonyms

drop synonym dept;
drop synonym emp;

drop Public synonym customer;
Create & Drop Synonyms

Synonym Syntax

Following is a complete syntax of creating Synonym

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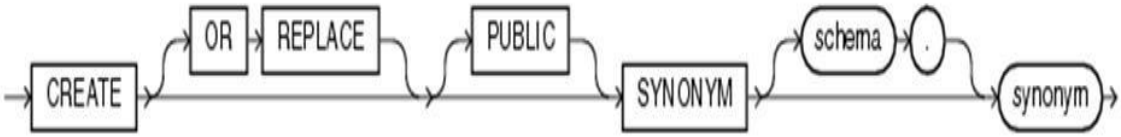

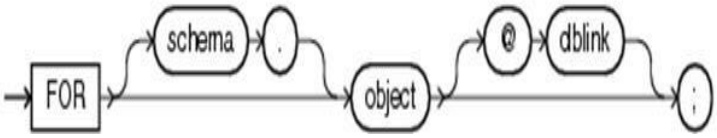

Ref: docs.oracle.com
Introduction to Database Administration

TOPIC 116

Data Dictionary Views for Synonyms, Views & Sequences

Data Dictionary Views for Synonyms, Views & Sequences

Create & Drop Sequences

Three Types of Views
Displaying Views
Data Dictionary Views for Synonym
Data Dictionary Views for Sequence
Data Dictionary Views for VIEWS
Data Dictionary Views for Synonyms, Views & Sequences

Three Types of Views

There are three types of Views to manage Hash Cluster related information:

DBA_ ALL_ USER_
Data Dictionary Views for Synonyms, Views & Sequences

Displaying Views

SQL statement to display Indexes related Views:

Select Table_name

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From Dict
Where Table_name like '%SYN%';
Or use ('%VIEW%' or '%SEQ%‘)
You can use following views as well: DBA_UPDATABLE_COLUMNS
ALL_UPDATABLE_COLUMNS USER_UPDATABLE_COLUMNS
Data Dictionary Views for Synonyms, Views & Sequences

Data Dictionary Views for Synonym

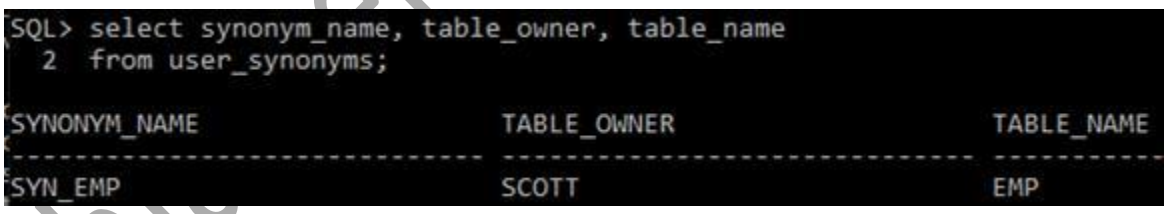
Following views can be used to see synonyms

Select object_name, object_type
from user_objects
where object_type='SYNONYM'; Select * from TAB;
Data Dictionary Views for Synonyms, Views & Sequences

Data Dictionary Views for Synonym

Following view can be used to see synonyms

select synonym_name, table_owner,
table_name
from user_synonyms;



```
SQL> select synonym_name, table_owner, table_name
  2  from user_synonyms;

SYNONYM_NAME                   TABLE_OWNER                    TABLE_NAME
------------------------------ ------------------------------ ----------
SYN_EMP                        SCOTT                          EMP
```

Data Dictionary Views for Synonyms, Views & Sequences

Data Dictionary Views for Sequence

Following sequence is created:

CREATE SEQUENCE customers_seq START WITH 1000
INCREMENT BY 1 NOCACHE NOCYCLE;
Data Dictionary Views for Synonyms, Views & Sequences

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Data Dictionary Views for Sequence

Following view can be used to see synonyms

```
select object_name, object_type
from user_objects
where object_type='SEQUENCE';
```

Data Dictionary Views for Synonyms, Views & Sequences

Data Dictionary Views for Sequence

Following view can be used to see synonyms

```
select sequence_name, cycle_flag,
cache_size, last_number from user_sequences;
```

```
SEQUENCE_NAME                  C CACHE_SIZE LAST_NUMBER
------------------------------ - ---------- -----------
CUSTOMERS_SEQ                  N          0        1000
```

Data Dictionary Views for Synonyms, Views & Sequences

Data Dictionary Views for VIEWS

```
grant create view to scott; create view v_emp
AS
select job, count(*) Count_EMP from emp
group by job;
```

Data Dictionary Views for Synonyms, Views & Sequences

Data Dictionary Views for VIEWS

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```
SQL> select view_name, text
  2  from user_views;

VIEW_NAME
------------------------------
TEXT
--------------------------------------------------------------------------------
V_EMP
select job, count(*) Count_EMP
from emp
group by job


SQL>
```

Following view can be used to see synonyms

End
Introduction to Database Administration

TOPIC 117

Introduction to Database Server Programming using PL/SQL

Introduction to Database Server Programming using PL/SQL

Introduction to PL/SQL

What is PL/SQL
PL/SQL & Other Languages
Introduction to Database Server Programming using PL/SQL

What is PL/SQL

Embedded structured programming
Performed on Server Machine
Centrally accessible from single database
Executed on server without any network overhead

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Introduction to Database Server Programming using PL/SQL

PL/SQL & Other Languages

Embedded SQL (PL/SQL, JAVA/ VB & DB)
Database Server Level Programming(PL/SQL, Transact-SQL, IBM DB2-Cobol, ProC, ProCobol)
(Front end programming can be changed without affecting Server programming)
Database Client Programming (Developer 9i, JDeveloper 9i, Java (J2EE), VB, .Net)

Introduction to Database Administration

TOPIC 118

PL/SQL Constructs

PL/SQL Constructs

PL/SQL Constructs

SQL & PL/SQL
PL/SQL Data Types
PL/SQL Contents
PL/SQL Constructs

SQL & PL/SQL

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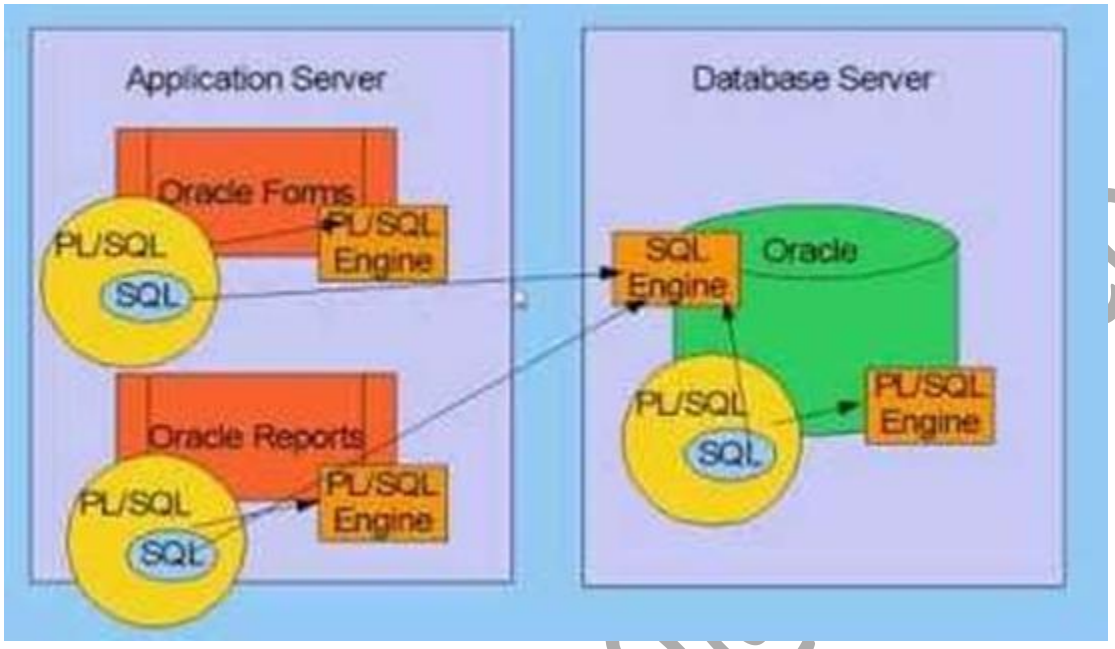
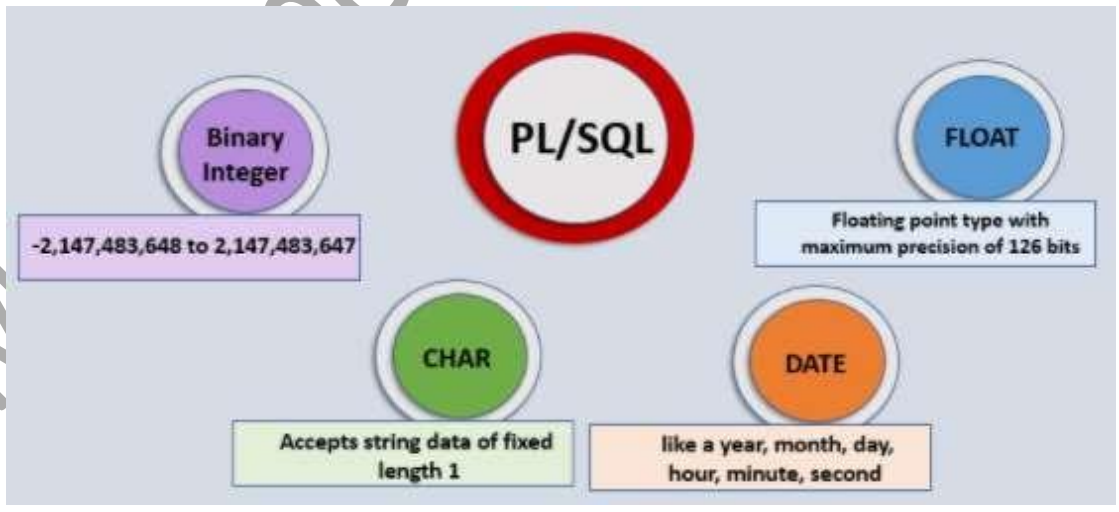
SQL & PL/SQL on Application & Server Sides



Ref: SQL ZeroToPro.com
PL/SQL Constructs

PL/SQL Data Types

Following main data types are used in PL/SQL



PL/SQL Constructs

PL/SQL Contents

Benefits
Basic Constructs
Anonymous blocks
Procedures
Functions
Packages
Triggers
Cursors
Dynamic SQL

End
Introduction to Database Administration

TOPIC 119

PL/SQL Benefits & Basic Constructs

PL/SQL Benefits & Basic Constructs

PL/SQL Benefits & Basic Constructs

PL/SQL Benefits
PL/SQL Basic Constructs
PL/SQL Benefits & Basic Constructs

PL/SQL Benefits

More powerful than pure SQL because it combines the power of SQL and
Iteration (loops)
Selection (Ifs)
Cursors
Block Structures
Stored Procedures
etc.
PL/SQL Benefits & Basic Constructs

PL/SQL Basic Constructs

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Basic Structure Running a program Variables
SELECT INTO
Comments IFs
LOOPs
Output
Introduction to Database Administration

TOPIC 120

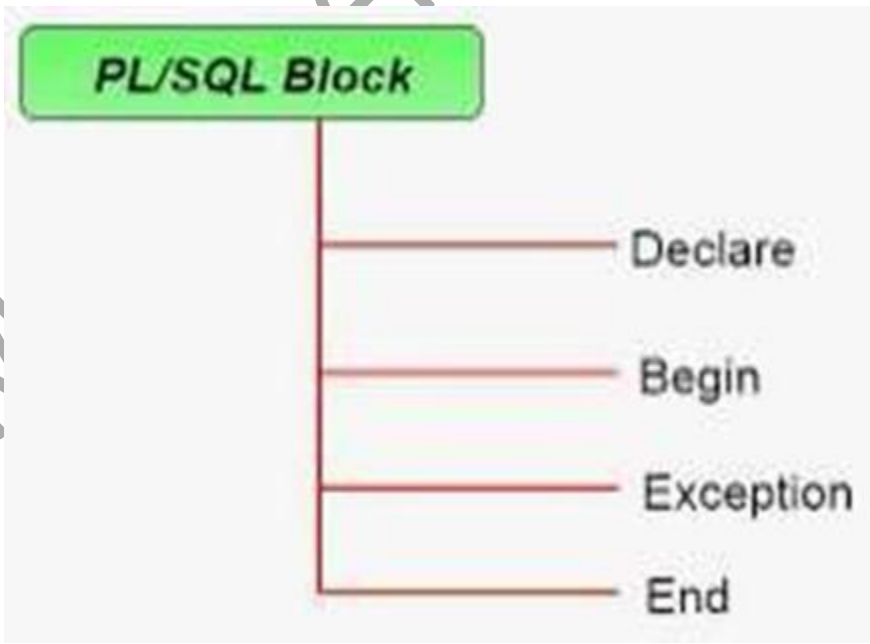
Basic Program Block Structure and Display output

Basic Program Block Structure and Display output

Basic Program Structure

Nested Basic Structures
First PL/SQL Program
First PL/SQL Program with Declaration
Basic Program Block Structure and Display output

Basic Structure



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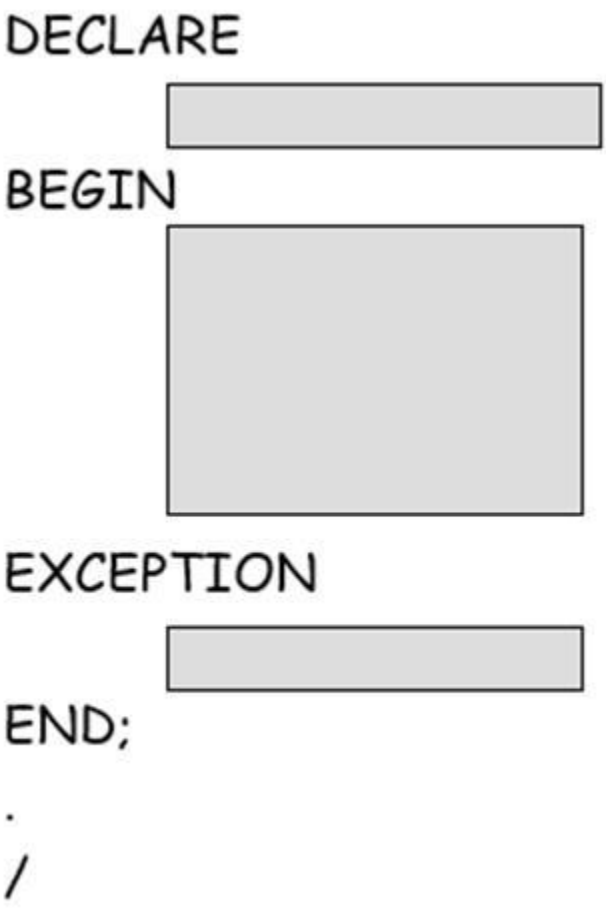
Basic Program Block Structure and Display output

Basic Structure



Basic Program Block Structure and Display output

Nested Basic Structures

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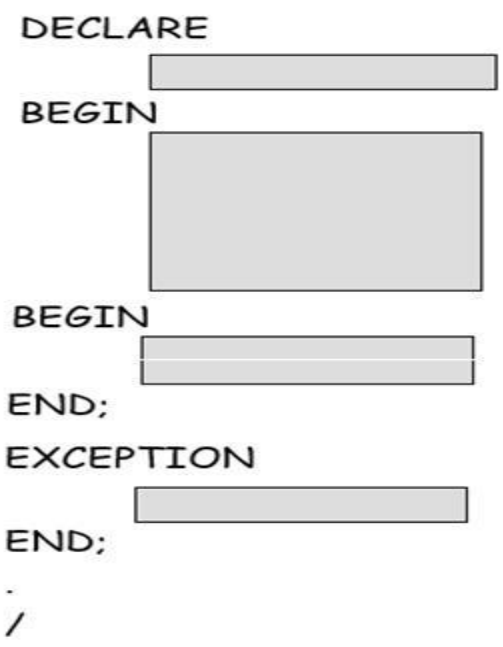

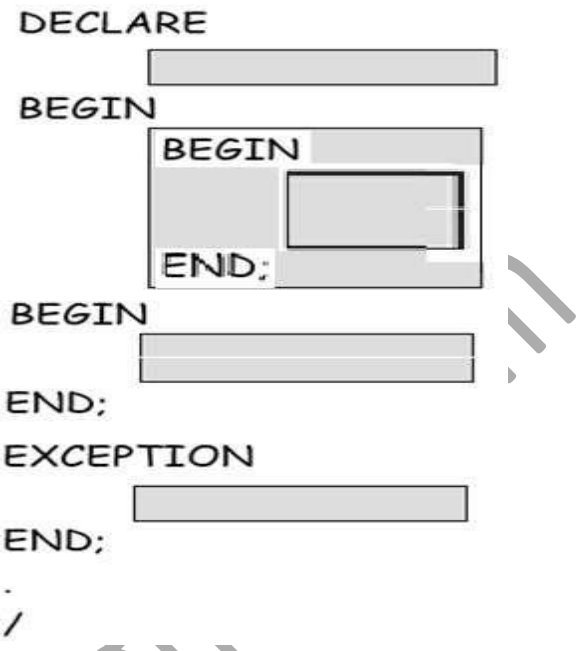

Basic Program Block Structure and Display output

First PL/SQL Program
SET SERVEROUTPUT ON; BEGIN
DBMS_OUTPUT.PUT_LINE('This is my first program'); END;
/

Before executing code that contains DBMS_OUTPUT.PUT_LINE, must run (in a current session) at SQL prompt: set serveroutput on.
System Package DBMS_OUTPUT exists in Oracle Dictionary. It accepts and return SINGLE argument.
Basic Program Block Structure and Display output

First PL/SQL Program with Declaration
SET SERVEROUTPUT ON; --if not runing already DECLARE
msg varchar2(40) := 'I love Oracle Programing' ; BEGIN

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```
SQL> DECLARE
  2       msg varchar2(40) := 'I love Oracle Programing' ;
  3  BEGIN
  4       dbms_output.put_line(msg);
  5  END;
  6  /
I love Oracle Programing

PL/SQL procedure successfully completed.

SQL>
```

dbms_output.put_line(msg); END;
/
Introduction to Database Administration

TOPIC 121

Basic Programs Block Structure with more examples
Basic Program Block Structures with More Examples

Basic Program Structure

Program Execution with an error
Program Fixing of an error
Program Compilation
Basic Program Block Structures with more Examples

Program Execution with an Error

Following program declarations, assigned values and display result:

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```
SQL> Declare
  2  -- declare variable x, y and z of datatype number
  3  x number(5);
  4  y number(5);
  5  z number(7);
  6  Begin
  7  -- Here we Assigning 10 into x
  8  x:=10;
  9  -- Assigning 20 into x
 10  y:=20;
 11  -- Assigning sum of x and y into z
 12  z:=x+y;
 13  --Print the Result
 14  dbms_output.put_line('Sum is '||z);
 15  End;
 16  /
Sum is 30
```

Basic Program Block Structures with more Examples

Program Fixing of an Error

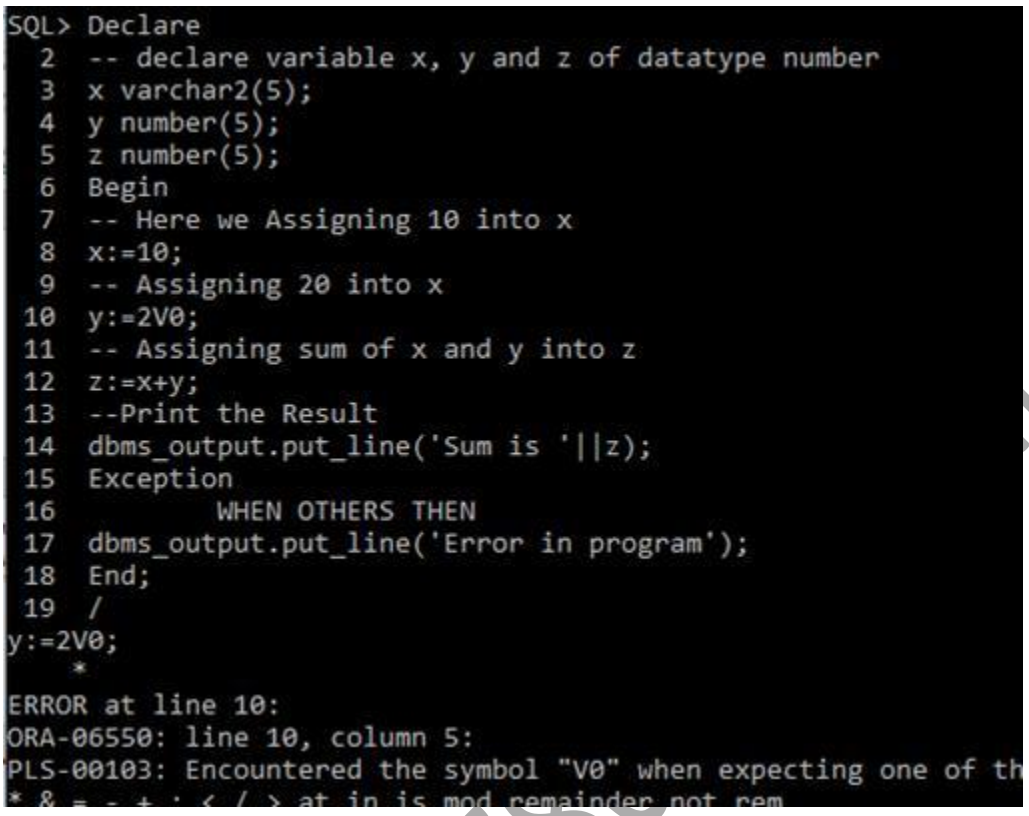
Following program terminates:

```
SQL> Declare
  2  -- declare variable x, y and z of datatype number
  3  x varchar2(5);
  4  y number(5);
  5  z number(5);
  6  Begin
  7  -- Here we Assigning 10 into x
  8  x:=10;
  9  -- Assigning 20 into x
 10  y:=2V0;
 11  -- Assigning sum of x and y into z
 12  z:=x+y;
 13  --Print the Result
 14  dbms_output.put_line('Sum is '||z);
 15  End;
 16  /
y:=2V0;
    *
ERROR at line 10:
ORA-06550: line 10, column 5:
PLS-00103: Encountered the symbol "V0" when expecting one of the following:
* & = - + ; < / > at in is mod remainder not rem
<an exponent (**)> <> or != or ~= >= <= <> and or like like2
like4 likec between || multiset member submultiset
The symbol "*" was substituted for "V0" to continue.
```

Basic Program Block Structures with more Examples

Program Compilation

Following program (Anonymous Block) executes with error due to compile &



```
SQL> Declare
  2  -- declare variable x, y and z of datatype number
  3  x varchar2(5);
  4  y number(5);
  5  z number(5);
  6  Begin
  7  -- Here we Assigning 10 into x
  8  x:=10;
  9  -- Assigning 20 into x
 10  y:=2V0;
 11  -- Assigning sum of x and y into z
 12  z:=x+y;
 13  --Print the Result
 14  dbms_output.put_line('Sum is '||z);
 15  Exception
 16          WHEN OTHERS THEN
 17  dbms_output.put_line('Error in program');
 18  End;
 19  /
y:=2V0;
    *
ERROR at line 10:
ORA-06550: line 10, column 5:
PLS-00103: Encountered the symbol "V0" when expecting one of th
* & = - + : < / > at in is mod remainder not rem
```

execute together
Introduction to Database Administration

TOPIC 122

Basic Programs Block Structure with more examples
Basic Program Block Structures with More Examples

Basic Program Structure

Program execution with an error
Program fixing of an error
Program with SELECT INTO
Basic Program Block Structures with more Examples

Program execution with an error

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Following program executes with an error during compilation/ execution:

```
SQL> DECLARE
  2        -- taking input for variable a
  3        a number := &a;
  4        -- taking input for variable b
  5        b varchar2(30) := &b;
  6  BEGIN
  7        c := a + b ;
  8       dbms_output.put_line('Sum of '||a||' and '||b||' is = '||c);
  9  END;
 10  /
Enter value for a: 4
old   3:       a number := &a;
new   3:       a number := 4;
Enter value for b: 9
old   5:       b varchar2(30) := &b;
new   5:       b varchar2(30) := 9;
      c := a + b ;
      *
ERROR at line 7:
ORA-06550: line 7, column 7:
PLS-00201: identifier 'C' must be declared
ORA-06550: line 7, column 7:
PL/SQL: Statement ignored
```

Basic Program Block Structures with more Examples

Program fixing of an error

Following program executes successfully:

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```
SQL> DECLARE
  2        -- taking input for variable a
  3        a number := &a;
  4        -- taking input for variable b
  5        b varchar2(30) := &b;
  6        c integer;
  7  BEGIN
  8        c := a + b ;
  9       dbms_output.put_line('Sum of '||a||' and '||b||' is = '||c);
 10  END;
 11  /
Enter value for a: 4
old   3:       a number := &a;
new   3:       a number := 4;
Enter value for b: 9
old   5:       b varchar2(30) := &b;
new   5:       b varchar2(30) := 9;
Sum of 4 and 9 is = 13

PL/SQL procedure successfully completed.
```

Basic Program Block Structures with more Examples
Program with SELECT INTO

Following program executes successfully with the retrieval of single record

```
SQL> DECLARE
  2        v_id      INTEGER;
  3        v_empno   NUMBER;
  4  BEGIN
  5       v_id := 7369;
  6       SELECT EMPNO
  7          INTO V_EMPNO
  8          FROM  EMP
  9          WHERE empno = v_id;
 10       DBMS_OUTPUT.PUT_LINE('Value is '||v_empno);
 11  EXCEPTION
 12       WHEN NO_DATA_FOUND THEN
 13        DBMS_OUTPUT.PUT_LINE('No record exists');
 14  END;
 15  /
Value is 7369

PL/SQL procedure successfully completed.
```

Basic Program Block Structures with more Examples
Program with SELECT INTO

Following program is terminated with the retrieval of single record

```
SQL> DECLARE
  2        v_id      INTEGER;
  3        v_empno   NUMBER;
  4  BEGIN
  5       v_id := 7777; --employee does not exists
  6       SELECT EMPNO
  7          INTO V_EMPNO
  8          FROM  EMP
  9          WHERE empno = v_id;
 10       DBMS_OUTPUT.PUT_LINE('Value is '||v_empno);
 11  END;
 12  /
DECLARE
*
ERROR at line 1:
ORA-01403: no data found
ORA-06512: at line 6
```

Basic Program Block Structures with more Examples

Program with SELECT INTO

Following program is successfully executed with the retrieval of single record and

```
SQL> DECLARE
  2        v_id      INTEGER;
  3        v_empno   NUMBER;
  4  BEGIN
  5       v_id := 7777; --employee does not exists
  6       SELECT EMPNO
  7          INTO V_EMPNO
  8          FROM  EMP
  9          WHERE empno = v_id;
 10       DBMS_OUTPUT.PUT_LINE('Value is '||v_empno);
 11  EXCEPTION
 12       WHEN NO_DATA_FOUND THEN
 13        DBMS_OUTPUT.PUT_LINE('No record exists');
 14  END;
 15  /
No record exists

PL/SQL procedure successfully completed.
```

exception raised.

Introduction to Database Administration

TOPIC 123

Compile & Run Program

Compile & Run Program

Compile & Run Program

Program Compilation & Execution
Program execution with an error
Run Program using SQL Developer
Compile Program using SQL Developer
Compile & Run Program

Program Compilation & Execution

```
DECLARE

BEGIN

EXCEPTION

END;
/
```

Following program compile and executes on SQL prompt:
Compile & Run Program

Program Compilation & Execution

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DECLARE

BEGIN

EXCEPTION END;

.

Following program run without compiling and execution on SQL prompt:
Compile & Run Program

Program execution with an error

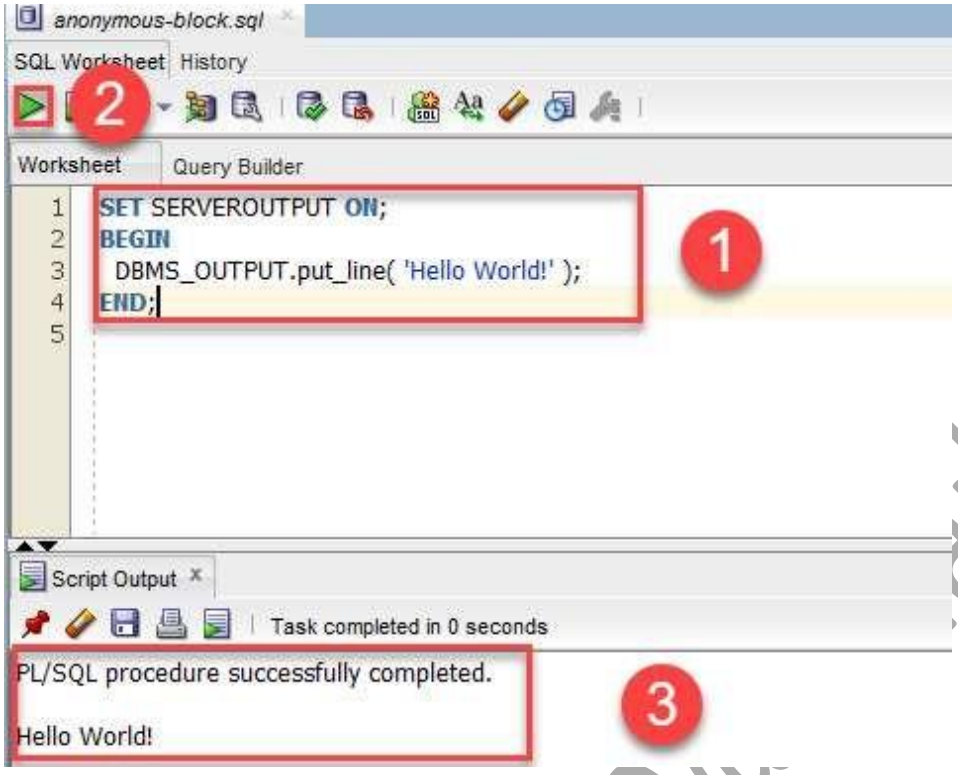
Following program executes with an error during compilation/ execution:

```
SQL> DECLARE
  2        -- taking input for variable a
  3        a number := &a;
  4        -- taking input for variable b
  5        b varchar2(30) := &b;
  6  BEGIN
  7        c := a + b ;
  8       dbms_output.put_line('Sum of '||a||' and '||b||' is = '||c);
  9  END;
 10  /
Enter value for a: 4
old   3:        a number := &a;
new   3:        a number := 4;
Enter value for b: 9
old   5:        b varchar2(30) := &b;
new   5:        b varchar2(30) := 9;
      c := a + b ;
      *
ERROR at line 7:
ORA-06550: line 7, column 7:
PLS-00201: identifier 'C' must be declared
ORA-06550: line 7, column 7:
PL/SQL: Statement ignored
```

Compile & Run Program

Run Program using SQL Developer

To compile the procedure, you click the Run Statement button:



Compile & Run Program

Run Program using SQL Developer

To compile the procedure, you click the Run Statement button:

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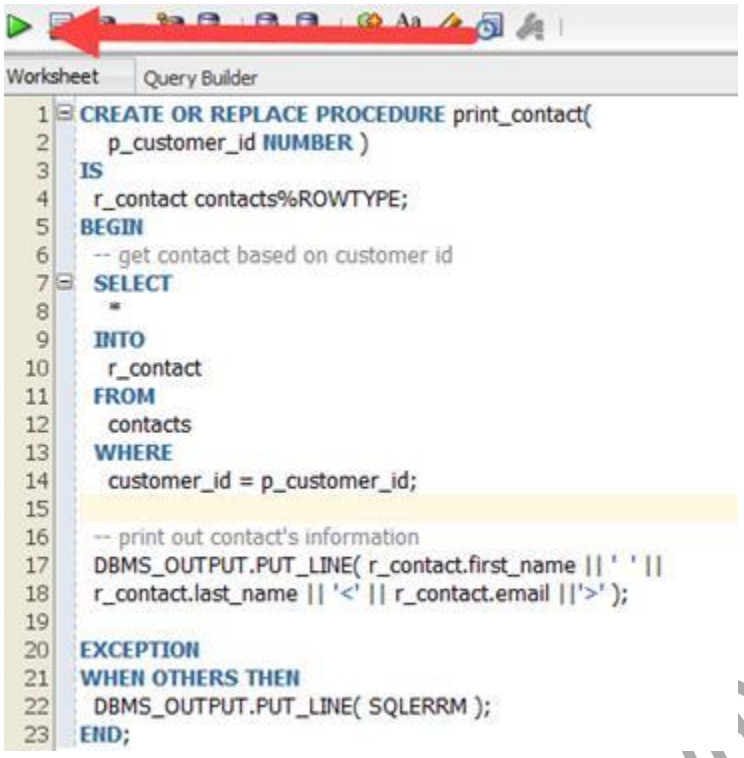

Compile & Run Program

Run Program using SQL Developer

If the procedure is compiled successfully, you will find the new procedure under the Procedures node as shown below:

EXEC procedure_name(arguments);

This link or path is not available for blocks codes without name

Compile & Run Program

Run Program using SQL Developer

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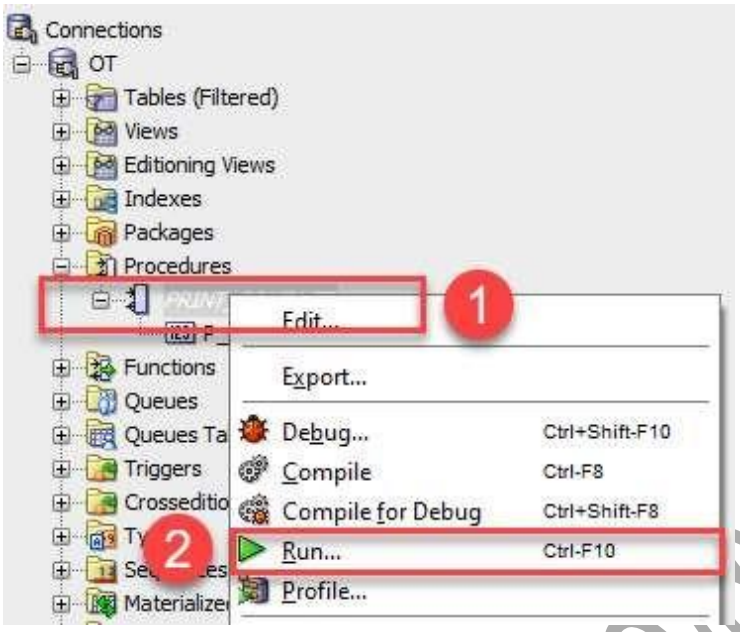
Right-click the procedure name and choose Run ... menu item:



Compile & Run Program

Run Program using SQL Developer

Enter a value for the in_customer_id parameter and click OK button:

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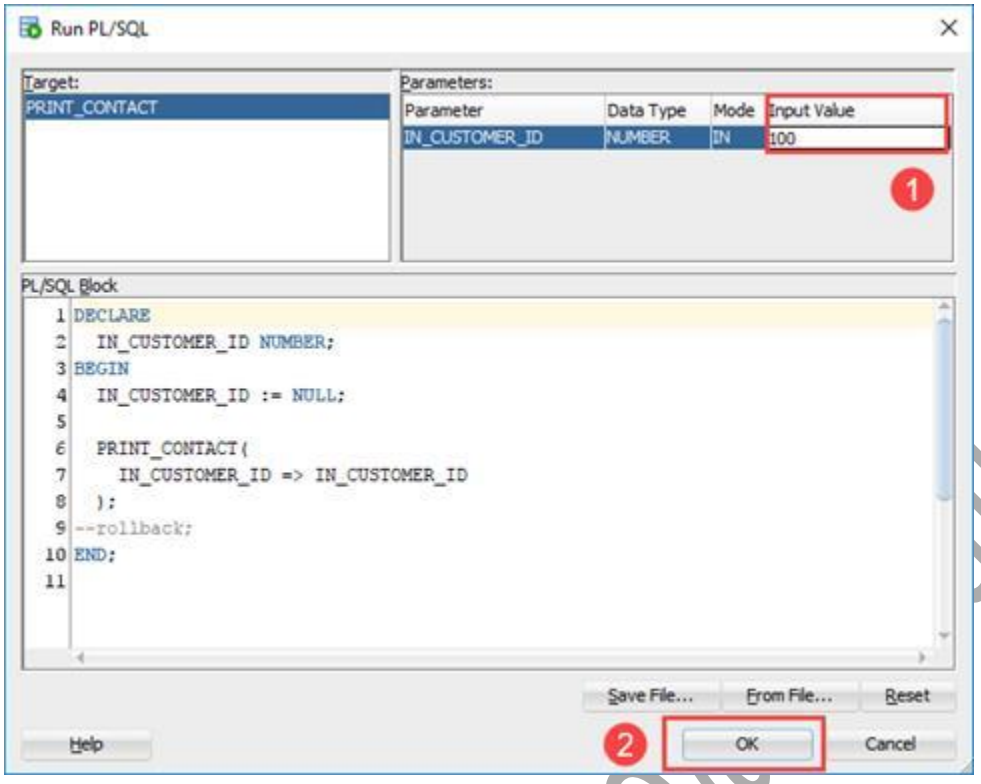
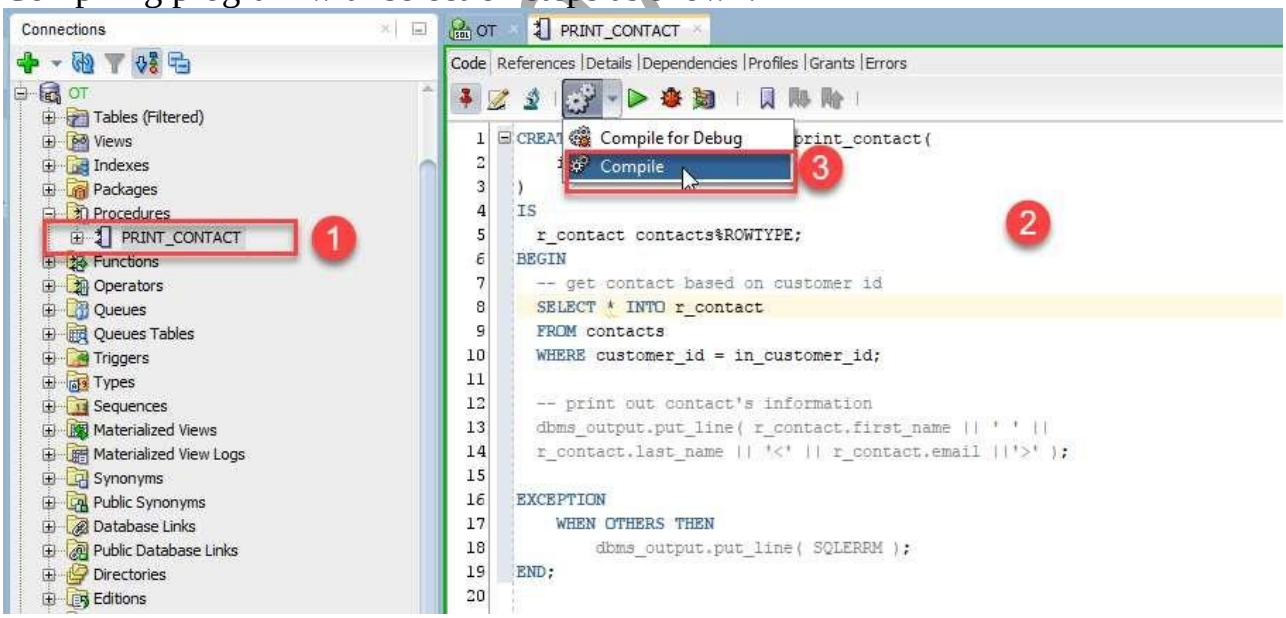


Compile & Run Program

Compile Program using SQL Developer

Compiling program with selection steps as shown:



https://www.oracletutorial.com/plsql-tutorial/plsql-procedure/

Introduction to Database Administration

Made by Mahjabeen

mahjabeen97869@gmail.com

contact # 0321 2711298

TOPIC 124

Data Types & Select INTO Clause
Data Types & Select INTO Clause

Data Types & Select INTO Clause

Introduction
Scalar Data Types Families
Numeric Data Types
Boolean Data Types
Character or String Data Types
DateTime Data Types
Composite Data Types
Data Types Synonyms
Data Types & Select INTO Clause

Introduction

Each value in PL/SQL such as a constant, variable and parameter has a data type that determines the storage format, valid values, and allowed operations.

PL/SQL has two kinds of data types:
scalar and composite.
Data Types & Select INTO Clause

Scalar Data Types Families

Number
Boolean
Character
Datetime

A scalar data type may have subtypes. A subtype is a data type that is a subset of another data type, which is its base type. A subtype further defines a base type by restricting the value or size of the base data type.
Data Types & Select INTO Clause

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Numeric Data Types

The numeric data types represent real numbers, integers, and floating-point numbers. They are stored as NUMBER, IEEE floating-point storage types (BINARY_FLOAT and BINARY_DOUBLE), and PLS_INTEGER.

The data types NUMBER, BINARY_FLOAT, and BINARY_DOUBLE are SQL data types. The PLS_INTEGER datatype is specific to PL/SQL. It represents signed 32 bits int.
Data Types & Select INTO Clause

Boolean Data Types

The BOOLEAN datatype has three data values: TRUE, FALSE, and NULL. Boolean values are typically used in control flow structure such as IF-THEN, CASE, and loop statements like LOOP, FOR LOOP, and WHILE LOOP.

SQL does not have the BOOLEAN data type, you can assign data type NUMBER(1) or CHAR(1)
Data Types & Select INTO Clause

Character or String Data Types

The character data types represent alphanumeric text. PL/SQL uses the SQL character data types such as
CHAR, VARCHAR2, LONG, RAW, LONG
RAW, ROWID, and UROWID
CHAR is used for fixed length columns
such primary keys or boolean
Data Types & Select INTO Clause

DateTime Data Types

The datetime data types represent dates, timestamp with or without time zone and intervals. PL/SQL datetime data types are DATE, TIMESTAMP, TIMESTAMP WITH TIME ZONE, TIMESTAMP WITH LOCAL TIME ZONE, INTERVAL YEAR TO MONTH, and INTERVAL DAY TO SECOND
Data Types & Select INTO Clause

Composite Data Types

TableName.Column%TYPE is a composite data type. For example, EMP.sal%TYPE
It will follow same data type and size of

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column of a table.
In case if size or type of column is changed then there is no need to re- compile the program
Data Types & Select INTO Clause

Data Types Synonyms

Data Type	Synonyms
NUMBER	DEC, DECIMAL, DOUBLE PRECISION, FLOAT, INTEGER, INT, NUMERIC, REAL, SMALLINT
CHAR	CHARACTER, STRING
VARCHAR2	VARCHAR

Data Types & Select INTO Clause

SELECT INTO Clause

We cannot use simple SQL Select clause statement, rather we use Select INTO by storing values in variables with condition of choosing single record

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```
DECLARE
        v_salary    EMP.sal%TYPE;
        v_deptno  NUMBER(3);
BEGIN
        SELECT sal, deptno
        INTO v_salary, v_deptno
        FROM EMP
        WHERE empno = 7369;
...
END;
/
```

Introduction to Database Administration

TOPIC 125

Program Examples
Program Examples

Program Examples with Select INTO Clause

Program-1 without Exception
Program-2 using Exception
Program-3 using Constant identifier with Exception
Program Examples
Program-1 without Exception

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```
declare
  v_ename          emp.ename%TYPE;
  v_sal            emp.sal%TYPE;
begin
   Select ename, sal
   INTO v_ename, v_sal
   from emp
   where empno = '7844'; --This id exists

     DBMS_OUTPUT.PUT_LINE('solution is:'||v_ename||' has '||v_sal);

end;
/

Before executing code that contains DBMS_OUTPUT.PUT_LINE,
must run at SQL prompt: set serveroutput on
```

Program Examples

```
declare
  v_ename          emp.ename%TYPE;
  v_sal            emp.sal%TYPE;
begin
   Select ename, sal
   INTO v_ename, v_sal
   from emp
   where empno = '7844'; --This id exists

     DBMS_OUTPUT.PUT_LINE('solution is:'||v_ename||' has '||v_sal);

exception
  When others then
   DBMS_OUTPUT.PUT_LINE('no record found');
end;
/
```

Program-2 using Exception

Program Examples

Program-3 using Constant identifier with Exception

```
declare
  v_ename          emp.ename%TYPE;
  v_sal            emp.sal%TYPE;
  v_empno          emp.empno%TYPE := '7844'; --Constant identifier
begin
   Select ename, sal
   INTO v_ename, v_sal
   from emp
   where empno = v_empno; --This id exists

     DBMS_OUTPUT.PUT_LINE('solution is:'||v_ename||' has salary '||v_sal);

exception
  When others then
   DBMS_OUTPUT.PUT_LINE('no record found');
end;
/
```

Introduction to Database Administration

TOPIC 126

Control IF Conditions

Control IF Conditions

PL/SQL Control IF-THEN-ELSE Conditions

IF THEN Condition

Structure of IF THEN Condition

Example of IF THEN Condition

Mahjabeen

Structure of IF THEN ELSE Condition
Example of IF THEN ELSE Condition
Structure of IF THEN ELSIF Condition
Example of IF THEN ELSIF Condition
Control IF Conditions

IF THEN Condition

There are three ways to write IF condition:

IF – END IF
IF – ELSE – END IF
IF – ELSIF – ELSE – END IF
Control IF Conditions

Structure of IF THEN Condition

There are three ways to write IF condition:

IF condition THEN
statements;
END IF;

For example:

IF v_sal > 2000 Then total_sal := v_sal + 5000;
END IF;
Control IF Conditions

Example of IF THEN Condition

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```
DECLARE
   v_sal EMP.SAL%TYPE;
BEGIN
   Select sal INTO v_sal
   From emp
   Where ename = 'SMITH';

   IF v_sal < 850 THEN
    DBMS_OUTPUT.PUT_LINE('Low paid salary person');
   END IF;
END;
/
```

Control IF Conditions

Structure of IF THEN ELSE Condition

There are three ways to write IF condition:

IF condition THEN
statements;
ELSE
statements;
END IF;
Control IF Conditions

Example of IF THEN ELSE Condition

```
DECLARE
   v_sal EMP.SAL%TYPE;
BEGIN
   Select sal INTO v_sal
   From emp
   Where ename = 'SMITH';

   IF v_sal < 850 THEN
    DBMS_OUTPUT.PUT_LINE('Low paid salary person');
   ELSE
    DBMS_OUTPUT.PUT_LINE('Higly paid salary person');
   END IF;
END;
/
```

M heen97869@gmail.com

Control IF Conditions

Structure of IF THEN ELSIF Condition

There are three ways to write IF condition:

IF condition THEN
statements;
ELSIF
statements;
ELSE
statements;
END IF;
Control IF Conditions

Example of IF THEN ELSIF Condition

```
DECLARE
   v_sal EMP.SAL%TYPE;
BEGIN
   Select sal INTO v_sal
   From emp
   Where ename = 'SMITH';

   IF v_sal < 850 THEN
     DBMS_OUTPUT.PUT_LINE('Low paid salary person');
   ELSIF (v_sal >= 850 AND v_sal <=1000) THEN
     DBMS_OUTPUT.PUT_LINE('Average paid salary person');
   ELSE
     DBMS_OUTPUT.PUT_LINE('Higly paid salary person');
   END IF;
END;
/
```

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Introduction to Database Administration

TOPIC 127

FOR & WHILE Loops

FOR & WHILE Loops

LOOPS, FOR & WHILE Loops

LOOPS
Loop with EXIT
FOR Loop
FOR Loop Syntax
FOR Loop - Example
FOR Loop - Bulk Data Insertion
WHILE Loop
WHILE Loop - Example
WHILE Loop Syntax
FOR & WHILE LOOPS

LOOPS

LOOP – EXIT WHEN – END LOOP
FOR – LOOP – END LOOP
WHILE – LOOP – END LOOP
FOR & WHILE LOOPS

Loop with EXIT

Following is its example (Repeat until LOOP):

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```
DECLARE
      ...
      v_deptno   dept.deptno%TYPE   := 50;
        v_counter  integer := 1;
       ...
BEGIN
       ...
       LOOP
          INSERT INTO dept(deptno)
                     VALUES(v_deptno);
          v_counter := v_counter + 1;
          v_deptno := v_deptno + 10;
          EXIT WHEN v_counter > 5;
      END LOOP;
      ...
END;
/
```

FOR & WHILE LOOPS

FOR Loop

Following is its Syntax:

FOR index IN lower_bound .. upper_bound
LOOP
statements;
END LOOP;
FOR & WHILE LOOPS
FOR Loop Syntax

Following is its generic syntax:

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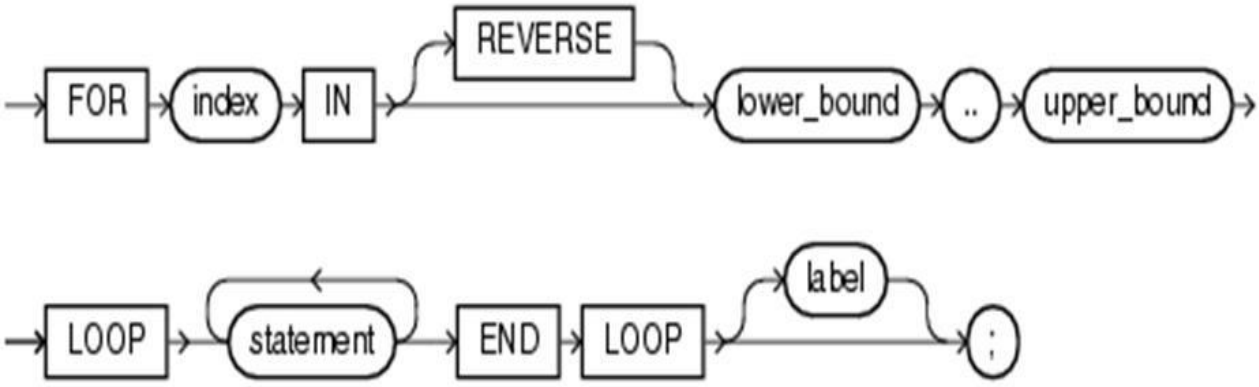


FOR & WHILE LOOPS

FOR Loop - Example

Following example displays serial numbers:

```
BEGIN
  FOR l_counter IN 1..5
  LOOP
    DBMS_OUTPUT.PUT_LINE( l_counter );
  END LOOP;
END;
/
```

FOR & WHILE LOOPS

FOR Loop - Example

Following example displays serial numbers in reverse:

Mahjabeen@gmail.com

```
BEGIN
  FOR l_counter IN REVERSE 1..3
  LOOP
    DBMS_OUTPUT.PUT_LINE( l_counter );
  END LOOP;
END;
/
```

FOR & WHILE LOOPS

FOR Loop - Bulk Data Insertion

Following example displays serial numbers in reverse:

```
BEGIN
  FOR i IN 55..70
  LOOP
    insert into dept(deptno, dname, loc)
    values (i, 'Dummy Dept-'||i, 'No Loc');
    DBMS_OUTPUT.PUT_LINE( i );
  END LOOP;
  Commit;
END;
/
```

```
DEPTNO DNAME          LOC
------ -------------- -------------
    55 Dummy Dept-55  No Loc
    56 Dummy Dept-56  No Loc
    57 Dummy Dept-57  No Loc
    58 Dummy Dept-58  No Loc
    59 Dummy Dept-59  No Loc
    60 Dummy Dept-60  No Loc
    10 ACCOUNTING     NEW YORK
```

FOR & WHILE LOOPS

WHILE Loop

Following is its Syntax:

WHILE condition
LOOP
statements;
END LOOP;
FOR & WHILE LOOPS

WHILE Loop - Example

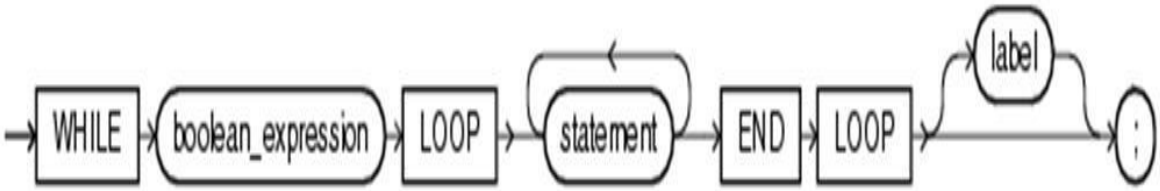
Following is its example:

```
DECLARE
  n_counter NUMBER := 1;
BEGIN
  WHILE n_counter <= 5
  LOOP
    DBMS_OUTPUT.PUT_LINE( 'Counter : ' || n_counter );
    n_counter := n_counter + 1
  END LOOP;
END;
/
```

FOR & WHILE LOOPS

WHILE Loop Syntax

Following is its generic syntax:



Introduction to Database Administration

TOPIC 128

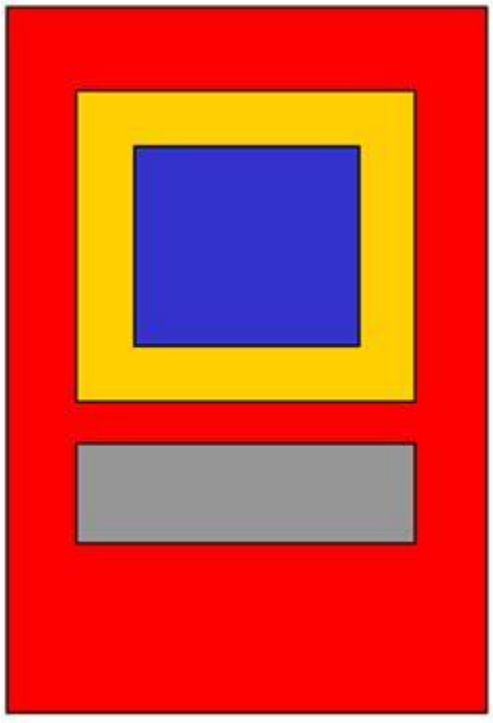
Anonymous Blocks with Examples

Anonymous Blocks with Examples

Nesting Anonymous Blocks
Nesting Anonymous Blocks – Example
Repeat Until LOOP - Example
Anonymous Blocks with Examples

Nesting Anonymous Blocks

Blocks within blocks give the concept of Nested blocks



Repeat Until LOOP - Example

This loop executes once first time. It is same as DO-WHILE Loop.

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```
LOOP
   monthly_value := daily_value * 31;
   EXIT WHEN monthly_value > 4000;
END LOOP;
```

Anonymous Blocks with Examples

Nesting Anonymous Blocks - Example

```
DECLARE
  n_counter NUMBER := 1;
BEGIN
  DBMS_OUTPUT.PUT_LINE('**************----Outer Block----**************');
  FOR i IN 55..70
  LOOP
    DBMS_OUTPUT.PUT_LINE( 'Outer Block Counter : ' || i );
  END LOOP;
  BEGIN
        WHILE n_counter <= 5
        LOOP
        DBMS_OUTPUT.PUT_LINE( 'Inner Block Counter : ' || n_counter );
        n_counter := n_counter + 1;
  END LOOP;
  END; --inner block end
END; --outer block end
/
```

Introduction to Database Administration

TOPIC 129

Exception Handlings-1

Exception Handlings-1

PL/SQL Exception Handlings

PL/SQL Exception
PL/SQL Exception Usage
PL/SQL Exception - Example-1
PL/SQL Exception - Example-2
Exception Handlings-1

PL/SQL Exception

PL/SQL treats all errors that occur in an anonymous block, procedure, or function as exceptions.
The exceptions can have different causes such as coding mistakes, bugs, even hardware failures.
It is not possible to anticipate all potential exceptions, however, you can write code to handle exceptions to enable the program to continue running as normal.
Exception Handlings-1

PL/SQL Exception

The code that you write to handle exceptions is called an exception handler.
A PL/SQL block can have an exception- handling section, which can have one or more exception handlers.
Exception Handlings-1

PL/SQL Exception Usage

```
BEGIN
-- executable section ...
-- exception-handling section EXCEPTION
WHEN e1 THEN
-- exception_handler1
WHEN e2 THEN
-- exception_handler1
WHEN OTHERS THEN
-- other_exception_handler
END;
/
```

Exception Handlings-1

PL/SQL Exception – Example-1

Following program will terminate without successfully execution when employee no does not exist in table EMP.

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```
DECLARE
    v_ename EMP.ename%TYPE;
    v_empno EMP.empno%TYPE := &empno;
BEGIN
    -- get the employee name by id
    SELECT ename INTO v_ename
    FROM EMP
    WHERE empno = v_empno;

    -- show the customer ename
    dbms_output.put_line('Employee name is ' || v_ename);
END;
/
```

Exception Handlings-1

PL/SQL Exception – Example-1

Following program will execute successfully when employee no does not exist in table EMP.

```
DECLARE
    v_ename EMP.ename%TYPE;
    v_empno EMP.empno%TYPE := &empno;
BEGIN
    -- get the employee name by id
    SELECT ename INTO v_ename
    FROM EMP
    WHERE empno = v_empno;

    -- show the customer ename
    dbms_output.put_line('Employee name is ' || v_ename);
EXCEPTION
        WHEN NO_DATA_FOUND THEN
          dbms_output.put_line('Employee ID' || v_empno ||
END;
/
```

Exception Handlings-1

PL/SQL Exception – Example-2

```
DECLARE
    v_ename EMP.ename%TYPE;
    v_job EMP.job%TYPE := &job;
BEGIN
    -- get the employee name by id
    SELECT ename INTO v_ename
    FROM EMP
    WHERE job = v_job;

    -- show the customer ename
    dbms_output.put_line('Employee name is ' || v_ename);
EXCEPTION
        WHEN NO_DATA_FOUND THEN
          dbms_output.put_line('Employee ID' || v_ename ||  ' does not exist');
        WHEN TOO_MANY_ROWS THEN
          dbms_output.put_line('Database returns many employees');
END;
/
```

```
Enter value for job: 'CLERK'
old   3:     v_job EMP.job%TYPE := &job;
new   3:     v_job EMP.job%TYPE := 'CLERK';
Database returns many employees

PL/SQL procedure successfully completed.
```

Following program will execute successfully using multiple Exceptions.
Introduction to Database Administration

TOPIC 130

Exception Handlings-2

Exception Handlings-2

PL/SQL Exception Handlings

Raise Exception
User-Defined Exception
Affecting PL/SQL Exception
Other Exceptions
Exception Handlings-2

Raise Exception

Exceptions are raised by the database server automatically whenever there is any internal database error, but exceptions can be raised explicitly by the programmer by using the command RAISE. Following is the simple syntax for raising an exception:

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```
DECLARE
   exception_name EXCEPTION;
BEGIN
   IF condition THEN
      RAISE exception_name;
   END IF;
EXCEPTION
   WHEN exception_name THEN
   statement;
END;
/
```

Exception Handlings-2

User-Defined Exception

```
DECLARE
   v_empno EMP.empno%type := &cv_empno;
   v_name  EMP.ename%type;
   v_job EMP.job%type;
   -- user defined exception
   ex_invalid_empno  EXCEPTION;
BEGIN
   IF v_empno <= 0 THEN
      RAISE ex_invalid_empno;
   ELSE
      SELECT  ename, job INTO  v_name, v_job
      FROM EMP
      WHERE empno = v_empno;
      DBMS_OUTPUT.PUT_LINE ('Name: '||  v_name);
      DBMS_OUTPUT.PUT_LINE ('job: ' || v_job);
   END IF;

EXCEPTION |
   WHEN ex_invalid_empno THEN
      dbms_output.put_line('empno must be greater than zero!');
   WHEN no_data_found THEN
      dbms_output.put_line('No such employee!');
   WHEN others THEN
      dbms_output.put_line('Error!');
END;
/
```

Exception Handlings-2

Affecting PL/SQL Exception

```
DECLARE
v_tname varchar2(100);
BEGIN
 BEGIN
  select tname into v_tname
  from tab
  where tname='CMG_EFFORTT';
  DBMS_OUTPUT.PUT_LINE('table name:'||v_tname);
  exception
    when no_data_found then
    DBMS_OUTPUT.PUT_LINE('No data');
 END;
 select tname into v_tname
  from tab
  where tname='CMG_EFFORT';
  DBMS_OUTPUT.PUT_LINE('table name:'||v_tname);
 exception
 when no_data_found then
    DBMS_OUTPUT.PUT_LINE('No data second exception');
 --go to 1;
END;
/
```

One exception does not affect the rest of program
Exception Handlings-2
Other Exceptions

Examples are
NO_DATA_FOUND, ZERO_DIVIDE, OTHERS

Raise some exception
WHEN NO_DATA_FOUND THEN
raise_application_error(-20011,'Invalid FK value'); Raise My_Excep;
To display details of oracle standard error message EXCEPTION
WHEN OTHERS THEN
DBMS_OUTPUT.PUT_LINE('Error detail is: '||SQLERRM)

Introduction to Database Administration

TOPIC 131

PL/SQL Procedure

PL/SQL Procedure

PL/SQL Procedure

What is a Procedure in PL/SQL?
Procedure - Example
Compiling & Executing Procedure
Invoking a Procedure in a Block
Executing a Procedure & Show Errors
Data Dictionary for Procedures
Managing Procedure using SQL Developer
PL/SQL Procedure

What is a Procedure in PL/SQL?

Is a block with a name
The DECLARE key word is not used
Parameters can be IN
OUT
IN OUT
Is stored (USER_SOURCE)
PL/SQL Procedure

What is Procedure in PL/SQL?

Writing PL/SQL procedure

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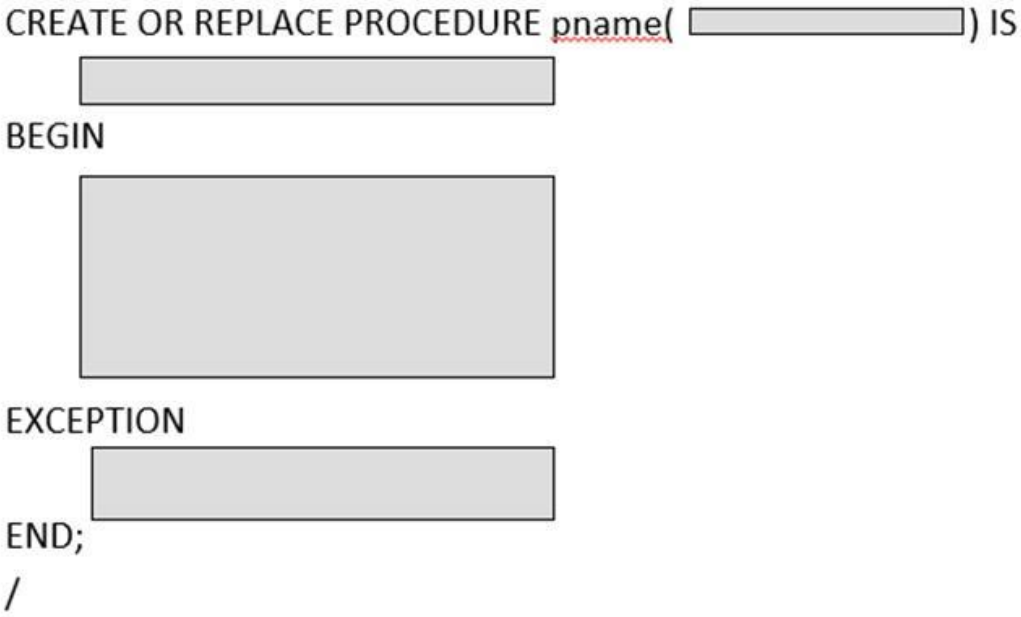


Procedure – Example

SET SERVEROUTPUT ON:
CREATE OR REPLACE PROCEDURE
proc_test(p_empno IN VARCHARZ) IB
v job EMP.job PE:
v_sal EMP.sal PE:
BEGIN

EXCEPTION
SELECT job. sal INTO v_job*v_sal FROM einp
HERE einpno - p_einpn o:
DBM8_0UTPUT . PUT_L INE (' j ob i s ' | | v_j ob) :

END:
GEN OTHERS THEN
DBMS OUTPUT . PUT LINE (' ERROR .
. ') ;
PL/SQL Procedure

Compiling & Executing Procedure

Mahjabeen97869@gm.com

```
SQL> Show errors
```

```
SQL> execute proc_test(5893);
```

PL/SQL Procedure

Invoking a Procedure in a Block

```
DECLARE
   ...
BEGIN
   ...
   proc_test('23');
   ...
END;
/

Or
SQL> exec proc_test('1123')
```

PL/SQL Procedure

Executing a Procedure & Show Errors

Manjaa@gmail.com

```
  1  create or replace procedure test_proc is
  2       v_id  INTEGER;
  3      v_empno emp.empno%TYPE;
  4  BEGIN
  5      v_id := 1234567;
  6      select empno into v_empno
  7      FROM  EMP
  8      WHERE empno = v_id;
  9  EXCEPTION
 10      WHEN NO_DATA_FOUND THEN
 11       DBMS_OUTPUT.PUT_LINE('No record exists');
 12*   END;
SQL> /

Procedure created.

