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Administration: User Management and Security

SAP Sybase IQ 16.0 SP01

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Contents

Security Management

SAP® Sybase® IQ provides a role-based security model to control access to database objects and the execution of privileged operations. A role-based security model provides complete control and granularity for the privileges you want to grant to users. Each privileged operation a user can perform in the database requires one or more system privilege or object-level privilege.

A *system privilege* is a right to perform an authorized database task. For example, the CREATE TABLE system privilege allows a user to create self-owned tables.

An *object-level privilege* is a right to perform an authorized task on a specified object. For example, having ALTER privileges on TableA allows a user to alter that table, but not other tables.

A *role* is a container which may contain one or more system, privileges, object-level privileges and other roles. Granting a role to a user is equivalent to granting the user the underlying system and object-level privileges of the role.

All new users are automatically granted the PUBLIC system role, which give users the ability to:

- View the data stored in the system views
- Execute most system stored procedures

Once you have created a new user, you can:

- Grant user-defined roles, system roles, system privileges, and object-level privileges to the user.
- Assign a login policy to the user. By default, a user is assigned to the root login policy.
- Set the user as the publisher or as a remote user of the database for use in a SQL Remote system.

Each new or migrated SAP Sybase IQ database includes a predefined set of roles you can use to get started. These system roles act as a starting point for implementing role-based security.

Note: If you are a pre-16.0 SAP Sybase IQ customer, it is recommended that you review the sections on how the security model has changed from the authority/permission/group model to the role/privilege/user-extended role model under *Upgrading to Role-Based Security* in the Migration document appropriate to your operating system.

Plan and Implement Role-Based Security

There is a distinct workflow to planning and implementing a role-based security model.

Design the Security Hierarchy

1. Identify the various authorized tasks to be performed by users. Group closely related tasks. Groupings can be based on any organizational structure—departmental, functional, and so on. A role hierarchy which matches the organizational hierarchy can be created. Assign a name to each grouping. These groupings are the *roles* you will create.
2. Identify the *system privileges* and *object-level privileges* required to perform each authorized task identified.
3. Identify the *users* to perform the various authorized tasks. Associate them with the applicable roles or with identified individual tasks.
4. (Optional) Identify administers for the roles you are going to create. Administrators can grant and revoke the role to other users.
5. (Optional) Identify administrators for the system privileges and object-level privileges that are not part of the roles you will be creating.

Build the Security Hierarchy

1. Create the required roles. See *Roles* on page 2.
2. To each role, grant the system privileges. See *Roles* on page 2 and *Privileges* on page 43.
3. Create the users. See *Users* on page 122.
4. Grant the applicable roles to each user, including granting administrative rights where applicable. See *Roles* on page 2
5. Grant the applicable object-level and system privileges to users, including granting administrative rights where applicable. See *Privileges* on page 43.

See also

- *Roles* on page 2
- *Privileges* on page 43
- *Users* on page 122

Roles

A role is a container which may contain system privileges, object-level privileges, and roles. Granting privileges to and revoking privileges from a role is the same as for a user. A role and user cannot have the same name.

There are three types of roles:

- **User-Defined Role –** a custom collection of system and object-level privileges, typically created to group privileges related to a specific task or set of tasks. You can create user-defined roles to suit the needs of your organization.
- **System Role –** a built-in role automatically created in each newly created database. A system role can be granted and revoked, but cannot be dropped. With some exceptions, their default underlying system privileges cannot be modified or revoked, but additional roles and system privileges can be granted to and revoked from a system role.
- **Compatibility Role –** created for backwards compatibility with earlier versions of SAP Sybase IQ, you can grant, revoke, and under specific conditions, drop them. You cannot, however, modify their underlying system privileges.

User-Defined Roles

A user-defined role is a custom collection of system and object-level privileges, typically created to group privileges related to a specific task or set of tasks.

A user-defined role:

- Can be a standalone object with no login privileges, which can own objects.
- Can be a database user with the ability to act as a role (user-extended role). If the original user has login privileges, the user-extended role inherits the login privileges.
- Can be granted privileges on other objects.
- Can be granted privileges of other roles.
- Has a case-insensitive name.

The granting of a user-defined role is semantically equivalent to individually granting each of its underlying system and object-level privileges.

