References :

1) Hassan A. Afyouni, “Database Security and Auditing”, Third Edition, Cengage Learning, 2009

2) Charu C. Aggarwal, Philip S Yu, “Privacy Preserving Data Mining”: Models and Algorithms, Kluwer Academic Publishers, 2008

3) Ron Ben Natan, ”Implementing Database Security and Auditing”, Elsevier Digital Press, 2005.

15CS338E – DATABASE SECURITY AND PRIVACY

UNIT II : ADMINISTRATION OF USERS & PROFILES, PASSWORD POLICIES,PRIVILEGES AND ROLES

- ✔ Administration of Users
  - Introduction
  - Authentication
  - Creating Users
- ✔ SQL Server
  - User Removing
  - Modifying Users
  - Default Users
- ✔ Remote Users
- ✔ Database Links
- ✔ Linked Servers
- ✔ Remote Servers
- ✔ Practices for administrators and Managers- Best Practices
- ✔ Profiles, Password Policies, Privileges and Roles
  - Introduction
  - Defining and Using Profiles
  - Designing and Implementing Password Policies
- ✔ Granting and Revoking User Privileges
- ✔ Creating, Assigning and Revoking User Roles-Best Practices

Administration of Users

- ✔ Introduction
  - Authentication and Authorization are essential services for every OS
  - Another service is Administration of Users
  - Administrators use this functionality
    - Creating users
    - Set Password Policies
    - Grant privileges

Documentation of User Administration

- ✔ At every type of organization, many security violations are caused by negligence and ignorance and in particular by failing to consider documentation
- ✔ Documentation is a main part of administration process
- ✔ There top three excuses for failing to incorporate documentation
  - Lack of Time
  - Belief that the administration process is already in documented in the system
  - Reluctance to complicate a process that is simple
- ✔ Everything is documented for two reasons
  - To provide a paper trail to retrace exactly what happened when breach of security occurs
  - To ensure administration consistency

Documentation of User Administration …

Documentation in Administration context includes the following

- ✔ Administration Policies
  - Documentation includes all policies for handling new and terminated employees, managers, system and database administrator, database managers, operation managers, and human resources.
  - A detailed document should describe guidelines for every task that is required for all common administrative situations.
- ✔ Security Procedures
  - This is an outline of a step-by-step process for performing administrative task according to company policies.
- ✔ Procedures implementation scripts and programs
  - This is documentation of any script or program used to perform an administrative task.
  - This includes user's manual and operational manual

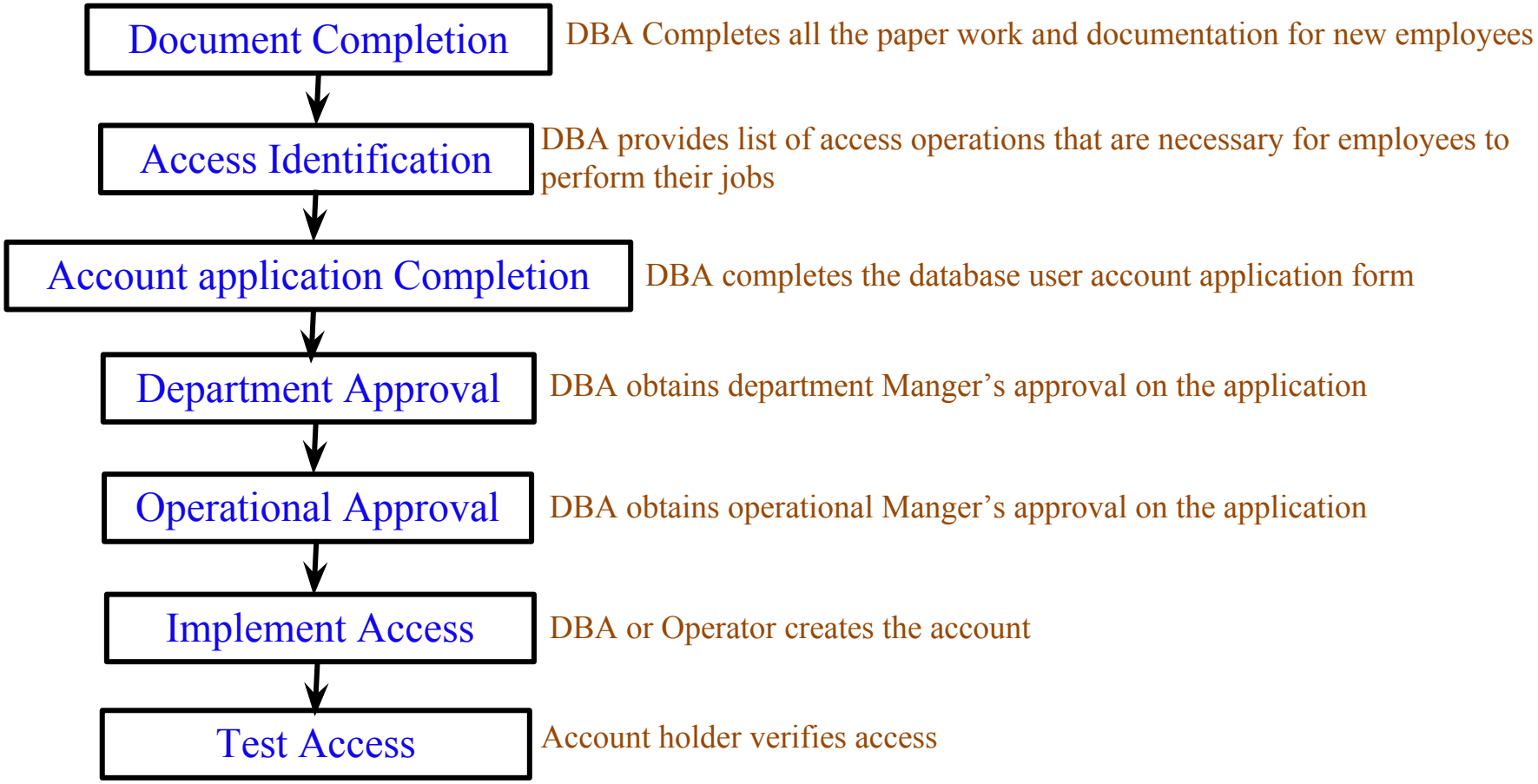
Documentation of User Administration …

Documentation in Administration context includes the following …

- ✔ Predefined roles description
  - This provides the full description of all predefined roles, outlining all tasks for which the role is responsible and the role's relationship to other roles
- ✔ Administration staff and management
  - This is usually a detailed description of each administration staff and management position.
  - This document includes an organizational chart.

Documentation of User Administration …

Many companies develop procedures and forms used to perform any security-related process. The following figure presents a sample process of creating a database user account that you can customize per your business requirements and company policies.

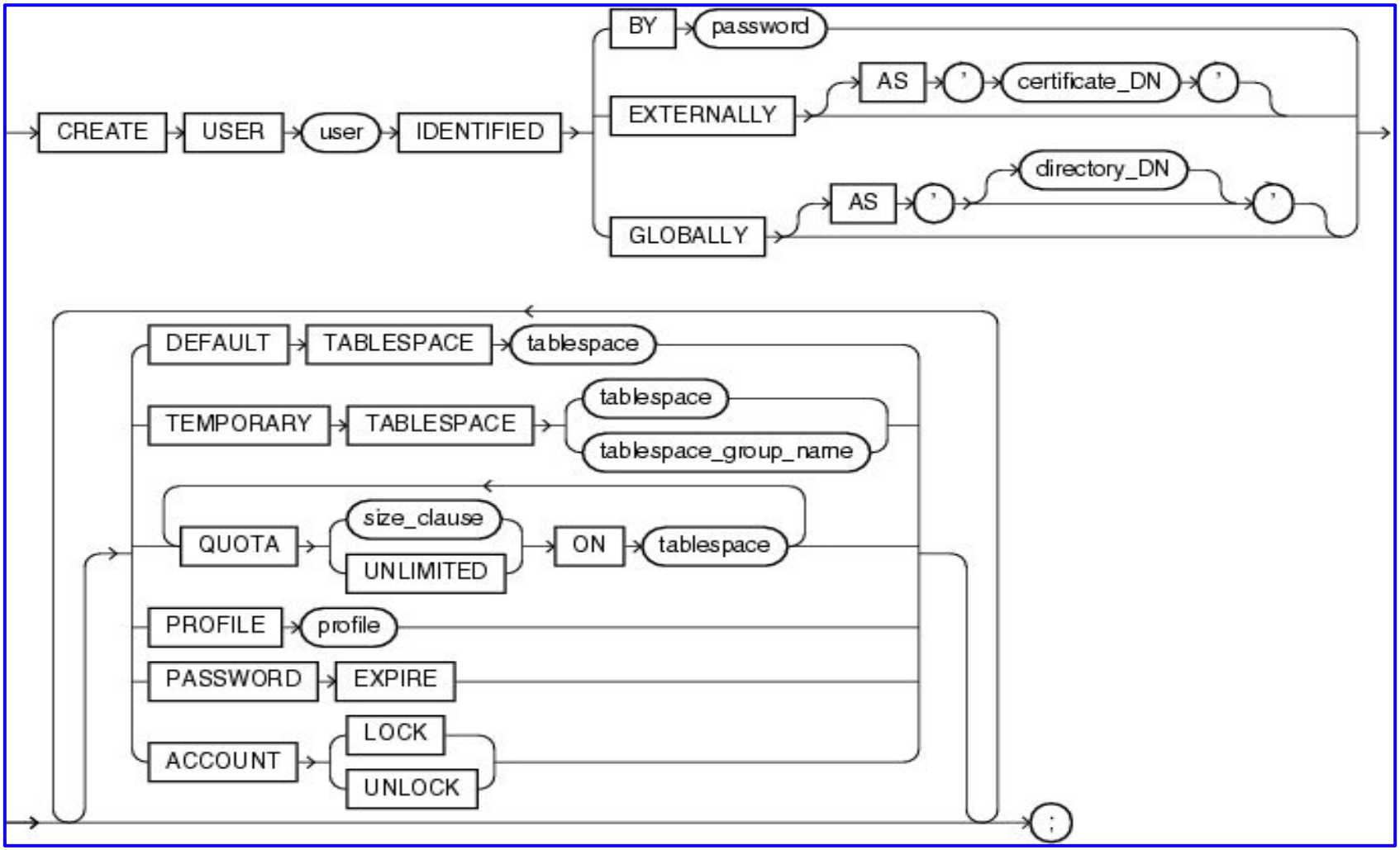


Creating users

- ✔ Creating users is one of the main tasks you will perform as a database operator or DBA
- ✔ In most organization , this process is standardized , well documented, and surely managed
- ✔ The DBA had written a script to create a user for every developer working on the project
- ✔ This script granted privileges to read and write data to the database scheme
- ✔ Regardless of the database you use , creating the user is generally an easy task once a policy is documented and followed

Creating users …

Creating an ORACLE 10g User



Creating users …

user

- ✔ Specify the name of the user to be created. This name can contain only characters from your database character set and must follow the rules described in the section "Schema Object Naming Rules". Oracle recommends that the user name contain at least one single-byte character regardless of whether the database character set also contains multibyte characters.