SQL> exec test_proc
No record exists

PL/SQL procedure successfully completed.

SQL> show errors                (to see errors for procedures, functions)
```

PL/SQL Procedure

Data Dictionary for Procedures

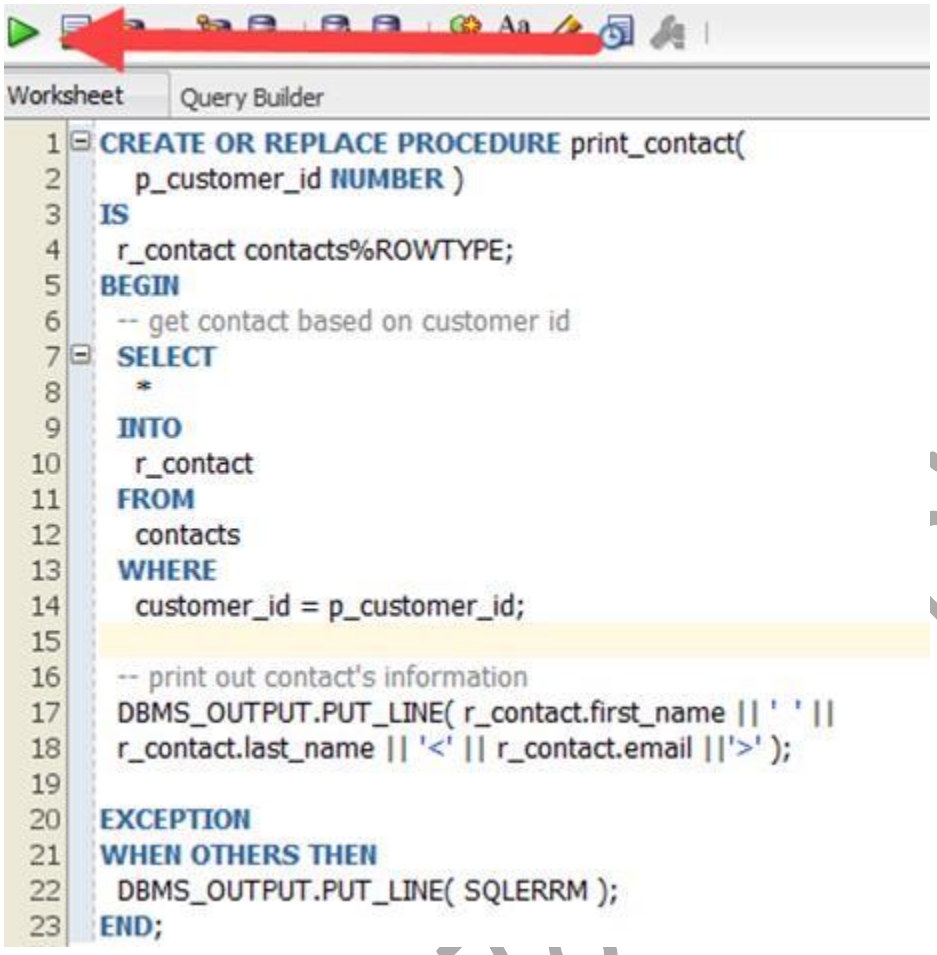
Mahjabeen9786@gmail.com

```
SQL> select Text from user_source
  2  where name='PROC_TEST';

TEXT
--------------------------------------------------
PROCEDURE
    proc_test(p_empno IN VARCHAR2)  IS
       v_job  EMP.job%TYPE;
       v_sal  EMP.sal%TYPE;
BEGIN
 SELECT job, sal
 INTO  v_job,v_sal
 FROM  emp
         WHERE  empno = p_empno;
 DBMS_OUTPUT.PUT_LINE('job is '||v_job);
EXCEPTION

TEXT
--------------------------------------------------
     WHEN OTHERS THEN
         DBMS_OUTPUT.PUT_LINE('ERROR...');
END;
```

PL/SQL Procedure

Managing Procedure using SQL Developer

Mahjabeen97@gmail.com



Introduction to Database Administration

TOPIC 132

PL/SQL Function
PL/SQL Function

PL/SQL Function

What is Function in PL/SQL?
Function - Example
Compiling & Executing Function
Executing a Function & Show Errors
Data Dictionary for Function
PL/SQL Function

Manjabeen9/c...ail.com

What is Function in PL/SQL?

Is a block with a name
Returns one value only.
The DECLARE key word is not used
Parameters can only be IN
Is stored (USER_SOURCE)
PL/SQL Function

What is Function in PL/SQL?

Writing PL/SQL Function

```
CREATE OR REPLACE FUNCTION fname(          )
RETURN datatype IS
        
BEGIN
        
EXECPTION
        
END;
/
```

Ma.ail.com

Function - Example

```
CREATE OR REPLACE FUNCTI ON
f unc   test (p   empno   IN   VARCHAR2 )   RETURN NUMBER   I S v   j ob   EMP . j ob
PE:
v  sat   EMP . sal   PPE:
BEGIN
SELECT,   j ob
sa 1
INTO   v, pj ob visa l| FROM   emp
HERE   empno = ppempno ; DBMS_0UTPUT . PUT LINE ( ' j sob i
refiurn v  sal  ;
EXCEPTI ON
;
GEN   OTHERS THEN
' 1 1= j ob ) ;
END:
DBMS OUTPUT . PUT LINE ( ' ERROR .   )


SQL   Show errors
PL/SQL Function
```

Compiling & Executing Function

```
SET SERVEROUTPUT ON;
DECLARE
…
v_sal   emp.sal%TYPE;
…
BEGIN
…
v_sal := func_test(3477);
DBMS_OUTPUT.PUT_LINE(TO_CHAR(v_sal)
);
…
END;
/
```

PL/SQL Function

Executing a Function & Show Errors

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```
SQL> CREATE OR REPLACE FUNCTION
  2      func_test(p_empno IN VARCHAR2)  RETURN NUMBER IS
  3         v_job  EMP.job%TYPE;
  4         v_sal  EMP.sal%TYPE;
  5  BEGIN
  6   SELECT job, sal
  7   INTO  v_job,v_sal
  8   FROM  emp
  9           WHERE  empno = p_empno;
 10   DBMS_OUTPUT.PUT_LINE('job is '||v_job);
 11           return v_sal;
 12  EXCEPTION
 13       WHEN OTHERS THENv_sal;
 14           DBMS_OUTPUT.PUT_LINE('ERROR...');
 15  END;
 16  /

Warning: Function created with compilation errors.

SQL> show error
Errors for FUNCTION FUNC_TEST:

LINE/COL ERROR
-------- -----------------------------------------------------------------
13/18    PLS-00103: Encountered the symbol "THENV_SAL" when expecting one
         of the following:
         then or
         The symbol "then" was substituted for "THENV_SAL" to continue.
```

PL/SQL Function

Data Dictionary for Function

```
SQL> select text from user_source
  2  where name='FUNC_TEST';

TEXT
--------------------------------------------------------------------------------
FUNCTION
    func_test(p_empno IN VARCHAR2)  RETURN NUMBER IS
       v_job  EMP.job%TYPE;
       v_sal  EMP.sal%TYPE;
BEGIN
 SELECT job, sal
 INTO  v_job,v_sal
 FROM  emp
         WHERE  empno = p_empno;
 DBMS_OUTPUT.PUT_LINE('job is '||v_job);
         return v_sal;

TEXT
--------------------------------------------------------------------------------
EXCEPTION
     WHEN OTHERS THEN
         DBMS_OUTPUT.PUT_LINE('ERROR...');
END;
```

End

TOPIC 133

Calling Procedures & Functions

Calling Procedures & Functions

Calling Procedures & Functions

Calling Procedure
Calling Function
Calling Procedure with Parameters
Calling Procedures & Functions

Calling Procedure

```
DECLARE
   ...
BEGIN
   ...
   proc_test('23');
   ...
END;
/
```

Or

```
SQL> exec proc_test('1123')
```

Procedure can be called after compilation in some other function, procedure, block or package. For example,
Calling Procedures & Functions

Calling Function

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Function can be called after compilation in some other function, procedure, block or package by assigning it to variable.

```
DECLARE
   ...
   v_sal        emp.sal%TYPE;
   ...
BEGIN
   ...
   v_sal := func_test(3477);
   DBMS_OUTPUT.PUT_LINE(TO_CHAR(v_sal));
   ...
END;
/
```

Calling Procedures & Functions

Calling Procedure with Parameters

Mahjabeen9786...il.com

```
create or replace procedure proc_inout
                            (p_empno in number,
                             p_sal out number) is
BEGIN
   select sal
   into p_sal
   from emp
     where empno=p_empno;
END;
/

create or replace procedure proc_out is
  v_sal EMP.SAL%TYPE;
BEGIN
    proc_inout(7369,v_sal);
    DBMS_OUTPUT.PUT_LINE('salary is :'||v_sal);
END;
/

SQL> exec proc_out
salary is :2000

PL/SQL procedure successfully completed.
```

Introduction to Database Administration

TOPIC 134

Exercises of Functions

Exercises of Functions

Exercises of Functions

Compiling & Executing Function

Function - Exercise-1

Function - Exercise-2

Exercises of Functions

Compiling & Executing Function

SET SERVEROUTPUT ON;

DECLARE

…

Mahjabeen978

v_sal emp.sal%TYPE;
… BEGIN
…
v_sal := func_test(3477);
DBMS_OUTPUT.PUT_LINE(TO_CHAR(v_sal)
);
… END;
/

Exercises of Functions

Function – Exercise-1

```
CREATE OR REPLACE FUNCTION
    func_MaxSal(p_deptno IN NUMBER)  RETURN NUMBER IS
       v_MaxSal          EMP.sal%TYPE;
BEGIN
         SELECT max(sal)
         INTO  v_MaxSal
         FROM  emp
         where deptno = p_deptno;
         DBMS_OUTPUT.PUT_LINE('Highest Salary is '||v_MaxSal);
         return v_MaxSal;
EXCEPTION
     WHEN OTHERS THEN
         DBMS_OUTPUT.PUT_LINE('ERROR...'||SQLERRM);
END;
/
```

```
SQL> DECLARE
  2    vv_MaxSal EMP.SAL%TYPE;
  3  BEGIN
  4    vv_MaxSal := func_MaxSal(10);
  5    DBMS_OUTPUT.PUT_LINE('Calling from block:'||vv_MaxSal);
  6  END;
  7  /
Highest Salary is 5000
Calling from block:5000
```

Exercises of Functions

Function – Exercise-2

```
CREATE OR REPLACE FUNCTION fact(x number)
RETURN number IS
   f number;
BEGIN
   IF x=0 THEN
      f := 1;
   ELSE
      f := x * fact(x-1);
   END IF;
RETURN f;
END;
/

DECLARE
   num number;
   factorial number;
BEGIN
   num:= 6;
   factorial := fact(num);
   dbms_output.put_line(' Factorial '|| num || ' is ' || factorial);
END;
/
```

```
Factorial 6 is 720

PL/SQL procedure successfully completed.
```

Introduction to Database Administration

TOPIC 135

Exercises of Procedures

Exercises of Procedures

Exercises of Procedures

Compiling & Executing Function
Procedure Exercise-I
Exercises of Procedures

Mahjabeen786

Compiling & Executing Procedure

```
DECLARE
…
BEGIN
…
proc_test('23');
…
END;
/
```

Or
SQL> exec proc_test(‘1123’)
Exercises of Procedures

Procedure – Exercise-1

```
CREATE OR REPLACE PROCEDURE
    proc_MaxSal(p_deptno IN NUMBER, p_MaxSal OUT NUMBER) IS
       v_MaxSal         EMP.sal%TYPE;
BEGIN
         SELECT max(sal)
         INTO  v_MaxSal
         FROM  emp
         where deptno = p_deptno;
         DBMS_OUTPUT.PUT_LINE('Highest Salary is '||v_MaxSal);
         p_MaxSal := v_MaxSal;
EXCEPTION
     WHEN OTHERS THEN
         DBMS_OUTPUT.PUT_LINE('ERROR...'||SQLERRM);
END;
/

CREATE OR REPLACE PROCEDURE proc_CALLING(p_dno IN NUMBER) IS
  vv_MaxSal EMP.SAL%TYPE;
BEGIN
  proc_MaxSal(p_dno, vv_MaxSal);
  DBMS_OUTPUT.PUT_LINE('Calling from block:'||vv_MaxSal);
END;
/

SQL> execute proc_CALLING(20);
```

```
SQL> execute proc_CALLING(20);
Highest Salary is 3400
Calling from block:3400

PL/SQL procedure successfully completed.
```

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TOPIC 136

PL/SQL Package-1
PL/SQL Package-1

PL/SQL Package-1

Purpose of PL/SQL Package
PL/SQL Package contains …
Schematic Diagram of Package
PL/SQL Package Specification
PL/SQL Package Body
Package Specification & its Body
PL/SQL Package-1

Purpose of PL/SQL Package

In PL/SQL, a package is a schema object that contains definitions for a group of related functionalities.
A package
includes variables, constants, cursors, exceptions, procedures, functions, and subprograms.
It is compiled and stored in the Oracle
Database.
PL/SQL Package-1

PL/SQL Package contains …

Typically, a package has a specification and a body. A package specification is mandatory while the package body can be required or optional, depending on the package specification.
PL/SQL Package-1

Schematic Diagram of Package

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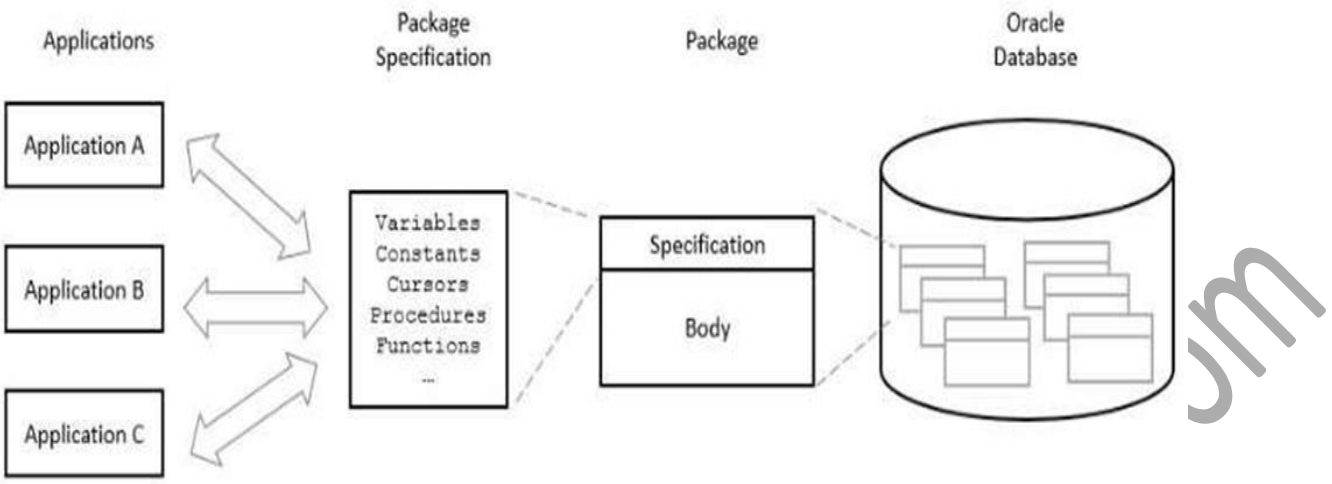

https://www.oracletutorial.com/plsql-tutorial/plsql-package/
PL/SQL Package-1

PL/SQL Package Specification

The package specification declares the public objects that are accessible from outside the package.
If a package specification whose public objects include cursors and subprograms, then it must have a body which defines queries for the cursors and code for the subprograms.
PL/SQL Package-1

PL/SQL Package Body

A package body contains the implementation of the cursors or subprograms declared in the package specification. In the package body, you can declare or define private variables, cursors, etc., used only by package body itself.
PL/SQL Package-1

PL/SQL Package Body

A package body can have an initialization part whose statements initialize variables or perform other one-time setups for the whole package.

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A package body can also have an exception-handling part used to handle exceptions.
PL/SQL Package-1

```
CREATE OR REPLACE PACKAGE emp_info IS



END emp_info;
/

CREATE OR REPLACE PACKAGE BODY emp_info is



END emp_info; --end of package body
/
```

Package Specification & its Body
Introduction to Database Administration

TOPIC 137

PL/SQL Package-2
PL/SQL Package-2

PL/SQL Package-2

What is a Package in PL/SQL?
Package Specification
Package Body
Add in a Package Body by hiding from
User Specification
Invoking Package Subprogram
PL/SQL Package-2

What is a Package in PL/SQL?

Selected and purposeful collection of procedures, functions and variables is managed in package.

Package
Package Specification
Package Body
Invoking Package subprogram
Abstract Programming
To avoid spreading of procedures &
functions
Is stored (USER_SOURCE)

PL/SQL Package-2

Package Specification

```
CREATE OR REPLACE PACKAGE emp_info IS

v count    INTEGER; —global variable for all sub programs inside package
```

```
PROCEDURE insert_record( p_empna IN NUMBER
p ename IN VARCHAR2
```



```
, p    ob IN VARCHAR2
, p_saI IN NUMBER
, p comm IN NUMBER
, p deptno IN VARCHAR2);
```

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PROCEDURE deIete_record(p_empno IN NUMBER)j

FUNCTION sum dept sal(p deptno IN dept.deptno36TYPE) RETURN is dept.sal96TYPE;

END emp_info;

/

Package Body

CREATE OR REPtACE PAŒAGE BODY eznp_info b

```
PROCEDURE  insert_record(p_empno  IN NUMBER,p_enameIN  VARCHAR2,
p_job IN VARCHAR2,p_sal  IN NUMBER,
p_comm  in    uMBER,p_deptno IN VARCHAR2) IS
BEGIN
     INSERTINTO  EMP(empno,ename,job,sal,comm,deptno)
     VALUES(p_empno,p_ename,p_job,p_sal,p_comm,p_deptno);
END insert_record;
```

```
PROCEDURE  delete_record(p_empno IN NUMBER) IS
BEGIN
   DELETE FROM EMP
   WHERE  empno=p_empno;
END delete_record;
```

```
FUNCTION sum_dept_sal(p_deptno  IN NUMBER) RETURN emp.saLRETYPE  IS
v_sum_sal   emp.sal%TYPE,
BEGIN
   SELECT SUM(sal)
   INTO v_sum_sal
    FROM emp
    WHERE  deptno= p_deptno,
   RETURN v_sum_sal,
END;
```

ENDemp_info; —end ofpackage body

PL/SQL Package-2

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Purpose of PL/SQL Package

Following are its main purposes:

Make code more modular
Hide implementation details
Improve application performance
Minimize unnecessary recompiling code
Manage authorization easily
PL/SQL Package-2

Add in a Package Body by hiding from User Specification

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```
Procedure call_from_out is
   v_empno EMP.empno%TYPE;
   v_ename EMP.ename%TYPE;
   v_job   EMP.job%TYPE;
   v_sal   EMP.sal%TYPE;
   v_comm  EMP.comm%TYPE;
   v_deptno EMP.dept%TYPE;
begin

   v_empno := 8899;
   v_ename := 'ALI';
   v_job   := 'MANAGER';
   v_sal   := 8000;
   v_comm  := 300;
   v_deptno := 10;

   insert_record(  v_empno, v_ename, v_job, v_sal, v_comm,v_deptno);
    commit;
EXCEPTION
   WHEN OTHERS THEN
     DBMS_OUTPUT.PUT_LINE('Except call_from_out:'||SQLERRM);
end;
/
```

PL/SQL Package-2

Invoking Package Subprogram

```
DECLARE
   v_sum_sal   emp.sal%TYPE;
BEGIN
   ...
   v_sum_sal := emp_info.sum_dept_sal(10);
   ...
   emp_info.delete_record(1234567);
   ...
END;
/
```

Or

```
SQL> exec emp_info.insert_record(...,...)
```

Introduction to Database Administration

TOPIC 138

Execution of Packages

Execution of Packages

Execution of Packages

Compiling a Package using SQL*Plus
Compiling a Package using Oracle Developer
Compiling a Package using Files on SQL*Plus
Calling Function and Procedure from Package
Execution of Packages

Mariabeen9

Compiling a Package using SQL*Plus

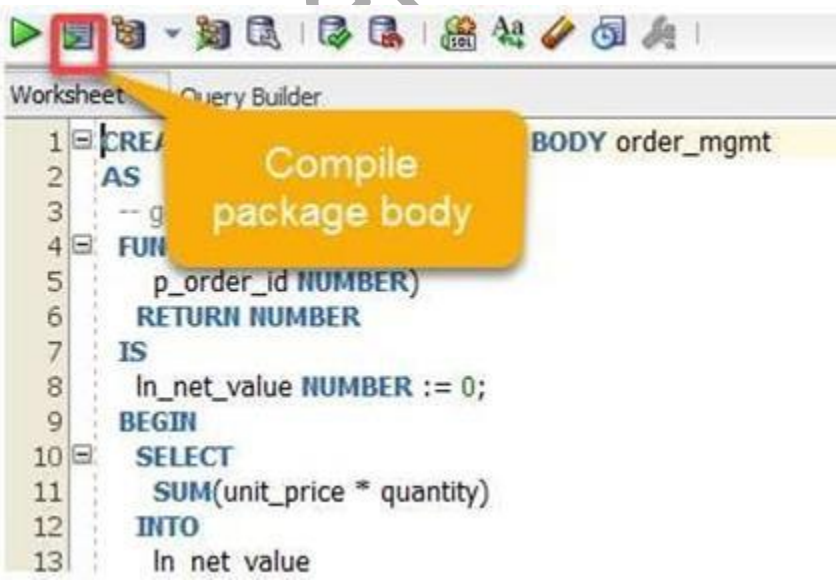
If you use SQL*Plus for compiling and creating a package body, you type forward slash (/) as follows:

```
44   return ln_net_value;
45   EXCEPTION
46   WHEN no_data_found THEN
47   DBMS_OUTPUT.PUT_LINE( SQLERRM );
48     END get_net_value_by_customer;
49
50   END order_mgmt;
51   /

Package body created.

SQL> _
```

Execution of Packages

Compiling a Package using Oracle Developer

From PL/SQL Developer, you click the Run Script button to compile the package body.



Execution of Packages

Compiling a Package using Files on SQL*Plus

If you manage package specification & body using separate files, you can compile separately using the following commands:

SQL> @path_to_packge_body_file

SQL > @path_to_package_body_file 2 /
Execution of Packages

Calling Function and Procedure from Package

```
DECLARE
   v_sum_sal   emp.sal%TYPE;
BEGIN
   ...
   v_sum_sal := emp_info.sum_dept_sal(10);
   ...
   emp_info.delete_record(1234567);
   ...
END;
/
```

Or

```
SQL> exec emp_info.insert_record(...,...)
```

End
Introduction to Database Administration

TOPIC 139

PL/SQL Triggers

PL/SQL Triggers

PL/SQL Triggers

What is an Oracle Triggers?
Oracle Trigger Usage
Oracle Trigger Syntax
Oracle Trigger Header
Oracle Trigger Body
Create or Replace a Trigger
PL/SQL Triggers

What is an Oracle Triggers?

A trigger is a named PL/SQL block stored in the Oracle Database and executed automatically when a triggering event takes place. The event can be any of the following:

A data manipulation language (DML) statement executed against a table e.g., INSERT, UPDATE, or DELETE.
PL/SQL Triggers

What is an Oracle Triggers?

For example, if you define a trigger that fires before an INSERT statement on the customers table, the trigger will fire once before a new row is inserted into the customers table.
A data definition language (DDL) statement executes e.g., CREATE or ALTER statement. These triggers are often used for auditing purposes to record changes of the schema.
PL/SQL Triggers

What is an Oracle Trigger?

A system event such as startup or shutdown of the Oracle Database.
A user event such as login or logout.
The act of executing a trigger is also known as firing a trigger. We say that the trigger is fired.
PL/SQL Triggers

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Oracle Trigger Usage

Oracle triggers are useful in many cases such as the following:
Enforcing complex business rules that cannot be established using integrity constraint such as UNIQUE, NOT NULL, and CHECK.
Preventing invalid transactions.
PL/SQL Triggers

Oracle Trigger Usage

Gathering statistical information on table accesses.
Generating value automatically for derived columns.
Auditing sensitive data.
PL/SQL Triggers

Oracle Trigger Syntax

Following is its syntax

```
CREATE [OR REPLACE] TRIGGER trigger_name
{BEFORE | AFTER } triggering_event ON table_name
[FOR EACH ROW]
[FOLLOWS | PRECEDES another_trigger]
[ENABLE / DISABLE ]
[WHEN condition]
DECLARE
    declaration statements
BEGIN
    executable statements
EXCEPTION
    exception_handling statements
END;
/
```

PL/SQL Triggers

Oracle Trigger Header

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```
CREATE [OR REPLACE] TRIGGER trigger_name
   {BEFORE | AFTER } triggering_event ON table_name
   [FOR EACH ROW]
   [FOLLOWS | PRECEDES another_trigger]
   [ENABLE / DISABLE ]
   [WHEN condition]
```

PL/SQL Triggers

Oracle Trigger Body

```
DECLARE
   declaration statements
BEGIN
   executable statements
EXCEPTION
   exception_handling statements
END;
```

PL/SQL Triggers

Create or Replace a Trigger

The CREATE keyword specifies that you are creating a new trigger. The OR REPLACE keywords are optional. They are used to modify an existing trigger.

Even though the OR REPLACE keywords are optional, they appear with the CREATE keyword in most cases.

End
Introduction to Database Administration

TOPIC 140

Trigger Examples

Trigger Examples

Trigger Examples

Trigger Example-1
Execution of Trigger Example-1
Trigger Example-2
Trigger & Function Example-3
Trigger Examples

Trigger Example-1

Display difference of salary when salary of employee is changed

```
CREATE OR REPLACE TRIGGER display_salary_changes
BEFORE DELETE OR INSERT OR UPDATE ON EMP
FOR EACH ROW
WHEN (NEW.EMPNO > 0)
DECLARE
   sal_diff number;
BEGIN
   sal_diff := :NEW.sal  - :OLD.sal;
   dbms_output.put_line('Old salary: ' || :OLD.sal);
   dbms_output.put_line('New salary: ' || :NEW.sal);
   dbms_output.put_line('Salary difference: ' || sal_diff);
END;
/
```

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Trigger Examples

Execution of Trigger Example-1

Display difference of salary when salary of employee is changed

```
SQL> CREATE OR REPLACE TRIGGER display_salary_changes
  2  BEFORE DELETE OR INSERT OR UPDATE ON EMP
  3  FOR EACH ROW
  4  WHEN (NEW.EMPNO > 0)
  5  DECLARE
  6     sal_diff number;
  7  BEGIN
  8     sal_diff := :NEW.sal  - :OLD.sal;
  9     dbms_output.put_line('Old salary: ' || :OLD.sal);
 10     dbms_output.put_line('New salary: ' || :NEW.sal);
 11     dbms_output.put_line('Salary difference: ' || sal_diff);
 12  END;
 13  /

Trigger created.

SQL> set serveroutput on
SQL> update emp
  2  set sal=777
  3  where ename='SMITH';
Old salary: 800
New salary: 777
Salary difference: -23

1 row updated.
```

Trigger Examples

Trigger Example-2

Keeping log of old data into a log table

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```
CREATE OR REPLACE TRIGGER del_emp
BEFORE DELETE ON emp
FOR EACH ROW
DECLARE
   x number(2);
BEGIN
      INSERT INTO emp_audit
             VALUES(:NEW.empno, USER, sysdate);
END;
/

--Other forms can be BEFORE INSERT OR UPDATE
--OF salary ON EMP
--Need to create table emp_audit
--select * from emp_audit;
```

Trigger Examples

Trigger & Function Example-3

```
create table emp1
as select * from emp;

alter table emp1
add bonus number(6,2);
CREATE OR REPLACE  FUNCTION "BONUS_CALC"
                   (p_sal IN NUMBER) RETURN NUMBER IS
BEGIN
    return(p_sal/600);
   dbms_output.put_line(' ***** THE RECORD HAS SUCCESSFULLY BEEN INSERTED *****');
END;
/


CREATE OR REPLACE TRIGGER "UPDATE_BONUS" before INSERT OR UPDATE  OF SAL ON "EMP1" FOR
BEGIN
    --AFTER option gives error of mutating
    --select Bonus_Calc(:New.sal) into :New.bonus from dual;
    --Or use the following asignment statement
    :New.bonus := Bonus_Calc(:New.sal);

   dbms_output.put_line(' ***** THE RECORD HAS SUCCESSFULLY BEEN INSERTED *****');
end;
/

Update emp1
set sal=1600
where ename in ('ALLEN');
```

Introduction to Database Administration

TOPIC 141

Trigger Exercises

Trigger Exercises

Trigger Exercises

Exercise-1 (Off day DML Restriction)
Exercise-2 (for Data Entry)
Trigger's Disable/ Enable
Trigger's Disable/ Enable using SQL Developer
Exercise-3 (Mutating Error)
Fired Triggers
Updating & Deleting on Table with specific Columns
Trigger Exercises

Exercise-1 (Off day DML Restriction)

This is a statement trigger on the EMP table, and it fires before an INSERT, UPDATE, or DELETE statement is issued. First, the trigger determines the day of the week. If the day is Saturday or Sunday, an error message is generated.

Trigger Exercises
Exercise-1 (Off day DML Restriction)

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```
SQL> CREATE OR REPLACE TRIGGER EMP_ModifyIssue
  2  BEFORE INSERT OR UPDATE OR DELETE ON EMP
  3  DECLARE
  4     v_day VARCHAR2(10);
  5  BEGIN
  6     v_day := RTRIM(TO_CHAR(SYSDATE, 'DAY'));
  7     IF v_day LIKE ('S%') THEN
  8   RAISE_APPLICATION_ERROR (-20000, 'A table cannot be modified during off hours');
  9  END IF;
 10  END;
 11  /

Trigger created.

SQL>
SQL> update emp
  2  set sal=700
  3  where ename='SMITH';
update emp
       *
ERROR at line 1:
ORA-20000: A table cannot be modified during off hours
ORA-06512: at "SCOTT.EMP_MODIFYISSUE", line 6
ORA-04088: error during execution of trigger 'SCOTT.EMP_MODIFYISSUE'
```

Trigger Exercises

Exercise-2 (for Data Entry)

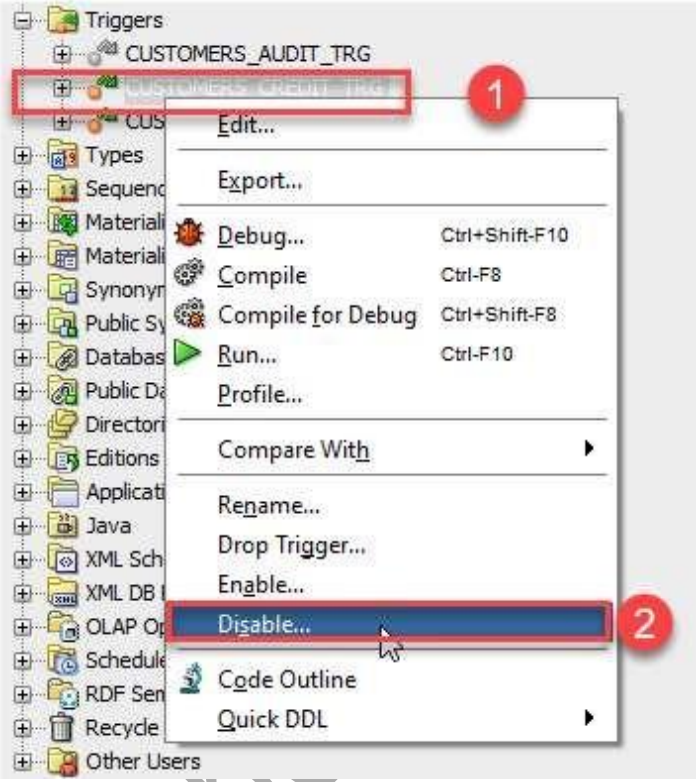
```
CREATE OR REPLACE TRIGGER Derived
BEFORE INSERT OR UPDATE OF Ename ON Emp

/* Before updating the ENAME field, derive the values for
   the UPPERNAME and SOUNDEXNAME fields. Restrict users
   from updating these fields directly: */
FOR EACH ROW
BEGIN
  :NEW.Uppername := UPPER(:NEW.Ename);
  :NEW.Soundexname := SOUNDEX(:NEW.Ename);
END;
/
```

Trigger Exercises

Trigger's Disable/ Enable

Sometimes, you may want to disable a trigger for testing and troubleshooting purposes. To disable a trigger, you use the ALTER TRIGGER DISABLE statement:
ALTER TRIGGER trigger_name DISABLE; ALTER TABLE table_name DISABLE ALL TRIGGERS;
Trigger Exercises

Trigger's Disable/ Enable using SQL Developer



Trigger Exercises

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```
SQL> CREATE OR REPLACE TRIGGER Update_EmpDeptno
  2  BEFORE INSERT OR UPDATE ON EMP
  3  FOR EACH ROW
  4  DECLARE
  5  v_cnt Number(3);
  6  BEGIN
  7  IF :NEW.deptno IS NOT NULL THEN
  8  BEGIN
  9  SELECT count(*)
 10  INTO v_cnt
 11  FROM EMP
 12  WHERE deptno = :NEW.deptno;
 13  EXCEPTION
 14  WHEN NO_DATA_FOUND THEN
 15  RAISE_APPLICATION_ERROR
 16  (-20001, 'This is not a valid deptno');
 17  END;
 18  END IF;
 19  END;
 20  /

Trigger created.

SQL> Update emp
  2  set deptno = 11
  3  where deptno=10;
Update emp
       *
ERROR at line 1:
ORA-04091: table SCOTT.EMP is mutating, trigger/function may not see it
ORA-06512: at "SCOTT.UPDATE_EMPDEPTNO", line 6
ORA-04088: error during execution of trigger 'SCOTT.UPDATE_EMPDEPTNO'
```

Exercise-3 (Mutating Error)

Trigger Exercises

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```
CREATE OR REPLACE TRIGGER Update_EmpDeptno
BEFORE INSERT OR UPDATE ON EMP
FOR EACH ROW
DECLARE
v_cnt Number(3);
BEGIN
   IF :NEW.deptno IS NOT NULL THEN
   BEGIN
        SELECT count(*)
        INTO v_cnt
        FROM dept
        WHERE deptno = :NEW.deptno;
        DBMS_OUTPUT.PUT_LINE(:NEW.deptno);
   EXCEPTION
   WHEN NO_DATA_FOUND THEN
   RAISE_APPLICATION_ERROR (-20001, 'This is not a valid deptno');
   END;
   END IF;
END;
/
```

Exercise-3 (Resolving Mutating Error)

Trigger Exercises

Fired Triggers

Need to see which trigger names are fired on commands such as

```
select distinct name
from user_source
where type='TRIGGER';

drop trigger DEL_EMP;
drop trigger UPDATE_EMPDEPTNO;
```

```
SQL> update emp
  2  set deptno=11
  3  where deptno=10;
11
Old salary:
New salary:
Salary difference:
11
Old salary: 4000
New salary: 4000
Salary difference: 0
11
Old salary: 2450
New salary: 2450
Salary difference: 0
```

Trigger Exercises

Updating & Deleting on Table with specific Columns

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```
CREATE OR REPLACE TRIGGER Updating_EMP
  BEFORE
    INSERT OR
    UPDATE OF sal, deptno OR
    DELETE
  ON EMP
BEGIN
  CASE
    WHEN INSERTING THEN
      DBMS_OUTPUT.PUT_LINE('Inserting');
    WHEN UPDATING('sal') THEN
      DBMS_OUTPUT.PUT_LINE('Updating sal');
    WHEN UPDATING('deptno') THEN
      DBMS_OUTPUT.PUT_LINE('Updating department ID');
    WHEN DELETING THEN
      DBMS_OUTPUT.PUT_LINE('Deleting');
  END CASE;
END;
/

update emp
set sal=2000
where ename='SMITH';
```


TOPIC 142

Cursor Programming-1

Cursor Programming-1

Cursor Programming-1

What is a Cursor?
Implicit Cursor
Execution Cycle of Explicit Cursor
Cursor's usage
Explicit Cursor Attributes
Cursor Programming-1

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What is a Cursor?

A cursor is a pointer that points to a result of a query.
It is mainly used with tables which return more than one row.
It is handled implicitly and explicitly.
Cursor Programming-1

Implicit Cursor

Whenever Oracle executes an SQL statement such as SELECT INTO, INSERT, UPDATE, and DELETE, it automatically creates an implicit cursor.

Oracle internally manages the whole execution cycle of implicit cursors and reveals only the cursor's information and statuses such as SQL%ROWCOUNT, SQL%ISOPEN, SQL%FOUND, and SQL%NOTFOUND.
Cursor Programming-1

Implicit Cursor

The implicit cursor is not elegant when the query returns zero or multiple rows which cause NO_DATA_FOUND or TOO_MANY_ROWS exception respectively.
Cursor Programming-1

Explicit Cursor

An explicit cursor is an SELECT statement declared explicitly in the declaration section of the current block or a package specification.

For an explicit cursor, you have control over its execution cycle from OPEN, FETCH, and CLOSE.

Oracle defines an execution cycle that executes an SQL statement and associates a cursor with it.
Cursor Programming-1

Execution Cycle of Explicit Cursor

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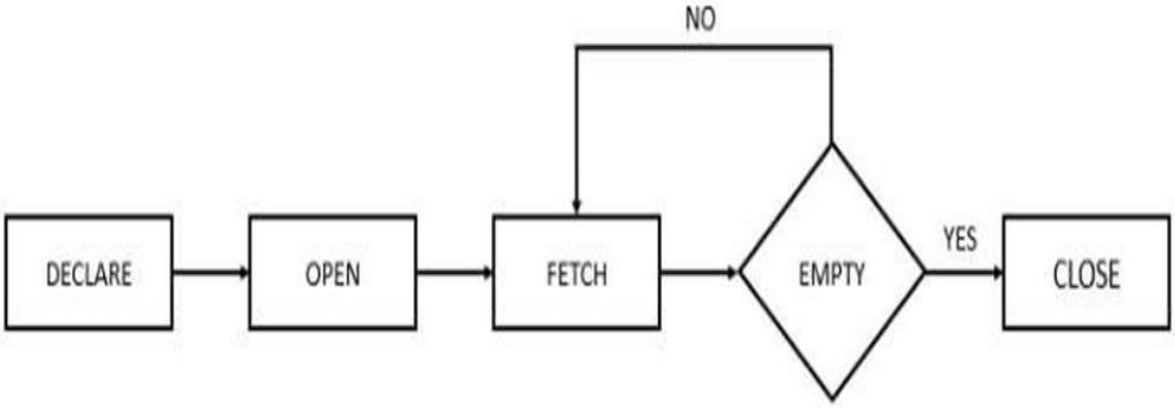

Cursor Programming-1

Cursor's usage

Declare a cursor

CURSOR cursor_name IS query;

Open a cursor

OPEN cursor_name;
Cursor Programming-1

Cursor's usage

Fetch from a cursor
The FETCH statement places the
contents of the current row into var. FETCH cursor_name INTO variable_list;
To retrieve all rows in a result set, you need to fetch each row till the last one.

Closing a cursor

CLOSE cursor_name;
Cursor Programming-1

Explicit Cursor Attributes

%ISOPEN

%FOUND

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%NOTFOUND

%ROWCOUNT
Introduction to Database Administration

TOPIC 143

Cursor Programming-2
Cursor Programming-2

Cursor Programming-2

Explicit Cursor Attributes
Implicit Cursor - Record Type
ROWTYPE Example - 1
ROWCOUNT Example
How to Declare Cursor?
%ISOPEN, %FOUND, FETCH Example
Cursor Programming-2

Explicit Cursor Attributes

%ISOPEN

%FOUND

%NOTFOUND

%ROWCOUNT
Cursor Programming-2

Implicit Cursor – Record Type

A record is a composite data structure, which means that it is composed of one or more elements.
Records are very much like a row of a database table, but each element of the record does not stand on its own. PL/SQL supports three kinds of records: table-based, cursor-based, and programmer-defined.

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v_EmpRec EMP%TYPE;
Cursor Programming-2

Implicit Cursor – Record Type

CURSOR c_emp IS
SELECT empno, ename, job
FROM emp
WHERE deptno = 20; vr_emp c_emp%ROWTYPE;

ROWTYPE Example - 1

DECLARE
v_emp EMP %RO PE ; BEGIN
SELECT ^
INTO v_emp
FROM EMP
HERE enare - ' PMI TH ' I
DBMS_OUTPUT . PUT_L INE (' Renocd z no1 umno are vpeinp . empno | | ' ' | | vpemp . enare) :
EXCEPTI ON
GEN N0_DATA_F0UND THEN
DBM8_0UTPUT.PUT_£INE('The Employee
| | 'is
not in the database'):
END:

ROWTYPE Example - 2

DECLARE
CURSOR c_emp I S SELECT * FROM EMP ;
vr_emp c_emp %R0\VIYP E ;

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```
BEGIN
OPEN    z_emp i

FETCH       z_emp    INT0    vr_emp ; EXIT    NHEN    z_emp 2N0TF OUND ;
DBMS_0UTPUT . PUT_L INE (vr_emp . empno
'  '||vr_emp.ename||'  '||vr_emp.sa   ;



/
*)
END    LOOP ;
END ;
```

ROWCOUNT Example

```
DECLARE
vpj ob EMP . j ob%type: BEGIN
SELECT j ob INTO vpj ob FROM ERP
HERE   empno   -   76 98 :
I F S9L%ROWC0UNT    -   1 THEN
DBMS_0UZPIJT . PUZ_L INE (v_job   II'   has   a   'II
' Empno   of   7698 ' ):
ELSIF SQL%R0WC0UNT = 0 THEN D8MS_0UTPUT.PUT_LINE('The Empno 7698 is '
not in the database'):
ELSE
D8MS_0UTPUT.PUT_LINE('Stop... ): END IF:
END:
```

Cursor Programming-2

How to Declare Cursor?

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```
CURSOR c_emp IS
SELECT empno, ename, job
FROM   emp
WHERE  deptno = 20;
```

Cursor Programming-2

%ISOPEN, %FOUND, FETCH Example

```
DECLARE
        v_empno EMP.Empno%TYPE;
        CURSOR c_EMP IS
        SELECT Empno
          FROM EMP
          WHERE Empno > 1000;
BEGIN
        OPEN c_EMP;
        LOOP
        FETCH c_EMP INTO v_empno;
        IF c_EMP%FOUND THEN
           DBMS_OUTPUT.PUT_LINE('Just FETCHED row '
           ||TO_CHAR(c_EMP%ROWCOUNT)||' EMP ID: '||v_empno);
        ELSE
           EXIT;
        END IF;
        END LOOP;
        CLOSE c_EMP;
        EXCEPTION
        WHEN OTHERS THEN
           IF c_EMP%ISOPEN
        THEN
           CLOSE c_EMP;
        END IF;
END;
/
```

TOPIC 144

Cursor Programming-3

Cursor Programming-3

Cursor Programming-3

How to Declare Cursor?
Sample Program using Cursor
Cursor for DML Insert
Cursor with Parameters
Cursor Program-1
Cursor Program-1 (Solution)
Cursor Programming-3

How to Declare Cursor?

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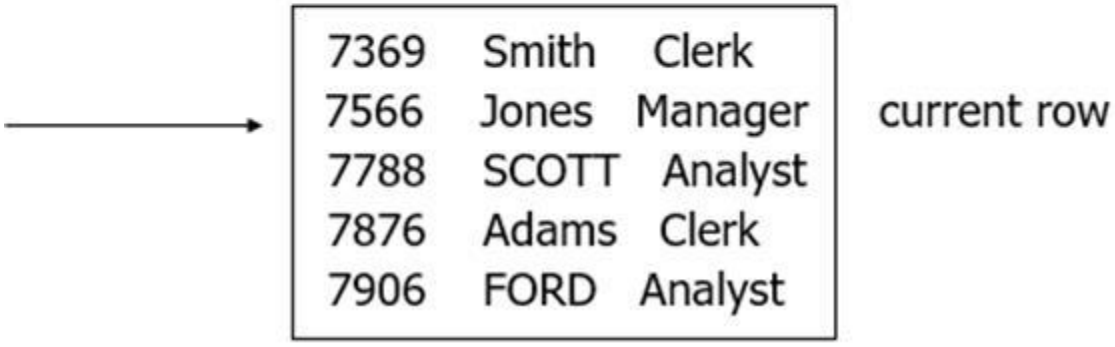
```
CURSOR c_emp  IS
SELECT  empno, ename, job
FROM    emp
WHERE  deptno = 20;
```



Cursor Programming-3

Sample Program using Cursor

Mahjabeen9786

```
DECLARE

    CURSOR c_emp IS
    SELECT  empno, ename, job
    FROM    emp
    WHERE  deptno = 20;

BEGIN

     FOR v_c IN c_emp  LOOP
      ...
       DBMS_OUTPUT.PUT_LINE(v_c.ename);
      ...
     END LOOP;
   ...
end;
/
```

Cursor Programming-3

Cursor for DML Insert

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```
DECLARE
  CURSOR c_emp IS
  SELECT empno, ename, job
  FROM EMP
  WHERE empno > 1100;
BEGIN
  FOR r_emp IN c_emp
  LOOP
    INSERT INTO table_log
    VALUES(r_emp.ename);
  END LOOP;
END;
/
```

Cursor Programming-3

Cursor with Parameters

```
DECLARE
  CURSOR c_emp (p_job IN EMP.job%TYPE) IS
  SELECT *
  FROM EMP
  WHERE job = p_job;
BEGIN
  FOR r_emp IN c_emp('CLERK')
  LOOP
        DBMS_OUTPUT.PUT_LINE(r_emp.ename||'--'||r_emp.job);
  END LOOP;
END;
/
```

Cursor Programming-3

Cursor Program-1

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```
SQL> desc patient_visit
 Name                                      Null?    Type
 ----------------------------------------- -------- ---------------
 PATIENT_ID                                NOT NULL CHAR(7)
 DEPEND_SNO                                NOT NULL VARCHAR2(2)
 PATIENT_VISITNO                           NOT NULL NUMBER(4)
 EMP_ID                                             CHAR(7)
 DOCTOR_SNO                                         NUMBER(3)
 VISIT_DATE                                         DATE
 VISIT_NOTE                                         VARCHAR2(50)
 CAT_TEMPLATE                                       LONG
 MEDICATION                                         VARCHAR2(500)
 CHECKUP_STATUS                                     CHAR(1)
 SUB_CAT_ID                                         NUMBER(6)
 CAT_TEMPLATE1                                       VARCHAR2(3000)
```

Given a table with first three columns are composite keys. Write a PL/SQL program using cursor to update cat_template1 with LONG column cat_template. Assuming this tables contains more than 40,000 records.

Cursor Programming-3

```
declare
  v_count number(7);
cursor c1 is
   select  PATIENT_ID,DEPEND_SNO,PATIENT_VISITNO,CAT_TEMPLATE
    from patient_visit;
begin
  v_count := 0;
  for v_c in c1 LOOP
    update  patient_visit
    set  CAT_TEMPLATE1   = v_c.CAT_TEMPLATE
    where PATIENT_ID = v_c.PATIENT_ID
        and DEPEND_SNO = v_c.DEPEND_SNO
        and PATIENT_VISITNO = v_c.PATIENT_VISITNO;
    If v_count = 300 Then
      v_count := 0;
      --DBMS_OUTPUT.PUT_LINE('commit test');
    else
      v_count := v_count + 1;
    end if;
  end LOOP;
  commit;
end;
/
```

Cursor Program-1 (Solution)
Introduction to Database Administration

TOPIC 145

Programming using an Array

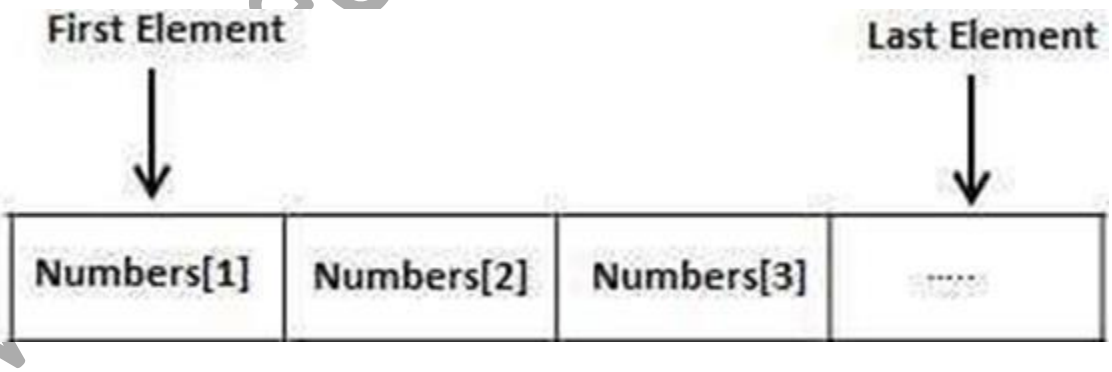
Programming using an Array

Programming using an Array

What is an Array?
Declaration of an Array
Basic Example of an Array
Associative Array
Associative Array - An Example
Use of Array with an Exception
Array Null and Empty Collection
Programming using an Array

What is an Array?

All VARRAYS consist of contiguous memory locations. The lowest address corresponds to the first element and the highest address to the last element.



https://www.tutorialspoint.com/plsql/plsql_collections.htm
Programming using an Array

Declaration of an Array

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A varray type is created with the CREATE TYPE statement. You must specify the maximum size and the type of elements stored in the varray.

CREATE Or REPLACE TYPE namearray AS
VARRAY(3) OF VARCHAR2(10);
/
Programming using an Array

Basic Example of an Array

```
DECLARE
   CURSOR c_emp is
   SELECT  ename FROM EMP;
   TYPE c_list is varray (20) of EMP.ename%type;
   ename_list c_list := c_list();
   counter integer :=0;
BEGIN
   FOR n IN c_emp LOOP
      counter := counter + 1;
      ename_list.extend;
      ename_list(counter)   := n.ename;
      dbms_output.put_line('Employee('||counter ||'):'
      ||ename_list(counter));
   END LOOP;
END;
/
```

Programming using an Array

Associative Array

An index-by table is a set of key-value pairs. Each key is unique and is used to locate the corresponding value. The key can be either an integer or a string.

TYPE type_name IS TABLE OF element_type [NOT NULL] INDEX BY subscript_type;

table_name type_name;
Programming using an Array
Associative Array – An Example

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```
DECLARE
   TYPE salary IS TABLE OF NUMBER INDEX BY VARCHAR2(20);
   salary_list salary;
   name   VARCHAR2(20);
BEGIN
   -- adding elements to the table
   salary_list('Sarah') := 62000;
   salary_list('Jamil') := 75000;
   salary_list('Wisal') := 100000;
   salary_list('Umar') := 78000;

   -- printing the table
   name := salary_list.FIRST;
   WHILE name IS NOT null LOOP
      dbms_output.put_line
      ('Salary of ' || name || ' is ' || TO_CHAR(salary_list(name)));
      name := salary_list.NEXT(name);
   END LOOP;
END;
/
```

Programming using an Array

Use of Array with an Exception

```
SQL> DECLARE
  2    CURSOR name_cur IS
  3    SELECT ename
  4    FROM EMP
  5    WHERE rownum <= 10;
  6    TYPE ename_type IS TABLE OF EMP.ename%TYPE
  7    INDEX BY BINARY_INTEGER;
  8    ename_tab ename_type;
  9    v_counter INTEGER := 0;
 10  BEGIN
 11    FOR name_rec IN name_cur LOOP
 12  v_counter := v_counter + 1;
 13  ename_tab(v_counter) := name_rec.ename;
 14  DBMS_OUTPUT.PUT_LINE ('ename('||v_counter||'): '||
 15  ename_tab(v_counter));
 16    END LOOP;
 17    DBMS_OUTPUT.PUT_LINE ('ename(11): '|| ename_tab(11));
 18  EXCEPTION
 19    WHEN NO_DATA_FOUND THEN
 20    DBMS_OUTPUT.PUT_LINE(SQLERRM);
 21  END;
 22  /
ename(1):
ename(2): ABC
ename(3): XYZ
ename(4): SMITH
ename(5): ALLEN
ename(6): WARD
ename(7): JONES
ename(8): MARTIN
ename(9): BLAKE
ename(10): CLARK
ORA-01403: no data found
```

Programming using an Array

Array Null and Empty Collection

```
DECLARE
   TYPE integer_type IS TABLE OF INTEGER;
   integer_tab integer_type;

   v_counter integer := 1;
BEGIN
   DBMS_OUTPUT.PUT_LINE (integer_tab(v_counter));
END;

DECLARE
*
ERROR at line 1:
ORA-06531: Reference to uninitialized collection
ORA-06512: at line 7
```

Introduction to Database Administration

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```
DECLARE
   TYPE integer_type IS TABLE OF INTEGER;
   integer_tab integer_type := integer_type();

   v_counter integer := 1;
BEGIN
   DBMS_OUTPUT.PUT_LINE (integer_tab(v_counter));
END;
```

```
DECLARE
*
ERROR at line 1:
ORA-06533: Subscript beyond count
ORA-06512: at line 7
```

TOPIC 146

Examples with Advance Topics
Examples with Advance Topics

Examples with Advance Topics

Use of Records Arrays
Use of PRAGMA Exception
PL/SQL Dynamic SQL
PL/SQL Dynamic SQL - Example-1
PL/SQL Dynamic SQL - Example-2
Examples with Advance Topics

Use of Records Arrays

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```
Declare
Cursor c1 is
  select sal
  from emp;
TYPE sal_type IS VARRAY(20) OF Integer;
v_col sal_TYPE := sal_type();
k number := 0;
Begin
  for i in C1 LOOP
    k := k+1;
    v_col.extend; --collection method
    v_col(k) := i.sal;
  end loop;
  for j in 1..4 LOOP
    DBMS_OUTPUT.PUT_LINE('sal is col('||j||') '
    ||v_col(j));
  end loop;
End;
```

Examples with Advance Topics

Use of PRAGMA Exception

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```
CREATE OR REPLACE TRIGGER Employee_permit_changes
  BEFORE INSERT OR DELETE OR UPDATE ON EMP
DECLARE
  Dummy              INTEGER;
  Not_on_weekends    EXCEPTION;
  Nonworking_hours   EXCEPTION;
  PRAGMA EXCEPTION_INIT (Not_on_weekends, -4097);
  PRAGMA EXCEPTION_INIT (Nonworking_hours, -4099);
BEGIN
   -- Check for weekends:
   IF (TO_CHAR(Sysdate, 'DAY') = 'SAT' OR
     TO_CHAR(Sysdate, 'DAY') = 'SUN') THEN
       RAISE Not_on_weekends;
   END IF;
  -- Check for work hours (8am to 6pm):
  IF (TO_CHAR(Sysdate, 'HH24') < 8 OR
    TO_CHAR(Sysdate, 'HH24') > 18) THEN
      RAISE Nonworking_hours;
  END IF;
EXCEPTION
  WHEN Not_on_weekends THEN
    Raise_application_error(-20324,'Might not change '
      ||'employee table during the weekend');
  WHEN Nonworking_hours THEN
    Raise_application_error(-20326,'Might not change '
     ||'emp table during Nonworking hours');
END;
/
```

Examples with Advance Topics

PL/SQL Dynamic SQL

Dynamic SQL is a programming methodology for generating and running SQL statements at run time.
It is useful when writing general- purpose and flexible programs like ad hoc query systems, when writing programs that must run database definition language (DDL) statements, or when you do not know at compilation time the full text of a SQL statement or the number or data types of its input and output variables.
Examples with Advance Topics

PL/SQL Dynamic SQL – Example-1

Creating a table during run-time.

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```
BEGIN
   execute immediate 'create table MyTable('
                                          ||'ID CHAR(3),'
                                          ||'Name VARCHAR2(50))';
END;
/
```

Note: grant create table to <user> is required

Examples with Advance Topics

PL/SQL Dynamic SQL - Example-2

Set to Null a column at run time

```
CREATE TABLE EMP_temp AS SELECT * FROM EMP;
/

DECLARE
  -- Set to NULL automatically at run time
  a_null  CHAR(1);
BEGIN
  EXECUTE IMMEDIATE 'UPDATE EMP_TEMP SET sal = :x'
    USING a_null;
END;
/
```

End
Introduction to Database Administration

TOPIC 147

Concepts of Oracle Instance-1
Concepts of Oracle Instance-1

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Concepts of Oracle Instance-1

Introduction
Configuration Option
Instance Structure
Database Instance Framework
Concepts of Oracle Instance-1

Introduction

A database instance is a set of memory structures that manage database files.

A Database is a set of physical files on disk created by the CREATE DATABASE statement.
Concepts of Oracle Instance-1

Introduction

The instance manages its associated data and serves the users of the database.
Every running Oracle database is associated with at least one Oracle database instance. Because an instance exists in memory and a database exists on disk, an instance can exist without a database and a database can exist without an instance.
Concepts of Oracle Instance-1

Configuration Option

During installation, oracle has an option to install instance, database or both

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Concepts of Oracle Instance-1

Instance Structure

When an instance is started, Oracle Database allocates a memory area called the system global area (SGA)and starts one or more background processes. The SGA serves various purposes, including the following:
Maintaining internal data structures that are accessed by many processes and threads concurrently
Caching data blocks read from disk
Buffering redo data before writing it to the online redo log files
Concepts of Oracle Instance-1

Instance Structure

Storing SQL execution plans

The SGA is shared by the Oracle processes, which include server processes and background processes, running on a single computer. The way in which Oracle processes are associated with the SGA varies according to operating system
Concepts of Oracle Instance-1

Instance Structure

A database instance includes background processes. Server processes, and the process memory allocated in these processes, also exist in the instance. The instance continues to function when server processes terminate.
Concepts of Oracle Instance-1

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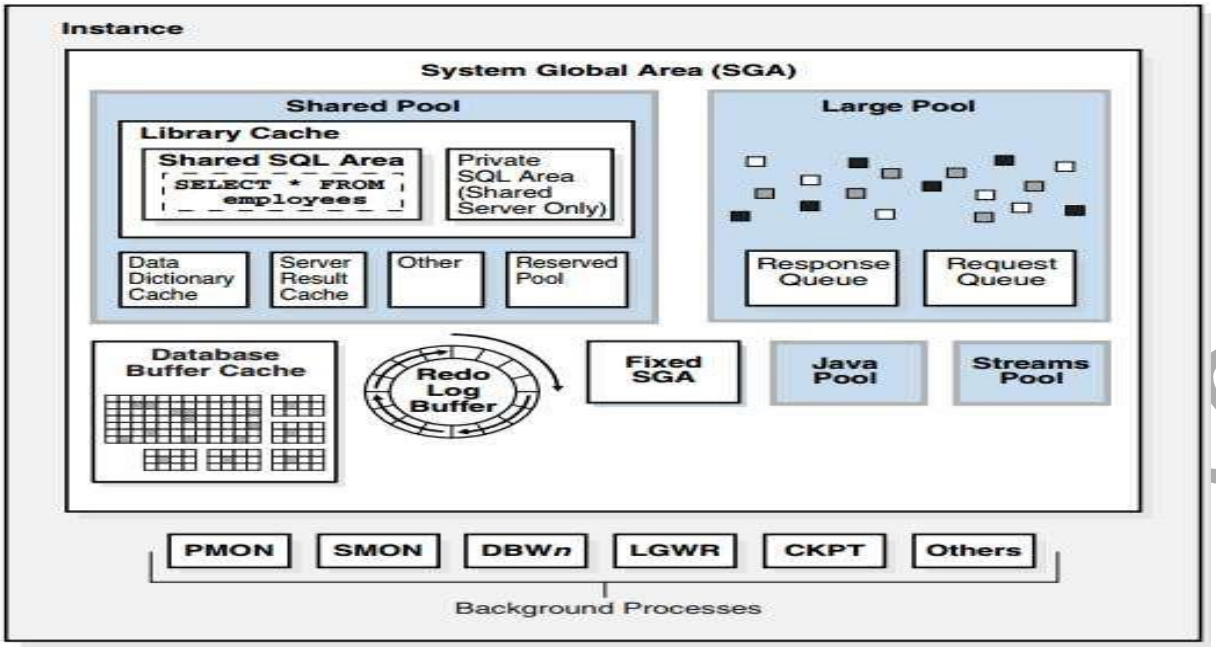

Database Instance Framework
Introduction to Database Administration

TOPIC 148

Concepts of Oracle Instance-2
Concepts of Oracle Instance-2

Concepts of Oracle Instance-2

Database Instance Configuration
Database Instance Configuration
Database Single & RAC Instance Configuration
Concepts of Oracle Instance-2

Database Instance Configuration

You can run Oracle Database in either of the following mutually exclusive configurations:
Single-instance configuration
A one-to-one relationship exists between the database and an instance.
Oracle Real Application Clusters (Oracle RAC) configuration
A one-to-many relationship exists between the database and instances.
Concepts of Oracle Instance-2
Database Instance Configuration

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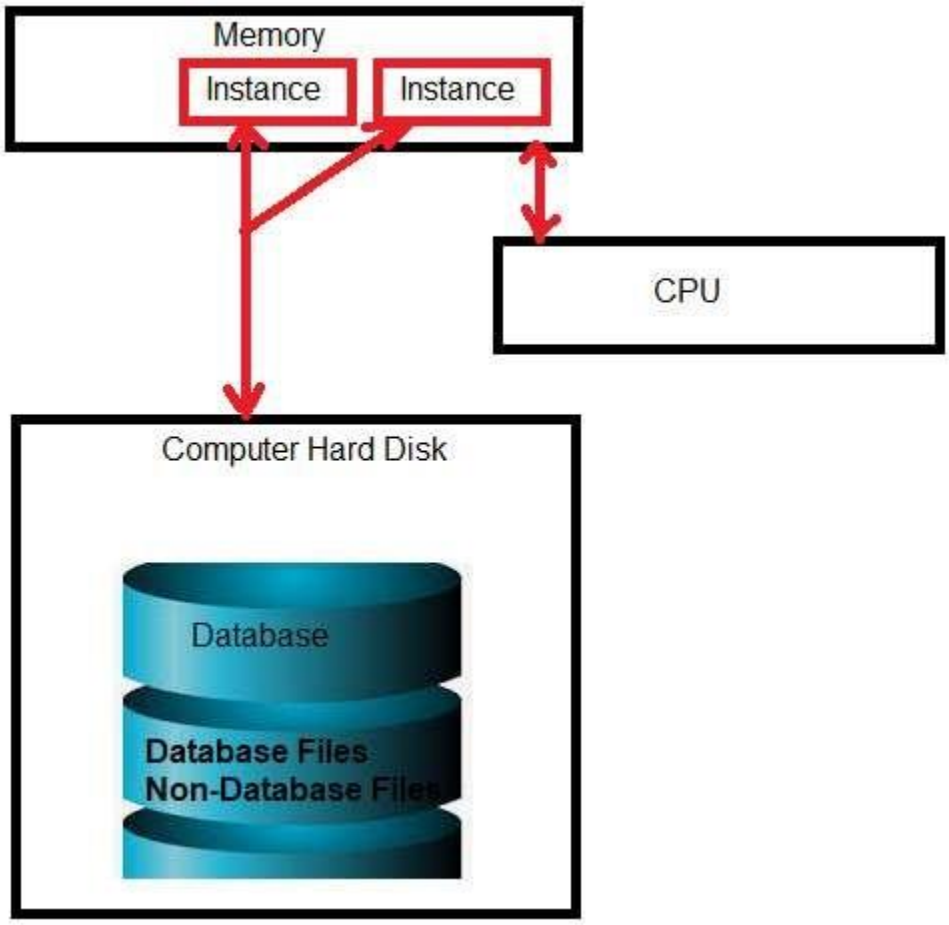
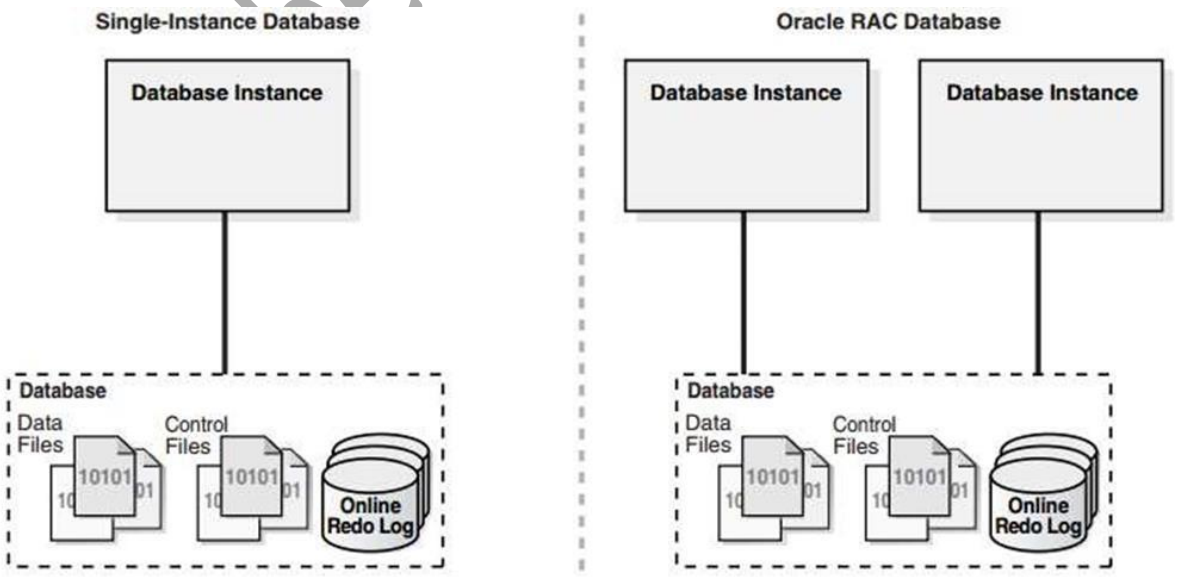


Concepts of Oracle Instance-2

Database Single & RAC Instance Configuration



Introduction to Database Administration

TOPIC 149

Concepts of Oracle Instance-3

Concepts of Oracle Instance-3

Concepts of Oracle Instance-3

Database Instance Configuration
Duration of an Instance
Instance Startup
Instance Shutdown & Startup
Instance & SID
Oracle Home & SID at Windows OS
Display Instance Name using Data Dictionary View
Concepts of Oracle Instance-3

Database Instance Configuration

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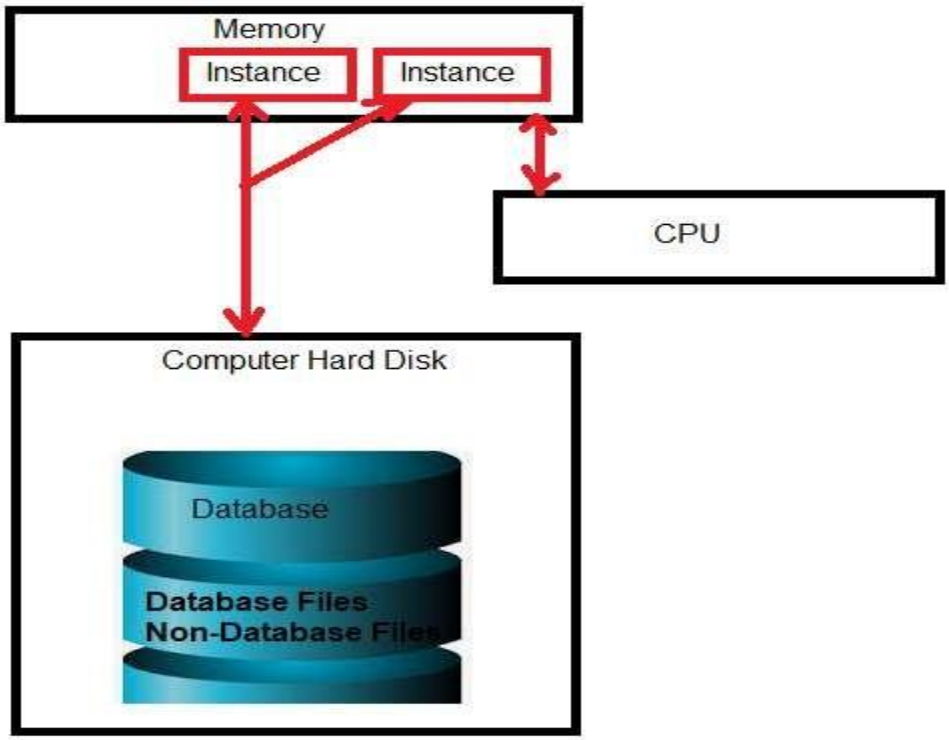

Concepts of Oracle Instance-3

Duration of an Instance

An instance begins when it is created with the STARTUP command and ends when it is terminated. During this period, an instance can associate itself with one and only one database. Furthermore, the instance can mount a database only once, close it only once, and open it only once. After a database has been closed or shut down, you must start a different instance to mount and open this database.
Concepts of Oracle Instance-3

Instance Startup

Login with user sys / as sysdba
After shutdown database, run the following:

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```
SQL> STARTUP
ORACLE instance started.