A user-defined role can be granted with or without administrative rights. When granted with administrative rights, a user can manage (grant, revoke, and drop) the role, as well as use any of the underlying system and object-level privileges of the role. When granted with administrative rights only, a user can manage the role, but cannot use its underlying system and object-level privileges. When granted with no administrative rights, a user can use its underlying system and object-level privileges, but cannot manage the role.

Extending a user to act as a role is useful when you have a user with a set of system and object-level privileges that you want to grant to another user.

You cannot convert a user-defined role to a user-extended role, and vice versa.

When you grant a user-extended role to a user or another role, the grantee inherits all the system and object-level privileges that the user-extended role has, including any administration rights.

Note: Unless otherwise noted, the term *user-defined role* refers to both user-extended and user-defined roles.

Creating a User-Defined Role

Create a new user-defined role.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

A user-defined role cannot have a login password. When creating a user-defined role, you can appoint administrators for the role, and indicate whether they are also to be members of the role. If you do not specify any administrators, the global role administrator (any user granted the MANAGE ROLES system privilege) becomes the default administrator of the role.

However, if at least one role administrator is specified during conversion, global role administrators will be unable to manage the role because the SYS_MANAGE_ROLES_ROLE system privilege is not automatically granted to the role with administrative rights. For this reason, it is strongly recommended that you either do not define any role administrators when creating a role (add them after creation), or explicitly grant the SYS_MANAGE_ROLES_ROLE system privilege with administrative rights only along with any role administrators during the creation process.

Role administrators can be added and removed after creation. When creating a role, if the new role name already exists, the statement fails.

To create a new user-defined role, execute one of these statements:

Create Condition	Statement
Global role administrator only; **no role administrators**	**CREATE ROLE** *role_name*
Role administrators with no role membership; **no global role administrator**	**CREATE ROLE** *role_name* **WITH ADMIN ONLY** *admin_name [,...]*
Role administrators with role membership; **no global role administrator***	**CREATE ROLE** *role_name* **WITH ADMIN** *admin_name [,...]*
Role administrators with no role membership; **with global role administrator***	**CREATE ROLE** *role_name* **WITH ADMIN ONLY SYS_MANAGE_ROLES_ROLE**, *admin_name [,...]*

*Since global role administrators cannot be granted membership in a role, you cannot include SYS_MANAGE_ROLES_ROLE in the administrators list when creating a role with role

administrators granted membership in the role (WITH ADMIN option). It can, however, be included when creating a role with role administrators not granted membership in the role (WITH ADMIN ONLY option).

Example:

This statement creates the role `Sales` with no role administrators specified. Any user with the MANAGE ROLES system privilege is a default administrator of this role.

```
CREATE ROLE Sales
```

This statement creates the role `Marketing` with *Jane* and *Bob* acting as role administrators, but are not granted membership in the role. It also allows global role administrators to manage the role.

```
CREATE ROLE Marketing WITH ADMIN ONLY SYS_MANAGE_ROLES_ROLE, jane,
bob
```

See also

- *Role and Global Role Administrators* on page 10
- *CREATE ROLE Statement* on page 259

Converting an Existing User to a User-Extended Role

You can extend an existing user ID to act as a role. If an original user has login privileges, the user-extended role retains the login privileges.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

When converting a user to act as a role, you can appoint administrators for the role, and indicate whether they are also to be members of the role. If you do not specify any administrators, the global role administrator (any user granted the MANAGE ROLES system privilege) becomes the default administrator of the role.

However, if at least one role administrator is specified during conversion, global role administrators will be unable to manage the role because the SYS_MANAGE_ROLES_ROLE system privilege is not automatically granted to the role with administrative rights. For this reason, it is strongly recommended that you either do not define any role administrators when creating a role (add them after creation), or explicitly grant the SYS_MANAGE_ROLES_ROLE system privilege with administrative rights only along with any role administrators during the creation process.

