

Introducing Oracle

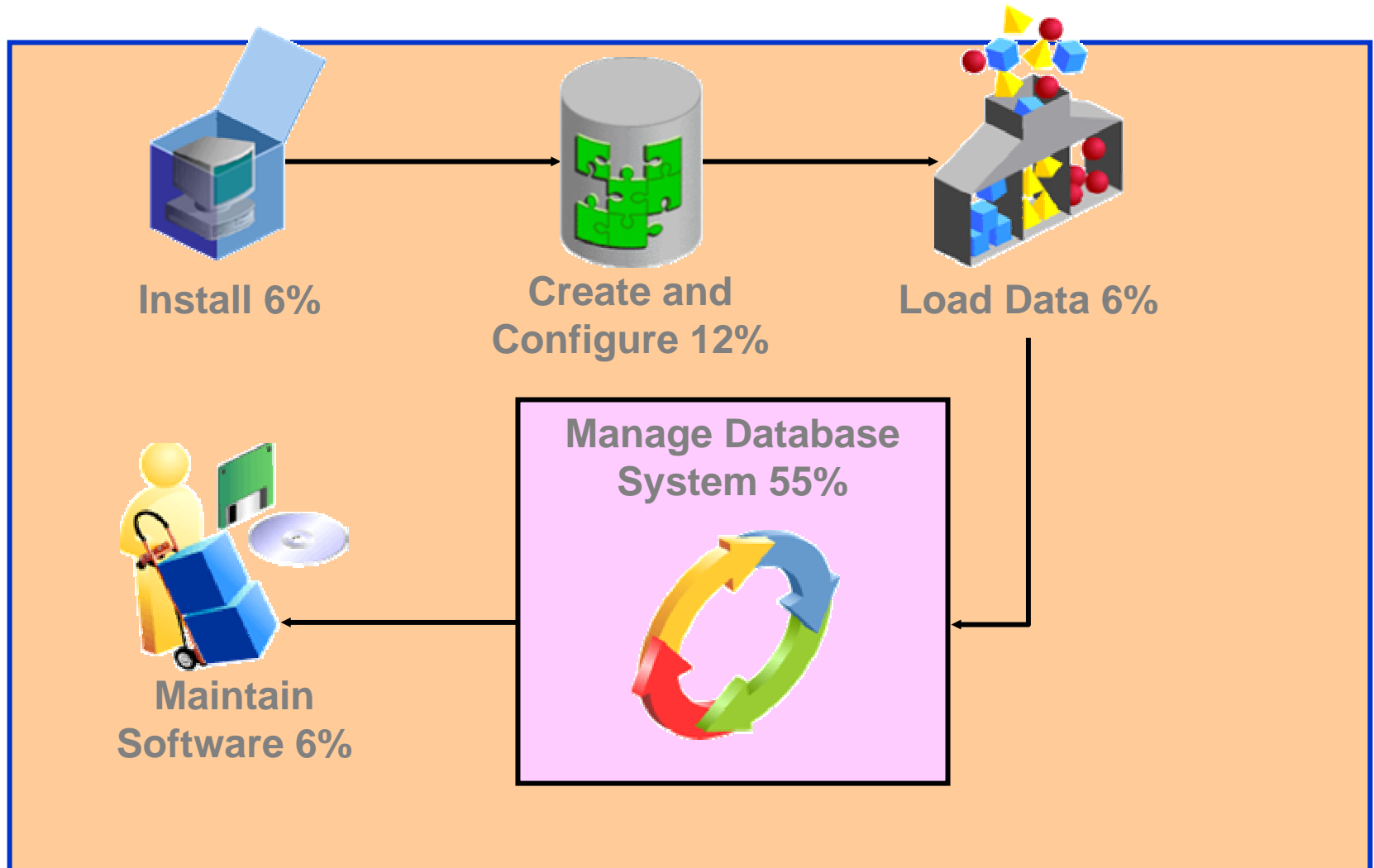
Oracle Database Administration

Objectives

You will learn:

- The different tasks of a DBA.
- The different types of databases.
- To differentiate between the physical and logical structure.
- The functions of the basic Oracle tools.
- The purpose of the Oracle utilities.