Total System Global Area  468729856 bytes
Fixed Size                  1333556 bytes
Variable Size             440403660 bytes
Database Buffers           16777216 bytes
Redo Buffers               10215424 bytes
Database mounted.
Database opened.
```

Concepts of Oracle Instance-3

Instance Startup

This query shows the time that the current instance was started:

```
SQL> SELECT
  2  TO_CHAR(STARTUP_TIME,'MON-DD-RR HH24:MI:SS')
  3  AS "Inst Start Time" FROM V$INSTANCE;

Inst Start Time
------------------
SEP-30-20 20:56:54
```

Concepts of Oracle Instance-3

Instance Shutdown & Startup

This query shows the time that the current instance was started:

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```
SQL>
SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> startup
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             696254928 bytes
Database Buffers          369098752 bytes
Redo Buffers                4603904 bytes
Database mounted.
Database opened.
SQL> SELECT
  2  TO_CHAR(STARTUP_TIME,'MON-DD-RR HH24:MI:SS')
  3  AS "Inst Start Time" FROM V$INSTANCE;

Inst Start Time
------------------
OCT-01-20 08:48:52
```

Concepts of Oracle Instance-3

Instance & SID

The system identifier (SID)is a unique name for an Oracle database instance on a specific host. On UNIX and Linux, Oracle Database uses the SID and Oracle home values to create a key to shared memory.
Also, the SID is used by default to locate the parameter file, which is used to locate relevant files such as the database control files.
Concepts of Oracle Instance-3

Instance & SID

On most platforms, the ORACLE_SID environment variable sets the SID, whereas the ORACLE_HOME variable sets the Oracle home.
When connecting to an instance, clients can specify the SID in an Oracle Net connection or use a net service name.
Oracle Database converts a service name into an ORACLE_HOME and ORACLE_SID.
Concepts of Oracle Instance-3

Oracle Home & SID at Windows OS

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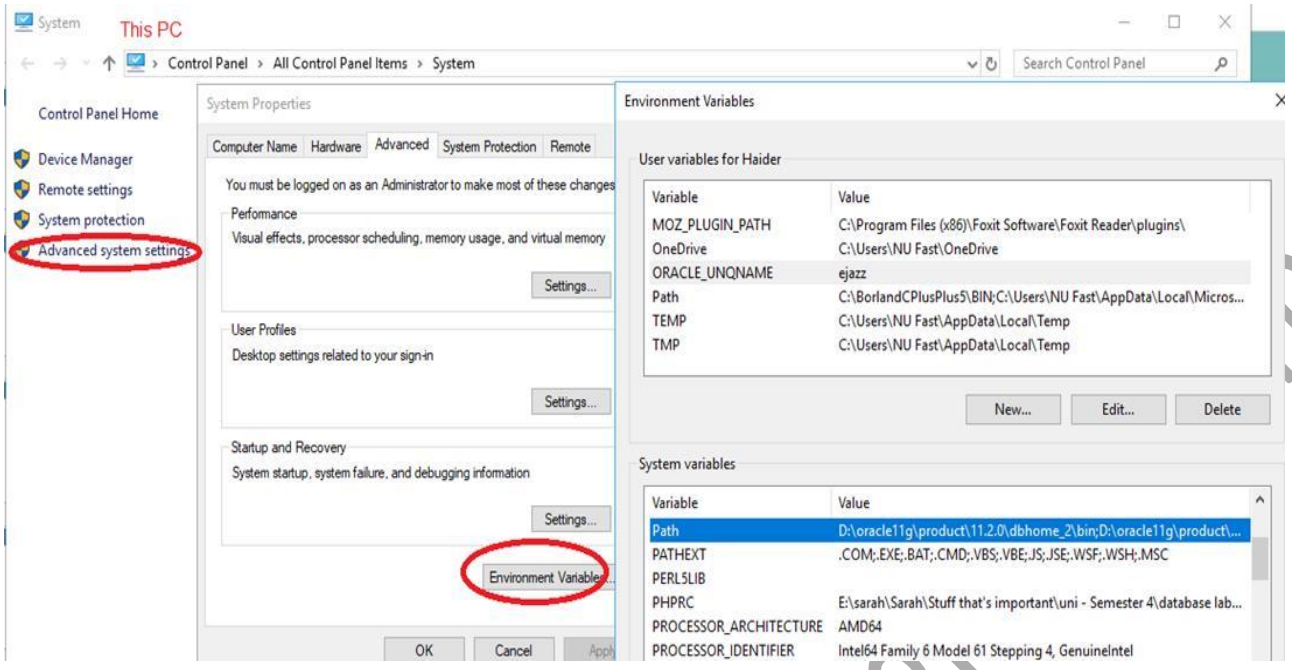

Concepts of Oracle Instance-3

Display Instance Name using Data Dictionary View

```
SQL> SELECT TO_CHAR(STARTUP_TIME,'MON-DD-RR HH24:MI:SS') AS "Inst Start Time",
  2  Instance_name , substr(Host_name,1,20)
  3  FROM V$INSTANCE;

Inst Start Time    INSTANCE_NAME    SUBSTR(HOST_NAME,1,2
------------------ ---------------- --------------------
OCT-01-20 08:48:52 orcl             HAIDER
```

Introduction to Database Administration

TOPIC 150

Instance Startup & Shutdown-1

Instance Startup & Shutdown-1

Instance Startup & Shutdown-1

Overview of Instance and Database Startup
SVRCTL Utility Help
Example - SVRCTL command
Progress from Shutdown & Startup OPEN
Instance Startup
Instance Startup MOUNT
Instance Startup NOMOUNT
Instance Startup & Shutdown-1

Overview of Instance and Database Startup

A database instance provides user access to a database.
In a typical use case, you manually start an instance and then mount and open the database, making it available for users. You can use the SQL*Plus STARTUP command, Oracle Enterprise Manager (Enterprise Manager), or the SRVCTL utility to perform these steps.
Instance Startup & Shutdown-1

SVRCTL Utility Help

Instance Startup & Shutdown-1

Example - SVRCTL command

Syntax to add a named service to a database with preferred instances in list one and available instances in list two, using basic failover for the available instances:

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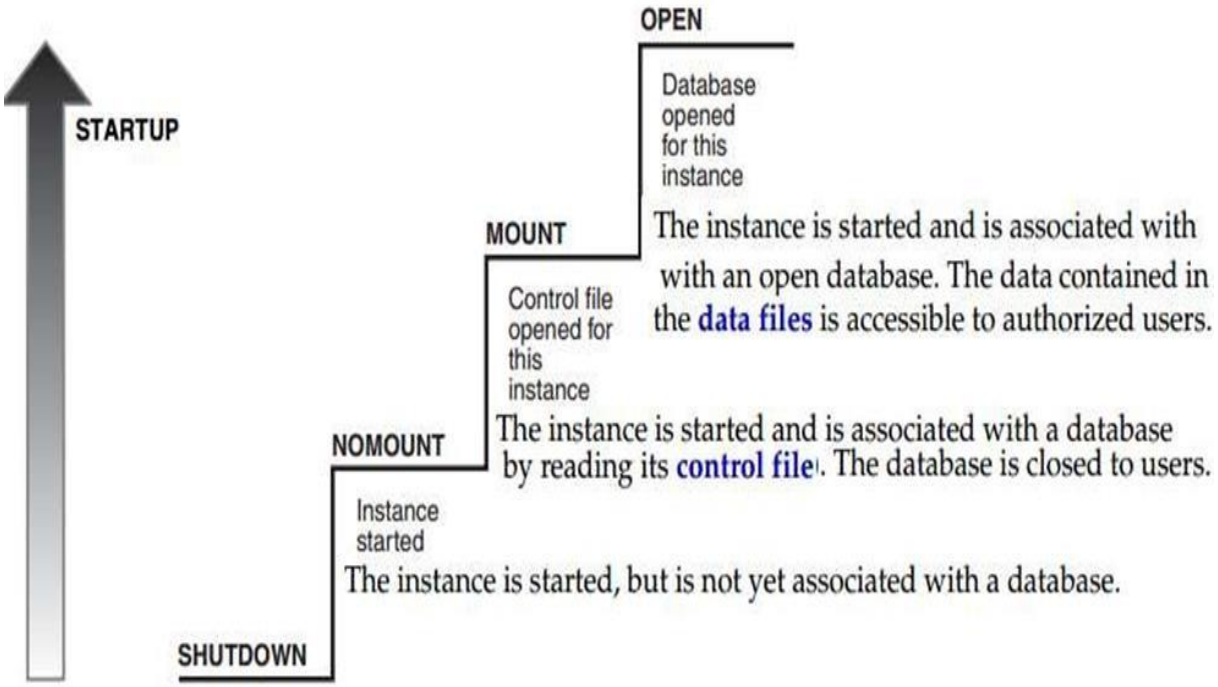
```
srvctl add  service -d crm -s sales -r crm01,crm02 -a crm03
```

Instance Startup & Shutdown-1

Progress from Shutdown & Startup OPEN



Instance Startup & Shutdown-1

Instance Startup

Login with user sys / as sysdba
After shutdown database, run the following:

```
SQL> STARTUP
ORACLE instance started.

Total System Global Area  468729856 bytes
Fixed Size                  1333556 bytes
Variable Size             440403660 bytes
Database Buffers           16777216 bytes
Redo Buffers               10215424 bytes
Database mounted.
Database opened.
```

Instance Startup & Shutdown-1

Instance Startup

This query shows the time that the current instance was started:

```
SQL> SELECT
  2  TO_CHAR(STARTUP_TIME,'MON-DD-RR HH24:MI:SS')
  3  AS "Inst Start Time" FROM V$INSTANCE;

Inst Start Time
------------------
SEP-30-20 20:56:54
```

Instance Startup & Shutdown-1

Instance Startup MOUNT

First perform shutdown immediate then startup mount:

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```
SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL>
SQL> startup mount
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             696254928 bytes
Database Buffers          369098752 bytes
Redo Buffers                4603904 bytes
Database mounted.
```

Instance Startup & Shutdown-1

Instance Startup NOMOUNT

First perform shutdown immediate then
startup nomount:

```
SQL> shutdown immediate
ORA-01109: database not open


Database dismounted.
ORACLE instance shut down.
SQL>
SQL> startup nomount
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             696254928 bytes
Database Buffers          369098752 bytes
Redo Buffers                4603904 bytes
SQL>
```

End
Database creation and certain backup & recovery operations are performed.
Introduction to Database Administration

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TOPIC 151

Instance Startup & Shutdown-2

Instance Startup & Shutdown-2

Instance Startup & Shutdown-2

Connection with Administrator Privileges
Instance Started to perform steps
How Database is Mounted?
How Database is opened?
Read-only Opened Database
Progress from Shutdown & Startup OPEN
Instance Startup & Shutdown-2

Connection with Administrator Privileges

Database startup and shutdown are powerful administrative options that are restricted to users who connect to Oracle Database with administrator privileges.
Normal users do not have control over the current status of an Oracle database.
Instance Startup & Shutdown-2

Connection with Administrator Privileges

Depending on the operating system, one of the following conditions establishes administrator privileges for a user:
The operating system privileges of the user enable him or her to connect using administrator privileges.
Instance Startup & Shutdown-2

Connection with Administrator Privileges

The user is granted the SYSDBA or SYSOPER system privileges and the database uses password files to authenticate database administrators over the network.
When you connect with the SYSDBA system privilege, you are in the schema owned by SYS.
When you connect as SYSOPER, you are in the public schema.
Instance Startup & Shutdown-2

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Instance Started to perform steps

Searches for a server parameter file in a platform-specific default location and, if not found, for a text initialization parameter file(specifying STARTUP with the SPFILE or PFILE parameters overrides the default behavior)
Reads the parameter file to determine the values of initialization parameters
Instance Startup & Shutdown-2

Instance Started to perform steps

Allocates the SGA based on the
initialization parameter settings
Starts the Oracle background processes
Opens the alert log and trace files and writes all explicit parameter settings to the alert login valid parameter syntax
Instance Startup & Shutdown-2

How Database is Mounted?

The instance mounts a database to associate the database with this instance. To mount the database, the instance obtains the names of the database control files specified in the CONTROL_FILES initialization parameter and opens the files.
Instance Startup & Shutdown-2

How Database is Mounted?

Oracle Database reads the control files to find the names of the data files and the online redo log files that it will attempt to access when opening the database.
In a mounted database, the database is closed and accessible only to database administrators.
Instance Startup & Shutdown-2

How Database is Mounted?

Administrators can keep the database closed while completing specific maintenance operations. However, the database is not available for normal operations
Instance Startup & Shutdown-2

How Database is opened?

Opening a mounted database makes it available for normal database operations
Opens the online data files in tablespaces other than undo tablespaces
Acquires an undo tablespace
Opens the online redo log files

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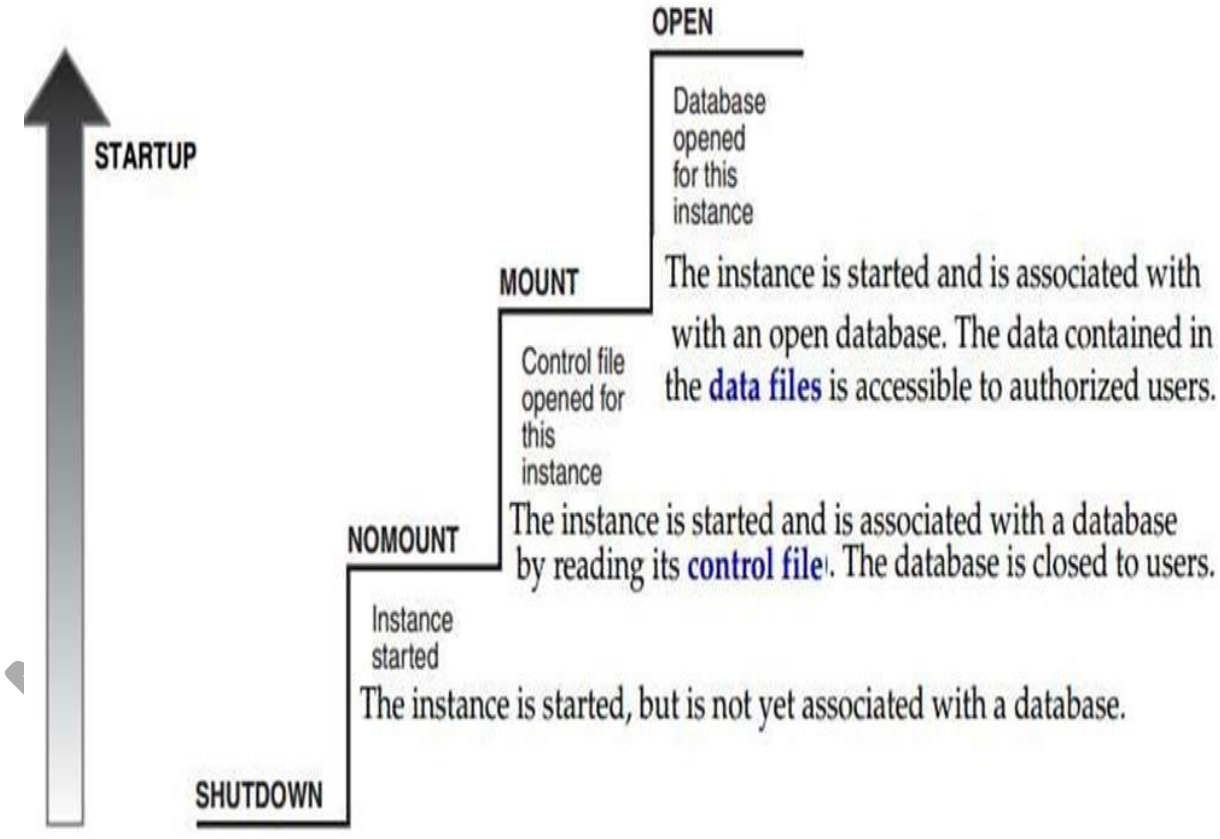
By default, the database opens in read/write mode.
Instance Startup & Shutdown-2

Read-only Opened Database

Data files can be taken offline and online. However, you cannot take permanent tablespaces offline.
Offline data files and tablespaces can be recovered.
The control file remains available
Temporary tablespaces created with the CREATE TEMPORARY TABLESPACE statement are read/write.
Writes to operating system audit trails,
trace files, and alert logs can continue.
Instance Startup & Shutdown-2

Progress from Shutdown & Startup OPEN



TOPIC 152

Instance Startup & Shutdown-3

Instance Startup & Shutdown-3

Instance Startup & Shutdown-3

Database with Shutdown Instance
Progress from OPEN to Shutdown
Steps to perform Database Shutdown
Shutdown ABORT
Shutdown IMMEDIATE
Shutdown TRANSACTIONAL
Shutdown NORMAL
Shutdown Modes Summary
Instance Startup & Shutdown-3

Database with Shutdown Instance

In a typical use case, you manually shut down the database, making it unavailable for users while you perform maintenance or other administrative tasks.
You can use the SQL*Plus SHUTDOWN command or Enterprise Manager to perform these steps.
Instance Startup & Shutdown-3

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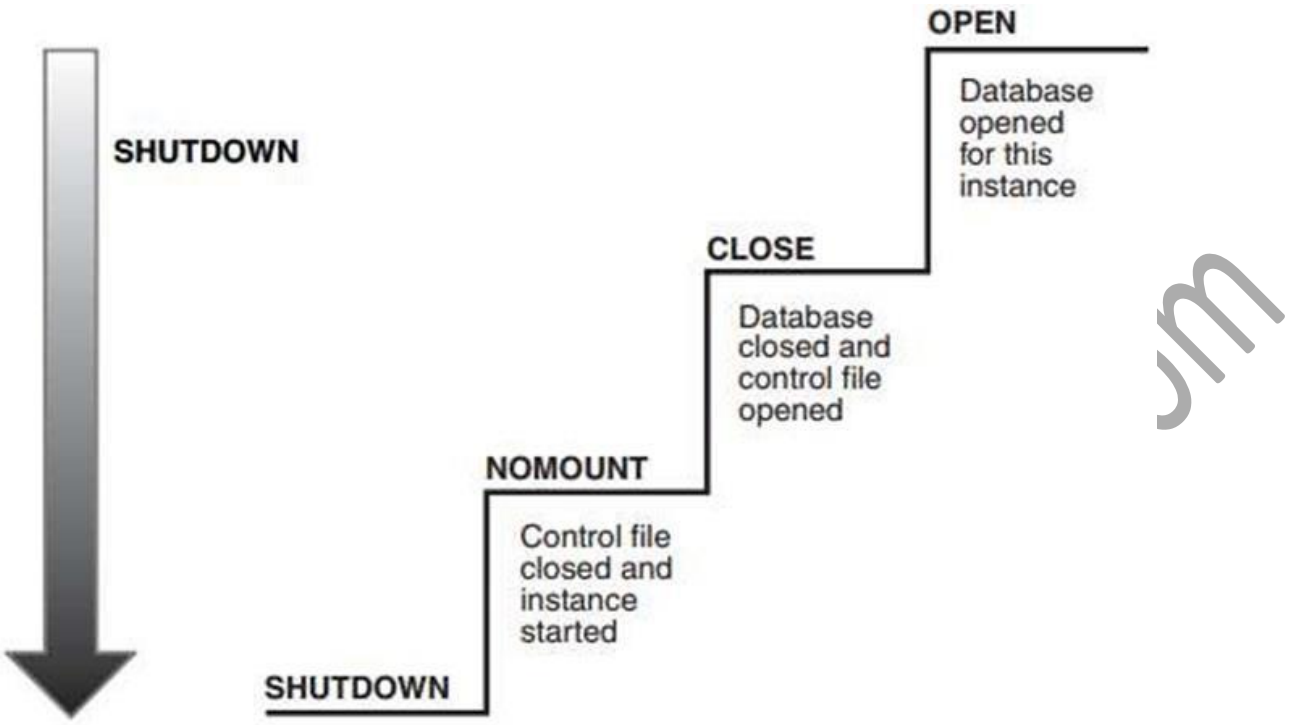

Progress from OPEN to Shutdown
Instance Startup & Shutdown-3

Steps to perform Database Shutdown

Database closed
The database is mounted, but online
data files and redo log files are closed.

Database unmounted
The instance is started, but is no longer associated with the control file of the database.
Database instance shut down
The database instance is no longer started.
Instance Startup & Shutdown-3

Steps to perform Database Shutdown

Oracle Database does not go through all of the preceding steps in an instance failure or SHUTDOWN ABORT, which immediately terminates the instance.
Instance Startup & Shutdown-3

Shutdown ABORT

Used in emergency situation. Shuting down instance may take substantially longer.
SHUTDOWN ABORT does not checkpoint the open data files

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Instance Startup & Shutdown-3

Shutdown IMMEDIATE

Fastest way to manage. Active transactions are terminated and uncommitted changes are rolled back.
Instance Startup & Shutdown-3

Shutdown TRANSACTIONAL

This mode prevents users from starting new transactions, but waits for all current transactions to complete before shutting down.
Instance Startup & Shutdown-3

Shutdown NORMAL

This is the default mode of shutdown. The
database waits for all connected users to disconnect before shutting down.
Instance Startup & Shutdown-3

Shutdown Modes Summary

A database administrator with SYSDBA or SYSOPER privileges can shut down the database using the SQL*Plus SHUTDOWN command or Enterprise Manager.

Database Behavior	ABORT	IMMEDIATE	TRANSACTIONAL	NORMAL
Permits new user connections	No	No	No	No
Waits until current sessions end	No	No	No	Yes
Waits until current transactions end	No	No	Yes	Yes
Performs a checkpoint and closes open files	No	Yes	Yes	Yes

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TOPIC 153

Overview of Checkpoints
Overview of Checkpoints

Overview of Checkpoints

What is a Checkpoint?
Purpose of Checkpoint?
Recovery without Checkpoints
Recovery using Checkpoints
Overview of Checkpoints

What is a Checkpoint?

A checkpoint is a crucial mechanism in consistent database shutdowns, instance recovery, and Oracle Database operation generally.
A data structure that indicates the checkpoint position, which is the SCN in the redo stream where instance recovery must begin The checkpoint position is determined by the oldest dirty buffer in the database buffer cache.
Overview of Checkpoints

What is Checkpoint?

The checkpoint position acts as a pointer to the redo stream and is stored in the control file and in each data file header.
The writing of modified database buffers in the database buffer cache to disk.

Whenever checkpoint happens all the dirty buffers of DB buffer cache (volatile storage) moves into data files (Non volatile storage)
Overview of Checkpoints

Purpose of Checkpoint?

Oracle Database uses checkpoints to achieve the following goals:
Reduce the time required for recovery incase of an instance or media failure
Ensure that dirty buffers in the buffer cache are written to disk regularly
Ensure that all committed data is written to disk during a consistent shutdown
Establish data consistency

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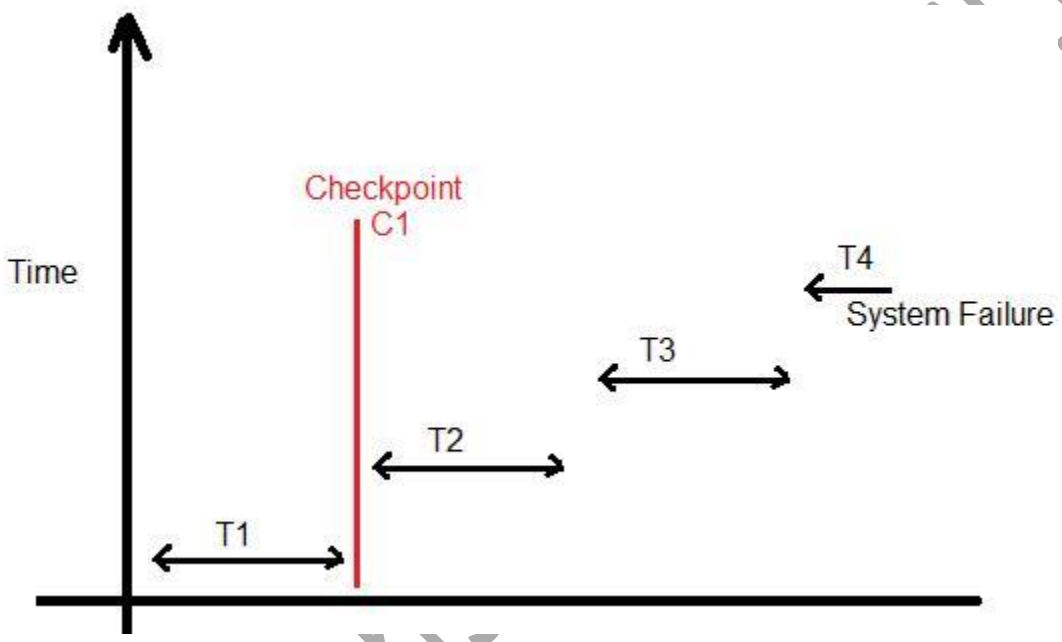
Overview of Checkpoints

Recovery without Checkpoints

Extra time is wasted in processing the entire log file Redoing of unnecessary transactions
Overview of Checkpoints

Recovery using Checkpoints



Checkpoint is a mechanism in which all the previous logs are removed from the system and are stored permanently in the storage disk.
Introduction to Database Administration

TOPIC 154

Initiate Checkpoints
Initiate Checkpoints

Initiate Checkpoints

When to initiate Checkpoint
Checkpoint Process
Thread Checkpoints Type
Tablespace and Data File Checkpoints

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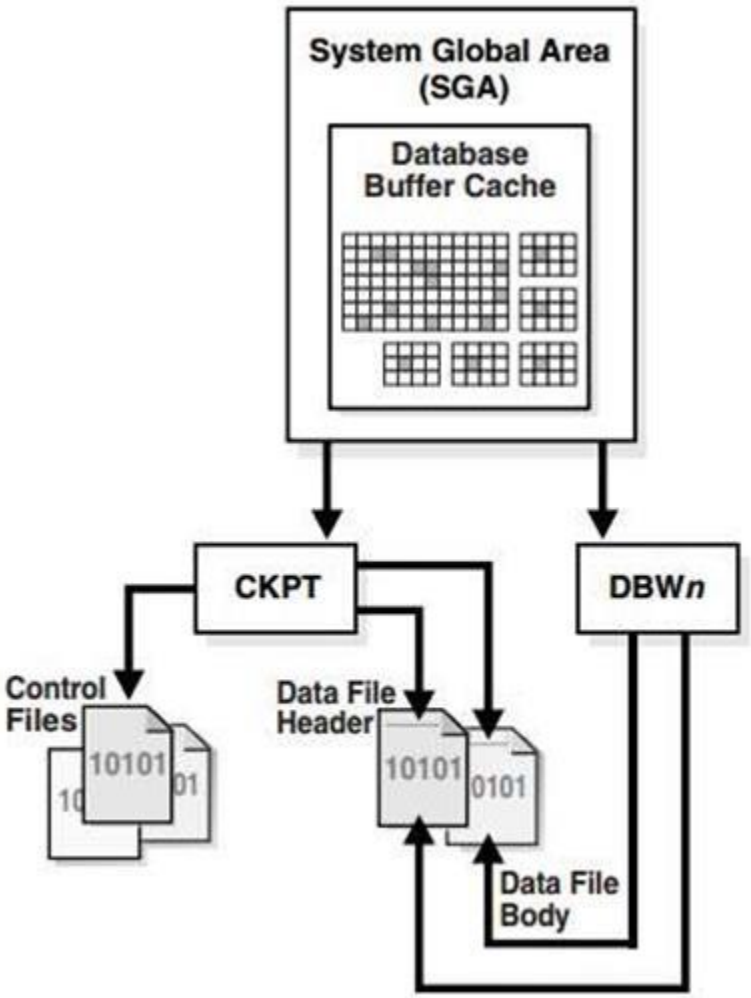
Type
Incremental Checkpoints Type
Checkpoints Processor and Database files
Initiate Checkpoints

When to initiate Checkpoint

The checkpoint process (CKPT) is responsible for writing checkpoints to the data file headers and control file.
Checkpoints occur in a variety of situations
Initiate Checkpoints



Checkpoint Process

The checkpoint process (CKPT)updates the control file and data file headers with checkpoint information and signals DBWn to write blocks to disk. Checkpoint information includes the checkpoint position, SCN, location in online redo log to begin recovery, and so on.
Initiate Checkpoints

Thread Checkpoints Type

The database writes to disk all buffers modified by redo in a specific thread before a certain target. The set of thread checkpoints on all instances in a database is a database checkpoint. Thread checkpoints occur in the following situations:
Consistent database shutdown
ALTER SYSTEM CHECKPOINT statement
Online redo log switch
ALTER DATABASE BEGIN BACKUP statement
Initiate Checkpoints

Tablespace and Data File Checkpoints Type

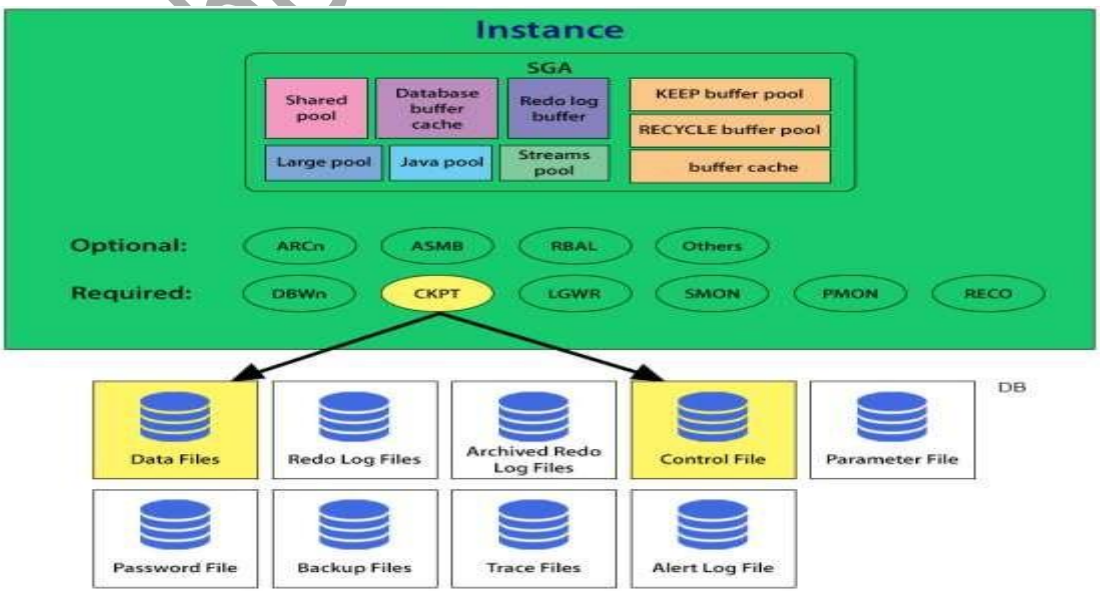
The database writes to disk all buffers modified by redo before a specific target. A tablespace checkpoint is a set of data file checkpoints, one for each data file in the tablespace. These checkpoints occur in a variety of situations, including making a tablespace read-only or taking it offline normal, shrinking a data file, or executing

ALTER TABLESPACE BEGIN BACKUP;
Initiate Checkpoints

Incremental Checkpoints Type

An incremental checkpoint is a type of thread checkpoint partly intended to avoid writing large numbers of blocks at online redo log switches. DBWn checks at least every three seconds to determine whether it has work to do.
When DBWn writes dirty buffers, it advances the checkpoint position, causing CKPT to write the checkpoint position to the control file, but not to the data file headers.
Initiate Checkpoints

Checkpoints Processor and Database files



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Introduction to Database Administration

TOPIC 155

Checkpoints Commands Samples

Checkpoints Commands Samples

Checkpoints Commands Samples

Checkpoints Commands Samples
When will a Checkpoint occur
Checkpoint Occurring Command
Data Dictionary View for Checkpoint
SCN is Changed After another Checkpoint
SCN is not Changed After Switch Logfile
Checkpoints Commands Samples

When will a Checkpoint occur

At each switch of the redo log files
Once the number of seconds defined in the LOG_CHECKPOINT_TIMEOUT is reached Once the current redo log file reaches the size
LOG Checkpoint Interval x size of IO-OS blocks, Example 10000*512=5MB

Directly by the Alter System switch Logfile command
Directly by the Alter System Checkpoint command
Checkpoints Commands Samples

Checkpoint Occurring Command

Run the following command with sys
user

Alter system checkpoint;
Checkpoints Commands Samples

Data Dictionary View for Checkpoint

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```
SQL> select Checkpoint_change#, checkpoint_time, sum(Bytes)/1024/1024 DataSize ,
  2  from v$datafile
  3  group by Checkpoint_change#, checkpoint_time;

CHECKPOINT_CHANGE# CHECKPOIN   DATASIZE
------------------ --------- ----------
          19352187 02-OCT-20   18749.75
         19352187 02/10/2020 10:06:26 AM          305
         19352187 02/10/2020 10:06:26 AM         8.75
         19352187 02/10/2020 10:06:26 AM         1000
```

Checkpoints Commands Samples

SCN is Changed After another Checkpoint

```
         19352187 02-OCT-20   18749.75

SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> startup
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             696254928 bytes
Database Buffers          369098752 bytes
Redo Buffers                4603904 bytes
Database mounted.
Database opened.
SQL> select Checkpoint_change#, TO_CHAR(checkpoint_time, 'DD/MM/YYYY HH:MI:SS AM') CHKP_Time,
  2  Bytes/1024/1024
  3  from v$datafile;

CHECKPOINT_CHANGE# CHKP_TIME                BYTES/1024/1024
------------------ ---------------------- ---------------
         19352722 02/10/2020 10:19:42 AM             710
         19352722 02/10/2020 10:19:42 AM             710
         19352722 02/10/2020 10:19:42 AM             305
         19352722 02/10/2020 10:19:42 AM            8.75
         19352722 02/10/2020 10:19:42 AM            1000
         19352722 02/10/2020 10:19:42 AM            1000
```

Checkpoints Commands Samples

SCN is not Changed After Switch Logfile

```
         19353247 02/10/2020 10:25:15 AM           1024
         19353247 02/10/2020 10:25:15 AM            800

22 rows selected.

SQL>
SQL> Alter System switch Logfile;

System altered.

SQL> select Checkpoint_change#, checkpoint_time, sum(Bytes)/1024/1024 DataSize
  2  from v$datafile
  3  group by Checkpoint_change#, checkpoint_time;

CHECKPOINT_CHANGE# CHECKPOIN   DATASIZE
------------------ --------- ----------
         19353247 02-OCT-20   18749.75
```

Introduction to Database Administration

TOPIC 156

Instance Recovery

Instance Recovery

Instance Recovery

Overview of Instance Recovery
Purpose of Instance Recovery
How Instance Recovery is Performed?
Instance Recovery

Overview of Instance Recovery

Instance recovery is the process of applying records in the online redo log to data files to reconstruct changes made after the most recent checkpoint.
Instance recovery occurs automatically when an administrator attempts to open a database that was previously shut down inconsistently.

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Instance Recovery

Overview of Instance Recovery

Instance recovery occurs automatically when an administrator attempts to open a database that was previously shut down inconsistently.

```
SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> startup
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             696254928 bytes
Database Buffers          369098752 bytes
Redo Buffers                4603904 bytes
Database mounted.
Database opened.
```

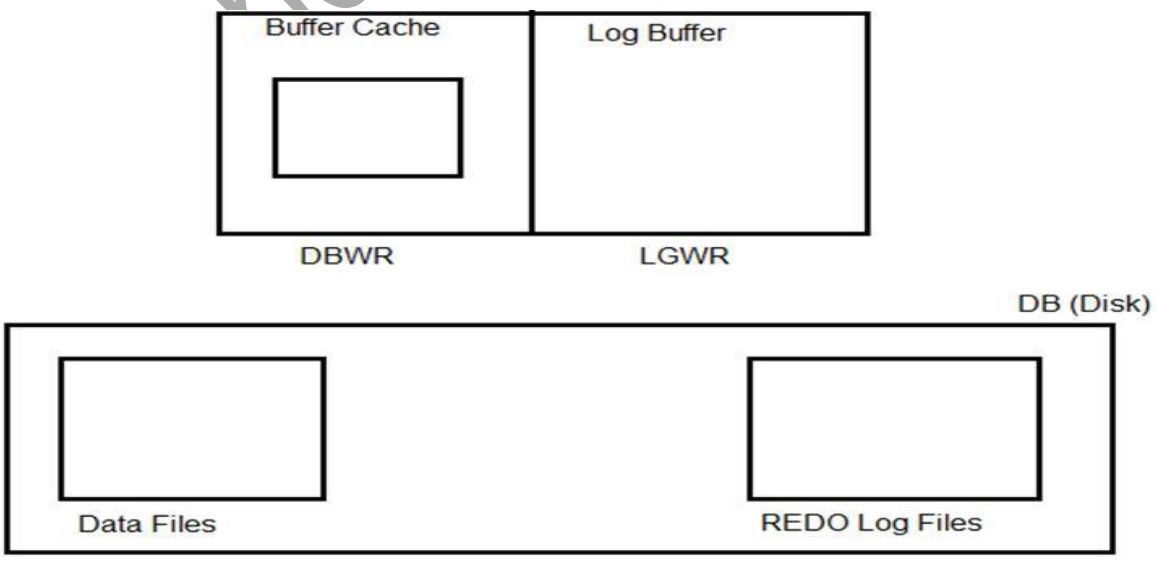
Instance Recovery

Purpose of Instance Recovery

Instance recovery ensures that the database is in a consistent state after an instance failure. The files of a database can be left in an inconsistent state because of how Oracle Database manages database changes.

Instance Recovery

How Instance Recovery is Performed?



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Introduction to Database Administration

TOPIC 157

Instance Recovery Protocol

Instance Recovery Protocol

Instance Recovery

Situations for Instance Recovery
Performing Instance Recovery
Importance of CKPT for Instance Recovery
Instance Recovery Protocol

Situations for Instance Recovery

If an instance of an open database fails, either because of a SHUTDOWN ABORT statement or abnormal termination, then the following situations can result:
Data blocks committed by a transaction are not written to the data files and appear only in the online redo log. These changes must be reapplied to the database.
Instance Recovery Protocol

Situations for Instance Recovery

The data files contains changes that had not been committed when the instance failed. These changes must be rolled back to ensure transactional consistency.

Instance recovery uses only online redo log files and current online data files to synchronize the data files and ensure that they are consistent
Instance Recovery Protocol

Performing Instance Recovery

Whether instance recovery is required depends on the state of the redo threads. A redo thread is marked open in the control file when a database instance opens in read/write mode, and is marked closed when the instance is shut down consistently.
If redo threads are marked open in the control file, but no live instances hold the thread enqueues corresponding to these threads, then the database requires instance recovery.
Instance Recovery Protocol

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Performing Instance Recovery

Oracle Database performs instance recovery automatically in the following situations:
The database opens for the first time after the failure of a single-instance database or all instances of an Oracle RAC database. This form of instance recovery is also called crash recovery. Oracle Database recovers the online redo threads of the terminated instances together.
Instance Recovery Protocol

Performing Instance Recovery

Some but not all instances of an Oracle RAC database fail. Instance recovery is performed automatically by a surviving instance in the configuration.

The SMON background process performs instance recovery, applying online redo automatically. No user intervention is required
Instance Recovery Protocol

Importance of CKPT for Instance Recovery

Instance recovery uses checkpoints to determine which changes must be applied to the data files. The checkpoint position guarantees that every committed change with an SCN lower than the checkpoint SCN is saved to the data files.
Instance Recovery Protocol
Importance of CKPT for Instance Recovery

During instance recovery, the database must apply the changes that occur

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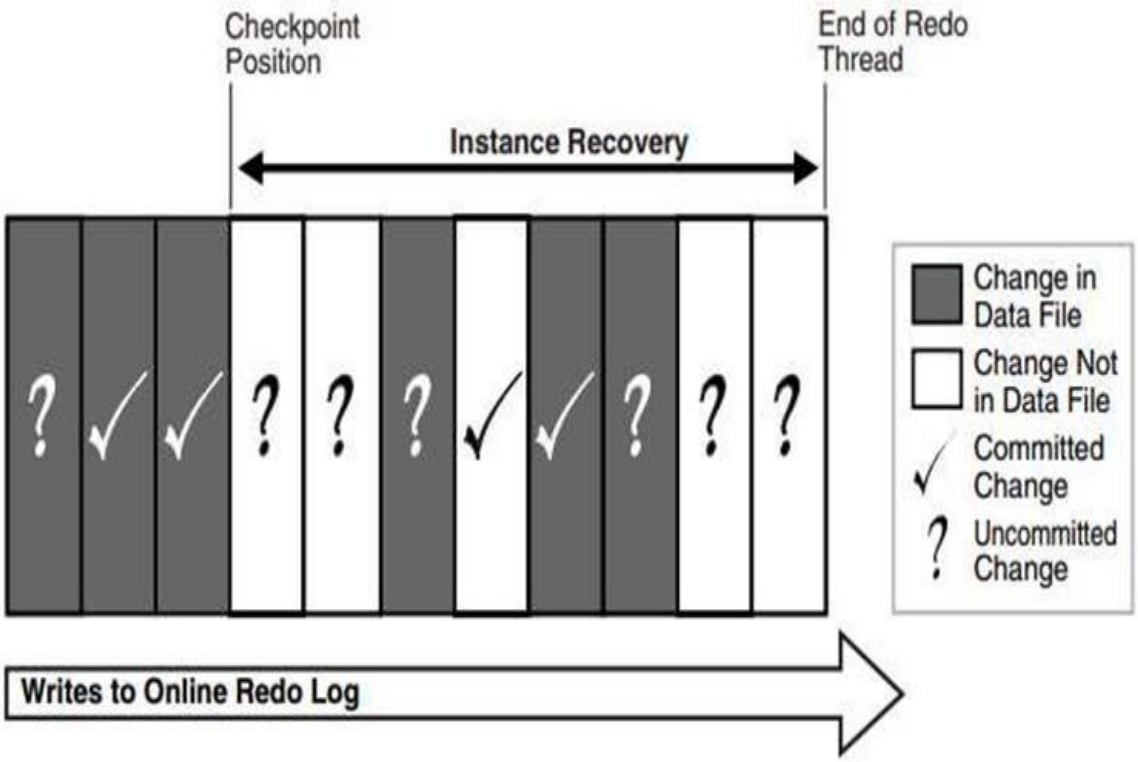

between the checkpoint position and the end of the redo thread.
Introduction to Database Administratio

TOPIC 158

Managing Recovery using MS SQL Server

Managing Recovery using MS SQL Server

MS SQL Server's Recovery

Restore & Recovery Overview
Overview of Restore Scenarios
Steps to Restore a Database
Accelerated Database Recovery
Steps to Restore a Database
Decision to adopt ADR
To View & Change the Recovery Model
- Transact SQL
Without ADR, DB Recovery Follows ARIES
DB Recovery Follows ARIES using ADR

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Managing Recovery using MS SQL Server

Restore & Recovery Overview

To recover a SQL Server database from a failure, a database administrator has to restore a set of SQL Server backups in a logically correct and meaningful restore sequence.:
The database (a complete database restore)
The data file (a file restore)
The data page (Bulk load, restore individual DB)
Managing Recovery using MS SQL Server

Overview of Restore Scenarios

A *restore scenario* in SQL Server is the process of restoring data from one or more backups and then recovering the database. The supported restore scenarios depend on the recovery model of the database and the edition of SQL Server.

Complete DB Restore
File Restore (individual files)
Managing Recovery using MS SQL Server

Steps to Restore a Database

To perform a database restore, the
Database Engine executes three steps:
Creates the database and transaction
log files if they do not already exist.
Copies all the data, log, and index pages from the backup media of a database to the database files.
Applies the transaction log in what is
known as the recovery process.
Managing Recovery using MS SQL Server

Accelerated Database Recovery

Accelerated Database Recovery (ADR) improves database availability, especially in the presence of long running transactions, by redesigning the SQL database engine recovery process. ADR is new in SQL Server 2019.

ADR is available for Azure SQL Database, Azure SQL Managed Instance and Azure Synapse SQL.
Managing Recovery using MS SQL Server

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Steps to Restore a Database

To perform a file restore, the Database Engine executes two steps:

Creates any missing database file(s).
Copies the data from the backup devices to the database file(s).

If you restore a file, you cannot recover it and bring it online until it has been rolled far enough forward to be consistent with the database.
Managing Recovery using MS SQL Server

Decision to adopt ADR

The following types of customers should consider enabling ADR:
Customers that have workloads with long running transactions.
Customers that have seen cases where active transactions are causing the transaction log to grow significantly.
Customers that have experienced long periods of database unavailability due to SQL Server long running recovery (such as unexpected SQL Server restart or manual transaction rollback).
Managing Recovery using MS SQL Server

To View & Change the Recovery Model - Transact SQL

Connect to the Database Engine. From the Standard bar, click New Query.

```
SQL

SELECT name, recovery_model_desc
    FROM sys.databases
        WHERE name = 'model' ;
GO
```

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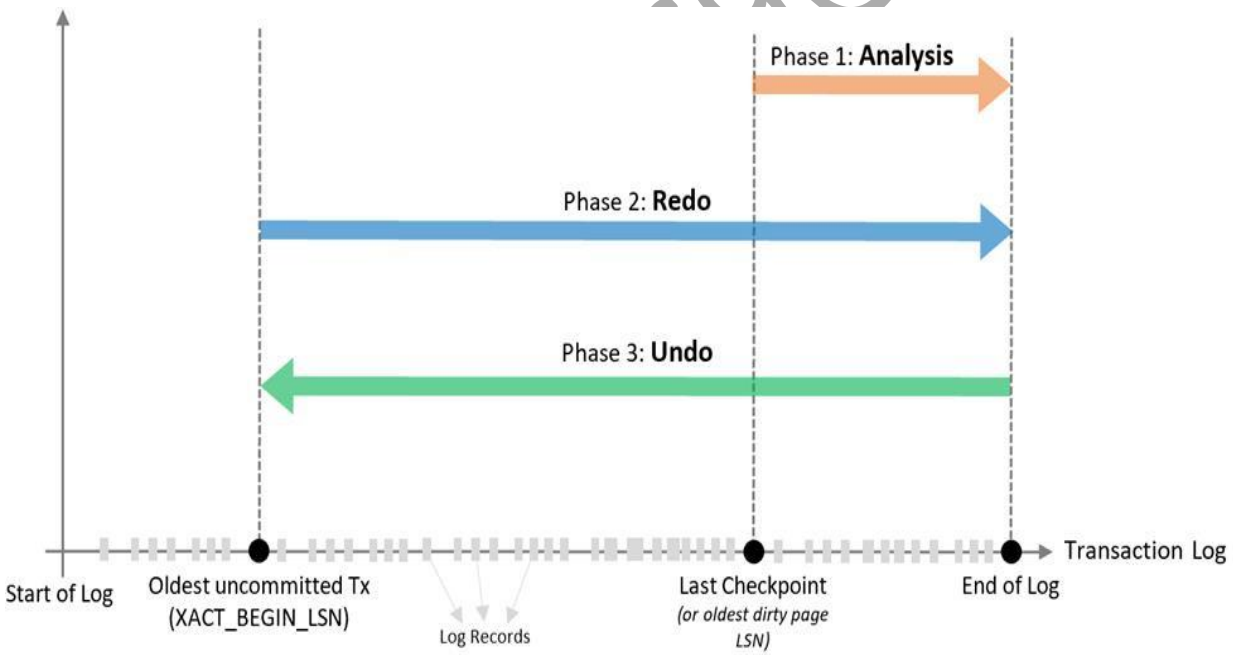
```
SQL

USE [master] ;
ALTER DATABASE [model] SET RECOVERY FULL ;
```

Copy and paste the following example into the query window and click Execute. This example shows how to query the sys.databases catalog view to learn the recovery model of the model database.
Managing Recovery using MS SQL Server



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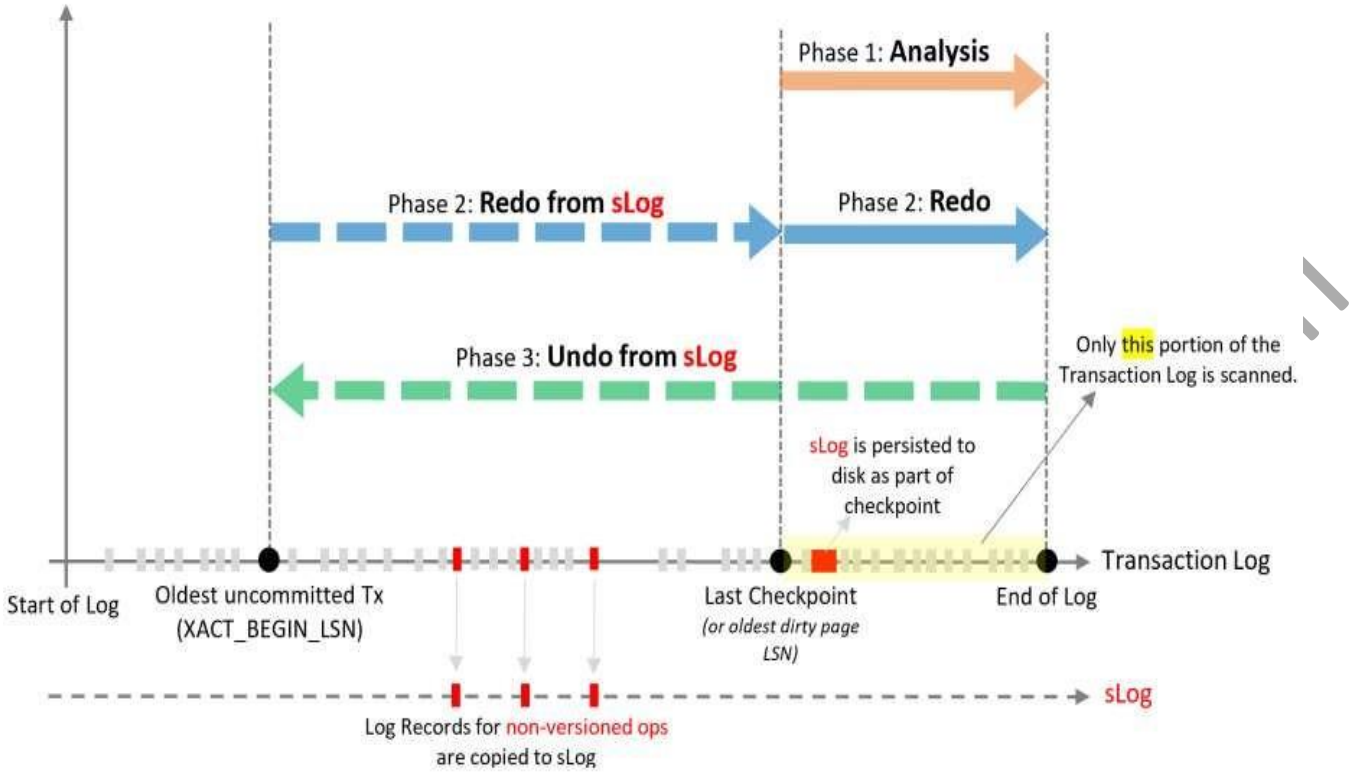
Managing Recovery using MS SQL Server



DB Recovery Follows ARIES using ADR
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Introduction to Database Administration

TOPIC 159

Phases of Instance Recovery using Oracle
Phases of Instance Recovery

Phases of Instance Recovery

Introduction
Rolling Forward
After Roll Forward
Rolling Forward & Rolling Backward
Phases of Instance Recovery

Introduction

The first phase of instance recovery is called cache recovery or rolling forward, and involves reapplying all of the changes recorded in the online redo log to the data files.

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Because rollback data is recorded in the online redo log, rolling forward also regenerates the corresponding undo segments.
Phases of Instance Recovery

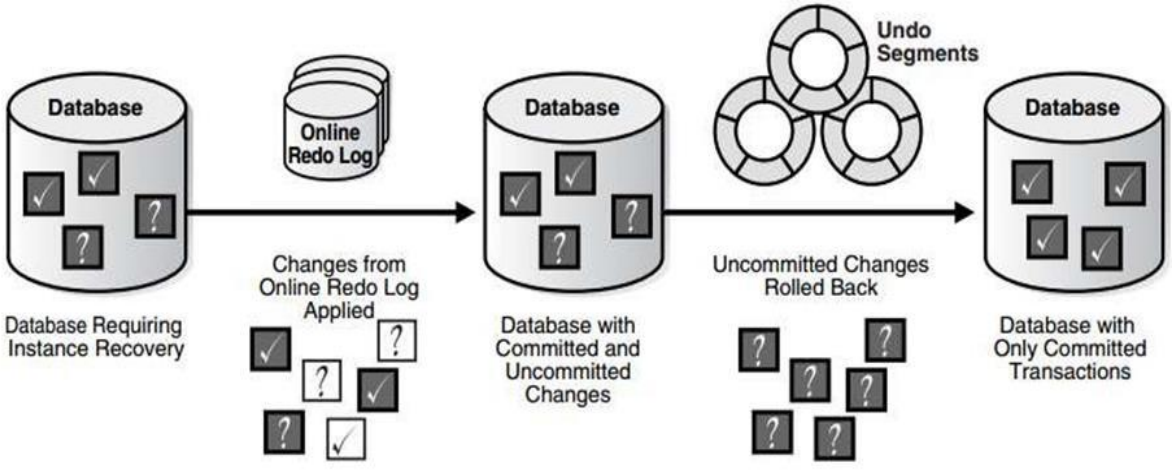
Rolling Forward

Rolling forward proceeds through as many online redo log files as necessary to bring the database forward in time.
After rolling forward, the data blocks contain all committed changes recorded in the online redo log files. These files could also contain uncommitted changes that were either saved to the data files before the failure, or were recorded in the online redo log and introduced during cache recovery.
Phases of Instance Recovery

After Roll Forward

After the roll forward, any changes that
were not committed must be undone. Oracle Database uses the checkpoint position, which guarantees that every committed change with an SCN lower than the checkpoint SCN is saved on disk.
Oracle Database applies undo blocks to roll back uncommitted changes in data blocks that were written before
the failure or introduced during cache recovery. This phase is called rolling back or transaction recovery.
Phases of Instance Recovery

Rolling Forward & Rolling Backward



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Introduction to Database Administration

TOPIC 160

Overview of Parameter Files with commands

Overview of Parameter Files with commands

Overview of Parameter Files with commands

Introduction
Initialization Parameters
Functional Group of Initialization Parameters
Purpose of Variable Parameters
Basic Initialization Parameters
Advance Initialization Parameters
Parameters during Installation
Parameters Files spfile and pfile
Overview of Parameter Files with commands

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Introduction

To start a database instance, Oracle Database must read either a server parameter file, which is recommended, or a text initialization parameter file, which is a legacy implementation. These files contain a list of configuration parameters.
Overview of Parameter Files with commands

Initialization Parameters

Initialization parameters are configuration parameters that affect the basic operation of an instance. The instance reads initialization parameters from a file at startup.
Oracle Database provides many initialization parameters to optimize its operation in diverse environments. Only a few of these parameters must be explicitly set because the default values are adequate in most cases.
Overview of Parameter Files with commands

Functional Group of Initialization Parameters

Most initialization parameters belong to one of the following functional groups:
Parameters that name entities such as files or directories
Parameters that set limits for a process, database resource, or the database itself
Parameters that affect capacity, such as the size of the SGA (these parameters are called variable parameters)
Overview of Parameter Files with commands

Purpose of Variable Parameters

Variable parameters are of particular interest to database administrators because they can use these parameters to improve database performance.
Overview of Parameter Files with commands

Basic Initialization Parameters

In most cases, you must set and tune only the approximately 30 basic parameters to obtain reasonable performance. The basic parameters set characteristics such as the database name, locations of the control files, database block size, and undo tablespace
Overview of Parameter Files with commands

Advance Initialization Parameters

In rare situations, modification to the advanced parameters may be required for optimal performance.

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The advanced parameters enable expert DBAs to adapt the behavior of the Oracle Database to meet unique requirements
Overview of Parameter Files with commands

Parameters during Installation

Oracle Database provides values in the starter initialization parameter file provided with your database software, or as created for you by the Database Configuration Assistant.

```
db_name=sample
control_files=/disk1/oradata/sample_cf.dbf
db_block_size=8192
open_cursors=52
undo_management=auto
shared_pool_size=280M
pga_aggregate_target=29M
.
.
```

Overview of Parameter Files with commands

Parameters during Installation

create spfile from pfile; create pfile from spfile; show parameter processes; show parameter spfile;
Overview of Parameter Files with commands

Parameters Files spfile and pfile

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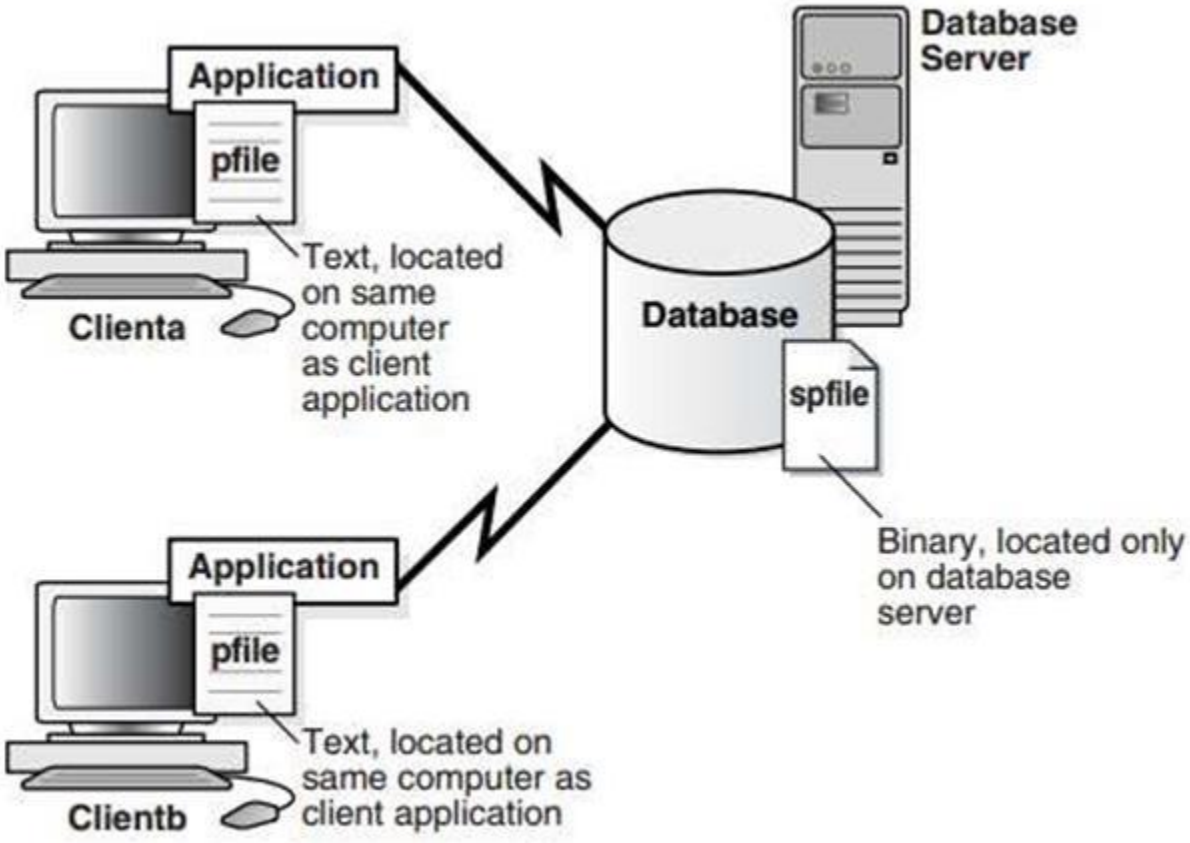

Introduction to Database Administration

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TOPIC 161

Initializing Parameter Files

Initializing Parameter Files

Initializing Parameter Files

Server's Parameters Characteristics
Text Parameters File
Text Parameters Characteristics
Use of alter system command
Static and Dynamic Parameters
Initializing Parameter Files

Server's Parameters Characteristics

Only one server parameter file (spfile) exists for a database. This file must reside on the database host.
The server parameter file is written to and read by only by Oracle Database, not by client applications.
The server parameter file is binary and cannot be modified by a text editor.
Initializing Parameter Files

Server's Parameters Characteristics

Initialization parameters stored in the server parameter file are persistent. Any changes made to the parameters while a database instance is running can persist across instance shutdown and startup.
Initializing Parameter Files

Text Parameters File

A text initialization parameter file (pfile) is a text file that contains a list of initialization parameters. It is readable and writeable to DBA and its changes are reflected into spfile on Server.