Role administrators can be added and removed after conversion. When converting a user to act as a role, if the specified user ID does not already exist, the statement fails

To convert an existing user, execute one of these statements:

Convert Condition	Statement
Global role administrator only; **no role administrators**	**CREATE ROLE FOR USER** *userID*
Role administrators with no role membership; **no global role administrator**	**CREATE ROLE FOR USER** *userID* **WITH ADMIN ONLY** *admin_name [,...]*
Role administrators with role membership; **no global role administrator***	**CREATE ROLE FOR USER** *userID* **WITH ADMIN** *admin_name [,...]*
Role administrators with no role membership; **global role administrator***	**CREATE ROLE FOR USER** *userID* **WITH ADMIN ONLY** **SYS_MANAGE_ROLES_ROLE**, *admin_name [,...]*

*Since global role administrators cannot be granted membership in a role, you cannot include SYS_MANAGE_ROLES_ROLE in the administrators list when creating a role with role administrators granted membership in the role (WITH ADMIN option). It can, however, be included when creating a role with role administrators not granted membership in the role (WITH ADMIN ONLY option).

Example:

This statement extends user `Sales1` to act as a role. Since no role administrators are specified, any user with the MANAGE ROLES system privilege can administrator the role.

```
 CREATE ROLE FOR USER Sales1
```

This statement extends the user `Marketing1` to act as a role, with *Jane* and *Bob* acting as role administrators. It also allows global role administrators to manage the role.

```
 CREATE ROLE FOR USER Marketing1 WITH ADMIN ONLY
SYS_MANAGE_ROLES_ROLE, jane, bob
```

See also

- *Role and Global Role Administrators* on page 10
- *CREATE ROLE Statement* on page 259

Converting a User-Extended Role Back to a User

You can convert a user-extended role back to a regular user.

Prerequisites

Requires administrative rights over the user-extended role being converted.

Task

The user retains any login privileges, system privileges and roles granted to the user-extended role. The user remains as the owner of the objects that were created after the user was extended to act as a role. Any members of the user-extended role are immediately revoked.

A minimum number of role or global role administrators (as defined by the **MIN_ROLE_ADMINS** database option) with a login password must exist for each role at all times. When converting a user-extended role back to a user, all dependent roles of the user-extended role must continue to meet this minimum requirement, or the conversion fails.

To convert a user-extended role back to a user, execute one of these:

Convert Condition	Statement
Role has not been granted any members.	**DROP ROLE FROM USER** *role_name*
Role has been granted members.	**DROP ROLE FROM USER** *role_name* **WITH REVOKE**

Adding a User-Defined Role to a User or Role

Add membership in a user-defined role to a user or role (grantee), with or without administrative rights.

Prerequisites

Requires administrative privilege over the role being granted.

Task

When granted with administrative rights, a user can manage (grant, revoke, and drop) the role, as well as use any of the underlying system privileges of the role. When granted with administrative rights only, a user can manage the role, but not use its underlying system privileges. Finally, when granted with no administrative rights, a user can only use its underlying system privileges. If no administrative clause is specified, the role is granted with no administrative rights.

When a user is granted membership in a role, the user inherits all underlying system privileges and roles of the role, including any object-level permissions on tables, views, and procedures.

When a role is granted to another role, all members of the role being granted (the child role) automatically become members of the receiving role (parent role) and inherit all underlying system privileges and roles of the parent role, including those on tables, views, and procedures. Existing members of the parent role do not become members of the child role or inherit any of its underlying system privileges and roles.

To grant a user-defined role to a grantee, execute one the these statements:

Grant Type	Statement
Membership in the role along with full administrative rights to the role	**GRANT ROLE** *role_name* **TO** *grantee [,...]* **WITH ADMIN OPTION**
Administrative rights to the role only	**GRANT ROLE** *role_name* **TO** *grantee [,...]* **WITH ADMIN ONLY OPTION**
Membership in the role, but with no administrative rights to the role	**GRANT ROLE** *role_name* **TO** *grantee [,...]* **WITH NO ADMIN OPTION**

Example:

- There are three users: User1, User2, User3.
- There are four roles: Role1, Role2, Role3, Role4.
- There are two system privileges: Priv1, Priv2.
- Role1 is granted Priv1 and Role3.
- User2 and User3 are members of Role1.
- Role2 is granted Priv2 and Role4.
- User3 is a member of Role2.

You execute the following statement:

```
GRANT ROLE Role1 TO User1 WITH ADMIN OPTION
```

User1 becomes a member of Role1.

As a member of Role1, User1 inherits Priv1 and (indirectly) all system privileges and roles from Role3.

User1 can also administer Role1.

You execute the following statement:

```
GRANT ROLE Role2 TO Role1 WITH ADMIN OPTION
```

Role1 becomes a member of Role2.