IDENTIFIED Clause

- ✔ The IDENTIFIED clause lets you indicate how Oracle Database authenticates the user.

BY password

- ✔ The BY *password* clause lets you creates a **local user** and indicates that the user must specify *password* to log on to the database. Passwords are case sensitive. Any subsequent CONNECT string used to connect this user to the database must specify the password using the same case (upper, lower, or mixed) that is used in this CREATE USER statement or a subsequent ALTER USER statement. Passwords can contain any single-byte, multibyte, or special characters, or any combination of these, from your database character set

EXTERNALLY Clause

- ✔ Specify EXTERNALLY to create an **external user.** Such a user must be authenticated by an external service, such as an operating system or a third-party service. In this case, Oracle Database relies on authentication by the operating system or third-party service to ensure that a specific external user has access to a specific database user.

Creating users …

AS '*certificate_DN*'

- ✔ This clause is required for and used for SSL-authenticated external users only. The *certificate_DN* is the distinguished name in the user's PKI certificate in the user's wallet.

GLOBALLY Clause

- ✔ The GLOBALLY clause lets you create a global user. Such a user must be authorized by the enterprise directory service (Oracle Internet Directory).

DEFAULT TABLESPACE Clause

- ✔ Specify the default tablespace for objects that the user creates. If you omit this clause, then the user's objects are stored in the database default tablespace. If no default tablespace has been specified for the database, then the user's objects are stored in the SYSTEM tablespace.

- ✔ Restriction on Default Tablespaces You cannot specify a locally managed temporary tablespace, including an undo tablespace, or a dictionary-managed temporary tablespace, as a user's default tablespace.

Creating users …

TEMPORARY TABLESPACE Clause

- ✔ Specify the tablespace or tablespace group for the user's temporary segments. If you omit this clause, then the user's temporary segments are stored in the database default temporary tablespace or, if none has been specified, in the SYSTEM tablespace.
- ✔ Specify *tablespace* to indicate the user's temporary tablespace.
- ✔ Specify *tablespace_group_name* to indicate that the user can save temporary segments in any tablespace in the tablespace group specified by *tablespace_group_name*.
- ✔ Restrictions on Temporary Tablespace
  - This clause is subject to the following restrictions:
  - The tablespace must be a temporary tablespace and must have a standard block size.
  - The tablespace cannot be an undo tablespace or a tablespace with automatic segment-space management.

Creating users …

- ✔ QUOTA Clause
  - Use the QUOTA clause to specify the maximum amount of space the user can allocate in the tablespace.
  - A CREATE USER statement can have multiple QUOTA clauses for multiple tablespaces.
  - UNLIMITED lets the user allocate space in the tablespace without bound.
  - Restriction on the QUOTA Clause You cannot specify this clause for a temporary tablespace.
- ✔ PASSWORD EXPIRE Clause
  - Specify PASSWORD EXPIRE if you want the user's password to expire. This setting forces the user or the DBA to change the password before the user can log in to the database.
- ✔ ACCOUNT Clause
  - Specify ACCOUNT LOCK to lock the user's account and disable access. Specify ACCOUNT UNLOCK to unlock the user's account and enable access to the account.

Creating users …

- The following create user statement implements the creation of user called bmnantha

```
SQL> CREATE USER bmnantha IDENTIFIED BY bmnantha23
  2  DEFAULT TABLESPACE  users
  3  TEMPORARY TABLESPACE temp
  4  QUOTA 25M ON users
  5  PROFILE default
  6  PASSWORD EXPIRE
  7   ACCOUNT UNLOCK
  8  /
User created
```

- Once the user is created you can modify a user account with an ALTER USER statement using clause listed in the previous example

DBA_USERS View

- DBA_USERS describes all users of the database.

Column	Datatype	NULL	Description
USER NAME	VARCHAR2(30)	NOT NULL	Name of the user
USER_ID	NUMBER	NOT NULL	ID number of the user
PASSWORD	VARCHAR2(30)		This column is deprecated in favor of the AUTHENTICATION_TYPE column
ACCOUNT_ STATUS	VARCHAR2(32)	NOT NULL	Account status: ✔ OPEN ✔ EXPIRED ✔ EXPIRED(GRACE) ✔ LOCKED(TIMED) ✔ LOCKED ✔ EXPIRED & LOCKED(TIMED) ✔ EXPIRED(GRACE) & LOCKED(TIMED) ✔ EXPIRED & LOCKED ✔ EXPIRED(GRACE) & LOCKED

DBA_USERS View …

Column	Datatype	NULL	Description
LOCK_DATE	DATE		Date the account was locked if account status was LOCKED
EXPIRY_DATE	DATE		Date of expiration of the account
DEFAULT_TABLESPACE	VARCHAR2(30)	NOT NULL	Default tablespace for data
TEMPORARY_TABLESPACE	VARCHAR2(30)	NOT NULL	Name of the default tablespace for temporary tables or the name of a tablespace group
CREATED	DATE	NOT NULL	User creation date
PROFILE	VARCHAR2(30)	NOT NULL	User resource profile name
INITIAL_RSRC_CONSUMER_GROUP	VARCHAR2(30)		Initial resource consumer group for the user

DBA_USERS View …

Column	Datatype	NULL	Description
EXTERNAL_ NAME	VARCHAR2(4000)		User external name
PASSWORD_ VERSIONS	VARCHAR2(8)		Database version in which the password was created or changed
EDITIONS_ ENABLED	VARCHAR2(1)		Indicates whether editions have been enabled for the corresponding user (Y) or not (N)
AUTHENTICATI ON_TYPE	VARCHAR2(8)		Indicates the authentication mechanism for the user: ✔ EXTERNAL - CREATE USER *user1* IDENTIFIED EXTERNALLY; ✔ GLOBAL - CREATE USER *user2* IDENTIFIED GLOBALLY; ✔ PASSWORD - CREATE USER *user3* IDENTIFIED BY *user3*;

Creating a SQL Server User

- To create a login id in SQL server can be member of SYSTEMADMIN OR SECURITYADMIN
- There are two types of login IDs:
  - Windows Integrated (Trusted) Logins
    - User can associate a Microsoft Windows account or group with either the server in which SQL Server is installed or the domain in which the server is a member
  - SQL Server Login

Creating a SQL Server User …

Creating Windows integrated Logins

- From the command Line

  To create a new login associated with a Window account (Windows Integrated) , in the Query Analyser tool use the SP_GRANTLOGIN system Procedure .

- The syntax is as follows:

```
sp_grantlogin [@login =] 'login'
```

- The login syntax is the fully qualified name of the Windows user account in the form of *machine_name\user_name* for local Windows users.
- *domain\username* for Windows domain accounts.
- Windows integrated login can also be associated can also be associated with windows groups on either the local server or domain

Creating a SQL Server User …

For example,

- ✔ If you have a local windows account named ‘bmnantha’ on the SQL Server itself where the server name is myserver, you enter the following

```
exec sp_grantlogin ‘myserver\bmnantha’
```

- ✔ For windows domain account named ‘manish’ in the mydomain, you are entering the following

```
exec sp_grantlogin ‘mydomain\manish’
```

- ✔ To associate local windows group called SQL_DBA , you are entering

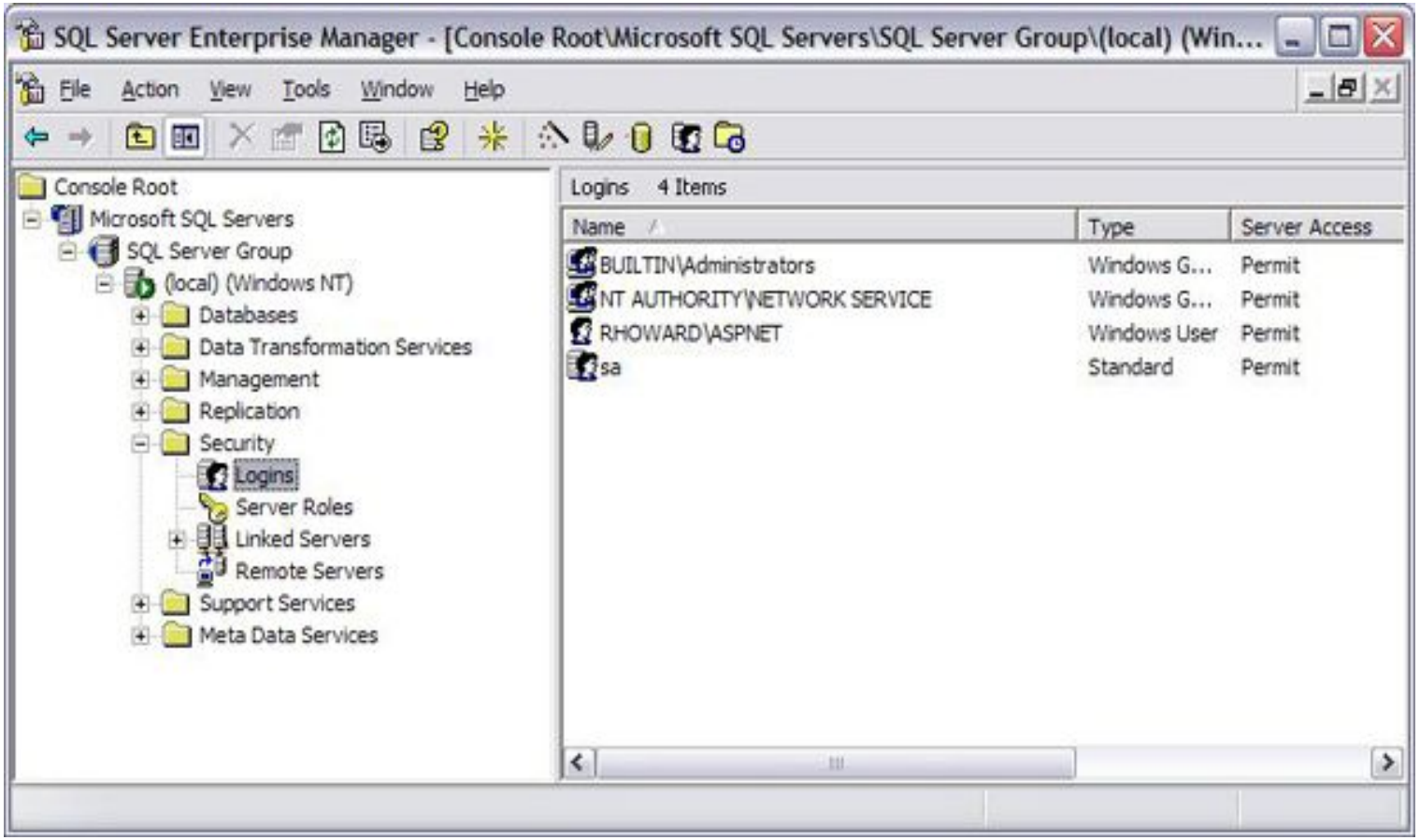
```
exec sp_grantlogin ‘myserver\sql_dba
```

- ✔ NOTE : A login must be between 1 to 128 characters in length and cannot contain any spaces.