The text initialization parameter file contains a series of key=value pairs, one per line
Initializing Parameter Files

Text Parameters Characteristics

When starting up or shutting down a database, the text initialization parameter file must reside on the same host as the client application that connects to the database.
A text initialization parameter file is text-based, not binary.
Oracle Database can read but not write to the text initialization parameter file. To change the parameter values you must manually alter the file with a text editor.
Initializing Parameter Files

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Text Parameters Characteristics

Changes to initialization parameter values by ALTER SYSTEM are only in effect for the current instance. You must manually update the text initialization parameter file and restart the instance for the changes to be known.
Initializing Parameter Files

```
global_txn_processes                 integer     1
job_queue_processes                  integer     1000
log_archive_max_processes            integer     4
processes                            integer     150
SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> startup  open
ORACLE instance started.

Total System Global Area 1071333376 bytes
Fixed Size                  1375792 bytes
Variable Size             696254928 bytes
Database Buffers          369098752 bytes
Redo Buffers                4603904 bytes
Database mounted.
Database opened.
SQL> show parameter processes;

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------
aq_tm_processes                      integer     0
db_writer_processes                  integer     1
gcs_server_processes                 integer     0
global_txn_processes                 integer     1
job_queue_processes                  integer     1000
log_archive_max_processes            integer     4
processes                            integer     200
SQL>
```

Use of Alter System command

Alter system set processes=200
scope=spfile;

create pfile='E:\app\Haider\product\11.2.0\dbho me_1\database\pfileORCL.ora' from SPFILE;

This change can be seen by opening spfile
Initializing Parameter Files

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Characteristic	Static	Dynamic
Requires modification of the parameter file (text or server)	Yes	No
Requires database instance restart before setting takes affect	Yes	No
Described as "Modifiable" in *Oracle Database Reference* initialization parameter entry	No	Yes
Modifiable only for the database or instance	Yes	No

Static and Dynamic Parameters

Static parameters include DB_BLOCK_SIZE, DB_NAME, and COMPATIBLE. Dynamic parameters are grouped into session-level parameters, which affect only the current user session, and system-level parameters, which affect the database and all sessions.
MEMORY_TARGET=system-level & NLS_DATE_FORMAT=session level parameters
Introduction to Database Administration

TOPIC 162

Diagnostic Instance Files
Diagnostic Instance Files

Diagnostic Instance Files

Overview of Diagnostic Files
Goals of fault Diagnosability Infrastructure
Automatic Diagnostic Repository
Problems & Incidence
DDL & DEBUG Log files - Example
ADR Directory Structure
Diagnostic Instance Files

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Overview of Diagnostic Files

Oracle Database includes a fault diagnosability infrastructure for preventing, detecting, diagnosing, and resolving database problems. Problems include critical errors such as code bugs, metadata corruption, and customer data corruption.
Diagnostic Instance Files

Goals of fault Diagnosability Infrastructure

Detecting problems proactively
Limiting damage and interruptions after
a problem is detected
Reducing problem diagnostic and resolution time
Simplifying customer interaction with Oracle Support
Diagnostic Instance Files

Automatic Diagnostic Repository

Automatic Diagnostic Repository (ADR) is a file-based repository that stores database diagnostic data such as trace files, the alert log, and Health Monitor reports. Key characteristics of ADR include:
Unified directory structure
Consistent diagnostic data formats
Unified tool set
Diagnostic Instance Files

Problems & Incidence

ADR proactively tracks problems, which are critical errors in the database. Critical errors manifest as internal errors, such as ORA-600, or other severe errors. Each problem has a problem key, which is a text string that describes the problem.
Diagnostic Instance Files

Problems & Incidence

When a problem occurs multiple times, ADR creates a time-stamped incident for each occurrence. An incident is uniquely identified by a numeric incident ID. When an incident occurs, ADR sends an incident alert to Enterprise Manager. Diagnosis and resolution of a critical error usually starts with an incident alert.
ADR informs you that a critical error is ongoing without overloading the system with diagnostic data
Diagnostic Instance Files

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DDL & DEBUG Log Files - Example

DDL Log: In the alert log file, DDL statements can be recorded when using parameter ENABLE_DDL_LOGGING to TRUE with NOMOUNT startup of database (in Oracle 11g version).
Following commands can be recorded with TRUE option:
Create Table Create Index Create User Drop Table
Diagnostic Instance Files
ADR Directory Structure

The ADR base is the ADR root directory. The ADR base can contain multiple ADR homes, where each ADR home is the root directory for all diagnostic data—traces, dumps, the alert log, and so on—for an instance of an Oracle product or component.

```
SQL> SELECT substr(NAME,1,30) Diag_name, substr(VALUE, 1, 50) diag_val
  2  FROM V$DIAG_INFO;

DIAG_NAME                      DIAG_VAL
------------------------------ --------------------------------------------------
Diag Enabled                   TRUE
ADR Base                       e:\app\haider
ADR Home                       e:\app\haider\diag\rdbms\orcl\orcl
Diag Trace                     e:\app\haider\diag\rdbms\orcl\orcl\trace
Diag Alert                     e:\app\haider\diag\rdbms\orcl\orcl\alert
Diag Incident                  e:\app\haider\diag\rdbms\orcl\orcl\incident
Diag Cdump                     e:\app\haider\diag\rdbms\orcl\orcl\cdump
Health Monitor                 e:\app\haider\diag\rdbms\orcl\orcl\hm
Default Trace File             e:\app\haider\diag\rdbms\orcl\orcl\trace\orcl_ora_
Active Problem Count           0
Active Incident Count          0

11 rows selected.
```

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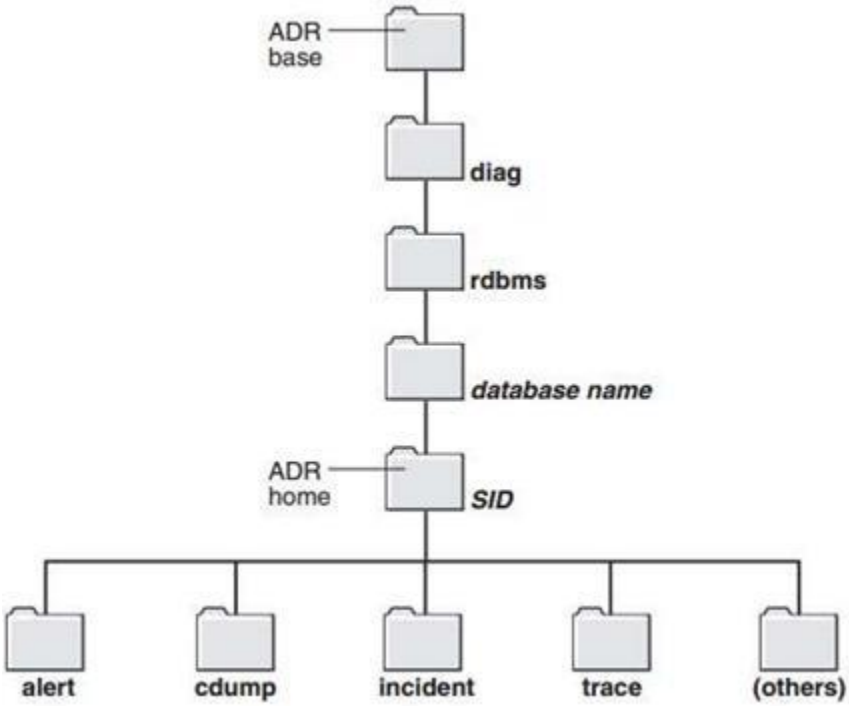

Introduction to Database Administration

TOPIC 163

Commands & Log Alerts

Commands & Log Alerts

Commands & Log Alerts

Overview of Alert File
Alert Log File
Alert Log File – Contents
Alert Log File - Maintenance
Alert Log File - Location
Commands & Log Alerts

Overview of Alert File

Each database has an alert log, which is an XML and text file containing a chronological log of database messages and errors. The alert log contents include the following:
Deadlock occurs
Any error written by Oracle Server process
Any unexpected messages and corruptions happened

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Any DBA DDL operations are managed
Commands & Log Alerts

Alert Log File

The Alert log file (ALERT.LOG) is a chronological log of messages and errors written out by an Oracle Database

This file should constantly be monitored to detect unexpected messages and corruptions
Commands & Log Alerts

Alert Log File - Contents

Non default initialization parameter
used at startup or
internal errors (Ora-600)
Block corruption error (Ora-1578)
DDL and STARTUP, SHUTDOWN,
ARCHIVE LOG, and RECOVER
Commands & Log Alerts

Alert Log File - Contents

The alert log file contains the following information that can be used to aid in tuning the database

Time to perform archiving
Instance recovery start and complete times
Deadlock and timeout errors
Incomplete checkpoints
Checkpoint start and end times
Commands & Log Alerts

Alert Log File - Maintenance

As Alert file grows bigger,
DBA can periodically backup the alert log file and delete the current file

When database attempts to write to the
alert file again, it will create a new file
Commands & Log Alerts

Alert Log File - Location

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Each database has an Alert_SID.log file Resides on Server with the database Default location Oracle- Base/diag/rdbms/DB_Name/SID/trace

End
Introduction to Database Administration

TOPIC 164

Trace Files Commands

Trace Files Commands

Trace Files Commands

Overview of Trace Files
Types of Trace Files
Contents of Trace Files
Locations of Trace Files
Trace Files Commands

Overview of Trace Files

A trace file is an administrative file that contain diagnostic data used to investigate problems. Also, trace files can provide guidance for tuning applications or an instance.
Trace Files Commands

Types of Trace Files

Each server and background process can periodically write to an associated trace file. The files information on the process environment, status, activities, and errors.

The SQL trace facility also creates trace files, which provide performance information on individual SQL statements.
Trace Files Commands

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Types of Trace Files

To enable tracing for a client identifier, service, module, action, session, instance, or database, you must execute the appropriate procedures in the DBMS_MONITOR package or use Oracle Enterprise Manager.
A dump is a special type of trace file. Whereas a trace tends to be continuous output of diagnostic data, a dump is typically a one-time output of diagnostic data in response to an event (such as an incident).
Trace Files Commands

Types of Trace Files

When an incident occurs, the database writes one or more dumps to the incident directory created for the incident. Incident dumps also contain the incident number in the file name
Trace Files Commands

Contents of Trace Files

Typically, database background process
trace file names contain the
Oracle SID,
background process name, and
operating system process number

An example of a trace file for the RECO process is mytest_reco_10355.trc
Trace Files Commands

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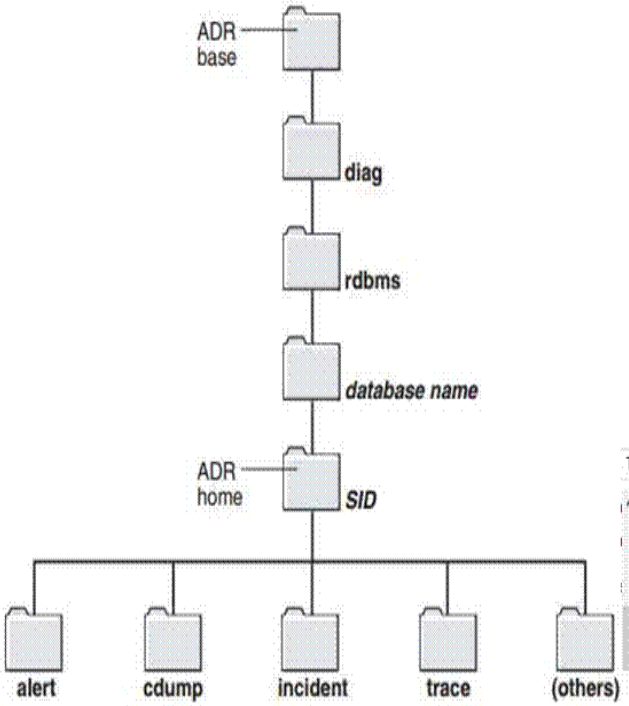

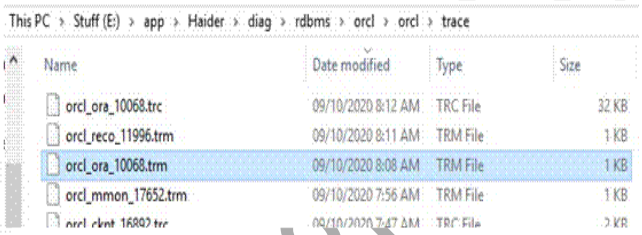

Locations of Trace Files

ADR stores trace files in the trace sub directory, as shown in Figure Trace file names are platform dependent and use the extension .trc.
Introduction to Database Administration

TOPIC 165

Managing users & Security

Managing users & Security

Managing users & Security

Types of Security
Threats to Databases
Security Domain
Schema Objects & User
User & Database
Creating Oracle User
Pre-defined Accounts
Managing users & Security

Types of Security

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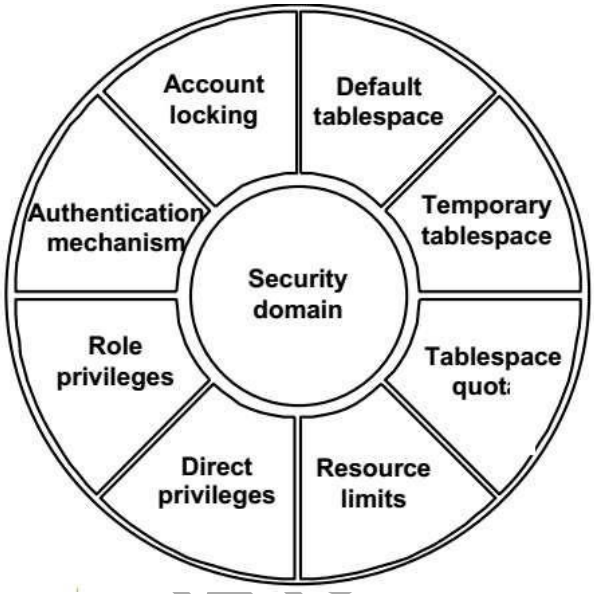
Following are the database security types and issues
Legal & Ethical Issues
Policy Issues in Enterprises
Systems' related Issues
Needs of Enterprises
Managing users & Security

Threats to Databases

Following are the database related threats and issues
Loss of integrity
Loss of availability
Loss of Confidentiality
Managing users & Security



Security Domain

The database administrator defines the names of the users who are allowed to access a database. A security domain defines the settings that apply to the user.

Authentication mechanisms are
Data Dictionary
Operating System
Network
Managing users & Security

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Schema Objects & User

A Schema is a collection of objects
A user is associated (owner) of schema
Creating schema means creating a user as an owner of schema
Managing users & Security

User & Database

Accessing Database (connection with the database)
Specifying database unique user account of ID
Specifying authentication (roles & privileges) to user account

Allocating space, quota, buffer etc. are additional features in security.
Managing users & Security

Creating Oracle User

A unique user name or account
Authentications (roles/ rights)
A default tablespace
A temporary tablespace
A user profile
An account status (lock/unlock)
Managing users & Security

Pre-defined Accounts

SYS account (sys as sysdba)
is granted the DBA role
has all privileges with ADMIN OPTION
is used for startup, shutdown etc.
owns the data dictionary

SYSTEM account is granted the DBA role
Normally not used for routine operations
Introduction to Database Administration

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TOPIC 166

Creating Users with Commands

Creating Users with Commands

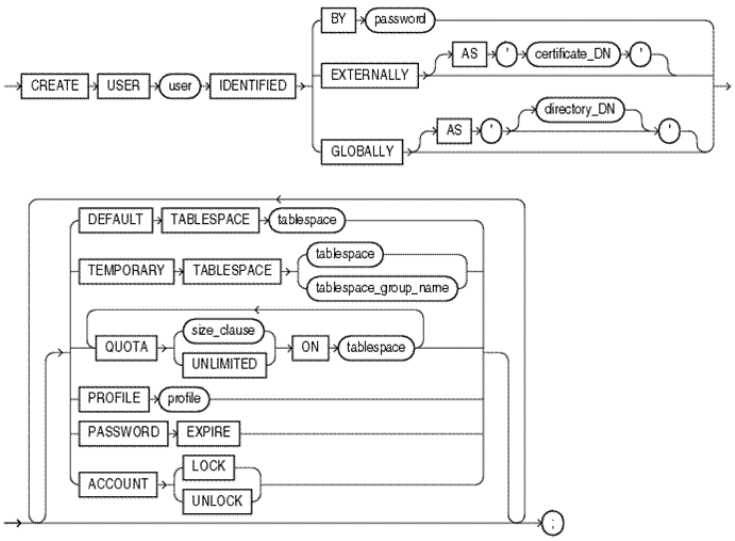
Creating Users with Commands

Creating Oracle User
Syntax for Creating Oracle User
Data Dictionary View DBA_USERS
Creating Users with Commands

Creating Oracle User

Checklist's clauses
Tablespaces
Quota
Roles/ privileges
Creating Users with Commands

Syntax for Creating Oracle User




```
CREATE USER sidney
    IDENTIFIED BY out standing1
    DEFAULT TABLESPACE example
    QUOTA 10M ON example
    TEMPORARY TABLESPACE temp
    QUOTA 5M ON system
    PROFILE app_user
    PASSWORD EXPIRE;
```

```
CREATE USER global_user
   IDENTIFIED GLOBALLY AS 'CN=analyst
   DEFAULT TABLESPACE example
   QUOTA 5M ON example;
```

docs.oracle.com
Creating Users with Commands

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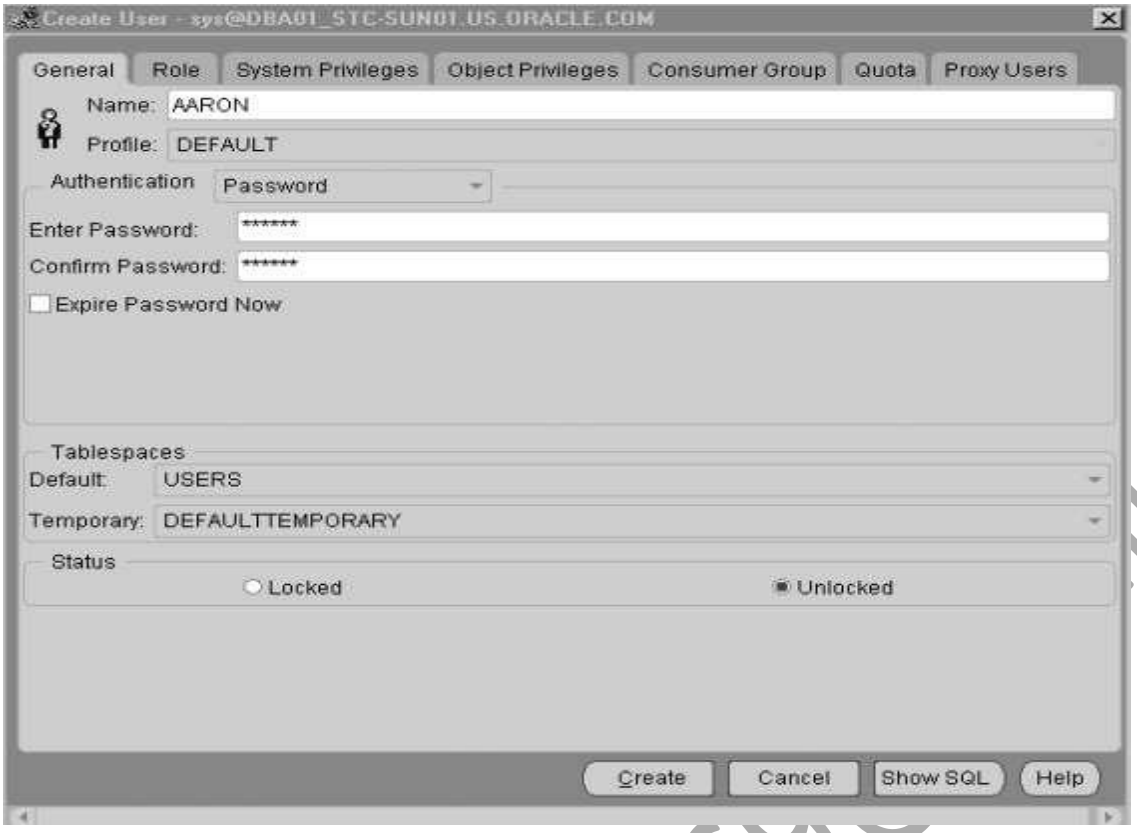

Creating Oracle User using Oracle-EM

docs.oracle.com
Creating Users with Commands
Data Dictionary View DBA_USERS

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```
SQL> select username, account_status, created
  2  from dba_users;

USERNAME                       ACCOUNT_STATUS                 CREATED
------------------------------ ------------------------------ ---------
NOVUS                          OPEN                           18-DEC-17
NOVUSDB                        OPEN                           16-OCT-17
PROD                           OPEN                           19-JUL-17
NOVUSDB2                       OPEN                           13-DEC-17
NEONDEV                        EXPIRED                        23-JAN-17
SCOTT                          OPEN                           02-APR-10
NEONDB                         OPEN                           31-MAY-17
TEST                           OPEN                           14-FEB-17
MDDATA                         EXPIRED                        02-APR-10
ORACLE_OCM                     EXPIRED & LOCKED               02-APR-10
```

Introduction to Database Administration

TOPIC 167

Users information using Data Dictionary Views
Users information using Data Dictionary Views

Users information using Data Dictionary Views

Searching Security Dictionary Views
Single SQL to Display All Views
Listing All Tablespace Quotas
Listing All Profiles & Assigned Limit
Users information using Data Dictionary Views

Searching Security Dictionary Views

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Searching Data Dictionary Views closest to security users' information. Search is managed by following SQL LIKE operator: '%QUOTA%', '%PASSWORD%' '%PROFILE%', '%COST%' '%SESS%', '%PROXY%' and *_USERS
Users information using Data Dictionary Views

Single SQL to Display All Views

```
SQL> SELECT *
  2  FROM DICTIONARY
  3  where table_name like '%QUOTA%'
  4  or table_name like '%PASSWORD%'
  5  or table_name like '%PROFILE%'
  6  or table_name like '%COST%'
  7  or table_name like '%SESS%'
  8  or table_name like '%PROXY%';

TABLE_NAME                     COMMENTS
------------------------------ --------------------------------------------------

DBA_HIST_SESS_TIME_S CPU and I/O time for interesting (STREAMS)
TATS                 sessions

DBA_LOGMNR_SESSION
DBA_PROFILES         Display all profiles and their limits
DBA_SQL_PROFILES     set of sql profiles
DBA_TS_QUOTAS        Tablespace quotas for all users
USER_AUDIT_SESSION   All audit trail records concerning CONNECT and
                     DISCONNECT
```

Users information using Data Dictionary Views

Listing All Tablespace Quotas

Mahjabeen

```
SELECT * FROM DBA_TS_QUOTAS;

TABLESPACE    USERNAME    BYTES     MAX_BYTES    BLOCKS    MAX_BLOCKS
---------     --------  --------  ----------   -------   ----------
USERS         JFEE             0      512000         0          250
USERS         DCRANNEY         0          -1         0           -1
```

Users information using Data Dictionary Views

Listing All Profiles & Assigned Limit

```
SELECT * FROM DBA_PROFILES
   ORDER BY PROFILE;

PROFILE              RESOURCE_NAME              RESOURCE   LIMIT
-----------------    ---------------            ---------- ----------
CLERK                COMPOSITE_LIMIT            KERNEL     DEFAULT
CLERK                FAILED_LOGIN_ATTEMPTS      PASSWORD   DEFAULT
CLERK                PASSWORD_LIFE_TIME         PASSWORD   DEFAULT
CLERK                PASSWORD_REUSE_TIME        PASSWORD   DEFAULT
CLERK                PASSWORD_REUSE_MAX         PASSWORD   DEFAULT
CLERK                PASSWORD_VERIFY_FUNCTION   PASSWORD   DEFAULT
CLERK                PASSWORD_LOCK_TIME         PASSWORD   DEFAULT
CLERK                PASSWORD_GRACE_TIME        PASSWORD   DEFAULT
CLERK                PRIVATE_SGA                KERNEL     DEFAULT
CLERK                CONNECT_TIME               KERNEL     600
CLERK                IDLE_TIME                  KERNEL     30
```

TOPIC 168

Managing Privileges

Managing Privileges

Managing Privileges

Types of Oracle User Privileges
System Privileges
System Privileges with ADMIN OPTION
Object Privileges Syntax
Object Privileges - Examples
Objects Privileges Options
Object Privileges using Oracle EM
Managing Privileges

Types of Oracle User Privileges

System: Enables users to perform particular actions in the database
Object: Enables users to access and manipulate a specific object
Managing Privileges

System Privileges

More than 100 distinct system privileges
ANY keyword in privileges signifies that users have the privilege in any schema
GRANT command adds a privilege to a user or a group of users
REVOKE command deletes the privileges
Managing Privileges

System Privileges with ADMIN OPTION

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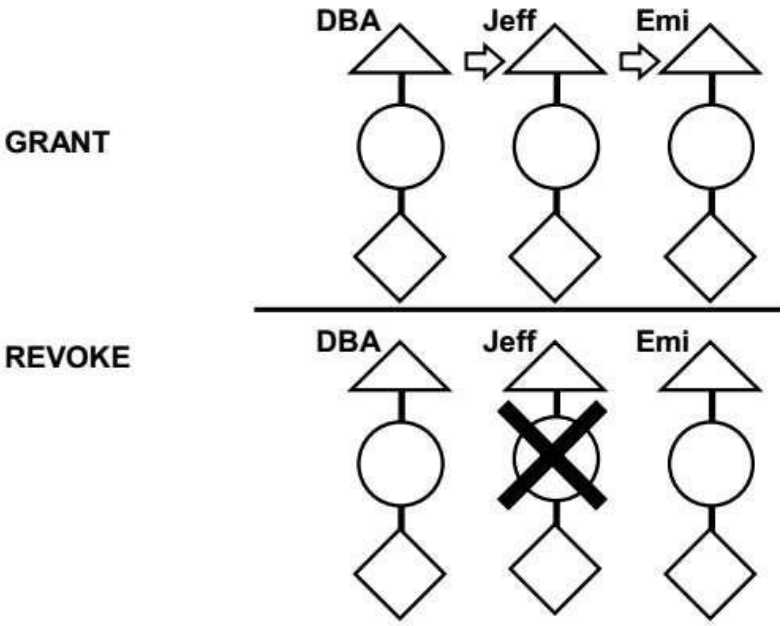

Scenario

1. The DBA grants the `CREATE TABLE` system privilege to Jeff with the `ADMIN OPTION`.
2. Jeff creates a table.
3. Jeff grants the `CREATE TABLE` system privilege to Emi.
4. Emi creates a table.
5. The DBA revokes the `CREATE TABLE` system privilege from Jeff.

The result

Jeff's table still exists, but no new tables can be created.

Emi's table still exists and she still has the `CREATE TABLE` system privilege.

Managing Privileges

Object Privileges Syntax

Oracle Internal & OA

```
GRANT { object_privilege [(column_list)]
      [, object_privilege [(column_list)] ]...
      |ALL [PRIVILEGES]}
ON    [schema.]object
TO    {user|role|PUBLIC}[, {user|role|PUBLIC} ]
      [WITH GRANT OPTION]
```

Managing Privileges

Object Privileges - Examples

grant select on EMP to utest;

grant select, update on DEPT to utest;

grant select on v_emp to utest;

--login with utest select *
from scott.dept;
Managing Privileges

Objects Privileges Options

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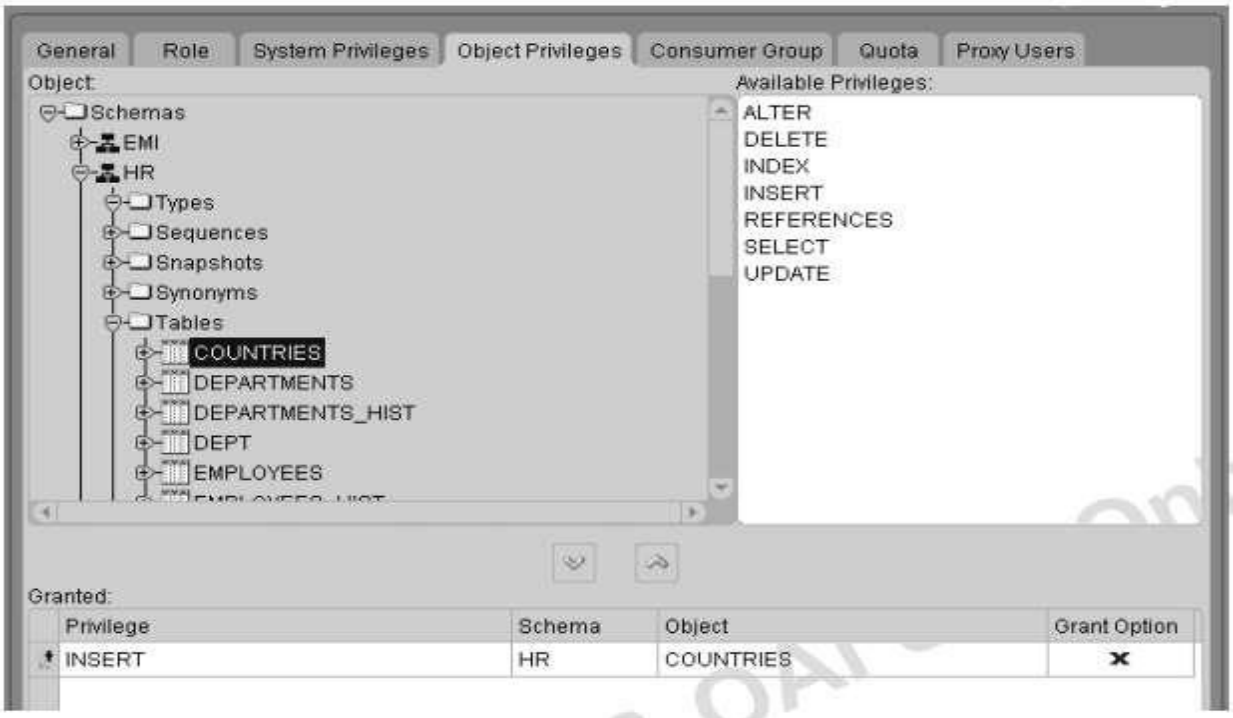
Object priv.	Table	View	Sequence	Procedure
ALTER	√	√	√	
DELETE	√	√		
EXECUTE				√
INDEX	√	√		
INSERT	√	√		
REFERENCES	√			
SELECT	√	√	√	
UPDATE	√	√		

--scott is the owner of EMP table and granting GRANT select on EMP to jef;
Managing Privileges

Object Privileges using Oracle EM



Introduction to Database Administration

TOPIC 169

System Privileges Commands

System Privileges Commands

System Privileges Commands

System Privileges
System Privileges with ADMIN OPTION
System Privileges - Examples
System Privileges SYSOPER & SYSDBA
System Privileges using Oracle EM
System Privileges Commands

System Privileges

More than 100 distinct system privileges
ANY keyword in privileges signifies that users have the privilege in any schema
GRANT command adds a privilege to a user or a group of users
REVOKE command deletes the privileges
System Privileges Commands

System Privileges with ADMIN OPTION

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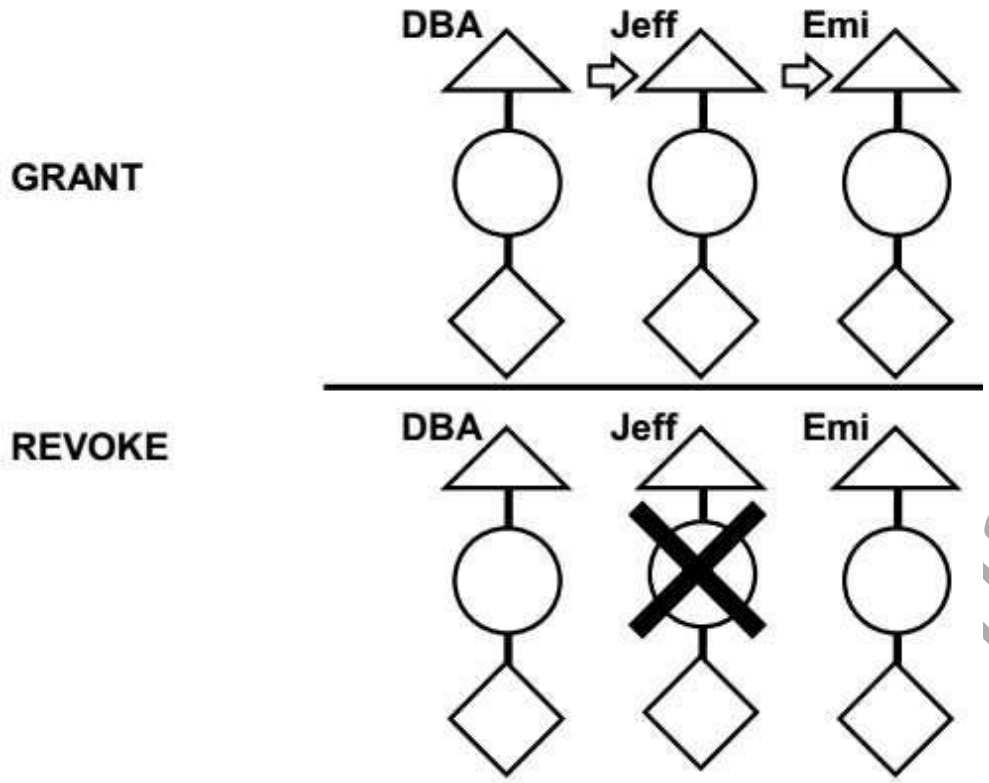

Scenario

1. The DBA grants the `CREATE TABLE` system privilege to Jeff with the `ADMIN OPTION`.
2. Jeff creates a table.
3. Jeff grants the `CREATE TABLE` system privilege to Emi.
4. Emi creates a table.
5. The DBA revokes the `CREATE TABLE` system privilege from Jeff.

The result

Jeff's table still exists, but no new tables can be created.

Emi's table still exists and she still has the `CREATE TABLE` system privilege.

System Privileges Commands

System Privileges - Examples

Grant create table to utest;

Grant create view, create procedure to utest; Grant create view to scott;

Revoke create table from utest;
System Privileges Commands

Category	Examples
SYSOPER	STARTUP SHUTDOWN ALTER DATABASE OPEN | MOUNT ALTER DATABASE BACKUP CONTROLFILE TO RECOVER DATABASE ALTER DATABASE ARCHIVELOG RESTRICTED SESSION
SYSDBA	SYSOPER PRIVILEGES WITH ADMIN OPTION CREATE DATABASE ALTER TABLESPACE BEGIN/END BACKUP RESTRICTED SESSION RECOVER DATABASE UNTIL

System Privileges SYSOPER & SYSDBA
--sys is giving grants to utest
GRANT create table, create table to utest;
System Privileges Commands

System Privileges using Oracle EM

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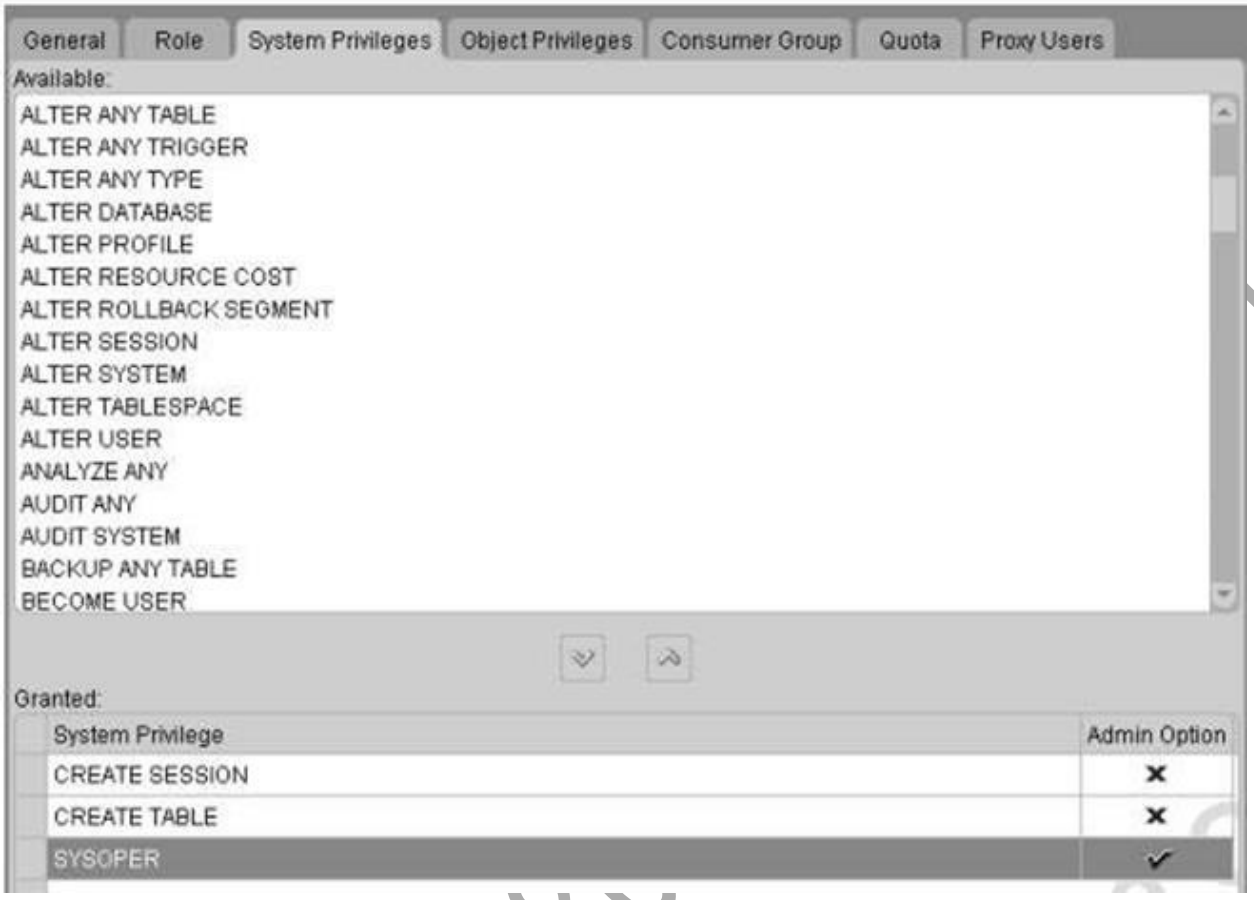

Introduction to Database Administration

TOPIC 170

System Multiple Privileges Commands
System Multiple Privileges Commands

System Multiple Privileges Commands

What is User Privileges?
Giving Privileges to Users
Script Create Synonym
Synonym Privileges to Users
System and Object Privileges
System Multiple Privileges Commands

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What is User Privileges?

A user privilege is the right to run a particular type of SQL statement, or the right to access an object that belongs to another user, run a PL/SQL package, and so on.

System Privileges
Object Privileges
Roles
System Multiple Privileges Commands

Giving Privileges to Users

-login sys / as sysdba

create user u1 identified by u1
temporary tablespace temp; conn u1/u1
--error ...

grant create session, create table to u1;
System Multiple Privileges Commands

Script Create Synonym

Run following SQL in owner's (scott) schema and run each command of script in granting user (say u1). Synonyms will be created in u1 schama.

```
SQL> select 'create synonym '||tname||' for scott.'||tname||';'
  2  from tab;

'CREATESYNONYM'||TNAME||'FORSCOTT.'||TNAME||';'
------------------------------------------------------------
create synonym BLOBS for scott.BLOBS;
create synonym BONUS for scott.BONUS;
create synonym CAMPUS for scott.CAMPUS;
create synonym CHAINED_ROWS for scott.CHAINED_ROWS;
create synonym CLIENT for scott.CLIENT;
create synonym CUSTOMER for scott.CUSTOMER;
```

System Multiple Privileges Commands

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Synonym Privileges to Users

User u1 is using object table as scott.emp, for example

Select * from scott.EMP; --when scott is authorizing select on EMP to u1

User u1 can run the following command create synonym emp for scott.emp;

select * from tab; --can display EMP as synonym
select * from emp;
(Subject to all assigned privileges)
System Multiple Privileges Commands

System and Object Privileges

SYSTEM PRIVILEGES	OBJECT PRIVILEGES
In System privilege are more than 100 privileges	All DML are come into object privileges.
CREATE SESSION	SELECT
CREATE TABLE	INSERT
CREATE USER	UPDATE
CREATE VIEW	DELETE
CREATE SEQUENCE	REFERENCES
CREATE PROCEDURE	ALTER
CREATE ROLE etc.	INDEX
	EXECUTE

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TOPIC 171

Revoke Privileges

Revoke Privileges

Revoke Privileges

Data Dictionary for Privileges
Revoke & Example
To See Existing Privileges
Revoke Privileges CASCADE
Revoke Privileges

Data Dictionary for Privileges

We can use string search PRIV to display
possible data dictionary views. For Example,
select table_name from dict
where table_name like '%PRIV%';
Revoke Privileges

Data Dictionary for Privileges

We choose following suitable PRIV View:
desc USER_TAB_PRIVS is showing columns GRANTEE
OWNER TABLE_NAME GRANTOR PRIVILEGE GRANTABLE HIERARCHY
Revoke Privileges

Revoke & Example

The REVOKE statement is used to revoke
object privileges.
You previously granted the object privilege to the user or role.

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You possess the GRANT ANY OBJECT PRIVILEGE system privilege that enables you to grant and revoke privileges on behalf of the object owner.

REVOKE REFERENCES ON dept FROM jward CASCADE CONSTRAINTS;
Revoke Privileges

Revoke & Example

Assuming you are the original grantor, the following statement revokes the SELECT and INSERT privileges on the emp table from the users jfee and tsmith:

REVOKE SELECT, insert ON emp FROM jfee, tsmith;
Revoke Privileges

To See Existing Privileges

```
SQL> COLUMN OWNER FORMAT A20
SQL> COLUMN GRANTOR FORMAT A20
SQL> COLUMN GRANTEE FORMAT A20
SQL> COLUMN privilege FORMAT A20
SQL> select OWNER, GRANTOR, GRANTEE, privilege
  2  from USER_TAB_PRIVS
  3  where table_name='EMP';

OWNER                GRANTOR              GRANTEE              PRIVILEGE
-------------------- -------------------- -------------------- ----------
SCOTT                SCOTT                U1                   SELECT
```

GRANT select on EMP to u1;

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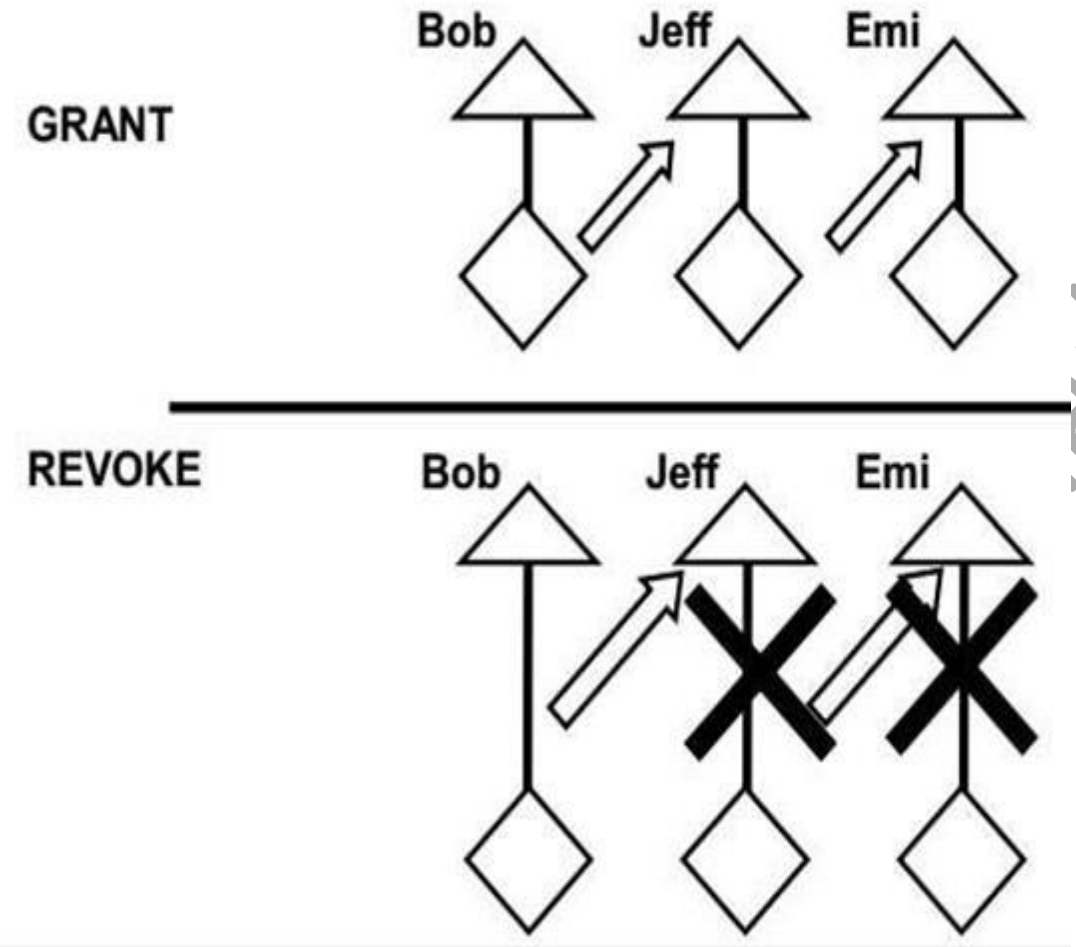
Revoke Privileges



Revoke Privileges CASCADE

```
--Login with Bob
Grant select on EMP to Jeff with grant option;
--Login Jeff
Grant select on EMP to Emi;

--Login with Bob
```

Revoke

```
 select on EMP from Jeff;
--This revoke is cascaded to Emi
```

Introduction to Database Administration

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TOPIC 172

Managing Roles
Managing Roles

Managing Roles

Introduction
Data Dictionary for Privileges
Privileges & Roles
Roles & Users
Managing Roles

Introduction

Roles are named groups of related privileges or rights.
Each user can be granted roles and privileges for each role, giving them a tailored set of abilities.
Roles define what actions the user can take, and privileges specify the targets to which their roles apply.
You can view the permissions granted by each role, add and remove users, and assign roles and notification profiles to users.
Managing Roles

Data Dictionary for Privileges

We can use string search PRIV to display
possible data dictionary views. For Example,
select table_name
from dict
where table_name like '%PRIV%';

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Privileges & Roles

Type	Description
System privilege	A system-defined privilege usually granted only by administrators. These privileges allow users to perform specific database operations.
Object privilege	A system-defined privilege that controls access to a specific object.
Role	A collection of privileges and other roles. Some system-defined roles exist, but most are created by administrators. Roles group together privileges and other roles, which facilitates the granting of multiple privileges and roles to users.

Roles & Users

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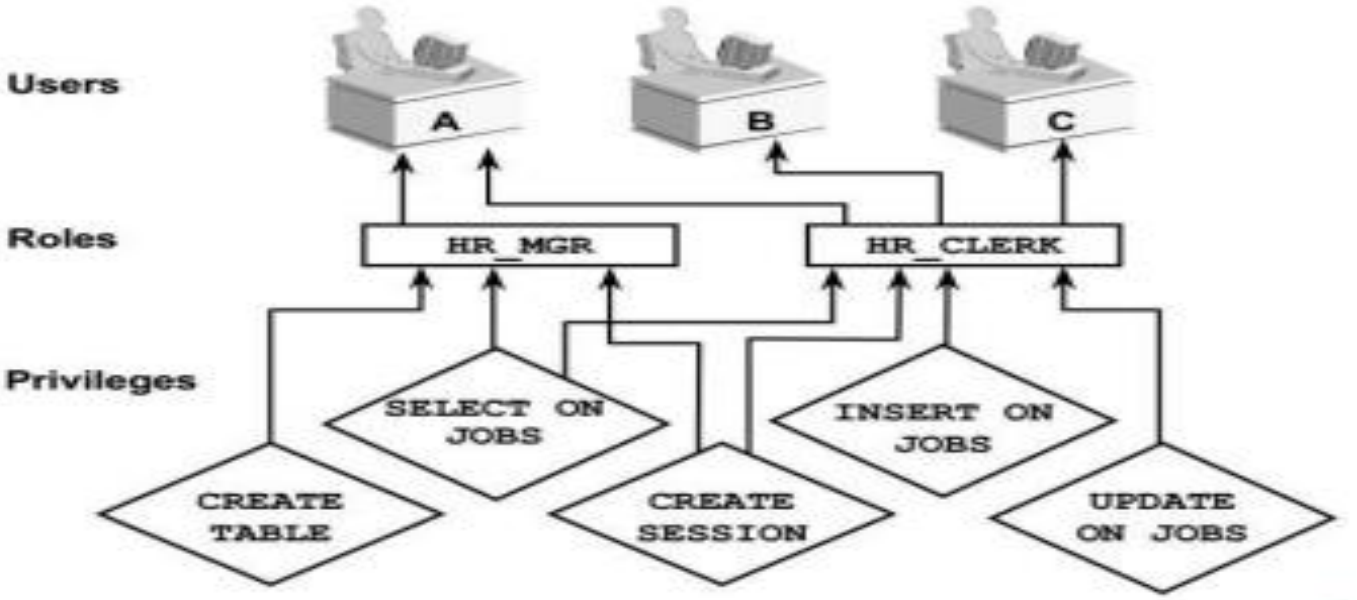

Introduction to Database Administration

TOPIC 173

Benefits of Roles-1
Benefits of Roles-1

Benefits of Roles-1

Benefits of Roles
Standard and Default Roles
Roles of User SYS
Analyzing Roles & Privileges to Users
Benefits of Roles-1

Benefits of Roles

Easier privilege management
Dynamic privilege management
Selective availability of privileges
Can be granted through the operating system
Benefits of Roles-1

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Benefits of Roles

Easier privilege management
Use roles to simplify privilege management. Rather than granting the same set of privileges to several users, you can grant the privileges to a role, and then grant that role to each user.
Dynamic privilege management
If the privileges associated with a role are modified, all the users who are granted the role acquire the modified privileges automatically and immediately.
Benefits of Roles-1

Benefits of Roles

Selective availability of privileges
Roles can be enabled or disabled to turn privileges on or off temporarily. Enabling a role can also be used to verify that a user has been granted that role.
Granting through the operating system
Operating system commands or utilities can be used to assign roles to users in the database.
Benefits of Roles-1

Standard and Default Roles

CONNECT is a role that Enterprise Manager automatically grants to a user when you create a user as shown in "Creating Users". This role has the CREATE SESSION privilege.

RESOURCE extends the privileges of a user beyond those granted by the CONNECT role. It includes CREATE PROCEDURE, CREATE TRIGGER, and other system privileges.
Benefits of Roles-1

Standard and Default Roles

DBA is the standard role that can be granted by an administrator to another administrator. It includes all system privileges and should only be granted to the most trusted and qualified of users. Assigning this role to a user enables the user to administer the database.
Benefits of Roles-1

Roles of User SYS

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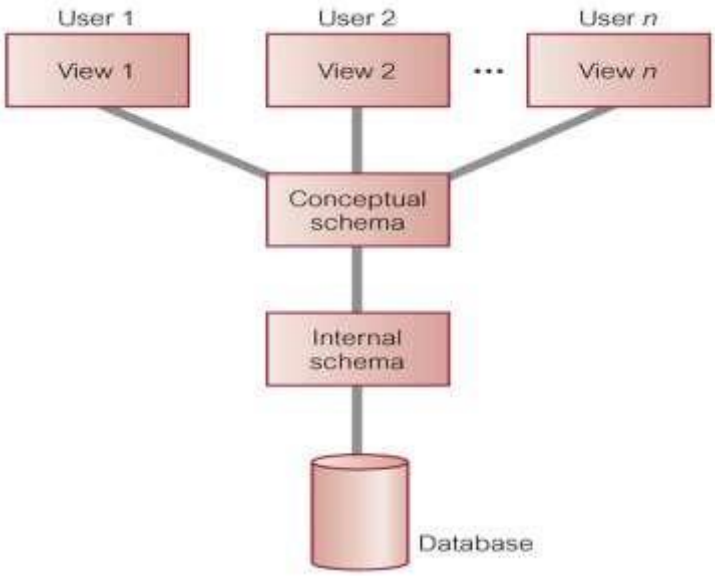
When you create an Oracle database, the user SYS is automatically created and granted the DBA role.
All base tables and views for the database data dictionary are stored in the schema SYS. These base tables and views are critical for the operation of Oracle Database.
Benefits of Roles-1

Roles of User SYS

To maintain the integrity of the data dictionary, tables in the SYS schema are manipulated only by the database. They should never be modified by any user or database administrator.
Also, you should not create any tables in the schema of user SYS, although you can change the storage parameters of the data dictionary settings if necessary.
Benefits of Roles-1

Analyzing Roles & Privileges to Users



Assuming there are three departments in some Enterprise
Sales
Accounting
Human Development & Resource (HR)
Employees are working as an external users
in these departments
Analyzing how Roles and Privileges are need
to be decided
Users Ali(Sales), Jamil(HR) and Nadeem (Accounting)
Introduction to Database Administration

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TOPIC 174

Benefits of Roles-2

Benefits of Roles-2

Benefits of Roles-2

Characteristics of Roles
Roles with Synonyms
Comparing Roles with Privileges
Benefits of Roles-2

Characteristics of Roles

Roles can be granted to and revoked from users with the same commands that are used to grant and revoke system privileges.
Roles can be granted to any user or role. However, a role cannot be granted to itself and cannot be granted circularly.
A role can consist of both system and object privileges.
Benefits of Roles-2

Characteristics of Roles

A role can be enabled or disabled for each user who is granted the role.
A role can be required a password to be enabled.
Each role name must be unique among existing usernames and role names.
Roles are not owned by anyone; and
they are not in any schema.
Roles have their description stored in
the data dictionary.
Benefits of Roles-2

Roles with Synonyms

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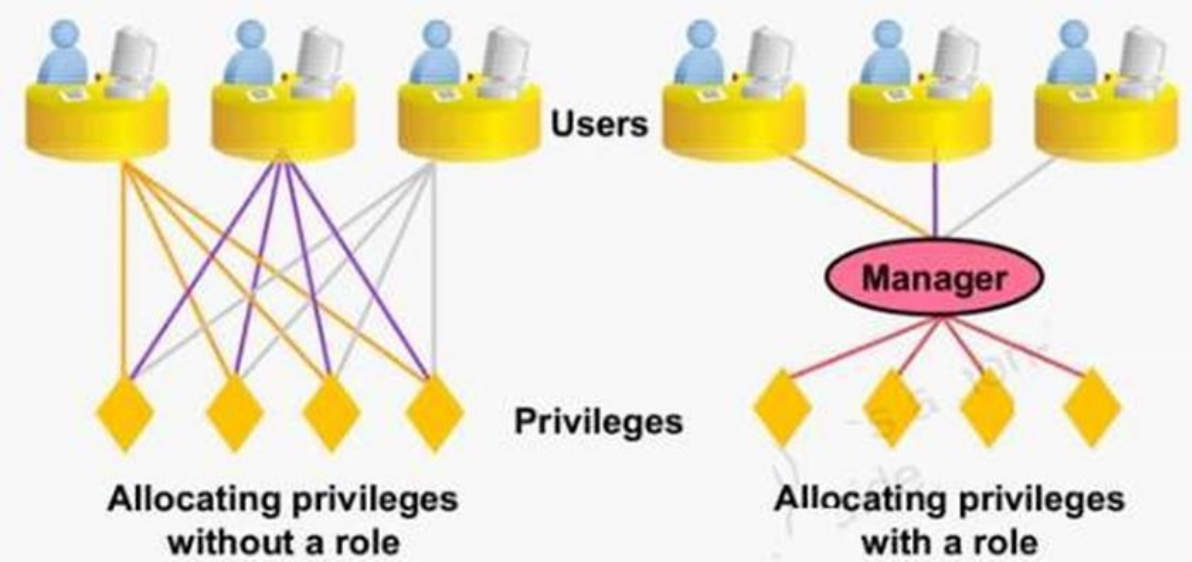
Roles and privileges are assigned to base table or view. Any Synonym will be granted as per base table or view.
For example,
--Table EMP owner gives grant: grant select on emp to u1;
--run in u1's schema
create synonym emp for scott.emp; select * from emp;
Benefits of Roles-2

Comparing Roles with Privileges



Introduction to Database Administration

TOPIC 175

Creating Roles

Creating Roles

Creating Roles

SQL-Create Role
Syntax of SQL-Create Role

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Roles with ADMIN option
Syntax of SQL-Create Role using EM
Creating Roles

SQL-Create Role

Use the CREATE ROLE statement to create roles. You must have the CREATE ROLE system privilege to create roles. When you create a role that is not identified externally or by password, the role is granted with the ADMIN option.
You need to decide set of privileges to put in one role and a user who will use those privileges by assigning just role.

Syntax of SQL-Create Role

Use the following command to create a role:

```
CREATE ROLE role [NOT IDENTIFIED | IDENTIFIED
  {BY password | EXTERNALLY | GLOBALLY | USING package}]
```

where:

- `role`: Is the name of the role
- `NOT IDENTIFIED`: Indicates that no verification is required when enabling the role
- `IDENTIFIED`: Indicates that verification is required when enabling the role
- `BY password`: Provides the password that the user must specify when enabling the role
- `USING package`: Creates an application role, which is a role that can be enabled only by applications using an authorized package
- `EXTERNALLY`: Indicates that a user must be authorized by an external service (such as the operating system or a third-party service) before enabling the role
- `GLOBALLY`: Indicates that a user must be authorized to use the role by the enterprise directory service before the role is enabled with the `SET ROLE` statement, or at login.

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Roles with ADMIN option

Not identified:
Create role oe_clerk;
By password:
Create role hr_clerk IDENTIFIED BY bonus;
Identified externally:
Create role hr_manager identified Externally;
Creating Roles

Syntax of SQL-Create Role using EM

End
Introduction to Database Administration

TOPIC 176

Pre-defined Roles & Assigning Roles

Pre-defined Roles & Assigning Roles

Pre-defined Roles & Assigning Roles

Meaning of Pre-defined Roles & Assigning Roles
Other Special Roles
List of Pre-defined Roles & Assigning Roles
Assigning Roles - An Enterprise Example
Pre-defined Roles & Assigning Roles

Meaning of Pre-defined Roles & Assigning Roles

The roles listed are defined automatically for Oracle databases when you run database creation scripts.
CONTENT, RESOURCE, and DBA roles are provided for backward compatibility to earlier versions of the Oracle server.
The EXP_FULL_DATABASE and IMP_FULL_DATABASE roles are provided for convenience in using the Import and Export utilities.
Pre-defined Roles & Assigning Roles

Meaning of Pre-defined Roles & Assigning Roles

The roles DELETE_CATALOG_ROLE,
EXECUTE_CATALOG_ROLE, and
SELECT_CATALOG_ROLE are provided for accessing data dictionary views and packages.
These roles can be granted to users who do not have the DBA role but who requires an access to the views and tables in the data dictionary.
Pre-defined Roles & Assigning Roles

Other Special Roles

The Oracle server also creates other roles that authorize you to administer the database. On many operating systems, these roles are called OSOPER and OSDBA. Their names may be different on your operating system.
Other roles are defined by SQL scripts provided with the database. For example, AQ_ADMINISTRATOR_ROLE provides privileges to administer advanced queuing.
AQ_USER_ROLE is obsolete but is kept mainly for release 8.0 compatibility.

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SELECT * FROM DBA_SYS_PRIVS;
Pre-defined Roles & Assigning Roles

Role Name	Description
CONNECT, RESOURCE, DBA	These roles are provided for backward compatibility
EXP_FULL_DATABASE	Privileges to export the database
IMP_FULL_DATABASE	Privileges to import the database
DELETE_CATALOG_ROLE	DELETE privileges on data dictionary tables
EXECUTE_CATALOG_ROLE	EXECUTE privilege on data dictionary packages
SELECT_CATALOG_ROLE	SELECT privilege on data dictionary tables

List of Pre-defined Roles & Assigning Roles
Pre-defined Roles & Assigning Roles

Assigning Roles – An Enterprise Example

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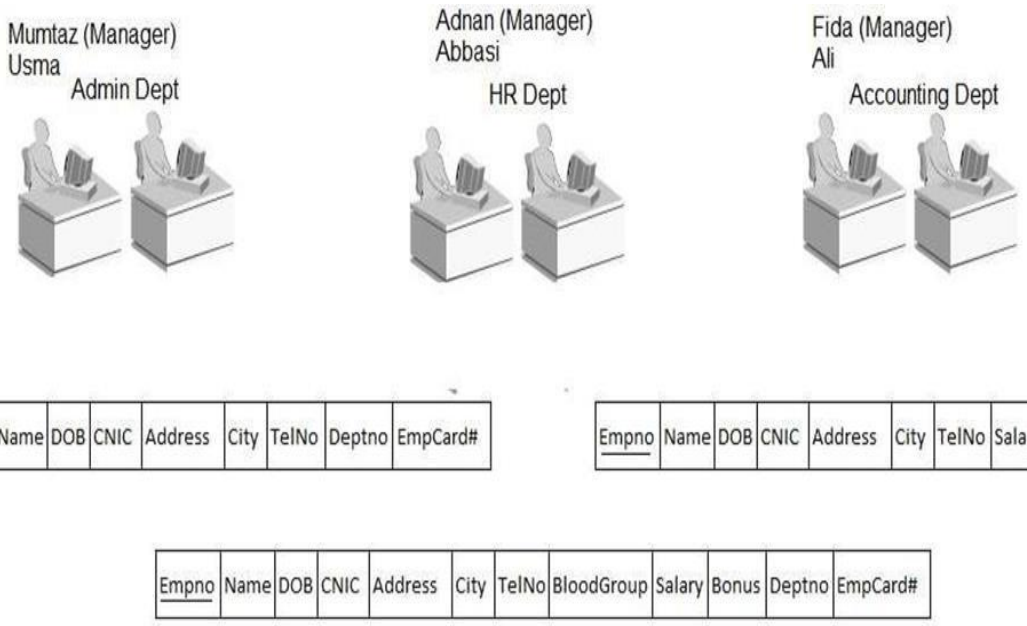

Introduction to Database Administration

TOPIC 177

Modifying & Align Roles

Modifying & Align Roles

Modifying & Align Roles

Alter Role
Alter Role - Sample SQLs
Alter Role - Syntax
Alter Role - EM
Modifying & Align Roles

Alter Role

ALTER ROLE modifies the authentication method.
Modifying roles requires the ADMIN option or ALTER ANY ROLE privilege
Modifying & Align Roles

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Alter Role – Sample SQLs

ALTER ROLE oe_clerk
IDENTIFIED BY order;

ALTER ROLE hr_clerk
IDENTIFIED EXTERNALLY;

ALTER ROLE hr_manager NOT IDENTIFIED;
Modifying & Align Roles

Alter Role – Syntax

```
ALTER ROLE role {NOT IDENTIFIED | IDENTIFIED
 {BY password |USING package| EXTERNALLY | GLOBALLY }};
```

where:

- `role`: Is the name of the role
- `NOT IDENTIFIED`: Indicates that no verification is required when enabling the role
- `IDENTIFIED`: Indicates that verification is required when enabling the role
- `BY password`: Provides the password used when enabling the role
- `EXTERNALLY`: Indicates that a user must be authorized by an external service (such as the operating system or a third-party service) before enabling the role
- `GLOBALLY`: Indicates that a user must be authorized to use the role by the enterprise directory service before the role is enabled with the `SET ROLE` statement, or at login

Modifying & Align Roles

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Alter Role – EM

Introduction to Database Administration

TOPIC 178

Default Roles

Default Roles

Default Roles

Default Roles

Assigning & Disable Roles - Sample SQLs

Establishing Default Roles

Default Roles

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Assigning & Disable Roles – Sample SQLs

GRANT oe_clerk TO scott;

GRANT hr_clerk TO hr_manager;

GRANT hr_manager TO scott WITH ADMIN OPTION;

Disable role during session of user u1 SQL> SET ROLE NONE;

Establishing Default Roles

A user can be assigned many roles.
A user can be assigned a default role.
Limit the number of default roles for a user.