How DBAs Spend their Time



Types of Database

- OLTP: Online Transaction Processing
- DSS: Decision Support
- ODS: Operational Data Store
- Data Warehouse

OLTP

- Online Transaction Processing
- Data dependency model
- Many-to-many relationships
- Many-to-one relationships
- If there is more detailed data, it must be better.

ODS: Operational Data Store

- An ODS has been defined as:
 - Subject oriented.
 - Integrated.
 - Volatile.
 - Current valued.
 - Comprised of only corporate detailed data.

Data Warehouse

- A Data Warehouse is a *collection* of integrated, subject-oriented databases designed to support the DSS (decision support) function, where each unit of data is relevant for some moment in *time*.

W. H. Inmon

- The data should be:
 - Well defined
 - Consistent
 - Non-volatile (read-only)

Data Warehouse

- Any information, from anywhere, of anytime, from internal and external data sources.
- This includes operational, historical and legacy data.
- It can also include data from Internet service providers and subscription databases.
- It must include Metadata; data about data.

Data Marts

- A Data Mart is a Data Warehouse.
- It is designed to meet the needs of a specific group of users.

Applications

- Web based
- SQL - sequel
- Embedded SQL - Java, C++, etc.

Oracle DBA

- What is the role of the DBA:
 - Ongoing maintenance
 - Planning, design and development
 - Data Administrator
- New issues:
 - Uptime
 - Backups with shorter windows
 - More visible

DBA Roles

- The systems or operational DBA:
 - Monitors all the production databases, adds users, tablespaces, etc.
 - Advises on the development and implementation of batch processes.
 - Manages nightly loads.

DBA Roles

- The Architect:
 - Works with the application development team.
 - Knows the operational side, in order that solutions can be developed which are easier to maintain.
 - Change management procedures.

DBA Roles

- The Internet DBA:
 - Stores objects in the database.
 - Needs to have web master skills.
 - Needs to have a working knowledge of HTML.
 - Needs to have a working knowledge of JAVA.
 - High Availability: no downtime window.

DBA Roles

- The Application DBA:
 - Develops and implement coding standards.
 - Develops applications.
 - Evaluates new functionality with new releases of the software.
 - Manages PL/SQL.
 - Manages JAVA.

DBA Roles

- The Data DBA is responsible for:
 - Data integrity and cleansing.
 - ETL: Extraction, Transformation and Loading.
 - Advising in the development of metadata.
 - Data warehouse.

DBA Tasks

- Software installation:
 - Setup the initial environment.
 - Advise the system administrators.
- Software additions
- Software upgrades:
 - What are the current releases.
 - Are they stable.

DBA Tasks

- Log TAR's: Technical Action Reports
 - These are requests of Oracle for help.
 - Research the Oracle and other websites for information on the current issue.
- Applying Patches
 - These are not full upgrades.
 - They correct some specific bug or group of bugs.
- System Tuning
 - System level
 - Database level
 - Application level

DBA Tasks

- Database issues
- Move/copy a database
- Development Issues
- Database standards
- Security policies