Creating a SQL Server User from Enterprise Manager

To create a new login associated with a Windows account (Windows Integrated) in Enterprise Manager, take the following steps

1. Open Enterprise Manager



SQL Serve Login …

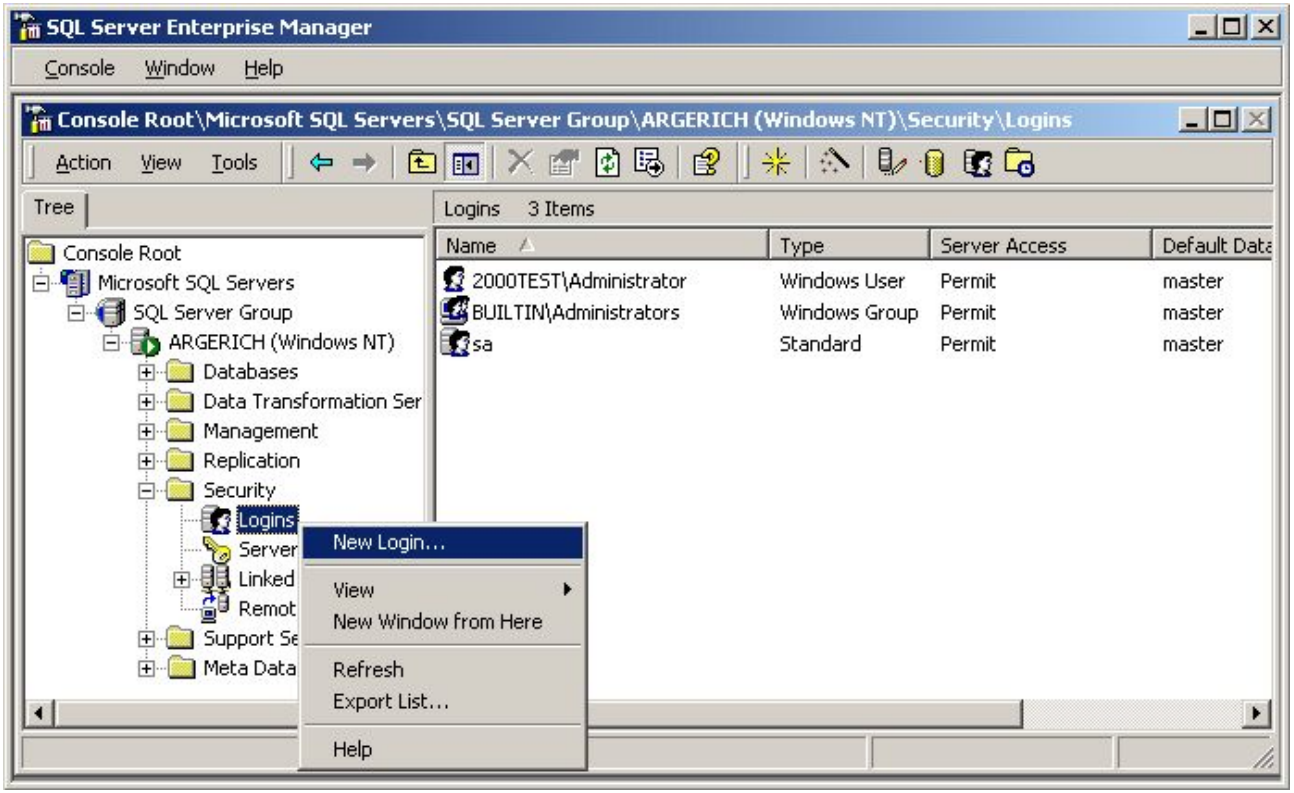
2. Expand the server group in which your server is functioning

3. Expand the server you want to create the login for

4. Expand the security container

5. Click Logins

6. On the menu bar , click action , then click new login



SQL Serve Login …

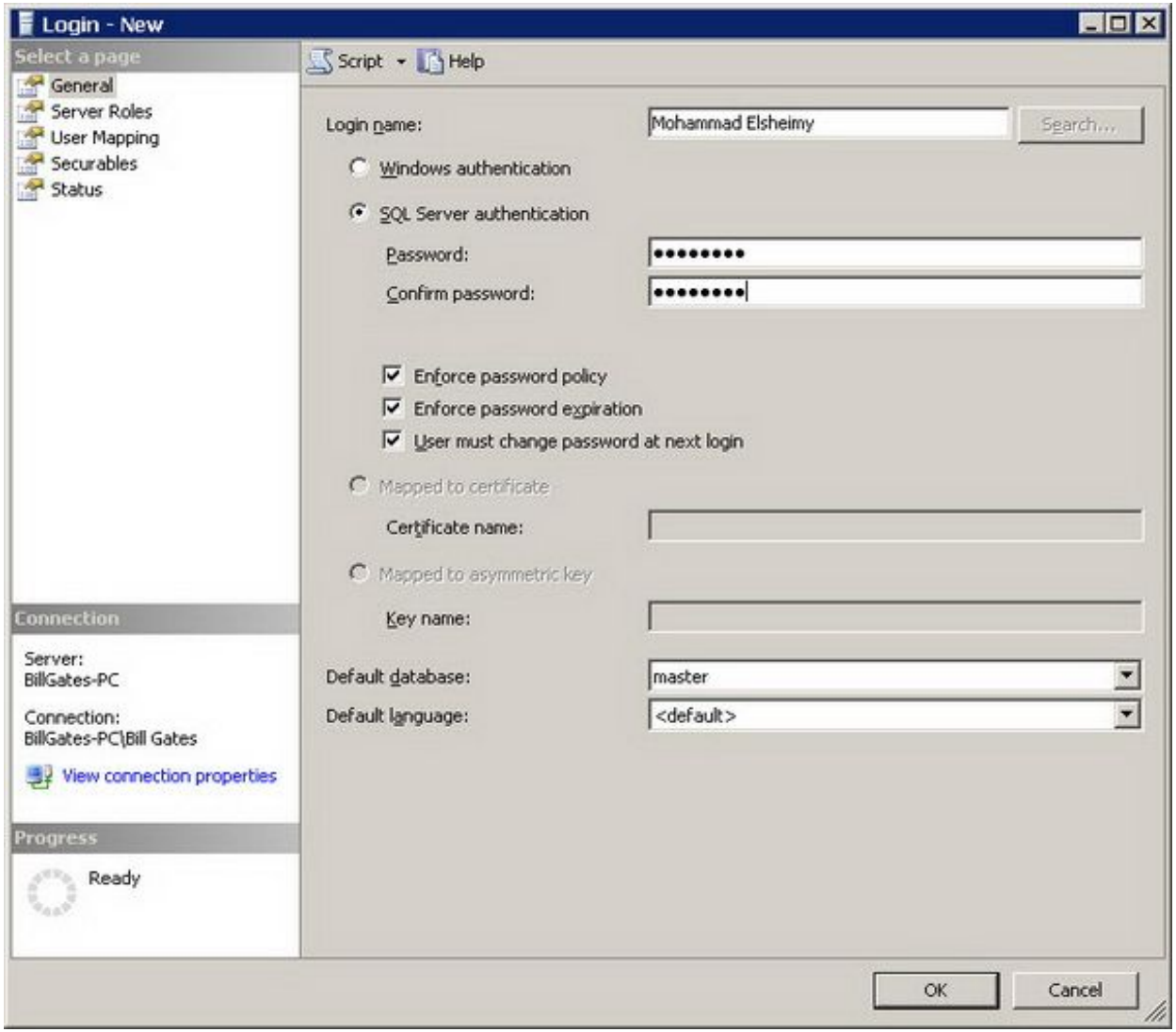
7. Type the name of user

8. Depending on the type of Windows account you are creating , select either the local server name or the domain name from the domain drop-down list. Enterprise Manager automatically fills in the machine or domain name in front of the username
9. Select the default database for the login from the Database drop-down list.