```
ALTER USER scott
      DEFAULT ROLE hr_clerk, oe_clerk;
```

```
ALTER USER scott DEFAULT ROLE ALL;
```

```
ALTER USER scott DEFAULT ROLE ALL EXCEPT
      hr_clerk;
```

```
ALTER USER scott DEFAULT ROLE NONE;
```

Default Roles

Establishing Default Roles

A user can be assigned many roles. A default role is a subset of these roles that is automatically enabled when the user logs on. By default, all the roles are assigned to a user are enabled at logon without the need of a password. Limit the default roles for a user with the *ALTER USER* command.
Default Roles

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Establishing Default Roles

The DEFAULT ROLE clause applies only to roles that have been granted directly to the user with a GRANT statement. The DEFAULT ROLE clause cannot be used to enable the following:
Roles not granted to the user.
Roles granted through other roles.
Roles managed by an external service (such as the operating system).
Default Roles

Establishing Default Roles

Use the following syntax to assign default roles to a user:

ALTER USER user *DEAFULT ROLE*
{role [,role]…| ALL [EXCEPT role [,role]…] |
NONE}
Where:
User: is the name of the user who is granted the roles
Role: is the role to be made the default
role for the user

Introduction to Database Administration

TOPIC 179

Application Roles
Application Roles

Application Roles

Application Roles
Application Roles - SQL
Application Roles

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Application Roles

Application roles can be enabled only by authorized PL/SQL packages

The USING package clause creates an
application role

CREATE ROLE admin_role
IDENTIFIED USING hr.employee;
Application Roles

Application Roles

The USING package clause in the CREATE ROLE statement creates an application role. An application role can be enabled only by applications by using an authorized PL/SQL package. Application developers do not need to secure a role by embedding passwords inside applications. Instead, they can create an application role and specify which PL/SQL package is authorized to enable the role.
Application Roles

Application Roles - SQL

CREATE ROLE admin_role IDENTIFIED USING hr.employee;

In this example, admin_role is an application role and the role can be enabled only by modules that are defined inside the hr.employee PL/SQL package.

End
Introduction to Database Administration

TOPIC 180

Enable & Disable Role
Enable & Disable Role

Enable & Disable Role

Restrictions on Enable & Disable Role
Specifying Roles to be Enabled
Restrictions on Enable & Disable Role - Sample
Restrictions on Enable & Disable Role - Syntax

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Enable & Disable Role

Enable & Disable Role

Disable a role to temporarily revoke the role from a user.
Enable a role to grant it temporarily.
The SET ROLE command enables and
disables roles
Default roles are enabled for a user at login.
A password may be required to enable a role.
Enable & Disable Role

Enable & Disable Roles

Enable and disable roles to temporarily activate and deactivate the privileges associated with the roles.
To enable a role, a role must first be
granted to the user.
Enable & Disable Role

Enable & Disable Roles

When a role is enabled, the user can use the privileges granted to that role. If a role is disabled, the user cannot use the privileges associated with that role unless those privileges are granted directly to a user or to another role enabled for that user. Roles are enabled for a session. At the next session, the user's active roles revert to default roles.
Enable & Disable Role

Specifying Roles to be Enabled

The SET command and the DBMS_SESSION.SET_ROLE procedure enable all of the roles included in the command and disable all other roles. Roles can be enabled from any tool or program that allows PL/SQL commands; however, a role cannot be enabled in a stored procedure.
You can use the ALTER USER-DEFAULT ROLE command to indicate which roles will be enabled for a user at login. All other roles are disabled.
Enable & Disable Role

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Specifying Roles to be Enabled

A password may be required to enable a role. The password must be included in the SET ROLE command to enable the role.
Default roles assigned to a user do not require a password; they are enabled at login, the same as a role without a password.
Enable & Disable Role

Restrictions on Enable & Disable Role

A role cannot be enabled from a stored procedure, because this action may change the security domain (set of privileges) that allowed the procedure to be called in the first place.
So, in PL/SQL, Role can be enabled and disabled in anonymous blocks and application procedures (for example, client Oracle Forms procedures), but not in stored procedures.
Enable & Disable Role

Restrictions on Enable & Disable Role

IF a stored procedure contains the command SET ROLE, the following error is generated at run time:
ORA-06565: cannot execute SET ROLE from within stored procedure
Enable & Disable Role

Restrictions on Enable & Disable Role - Sample

```
SET ROLE hr_clerk;
```

```
SET ROLE oe_clerk IDENTIFIED BY order;
```

```
SET ROLE ALL EXCEPT oe_clerk;
```

Enable & Disable Role

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Restrictions on Enable & Disable Role - Syntax

```
SET ROLE {role [ IDENTIFIED BY password ]
   [, role [ IDENTIFIED BY password ]]
   | ALL [ EXCEPT role [, role ]    ]
   | NONE }
```

Introduction to Database Administration

TOPIC 181

Removing Roles
Removing Roles

Removing Roles

Revoke Roles
Revoke Roles from Users
Revoke Roles using OEM
Removing Roles
Removing Roles

Revoke Roles

Disable a role to temporarily revoke the role from a user.
Enable a role to grant it temporarily.
The SET ROLE command enables and
disables roles
Default roles are enabled for a user at login.
A password may be required to enable a role.
Removing Roles

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Revoke Roles from Users

To revoke a role from a user, use the SQL statement REVOKE. Any user with the admin option for a role can revoke the role from any other database user or role. Also, users with the GRANT ANY ROLE privilege can revoke any role.
Removing Roles

Revoke Roles from Users

```
REVOKE role [, role ]
   FROM {user|role|PUBLIC}
   [, {user|role|PUBLIC} ]
```

where
role: Is the role to be revoked or the role from which roles are revoked.
user: is the user from which the system privileges or roles are revoked.
PUBLIC: Revokes the privilege or role
from all users
Removing Roles

Revoke Roles using OEM

Using Oracle Enterprise Manager to
Revoke a Role from a User

From the OEM Console:
Navigate to Security>Users.
Highlight the user for whom a role is to
be revoked.
Navigate to Roles Granted.
Select the role to be revoked.
Select Revoke from the right-mouse
menu.

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Select Yes to confirm revocation.
Removing Roles

Removing Roles

To remove a role from the database, use
the following syntax:

SQL> DROP ROLE role;
When you drop a role, the Oracle server revokes it from all users and roles to whom it has been granted and removes it from the database.
In order to drop the role, you must have been granted the role with ADMIN OPTION or have the DROP ANY ROLE system privilege.
Removing Roles
Removing Roles

- **Dropping a role:**
  - **Removes it from all users and roles it was granted**
  - **Removes it from the database**
- **Requires the `ADMIN OPTION` or `DROP ANY ROLE` privilege**
- **To drop a role:**

```
DROP ROLE hr_manager;
```

Introduction to Database Administration

TOPIC 182

Guidelines for Creating Roles
Guidelines for Creating Roles

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Guidelines for Creating Roles

Guidelines
Guidelines for an Example
Guidelines for Assigning Roles
Guidelines for using Password and Default Roles
Roles with Password
Guidelines for Creating Roles

Guidelines

Because a role includes the privileges that are necessary to perform a task, the role name is usually an application task or a job title.
Our example uses both application tasks and job titles for role names.
Guidelines for Creating Roles

Guidelines for an Example

Use the following steps to create, assign, and grant users roles:
Create a role for each application task. The name of the application role corresponds to a task in the application, such as PAYROLL.
Assign the privileges necessary to perform the task to the application role.
Guidelines for Creating Roles

Guidelines for an Example

Create a role for each type of user. The name of the user role corresponds to a job title, such as PAY_CLERK.
Grant application roles to user's roles.
Grant user's roles to users.
Guidelines for Creating Roles

Guidelines for an Example

If a modification to the application requires that the new privileges are needed to perform the payroll task, then the DBA only needs to assign the new privileges to the PAYROLL application role. All of the users that are currently performing this task will receive the new privileges.
Guidelines for Creating Roles

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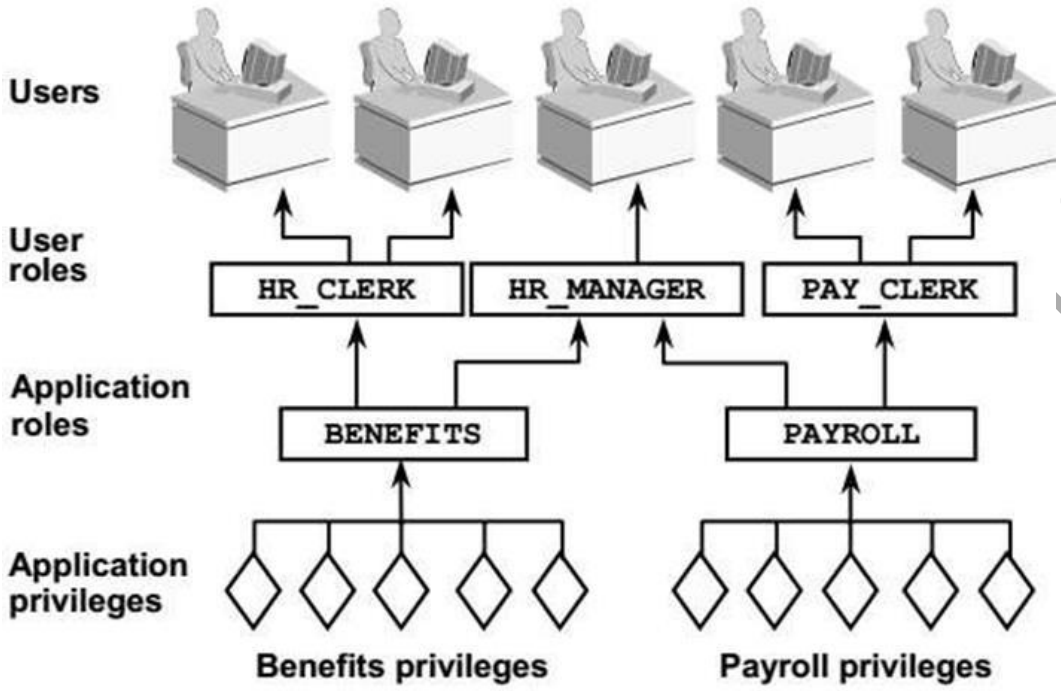
Guidelines for Assigning Roles



Guidelines for Creating Roles

Guidelines for using Password and Default Roles

Passwords provide an additional level of
security when enabling a role.
For example, the application might require a user to enter a password when enabling the PAY_CLERK role, because this role can be used to issue checks.
Guidelines for Creating Roles

Guidelines for using Password and Default Roles

Passwords allow a role to be enabled only through an application. This technique is shown in the example in the slide.
The DBA has granted the user two roles, PAY_CLERK and PAY_CLERK_RO.
The PAY_CLERK has been granted all of the privileges that are necessary to perform the payroll clerk function.
Guidelines for Creating Roles

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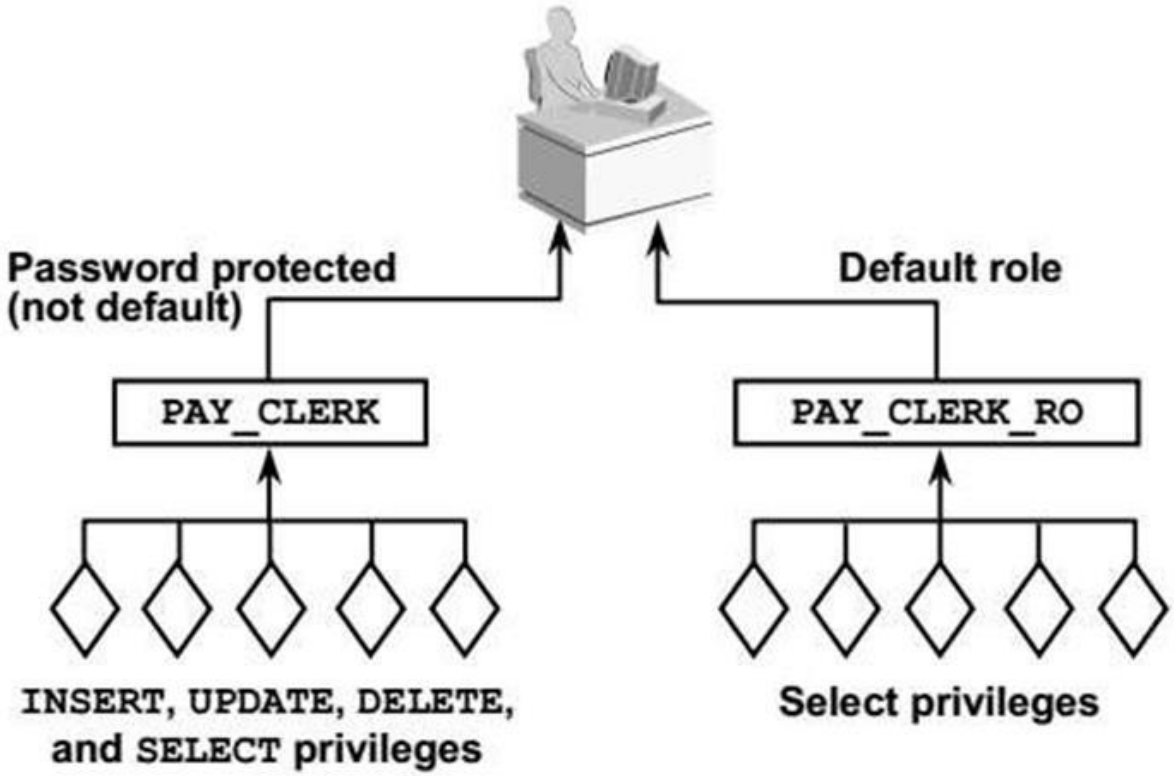
Roles with Password



Introduction to Database Administration

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TOPIC 183

Using Roles Data Dictionary Views

Using Roles Data Dictionary Views

Using Roles Data Dictionary Views

Data Dictionary Views of Roles
Roles' Views
Privileges and Roles - An Example
Using Roles Data Dictionary Views

Data Dictionary Views of Roles

Information about roles can be obtained by querying the following SQL

select table_name, comments from DICT
where table_name like '%ROLE%';
Using Roles Data Dictionary Views

Roles' Views

DBA_ROLES: All roles that exist in the database
DBA_ROLE_PRIVS: Roles granted to users and roles
ROLE_ROL_PRIVS: Roles that are granted to roles
DBA_SYS_PRIVS: System privileges granted to users and roles
ROLE_SYS_PRIVS: System privileges granted to roles
ROLE_TAB_PRIVS: Object privileges granted to roles
SESSION_ROLES: Roles that the user currently has enabled

Using Roles Data Dictionary Views

Privileges and Roles – An Example

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User is u1

Privileges are
select, update for table EMP Assigning Role EMP_SU Assigning EMP_SU to user u1
Using Roles Data Dictionary Views

Privileges and Roles – An Example

To user has which roles

```
SQL> select Grantee, granted_role
  2  from DBA_ROLE_PRIVS
  3  where rownum<=10;

GRANTEE                        GRANTED_ROLE
------------------------------ --------------------
U1                             EMP_SU
DBA                            OLAP_DBA
DBA                            XDBADMIN
DBA                            JAVA_ADMIN
DBA                            JAVA_DEPLOY
DBA                            OLAP_XS_ADMIN
DBA                            WM_ADMIN_ROLE
DBA                            SCHEDULER_ADMIN
DBA                            XDB_SET_INVOKER
DBA                            EXP_FULL_DATABASE
```

Introduction to Database Administration

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TOPIC 184

Introduction to Data Migration & Data Loading

Introduction to Data Migration & Data Loading

Data Migration
Data Migration - Source to Target Schema
Data Migration Choices
Data Migration & Staging Schema
Introduction to Data Migration & Data Loading

Data Migration

Data migration is the process of transferring data from one storage system or computing environment to another.

Non integrated/ distributed data can be integrated through data migration
Introduction to Data Migration & Data Loading

Data Migration

There are many reasons your enterprise might need to undertake a data migration project. For example, you might be replacing servers or storage devices or consolidating or decommissioning data center.
Data migration is also an essential step in the overall process of migrating on- premises IT infrastructure to a cloud computing environment.
Introduction to Data Migration & Data Loading

Data Migration

Whether you are moving to a public cloud, private cloud, hybrid cloud, or multi-cloud environment, you will need to find a secure, cost-effective, and efficient method of migrating your data to its new storage location.
Introduction to Data Migration & Data Loading

Data Migration – Source to Target Schema

Typically, the first step in the database migration process involves converting the source database's schema (if necessary) so that it's compatible with the target database. A database's

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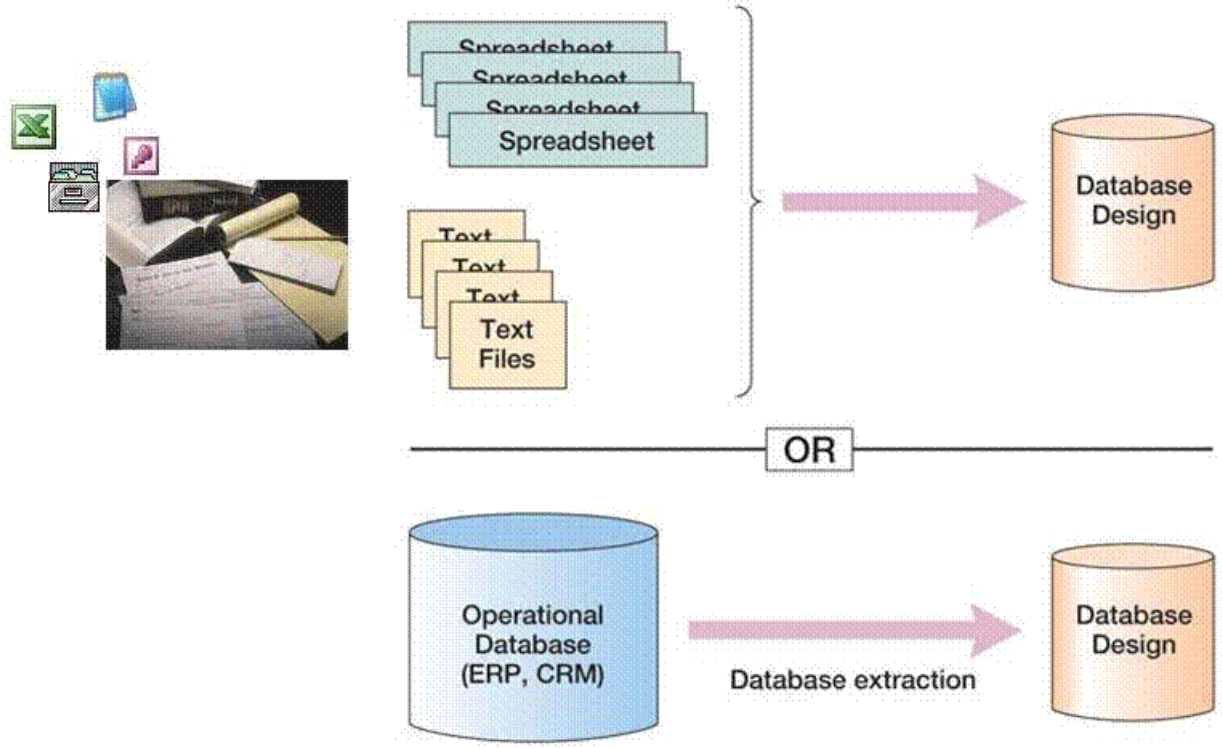
schema is like a blueprint for how it is organized, controlling its logical architecture and structure. If the target database management system uses a data definition language (DDL) that is not compatible with the source's, the schema will need to be converted.
Introduction to Data Migration & Data Loading

Data Migration Choices



Introduction to Data Migration & Data Loading

Data Migration Ways

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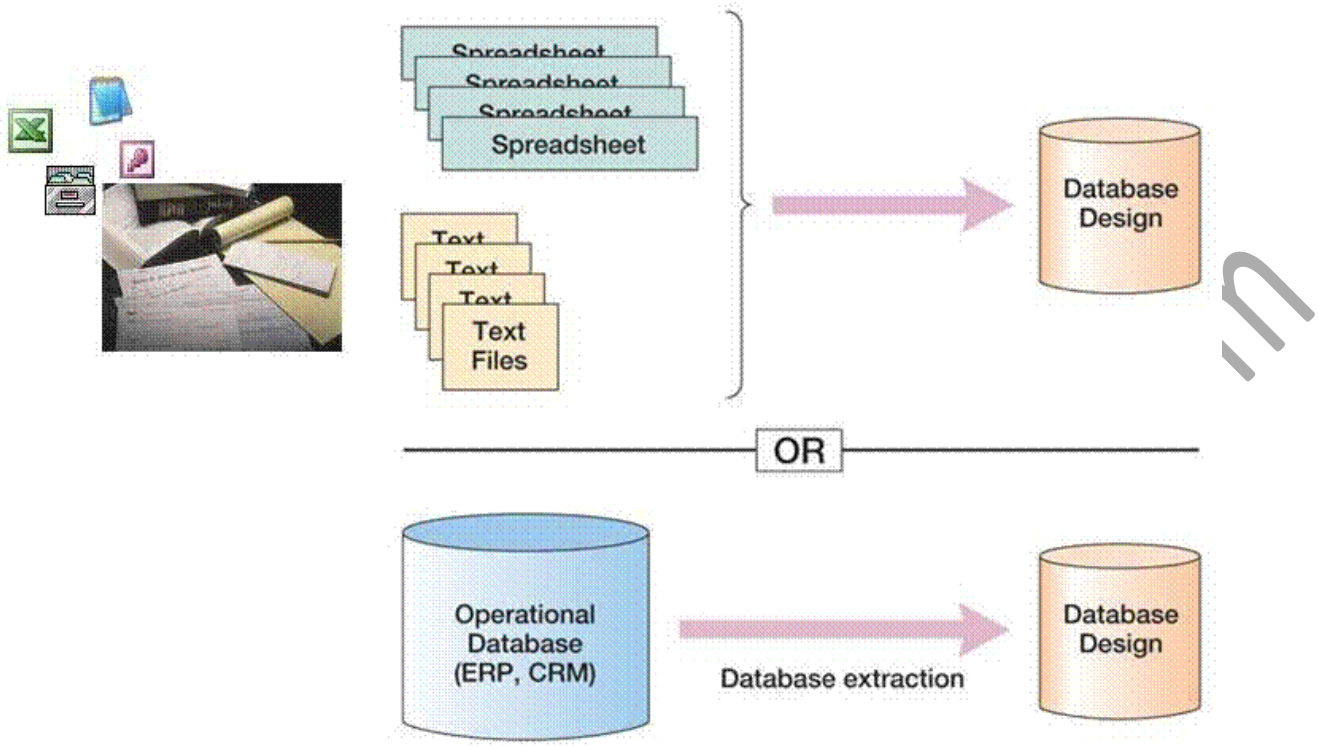
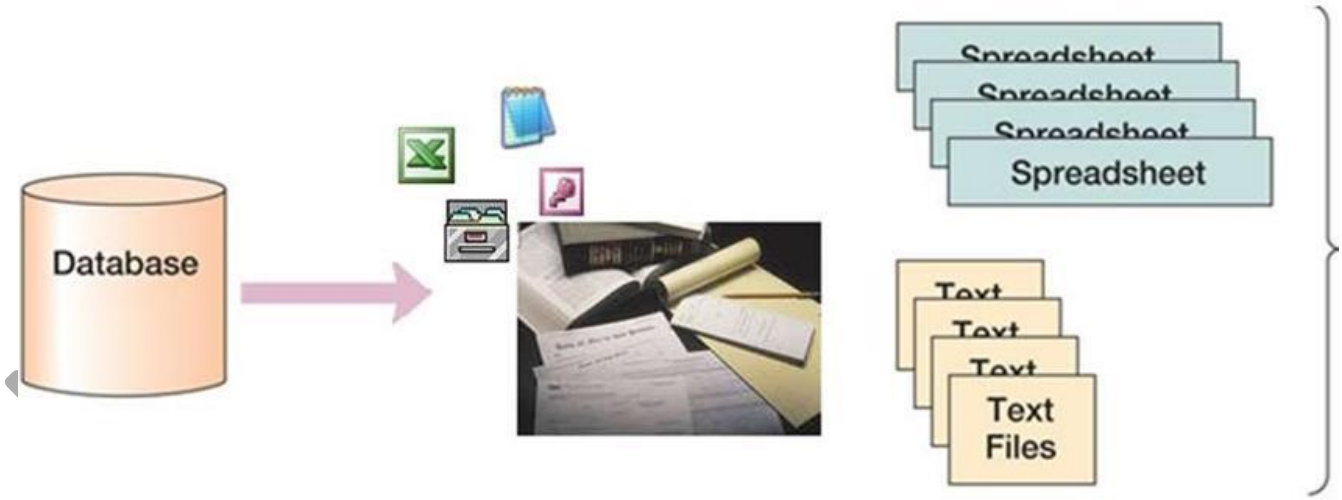
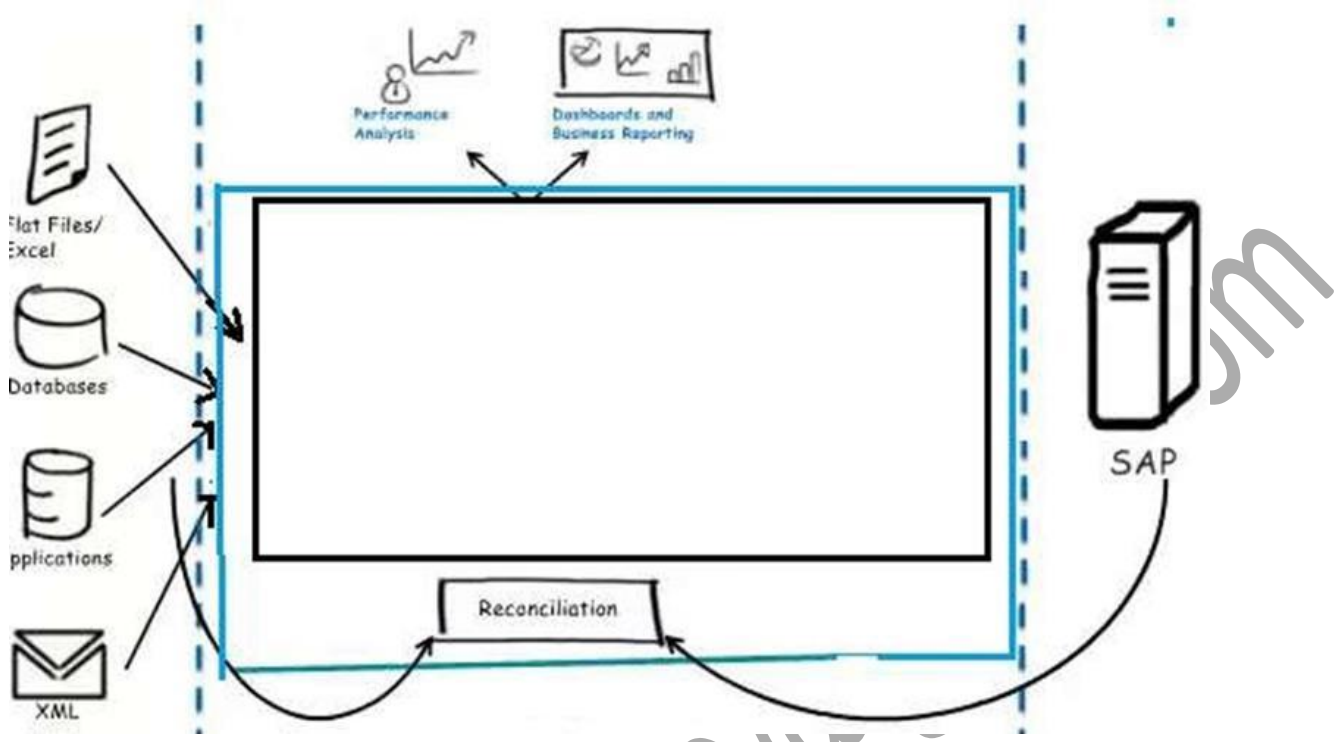


Introduction to Data Migration & Data Loading

Data Migration Ways



Introduction to Data Migration & Data Loading



Data Migration & Staging Schema
Introduction to Database Administration

TOPIC 185

Data Loading Methods
Data Loading Methods

Data Loading Methods

Introduction
SQL*Loader Method
Direct Load Method
Oracle Export and Oracle Import
Data Loading Methods

Introduction

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Several methods are available for loading data into tables in an Oracle database. Of the methods available, Direct Load insert and SQL*Loader are discussed here.
Data Loading Methods

SQL*Loader Method

SQL*Loader loads data from external files into tables of an Oracle database. It has a powerful data parsing engine that places little limitation on the format of the data in the data file.
Data Loading Methods

Direct Load Method

Direct Load insert can be used to copy data from one table to another table within the same database. It speeds up the insert operation, bypassing the database buffer cache and writing data directly into the data files.
Data Loading Methods

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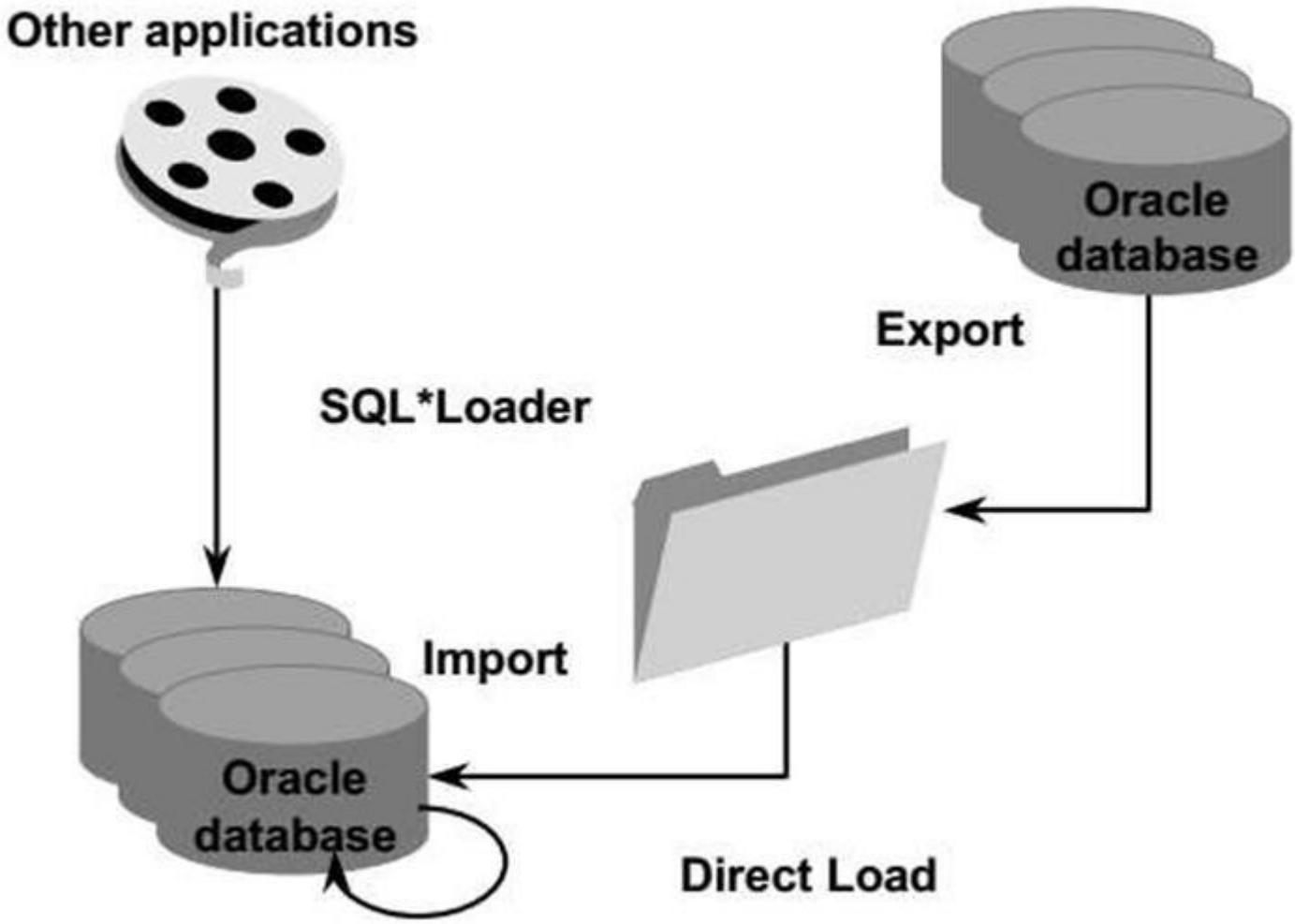

Oracle Export and Oracle Import
Introduction to Database Administration

TOPIC 186

Direct & Parallel Load
Direct & Parallel Load

Direct & Parallel Load

Direct Load
Serial Direct Load - Example
Parallel Direct Load
Parallel Direct Load - Example
Direct & Parallel Load

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Direct Load

Direct Load insert can be performed in the following ways:
Normal (Serially), or in parallel
Into partition tables, non-partitioned
tables, or single partitions of a table
With or without logging of redo data
Direct & Parallel Load

Direct Load

Direct Load insert (serial or parallel) can only support the INSERT …
SELECT syntax of an INSERT statement, not the INSERT Values syntax. The parallelism for INSERT
SELECT is determined from either parallel
hints or parallel table definition.
Oracle provides syntax extensions that extend the scope of the INSERT SELECT statement, so that you can insert rows into multiple tables as part of a single DML statement.
Direct & Parallel Load

Direct Load

A Direct Load insert can be invoked by using the APPEND hint, as shown in following command:

```
INSERT /*+APPEND * / INTO [ schema. ]
table [ [NO] LOGGING ]
sub query;
```

Where
schema: Is the owner of the table
table: Is the name of the table
sub-query: Is the sub-query used to select the columns and rows for insert
Direct & Parallel Load

Serial Direct Load - Example

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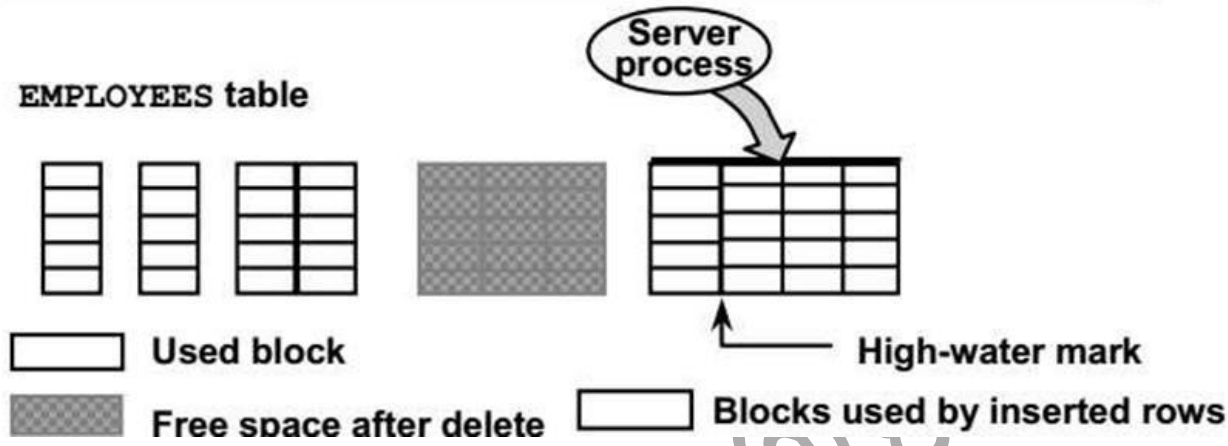
```
INSERT /*+ APPEND */ INTO emp
NOLOGGING
SELECT * FROM t_employees;
COMMIT;
```



Direct & Parallel Load

Parallel Direct Load

Direct Load inserts can be made in parallel by one of the following methods:
Using a PARALLEL hint in the INSERT statement, as in the above example
Creating the table or altering it to specify the PARALLEL clause
When parallel Direct Load inserts are made, the Oracle server uses several processes, known as parallel query slaves, to insert data into the table.
Direct & Parallel Load

Parallel Direct Load

Temporary segments are allocated to store the data inserted by each slave process.
When the transaction commits, the extents in these individual segments become a part of the table in which records are inserted.
The ALTER SESSION ENABLE PARALLEL DML command must be executed at the beginning of a transaction.
An object that is modified using parallel
Direct Load insert cannot be queried or modified again within the same transaction.
Direct & Parallel Load

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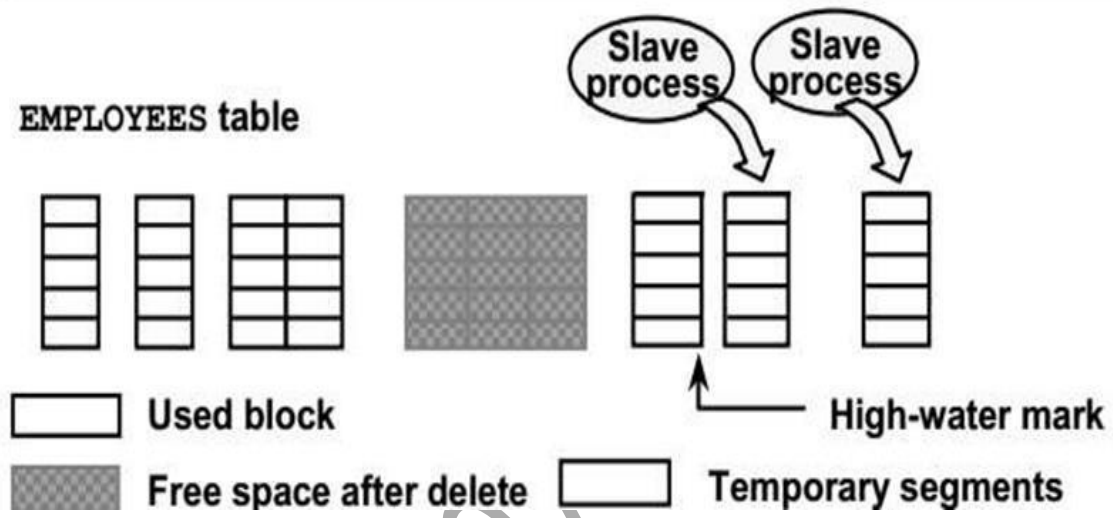
Parallel Direct Load - Example

```
ALTER SESSION ENABLE PARALLEL DML;
INSERT /*+PARALLEL(hr.employees,2) */
INTO hr.employees NOLOGGING
SELECT * FROM hr.old_employees;
```



Introduction to Database Administration

TOPIC 187

SQL*Loader
SQL*Loader

SQL*Loader

Introduction
Files used by SQL*Loader

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Using SQL*Loader
SQL*Loader

Introduction

SQL*Loader loads data from external files into tables in an Oracle database.
SQL*Loader has the following features:
SQL*Loader can use one or more input
files.
Several input records can be combined into one logical record for loading.
Input fields can be of fixed or variable lengths.
Input data can be in any format: character, binary, packed decimal, date, and zoned decimal.
SQL*Loader

Introduction

Data can be loaded from different types of media such as disk, tape, or named pipes.
Data can be loaded into several tables
in one run.
Options are available to replace or to
append to existing data in the tables.
SQL functions can be applied on the input data before the row is stored in the database.
SQL*Loader

Introduction

Column values can be auto generated based on rules. For example, a sequential key value can be generated and stored in a column.
Data can be loaded directly into the table, bypassing the database buffer cache.
SQL*Loader

Files used by SQL*Loader

SQL*Loader uses the following files:
Loader control file: Specifies the input format, output tables, and optional conditions that can be used to load only part of the records found in the input data files
Input data files: Contain the data in the format defined in the control file
Parameter file: Is an optional file that can be used to define the command line parameters for the load

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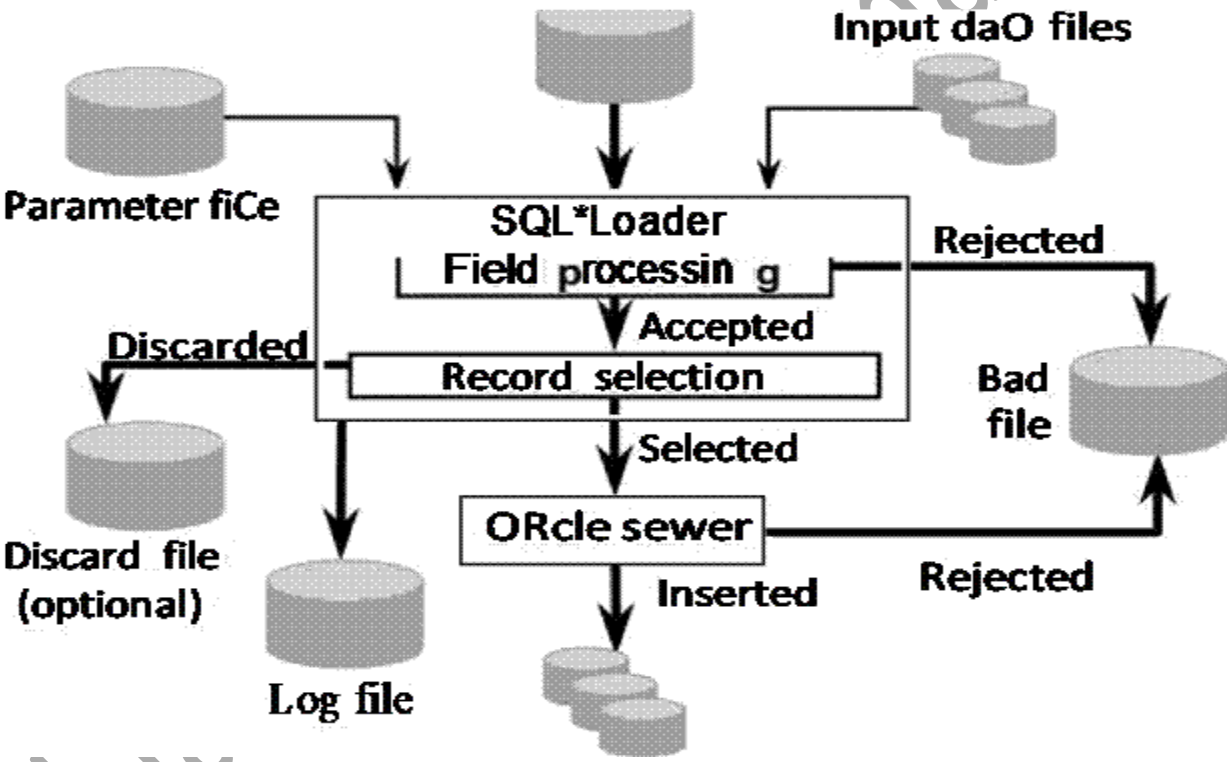
SQL*Loader

Files used by SQL*Loader

Log file: Is created by SQL*Loader and contains a record of the load
Bad file: Is used by the utility to write the records that are rejected during the load.
Discard file: Is a file that can be created, if necessary, to store all records that did not satisfy the selection criteria

Files used by SQL*Loader

Loader control file



Database data files
SQL*Loader

Using SQL*Loader

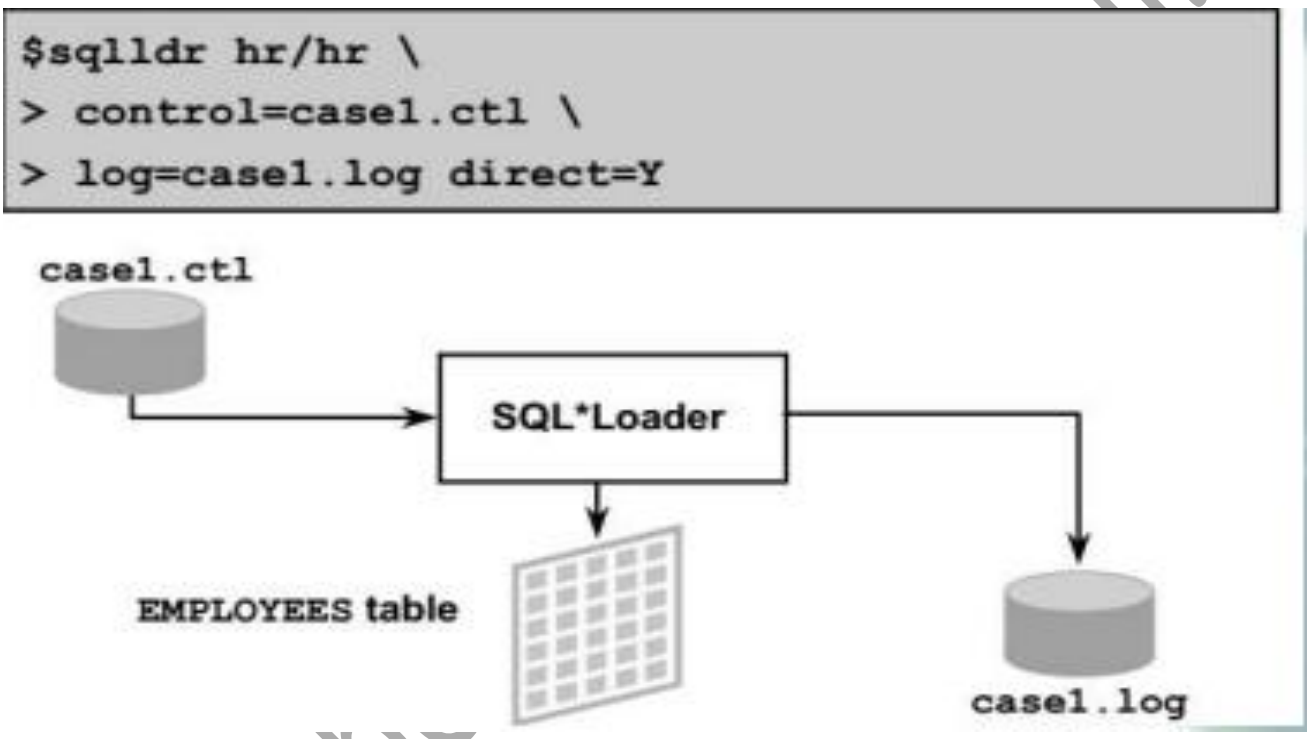
When you invoke SQL*Loader, you can specify parameters that establish session characteristics. Parameters can be entered in any order, optionally separated by commas. You can specify values for parameters, or in some cases, you can accept the default without entering a value.
SQL*Loader

Using SQL*Loader

If you invoke SQL*Loader without specifying any parameters, SQL*Loader displays a Help screen that lists the available parameters and their default values.

SQL*Loade

Using SQL*Loader



Introduction to Database Administration

TOPIC 188

SQL*Loader Control Files

SQL*Loader Control Files

SQL*Loader Control Files

Introduction

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Three Sections of Control Files
Sample Control File
Sample Control File Explanation
SQL*Loader Control Files

Introduction

The loader control file tells SQL*Loader:
Where to find the load data
The data format
Configuration details:
Memory management
Record rejection
Interrupted load handling details
How to manipulate the data
SQL*Loader Control Files

Introduction

The SQL*Loader control file is a text file that contains DDL instructions. DDL is used to control the following aspects of a SQL*Loader session:
Where SQL*Loader finds the data to load
How SQL*Loader expects that data to be formatted
How SQL*Loader configures (memory management, rejecting records, interrupted load handling, and so on) as it loads the data
SQL*Loader Control Files

Introduction

How SQL*Loader manipulates the data being loaded
SQL*Loader Control Files

Three Sections of Control Files

The first section contains session-wide information, for example:
Global options such as bind size, rows, records to skip, and so on
INFILE clauses to specify where the input data is located
How data is to be loaded
SQL*Loader Control Files

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Three Sections of Control Files

The second section consists of one or more INTO TABLE blocks. Each of these blocks contain information about the table into which the data is to be loaded, such as the table name and the columns of the table.
The third section is optional and, if present, contains input data.
SQL*Loader Control Files

Sample Control File

```
1   -- This is a sample control file
2  LOAD DATA
3  INFILE 'SAMPLE.DAT'
4  BADFILE 'sample.bad'
5  DISCARDFILE 'sample.dsc'
6  APPEND
7  INTO TABLE emp
8  WHEN (57) = '.'
9  TRAILING NULLCOLS
10 (hiredate SYSDATE,
       deptno POSITION(1:2) INTEGER EXTERNAL(3)
        NULLIF deptno=BLANKS,
       job POSITION(7:14) CHAR TERMINATED BY WHITESPACE
       NULLIF job=BLANKS "UPPER(:job)",
       mgr POSITION(28:31) INTEGER EXTERNAL
       TERMINATED BY WHITESPACE, NULLIF mgr=BLANKS,
```

SQL*Loader Control Files

Sample Control File Explanation

This is how comments are entered in a control file. Comments can appear anywhere in the command section of the file, but they should not appear within the data.

The LOAD DATA statement tells SQL*Loader that this is the beginning of a new data load. If you were continuing a load that had been interrupted in progress, you would use the CONTINUE LOAD DATA statement.
The INFILE keyword specifies the name of a data file containing data that you want to load.
SQL*Loader Control Files

Control File Syntax Consideration

The syntax is free-format Syntax is not case sensitive
Comments extend from the two hyphen (--) that mark the beginning of the comment to the end of the line
The CONSTANT keyword is reserved
SQL*Loader Control Files

Control File Syntax Consideration

The syntax is free format. (Statements can extend over multiple lines.)
It is case insensitive; however, strings enclosed in single or double quotation marks are taken literally, including case.
In control file syntax, comments extend from the two hyphens (—) that mark the beginning of the comment to the end of the line. The optional third section of the control file is interpreted as data rather than as control file syntax; consequently, comments in this section are not supported.
The CONSTANT keyword has special meaning to SQL*Loader and is therefore reserved. To avoid potential conflicts, do not use the word CONSTANT as a name for any tables or columns.

Introduction to Database Administration

TOPIC 189

Input & Data Files
Input & Data Files

Input & Data Files

Introduction
Fixed-Record Format
Variable-Record Format

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Stream-Record Format
Input & Data Files

Introduction

SQL*Loader reads data from one or more files specified in the control file.
From SQL*Loader's perspective, the data in the data file is organized as records.
A data file can be in one of three formats:
Fixed-record format
Variable-record format
Stream-record format
Input & Data Files

Fixed-Record Format

Records in a file are of same byte Format is specified as

INFILE <data file> "fix n"
Following is a control file contents for two
columns
load data
infile 'example.dat' "fix 10"
into table example
fields terminated by ' ' (col1, col2)
Input & Data Files

Fixed-Record Format

example.dat: 0001, abcd
0002, fghi
0003, klmn
Input & Data Files

Variable-Record Format

A file is in variable format when the length of each record in a character field is included at the beginning of each record in the data file.

For example, specifying data file as INFILE "datafile_name" "var n"

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n represents the number of bytes in the record length field
If n is not specified, SQL*Loader assumes a length of 6.
Input & Data Files

Variable-Record Format

In example.dat, record length fields/ columns are 3 bytes long

```
load data
infile 'example.dat' "var 3"
into table example
fields terminated by ',' optionally enclosed by '"'
(col1 char(5),col2 char(7))
example.dat:
009hello,cd,
010world,im,
012my,name is,
```

Input & Data Files

Stream-Record Format

A file is in stream-record format when records are not specified by size; instead SQL*Loader forms records by scanning for the record terminator. It is flexible but it has performance issues.
For example, specifying data file as INFILE <datafile_name> ["str terminator_string"]
Input & Data Files

Stream-Record Format

Non printable characters will be
\n new line
\t horizontal tab
\f form feed

\v vertical tab
\r carriage return
Input & Data Files

Stream-Record Format

In example.dat, data loading with stream-record format

```
load data
infile 'example.dat' "str '|\n'"
into table example
fields terminated by ',' optionally enclosed by '"'
(col1 char(5),
col2 char(7))
example.dat:
hello,world,|
james,bond,|
```

Introduction to Database Administration

TOPIC 190

Logical Records & Loading Methods

Logical Records & Loading Methods

Logical Records & Loading Methods

Logical Records
Using CONCATENATE to Assemble Logical Records
Using CONTINUEIF to Assemble Logical Records
Conventional Path Load
Direct Path Load
Loading Methods

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Logical Records & Loading Methods

Logical Records

SQL*Loader can be instructed to follow one of the following two logical record- forming strategies:

Combine a fixed number of physical records to form each logical record

Combine physical records into logical records while a certain condition is true
Logical Records & Loading Methods

Logical Records

SQL*Loader organizes the input data into physical records, according to the specified record format. By default, a physical record is a logical record. However, for added flexibility, SQL*Loader can be instructed to combine a number of physical records into a logical record.
SQL*Loader can do
Combine fixed number of physical records to form each logical record
Combine physical records into logical records while a certain condition is true
Logical Records & Loading Methods

Using CONCATENATE to Assemble Logical Records

CONCATENATE is used when SQL*Loader should always add the same number of physical records to form one logical record. For example,

CONCATENATE integer

Means number of physical records to
combine
Logical Records & Loading Methods

Using CONTINUEIF to Assemble Logical Records

CONTINUEIF must be used if the number of physical records to be continued varies. The CONTINUEIF keyword is followed by a condition that is evaluated for each physical record as it is read.

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For example, two records might be combined if there was a pound sign (#) in character position 80 of the first record.
Logical Records & Loading Methods

Conventional Path Load

Conventional path Load builds an array of rows to be inserted and uses the SQL INSERT statement to load the data. During conventional path loads, input records are parsed based on field specifications, and an array of records is built and inserted into the table specified in the control file.
Records that do not conform to the field specifications are rejected and those records that do not satisfy the selection criteria are discarded.
Logical Records & Loading Methods

Conventional Path Load

Conventional path loads can be used to load data into both the clustered and unclustered tables.
Redo generation is controlled by the logging attribute for the table that is being loaded.
Logical Records & Loading Methods

Direct Path Load

A Direct path load builds blocks of data in memory and saves these blocks directly into the extents allocated for the table being loaded. Online redo log file entries are not generated unless the database is in ARCHIVELOG mode.

Direct load path is generally faster than
conventional path load.
Logical Records & Loading Methods

Loading Methods

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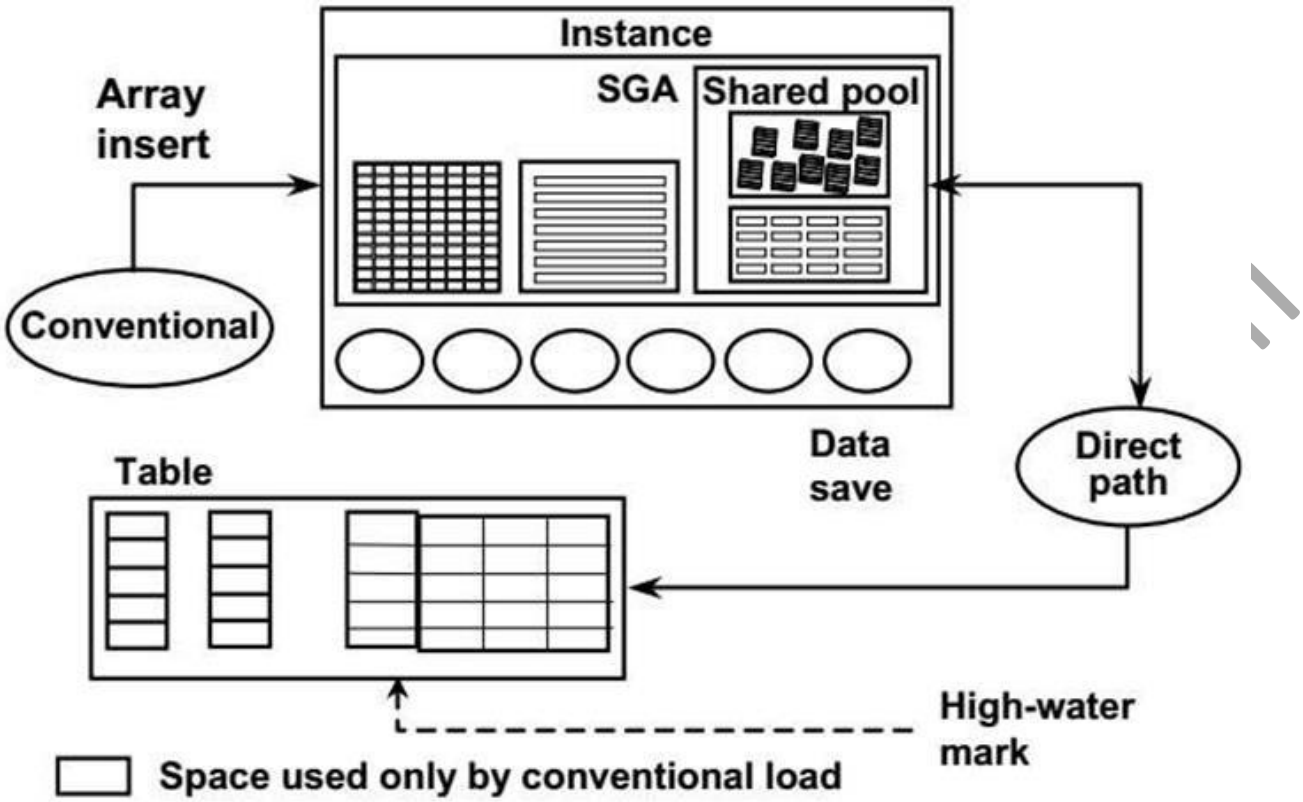

TOPIC 191

Direct & Conventional Path Loads

Direct & Conventional Path Loads

Direct & Conventional Path Loads

Method of Saving Data
Comparison of Conventional and Direct Path Loads
Logging Changes
Enforcing Constraints
Parallel Direct Paths
Enforcing Constraints
Direct & Conventional Path Loads

Method of Saving Data

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Conventional path loads use SQL processing and database COMMITS for saving data. The insertion of an array of records is followed by a commit operation. Each data load might involve several transactions.
Direct & Conventional Path Loads

Method of Saving Data

Direct path loads use data saves to write blocks of data to Oracle data files. The following features differentiate a data save from a COMMIT:
During a data save, only full database blocks are written to the database The blocks are written after the high-water mark of the table
After a data save, the high-water mark is moved Internal resources are not released after a data save A data save does not end the transaction
Indexes are not updated at each data save
Direct & Conventional Path Loads

Conventional Load	Direct Path Load
Uses COMMITs to make changes permanent	Uses data saves
Redo entries always generated	Generates redo only under specific conditions
Enforces all constraints	Enforces only primary key, unique, and NOT NULL
INSERT triggers fire	INSERT triggers do not fire
Can load into clustered tables	Cannot load into clustered tables
Other users can make changes to tables	Other users cannot make changes to tables

Comparison of Conventional and Direct Path Loads

Direct & Conventional Path Loads

Logging Changes

Conventional path loading generates redo entries just as any DML statement. When using a Direct path load, redo entries are not generated if:
The database is in NOARCHIVELOG mode The database is in ARCHIVELOG mode, but logging is disabled. Logging can be disabled by setting the NOLOGGING attribute for the table or by using the UNRECOVERABLE clause in the control file
Direct & Conventional Path Loads

Enforcing Constraints

During Direct path loads, the constraints are handled as follows:
NOT NULL constraints are checked when arrays are built.
FK and CHECK constraints are disabled
PK and unique constraints are checked during and at the end of the run and may be disabled
Direct & Conventional Path Loads

Parallel Direct Paths

Multiple SQL*Loader sessions improve the performance of a Direct path load. Three models of concurrency can be used to minimize the time required for data loading:
Parallel conventional path loads
Intersegment concurrency with Direct path load method
Intra segment concurrency with Direct
path load method
Direct & Conventional Path Loads

Parallel Direct Paths

Concurrent conventional path
When trigger or integrity constraints pose
a problem
Intersegment concurrency with Direct
path load method
Loading of different objects such as tables and partitions of same table.
Intra segment concurrency with Direct path load method
Multiple Direct path load session concurrently into same table or partition

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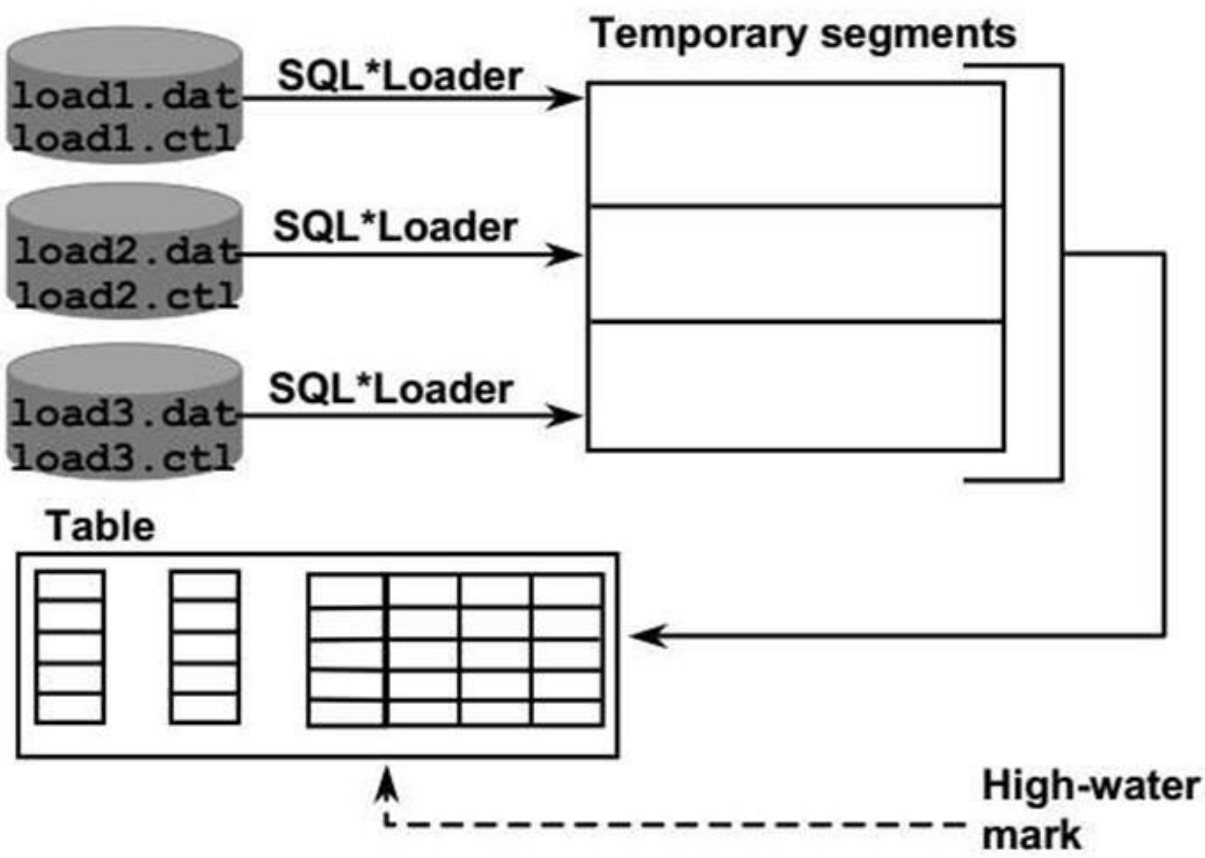
Direct & Conventional Path Loads

Enforcing Constraints



Introduction to Database Administration

TOPIC 192

Data Conversion

Data Conversion

Data Conversion

Introduction
SQL*Loader Rejects
Discarded or Rejected Records
Data Conversion

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Introduction

During a conventional path load, data fields in the data file are converted into columns in the database in two steps:
The field specifications in the control file are used to interpret the format of the data file and convert it to a SQL INSERT statement using that data.

The Oracle database server accepts the data and executes the INSERT statement to sore the data in the database
Data Conversion

SQL*Loader Rejects

When input format is invalid
When delaminated field exceeds its maximum length
All bad records are saved in bad file
Oracle determines row is valid or not.
If row or record is rejected, SQL*Loader puts it in the bad file
Why row can be rejected?
(unique or not null constraints)
Data Conversion

Discarded or Rejected Records

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Bad file:

- **SQL*Loader rejects records when the input format is invalid.**
- **If the Oracle database finds that the row is invalid, then the record is rejected and SQL*Loader puts it in the bad file.**

Discard file:

- **This can be used only if it has been enabled.**
- **This file contains records that were filtered out because they did not match any record-selection criteria specified in the control file.**

Introduction to Database Administration

TOPIC 193

Log Files & Steps to adopt
Log Files & Steps to adopt

Log File Contents

Header Information
Global Information
Table Information
Data File Information
Table Load Information
Summary Statistics
Additional statistics for Direct path loads and multithreading Information
Log Files & Steps to adopt

Header Information

Date of the run

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Software version number
Log Files & Steps to adopt

Global Information

Name of all input/ output file Echo of command-line arguments
Continuation character specification
Log Files & Steps to adopt

Table Information

Table Name Load Conditions
INSERT, APPEND or REPLACE specifications
Columns, length, data type and deliminator
Log Files & Steps to adopt

Data File Information

SQL*Loader and Oracle data record errors
Log Files & Steps to adopt

Table Load Information

Number of rows loaded, rejected, discarded, Null fields discarded
Log Files & Steps to adopt

Summary Statistics

Amount of space used for bind array Cumulative load statistics for data files, skipped, read and rejected records
Log Files & Steps to adopt

Additional statistics for Direct path loads and multithreading Information

Direct path load of a partitioned table reports per-partition statistics
Conventional-path load cannot report per- partition statistics
Introduction to Database Administration

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TOPIC 194

Sample Example to Load Data-1

Sample Example to Load Data-1

Example's Contents

Data Loading
Data Migration – From File to Database
Example of Data Loading
Sample Example to Load Data-1

Data Loading

Loading data from files

Files can be comma delaminated Files can be in XML format Binary files (Oracle to Oracle)
Sample Example to Load Data-1

Data Migration – Files to Database

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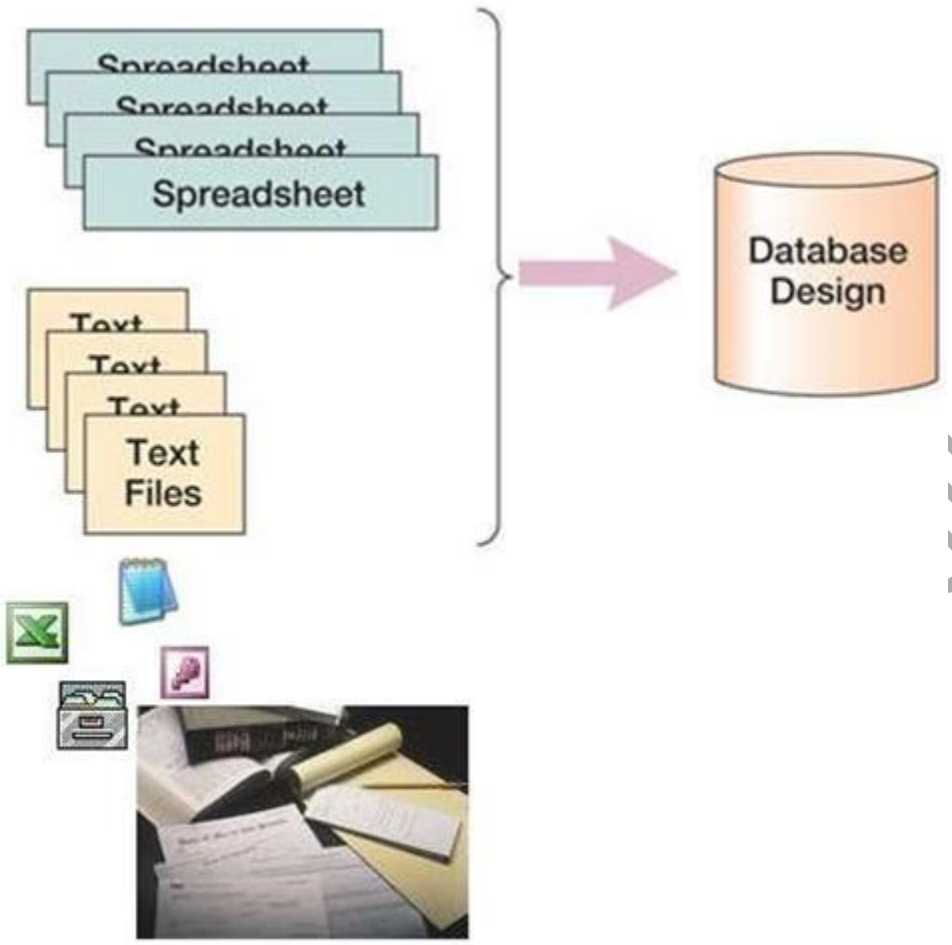

Sample Example to Load Data-1

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```
Login scott
create table TEMP_EMP
(Empno Number(4),
Ename  VARCHAR2(50),
Salary Number(8)
);

c:\test\control.ctl
load data
infile 'c:\test\DBA-EXP-194.csv'
truncate
into table scott.temp_emp
fields terminated by ','
(empno, ename, salary)

cd E:\app\Haider\product\11.2.0\dbhome_1\BIN
c:\test>sqlldr control=c:\test\control.ctl
data=c:\test\DBA-EXP-194.csv log=c:\test\ulcase2.log
```