As members of Role1, User2, User3, and User1 (from previous grant) inherit the following from Role2: Priv2 and (indirectly) all system privileges and roles of Role4.

As a member of Role2, User3 does not become a member of Role1 and does not inherit any system privileges or roles of Role1.

User1, User2, and User3 can administer Role2.

See also

- *GRANT ROLE Statement* on page 272

Removing Members from a User-Defined Role

Remove a user or role as a member of a role. The user or role loses the ability to use any underlying system privileges or roles of a role, along with the ability to administer the role, if granted.

Prerequisites

Requires administrative privilege over the role being managed.

Task

A minimum number of role or global role administrators (as defined by the **MIN_ROLE_ADMINS** database option) with a login password must exist for each role at all times. When removing a member from a user-extended role, if the member is an administrator of the role and their removal would violate the minimum requirement, the removal fails.
To remove membership in a user-defined role from a grantee, execute one the these statements:

Revoke Type	Statement
Role membership and all administrative rights to the role	**REVOKE ROLE** *role_name* **FROM** *grantee [,...]*
Administrative rights to the role only	**REVOKE ADMIN OPTION FOR ROLE** *role_name* **FROM** *grantee [,...]*

See also

- *REVOKE ROLE Statement* on page 288

Deleting a User-Defined Role

Delete a user-defined role from the database as long as all dependent roles retain the minimum required number of administrator users with active passwords after the drop. If the minimum value is not maintained, the command fails.

Prerequisites

- Requires administrative privilege over the role being dropped.
- If the role being dropped is a user-defined role, the role does not own any objects.

Task

A user-defined role can be deleted as long as all dependent roles retain the minimum required number of administrator users with active passwords after the drop. If the minimum value is not maintained, the delete fails.

If a user-extended role is converted back to a user, the objects owned are not deleted. They remain owned by the converted user.

The type of role being deleted and whether it was granted to users determines the clauses required by the DROP statement.

- **FROM USER –** required when deleting a user-extended role.
- **WITH REVOKE –** required to delete a role that has been granted to multiple users and roles.

To delete a user-defined role, execute one of the these statements:

Delete Condition	Statement
User-defined role has not been granted any members	**DROP ROLE** *role_name*
User-extended role has been granted members	**DROP ROLE** *role_name* **WITH REVOKE**
User-extended role has not been granted any members*	**DROP ROLE FROM USER** *role_name*
User-extended role has been granted members*	**DROP ROLE FROM USER** *role_name* **WITH REVOKE**

*User-extended role becomes a regular user.

See also

- *DROP ROLE Statement* on page 264

Role and Global Role Administrators

Role administrators and *global role administrators* are responsible for granting and revoking user-defined roles to users and other roles. You can add and remove role and global role administrators on a role as needed.

There is no maximum number of role administrators that can be granted to a single role. However, there is a minimum number, as specified by the configurable **MIN_ROLE_ADMINS** database option. This minimum requirement is validated before you can revoke a role

administrator or global role administrator from a role. The minimum number of role administrators can be set to any value between 1 (default) and 10.

A role administrator can be can be a user, a user-extended role, or a user-defined role.

Global role administrators are any users granted the MANAGE ROLES system privilege. Global role administrators can administer any role to which the SYS_MANAGE_ROLES_ROLE system privilege has been granted with administrative rights.

Both role and global role administrators can grant, revoke, and drop roles, and can add or remove role and global role administrators to and from a role. A role administrator can be a user or a role and does not require the MANAGE ROLES system privilege to administer a role.

You can appoint role administrators to a role during the creation process or after the role has been created and indicate whether they are also to be members of the role. If you do not specify any administrators, the global role administrator becomes the default administrator of the role.

If at least one role administrator is specified during role creation, global role administrators will be unable to manage the role because the SYS_MANAGE_ROLES_ROLE system privilege is not automatically granted to the role. For this reason, it is strongly recommended that you either do not define any role administrators when creating a role (add them after creation), or explicitly grant the SYS_MANAGE_ROLES_ROLE system privilege with administrative rights only along with any role administrators during the creation process.

If no role administrator is specified during the creation process, the global role administrator (SYS_MANAGE_ROLES_ROLE system privilege) is automatically granted to the role with administrative only rights.