10. Select the default language for the login from the language drop-down list.

SQL Serve Login …

11. Click OK



SQL Serve Login …

- The second type of login is a SQL Server Login, sometimes called a SQL Server active login.
- This login associated with a windows account, instead , it is a security account created within SQL Server itself.
- Creating SQL Server Logins from command line
  - To create a SQL Server login from the Query analyzer , you use the SP_ADDLOGIN system stored procedure.
  - The syntax is as follows :

```
sp_addlogin [@loginame = ] 'login'
[ , [ @passwrd = ] 'password' ]
[ , [ @dbdef=] 'database']
[ , [ @deflanguage = ] 'language']
[ , [ @sid =] sid]
[ , [ @encryptopt =] 'encryption_opotion']
```

@loginame – choose for the login
@dbdef – Name of the default database for the user, The default is NULL
@deflanguage – The default language for the user.
The default is the current default language of the SQL Server Instance
@sid – Security Identification Number (SID).
The default is NULL, if it is NULL SQL Server
automatically generates SID for the login
@encryptopt – Specifies weather or not to encrypt the password in the database

SQL Serve Login …

For example

- ✔ To create a SQL Server login named ‘bmnantha’ with password ‘manish’ you issue the following command

```
exec sp_addlogin ‘bmnantha’ , ‘manish’
```

- ✔ To specify a default database of Northwind for bmnantha, enter the following

```
exec sp_addlogin ‘bmnantha’, ‘manish’, ‘Northwind’
```

SQL Serve Login …

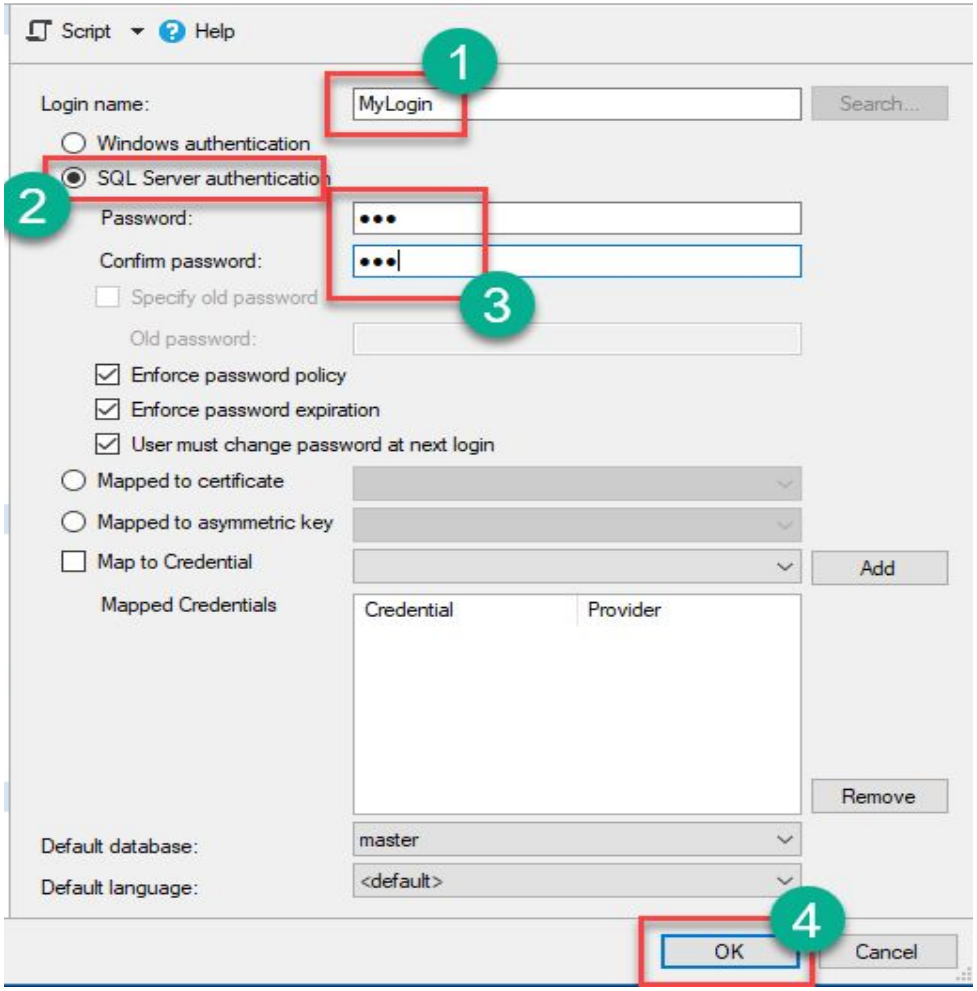
From Enterprise Manager

To create a new SQL Server login in Enterprise Manager , follow these steps

1. Open Enterprise Manager
2. Expand the server group your is in
3. Expand the server you want to create the login for.
4. Expand the Security container
5. Click Logins
6. On the menu bar , Click Action, then click New Login
7. Type the name of the user, in this case , bmnantha
8. Click the SQL Server Authentication option button
9. Provide a password for the user in the password textbox. The password is marked as you type
10. Click OK

SQL Serve Login …

The following figure gives the Server login properties – new login screen (Latest Version)



Removing Users

- Removing an ORACLE User

  SQL > DROP USER SCOTT;
  User Dropped

- If the user does not have any objects , the command is successfully executed. If the user own any objects CASECADE option should be used

  SQL> DROP USER SCOTT CASCADE;
  User Dropped

- SQL Server: Removing Windows Integrated Logins
  From the command Line : Use the SP_DENYLOGIN system procedures

  sp_denylogin [@loginame =] 'login'

- The following statement drop the login account bmnantha.

  exec sp_denylogin 'myserver\bmnantha'

- From the Enterprise Manager
  To drop the login in Enterprise Manager simply highlight the desired login and choose delete from the action menu

Modifying Users

The existing user account can be changed such as password, database, tablespace, quota, password profile, account by the DBA

- ✔ Modifying an ORACLE User

```
SQL > ALTER USER SCOTT IDENTIFIED BY LION;
User Altered
```

- ✔ SQL Server : Modifying Windows Integrated Login Attributes

- ✔ From the Command Line

The default database for the user initially set to master, to change the database SP_DEFAULTDB system stored procedure is used.

```
sp_default [ @loginame = ] 'login' ,
      [ @defdb =] 'database'
```

- ✔ To change the default database to the login mydomain\bmnantha , issue the following statement

```
exec sp_defaultdb 'mydomain \bmnantha' ,'Northwind'
```

Default Users

- ORACLE default users, will be created at the time of ORACLE software installation
  - SYS (Super user will all DBA rights , can't be changed)
  - SYSTEM (With Minimal DBA rights
  - SCOTT (User without DBA rights)
- SQL server default users, will be created at the time of SQL Server software installation
  - SA (System Administrator , It is equivalent to SYS in Oracle and can't be changed)
  - BUILT-IN\Administrators (Associated with the local administrators' group on the Windows server)

Remote Users

- ✔ All the DB user accounts are created and stored in the DB regardless of whether they are connected locally or remotely.
- ✔ When a user logs on to the DB through the machine where the DB is located , called as Local user.
- ✔ When a user logs on to the DB through the machine where the DB is not located , called as remote user.
- ✔ ORACLE10g , remote users can be authenticated by the OS provided the REMOTE_OS_AUTHENT initialization parameter is set to TRUE. If the parameter is set to FALSE , user can't login from remote.
- ✔ SQL Server does not support this type of remote user authentication.

Database Links

- ✔ It is a connection from one DB to another DB
- ✔ The linked DBs can be like
  - Both be ORACLE10g
  - Both be SQL Server
  - Mix of ORACLE10g and SQL Server
- ✔ A DB link enables a user to perform Data Manipulation Language (DML) or any other valid SQL statements on a DB.
- ✔ The following figure gives the architecture of DB Link

- ✔ In Oracle 10g ,DB Links can be created in two ways as

1. Public – Which makes the database links accessible by every user in DB
2. Private – Which gives the ownership of the database to a user

The DB is not accessible by any other user unless the user has been access by the owner

Database Links …

Authentication Methods

- ✔ Authentication methods for connecting ORACLE10g DB using DB link mechanism.
- ✔ There are three types of authentication methods when creating a DB link.
- ✔ Authentication Method 1: CURRENT USER
  - This authentication method orders ORACLE10g to use the current user credentials for authentication to the DB to which the user is trying to link.

```
SQL > CONNECT SYSTEM@DB1
Enter password: ******
Connected

SQL > CREATE PUBLIC DATABASE LINK DB2
    2    CONNECT TO CURRENT_USER
    3    USING 'DB2'
    4    /

Database link created
```

Database Links …

✔ Authentication Method 2: FIXED USER

This authentication method orders ORACLE10g to use the user password provided in this clause for authentication to the DB to which the user is trying to link.

```
SQL > CREATE PUBLIC DATABASE LINK DB2
    2    CONNECT TO SCOTT IDENTIFIED BY TIGER
    3    USING 'DB2'
    4    /

Database link created
```

Database Links …

✔ Authentication Method 3: CONNECT USER

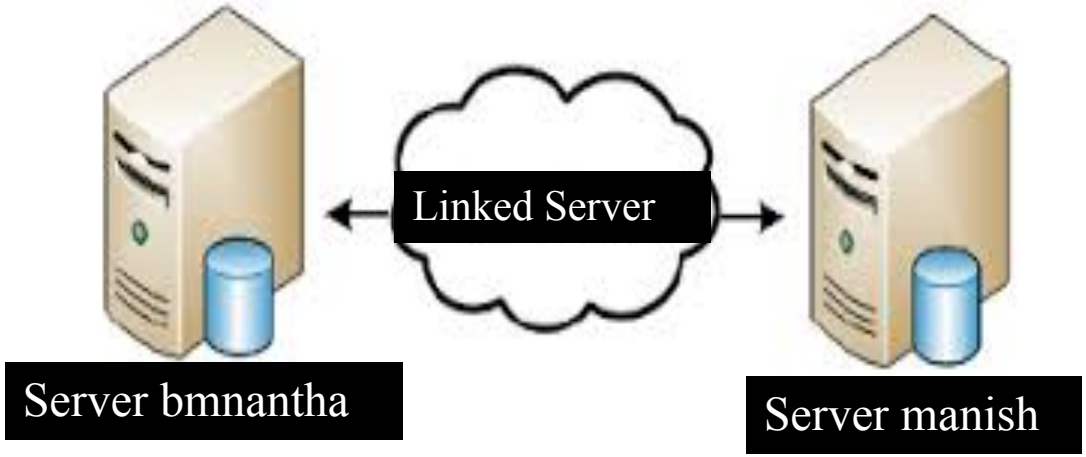
This authentication method orders ORACLE10g to use credentials of the connected user who has an existing account in the database to which the user is trying to link.

```
SQL > CREATE PUBLIC DATABASE LINK DB2
    2    USING 'DB2'
    3    /

Database link created
```