Example of Data Loading

Sample Example to Load Data-1

Example of Data Loading

```
E:\app\Haider\product\11.2.0\dbhome 1\BIN>sqlldr control=c:\test\control.ctl
                    data=c:\test\DBA-EXP-194.csv log=c:\test\ulcase2.log
Username:scott
Password:
SQL*Loader: Release 11.2.0.1.0 - Production on Wed Nov 4 19:13:30 2020

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Commit point reached - logical record count 6

E:\app\Haider\product\11.2.0\dbhome 1\BIN>
```

Sample Example to Load Data-1

Example of Data Loading

```
SQL> create table TEMP_EMP
  2  (Empno Number(4),
  3  Ename  VARCHAR2(50),
  4  Salary Number(8)
  5  );

Table created.

SQL> select * from temp_emp;

     EMPNO ENAME                                              SALARY
---------- -------------------------------------------------- ----------
      1001 Ejaz                                                 5000
      1002 Ali                                                  3500
      1003 Qadeer                                               3400
      1004 Yaseen                                               4000
      1005 Asim                                                 3400
```

Sample Example to Load Data-1

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Introduction to Database Administration

TOPIC 195

Sample Example to Load Data-2
Sample Example to Load Data-2

Example's Contents

Material's Data Loading
Data Migration - Files to Database
Reasons to Load Data into TEMP_Material
Required Files Data Loading of Material
Data Loading Files with Contents
Sample Example to Load Data-2

Material's Data Loading

Data is comma delaminated regarding material or products

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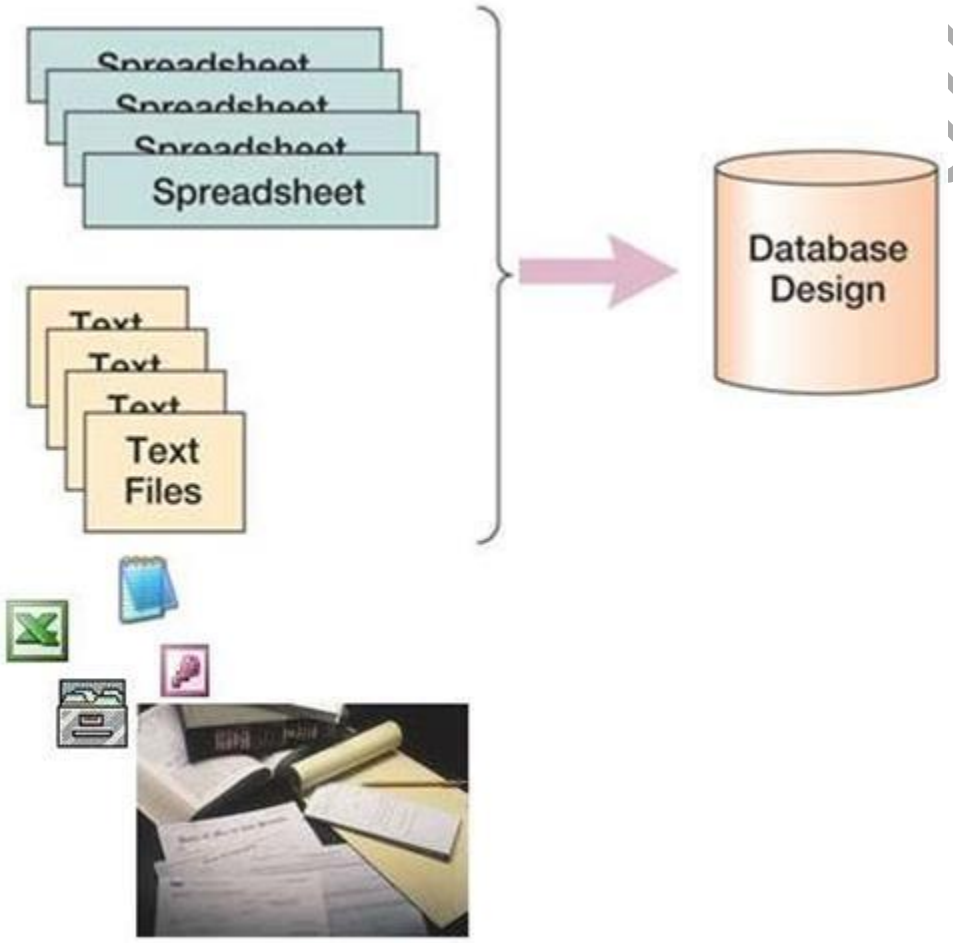
Need to load into table Material via
TMP_Material
Sample Example to Load Data-2

Data Migration – Files to Database



Sample Example to Load Data-2

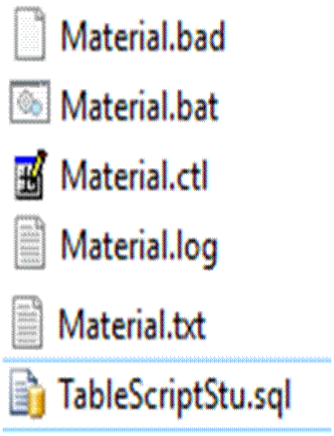
Reasons to Load Data into TEMP_Material

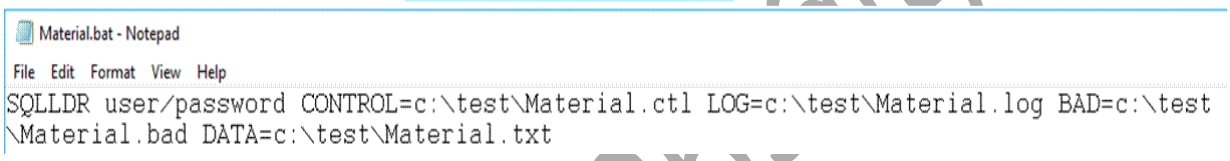
Try to avoid to load data into bad files Format of data
For example $ symbol is given with numeric currency column

Size of column may less in the target table

Sample Example to Load Data-2

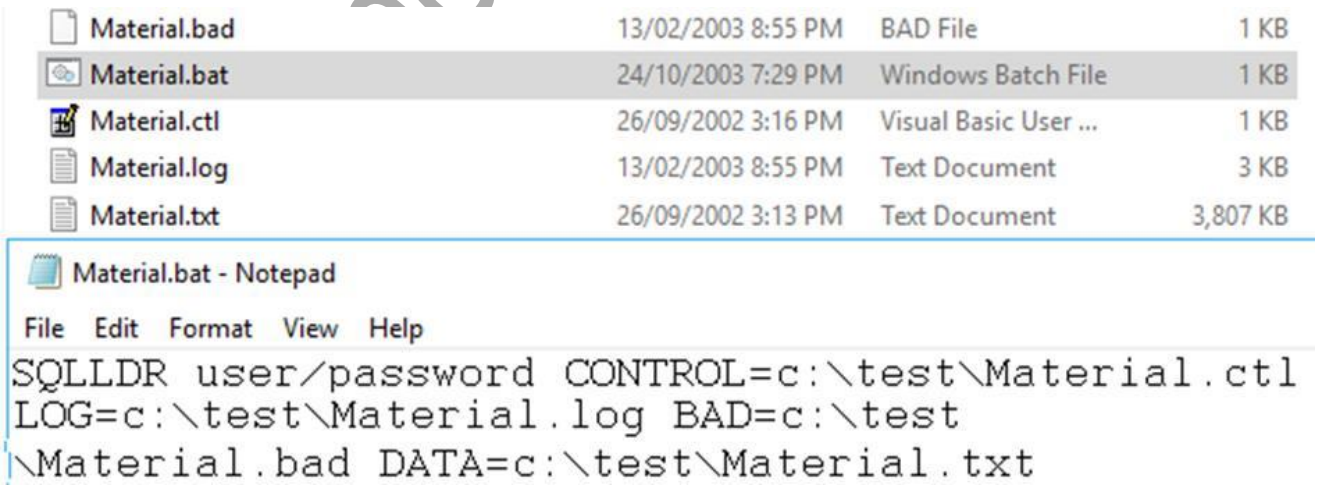
Required Files Data Loading of Material



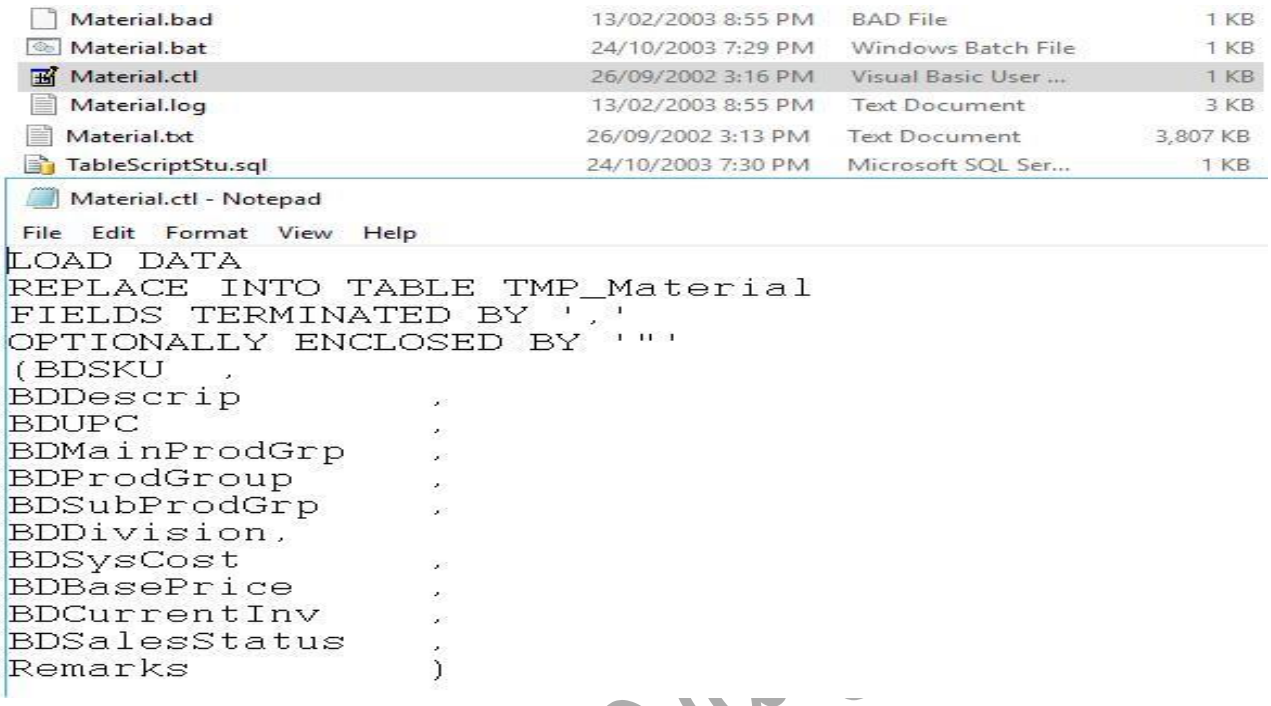


Sample Example to Load Data-2

Data Loading Files with Contents



Sample Example to Load Data-2



Material.bad	13/02/2003 8:55 PM	BAD File	1 KB
Material.bat	24/10/2003 7:29 PM	Windows Batch File	1 KB
Material.ctl	26/09/2002 3:16 PM	Visual Basic User ...	1 KB
Material.log	13/02/2003 8:55 PM	Text Document	3 KB
Material.txt	26/09/2002 3:13 PM	Text Document	3,807 KB
TableScriptStu.sql	24/10/2003 7:30 PM	Microsoft SQL Ser...	1 KB

Material.ctl - Notepad

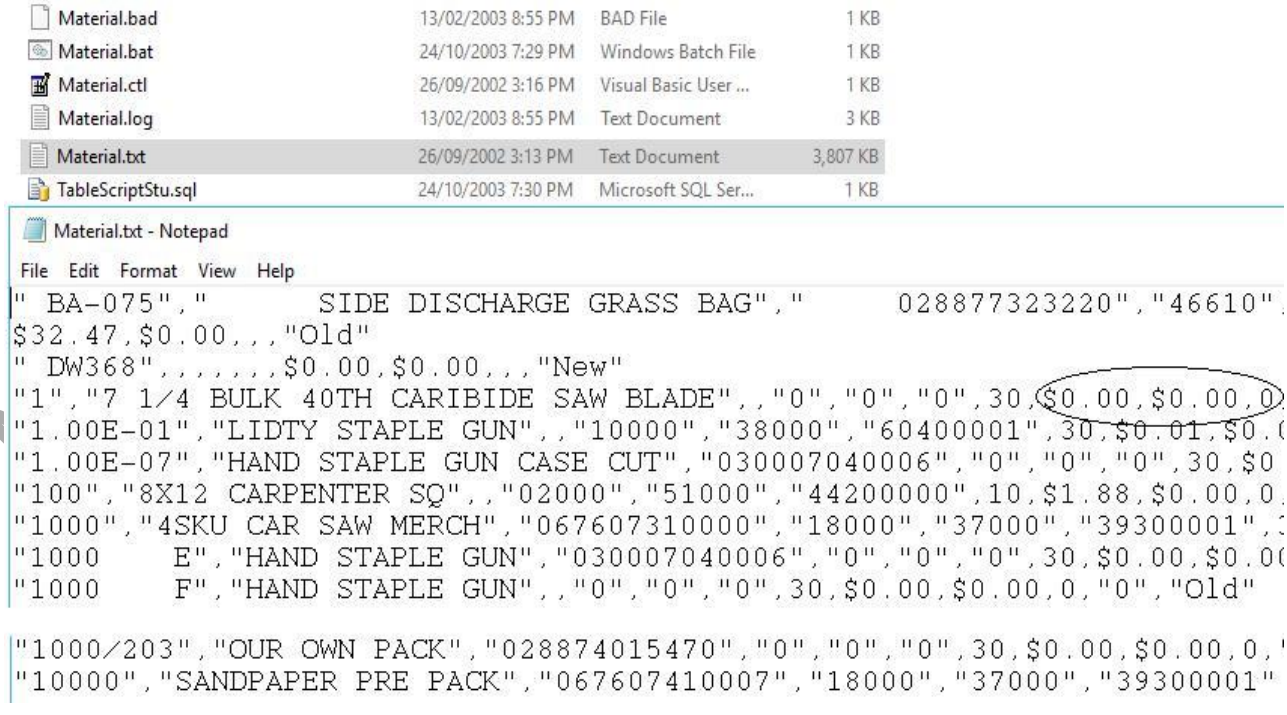
File Edit Format View Help

```
LOAD DATA
REPLACE INTO TABLE TMP_Material
FIELDS TERMINATED BY ','
OPTIONALLY ENCLOSED BY '"'
(BDSKU    ,
BDDescrip          ,
BDUPC              ,
BDMainProdGrp      ,
BDProdGroup        ,
BDSubProdGrp       ,
BDDivision,
BDSysCost          ,
BDBasePrice        ,
BDCurrentInv       ,
BDSalesStatus      ,
Remarks            )
```

Data Loading Files with Contents

Sample Example to Load Data-2

Data Loading Files with Contents



Material.bad	13/02/2003 8:55 PM	BAD File	1 KB
Material.bat	24/10/2003 7:29 PM	Windows Batch File	1 KB
Material.ctl	26/09/2002 3:16 PM	Visual Basic User ...	1 KB
Material.log	13/02/2003 8:55 PM	Text Document	3 KB
Material.txt	26/09/2002 3:13 PM	Text Document	3,807 KB
TableScriptStu.sql	24/10/2003 7:30 PM	Microsoft SQL Ser...	1 KB

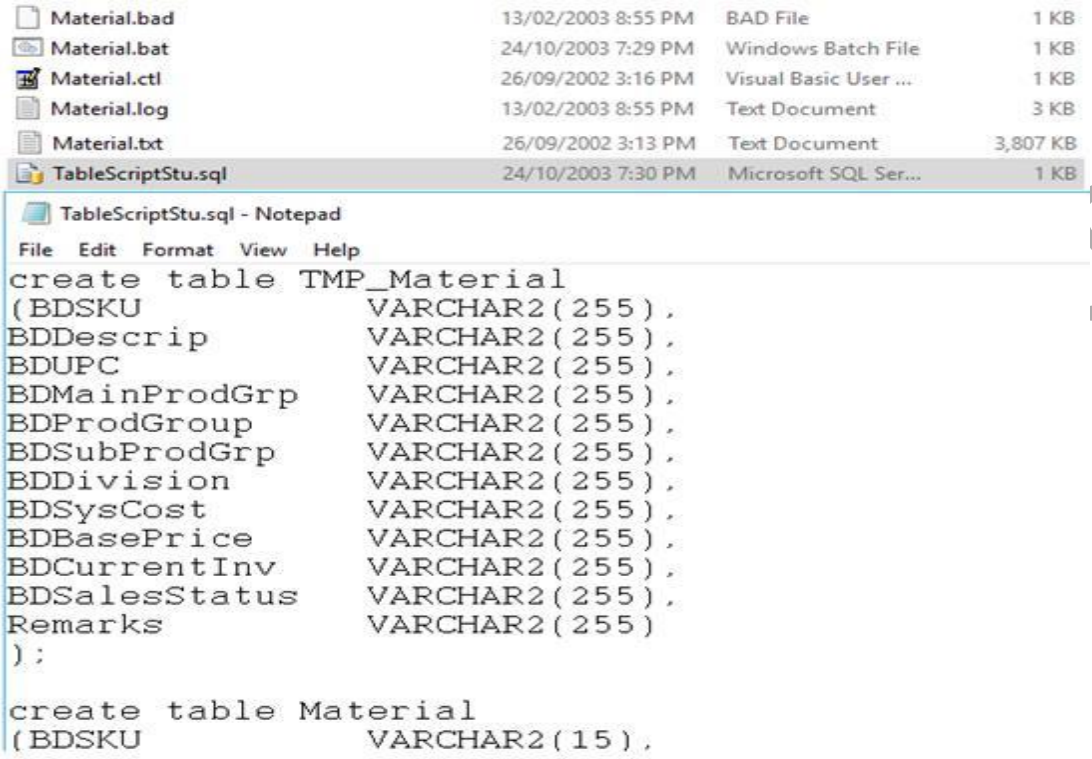
Material.txt - Notepad

File Edit Format View Help

```
" BA-075","      SIDE DISCHARGE GRASS BAG","     028877323220","46610",
$32.47,$0.00,,,"Old"
" DW368",,,,,,,$0.00,$0.00,,,"New"
"1","7 1/4 BULK 40TH CARIBIDE SAW BLADE",,"0","0","0",30,$0.00,$0.00,0,
"1.00E-01","LIDTY STAPLE GUN",,"10000","38000","60400001",30,$0.01,$0.(
"1.00E-07","HAND STAPLE GUN CASE CUT","030007040006","0","0","0",30,$0
"100","8X12 CARPENTER SQ",,"02000","51000","44200000",10,$1.88,$0.00,0,
"1000","4SKU CAR SAW MERCH","067607310000","18000","37000","39300001",3
"1000    E","HAND STAPLE GUN","030007040006","0","0","0",30,$0.00,$0.0(
"1000    F","HAND STAPLE GUN",,"0","0","0",30,$0.00,$0.00,0,"0","Old"

"1000/203","OUR OWN PACK","028874015470","0","0","0",30,$0.00,$0.00,0,'
"10000","SANDPAPER PRE PACK","067607410007","18000","37000","39300001"
```

Sample Example to Load Data-2



Data Loading Files with Contents
Sample Example to Load Data-2

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TOPIC 196

Sample Example to Load Data-3
Sample Example to Load Data-3

Example's Contents

Executing Data Loading for Material (for Slide#195)
Data Migration - Files to Database
Sample Example to Load Data-3

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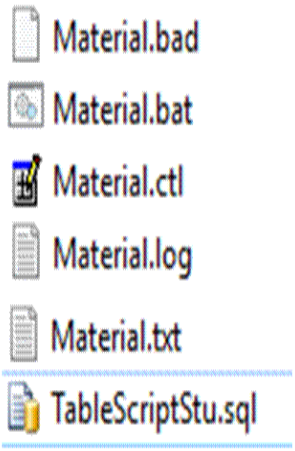
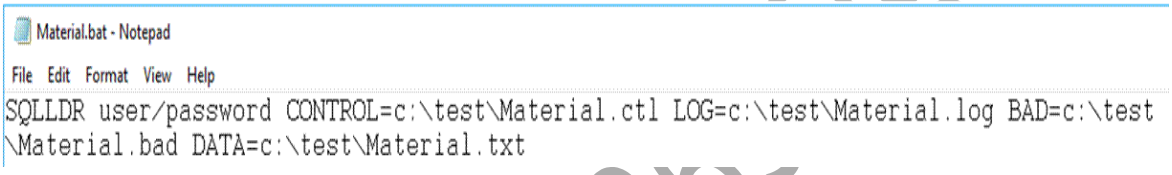
Executing Data Loading for Material

We will execute SQLLDR command to load data of material into scott's schema





Sample Example to Load Data-3

Data Migration – Files to Database

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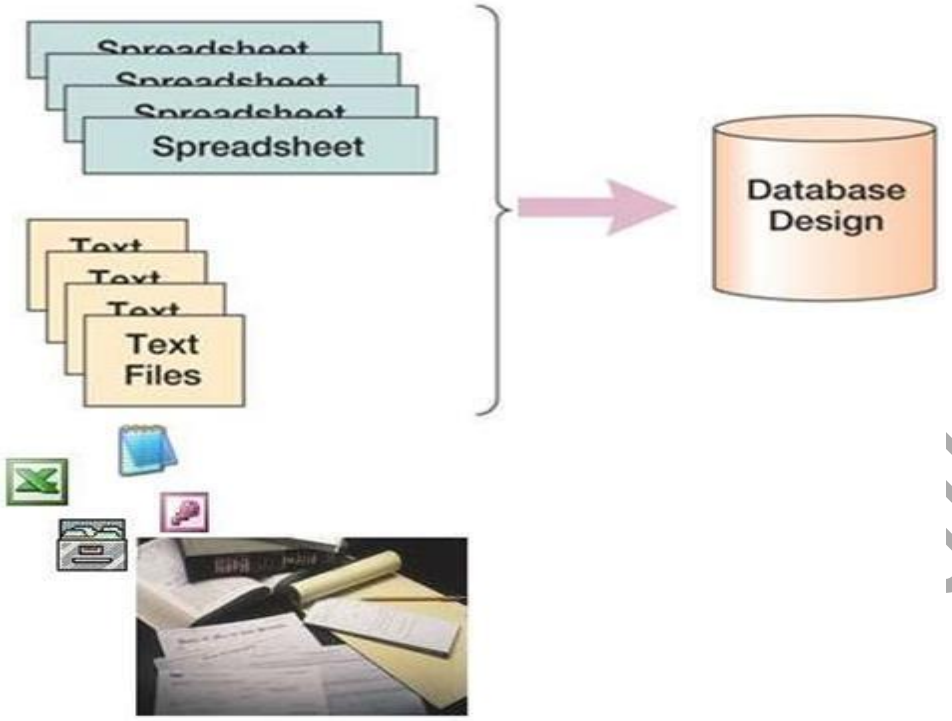

Sample Example to Load Data-3

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Introduction to Database Administration

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Sample Example to Load Data-4
Sample Example to Load Data-4

Data Loading Tasks in Schema

Loading data from TEMP to actual Material Table
Tasks to load data from TEMP to actual Material Table
Sample Example to Load Data-4

Loading data from TEMP to actual Material Table

You have data in TMP_Material and you want to move or copy data into Material Table
Sample Example to Load Data-4

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Tasks to load data from TEMP to actual Material Table

Use INSERT INTO … SELECT command
Understand an error
See where data discrepancies are found
Run SQL UPDATE statements to fix discrepancies
Sample Example to Load Data-4

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Sample Example to Load Data-5

Sample Example to Load Data-5

Data Loading Tasks using MS Access

Tasks to Connect MS Access & Oracle
Choosing MS Access by Connecting with Oracle Schema
Link Tables of MS Access & Oracle Schema
Sample Example to Load Data-5

Tasks to Connect MS Access & Oracle

Create ODBC data source of Oracle with use scott
Open sample MS Access File and connect it with ODBC source user scott
Link or data import is possible in MS Access
Data can be inserted from MS Access into Oracle schema scott
Sample Example to Load Data-5

Choosing MS Access by Connecting with Oracle Schema

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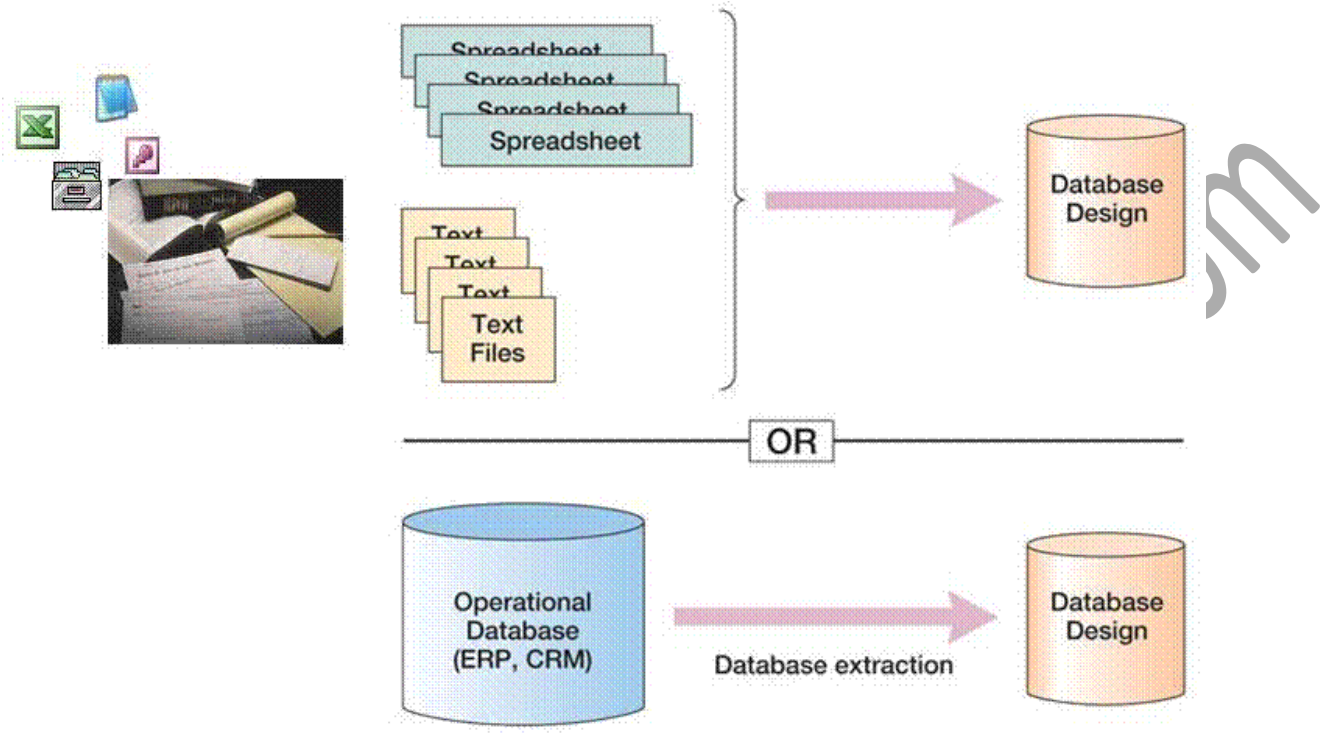
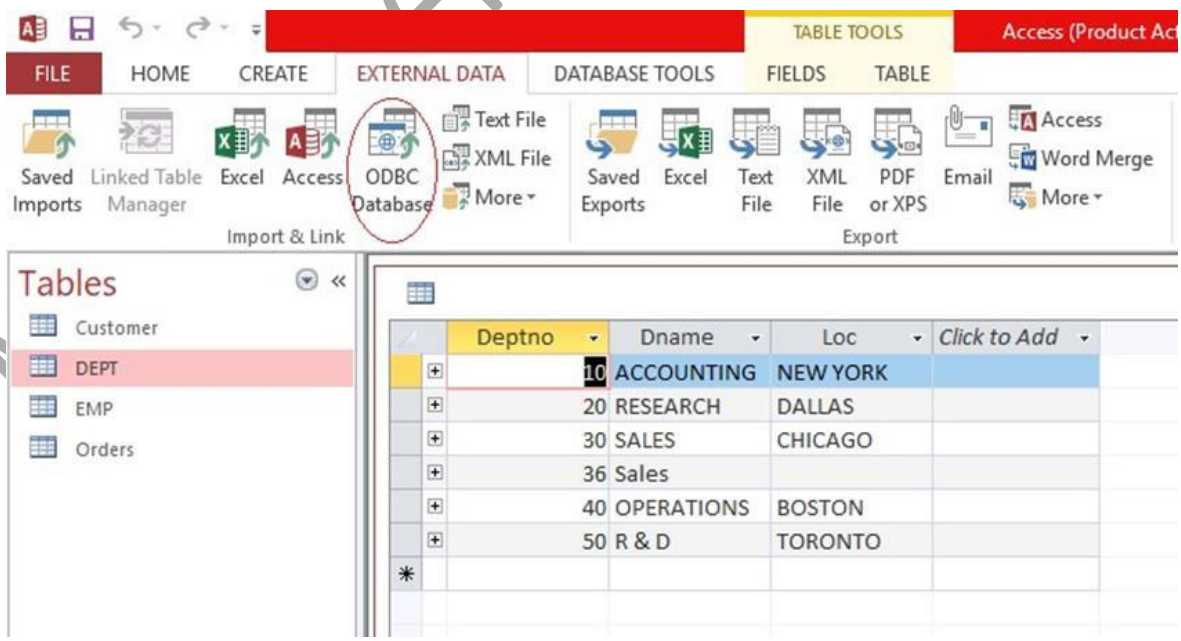


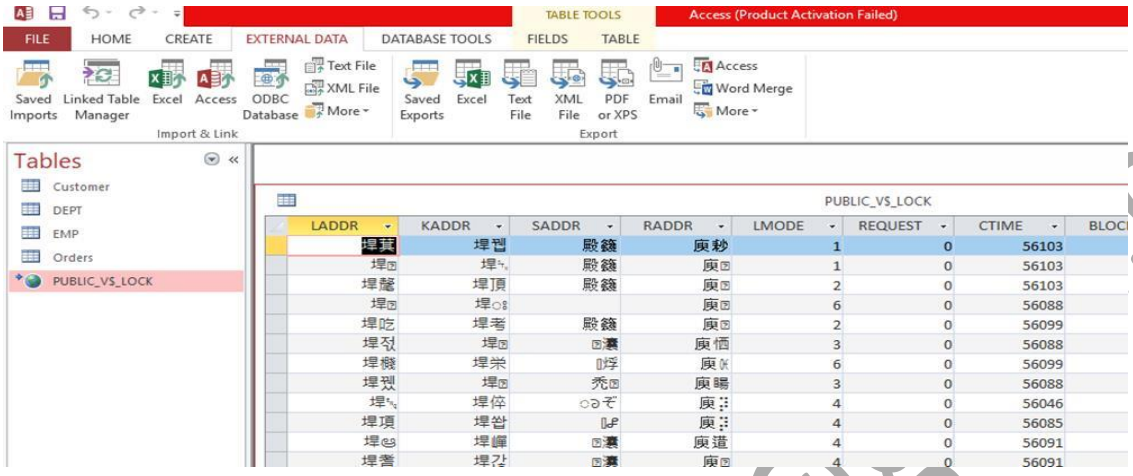
Sample Example to Load Data-5

Link Tables of MS Access & Oracle Schema



Sample Example to Load Data-5

Link Tables of MS Access & Oracle Schema



Sample Example to Load Data-5
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Sample Example to Load Data-6

Sample Example to Load Data-6

Data Loading Tasks for Schema to Schema/ Files using Text Files

Preparing Spool File of Schema's Table using SQL
Data Load from Oracle Schema into Files
Sample Example to Load Data-6

Preparing Spool File of Schema's Table using SQL

In Scott schema
Spool c:\test\emp.txt
Select … from EMP;
Spool off
Spool file contains comma
delaminated rows
File can be used to load data into any

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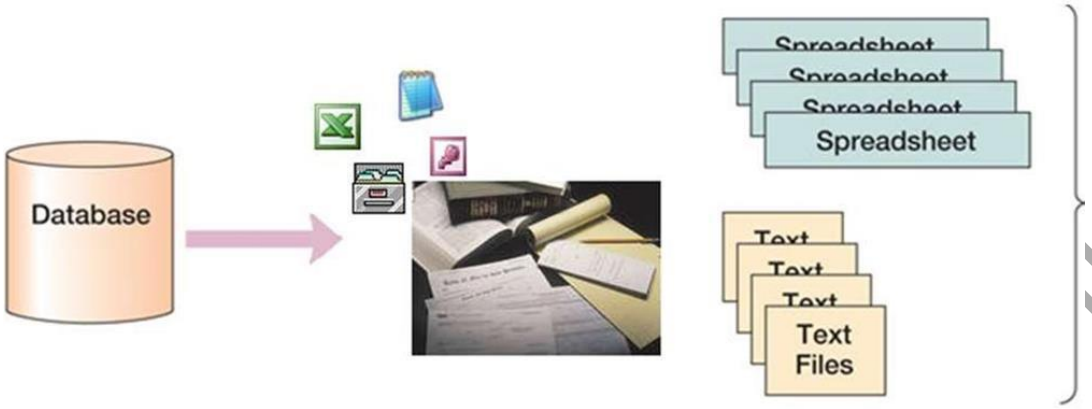
DBMS
Sample Example to Load Data-6

Data Load from Oracle Schema into Files



Sample Example to Load Data-6

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TOPIC 200

Sample Example to Load Data-7

Sample Example to Load Data-7

Data Preparation for Tasks using XML data

Preparing Spool File of Schema's Table using XML SQL
Sample SQL using XML Elements
Data Load from Oracle Schema into Files
Output Results of Sample XML SQLs
Sample Example to Load Data-7

Preparing Spool File of Schema's Table using XML SQL

In Scott schema
Spool c:\test\emp.txt

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XML: Select … from EMP;
Spool off
Spool file contains XML-taged rows
File can be used to load data into any DBMS
Sample Example to Load Data-7

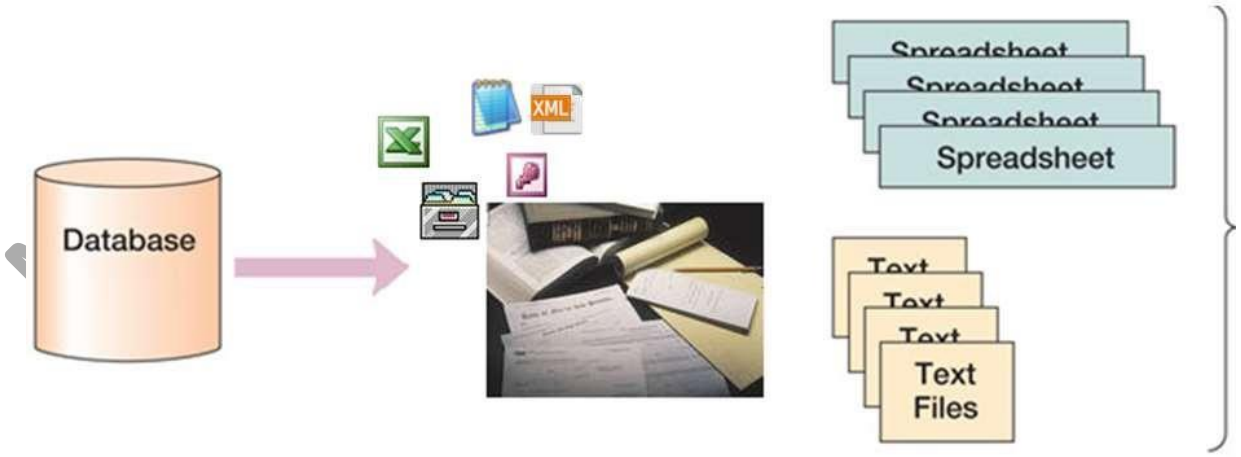
Sample SQL using XML Elements

select xmlelement(name "emp", xmlelement(name "eno",empno), xmlelement(name "names",ename))
XML_output from emp
/
Sample Example to Load Data-7

Sample SQL using XML Elements

create table XML1 as select xmlelement("EMP", xmlelement("empno",e.empno), xmlelement("ename",e.ename), xmlelement("job", e.job), xmlelement("mgr", e.mgr), xmlelement("mgr1", e.mgr)) xml_desc
from emp e
where rownum<=1;
Sample Example to Load Data-7

Data Load from Oracle Schema into Files



Sample Example to Load Data-7

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Output Results of Sample XML SQLs

```
SQL> select xmlelement(name "emp",
  2         xmlelement(name "eno",empno),
  3         xmlelement(name "names",ename)) XML_output
  4  from emp
  5  /

XML_OUTPUT
--------------------------------------------------------------------
<emp><eno>1234</eno><names></names></emp>
<emp><eno>8822</eno><names>ABC</names></emp>
<emp><eno>3513</eno><names>XYZ</names></emp>
<emp><eno>7369</eno><names>SMITH</names></emp>
<emp><eno>7499</eno><names>ALLEN</names></emp>
<emp><eno>7521</eno><names>WARD</names></emp>
<emp><eno>7566</eno><names>JONES</names></emp>
<emp><eno>7654</eno><names>MARTIN</names></emp>
<emp><eno>7698</eno><names>BLAKE</names></emp>
<emp><eno>7782</eno><names>CLARK</names></emp>
<emp><eno>7788</eno><names>SCOTT</names></emp>
```

```
SQL> create table XML1 as
  2  select xmlelement("EMP",
  3         xmlelement("empno",e.empno),
  4         xmlelement("ename",e.ename),
  5         xmlelement("job", e.job),
  6         xmlelement("mgr", e.mgr),
  7         xmlelement("mgr1", e.mgr)) xml_desc
  8  from emp e
  9  where rownum<=1;

Table created.

SQL> select * from XML1;

XML_DESC
--------------------------------------------------------------------------------
<EMP><empno>1234</empno><ename></ename><job></job><mgr></mgr><mgr1></mgr1></EMP>
```

Sample Example to Load Data-7

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TOPIC 201

Backup & Recovery Strategies

Backup & Recovery Strategies

Backup & Recovery Strategies

Backup & Recovery Concepts
Physical & Logical Backup
Backup & Recovery Strategies

Back & Recovery Concepts

Backup and recovery is the set of concepts, procedures, and strategies involved in protecting the database against data loss caused by media failure or users errors.
In general, the purpose of a backup and recovery strategy is to protect the database against data loss and reconstruct lost data.
Backup & Recovery Strategies

Back & Recovery Concepts

A backup is a copy of data. A backup can include crucial parts of the database such as data files, the server parameter file, and control file. A sample backup and recovery scenario is a failed disk drive that causes the loss of a data file.
If a backup of the lost file exists, then you can restore and recover it. Media recovery refers to the operations involved in restoring data to its state before the loss occurred.
Backup & Recovery Strategies

Physical & Logical Backup

Backups can be divided into physical
backups and logical backups.
Physical backups are backups of the physical files used in storing and recovering your database, such as datafiles, control files, and archived redo logs. Ultimately, every physical backup is a

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copy of files storing database information to some other location, whether on disk or some offline storage such as tape.
Backup & Recovery Strategies

Physical & Logical Backup

Logical backups contain logical data (for example, tables or stored procedures) exported from a database with an Oracle export utility and stored in a binary file, for later re-importing into a database using the corresponding Oracle import utility.
Backup & Recovery Strategies

Physical & Logical Backup

Physical backups are the foundation of any sound backup and recovery strategy.
Logical backups are a useful supplement to physical backups in many circumstances but are not sufficient protection against data loss without physical backups.
Backup & Recovery Strategies

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TOPIC 202

Understanding Physical & Logical Data Loss
Understanding Physical & Logical Data Loss

Understanding Physical & Logical Data Loss

Errors & Failures
Understanding User Error
Understanding Media Failure
Understanding Physical & Logical Data Loss

Errors & Failures

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While there are several types of problem that can halt the normal operation of an Oracle database or affect database I/O operations, only two typically require DBA intervention and media recovery: media failure, and user errors.
Understanding Physical & Logical Data Loss

Errors & Failures

Other failures may require DBA intervention to restart the database (after an instance failure) or allocate more disk space (after statement failure due to, for instance, a full datafile) but these situations will not generally cause data loss or require recovery from backup.
Understanding Physical & Logical Data Loss

Understanding User Error

User errors occur when, either due to an error in application logic or a manual mis-step, data in your database is changed or deleted incorrectly.
Data loss due to user error includes such missteps as dropping important tables or deleting or changing the contents of a table.
Understanding Physical & Logical Data Loss

Understanding User Error

While user training and careful management of privileges can prevent most user errors, your backup strategy determines how gracefully you recover the lost data when user error does cause data loss.
Understanding Physical & Logical Data Loss

Understanding Media Failure

A media failure is the failure of a read or write of a disk file required to run the database, due to a physical problem with the disk such as a head crash. Any database file can be vulnerable to a media failure.
The appropriate recovery technique following a media failure depends on the files affected and the types of backup available.
Understanding Physical & Logical Data Loss

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TOPIC 203

Full Logical Backup

Full Logical Backup

Full Logical Backup

Logical Backup
Logical Backup Entire Applications
Outcome of Logical Backup
Periodic Logical Backup
Full Logical Backup

Logical Backup

A logical backup copies data, but not physical files, from one location to another. A logical backup is used to move or archive a database, tables, or schemas and to verify database structures.
Full Logical Backup

Logical Backup Entire Applications

A full logical backup enables you to copy these items across environments that use different components, such as operating systems:
Entire applications
Data repositories such as the Oracle Hyperion Shared Services Registry and Oracle Essbase cubes
Individual artifacts such as scripts, data
forms, and rule files
Full Logical Backup

Outcome of Logical Backup

A logical export backup generates necessary Structured Query Language (SQL) statements to obtain all table data that is written to a binary file.
A logical export backup does not contain database instance-related information, such as the physical disk location, so you can restore the same data on another database machine.

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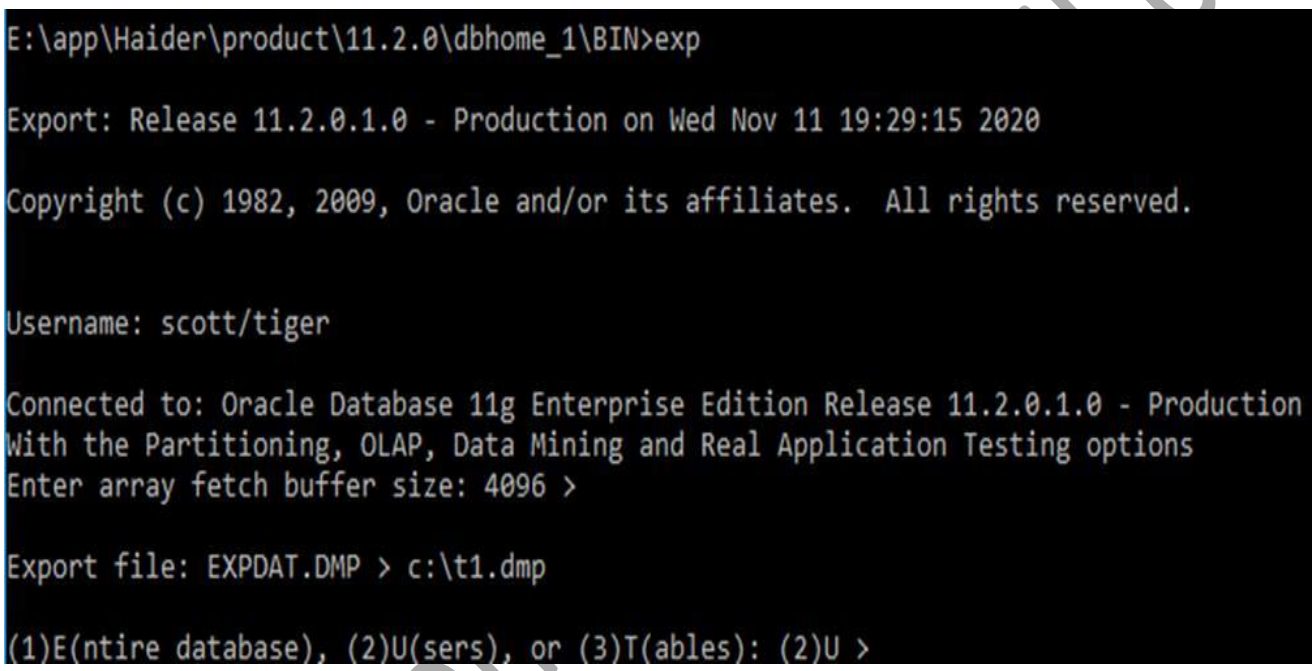
Full Logical Backup

Periodic Logical Backup

Periodic logical export backups (at least weekly) are recommended in case physical backups fail or the database machine becomes unavailable.
Full Logical Backup

Logical Backup using EXPORT



Full Logical Backup

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TOPIC 204

Logical Backup of a Schema/ User
Logical Backup of a Schema/ User

Logical Backup of a Schema/ User

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Logical Backup of Schema
Export utility for Logical Backup
Benefits of Export Utility for Logical Backup
Logical Backup of a Schema/ User

Logical Backup of Schema

A logical backup copies the data in the database and does not records the location of data.
It can copy the data of schema,
database and tables
Logical Backup of a Schema/ User

Export utility for Logical Backup

The export utility (export and export pump) offered by the Oracle can be used to take logical backup.
The export utility copies the data and database definitions, and saves in binary OS file in Oracle internal format
Logical Backup of a Schema/ User

Benefits of Export Utility for Logical Backup

Data block corruption can be detected while exporting data and export procedure will fail.
If use drops some table and it will recover from import command.
What data and definition/ structure can be exported?
Portable backup, can be imported in same or higher version of Oracle database.
Logical Backup of a Schema/ User

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TOPIC 205

Logical Backup of Schema Contents Tables

Logical Backup of Schema Contents Tables

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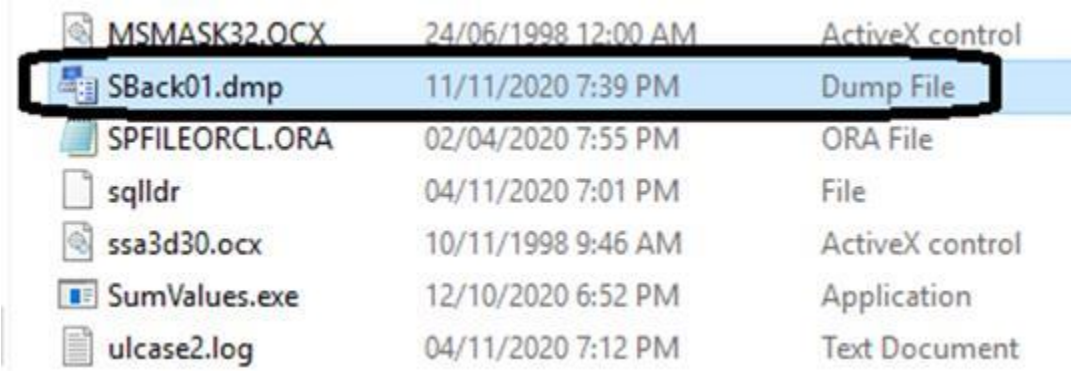
Logical Backup of Schema Contents Tables

Logical Backup of Schema Contents Tables
Logical Backup Full/ Tables
Export using Full Option
Export with Individual Table
Logical Backup of Schema Contents Tables

Logical Backup Full/ Tables

Run export command with Full=y
option.
User will be scott/tiger
Export data of some table



Logical Backup of Schema Contents Tables

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```
E:\app\Haider\product\11.2.0\dbhome_1\BIN>exp scott/tiger full=y file=c:\test\FBack01.dmp constraints=Y

Export: Release 11.2.0.1.0 - Production on Wed Nov 11 19:49:30 2020

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Connected to: Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production
With the Partitioning, OLAP, Data Mining and Real Application Testing options
Export done in WE8MSWIN1252 character set and AL16UTF16 NCHAR character set

About to export the entire database ...
. exporting tablespace definitions
. exporting profiles
. exporting user definitions
. exporting roles
. exporting resource costs
. exporting rollback segment definitions
. exporting database links
. exporting sequence numbers
. exporting directory aliases
. exporting context namespaces
. exporting foreign function library names
. exporting PUBLIC type synonyms
. exporting private type synonyms
. exporting object type definitions
. exporting system procedural objects and actions
```

Export using Full Option

Logical Backup of Schema Contents Tables

Export with Individual Table

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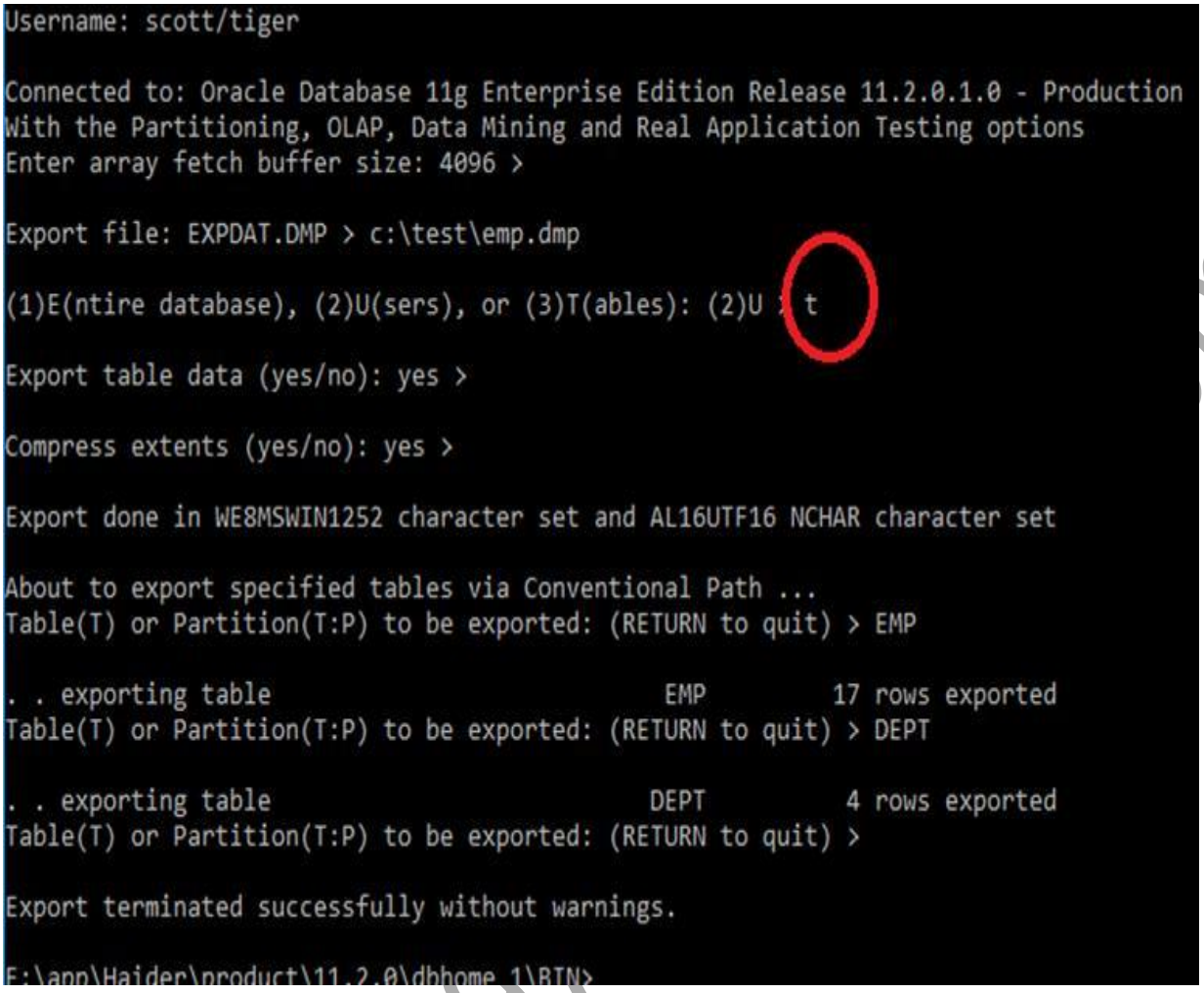

Logical Backup of Schema Contents Tables

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Introduction to Database Administration

TOPIC 206

Cold Physical Backup
Cold Physical Backup

Cold Physical Backup

Cold Physical Backup

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Cold Physical Backup Files
Performing Cold Backup
Cold Physical Backup

Cold Physical Backup

Offline or cold backups are performed when the database is completely shutdown.
The disadvantage of an offline backup is that it cannot be done if the database needs to be run 24/7.
Additionally, you can only recover the database up to the point when the last backup was made unless the database is running in ARCHIVELOG mode.
Cold Physical Backup

Cold Physical Backup Files

An offline backup consists of physically
copying the following files:

Data files

Control files
Init.ora and config.ora files Warning: If you make a cold backup in
ARCHIVELOG mode do not backup redo log files.
Cold Physical Backup

Performing Cold Backup

Before performing a cold backup, you need to know the location of the files that need to be backed up.
Because the database structure changes day to day as more files get added or moved between directories, it is always better to query the database to get the physical structure of database before making a cold backup.
Cold Physical Backup

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TOPIC 207

Cold Backup using RMAN
Cold Backup using RMAN

Cold Backup using RMAN

Cold Backup using RMAN
Start Backup using RMAN
Cold Backup using RMAN

Cold Backup using RMAN

Keep Database in Archive Mode
Go to location where RMAN can run E:\app\Haider\product\11.2.0\dbhome_1 \BIN>rman target / RMAN>show all;
Cold Backup using RMAN

Start Backup using RMAN

RMAN> Backup as Backupset database;

Cold Backup using RMAN

NOTE
[CHECK THE VIDEO OF THIS TOPIC BECAUSE IT CONSIST ON PROPER PRACTICAL WORK]

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Introduction to Database Administration

TOPIC 208

Hot Backup Concepts

Hot Backup Concepts

Hot Backup Concepts

Hot Backup Concepts
Startup Archive Mode
Hot Backup Concepts

Hot Backup Concepts

A hot backup is taken when the
database needs to run all the time.
It is an online backup.
All files of the database are copied and there may be changes to the database during the copy.
Hot Backup Concepts

Hot Backup Concepts

An online backup or hot backup is also referred to as ARCHIVE LOG backup. An online backup can only be done when the database is running in ARCHIVELOG mode and the database is open.
When the database is running in ARCHIVELOG mode, the archiver (ARCH) background process will make a copy of the online redo log file to archive backup location.
Hot Backup Concepts

Hot Backup Concepts

An online backup consists of backing up the following files. But, because the database is open while performing a backup, you have to follow the procedure to backup the following files:
Data files of each tablespace
Archived redo log files
Control file

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Init.ora and config.ora files
Hot Backup Concepts

Startup Archive Mode

Shutdown database and startup
NoArchive to Archive database process

```
Database dismounted.
ORACLE instance shut down.
SQL> startup open;
ORACLE instance started.