If role administrators are later added to a role originally created with no role administrators specified, the global role administrator (SYS_MANAGE_ROLES_ROLE system privilege) may or may not be removed, depending on how the role administrators are added. If the **GRANT** statement is used, the SYS_MANAGE_ROLES_ROLE system privilege remains granted to the role. However, if the **CREATE OR REPLACE** statement is used, the SYS_MANAGE_ROLES_ROLE system privilege is removed if it is not explicitly included in the new list of role administrators.

Note: You will be unable to remove the SYS_MANAGE_ROLES_ROLE system privilege from a role if so doing would result in a failure to meet the minimum number of role administrators defined.

By default, the SYS_MANAGE_ROLES_ROLE system privilege is not granted to compatibility roles (SYS_AUTH_*_ROLE). Therefore, to allow global role administrators to manage a compatibility role, you must explicitly grant SYS_MANAGE_ROLES_ROLE with administrative rights only to the role.

Adding a Role Administrator when Creating a Role

Specify a role administrator when creating a new role.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

If at least one role administrator is specified during creation, global role administrators will be unable to manage the role unless explicitly specified.

For this reason, it is strongly recommended that you consider always adding the global role administrator to the list of role administrators during the creation process.

To add role administrators during the creation process, execute one of these statements:

Create Type	Statement
Administrative rights only; no role membership	**CREATE ROLE** *role_name* **WITH ADMIN ONLY** *admin_name [,...]*
Role and global role administrators granted administrative rights only; no role membership*	**CREATE ROLE** *role_name* **WITH ADMIN ONLY SYS_MANAGE_ROLES_ROLE**, *admin_name [,...]*
Administrative rights along with role membership	**CREATE ROLE** *role_name* **WITH ADMIN** *admin_name [,...]*

*Since global role administrators cannot be granted membership in a role, you cannot include SYS_MANAGE_ROLES_ROLE in the administrators list when creating a role with role administrators granted membership in the role (WITH ADMIN option).

Example:

Execute this statement to make `Joe` and `Bob` role administrators of the `Sales` role:

```
CREATE ROLE Sales WITH ADMIN Joe, Bob
```

Because it uses the WITH ADMIN clause, both `Joe` and `Bob` can both grant and revoke the role, as well as use the underlying system privileges of the role. If the WITH ADMIN ONLY clause were used, both `Joe` and `Bob` would be able to only grant and revoke the role.

Execute this statement to make `Joe` and `Bob` role administrators of the `Sales` role as well as allow global role administrators to manage the role:

```
CREATE ROLE Sales WITH ADMIN ONLY SYS_MANAGE_ROLES_ROLE, Joe, Bob
```

See also

- *CREATE ROLE Statement* on page 259

Adding the Global Role Administrator when Creating a Role

Allow global role administrators to administer a new role.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

If at least one role administrator is specified during creation, global role administrators will be unable to manage the role unless explicitly specified.

For this reason, it is strongly recommended that you consider always adding the global role administrator to the list of role administrators during the creation process.

To add the global role administrator during the creation process, execute one of these statements:

Create Type	Statement
Global role administrator only; no role administrators	**CREATE ROLE** *role_name*
Both role and global role administrators*	**CREATE ROLE** *role_name* **WITH ADMIN ONLY SYS_MANAGE_ROLES_ROLE**, *admin_name [,...]*

*Global role administrator can only have administrative rights (WITH ADMIN ONLY) on a role. Therefore, when specifying both role and global role administrators during role creation, only the WITH ADMIN ONLY clause is valid.

Example:

Execute this statement to create the `Sales` role and allow only global role administrators to manage it:

```
CREATE ROLE Sales
```

Execute this statement to make `Joe` and `Bob` role administrators of the `Sales` role, with administrative rights only, as well as allow global role administrators to manage the role:

```
CREATE ROLE Sales WITH ADMIN ONLY SYS_MANAGE_ROLES_ROLE, Joe, Bob
```

Adding Role Administrators to an Existing Role

Add role administrators to an existing role. There is no maximum number of role administrators that can be granted to a single role.

Prerequisites

Requires administrative privilege over the role, or the MANAGE ROLES system privilege, if the role has a global role administrator.