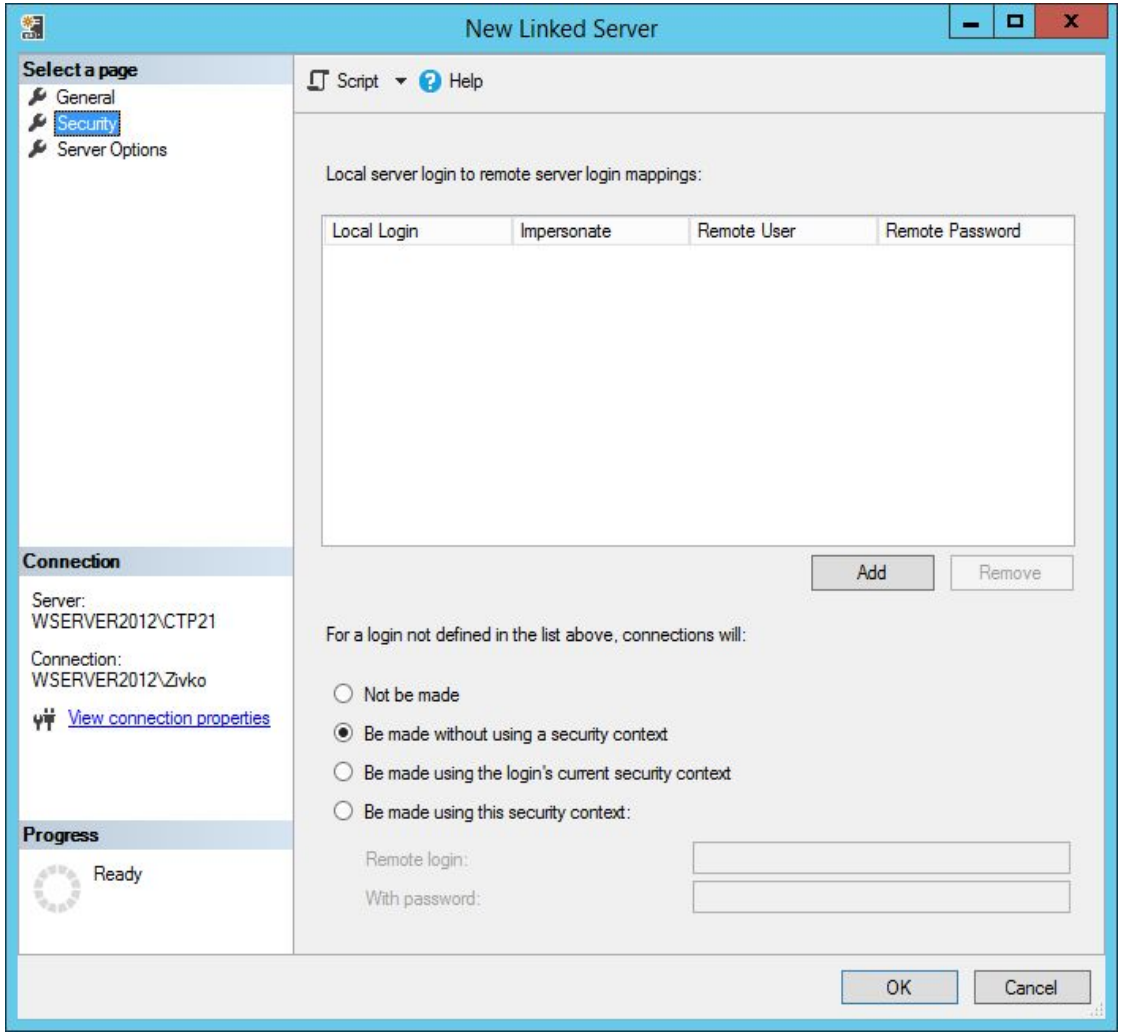
Linked Servers

- ✔ Linked serves allow you to connect to almost any object Linking Embedding Database (OLEDB) or Open Database Connectivity .
- ✔ Microsoft SQL Server 2000 also uses the concept of linked serves.
- ✔ OLEDB is a Microsoft component that allows Windows applications to connect and access different database systems.
- ✔ ODBC is a Microsoft protocol used for connecting Windows applications to different DB systems
- ✔ The following figure represents the Linked server architecture using SQL Server



Linked Server …

Creating a new linked server with SQL Server



Remote Servers

- ✔ Along the same line as Linked Servers , you can communicate with another SQL server by creating remote server

- ✔ Instead of using OLEDB , communications occurs across a Remote Procedure Call (RPC)

Best Practices for Administrators and Managers

- ✔ The DBA job is never ending and very challenging
- ✔ DBA is constantly performing other administrative tasks such as backup, recovery and performance tuning.
- ✔ To make wise decisions DBA have the sizable responsibility of keeping up with database practices, database technology and database security issues.
- ✔ These are the best practices for administrating users, privileges , and roles.
  - Follow you company ‘s procedures and policies to create , remove or modify database users.
  - Always change the default password and never write it, or save it in a file that neither encrypted nor safe.
  - Never share the user accounts with anyone , especially DBA accounts.
  - Always document and create logs for changes to removals of database user accounts.

Best Practices for Administrators and Managers …

- ✔ These are the best practices for administrating users, privileges , and roles…
  - Never remove an account even if it is out dated, Instead disable or revoke connections privileges of the account.
  - Give access permission to users only as required and use different logins and passwords for different applications.
  - Educate users, developers and administrators on user administration best practices as well as the company policies and procedures.
  - Keep abreast (up-to date) of database and security technology. Should be aware of all new vulnerabilities that may increase database security risks.
  - Constantly review and modify the procedures as necessary to be in line up with the company's policies and procedures. Keep procedures up to date with the dynamic nature of database and security technology

Profiles, Password Policies, Privileges and Roles

Introduction

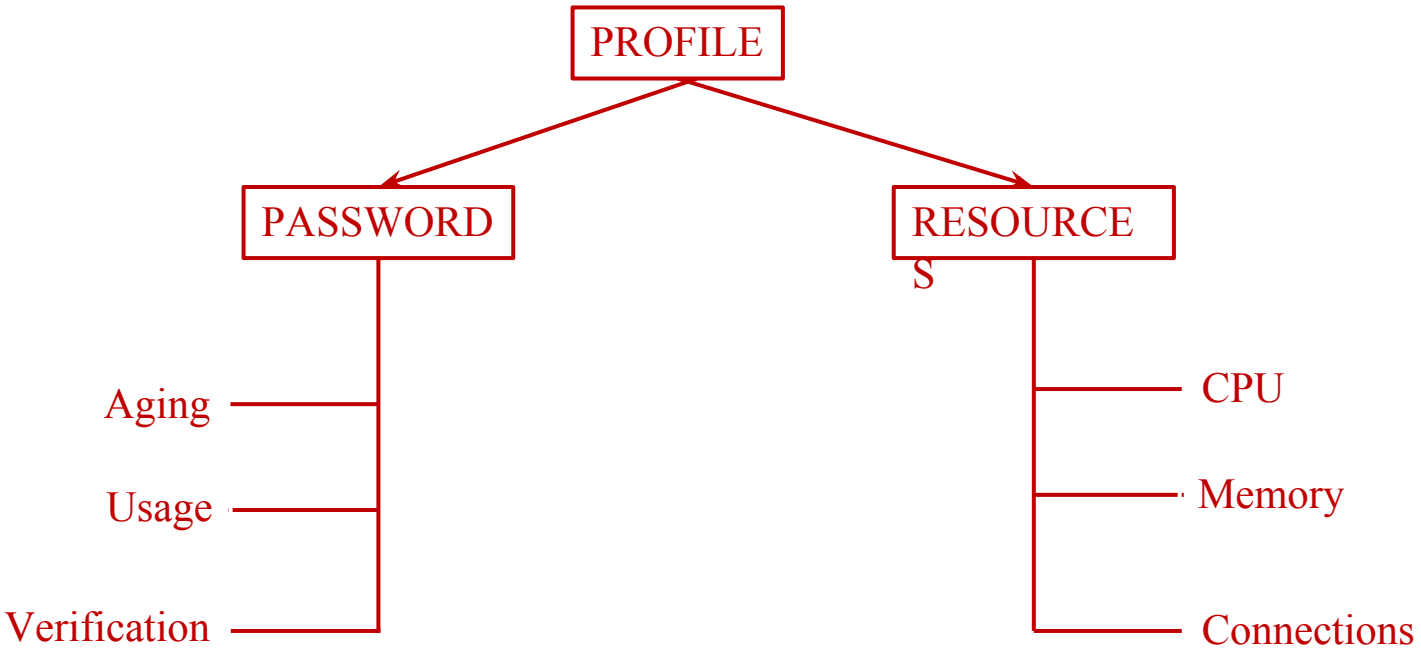
- ✔ The key to the house is the password
- ✔ Put the scenario into the context of computer passwords.
- ✔ For home security , in addition to changing the key , you might install an alarm, , motion detector, camera, etc.,
- ✔ A company's user accounts should have equal protection.
- ✔ The company needs to protect its assets and enforce stringent (strict, precise, and exacting) guidelines to protect the keys to computer accounts.
- ✔ This key is the password

Defining and Using Profiles

- A profile is a security concept that describes the limitation of database resources that are granted database uses.
- A profile is a way of defining database user behaviour to prevent users from wasting resources such as memory and CPU consumption
- For this reason some DBMSs have implemented the profile concept.
- Not every DBMS offers profile concept.
- ORACLE does and Microsoft SQL Server 2000 doesn't.

Defining and Using Profiles…

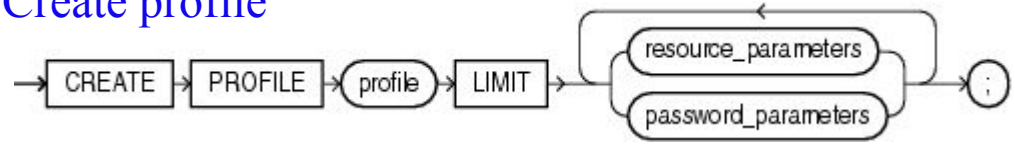
- ✔ Creating Profiles in ORACLE
- ✔ A profile in ORACLE helps define two elements of Security
- ✔ Restrictions on Resources
- ✔ Implementation of password policy
- ✔ The following figure shows the two aspects of a profile in ORACLE



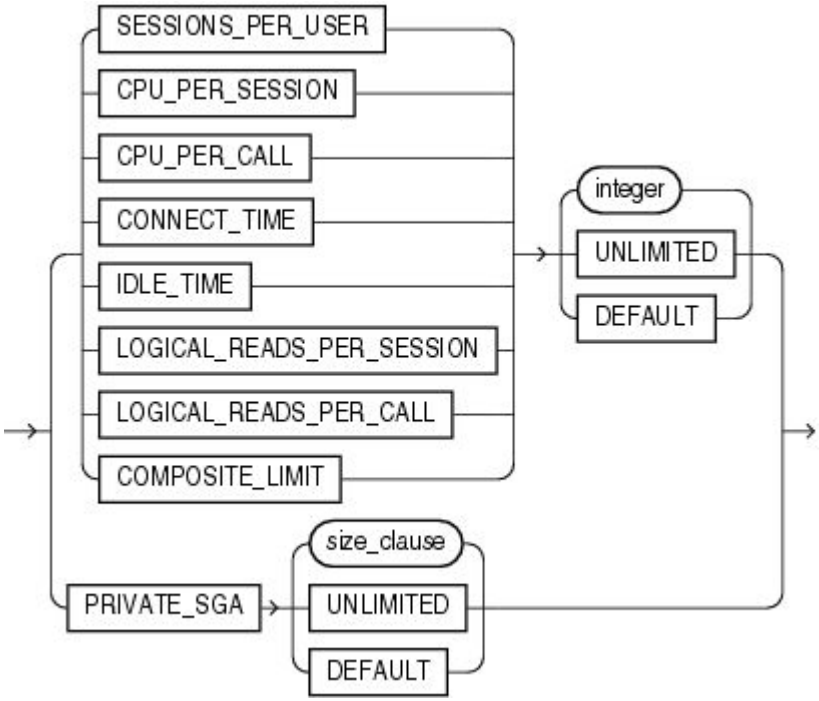
Defining and Using Profiles…

ORACLE allows you to create a profiles using the CREATE PROFILE statement. The full syntax of the statement follows