Total System Global Area 3390558208 bytes
Fixed Size                  2180464 bytes
Variable Size            1862273680 bytes
Database Buffers         1509949440 bytes
Redo Buffers               16154624 bytes
Database mounted.
Database opened.
SQL> archive log list;
Database log mode              Archive Mode
Automatic archival             Enabled
Archive destination            USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence     244
Next log sequence to archive   246
Current log sequence           246
```

Hot Backup Concepts

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TOPIC 209

Hot Backup Demo

Hot Backup Demo

Hot Backup Demo

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Hot Backup Demo
Advise for Hot Backup
Hot Backup Demo

Hot Backup Demo

Following steps are required for Hot
Backup:
Put the tablespace in the Backup mode and copy the data files.
Back up the control and Init.ora files.
Stop archiving
Back up the archive files
Restart the archive process.
Hot Backup Demo

Advise for Hot Backup

An online backup of a database will keep the database open and functional for 24/7 operations. It is advised to schedule online backups when there is the least user activity on the database, because backing up the database is very I/O intensive and users can see slow response during the backup period. Additionally, if the user activity is very high, the archive destination might fill up very fast.
Hot Backup Demo

NOTE
[CHECK THE VIDEO OF THIS TOPIC BECAUSE IT CONSIST ON PROPER PRACTICAL WORK]

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TOPIC 210

Restore from Backup using RMAN

Restore from Backup using RMAN

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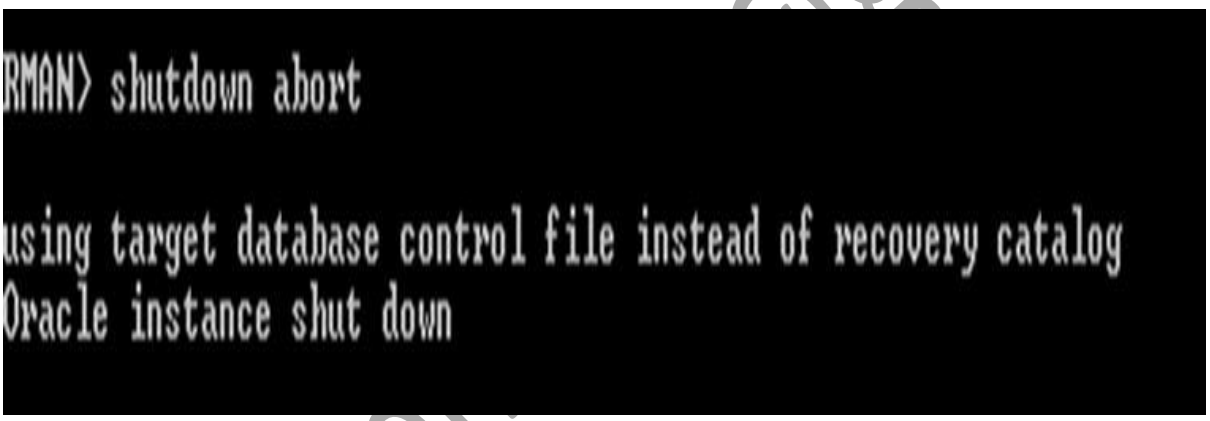
Restore from Backup using RMAN
Shutdown database
Remove files from E:\app\Haider\oradata\orcl
Startup nomount
Login with RMAN target /
Restore controlfile
Alter database mount;
Restore database
Recover database;
Resetlogs & Recovered Files
Restore from Backup using RMAN

Shutdown Database Now for recovery first off all shutdown your database using “shutdown abort”



Restore from Backup using RMAN

Remove Files from E:\app\Haider\oradata\orcl

Now remove your database or do any change in database, here we physically removed all database files from database

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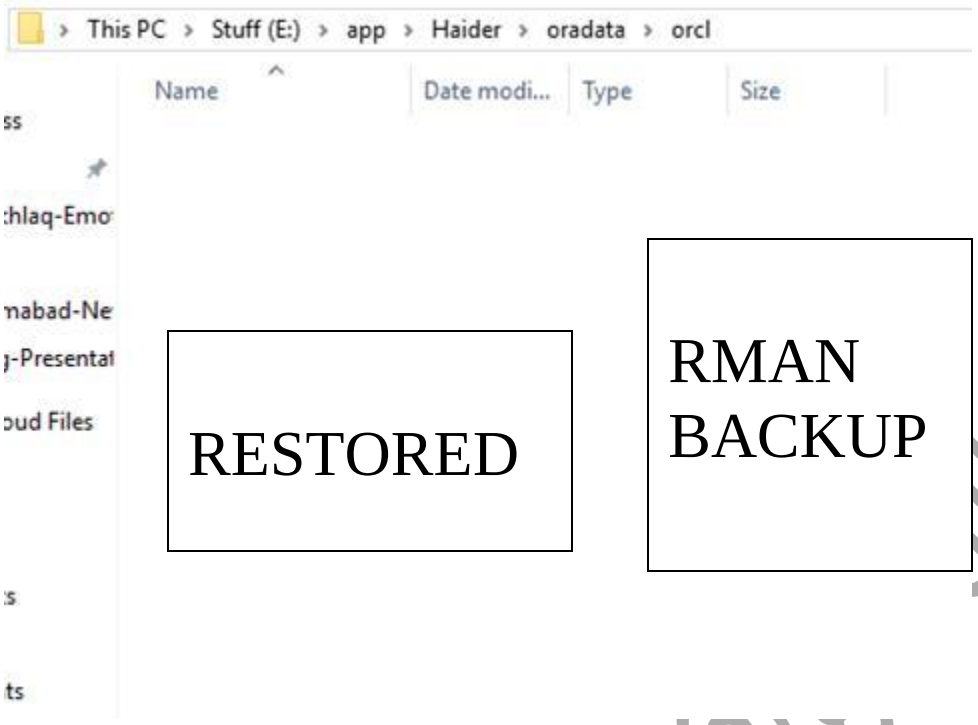


Restore from Backup using RMAN

Startup nomount

```
RMAN> startup nomount;

Oracle instance started

Total System Global Area     293601280 bytes

Fixed Size                     1290208 bytes
Variable Size                146800672 bytes
Database Buffers             138412032 bytes
Redo Buffers                   7098368 bytes

RMAN>
```

Restore from Backup using RMAN

Login with RMAN target /

```
C:\oracle\product\10.2.0\db_1\bin>rman target /

Recovery Manager: Release 10.2.0.3.0 - Production on Thu Nov 27 06:58:55 2014

Copyright (c) 1982, 2005, Oracle.  All rights reserved.

connected to target database (not started)

RMAN>
```

Restore from Backup using RMAN

Restore Control Files

```
RMAN> restore controlfile from 'C:\rmanbackup\rman\FULL_0IPOK2TH_18_1';

Starting restore at 27-NOV-14
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=156 devtype=DISK

channel ORA_DISK_1: restoring control file
channel ORA_DISK_1: restore complete, elapsed time: 00:00:10
output filename=C:\ORACLE\PRODUCT\10.2.0\ORADATA\ORCL\CONTROL01.CTL
output filename=C:\ORACLE\PRODUCT\10.2.0\ORADATA\ORCL\CONTROL02.CTL
output filename=C:\ORACLE\PRODUCT\10.2.0\ORADATA\ORCL\CONTROL03.CTL
Finished restore at 27-NOV-14
```

Restore from Backup using RMAN

Alter Database Mount

```
RMAN> alter database mount;

database mounted
released channel: ORA_DISK_1
```

Restore from Backup using RMAN

Restore Database

```
RMAN> restore database;

Starting restore at 27-NOV-14
Starting implicit crosscheck backup at 27-NOV-14
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=156 devtype=DISK
```

Restore from Backup using RMAN

Recover Database

```
RMAN> recover database;

Starting recover at 27-NOV-14
using channel ORA_DISK_1

starting media recovery
restoring datafile 00010 to C:\ORACLE\PRODUCT\10.2.0\ORADATA\MCARE_INDX01.DBF
restoring datafile 00011 to C:\ORACLE\PRODUCT\10.2.0\ORADATA\TESTING01.DBF
restoring datafile 00012 to C:\ORACLE\PRODUCT\10.2.0\ORADATA\MED_PHARMA01.DBF
restoring datafile 00013 to C:\ORACLE\PRODUCT\10.2.0\ORADATA\MED_INDX01.DBF
channel ORA_DISK_1: reading from backup piece C:\RMANBACKUP\RMAN\FULL_0HPOK2RP_1
7_1
channel ORA_DISK_1: restored backup piece 1
piece handle=C:\RMANBACKUP\RMAN\FULL_0HPOK2RP_17_1 tag=TAG20141126T221521
channel ORA_DISK_1: restore complete, elapsed time: 00:04:25
Finished restore at 27-NOV-14

RMAN>
```

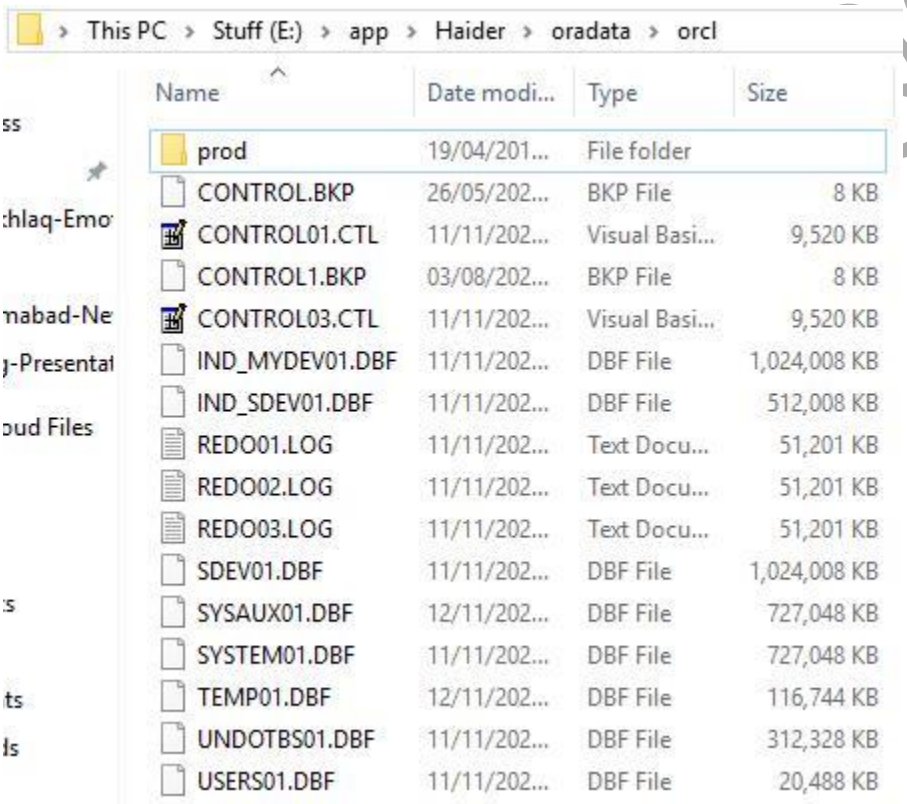
Restore from Backup using RMAN

Resetlogs & Recovered Files

```
RMAN> alter database open resetlogs;

database opened

RMAN> _
```



Restore from Backup using RMAN

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TOPIC 211

Partial Restore Logical Backup

Partial Restore Logical Backup

Partial Restore Logical Backup

Partial Restore Logical Backup
Steps Partial Restore Logical Backup
Partial Restore Tablespace
Restore Archive Logs
Partial Restore Logical Backup

Partial Restore Logical Backup

A partial database backup includes a subset of the database: individual tablespaces or data files. A tablespace backup is a backup of all the data files in a tablespace or in multiple tablespaces.
Partial Restore Logical Backup

Partial Restore Logical Backup

Tablespace backups, whether consistent or inconsistent, are valid only if the database is operating in ARCHIVELOG mode because redo is required to make the restored tablespace consistent with the rest of the database.
Partial Restore Logical Backup

Steps of Partial Restore Logical Backup

Before beginning a backup of a tablespace, identify all of the datafiles in the tablespace with the DBA_DATA_FILES data dictionary view:

```
SELECT TABLESPACE_NAME, FILE_NAME FROM SYS.DBA_DATA_FILES
WHERE TABLESPACE_NAME = 'USERS';
```

Partial Restore Logical Backup

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Steps Partial Restore Logical Backup

Mark the beginning of the online tablespace backup:
Back up the online datafiles of the online tablespace with operating system commands
After backing up the datafiles of the online tablespace, run the SQL statement ALTER TABLESPACE with the END BACKUP option
Partial Restore Logical Backup

Steps Partial Restore Logical Backup

Archive the unarchived redo logs so that the redo required to recover the tablespace backup is archived
Partial Restore Logical Backup

Partial Restore Tablespace

RMAN> restore tablespace users; RMAN> recover tablespace users;
Partial Restore Logical Backup

Restore Archive Logs

mkdir d:\archive rman target / RMAN> run {
2> set archivelog destination to 'd:\archive';
3> restore archivelog all; 4> }
Partial Restore Logical Backup

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Introduction to Database Administration

TOPIC 212

Complete & Incomplete Recovery

Complete & Incomplete Recovery

Complete & Incomplete Recovery

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Complete Recovery
Incomplete Recovery
Database point-in-time Recovery
Requirements for DPITR
Parents, Ancestor & Sibling Incarnations
Database Incarnation History with Multiple Resetlogs
DPITR Incarnations
DPITR Commands
Complete & Incomplete Recovery

Complete Recovery

Complete recovery applies all redo changes contained in the archived and online logs to a backup. Typically, you perform complete media recovery after a media failure damages data files or the control file. You can perform complete recovery on a database, tablespace, or data file.
Complete & Incomplete Recovery

Incomplete Recovery

Incomplete recovery, also called database point-in-time recovery, results in a noncurrent version of the database. In this case, you do not apply all of the redo generated after the restored backup. Typically, you perform point-in-time database recovery to undo a user error when Flashback Database is not possible.
Complete & Incomplete Recovery

Incomplete Recovery

To perform incomplete recovery, you must restore all data files from backups created before the time to which you want to recover and then open the database with the RESETLOGS option when recovery completes. Resetting the logs creates a new stream of log sequence numbers starting with log sequence 1.
Complete & Incomplete Recovery

Database point-in-time Recovery

Database point-in-time recovery (DBPITR)

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restores the database from backups prior to the target time for recovery, then uses incremental backups and redo to roll the database forward to the target time.
DBPITR is sometimes called incomplete recovery because it does not use all of the available redo or completely recover all changes to your database.
Complete & Incomplete Recovery

Database point-in-time Recovery

The target SCN can be specified using a date and time, in which case the operation is sometimes called time- based recovery.
Complete & Incomplete Recovery

Requirements for DPITR

The requirements for database point-in- time recovery are as follows:
Your database must be running in ARCHIVELOG mode.

You must have backups of all data files from before the target SCN for DBPITR and archived redo logs for the period between the SCN of the backups and the target SCN.
Complete & Incomplete Recovery

Parents, Ancestor & Sibling Incarnations

The incarnation from which the current incarnation branched following an OPEN RESETLOGS operation is called the parent incarnation of the current incarnation.

The parent incarnation and all of its parent incarnations are the ancestor incarnations of the current incarnation.

Two incarnations that share a common ancestor are sibling incarnations if neither one is an ancestor of the other.
Complete & Incomplete Recovery

Database Incarnation History with Multiple Resetlogs

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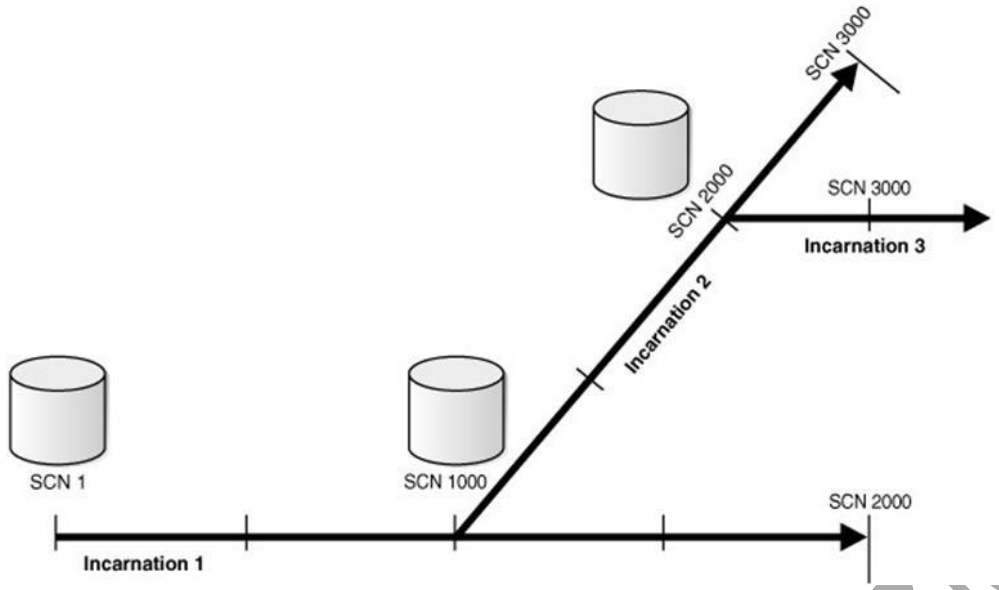

Complete & Incomplete Recovery

DPITR Incarnations

The requirements for database point-in- time recovery are as follows:
Your database must be running in ARCHIVELOG mode.
You must have backups of all data files from before the target SCN for DBPITR and archived redo logs for the period between the SCN of the backups and the target SCN.
Complete & Incomplete Recovery

DPITR Commands

RMAN> RECOVER DATABASE TO SCN 1500;

RMAN> RESET DATABASE INCARNATION
TO 1;

RMAN> RECOVER DATABASE TO SCN
1500;
Complete & Incomplete Recovery

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Introduction to Database Administration

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TOPIC 213

Understanding of Import/ Export

Understanding of Import/ Export

Understanding of Import/ Export

Export Utility
Export Dump File
Export Commands
Import Utility
Import Ordering
Export Commands
Understanding of Import/ Export

Export Utility

The Export utility provides a simple way for you to transfer data objects between Oracle databases, even if they reside on platforms with different hardware and software configurations. When you run Export against an Oracle database, objects (such as tables) are extracted, followed by their related objects (such as indexes, comments, and grants), if any. The extracted data is written to an Export file.
Understanding of Import/ Export

Export Utility

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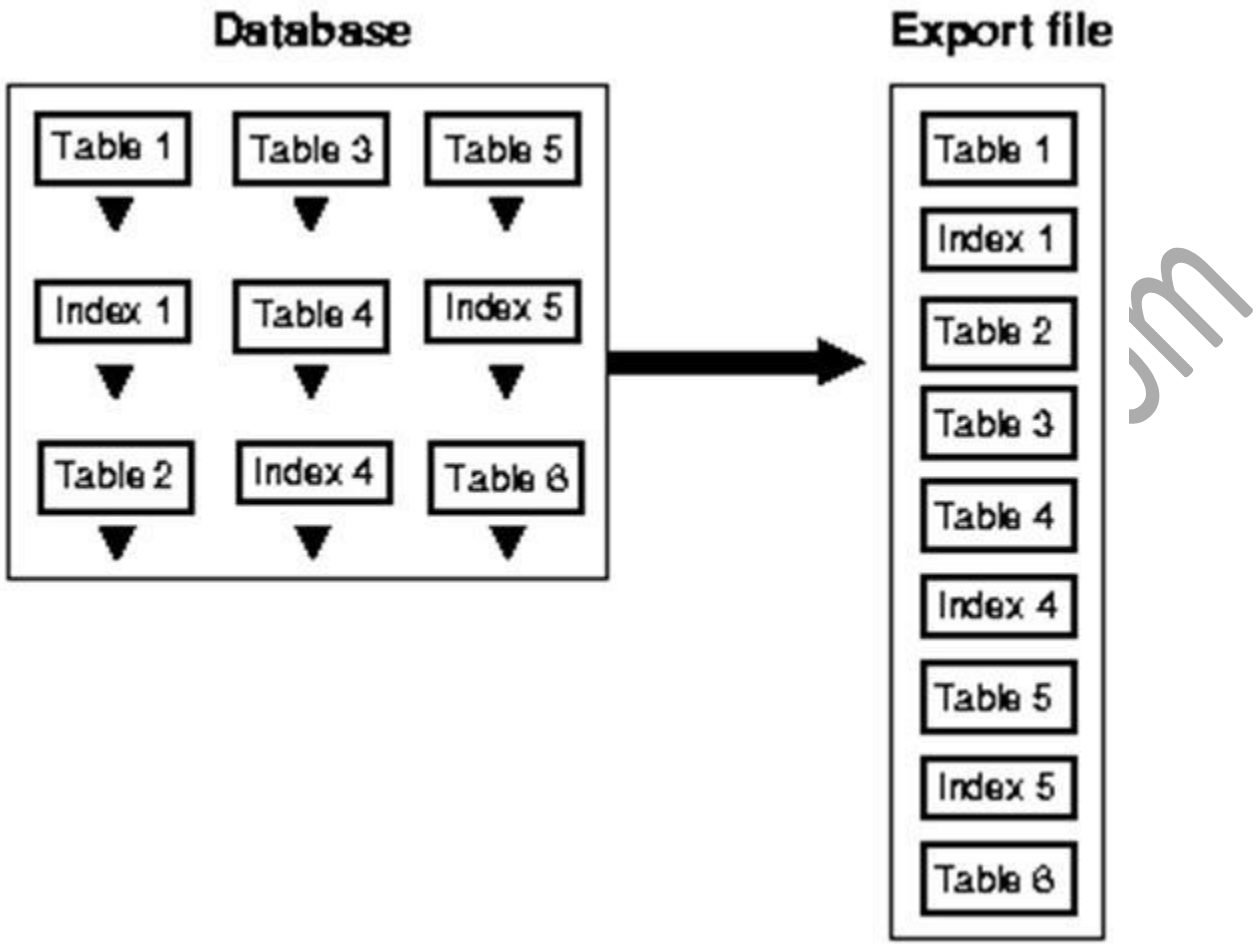

Understanding of Import/ Export

Export Dump File

An Export file is an Oracle binary- format dump file that is typically located on disk or tape. The dump files can be transferred using FTP or physically transported (in the case of tape) to a different site. The files can then be used with the Import utility to transfer data between databases that are on systems not connected through a network. The files can also be used as backups in addition to normal backup procedures.

Understanding of Import/ Export

Export Dump File

Export dump files can only be read by the Oracle Import utility. The version of the Import utility cannot be earlier than the version of the Export utility used to create the dump file.
You can also display the contents of an export file without actually performing an import. To do this, use the Import SHOW parameter.

Understanding of Import/ Export

Export Commands

exp PARFILE=filename
exp username/password PARFILE=filename

FULL=y FILE=dba.imp GRANTS=y INDEXES=y CONSISTENT=y

exp username/password PARFILE=params.dat INDEXES=n exp \'username/password AS SYSDBA\'
Understanding of Import/ Export

Import Utility

The Import utility reads the object definitions and table data from an Export dump file. It inserts the data objects into an Oracle database.
Understanding of Import/ Export

Import Ordering

The export file contains objects in the
following order
Type definitions
Table definitions
Table data
Table indexes
Integrity constraints, views,
procedures, and triggers
Bitmap, functional, and domain indexes
Understanding of Import/ Export

Export Commands

imp username/password PARAMETER=value or
imp username/password PARAMETER=(value1,value2,...,valuen)

imp PARFILE=filename

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imp username/password PARFILE=filename FULL=y FILE=dbay INDEXES=y CONSISTENT=y
Introduction to Database Administration

TOPIC 214

Controlling & Configuring Import/ Export

Controlling & Configuring Import/ Export

Controlling & Configuring Import/ Export

Error Handling
Failed Integrity Constraints
Invalid Data
Errors Importing Objects
Object Already Exists
Sequence
Partition Level Import
Controlling & Configuring Import/ Export

Error Handling

If a row is rejected due to an integrity constraint violation or invalid data, Import displays a warning message but continues processing the rest of the table. Some errors, such as "tablespace full," apply to all subsequent rows in the table. These errors cause Import to stop processing the current table and skip to the next table.
A "tablespace full" error can suspend the import if the RESUMABLE=y parameter is specified.
Controlling & Configuring Import/ Export

Failed Integrity Constraints

A row error is generated if a row violates one of the integrity constraints in force on your system, including:
NOT NULL constraints
Uniqueness constraints
Primary key (not null and unique)
constraints
Referential integrity constraints

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Check constraints
Controlling & Configuring Import/ Export

Invalid Data

Row errors can also occur when the column definition for a table in a database is different from the column definition in the export file.
The error is caused by data that is too long to fit into a new table's columns, by invalid datatypes, or by any other INSERT error.
Controlling & Configuring Import/ Export

Errors Importing Objects

Errors can occur for many reasons when you import database objects.
When these errors occur, import of the current database object is discontinued. Import then attempts to continue with the next database object in the export file.
Controlling & Configuring Import/ Export

Object Already Exists

If a database object to be imported already exists in the database, an object creation error occurs. What happens next depends on the setting of the IGNORE parameter.

If IGNORE=n (the default), the error is reported, and Import continues with the next database object. The current database object is not replaced.
Controlling & Configuring Import/ Export

Object Already Exists

If IGNORE=y, object creation errors are not reported. The database object is not replaced. If the object is a table, rows are imported into it. Note that only object creation errors are ignored; all other errors (such as operating system, database, and SQL errors) are reported and processing may stop.
Controlling & Configuring Import/ Export

Sequence

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If sequence numbers need to be reset to the value in an export file as part of an import, you should drop sequences.
If a sequence is not dropped before the import, it is not set to the value captured in the export file, because Import does not drop and re-create a sequence that already exists. If the sequence already exists, the export file's CREATE SEQUENCE statement fails and the sequence is not imported.
Controlling & Configuring Import/ Export

Partition Level Import

You can import tables, partitions, and sub-partitions in the following ways:
Table-level Import: imports all data from the specified tables in an Export file.
Partition-level Import: imports only data from the specified source partitions or sub-partitions.
You must set the parameter IGNORE=y when loading data into an existing table.
Introduction to Database Administration

TOPIC 215

Walkthrough Import when Table Data Exist
Walkthrough Import when Table Data Exist

Walkthrough Import when Table Data Exist

Import When Table Already Exists
Walkthrough Import when Table Data Exist

Import when Table Already Exist

When tables are manually created before data is imported, the CREATE TABLE statement in the export dump file will fail because the table already exists. To avoid this failure and continue loading data into the table, set the import parameter IGNORE=y. Otherwise, no data will be loaded into the table because of the table creation error or use table_exists_action=append using expdp and impdp
Walkthrough Import when Table Data Exist

NOTE
[CHECK THE VIDEO OF THIS TOPIC BECAUSE IT CONSIST ON PROPER PRACTICAL WORK]

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Introduction to Database Administration

TOPIC 216

Walkthrough Import with Moving Objects

Walkthrough Import with Moving Objects

Walkthrough Import with Moving Objects

Portal Import
Moving Data to the Target System
Walkthrough Import with Moving Objects

Portal Import

Create transport sets and extract the content of the transport sets to transport tables. Transport sets contain the portal objects that you want to export to your target portal environment. This information is displayed in a manifest. The manifest is a list of objects in a transport set, used to provide a granular level of control over the export. For more information on the export process and using the Transport Sets
Walkthrough Import with Moving Objects

Portal Import

Move the transport sets from one system (source) to another (target) using the Transport Sets - Acquire Service portlet, or using the Oracle Portal Export and Import command- line scripts if there is an intervening firewall. Moving the transport set from the source to the target system using the Transport Sets
Walkthrough Import with Moving Objects

Portal Import

Import the objects from the transport tables to the target portal repository using the Import Transport Set portlet.
Walkthrough Import with Moving Objects

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Moving Data to the Target System

To move your content using the Acquire Transport Sets portlet:

In the Transport Set - Acquire Services portlet, click the Browse Source Portals on the Administer page and check that the source portal you're moving data from is registered on the target instance.

If the source portal has not previously been registered, from the Acquire Transport Sets portlet, click Register A Source Portal and register. From the Transport Set - Acquire Services portlet, click Acquire Transport Sets to display the Acquire a Transport Set page.
Walkthrough Import with Moving Objects

Moving Data to the Target System

Specify the source portal and the transport set and click Acquire to start transferring the data.
When the transfer is complete, click Display Manifest to display the transport set manifest.
Click on the explicitly selected object to display the detailed manifest. Click Tree View to see the nested dependencies.
Click Close to return to the manifest, and then click Pre-check Now to perform a pre-check of the transferred data. The system checks that all object dependencies have been resolved.
Click Display Manifest when the pre-check is complete and check the status column for errors.
Resolve any errors before continuing with importing the transport set.

Moving Data to the Target System

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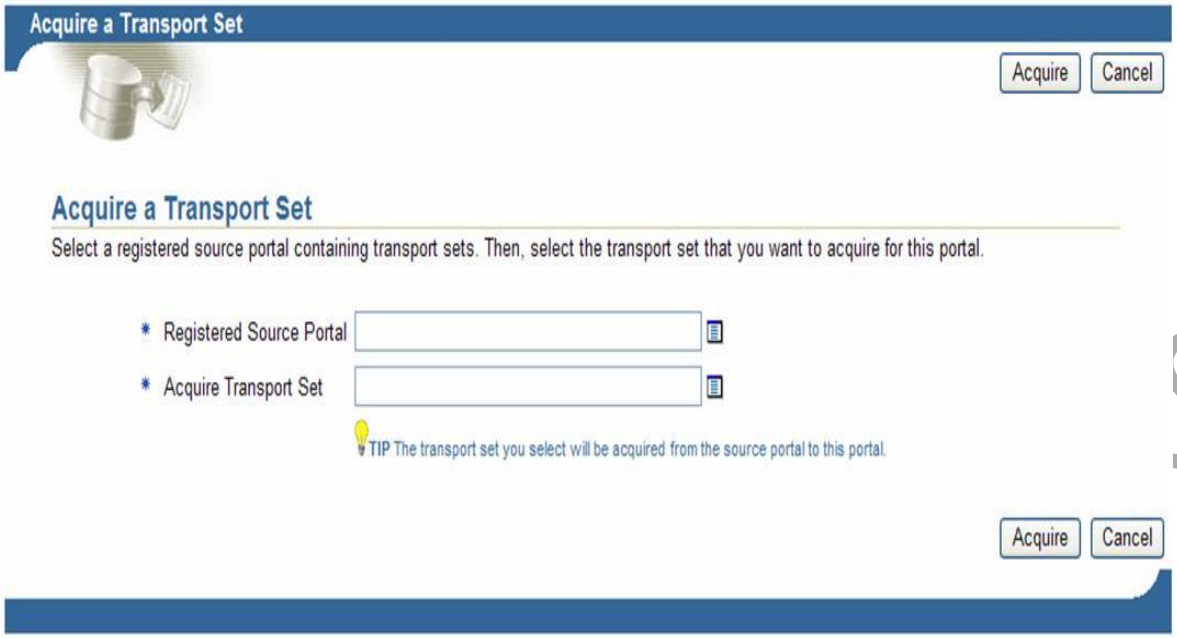

Introduction to Database Administration

TOPIC 217

Logical Backup with Oracle Utilities

Logical Backup with Oracle Utilities

Logical Backup with Oracle Utilities

Logical Backup
Oracle Data Pump Architecture
Modes of Data Pump
Examples of Data Pump
Logical Backup with Oracle Utilities

Logical Backup

Logical backups are backups in which the export utility (for example Exp) uses SQL to read database data and then export it into a binary file at the operating system level. You can then import the data back into a database using the import utility (Imp).
Logical Backup with Oracle Utilities

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Logical Backup

The Oracle Export Utility can create a file that contains all the objects in a particular schema. The file that is created can then be imported to the same schema to recover from a failure or to a different instance or schema for archiving purposes.
Logical Backup with Oracle Utilities

Oracle Data Pump Architecture

Data Pump consists of the following components:

expdp (Data Pump export utility) impdp(Data Pump import utility)
DBMS_DATAPUMP PL/SQL package(Data Pump application interface [API])
DBMS_METADATA PL/SQL package (Data Pump Metadata API)
Logical Backup with Oracle Utilities

Modes of Data Pump

Entire database
Schema level
Table level
Tablespace level
Transportable tablespace level
Logical Backup with Oracle Utilities

Examples of Data Pump

An example of Export:-
$ expdp mv_maint/foo directory=dp_dir dumpfile=full.dmp logfile=full.log full=y

An example of Import:-
$ impdp mv_maint/foo directory=dp_dir dumpfile=full.dmp logfile=fullimp.log full=y
Introduction to Database Administration

TOPIC 218

Walkthrough Export with Moving Objects

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Walkthrough Export with Moving Objects

Pre-requisite Portal Export & Import
Command-line Access
Oracle Export & Import with Character Sets
Role of Character Sets in Export & Import
Walkthrough Export with Moving Objects

Pre-requisite Portal Export & Import

Oracle Portal instance information: Before beginning the export and import process, ensure you have the following information:
System Requirements
Additional Considerations
Walkthrough Export with Moving Objects

Pre-requisite Portal Export & Import

Privileges for Exporting and Importing Content
Portal schema name.
Portal schema password.
Portal connect string information.
Portal user name.
Portal user password.
Company name (used only for hosted portal installations). In most cases, this should be left blank.
Walkthrough Export with Moving Objects

Oracle Export & Import with Character Sets

The Oracle Database exp utility always exports user data, including Unicode data, in the character sets of the export server. The character sets are specified when the database is created.

The Oracle Database imp utility automatically converts the data to the character sets of the import server.
Walkthrough Export with Moving Objects

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Command-line Access

If you are using the Oracle Portal Export and Import command-line scripts to move the transport sets from one system to another, you must have command-line access to run the shell or command utilities generated by the export import process. The command- line utilities, in turn, access the Oracle Database exp and imp utilities, and the Oracle Portal instance.
Walkthrough Export with Moving Objects

Oracle Export & Import with Character Sets

Some 8-bit characters can be lost (that is, converted to 7-bit equivalents) when you import an 8-bit character set export file. This occurs if the client system has a native 7-bit character set or if the NLS_LANG operating system environment variable is set to a 7-bit character set. Most often, you notice that accented characters lose their accent marks.
Walkthrough Export with Moving Objects

Oracle Export & Import with Character Sets

Both the Oracle Database exp and imp utilities alert you of any required character set conversion before exporting or importing the data.
Walkthrough Export with Moving Objects

Role of Character Sets in Export & Import

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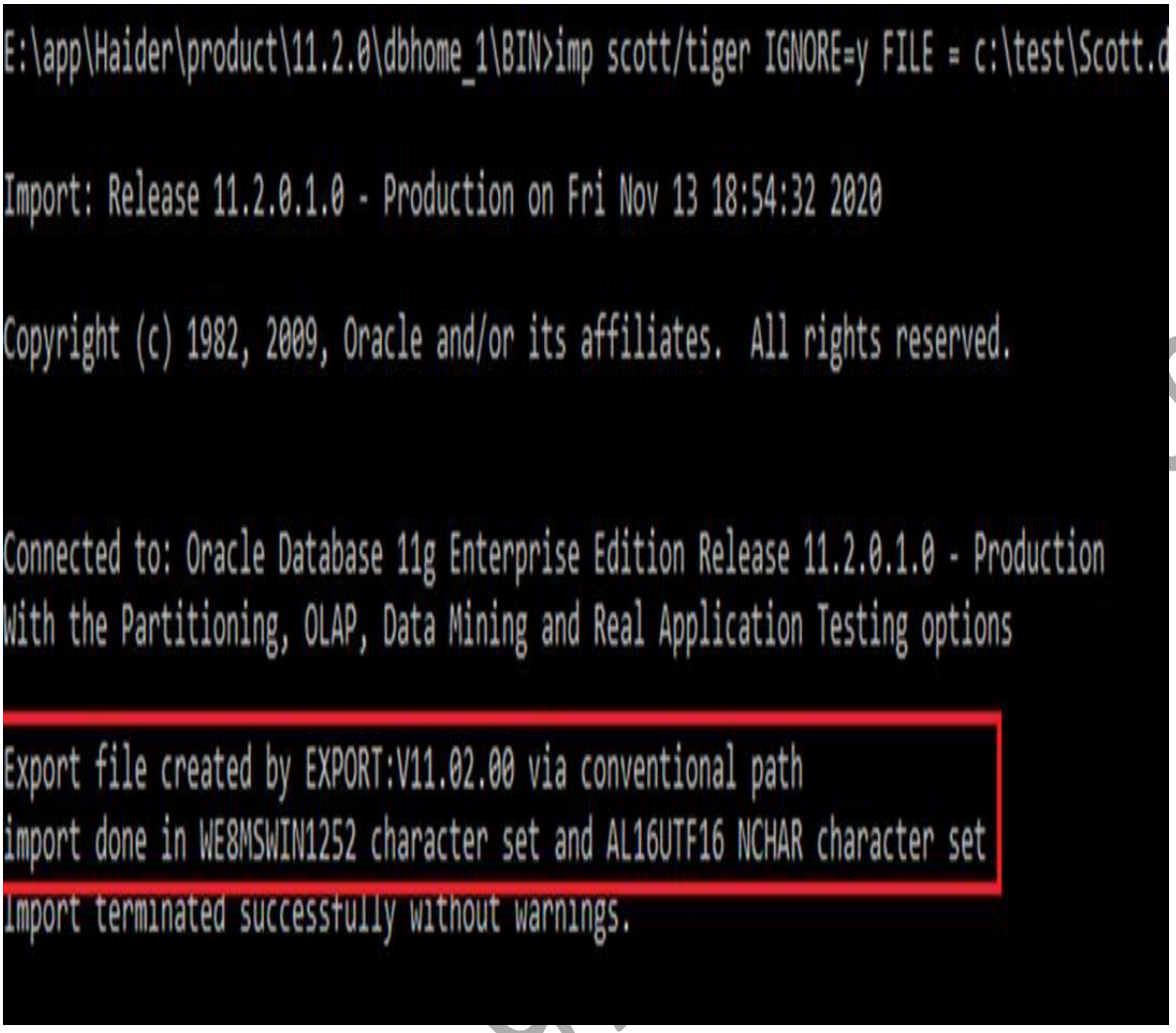

Introduction to Database Administration

TOPIC 219

General Overview of Database Manager

General Overview of Database Manager

General Overview of Oracle Enterprise Manager (OEM)

Starting OEM
Oracle Database Control Login

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OEM Home Page
OEM - Grant Management Privileges
OEM - Users Credentials
General Overview of Database Manager

Starting OEM

On cmd (DOS prompt), you may run
set oracle_sid=orcl emctl stop dbconsole emctl start dbconsole

In the browser, you can run URL
https://localhost:1158/em
General Overview of Database Manager

Oracle Database Control Login

General Overview of Database Manager
OEM Home Page

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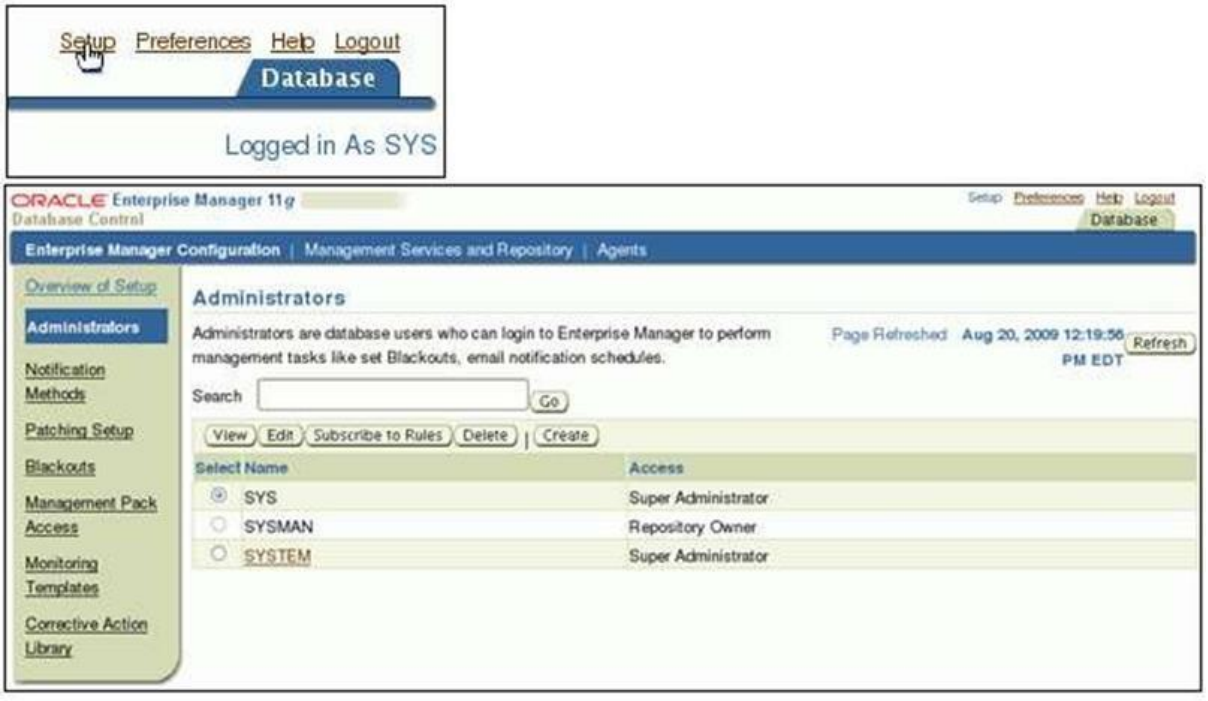
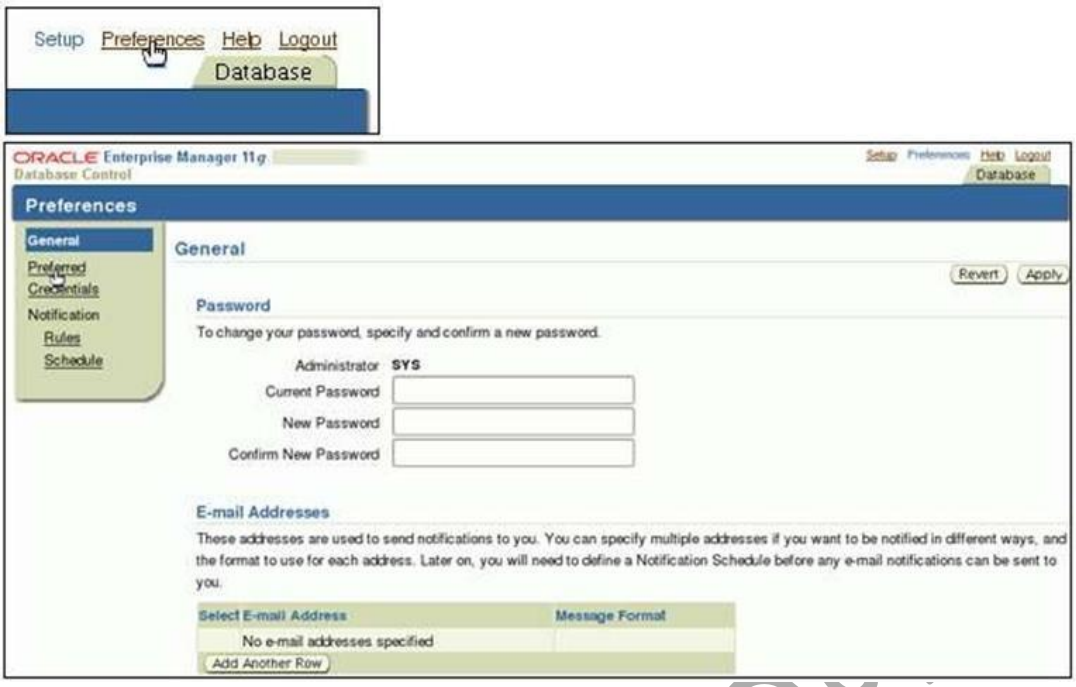
General Overview of Database Manager

OEM – Grant Management Privileges



General Overview of Database Manager

OEM – Users Credentials



General Overview of Database Manager

OEM – Users Credentials

Introduction to Database Administration

TOPIC 220

Transaction Processing

Transaction Processing

Transaction Processing

What is a Transaction?
Processing of Transactions
Processing of Transactions in Oracle
Transaction Processing

What is a Transaction?

SQL is initiated at user level (client) with Start-End and it executes on Server (central Database) at a certain distance.

A transaction is a logical, atomic unit of work (block) that contains one or more SQL statements.
Either transaction is done (committed) or not done (rolled back). No partial execution of transaction is allowed.
Transaction Processing

Processing of Transactions

Generally reflects the activities in the real world system
Depositing some amount in an account, will be a transaction
Transferring amount from one account to another; if ok then DB is in consistent state otherwise inconsistent.
One transaction can be calculating GPA in our exam system
Transaction Processing

Processing of Transactions in Oracle

In Oracle Database, each user must see a consistent view of the data, including visible changes made by a user's own transactions and committed transactions of other users.
Transaction Processing

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Processing of Transactions in Oracle

Single-user VS multi-user systems
A DBMS is single-user if at most one user can use the system at a time
A DBMS is multi-user if many users can use the system concurrently
Problem
How to make the simultaneous interactions of multiple users with the database safe, consistent, correct, and efficient?
Introduction to Database Administration

TOPIC 221

Defining Transaction

Defining Transaction

Defining Transaction

What is a Transaction?
Transaction with SQL
Converting SQL into Transaction
Defining Transaction

What is a Transaction?

SQL is initiated at user level (client) with Start-End and it executes on Server (central Database) at a certain distance.

A transaction is a logical, atomic unit of work (block) that contains one or more SQL statements.
Either transaction is done (committed) or not done (rolled back). No partial execution of transaction is allowed.
Defining Transaction

What is a Transaction?

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A transaction T is a logical unit of database processing that includes one or more database access operations
Embedded within an application
program
Specified interactively (e.g., via SQL)
Transaction boundaries: Begin/end transaction
Types of transactions Read transaction write transaction
Defining Transaction

Transaction with SQL

For example, following SQL update will change the salary of some Employee

Update EMP Set sal = 850
Where empno = 7369;

Is it statement or a transaction?
Defining Transaction

Converting SQL into Transaction

```
begin

    Update EMP
    Set sal = 850
    Where empno = 7369;