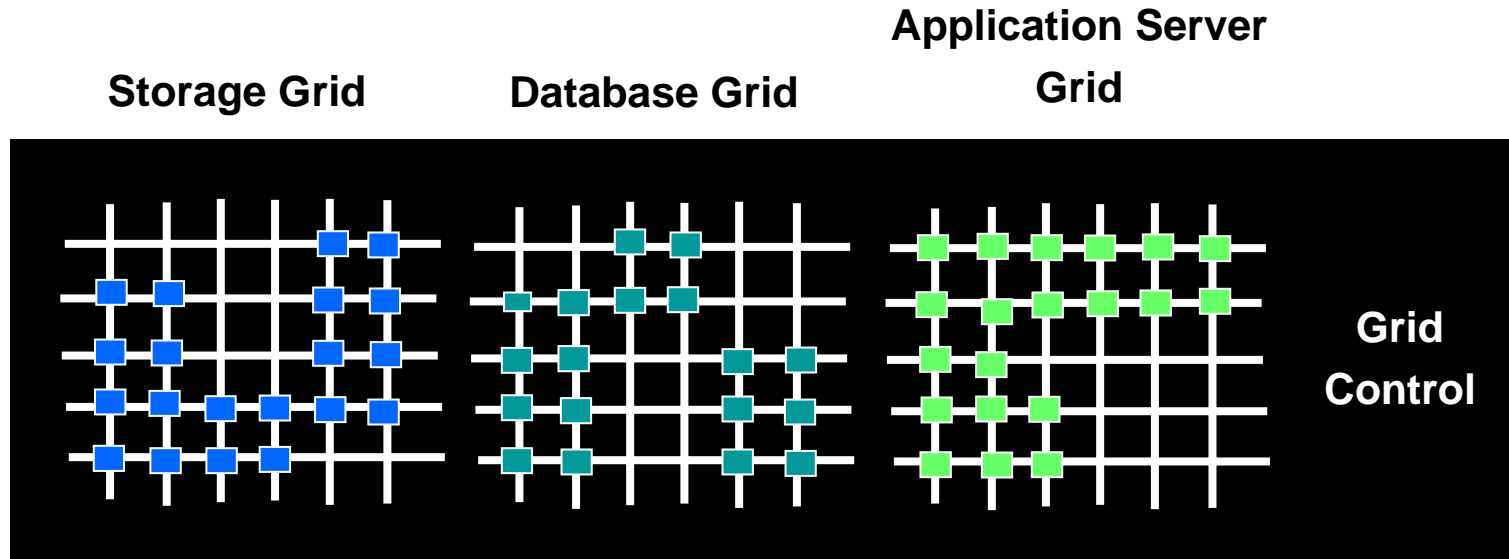
DBA Tasks

- Education of others
- Reading, related technical publications
- Third party software
- Monitoring tools
- Automation

Islands of Computation

- Limited scalability; no resource sharing
- Must be configured for peak loads, when implemented.
- Single points of failure.
- Slow to adjust to the new needs of the business.