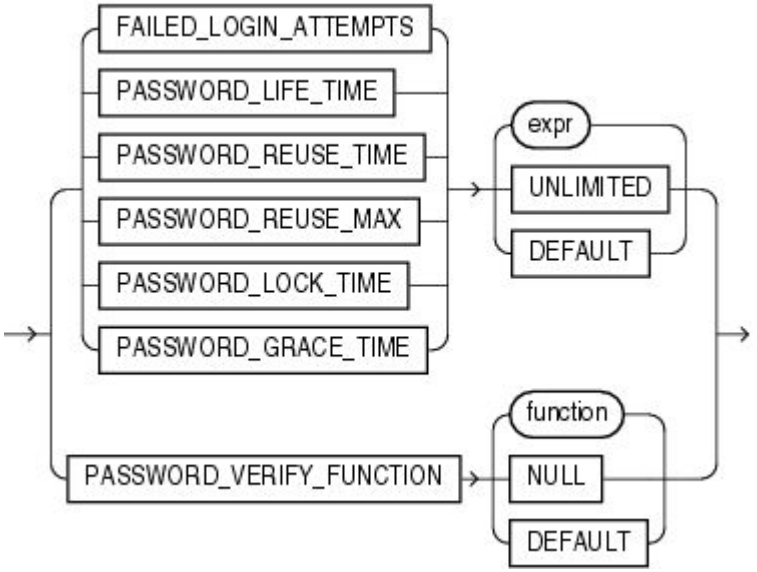
Create profile



Resource parameters



Password parameters



Defining and Using Profiles…

```
CREATE PROFILE Profile_name
LIMIT
SESSIONS_PER_USER number
CPU_PER_SESSION  hunderth of seconds
CPU_PER_CALL  hunderth of seconds
CONNECT_TIME UNLIMITED  minutes
IDLE_TIME  minutes
LOGICAL_READS_PER_SESSION DEFAULT  db_blocks
LOGICAL_READS_PER_CALL DEFAULT db blocks
COMPOSITE_LIMIT DEFAULT   number
PRIVATE_SGA bytes
FAILED_LOGIN_ATTEMPTS number
PASSWORD_LIFE_TIME  days
PASSWORD_REUSE_TIME number
PASSWORD_REUSE_MAX number
PASSWORD_LOCK_TIME days
PASSWORD_GRACE_TIME days
PASSWORD_VERIFY_FUNCTION function_name;
```

Resource Limits

Password Limits

Defining and Using Profiles…

- In this syntax:
  - First, specify the name of the profile that you want to create.
  - Second, specify the LIMIT on either database resources or password
- Resource Parameters
  - SESSIONS_PER_USER – specify the number of concurrent sessions that a user can have when connecting to the Oracle database.
  - CPU_PER_SESSION – specify the CPU time limit for a user session, represented in hundredth of seconds.
  - CPU_PER_CALL – specify the CPU time limit for a call such as a parse, execute, or fetch, expressed in hundredths of seconds.
  - CONNECT_TIME – specify the total elapsed time limit for a user session, expressed in minutes.
  - IDLE_TIME – specify the number of minutes allowed periods of continuous inactive time during a user session. Note that the long-running queries and other operations will not subject to this limit.
  - LOGICAL_READS_PER_SESSION – specify the allowed number of data blocks read in a user session, including blocks read from both memory and disk.
  - LOGICAL_READS_PER_CALL – specify the allowed number of data blocks read for a call to process a SQL statement.
  - PRIVATE_SGA – specify the amount of private memory space that a session can allocate in the shared pool of the system global area (SGA).
  - COMPOSITE_LIMIT – specify the total resource cost for a session, expressed in service units. The total service units are calculated as a weighted sum of of CPU_PER_SESSION CONNECT_TIME, LOGICAL_READS_PER_SESSION, and PRIVATE_SGA.

Defining and Using Profiles…

- Password_parameters
  - You use the following clauses to set the limits for password parameters:
  - FAILED_LOGIN_ATTEMPTS – Specify the number of consecutive failed login attempts before the user is locked. The default is 10 times.
  - PASSWORD_LIFE_TIME – specify the number of days that a user can use the same password for authentication. The default value is 180 days.
  - PASSWORD_REUSE_TIME – specify the number of days before a user can reuse a password.
  - PASSWORD_REUSE_MAX – specify the number of password changes required before the current password can be reused. Note that you must set values for both PASSWORD_REUSE_TIME and PASSWORD_REUSE_MAX parameters make these parameters take effect.
  - PASSWORD_LOCK_TIME – specify the number of days that Oracle will lock an account after a specified number of a consecutive failed login. The default is 1 day if you omit this clause.
  - PASSWORD_GRACE_TIME – specify the number of days after the grace period starts during which a warning is issued and login is allowed. The default is 7 days when you omit this clause.
- Note that to create a new profile, your user needs to have the CREATE PROFILE system privilege.

Defining and Using Profiles…

Setting Profile Resource Limits: Example The following statement creates the profile app_user:

```
SQL> CREATE PROFILE app_user
  2 LIMIT
  3 SESSIONS_PER_USER UNLIMITED
  4 CPU_PER_SESSION UNLIMITED
  5 CPU_PER_CALL 3000
  6 CONNECT_TIME 45
  7 IDLE_TIME  15
  8 LOGICAL_READS_PER_SESSION DEFAULT
  9 LOGICAL_READS_PER_CALL 1000
  10 PRIVATE_SGA 15K
  11 COMPOSITE_LIMIT 5000000;
  12 /
Profile created
```

Defining and Using Profiles…

- To view all profiles created in the database , query the data dictionary view, DBA_PROFILES

```
SQL> select * from dba_profiles where profile = 'DEFAULT';

PROFILE    RESOURCE_NAME                  RESOURCE_TYPE     LIMIT
 ----------    ----------------------------    ------------- ---------       -----------
DEFAULT        COMPOSITE_LIMIT                KERNEL         UNLIMITED DEFAULT
SESSIONS_PER_USER              KERNEL         UNLIMITED DEFAULT     CPU_PER_SESSION
               KERNEL         UNLIMITED DEFAULT     CPU_PER_CALL                  KERNEL
               UNLIMITED DEFAULT     LOGICAL_READS_PER_SESSION      KERNEL
UNLIMITED DEFAULT  LOGICAL_READS_PER_CALL          KERNEL         UNLIMITED
DEFAULT        IDLE_TIME                      KERNEL         UNLIMITED DEFAULT
CONNECT_TIME                   KERNEL         UNLIMITED DEFAULT  PRIVATE_SGA
               KERNEL         UNLIMITED DEFAULT FAILED_LOGIN_ATTEMPTS
PASSWORD       UNLIMITED DEFAULT PASSWORD_LIFE_TIME              PASSWORD
UNLIMITED DEFAULT PASSWORD_REUSE_TIME          PASSWORD      UNLIMITED
DEFAULT PASSWORD_REUSE_MAX             PASSWORD      UNLIMITED DEFAULT
PASSWORD_VERIFY_FUNCTION       PASSWORD      NULL
DEFAULT PASSWORD_LOCK_TIME             PASSWORD      UNLIMITED DEFAULT
PASSWORD_GRACE_TIME            PASSWORD      UNLIMITED

 16 rows selected.
```

Defining and Using Profiles…

- To Modify a limit for profile , you use ALTER PROFILE as follows

```
SQL> ALTER PROFILE APP_USER
  2   LIMIT IDLE_TIME 30;
Profile altered
```

- To assign a profile , use ALTER USER as follows

```
SQL> ALTER USER BMNANTHA PROFILE APP_USER
  2   /
User altered
```

- In SQL Server 2000 or 2005 profiles of similar objects are not available

Designing and Implementing password policies

- ✔ Password is key to opening the user account.
- ✔ The stronger the password, the longer it takes a hacker to break it.
- ✔ Many hackers security violations begin with breaking password.
- ✔ If you joining any financial company the orientation program on security administration including password selection, password storage, and the company's policies on password.

Designing and Implementing password policies …

- ✔ Password policy is a set of guidelines that enhances the robustness of the password and reduces the likelihood of its being broken

- ✔ Importance of Password Policies
  - The frontline defence of your account is your password.
  - If your password is weak, the hacker can break in, destroy your data, and violate your sense of security .
  - For this specific reason, most of the companies invest considerable resources to strengthen authentication by adopting technological measures that protect their assets.

Designing and Implementing password policies …

Designing password policies

- ✔ Most companies use a standard set of guidelines for their password policies
- ✔ These guidelines can comprise one or more of the following
  - ✔ Password Complexity – A set of guidelines used when selecting password, for example minimum 8 characters, 1 special character, 1 Capital letter, etc.,

    The purpose of password complexity is to decrease the chances of a hacker guessing or breaking a password.
  - ✔ Password Aging – Indication of how long the password can be used before it expires
  - ✔ Password usage – Indication of how many times the same password can be used
  - ✔ Password storage – A method of storing a password in an encrypted manner

Designing and Implementing password policies …

- ✔ Implementing Password Policies
- ✔ How to implement password policy depends on whether or not DBMS provides functions that support password security
- ✔ ORACLE has invested heavily in providing mechanism to enforce security , including implementation of password policies.
- ✔ Whereas a Microsoft SQL Server depends on the OS to implement password policies.