end;
/
```

Defining Transaction

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Introduction to Database Administration

TOPIC 222

Role of Transaction

Role of Transaction

Role or Importance of Transactions

Transaction & SQL
Importance of Transaction Processing System
Transaction with Client-Server Environment
Role of Transaction

Transaction & SQL

Transaction is travelled on network, it may have chances of lost and it requires transaction logs for tracing

Can a simple SQL manages logs?
Can transaction in block manageable?

Issues of Multi-user environment.
Issues of Consistent, Correct and Efficiency are important.
Role of Transaction

Importance of Transaction Processing System

Transaction processing (TP) systems underlie the online applications. a transaction rate of 15 simple Debit Credit transactions per second was “common”, 50 TPS was a “good” system, 100 TPS was “fast”, and a 400 TPS system was characterized as being a very “lean and mean” system.

Teradata capabilities, usage of parallel databases, configuration and tuning etc.
Role of Transaction

Transaction with Client-Server Environment

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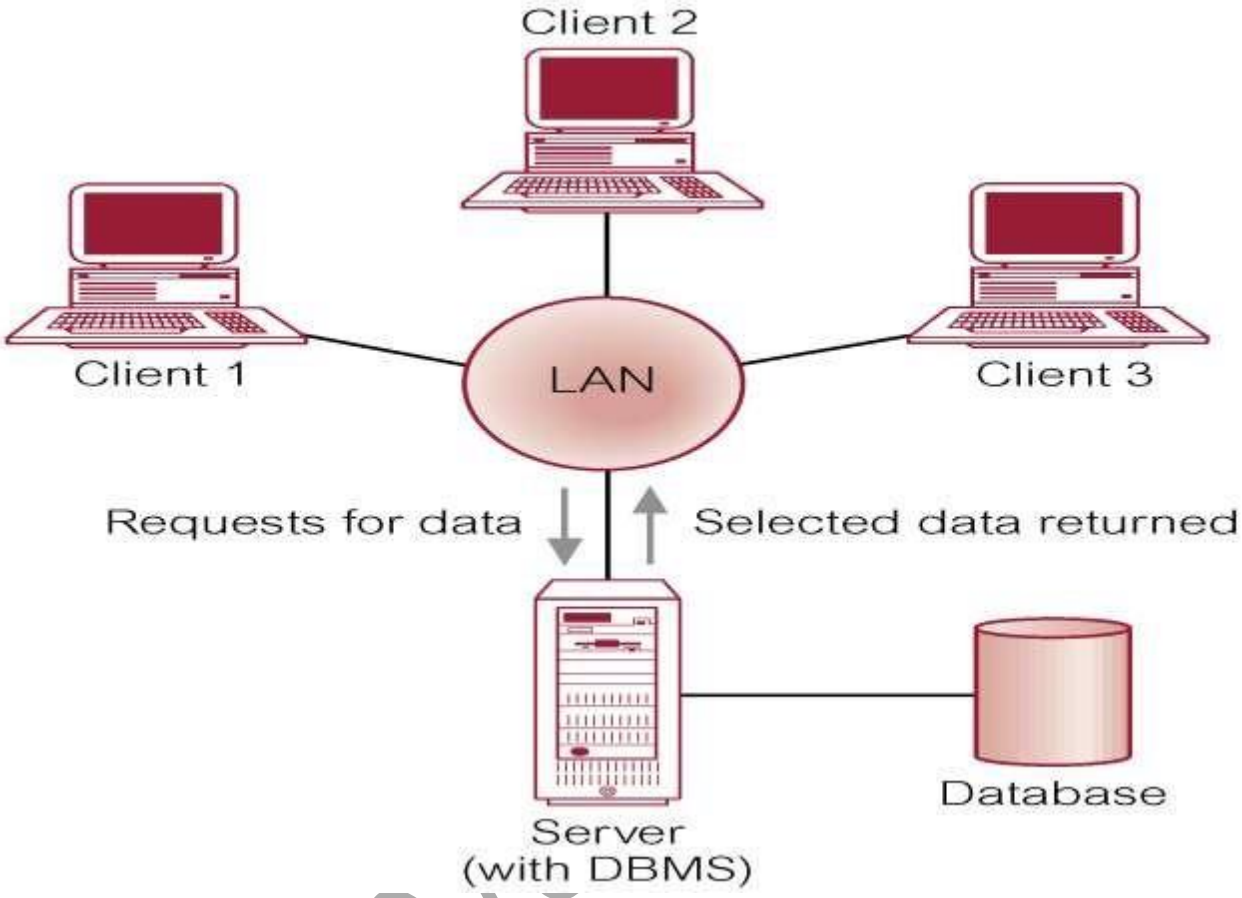

Introduction to Database Administration

TOPIC 223

Examples of Transactions
Examples of Transactions

Example of Transactions

Usage of ATM - An Example
Funds Transfer Concept
Writing a Transaction
Examples of Transactions

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Usage of ATM – An Example

Usage of ATM to draw/ transfer money, to collect currency with dispenser

Examples of Transactions

Funds Transfer Concept

Transfer 400,000 from checking account to savings account For a user it is one activity
To database:
Read balance of checking account: read(X) Read balance of savings account: read (Y) Subtract 400,000 from X
Add 400,000 to Y
Write new value of X back to disk Write new value of Y back to disk
Examples of Transactions

Writing a Transaction

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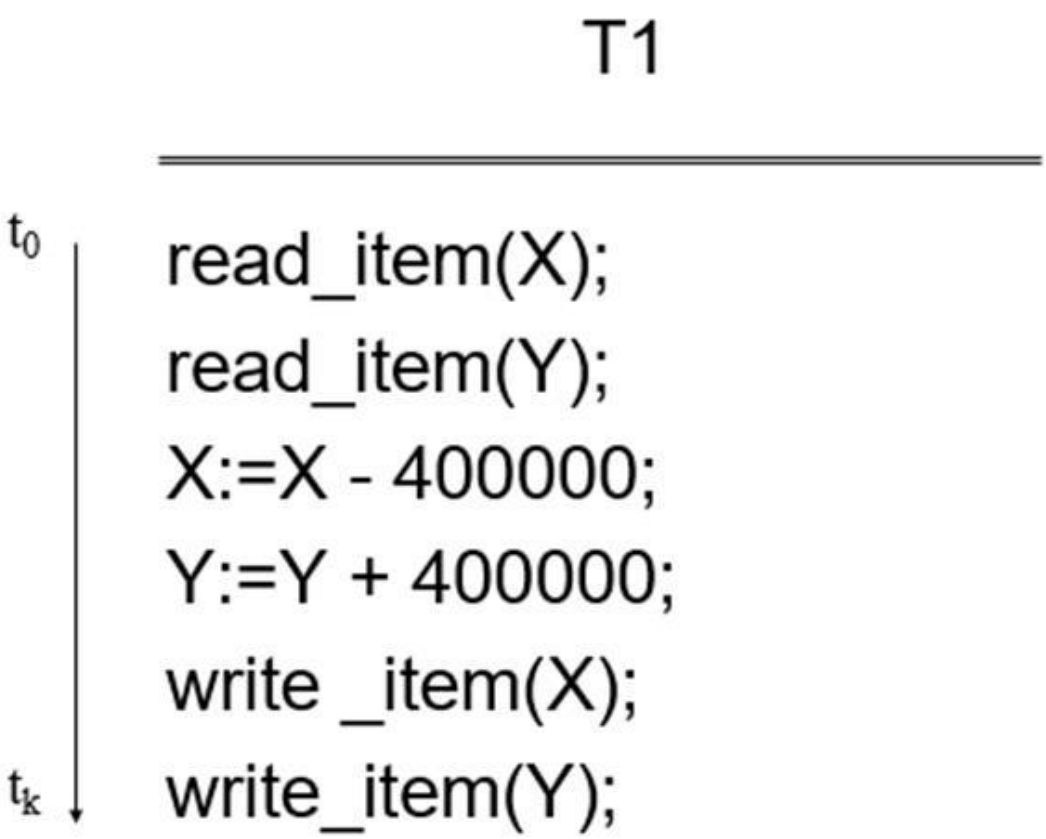

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Introduction to Database Administration

TOPIC 224

Examples of Transactions

Examples of Transactions

Example of Transactions

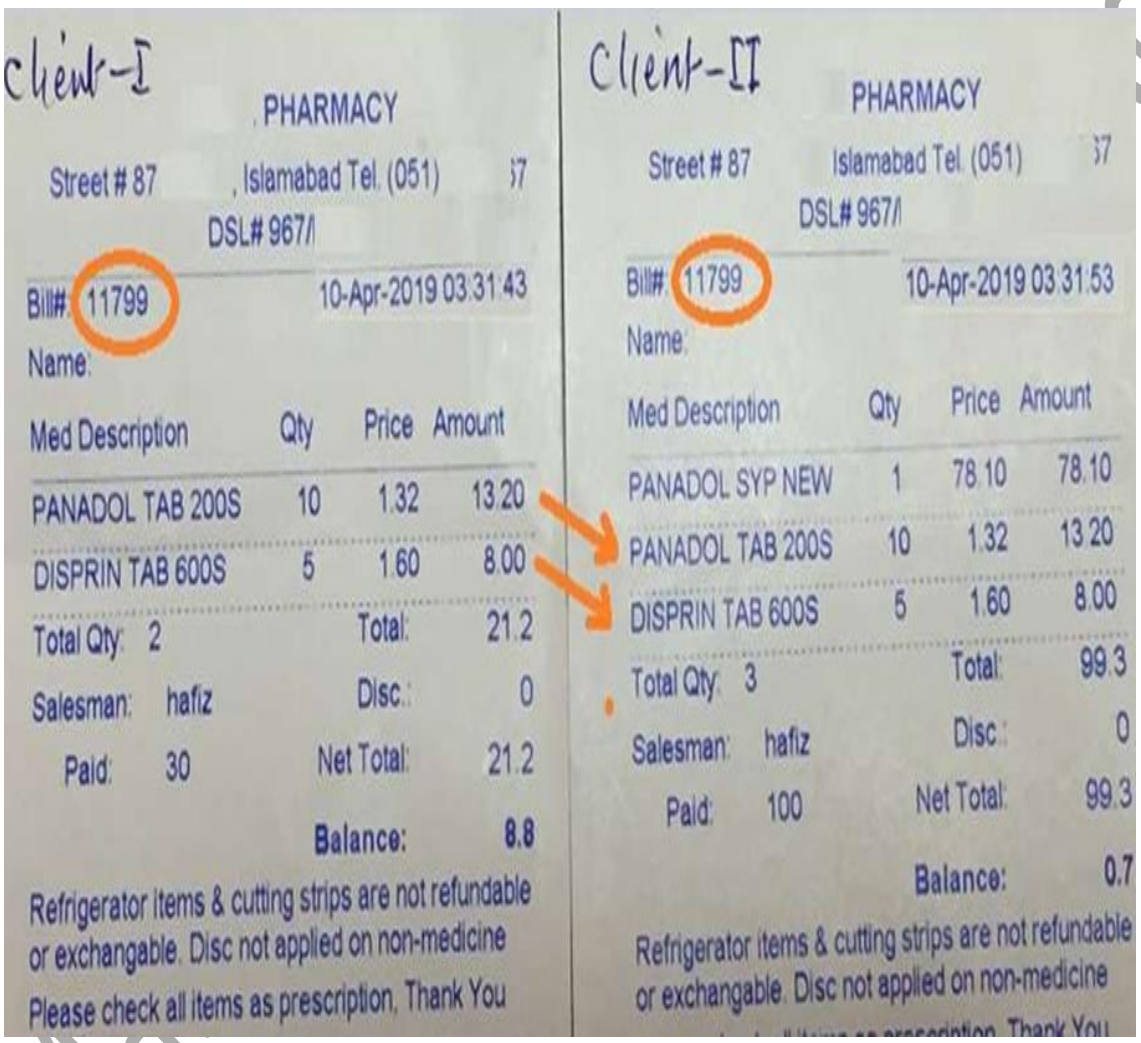
Retail System - An Example
Transactions & Their Issues
Examples of Transactions

Retail Store – An Example

Invoice is issued a transaction when buying items

What happened multiple invoices are issued in Multi-user environment
Examples of Transactions

Transactions and their Issues



client-I

PHARMACY

Street # 87 , Islamabad Tel. (051) 57

DSL# 967/

Bill#: 11799 10-Apr-2019 03:31:43

Name:

Med Description	Qty	Price	Amount
PANADOL TAB 200S	10	1.32	13.20
DISPRIN TAB 600S	5	1.60	8.00

Total Qty: 2 Total: 21.2

Salesman: hafiz Disc.: 0

Paid: 30 Net Total: 21.2

Balance: 8.8

Refrigerator items & cutting strips are not refundable or exchangable. Disc not applied on non-medicine

Please check all items as prescription, Thank You

client-II

PHARMACY

Street # 87 Islamabad Tel. (051) 57

DSL# 967/

Bill#: 11799 10-Apr-2019 03:31:53

Name:

Med Description	Qty	Price	Amount
PANADOL SYP NEW	1	78.10	78.10
PANADOL TAB 200S	10	1.32	13.20
DISPRIN TAB 600S	5	1.60	8.00

Total Qty: 3 Total: 99.3

Salesman: hafiz Disc.: 0

Paid: 100 Net Total: 99.3

Balance: 0.7

Refrigerator items & cutting strips are not refundable or exchangable. Disc not applied on non-medicine

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TOPIC 225

Transactions Read & Write

Transactions Read & Write

Example of Transactions

Transaction Read Item
Transaction Write Item
Two Transactions
Transactions Read & Write

Transaction Read Item

A database is represented as a collection of named data items
Read-item (X)
Find the address of the disk block that
contains item X
Copy the disk block into a buffer in
main memory
Copy the item X from the buffer to
the program variable named X
Transactions Read & Write

Transactions Write Item

Write-item (X)
Find the address of the disk block that contains item X.
Copy that disk block into a buffer in
main memory
Copy item X from the program variable named X into its correct location in the buffer.
Store the updated block from the buffer back to disk (either immediately or at some later point in time).
Transactions Read & Write

Two Transactions

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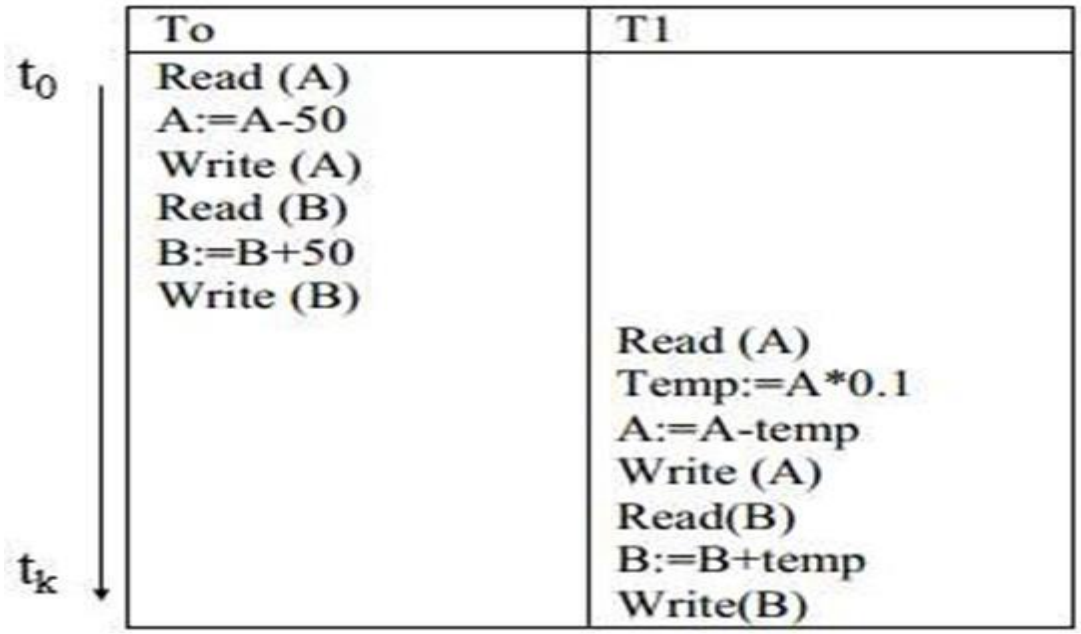

Introduction to Database Administration

TOPIC 226

Concurrent Transactions Examples

Concurrent Transactions Examples

Example of Transactions

Concurrent Transaction
Interleaved & Parallel Processing
Concurrent Processing - An Example
Concurrent Transactions Examples

Concurrent Transaction

In the transaction process, a system usually allows executing more than one transaction simultaneously. This process is called a concurrent execution.

The reasons for wanting to run transactions concurrently are slow input/output devices (usually disks) and the presence of multiple processors on which different transactions can run at the same time.

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Concurrent Transactions Examples

Concurrent Transaction

Informally, if there are two transactions in progress concurrently (that is, the Begin of one happens between the Begin and the Commit of the other), we want all the observable effects to be as though all the actions of one transaction happen either before or after all the actions of the other.
Concurrent Transactions Examples

Interleaved & Parallel Processing

Concurrent transactions refer to two or more transactions that appear to users as they are being processed against a database at the same time
In reality, CPU can execute only one instruction at a time
Transactions are interleaved meaning that the operating system quickly switches CPU services among tasks so that some portion of each of them is carried out in a given interval
Concurrency problems: lost update and inconsistent reads
Concurrent Transactions Examples

Interleaved & Parallel Processing

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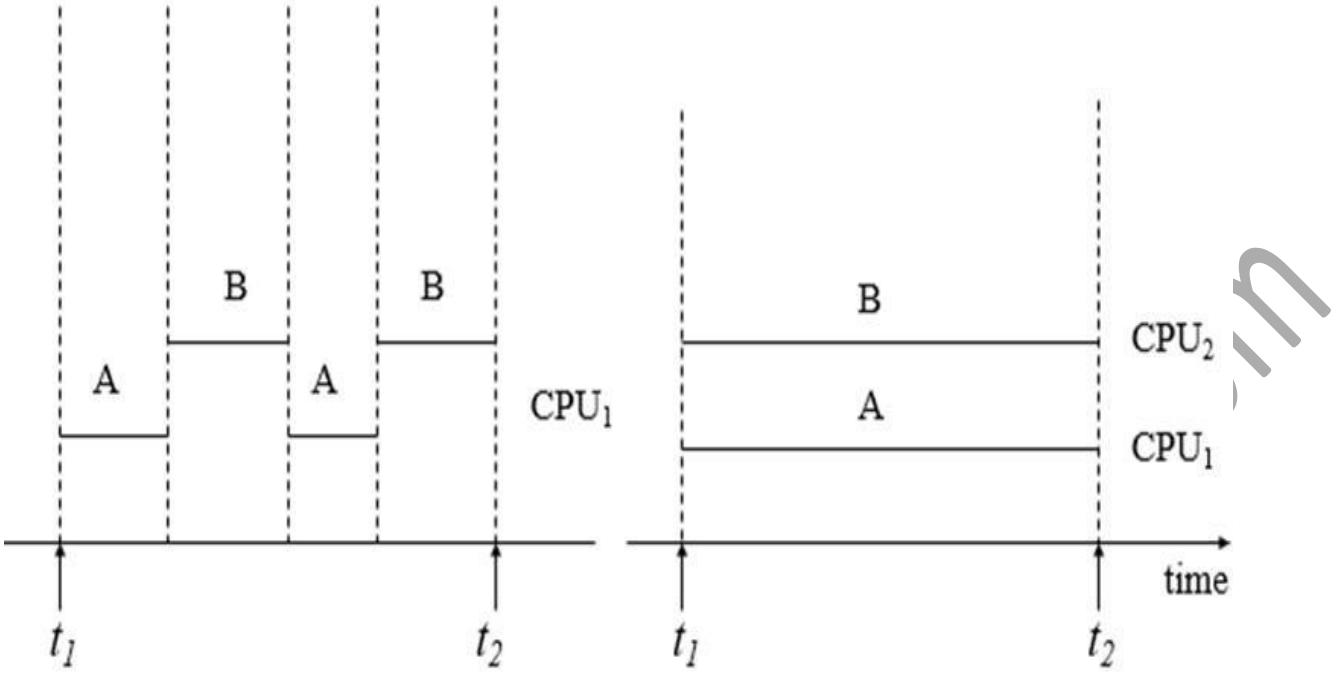

Interleaved processing
(Single processor)

Parallel processing
(Two or more processors)

Concurrent Transactions Examples

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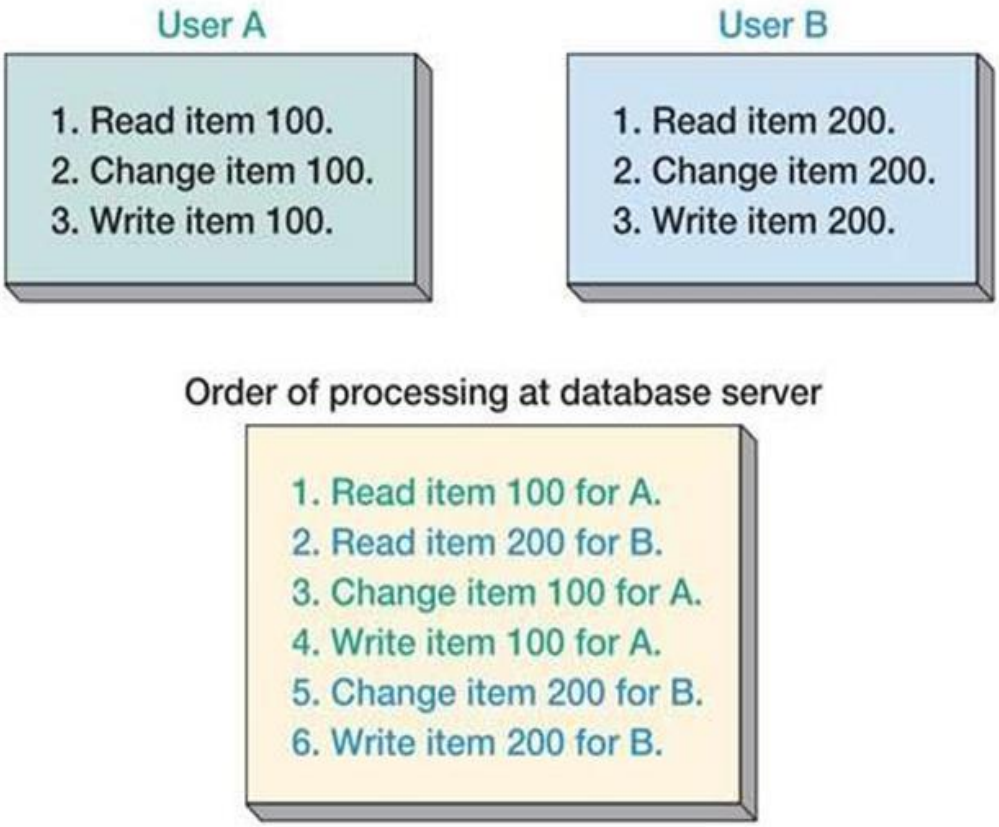

Concurrent Processing – An Example
Introduction to Database Administration

TOPIC 227

Lost Update Example-1
Lost Update Example-1

Example of Transactions

Concurrency Problems
Lost Update Problems
Lost Update Example-1
Lost Update Example-1

Concurrency Problems

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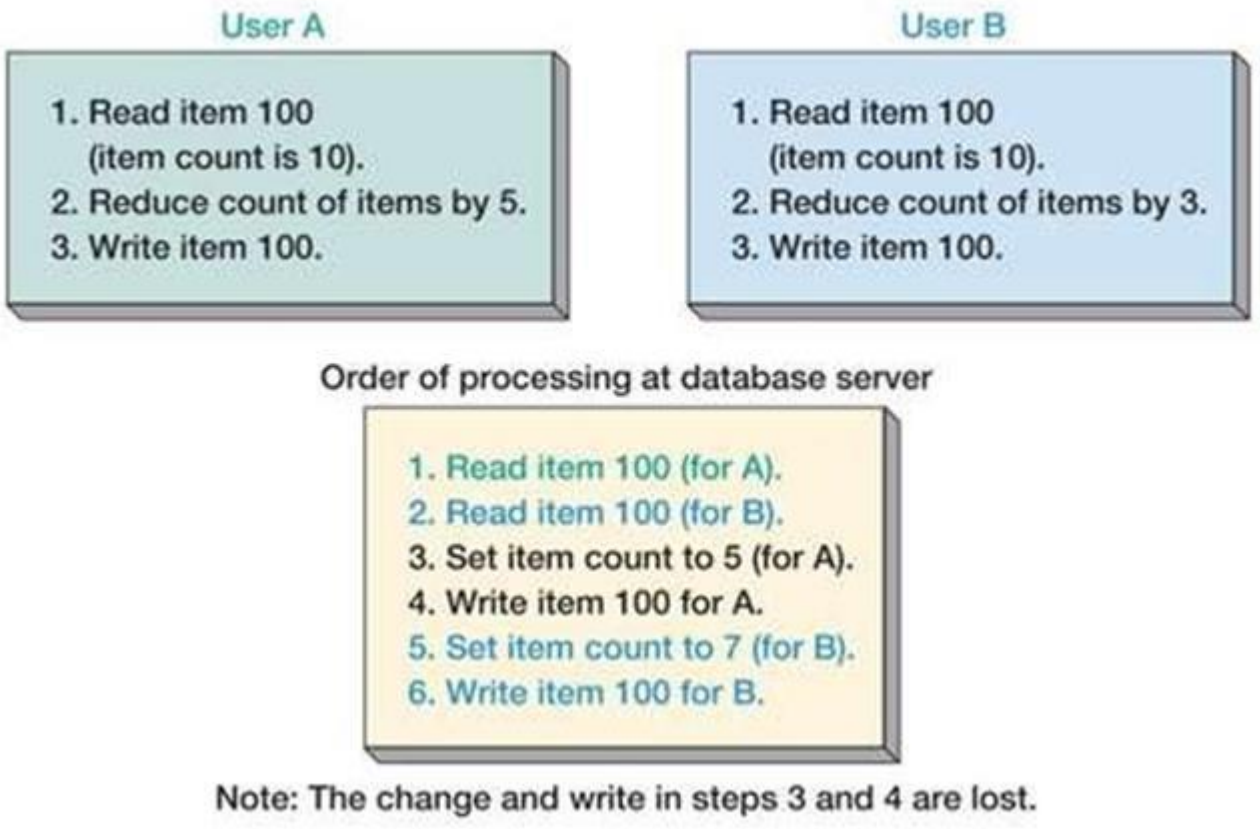
Several problems can occur when concurrent transactions are run in an uncontrolled manner, such type of problems is known as concurrency problems.
Lost Update Example-1

Lost Update Problems

This type of problem occurs when two transactions in database access the same data item and have their operations in an interleaved manner that makes the value of some database item incorrect.
Lost Update Example-1

Lost Update Example-1



TOPIC 228

Lost Update Example-2

Lost Update Example-2

Example of Transactions

Concurrency Problems
Lost Update Problems
Lost Update Example-2
Lost Update Example-2

Concurrency Problems

Several problems can occur when concurrent transactions are run in an uncontrolled manner, such type of problems is known as concurrency problems.
Lost Update Example-2

Lost Update Problems

This type of problem occurs when two transactions in database access the same data item and have their operations in an interleaved manner that makes the value of some database item incorrect.
Lost Update Example-2

Lost Update Example-2

Time	T1	T2	balx
t1		BEGIN	100
t2	BEGIN	read(balx)	100
t3	read(balx)	balx=balx+100	100
t4	balx=balx-10	write(balx)	200
t5	write(balx)	commit	90
t6	commit	END	90
t7	END		

Lost Update Example-2

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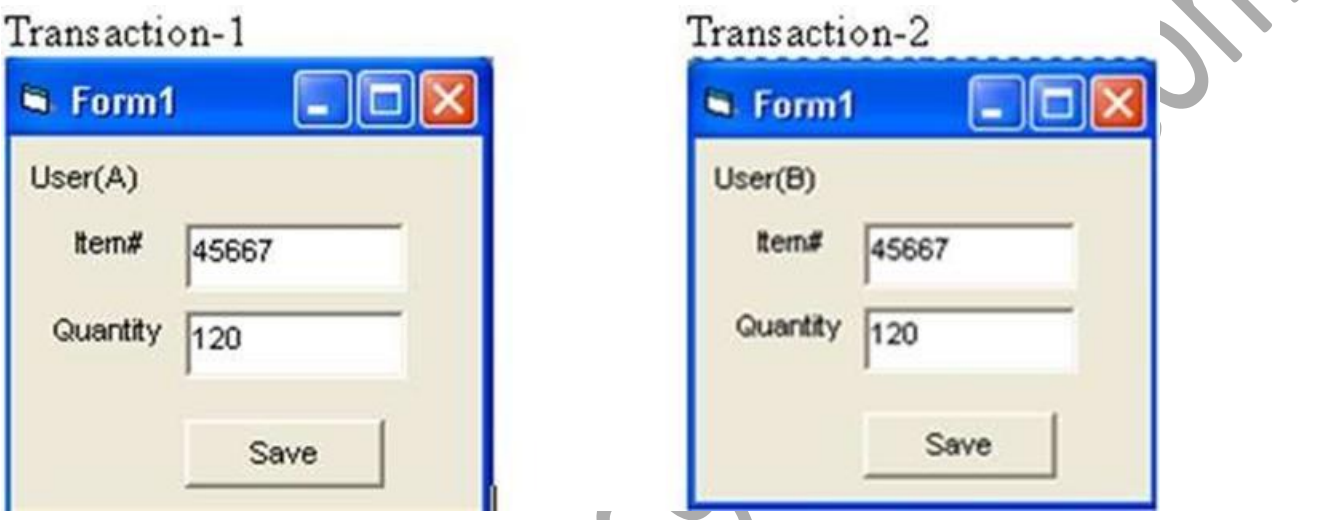
Lost Update Example-2

Two users are reading a same Item#45667, reading current quantity 120 simultaneously



Introduction to Database Administration

TOPIC 229

Dirty Read Example

Dirty Read Example

Dirty Read Transactions

Dirty Read Problem
Dirty Read Example
Dirty Read Example

Dirty Read Problem

This type of problem occurs when one transaction T1 updates a data item of the database, and then that transaction fails due to some reason, but its updates are accessed by some other transaction.

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Dirty Read Example

Dirty Read Example

Time	T3	T4	balx
t1		BEGIN	100
t2		read(balx)	100
t3		balx=balx+100	100
t4	BEGIN	write(balx)	200
t5	read(balx)	...	200
t6	balx=balx-10	rollback	100
t7	write(balx)	END	190
t8	commit		190
t9	END		

Dirty Read Example

Time	Transaction T1	Transaction T2
tï tû t3	Rzad(A) A=A•2D Wr/te(,4)	
t4		head(A)
t5 t5		A=A+30 Wi-tte(A)
t7	Wrtte(B)	

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TOPIC 230

Incorrect Summary Problem
Incorrect Summary Problem

Incorrect Summary Problem

Incorrect Summary Problem
Incorrect Summary Problem - An Example
Incorrect Summary Problem

Incorrect Summary Problem

It is also known as an inconsistent retrieval problem. If a transaction T_1 reads a value of data item twice and the data item is changed by another transaction T_2 in between the two read operation. Hence T_1 access two different values for its two read operation of the same data item.
Incorrect Summary Problem

Incorrect Summary Problem – An Example

Time	Transaction T1	Transaction T2
t1	Read(A)	
t2		Read(A)
t3		A=A+30
t4		Write(A)
t5	Read(A)	

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Incorrect Summary Problem

Incorrect Summary Problem – An Example

Time	T3	T4	balx	baly	balz	sum
t1		BEGIN	100	50	25	
t2	BEGIN	sum=0				
t3	read(balx)	read(balx)				
t4	balx=balx-10	sum=sum+balx				
t5	write(balx)	read(baly)				
t6	read(balz)	sum=sum+baly				
t7	balz=balz+10					
t8	write(balz)					
t9	commit	read(balz)				
t10	END	sum=sum+balz				
t11		commit				
t12		END				

Introduction to Database Administration

TOPIC 231

Data Inconsistency in Two Invoices

Data Inconsistency in Two Invoices

Data Inconsistency with Multiple Users

Single User in a Retail Store
Retail Store - An Example
Transactions and their Issues
Data Inconsistency in Two Invoices

Single User in a Retail Store

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Single user issue an Invoice one at a time
when only one POS terminal is active

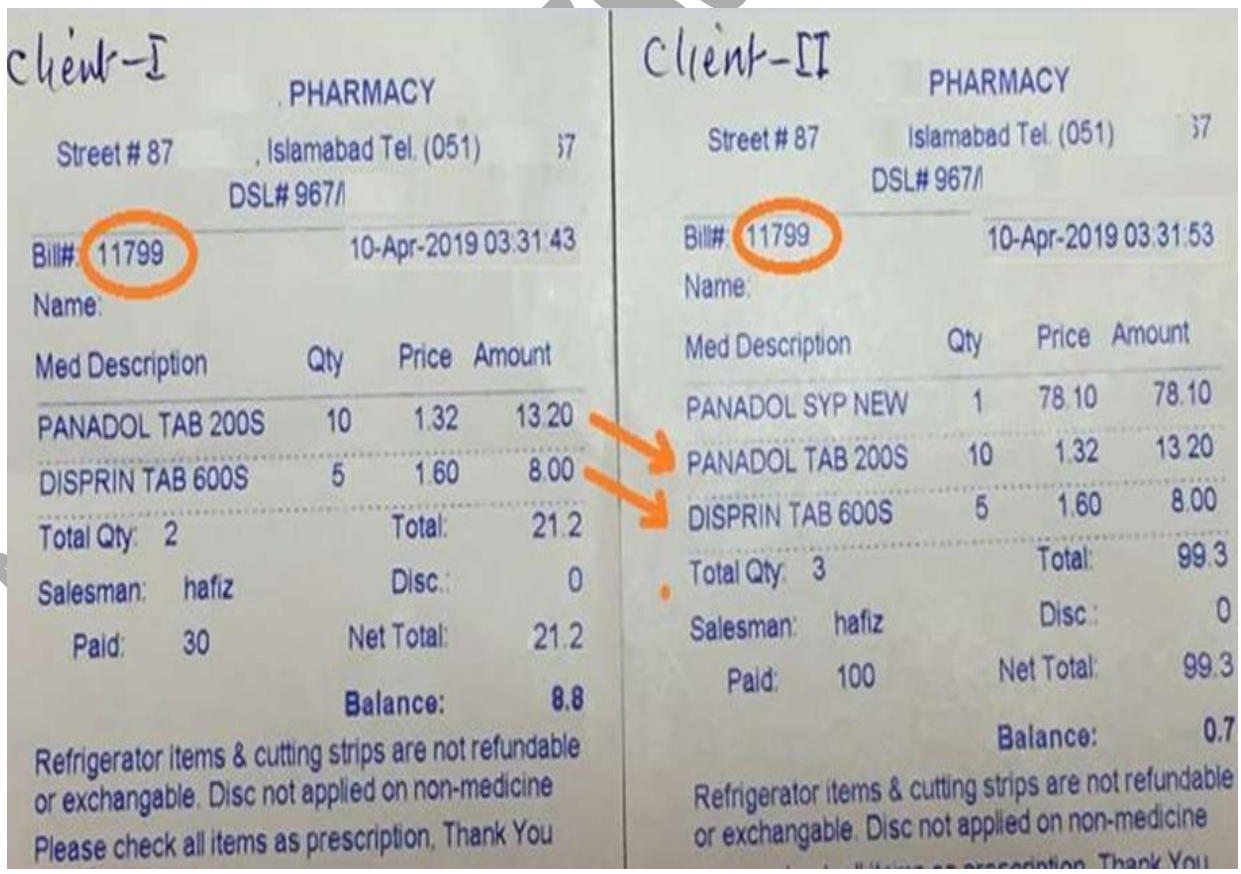
When two or more users are issuing invoices, there is a chance of data inconsistency
Data Inconsistency in Two Invoices

Retail Store – An Example

For example, two invoices are issued at
the same time from two POS terminals

What happened multiple invoices are
issued in Multi-user environment
Data Inconsistency in Two Invoices

Transactions and their Issues



Client-I

PHARMACY

Street # 87 , Islamabad Tel. (051) 57

DSL# 967/

Bill#: 11799 10-Apr-2019 03:31:43

Name:

Med Description	Qty	Price	Amount
PANADOL TAB 200S	10	1.32	13.20
DISPRIN TAB 600S	5	1.60	8.00

Total Qty: 2 Total: 21.2

Salesman: hafiz Disc.: 0

Paid: 30 Net Total: 21.2

Balance: 8.8

Refrigerator items & cutting strips are not refundable or exchangable. Disc not applied on non-medicine

Please check all items as prescription. Thank You

Client-II

PHARMACY

Street # 87 Islamabad Tel. (051) 57

DSL# 967/

Bill#: 11799 10-Apr-2019 03:31:53

Name:

Med Description	Qty	Price	Amount
PANADOL SYP NEW	1	78.10	78.10
PANADOL TAB 200S	10	1.32	13.20
DISPRIN TAB 600S	5	1.60	8.00

Total Qty: 3 Total: 99.3

Salesman: hafiz Disc.: 0

Paid: 100 Net Total: 99.3

Balance: 0.7

Refrigerator items & cutting strips are not refundable or exchangable. Disc not applied on non-medicine

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Introduction to Database Administration

TOPIC 232

System Failure Problems

System Failure Problems

System Failure Problems

What Can Go Wrong?
System Failure Problems
System Failure Problems

What Can Go Wrong?

System may crash before data is written back to disk
Problem of *atomicity*
Some transaction is modifying shared data while another transaction is ongoing (or vice versa)
Problem of *serialization* and
isolation
System Failure Problems

What Can Go Wrong?

System may not be able to obtain one or more of the data items
System may not be able to write one or more of the data items (Problems of *atomicity)*
DBMS has a *Concurrency Control* subsytem to assure database remains in consistent state despite concurrent execution of transactions
System Failure Problems

System Failure Problems

System failures may occur Types of failures:
System crash
Transaction or system error
Local errors Concurrency control enforcement
Disk failure Physical failures

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DBMS has a *Recovery* Subsystem to protect database against system failures

Introduction to Database Administration

TOPIC 233

System Log

System Log

System Log

Introduction
System Log
How the Log File is used?
Transaction Log Example
System Log

Introduction

Log or Journal : The log keeps track of all transaction operations that affect the values of database items. This information may be needed to permit recovery from transaction failures. The log is kept on disk, so it is not affected by any type of failure except for disk or catastrophic failure. In addition, the log is periodically backed up to archival storage (tape) to guard against such catastrophic failures.
System Log

Introduction

T refers to a unique transaction-id that is generated automatically by the system and is used to identify each transaction
System Log

System Log

Transaction –id
System log
Multiple record-type file

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Log is kept on disk
Periodically backed up
System Log

System Log

Log records
[start_transaction, T]
[write_item, T,X,old_value,new_value]:
[read_item, T,X]
[commit,T]
[abort,T]
[checkpoint]
Commit point of a transaction
System Log

How the Log File is used?

All permanent changes to data are recorded
Possible to undo changes to data
After crash, search log backwards until find last checkpoint
Know that beyond this point, effects of transaction are permanently recorded
System Log

How the Log File is used?

Need to either *redo* or *undo* everything that happened since last checkpoint
Undo: When transaction only
partially completed (before crash)
Redo: Transaction completed but we are unsure whether data was written to disk

Transaction Log Example

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TransID	Table	RowID	column	Before	After
100	**start**				
100	EMPLOYEE	1005472	Salary	8000	8250
100	PROJECT	1423PRJ	PrjRate	253	256
100	**end committed**				

Introduction to Database Administration

TOPIC 234

Schedules & Recoverability

Schedules & Recoverability

Schedules & Recoverability

Transaction and Schedule
Schedule
Example of Schedule
Schedules & Recoverability

Transaction and Schedule

We have discussed that Multiple transactions can be executed concurrently by interleaving their operations
Schedule
Ordering of execution of operations from various transactions T_1, T_2, … , T_n is called a schedule *S*
Schedules & Recoverability

Schedule

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Schedule S of n transactions T_1, T_2, … , T_n is an ordering of the operations of the transactions subject to the constraint that, for each transaction T_i that participates in S, the operations of T_i in S must appear in the same order in which they occur in T_i.
Schedules & Recoverability

Example of Schedule

Transaction T_1: $r_1(X)$; $w_1(X)$; $r_1(Y)$; $w_1(Y)$; c_1 Transaction T_2: $r_2(X)$; $w_2(X)$; c_2

A schedule, S:
$r_1(X)$; $r_2(X)$; $w_1(X)$; $r_1(Y)$; $w_2(X)$; $w_1(Y)$; c_1; c_2

Introduction to Database Administration

TOPIC 235

Conflicts
Conflicts

Schedule with Conflicts

Conflicts
Conditions for Conflicts
Example of Conflicts
Conflicts

Conflicts

Conflict operations can creates inconsistency
Two operations *conflict* if they satisfy ALL three conditions:
they belong to different transactions AND
they access the same item AND
at least one is a
write_item()operation
Conflicts

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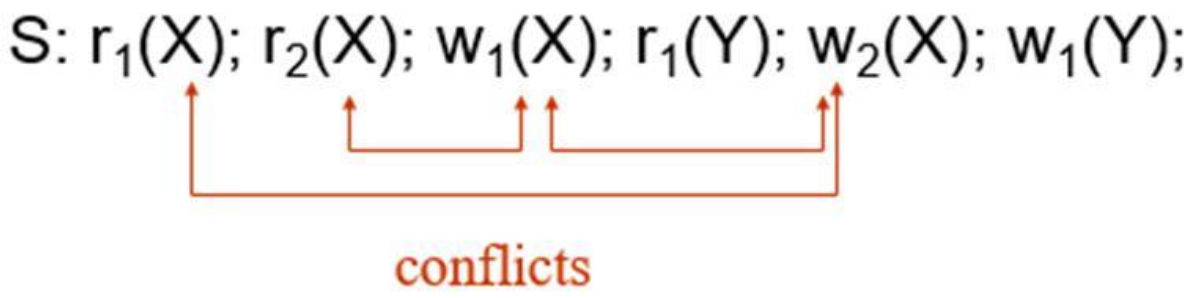
Conditions for Conflicts

Two operations *conflict* if they satisfy ALL three conditions:
they belong to different transactions AND
they access the same item AND
at least one is a
write_item()operation
Conflicts

Example of Conflicts



Introduction to Database Administration

TOPIC 236

Serializability

Serializability

Schedule with Serializability

Serializability
Serial Schedule
Characteristics of Serial Schedule
Serializability

Serializability

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Serial Schedule
Non-serial schedule
Serializable schedule
Conflict-serializable schedule
View-serializable schedule
Serializability

Serializability

Serial and Non-serial schedule A schedule *S* is serial if, for every transaction *T* participating in the
schedule, all the operations of *T* are
executed consecutively in the schedule; otherwise, the schedule is called non-serial
Serializable schedule
A schedule *S* of *n* transactions is serializable if it is *equivalent to some serial schedule* of the same *n* transactions
Serializability

Serial Schedule

Serial schedule is guaranteed correct, should we adopt it?

No, that will be inefficient, under the
utilization of resources

Dislike by the users
Serializability

Characteristics of Serial Schedule

Result equivalent: Two schedules are called result equivalent if they produce the same final state of the database.
Conflict equivalent: Two schedules are said to be conflict equivalent if the order of any two conflicting operations is the same in both schedules.
Conflict serializable: A schedule S is said to be conflict serializable if it is conflict equivalent to some serial schedule S'.

End
Introduction to Database Administration

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TOPIC 237

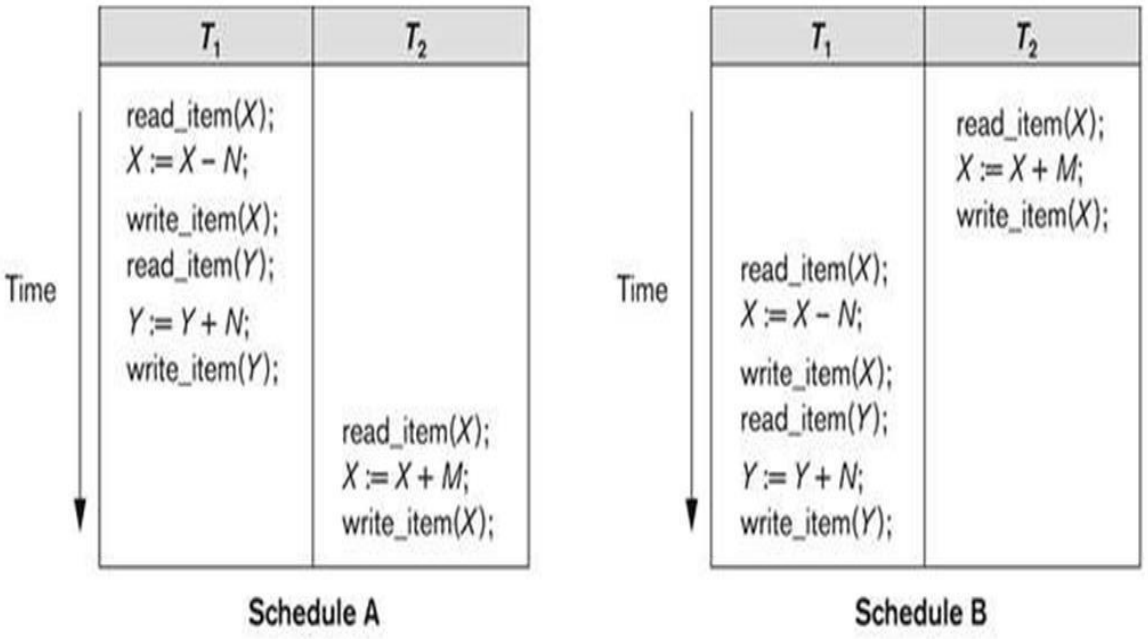
Serial Schedules Example-1

Serial Schedules Example-1

Schedule with Serial Schedules Example-1

Example-1
Serial Schedules Example-1

Example-1



Assume X=90, Y=90, N=3, M=2
Introduction to Database Administration

TOPIC 238

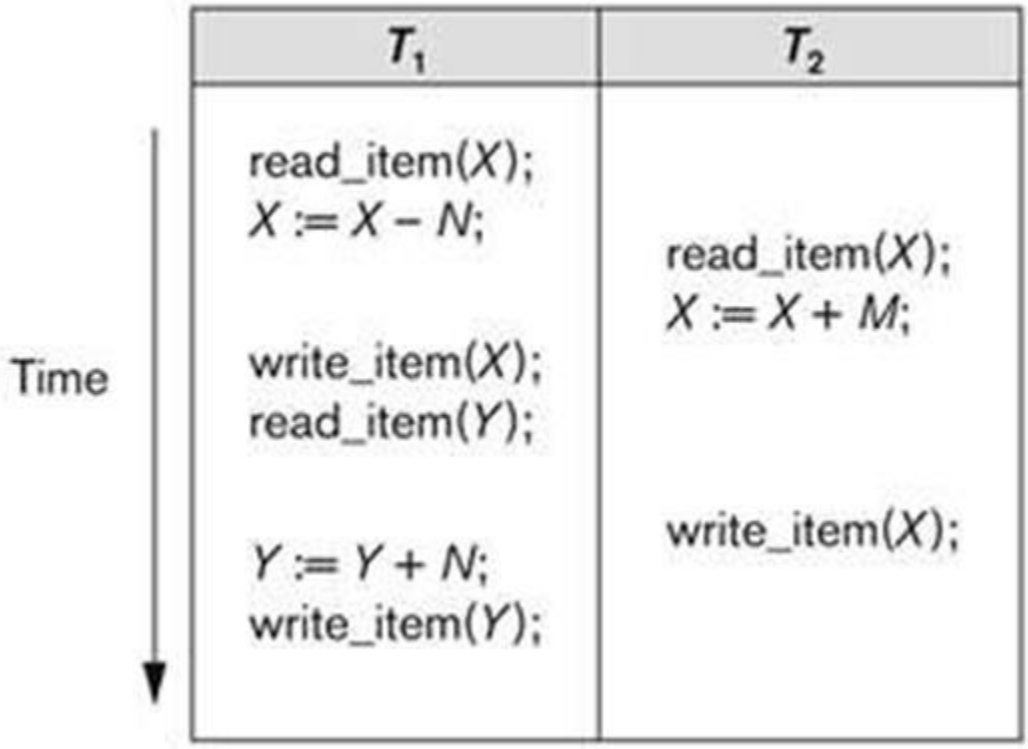
Serial Schedules Example-2

Serial Schedules Example-2

Schedule with Serial Schedules Example-2

Example-2
Serial Schedules Example-2

Example-2 (Schedule S')



Assume X=90, Y=90, N=3, M=2
Not Correct Values
Introduction to Database Administration

TOPIC 239

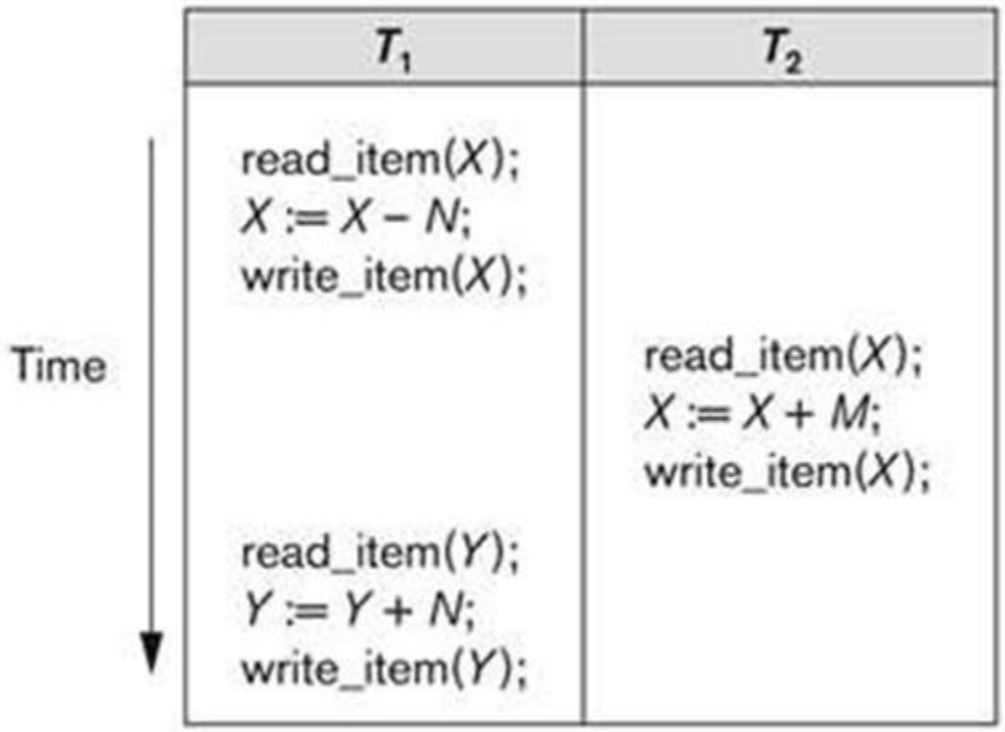
Serial Schedules Example-3

Serial Schedules Example-3

Schedule with Serial Schedules Example-3

Example-3
Serial Schedules Example-3

Example-3 (Schedule S'')



Assume X=90, Y=90, N=3, M=2
Produces same result as serial schedule
Introduction to Database Administration

TOPIC 240

Conflict Serializability Example-1

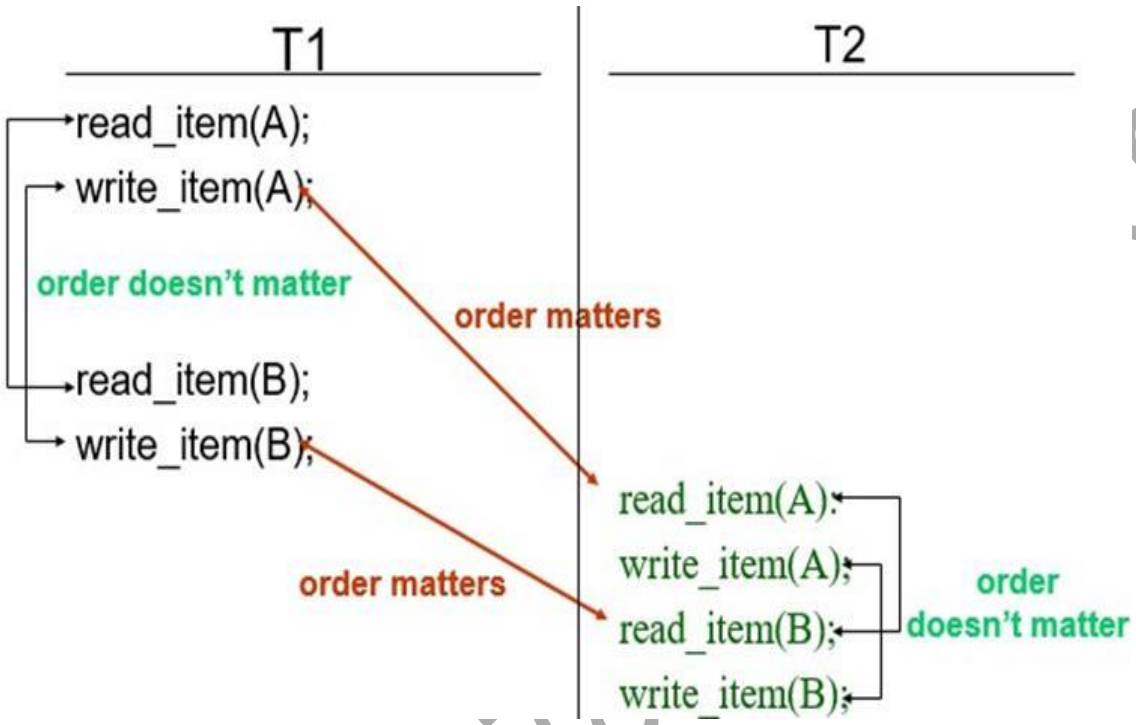
Conflict Serializability Example-1

Schedule with Conflict Serializability Example-1

Example-1 (S1)
Example-1 (S1')
Example-1 (Schedules A, B)

Conflict Serializability Example-1

Example-1 (Schedule S)



Conflict Serializability Example-1

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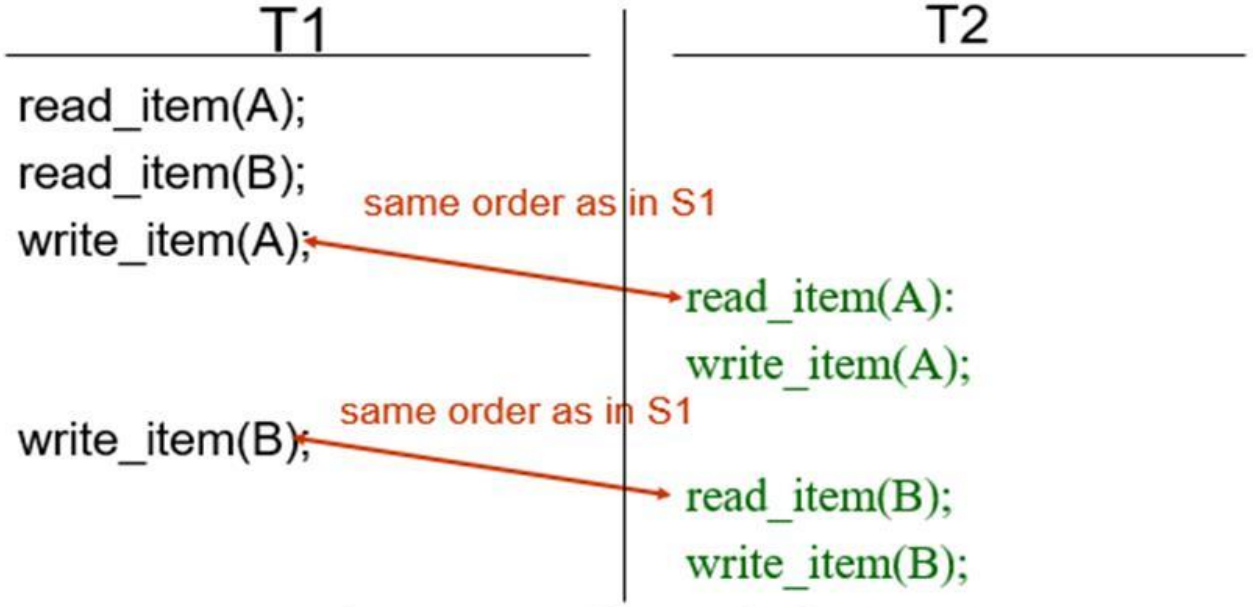

S1 and S1' are conflict equivalent
(S1' produces the same result as S1)

Example-1 (Schedule S1')

Conflict Serializability Example-1

Example-1 (Schedules A, B)

Schedule A

T1	T2
read_item(X);	
X:=X-N;	
write_item(X);	
read_item(Y);	
Y:=Y+N;	
write_item(Y);	
	read_item(X);
	X:=X+M;
	write_item(X);

Schedule B

T1	T2
read_item(X);	
X:=X-N;	
write_item(X);	
	read_item(X);
	X:=X+M;
	write_item(X);
read_item(Y);	
Y:=Y+N;	
write_item(Y);	

B is conflict equivalent to A ⇒ B is serializable

TOPIC 241

Conflict Serializability Example-2 (Graph Test)

Conflict Serializability Example-2 (Graph Test)

Conflict Serializability Example-2 (Graph Test)

Test for Serializability
Example-2 (Graph Test)
Conflict Serializability Example-2 (Graph Test)

Test for Serializability

Construct a directed graph, *precedence graph*, G = (V, E)
V: set of all transactions participating
in schedule
E: set of edges T_i □ T_j for which one of
the following holds:
T_i executes a write_item(X) before
T_j executes read_item(X)
T_i executes a read_item(X) before
T_j executes write_item(X)
T_i executes a write_item(X) before
T_j executes write_item(X)
Conflict Serializability Example-2 (Graph Test)

Test for Serializability

An edge T_i □ T_j means that in any serial schedule equivalent to S, T_i must come before T_j
If G has a cycle, then S is not conflict serializable
If not, use topological sort to obtain serializable schedule (linear order consistent with precedence order of graph)
To check consistency if graph is acyclic otherwise schedule has deadlock means inconsistent
Conflict Serializability Example-2 (Graph Test)

Example-2 (Graph Test)

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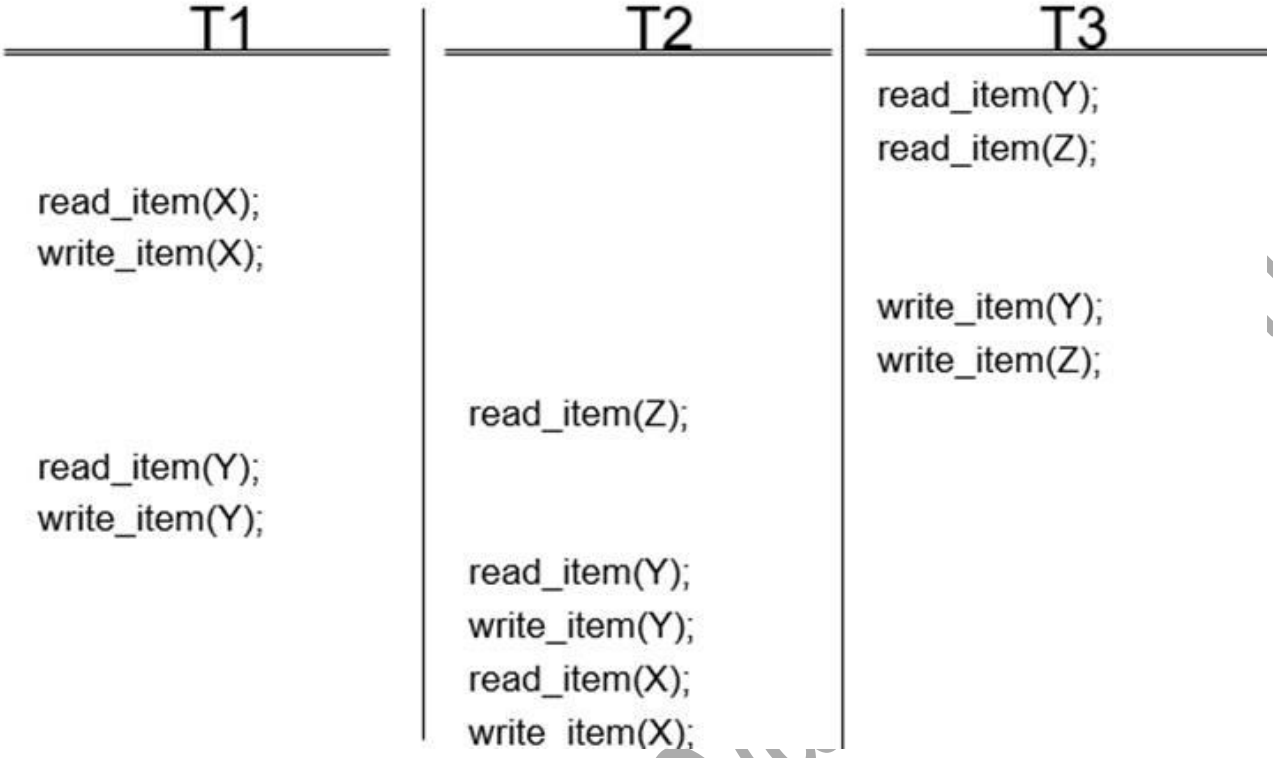

Introduction to Database Administration

TOPIC 242

Apply Locking

Apply Locking

Apply Locking

Database Locks
Locks in Oracle SQL
Locks Update
Apply Locking

Database Locks

When two sessions or users of database try to update or delete the same data in a table, then there will be a concurrent update problem. In order to avoid this problem, database locks the data for the first user and allows him to update/delete the data.

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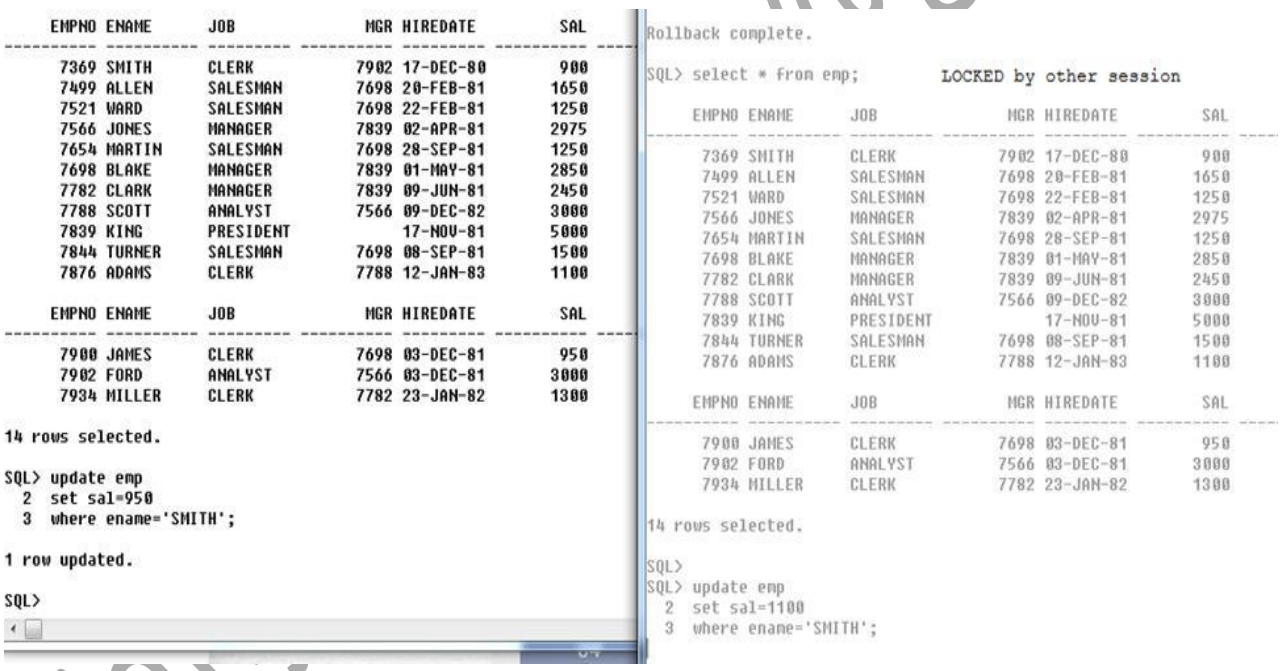
Once he is done with his update/delete, he COMMITs or ROLLBACK the transaction, which will release the lock on the data. When lock on the data is released, another user can lock it for his changes.
Apply Locking

Database Locks

An Object is locked before it performs any operation

Two types of operations, two types of locks
Shared & Exclusive Locks
Apply Locking

Locks in Oracle SQL



```
     EMPNO ENAME      JOB              MGR HIREDATE         SAL
---------- ---------- --------- ---------- --------- ---------- ----
      7369 SMITH      CLERK           7902 17-DEC-80        900
      7499 ALLEN      SALESMAN        7698 20-FEB-81       1650
      7521 WARD       SALESMAN        7698 22-FEB-81       1250
      7566 JONES      MANAGER         7839 02-APR-81       2975
      7654 MARTIN     SALESMAN        7698 28-SEP-81       1250
      7698 BLAKE      MANAGER         7839 01-MAY-81       2850
      7782 CLARK      MANAGER         7839 09-JUN-81       2450
      7788 SCOTT      ANALYST         7566 09-DEC-82       3000
      7839 KING       PRESIDENT            17-NOV-81       5000
      7844 TURNER     SALESMAN        7698 08-SEP-81       1500
      7876 ADAMS      CLERK           7788 12-JAN-83       1100

     EMPNO ENAME      JOB              MGR HIREDATE         SAL
---------- ---------- --------- ---------- --------- ---------- ----
      7900 JAMES      CLERK           7698 03-DEC-81        950
      7902 FORD       ANALYST         7566 03-DEC-81       3000
      7934 MILLER     CLERK           7782 23-JAN-82       1300

14 rows selected.

SQL> update emp
  2  set sal=950
  3  where ename='SMITH';

1 row updated.

SQL>
```

```
Rollback complete.

SQL> select * from emp;        LOCKED by other session

     EMPNO ENAME      JOB              MGR HIREDATE         SAL
---------- ---------- --------- ---------- --------- ---------- ----
      7369 SMITH      CLERK           7902 17-DEC-80        900
      7499 ALLEN      SALESMAN        7698 20-FEB-81       1650
      7521 WARD       SALESMAN        7698 22-FEB-81       1250
      7566 JONES      MANAGER         7839 02-APR-81       2975
      7654 MARTIN     SALESMAN        7698 28-SEP-81       1250
      7698 BLAKE      MANAGER         7839 01-MAY-81       2850
      7782 CLARK      MANAGER         7839 09-JUN-81       2450
      7788 SCOTT      ANALYST         7566 09-DEC-82       3000
      7839 KING       PRESIDENT            17-NOV-81       5000
      7844 TURNER     SALESMAN        7698 08-SEP-81       1500
      7876 ADAMS      CLERK           7788 12-JAN-83       1100

     EMPNO ENAME      JOB              MGR HIREDATE         SAL
---------- ---------- --------- ---------- --------- ---------- ----
      7900 JAMES      CLERK           7698 03-DEC-81        950
      7902 FORD       ANALYST         7566 03-DEC-81       3000
      7934 MILLER     CLERK           7782 23-JAN-82       1300

14 rows selected.

SQL>
SQL> update emp
  2  set sal=1100
  3  where ename='SMITH';
```

Record level lock/ Row Lock – same record

Locks Update

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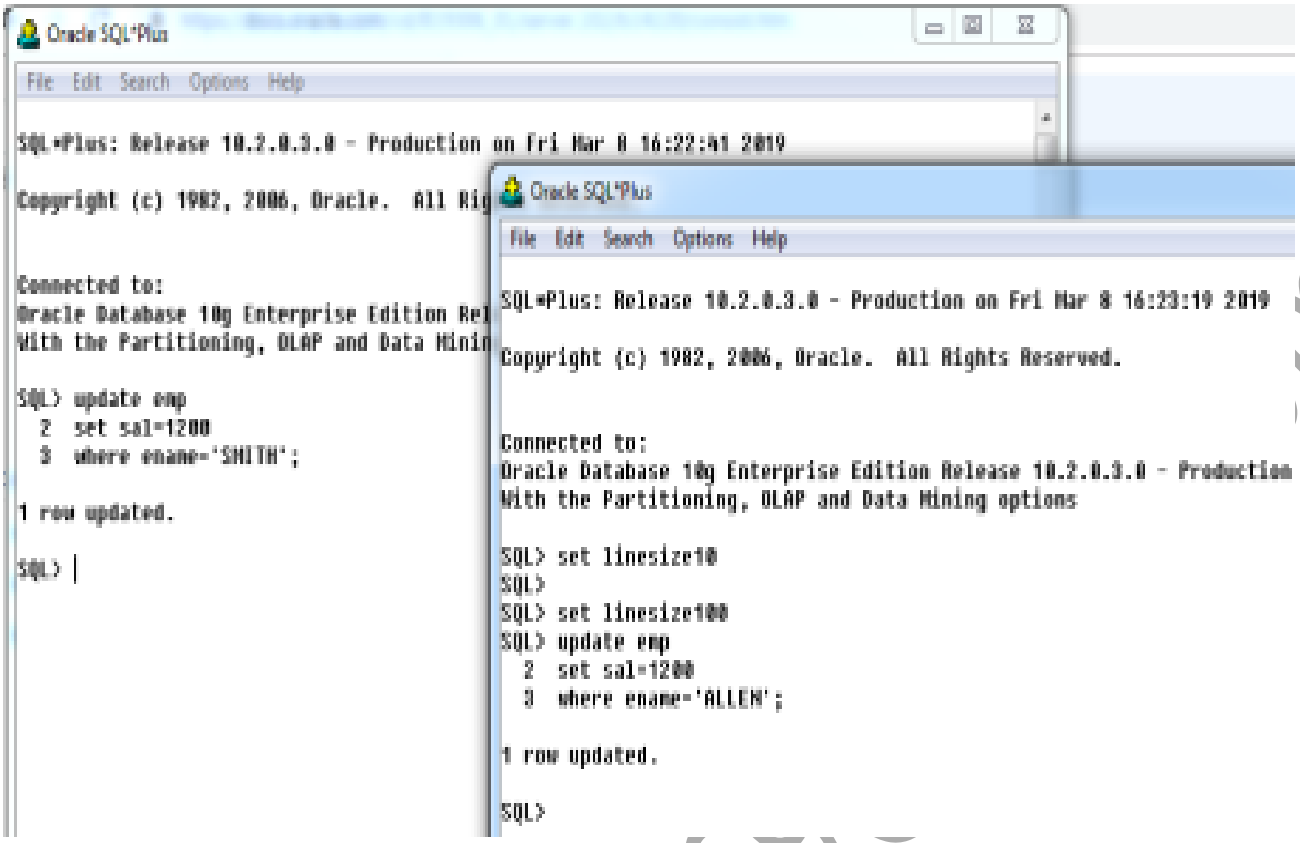

Introduction to Database Administration

TOPIC 243

Deadlocks

Deadlocks

Deadlocks

Database Deadlocks
Deadlocks - Two Transactions
Applying Locks at Table Level
Deadlock - Example
Deadlocks

Database Deadlocks

In a database, a deadlock is a situation in which two or more transactions are waiting for one another to give up locks.

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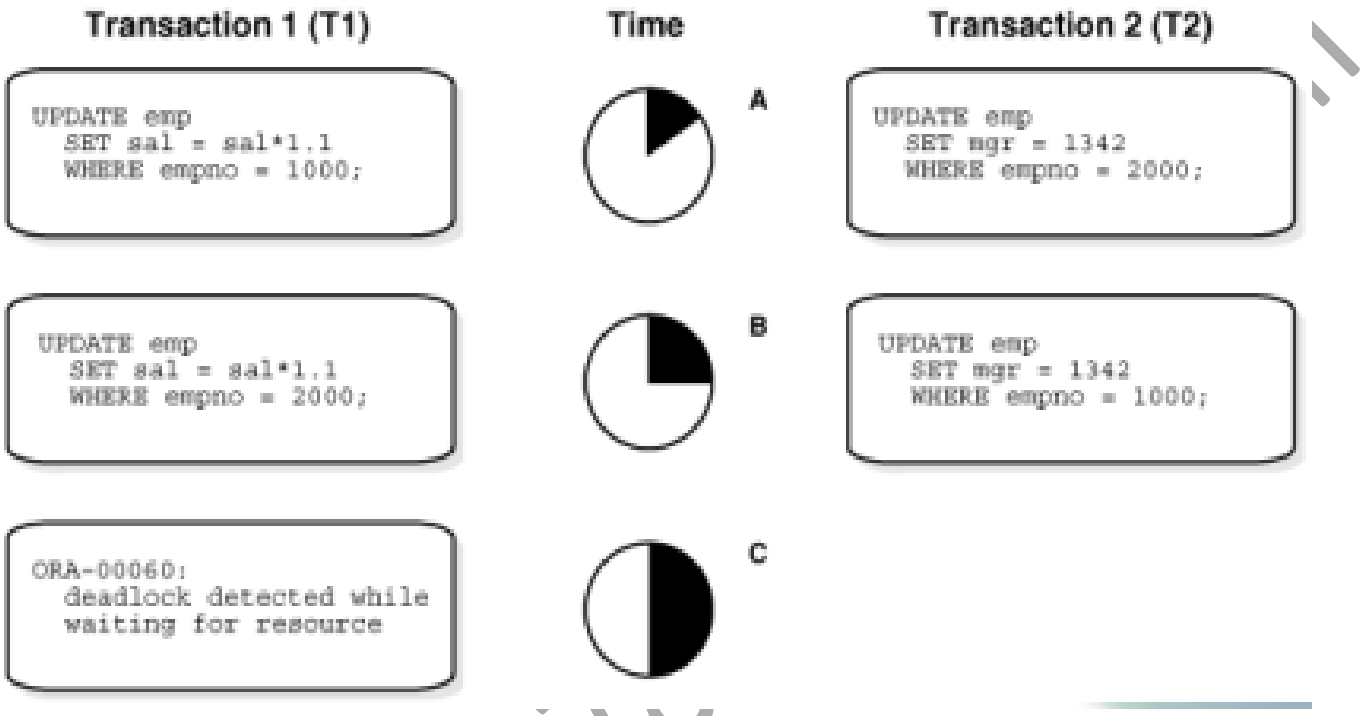
For example, Transaction A might hold a
lock on some rows in the Accounts table and needs to update some rows in the Orders table to finish.

Deadlocks – Two Transactions



Applying Locks at Table Level

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```
--user scott
Lock table dept IN EXCLUSIVE MODE;

--user can use rollback to unlock this table

--user sys
 select object_id, session_id, oracle_username, locked_mode
 from V$Locked_Object;

 OBJECT_ID SESSION_ID ORACLE_USERNAME                LOCKED_MODE
---------- ---------- ------------------------------ -----------
     53768        140 SCOTT                                    6  (Locked applied)
     53768        148 SCOTT                                    0  (Locked in other session)

--in session 148
SQL> update dept
  2  set loc='BOSTON1'
  3  where deptno=40;

----LOCKED-------

How to put in share mode?
Lock table dept in share mode;
```

Deadlock - Example

Tiw	T1	T2
t1	XLek(x)	
t2	..	XLek(y)
t3	Request y	
t4	wait	Request x
t5	wait	wait
t6	wait	wait

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TOPIC 244

DDL Schema Script for Project

DDL Schema Script for Project

DDL Schema Script for Project

Plan the Script for Schema
Sample Script
DDL Schema Script for Project

Plan the Script for Schema

ANSI standard script of SQL consists of Create and Alter Statements
Standard & Additional Constraints
Tables with Tablespace Storage
Database Security
Shared Logical Objects such as Views, Synonyms
Logical & Physical Storage DML - SQL
DDL Schema Script for Project

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```
Drop table employee;
Drop table orders;
Drop table customer;
Drop table Item;

create table Customer
(custID          CHAR(10),
CustName         VARCHAR2(25) NOT NULL,
Address          VARCHAR2(50),
City             VARCHAR2(50),
TelNo            VARCHAR2(15),
Email            VARCHAR2(50) UNIQUE)
tablespace TS_Sales;

Alter table Customer
add constraint PK_Custid primary key (CustID);

Create table Orders
(InvoiceNo       CHAR(12),
InvType          CHAR(1),
InvDate          Date NOT NULL,
TotalPrice       Number(6,2),
SalesEmpID       CHAR(5),
CustID           CHAR(8))
tablespace TS_Sales;

Alter table Orders
add constraint PK_InvNo primary key (InvoiceNO)
USING INDEX TABLESPACE Sale_indx;

Alter table Orders
add constraint FK_Cust_CustID foreign key (custID)
references Customer(CustID);
```

Sample Script

DDL Schema Script for Project

Alter Table with Move on Storage

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```
ALTER TABLE hr.admin_emp MOVE
      STORAGE ( INITIAL 20K
                NEXT 40K
                MINEXTENTS 2
                MAXEXTENTS 20
                PCTINCREASE 0 )
   TABLESPACE hr_tbs;

ALTER TABLE hr.admin_emp
      ADD (bonus NUMBER (7,2));
```

Introduction to Database Administration

TOPIC 245

DDL Schema Script including Tables, Columns and Data Types
DDL Schema Script including Tables, Columns and Data Types

DDL Schema Script including Tables, Columns and Data Types

DDL Script for Schema
Sample Create Table - SQL
Sample Create/ Alter Table with Constraints
Sample Create Table with Additional Constraints
DDL Schema Script including Tables, Columns and Data Types

DDL Script for Schema

Scripts are used to create objects (structures) such as tables, sequences, views and PL/SQL programs etc in a schema. Many script contains DDL SQL.

Script can contain DML for populating data

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for development and testing.

Similarly, structure of schema objects can
be populated using exported DMP file.
DDL Schema Script including Tables, Columns and Data Types

Sample Create Table - SQL

```
CREATE TABLE hr.admin_emp (
        empno      NUMBER(5) PRIMARY KEY,
        ename      VARCHAR2(15) NOT NULL,
        ssn        NUMBER(9) ENCRYPT USING 'AES256',
        job        VARCHAR2(10),
        mgr        NUMBER(5),
        hiredate   DATE DEFAULT (sysdate),
        photo      BLOB,
        sal        NUMBER(7,2),
        hrly_rate  NUMBER(7,2) GENERATED ALWAYS AS (sal/2080),
        comm       NUMBER(7,2),
        deptno     NUMBER(3) NOT NULL
                    CONSTRAINT admin_dept_fkey REFERENCES hr.departments
                    (department_id))
   TABLESPACE admin_tbs
   STORAGE ( INITIAL 50K);

COMMENT ON TABLE hr.admin_emp IS 'Enhanced employee table';
```

DDL Schema Script including Tables, Columns and Data Types

```
Drop table employee;
Drop table orders;
Drop table customer;
Drop table Item;

create table Customer
(custID          CHAR(10),
CustName         VARCHAR2(25) NOT NULL,
Address          VARCHAR2(50),
City             VARCHAR2(50),
TelNo            VARCHAR2(15),
Email            VARCHAR2(50) UNIQUE)
tablespace TS_Sales;

Alter table Customer
add constraint PK_Custid primary key (CustID);

Create table Orders
(InvoiceNo       CHAR(12),
InvType          CHAR(1),
InvDate          Date NOT NULL,
TotalPrice       Number(6,2),
SalesEmpID       CHAR(5),
CustID           CHAR(8))
tablespace TS_Sales;

Alter table Orders
add constraint PK_InvNo primary key (InvoiceNO)
USING INDEX TABLESPACE Sale_indx;

Alter table Orders
add constraint FK_Cust_CustID foreign key (custID)
references Customer(CustID);
```

Sample Create/ Alter Table with Constraints

DDL Schema Script including Tables, Columns and Data Types

Sample Create Table with Additional Constraints

```
create table Employee
(EmpID           CHAR(3),
EmpName          VARCHAR2(25) NOT NULL,
Address          VARCHAR2(50),
City             VARCHAR2(50),
TelNo            VARCHAR2(15),
Email            VARCHAR2(50) UNIQUE,
Status           CHAR(1))
tablespace TS_Sales;

Alter table Employee
add constraint ck_status
check (Status in ('Y', 'N'));

Alter table Employee
add constraint PK_EmpID primary key (EmpID)
USING INDEX TABLESPACE Sale_indx;
```

TOPIC 246

DDL Schema Script including Allocation of Tablespaces with Sizes
DDL Schema Script including Allocation of Tablespaces with Sizes

DDL Schema Script for Tablespaces

Logical & Physical Storage
Data Tablespaces for Tables
Tablespace for Indexes
Temporary Tablespace for Project
DDL Schema Script including Allocation of Tablespaces with Sizes

Logical & Physical Storage

Creating tablespaces for data, indexes
Tablespaces for table or tables
Tablespace with OS level storage
DDL Schema Script including Allocation of Tablespaces with Sizes

Data Tablespaces for Tables

```
Create tablespace MedCare Datafile
    'D:\oracle9i\ora92\oradata\MCare01.dbf' Size 150M online
    MINIMUM EXTENT 64K
    DEFAULT STORAGE (INITIAL 64K NEXT 64K);


Create tablespace MCare_IVF Datafile
     'D:\oracle9i\ora92\oradata\MCIVF01.dbf' Size 50M online
     MINIMUM EXTENT 64K
     DEFAULT STORAGE (INITIAL 64K NEXT 64K);

CREATE TABLESPACE MCare_IVFCHART DATAFILE
    'D:\oracle9i\ora92\oradata\MCare_IVFCHART01.dbf' SIZE 50M
    MINIMUM EXTENT 1024K
    DEFAULT STORAGE (INITIAL 1024K NEXT 1024K);
```

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DDL Schema Script including Allocation of Tablespaces with Sizes

Tablespace for Indexes

```
CREATE TABLESPACE MCare_indx
DATAFILE 'D:\oracle9i\ora92\oradata\MCare_indx01.dbf' SIZE 100M
MINIMUM EXTENT 64K
DEFAULT STORAGE (INITIAL 64K NEXT 64K);
```

DDL Schema Script including Allocation of Tablespaces with Sizes

Temporary Tablespace for Project

```
CREATE TEMPORARY TABLESPACE "TEMP_DEFAULT3" TEMPFILE
    'D:\ORACLE9I\ORA92\ORADATA\eahmed\TEMP_DEFAUL3.DBF' SIZE
    1000M EXTENT MANAGEMENT LOCAL UNIFORM SIZE 1M;

ALTER DATABASE DEFAULT TEMPORARY TABLESPACE "TEMP_DEFAULT3";
```

TOPIC 247

Creation of DML Insert Statements for Data

Creation of DML Insert Statements for Data

DML Schema Script

DDL & DML Script
Sample DML Insert Statements
Sample DML Insert & Update Statements
Creation of DML Insert Statements for Data

DDL & DML Script

One script file can be created to manage DDL & DML commands
Separate files for DDL & DML
DML Insert, Delete and Update commands
All commands are in an order
Well-defined datasets are selected
Creation of DML Insert Statements for Data

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```
insert into customer(
CUSTID,
CUSTNAME,
ADDRESS,
CITY,
TELNO,
EMAIL)
values(
'88700110',
'3M Co',
'41 Main st.',
'Lahore',
'0514568877',
'ejaz@nu.edu.pk'
);

insert into customer(
CUSTID,
CUSTNAME,
ADDRESS,
```

Sample DML Insert Statements

Creation of DML Insert Statements for Data

Sample DML Insert & Update Statements

```
Insert into Customer

...

Update Sold
set qty = (select qty
           from Item
           where ItemID='254011');
```

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TOPIC 248

DDL Schema Script including List of Roles and Privileges

DDL Schema Script including List of Roles and Privileges

Script for Security

Roles & Privileges
Creating User with Grants
DDL Schema Script including List of Roles and Privileges

Roles & Privileges

Create roles
Assign privileges to roles
Assign privileges to users
DDL Schema Script including List of Roles and Privileges

Creating User with Grants

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```
create tablespace work
datafile 'E:\oracle\product\10.2.0\db_2\oradata\work01.dbf'size 500M online;

create user uwork
identified by xyz
default tablespace work
temporary tablespace temp;

grant connect, resource to uwork;
grant create table to uwork;


create tablespace work_indx
datafile 'E:\oracle\product\10.2.0\db_2\oradata\WIndx01.dbf'size 200M online;

create tablespace work_depend
datafile 'E:\oracle\product\10.2.0\db_2\oradata\WDepend01.dbf'size 300M online;
```

DDL Schema Script including List of Roles and Privileges

Creating User with Grants

```
grant select on MED_STOCK  to public;
grant select on TRANSACTION   to public;
grant select on TRANS_DETAIL  to public;


grant select, insert, update on EMP to public;
grant select, insert, update on DEPT to ejaz;
```

TOPIC 249

DDL Schema Script including Synonyms of Tables & Drop of all Objects
DDL Schema Script including Synonyms of Tables & Drop of all Objects

Synonyms & Drop Objects

Generate SQL Script using SELECT Clause
Creating Synonyms
Drop Synonyms
Drop Tables
DDL Schema Script including Synonyms of Tables & Drop of all Objects

Generate SQL Script using Select Clause

```
--Table EMP owner (scott) gives grant:
grant select on emp to u1;
--generate the following SQLs from scott schema and run in u1 schema
select 'create synonym '||tname||' for scott.'||tname||';'
from tab;
```

DDL Schema Script including Synonyms of Tables & Drop of all Objects

Creating Synonyms

```
grant create synonym to u1;
grant create public synonym to u1;
grant create synonym to scott;
grant create public synonym to scott;
```

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DDL Schema Script including Synonyms of Tables & Drop of all Objects

Drop Synonyms

```
--inside same schema of scott:
create public synonym syn_emp for scott.emp;

drop synonym dept;
drop synonym emp;
```

DDL Schema Script including Synonyms of Tables & Drop of all Objects

Drop Tables

```
drop table EMP;
drop table ProjectAssign;
drop table DEPT;
drop project;
```

Introduction to Database Administration

TOPIC 250

Revision of Course Contents

Revision of Course Contents

Revision of DBA Course

Introduction to Database & Architecture
Database Design (Development)
DBA
PL/SQL
Project's Preparations & Scripts
Logical & Physical Storage
Revision of Course Contents

Introduction to Database & Architecture

What is Database?
What is DBMS?
ANSI SPARK 3 Level Architecture
2 & 3 Tiers Client Server Architecture
Keys & Constraints
Revision of Course Contents

Database Design (Development)

What is ER Model?
ER Model Artifacts
ER Mapping & Implementation
Revision of Course Contents

DBA

DBA tasks & responsibilities
Data Dictionary
Oracle Installation & Configuration
Logical & Physical Storage
Backup & Recovery
Database Tuning & Performance
Support & Services
Transaction Processing
Revision of Course Contents

PLSQL

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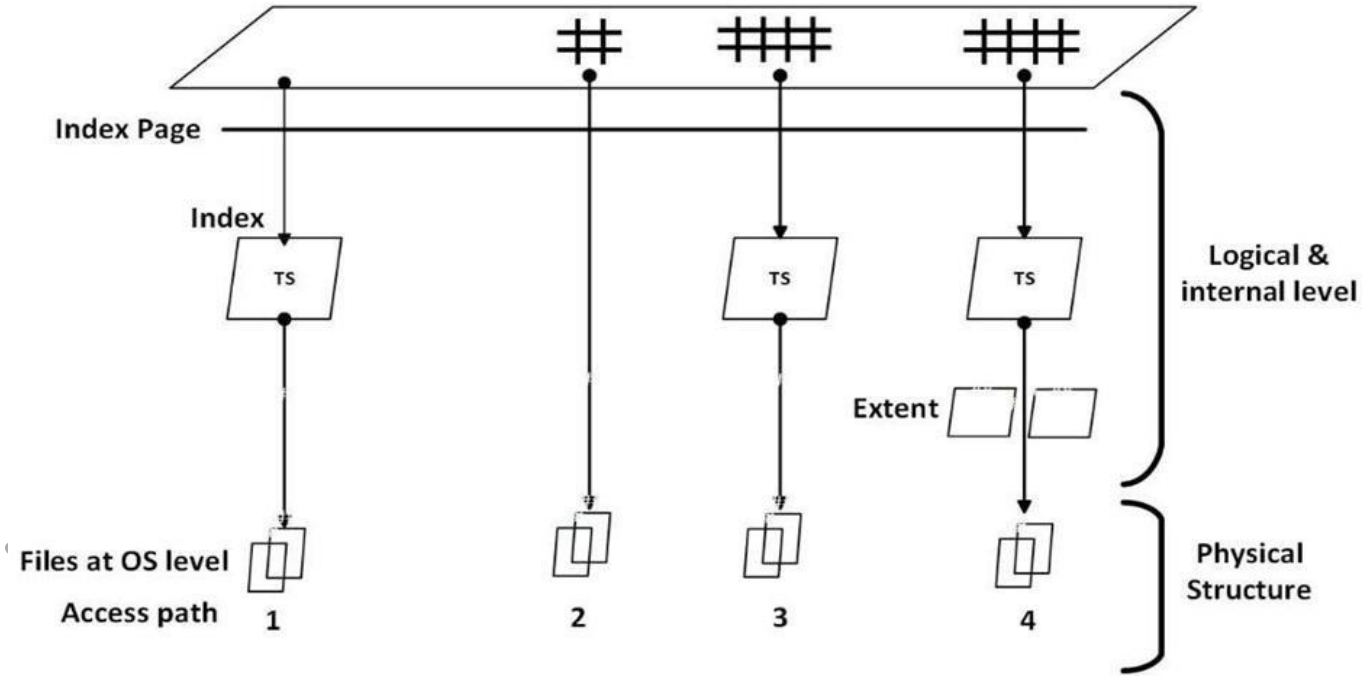
Procedure programming using Blocks
Programming exceptions
Procedures, functions & packages
Cursor and loops
Advance topics using Arrays, Dynamic SQL.
Revision of Course Contents

Project's Preparation and Scripts

Database Mapping or Implementation
Scripts for DDL
Scripts for logical tablespaces
Scripts for Security
Data Migration
Revision of Course Contents

Logical & Physical Storage



THE END

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