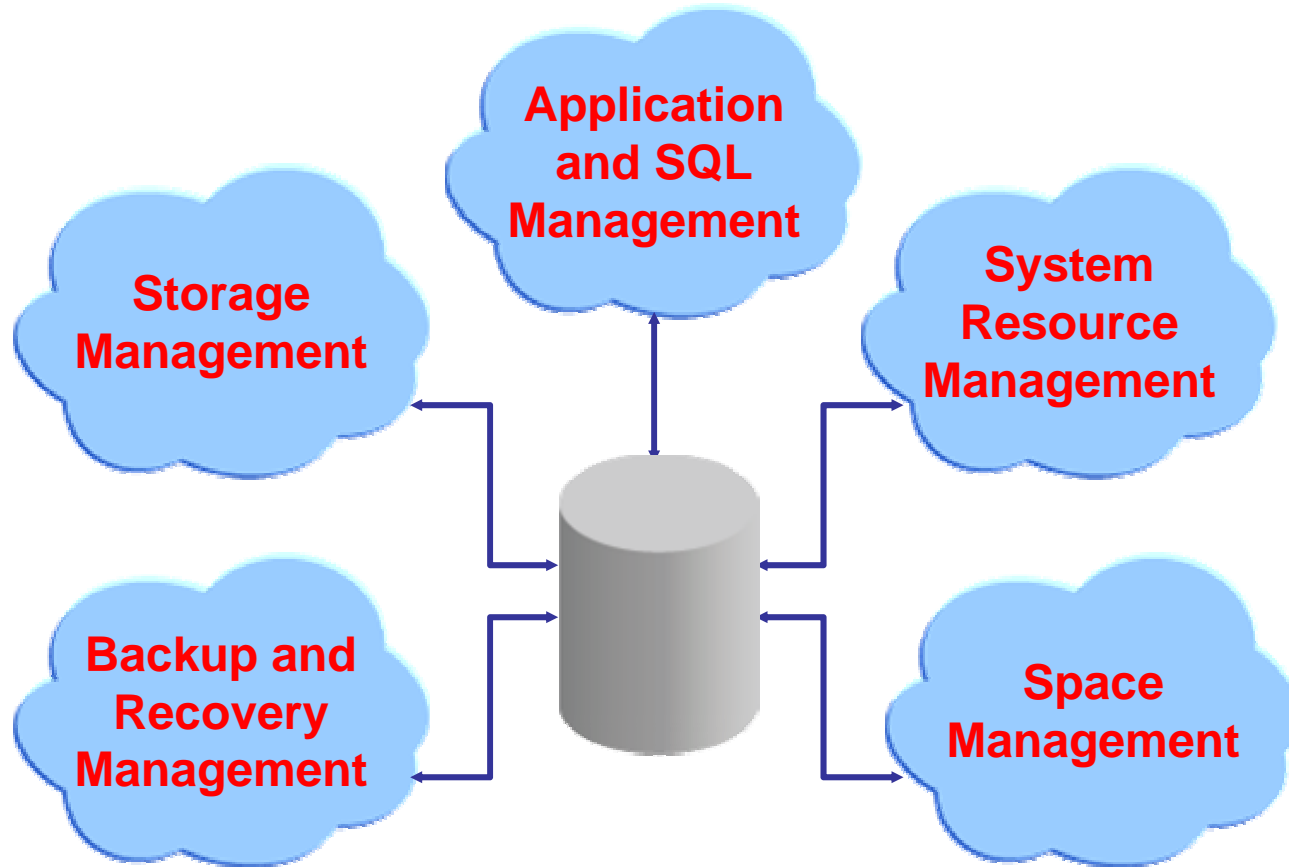
Grid Computing



Grid Vision

- Computing as a utility
 - A network of clients and service providers.
- Client-side: Simplicity
 - Request computation or information and receive it.
- Server-side: Sophistication
 - Availability, reliability, security.
 - Capacity on demand, load balancing.
- Virtualization
 - Nothing more virtual than a utility.
 - Massive potential.

Database Management Challenges



Oracle Grid Architecture

- The Oracle grid architecture pools large numbers of servers, storage, and networks into a flexible, on-demand computing resource for enterprise computing needs.
- The grid computing infrastructure continually analyzes demand for resources and adjusts supply accordingly.
- In this course, the grid topics are not discussed.

Architect a Database

- There are two common ways to architect a database: client/server or multi-tier.
- Client/server architecture
 - The database system is divided into two parts: a front-end or a client, and a back-end or a server.
- Multi-tier architecture
 - A client or initiator process that starts an operation.
 - One or more application servers that perform parts of the operation.
 - An end or database server that stores most of the data used in the operation.

Physical Database Structures

Oracle Database

- An Oracle database is a collection of data treated as a unit.
- The purpose of a database is to store and retrieve related information.
- The database has logical structures and physical structures.
- Because the physical and logical structures are separate, the physical storage of data can be managed without affecting the access to logical storage structures.

Datafiles

- Every Oracle database has one or more physical datafiles.
- The datafiles contain all the database data.
- A datafile can be associated with only one database.
- Datafiles can have certain characteristics set to let them automatically extend when the database runs out of space.
- One or more datafiles form a logical unit of database storage called a tablespace.