Designing and Implementing password policies …

- ✔ Password Policies in ORACLE

```
CREATE PROFILE PASSWORD _POLICY
LIMIT
{ {
  |PASSWORD_LIFE_TIME 365
  |PASSWORD_GRACE_TIME 10
  |PASSWORD_REUSE_TIME UNLIMITED
  |PASSWORD_REUSE_MAX 0
  |FAILED_LOGIN_ATTEMPTS 3
  |PASSWORD_LOCK_TIME UNLIMITED;
 }
 { expr | UNLIMITED | DEFAULT }
  |PASSWORD_VERYFY_FUNCTION
 {function | NULL | DEFAULT }
}
```

Designing and Implementing password policies …

- ✔ **Oracle password security profile parameters**
- ✔ Here are the password security parameters:
  - **failed_login_attempts** - This is the number of failed login attempts before locking the Oracle user account. The default in 11g is 10 failed attempts.
  - **password_grace_time** - This is the grace period after the password_life_time limit is exceeded.
  - **password_life_time** - This is how long an existing password is valid. The default in 11g forces a password change every 180 days.
  - **password_lock_time** - This is the number of days that must pass after an account is locked before it is unlocked. It specifies how long to lock the account after the failed login attempts is met. The default in 11g is one day.
  - **password_reuse_max** - This is the number of times that you may reuse a password and is intended to prevent repeating password cycles (north, south, east, west).
  - **password_reuse_time** - This parameter specifies a time limit before a previous password can be re-entered. To allow unlimited use of previously used passwords, set *password_reuse_time* to UNLIMITED.
  - **password_verify_function** - This allows you to specify the name of a custom password verification function.

Designing and Implementing password policies …

- ✔ Profile creation using ORACLE Enterprise Manager Security Tools

Designing and Implementing password policies …

Password Policies in SQL Server

- ✔ Microsoft SQL Server 2000 as a stand-alone product, does not provide for password policy enforcement when logging on a SQL Server
- ✔ Microsoft architecture follows a model known as an Integrated Server System.
- ✔ In this method all the server applications and the resources they provide are tightly integrated with the Windows server system and its security architecture.
- ✔ Password policy enforcement in a SQL Server environment handled by implementing SQL server in Windows authentication mode and applying polices within the Windows Server System
- ✔ There are two authentication protocols supported by Windows
  - NTLM (Network LAN Manager)
  - Kerberos 5

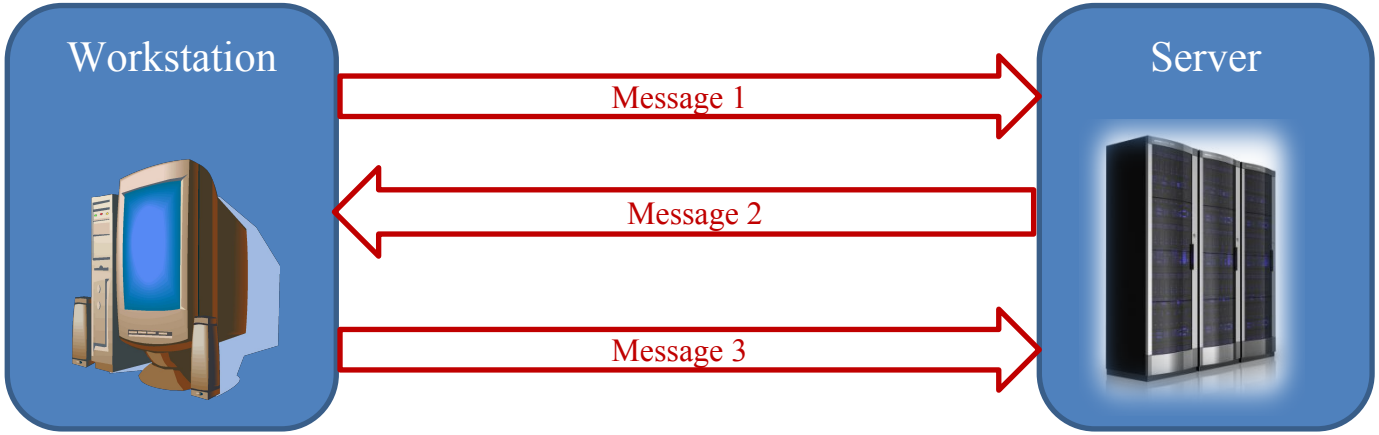
Designing and Implementing password policies …

NTLM

- ✔ NTLM authenticates using a challenge / response methodology
- ✔ When the user attempt to access a resource , the server hosting the resource "challenges" , user to prove his / her identity.
- ✔ User then issue a "response" to that challenge
- ✔ If the response is correct then the user is authenticated to the server.
- ✔ The server goes through an authorization process for the requested resource.

Designing and Implementing password policies …

- Authentication process consists of three messages
  - Message 1 : Sent from the client to the server and is the initial request for authentication
  - Message 2 : Sent from the server to client, contains challenge (Eight bytes of Random Data)
  - Message 3 : Sent from client to server , contains response to the challenge



- The response is a 24-byte DES encrypted hash of the 8 byte challenge that can be decrypted only by a set of DES keys created using the user's password.
- The benefit to NTLM is that password are verified without ever actually sending the password across the Web

Designing and Implementing password policies …

Kerberos

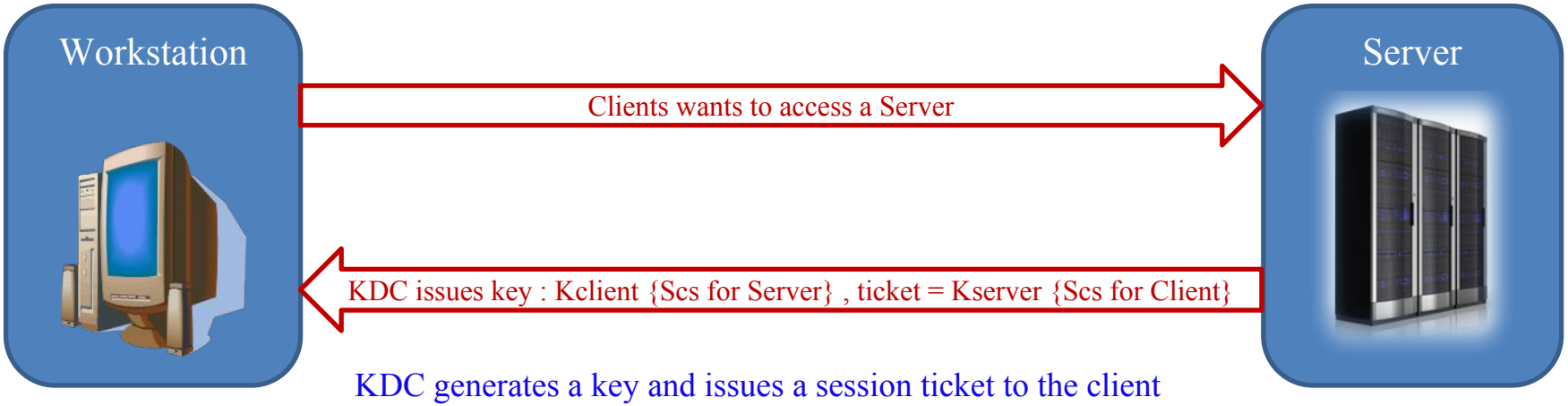
- ✔ Kerberos authentication differs from NTLM in many ways.
- ✔ Instead of using password encrypt / decrypt challenge / response messages, a secret key, known only to the server and client and also unique to the session, used to encrypt the handshake data.
- ✔ This allows not only for the server to validate the authenticity of client , but for the client to validate the authenticity of the server.
- ✔ This is an important difference and is one the reason Kerberos is more secure than NTLM
- ✔ Kerberos authentication requires a trusted third resource known as Key Distribution Center (KDC).
- ✔ The KDC generates the secret key for each session established.
- ✔ The new session ticket , containing the new key, has a time-out value associated with it.

Designing and Implementing password policies …

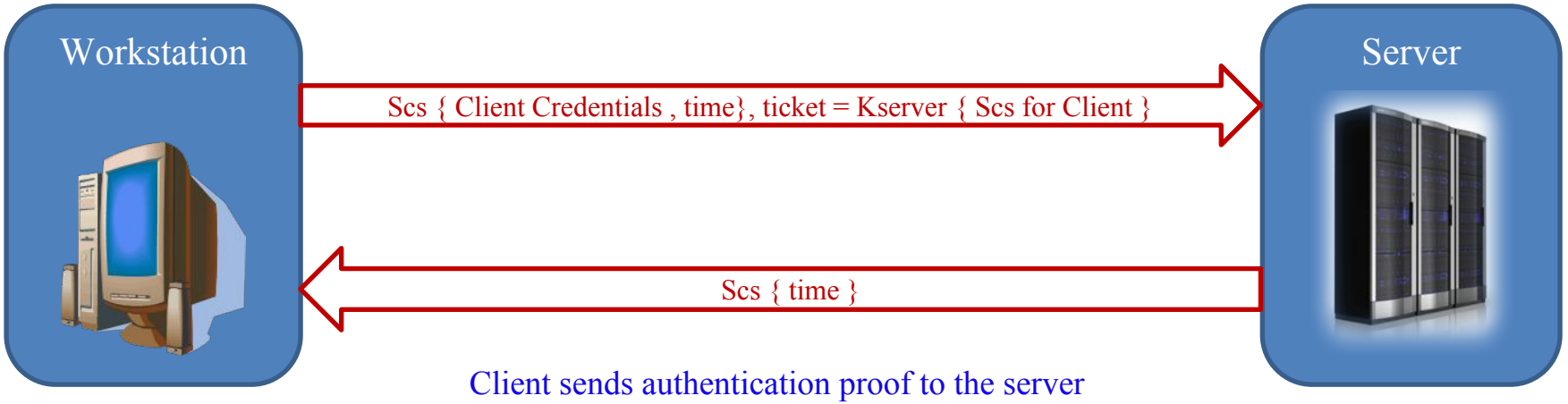
- ✔ Once the secret key is obtained from the KDC
  - The client encrypts its request for a resource with the secret key.
  - The server decrypts the message using the same key, decrypts just on time stamp on the message and send back to client.
  - This tells the server and the client has the same key for the session which is established.

Designing and Implementing password policies …

The following figures explain the authentication process in Kerberos



KDC generates a key and issues a session ticket to the client



Client sends authentication proof to the server

Granting and Revoking User Privileges

- ✔ Privilege is a method to permit or deny access to data or to perform database operations (Data Manipulation)

- ✔ Privileges in ORACLE

  - System Privileges – Privileges granted only by DBA or users who have been granted the administration option.

  - Object Privileges – Privileges granted to an ORACLE user by the scheme owner of a database object or a user who has been granted the GRANT option.