Task

To add role administrators, execute one of these statements:

Grant Type	Statement
Administrative privileges only	**GRANT ROLE** *role_name* **TO** *admin_name [,...]* **WITH ADMIN ONLY OPTION**
Administrative privileges and role membership	**GRANT ROLE** *role_name* **TO** *admin_name [,...]* **WITH ADMIN OPTION**

Example:

Execute this statement to make `Mary` and `Bob` role administrators of the `Sales` role.

```
GRANT ROLE Sales TO Mary, Bob WITH ADMIN ONLY OPTION
```

Each can administer the role, but not use its underlying system privileges because of the WITH ADMIN ONLY OPTION clause.

Execute this statement to make `Sarah` a role administrator of the `Sales` role with the ability to both administer the role and use its underlying system privileges because of the WITH ADMIN OPTION clause.

```
GRANT ROLE Sales TO Sarah WITH ADMIN OPTION
```

See also

- *GRANT ROLE Statement* on page 272

Adding the Global Role Administrator to an Existing Role

Add the global role administrator to an existing role.

Prerequisites

Requires administrative privilege over the role.

Task

The global role administrator can be granted to a role with administrative rights only (WITH ADMIN ONLY option).
To reinstate the global role administrator on a role, execute:

```
GRANT ROLE role_name TO SYS_MANAGE_ROLES_ROLE
WITH ADMIN ONLY OPTION
```

See also

- *GRANT ROLE Statement* on page 272

Making a User or Role a Global Role Administrator

Allow a user or role to act as a global role administrator.

Prerequisites

Requires the MANAGE ROLES system privilege granted with administrative rights.

Task

To become a global role administrator, you must be granted the MANAGE ROLES system privilege. Administrative rights on the MANAGE ROLES system privilege are not required to act as a global role administrator. If the MANAGE ROLES system privilege is granted to a role, all members of the role inherit the system privilege, and thus the ability to act as a global role administrator.
To grant the MANAGE ROLES system privilege execute this statement:

```
GRANT MANAGE ROLES TO grantee [,...]
```

See also

- *GRANT System Privilege Statement* on page 279

Replacing Existing Role Administrators on a Role

Replace current role administrators with new administrators.

Prerequisites

Requires administrative privilege over the role, or the MANAGE ROLES system privilege, if the role has a global role administrator.

Task

Replacing role administrators can involve changing the users and roles who can act as administrators and their level of administrative rights on the role. Depending on the extent of the replacement, there are two approaches that can be taken. Each approach handles the replacement task very differently, and have very different net effects on role and global administrators. The first approach allows you to selectively replace the administrators of an existing role. The second approach allows you to completely replace all existing role

administrators with new role administrators. It is important to note that replacement of administrators using the second approach includes the global role administrator.

The first approach is a two step process. It involves adding new role administrators and removing existing administrators from the role. Since the minimum number of administrators requirement must be met at all times through the process, it is recommended that you add before you remove. With this approach, if the role has a global role administrator, it is retained unless it is explicitly removed.

The second approach is a one step process, but has a much broader impact. It involves defining a new list of role administrators. All current role administrators are overwritten with new role administrators. If any current role administrators are to continue in this capacity, you must include them in the list of replacement role administrators. The list replaces all existing administrators, with the following behavior:

- All existing role administrators granted the WITH ADMIN OPTION not included on the new role administrators list become members of the role with no administrative rights on the role.
- All existing role administrators granted the WITH ADMIN ONLY OPTION not included on the new role administrators list are removed as members of the role.
- An existing role administrator included on the new role administrators list retains his or her original administrative rights if they are higher than the replacement rights. For example, if the new role administrators are granted WITH ADMIN ONLY rights, and UserA (an existing role administrator who was originally granted the role with WITH ADMIN rights) is included on the new list, UserA retains the higher WITH ADMIN rights.
- If the role has a global role administrator, it is removed from the role unless it is explicitly included on the new role administrators list.
- If the role has a global role administrator, and the new role administrators are granted WITH ADMIN rights, the global role administrator cannot be included in the list, since it cannot be granted WITH ADMIN rights. However, since it is not included on the list, it is removed from the role.

The replacement role command can be issued as long as the replacement administrative option is equal to or higher than the current level. To lower the administrative level, all role administrators must first be removed (revoked) from the role and then be regranted.

A minimum number of role or global role administrators (as defined by the **MIN_ROLE_ADMINS** database option) with a login password must exist for each role at all times. When replacing role administrators, if the number of replacement administrators would violate the minimum requirement, the replacement fails.