Control Files

- Every Oracle database has a control file.
- A control file contains entries that specify the physical structure of the database.
- Every time an instance of an Oracle database is started, its control file identifies the database and redo log files that must be opened for database operation to proceed.

Redo Log Files

- Every Oracle database has a set of two or more redo log files.
- The set of redo log files is collectively known as the redo log for the database.
- The primary function of the redo log is to record all changes made to data.
- If a failure prevents modified data from being permanently written to the datafiles, then the changes can be obtained from the redo log.

Archive Log Files

- Automatic archiving of the redo log can be enabled.
- Oracle automatically archives log files when the database is in ARCHIVELOG mode.

Parameter Files

- Parameter files contain a list of configuration parameters for that instance and database.

Alert and Trace Log Files

- Each server and background process can write to an associated trace file.
- When an internal error is detected by a process, it dumps information about the error to its trace file.

Logical Database Structures

The Logical World

- A tablespace is a logical division of a database.
- Each tablespace is made up of one or more files, called datafiles. A datafile belongs to one tablespace.
- A table is a logical structure, inside a tablespace.

Database Structures

- Three Types:
 - Internal to the database.
 - Internal to the memory: SGA and processes.
 - External to the database.

Internal Database Structures

- Tables
- Indexes
 - It is a partial copy of a table, used to help speed up accessing the data in the table.
- Views
 - A method of looking at “some” of the data in a table or group of tables.

Internal Database Structures

- Procedures:
 - Blocks of PL/SQL statements, called by applications.
 - They do not return a value to the calling program.
- Functions:
 - Similar to a procedure, but can return a value to the calling program.

Internal Database Structures

- Packages
 - These hold procedures and functions in logical groups.
 - A package can have PUBLIC and PRIVATE elements.
 - Public, would be procedures for a USERS usage.
 - Private may be called by other procedures in the package.

Internal Database Structures

- Triggers
 - Procedures that execute when a specific event occurs.
 - Used to augment referential integrity, enforce additional integrity.
 - Statement triggers.
 - Row triggers.

Internal Database Structures

- Sequences
 - Sequential lists of unique numbers.
 - Used as primary keys.
- Users
- Schemas
- Database Links
- Undo Segments: rollback segments.

Tablespaces

- A database is divided into logical storage units called tablespaces, which group related logical structures together.
- Each database is logically divided into one or more tablespaces.
- One or more datafiles are explicitly created for each tablespace to physically store the data of all logical structures in a tablespace.
- Every Oracle database contains a SYSTEM tablespace and a SYSAUX tablespace.

Segments

- A segment is a set of extents allocated for a certain logical structure.
 - Data segment
 - Index segment
 - Temporary segment
 - Rollback segment

Schemas

- A schema is a collection of database objects.
- A schema is owned by a database user and has the same name as that user.
- Schema objects are the logical structures that directly refer to the database's data.
- Schema objects include structures like tables, views, and indexes.

Schemas

- Tables
 - Tables are the basic unit of data storage in an Oracle database.
- Indexes
 - Indexes can be created to increase the performance of data retrieval.
- Views
 - Views are customized presentations of data in one or more tables or other views.
- Clusters
 - Clusters are groups of one or more tables physically stored together because they share common columns and are often used together.
- Synonyms
 - A synonym is an alias for any table, view, materialized view, sequence, procedure, function, package, type, Java class schema object, user-defined object type, or another synonym.

Oracle Data Dictionary

- An Oracle data dictionary is a set of tables and views that are used as a read-only reference about the database.
- A data dictionary is created when a database is created.

Oracle Instance

Oracle Instance

- An Oracle database server consists of an Oracle database and Oracle instance.
- Every time a database is started, a system global area (SGA) is allocated and Oracle background processes are started.
- The combination of the background processes and memory buffers is called an Oracle instance.

