Introduction to Oracle RDBMS

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What’s a Relational Database?

- Data is represented as Entities and Relationships
- Entities
  - Attributes
- Relationships
  - One-to-One
  - One-to-Many
  - Many-to-many
Logical Design
Logical Design Example

Department

<table>
<thead>
<tr>
<th>dept_no</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
</tr>
</tbody>
</table>

Employee

<table>
<thead>
<tr>
<th>emp_no</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
</tr>
<tr>
<td>address</td>
</tr>
<tr>
<td>soc_sec_no (AK)</td>
</tr>
<tr>
<td>hire_dt</td>
</tr>
<tr>
<td>salary</td>
</tr>
<tr>
<td>hourly_rate</td>
</tr>
<tr>
<td>dept_no (FK) (IE)</td>
</tr>
</tbody>
</table>

Project

<table>
<thead>
<tr>
<th>proj_no</th>
</tr>
</thead>
<tbody>
<tr>
<td>name (AK)</td>
</tr>
</tbody>
</table>

Project_Employee

<table>
<thead>
<tr>
<th>emp_no</th>
</tr>
</thead>
<tbody>
<tr>
<td>proj_no (FK)</td>
</tr>
<tr>
<td>emp_no (FK)</td>
</tr>
</tbody>
</table>

Employee_Project

<table>
<thead>
<tr>
<th>emp_no</th>
</tr>
</thead>
<tbody>
<tr>
<td>proj_no (FK)</td>
</tr>
<tr>
<td>emp_no (FK)</td>
</tr>
</tbody>
</table>
Physical Design
Database Objects

- **Tables**
  - Rows and Columns
  - Constraints
    - PK: Primary Keys
    - UK: Unique Keys/Alternate Keys
    - FK: Foreign Keys
    - CK: check Constraints
- **Triggers**
  - Auto execution of code based on Table action (Insert, Update, Delete)
Database Objects (contd.)

- **Indexes**
  - Unique
  - Non-unique

- **Views**
  - Logical Views of data

- **Object Tables**

- **Object Type**

- **Stored Procedures/Functions**
  - Server side code
Database Object Placement

- Tablespaces
  - System
  - Rollback
  - Temporary
  - Application data
  - Redo Logs

- Data Files
  - Physical placement of tablespaces
Object Creation and Data Manipulation
**Data Manipulation**

- **DDL – Data Definition Language**
  - CREATE Table/Index/Procedure/Function/Trigger
  - ALTER Table/Index

- **DML – Data Manipulation Language**
  - INSERT, UPDATE, DELETE
  - SELECT
    - SELECT <select list>
    - FROM <table list>
    - WHERE <filters>
    - ORDER BY <sort list>
Transaction Control

- Rollback Segments
  - Logs uncommitted changes, in case they need to be undone

- Redo Logs
  - Logs data block changes, in case of database recovery

- Commit

- Rollback
Database Access/Security

- **System Privileges**
  - Create session, create table, alter table, select any table, ...

- **Object Privileges**
  - Select, Insert, Update, Delete, Alter, ...

- Can group privs into roles
  - Connect, resource, DBA, ...

- **Highest access level**: internal or sys
- **Lowest access level**: no privs
Oracle Configuration
Physical Configuration

Env variables:
- ORACLE_BASE
- ORACLE_HOME
- ORACLE_SID
- PATH: $ORACLE_HOME/bin
- LD_LIBRARY_PATH: $ORACLE_HOME/lib

Initialization parameters
- $ORACLE_HOME/dbs
Physical Configuration

- Admin directory structure
  - $ORACLE_BASE/admin/<sid>/
  - create, pfile, bdump, cdump, udump
  - alert_<sid>.log
- /u*/oradata/<sid>/
  - data files: <tablespace name>xx.dbf
  - control files: *.ctl
  - redo logs: *.log
- archive logs: arch*.log
Client/Server Communication
Client/Server Communication

- **Server:**
  - Listener.ora
  - Listener process

- **Client:**
  - Sqlnet.ora
  - Tnsnames.ora

- **Oracle Names**
Data Transfer

CLIENT

Request

Sql*Net

Transport Layer (TCP/IP)

SERVER

Request

Sql*Net

Transport Layer (TCP/IP)
Oracle Memory Structures
Memory Use

- Shared Memory
  - Data cache
  - Sql stmt Cache
  - Data Dictionary Cache

- Private Memory
  - Heap
  - Sort Area
Oracle Processes
Background Processes

- *Pmon* (process monitor)
- *Smon* (system monitor)
- *Dbwr* (database writer)
- *Ckpt* (checkpoint)
- *Lgwr* (log writer)
- *Reco* (recovery)
- *Pxx* (parallel query)
- *Snp* (snapshot/job)
- *Arch* (archiver)
Other Processes

- **Listener**
  - Listens for connections and spawns server processes

- **Server Processes**
  - Receive client requests, process requests and serve results
  - One per connection (unless MTS)
Questions?