Granting and Revoking User Privileges …

✔ System Privileges :

There are more than 100 system privileges in ORACLE , these are some important frequently used privileges

- CREATE USER
- CREATE SESSION
- CREATE ROLE
- CREATE PROCEDURE
- CREATE TRIGGER
- CREATE TABLESPACE
- CREATE TYPE
- CREATE DATABASE LINK
- CREATE TABLE
- CREATE VIEW
- CREATE SEQUENCE
- DROP VIEW
- DROP USER
- DRO P TABLE

✔ Object Privileges:

All DML are come into object privileges

- INSERT
- UPDATE
- DELETE
- SELECT
- INDEX
- REFERENCES

Granting and Revoking User Privileges …

SQL GRANT Command

SQL GRANT is a command used to provide access or privileges on the database objects to the users.

- The Syntax for the GRANT command is:

GRANT privilege_name ON object_name TO {user_name |PUBLIC |role_name} [WITH GRANT OPTION];

- *privilege_name* is the access right or privilege granted to the user. Some of the access rights are ALL, EXECUTE, and SELECT.
- *object_name* is the name of an database object like TABLE, VIEW, STORED PROC and SEQUENCE.
- *user_name* is the name of the user to whom an access right is being granted.
- *PUBLIC* is used to grant access rights to all users.
- *ROLES* are a set of privileges grouped together.
- *WITH GRANT OPTION* - allows a user to grant access rights to other users.

Eaxmple :

SQL > Grant select on emp to bmnantha;

Grant succeeded

The schema owner of emp object gave select privilege to user bmnantha

Granting and Revoking User Privileges …

SQL REVOKE Command:

The REVOKE command removes user access rights or privileges to the database objects.

✔ The Syntax for the REVOKE command is:

```
REVOKE privilege_name ON object_name
FROM {user_name |PUBLIC |role_name}
```

✔ Example :

```
SQL > Revoke select on emp from bmnantha;
Revoke succeeded
```

The schema owner of emp object get back the select privilege to user bmnantha

Granting and Revoking User Privileges …

Privileges in SQL Server

- ✔ SQL Server has four levels of permissions
  - System or Server level
  - Database level
  - Table (Object) level
  - Column level

- ✔ Note : It is important to note that having server or database level permission doesn't mean you have access to subordinate objects.

Granting and Revoking User Privileges …

Privileges in SQL Server

Server Privileges

- ✔ Sysadmin – Can perform any function within the system
- ✔ Serveradmin – Can perform certain server-level functions.
- ✔ Setupadmin – Can manage linked servers and startup procedures
- ✔ Securityadmin – Can manage logons, change passwords
- ✔ Processadmin – Can manage processes running
- ✔ Dbcreator – Create, Alter and Drop Databases
- ✔ Diskadmin – Can manage the disk files for the server and database
- ✔ Bulkadmin – Can insert bulk insert operations

Granting and Revoking User Privileges …

Privileges in SQL Server

Database Privileges – Fixed Database Roles

- ✔ db_owner – Have complete access to the database
- ✔ db_accessadmin – Can add or remove users
- ✔ db_securityadmin – Can change all permissions, object ownership, roles and role membership
- ✔ db_ddladmin – Can execute all DDL statements
- ✔ db_backupoperator – Can execute DBCC statements (DBCC is a SQL Server tool used for DB performance)
- ✔ db_datareader – Can issue SELECT and READTEXT statements
- ✔ db_datawriter – Can issue INSERT, UPDATE, DELETE and UPDATENEXT statements
- ✔ db_denydatareader – Explicitly denied SELECT and READTEXT statements
- ✔ db_denydatawriter – Explicitly denied INSERT, UPDATE, DELETE and UPDATENEXT statements

Granting and Revoking User Privileges …

Privileges in SQL Server

Database Privileges – Statement permissions

- ✔ CREATE TABLE
- ✔ CREATE VIEW
- ✔ CREATE PROCEDURE
- ✔ CREATE FUNCTION
- ✔ CREATE DEFAULT
- ✔ CREATE ROLE
- ✔ BACKUP DATABASE
- ✔ BACKUP LOG

Granting and Revoking User Privileges …

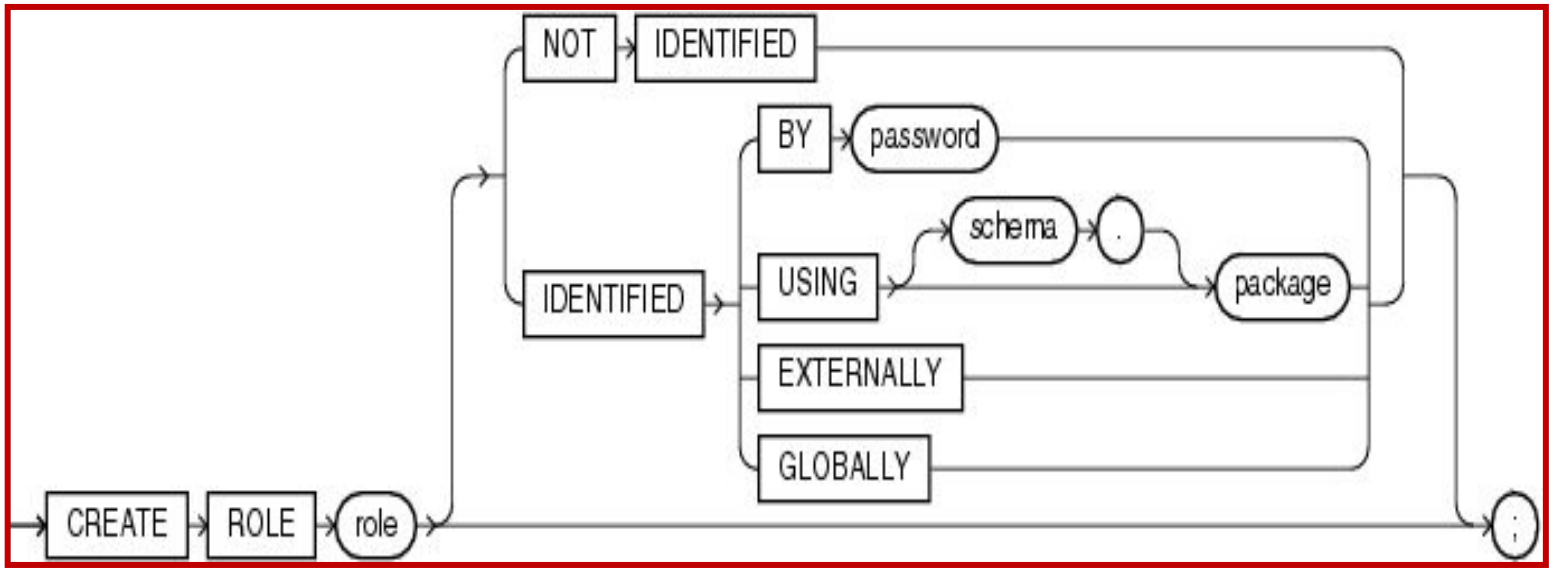
Privileges in SQL Server

Table and Database Objects privileges and Column level privileges

- ✔ Same as ORACLE Grant and Revoke command.
- ✔ Refer Slide numbers : 68 and 69

Creating , Assigning and Revoking User Roles

Creating role with ORACLE



✔ **NOT IDENTIFIED Clause -** Specify NOT IDENTIFIED to indicate that this role is authorized by the database and that no password is required to enable the role.

✔ **IDENTIFIED Clause -** Use the IDENTIFIED clause to indicate that a user must be authorized by the specified method before the role is enabled with the SET ROLE statement.

Creating , Assigning and Revoking User Roles …

Creating role with ORACLE – Example

- ✔ The following statement creates the role dw_manager:

```
CREATE ROLE dw_manager;
```

  - Users who are subsequently granted the dw_manager role will inherit all of the privileges that have been granted to this role.

- ✔ You can add a layer of security to roles by specifying a password, as in the following example:

```
CREATE ROLE dw_manager IDENTIFIED BY warehouse;
```

  - Users who are subsequently granted the dw_manager role must specify the password warehouse to enable the role with the SET ROLE statement.

- ✔ The following statement creates global role warehouse_user:

```
CREATE ROLE warehouse_user IDENTIFIED
GLOBALLY;
```

- ✔ The following statement creates the same role as an external role:

```
CREATE ROLE warehouse_user IDENTIFIED EXTERNALLY;
```

Creating , Assigning and Revoking User Roles …

Assigning Role to User in ORACLE - Example

- ✔ To assign privileges to role issue the following statement

```
SQL > GRANT CREATE SESSION TO dw_manager;

Grant succeeded
```

- ✔ To assign a role to a user (Ex: bm_nantha) issue the following statement

```
SQL > GRANT dw_manager to bm_nantha;

Grant succeeded
```

Creating , Assigning and Revoking User Roles …

Create Roles with SQL Server

✔ To create a new database role using Query Analyzer , execute the SP_ADDROLE system stored procedure

```
sp_addrole [ @rolename = ] 'role' [ , [ @ownername = ] 'owner' ]
```

@rolename – The name of the new role
@ownername – The owner of new role , default is dbo

✔ To add the role of "sales" to the database Northwind

```
use northwind
exec sp_addrole 'sales'
```

✔ To add the user bm_nantha to the role sales

```
exec sp_addrolemember 'sales' , 'bm_nantha'
```

Creating , Assigning and Revoking User Roles …

Dropping a Role in ORACLE

✔ **Example :** To drop the role dw_manager, issue the following statement

```
DROP ROLE dw_manager;
```

Dropping a Role in SQL Server

✔ **Example :** To drop the user ‘bm_nantha’ from the role sales, issue the following statement

```
use northwind
exec sp_droprolemember ‘sales’ , ‘jason’
```

Creating , Assigning and Revoking User Roles
Best Practices

- ✔ Never store passwords in plain text, make sure it is encrypted
- ✔ Change passwords frequently
- ✔ Make sure the passwords are complex
- ✔ Pick password that you can remember
- ✔ Use roles to control administer privileges
- ✔ Should report the compromise or loss of password security
- ✔ Should report to security any violation of company guidelines like roles, profiles, privileges, passwords, etc.,
- ✔ Never give / share the password
- ✔ Never give the password over the phone
- ✔ Never type your password in an e-mail
- ✔ Use Windows integrated security mode for securing SQL Server
- ✔ Use Kerberos
- ✔ When Configuring Policies:

  Require complex passwords , Set an account lockout threshold Do not allow passwords to automatically reset , Expire end-user passwords , Enforce password history