Instance Memory Structures

- **System Global Area**
 - The System Global Area (SGA) is a shared memory region that contains data and control information for one Oracle instance. Oracle allocates the SGA when an instance starts and deallocates it when the instance shuts down. Each instance has its own SGA.
- **Database Buffer Cache of the SGA**
 - Database buffers store the most recently used blocks of data. The set of database buffers in an instance is the database buffer cache.
- **Redo Log Buffer of the SGA**
 - The redo log buffer stores redo entries—a log of changes made to the database. The redo entries stored in the redo log buffers are written to an online redo log, which is used if database recovery is necessary.
- **Shared Pool of the SGA**
 - The shared pool contains shared memory constructs, such as shared SQL areas. A shared SQL area is required to process every unique SQL statement submitted to a database.
- **Statement Handles or Cursors**
 - A cursor is a handle or name for a private SQL area in which a parsed statement and other information for processing the statement are kept.
- **Program Global Area**
 - The Program Global Area (PGA) is a memory buffer that contains data and control information for a server process. A PGA is created by Oracle when a server process is started.

Oracle Background Processes

- An Oracle database uses memory structures and processes to manage and access the database.
- Processes are jobs that work in the memory of these computers.
- An Oracle database server has two general types of processes: user processes and Oracle processes.
- User processes are created and maintained to run the software code of an application program
- Oracle processes are invoked by other processes to perform functions on behalf of the invoking process.

Oracle Net Services

Network Connections

- Oracle Net Services is Oracle's mechanism for interfacing with the communication protocols used by the networks that facilitate distributed processing and distributed databases.
- With Oracle Net Services, application developers do not need to be concerned with supporting network communications in a database application.
- Oracle Net, a component of Oracle Net Services, enables a network session from a client application to an Oracle database server.
- Once a network session is established, Oracle Net acts as the data courier for both the client application and the database server.

Starting Up the Database

- The three steps to starting an Oracle database and making it available for system wide use are:
 - Starting an instance.
 - Mounting the database.
 - Opening the database.
- A database administrator can perform these steps using the SQL*Plus STARTUP statement or Enterprise Manager.
- When Oracle starts an instance, it reads the server parameter file (SPFILE) or initialization parameter file to determine the values of initialization parameters. Then, it allocates an SGA, and creates background processes.

Oracle Tools

Enterprise Manager

- Enterprise Manager is a system management tool that provides an integrated solution for centrally managing a heterogeneous environment.
- The following tasks can be performed:
 - Administering the complete Oracle environment, including databases, iAS servers, applications, and services.
 - Diagnose, modify, and tune multiple databases.
 - Schedule tasks on multiple systems at varying time intervals.
 - Monitor database conditions throughout the network.
 - Administer multiple network nodes and services from many locations.
 - Share tasks with other administrators.
 - Launch integrated Oracle and third-party tools.
 - Customize the display of an Enterprise Manager administrator.

SQL*Plus

- SQL*Plus is a tool for entering and running ad-hoc database statements.
- It allows SQL statements and PL/SQL blocks to be run.

Database Backup and Recovery

- Oracle provides various mechanisms for the following:
 - Database recovery required by different types of failures.
 - Flexible recovery operations to suit any situation.
 - Availability of data during backup and recovery operations so users of the system can continue to work.

Security

- Oracle includes security features that control how a database is accessed and used.

For example, security mechanisms which:

- Prevent unauthorized database access.
- Prevent unauthorized access to schema objects.
- Audit user actions.

Application Development

- SQL (pronounced SEQUEL) is the programming language that defines and manipulates the database.
- DDL: Data Definition Language statements
 - These statements create, alter, maintain, and drop schema objects. DDL statements also include statements that permit a user to grant other users the privileges to access the database and specific objects within the database.
- DML: Data Manipulation Language statements
 - These statements manipulate data.
- Transaction Control Statements
 - Manage the changes made by DML statements.

Utilities

- Data Pump Export and Import
- SQL*Loader
- External Tables
- LogMiner
- DBVERIFY Utility
- DBNEWID Utility