To replace role administrators, execute one of these statements:

Replacement Option	Statement
Replace select role administrators **with administrative only rights;** **no role membership**	• **GRANT ROLE** *role_name* **TO** *admin_name [,...]* **WITH ADMIN ONLY OPTION** • **REVOKE ADMIN OPTION FOR ROLE** *role_name* **FROM** *admin_name [,...]*
Replace select role administrators **with administrative and role membership**	• **GRANT ROLE** *role_name* **TO** *admin_name [,...]* **WITH ADMIN OPTION** • **REVOKE ADMIN OPTION FOR ROLE** *role_name* **FROM** *admin_name [,...]*
Replace all role administrators **with administrative rights only; no role membership.** **Remove the global role administrator, if exists.**	**CREATE OR REPLACE ROLE** *role_name* **WITH ADMIN ONLY** *admin_name [,...]*
Replace all role administrators with **administrative rights and role membership.** **Remove the global role administrator, if exists.**	**CREATE OR REPLACE ROLE** *role_name* **WITH ADMIN** *admin_name [,...]*
Replace all role administrators with **administrative rights only,** **including the global role administrator.***	**CREATE OR REPLACE ROLE** *role_name* **WITH ADMIN ONLY SYS_MANAGE_ROLES_ROLE**, *admin_name [,...]*
Replace all role administrators **with full administrative rights.** **Restore the global role administrator to the role***	• **CREATE OR REPLACE ROLE** *role_name* **WITH ADMIN** *admin_name [,...]* • **GRANT ROLE** *role_name* **TO SYS_MANAGE_ROLES_ROLE WITH ADMIN ONLY OPTION**

*SYS_MANAGE_ROLES_ROLE can only be granted to a role using the WITH ADMIN ONLY option. Therefore, when the CREATE OR REPLACE statement includes the WITH ADMIN ONLY option, SYS_MANAGE_ROLES_ROLE can be included in the

administrator list. When the CREATE OR REPLACE statement uses the WITH ADMIN option, a separate grant statement is required to grant SYS_MANAGE_ROLES_ROLE to the role using the WITH ADMIN ONLY option.

Examples:

`Sales` has `Mary` and `Bob` as role administrators with full administrative rights. `Sales` has a global role administrator.

Execute these statements to remove `Bob` as a role administrator and replace him with `Sarah` and `Jeff`, with the same administrative rights. `Bob` remains a member of `Sales` with no administrative rights.

```
GRANT ROLE sales TO Sarah, Jeff WITH ADMIN OPTION
REVOKE ADMIN OPTION FOR ROLE Sales FROM Bob
```

Execute these statements to replace the existing role administrators (`Mary` and `Bob`) with `Sarah` and `Jeff`, with full administrative rights. Since the global role administrator cannot be included on the list (cannot be granted with full administrative rights), it must be explicitly regranted to the role after replacement of the role administrators.

```
CREATE OR REPLACE ROLE Sales WITH ADMIN Sarah, Jeff
GRANT ROLE sales TO SYS_MANAGE_ROLES_ROLE WITH ADMIN ONLY OPTION
```

Execute these statements to replace the existing role administrators (`Mary` and `Bob`) with `Bob` and `Sarah` with administrative rights only. To preserve the global role administrator, it must be included on the list. Since Bob is to remain as a role administrator, and originally had higher administrative rights than the new role administrators, he retains the original higher administrative rights.

```
CREATE OR REPLACE ROLE Sales WITH ADMIN ONLY Bob, Sarah,
SYS_MANAGE_ROLES_ROLE
```

See also

- *GRANT ROLE Statement* on page 272
- *REVOKE ROLE Statement* on page 288
- *CREATE ROLE Statement* on page 259

Removing a Role Administrator from a Role

Remove a role administrator from a role.

Prerequisites

Requires administrative privilege over the role.

Task

A minimum number of role or global role administrators (as defined by the **MIN_ROLE_ADMINS** database option) with a login password must exist for each role at all times. You can remove role administrators only as long as the this minimum is still met after removal.

When removing a role administrator, if role administration was originally granted to the user using the WITH ADMIN OPTION clause, revoking role administration only removes their ability to manage the role (grant, revoke, drop), not the ability to use the underlying system privileges of the role (membership). However, if role administration was originally granted to the user using the WITH ADMIN ONLY OPTION clause, revoking role administration has the same effect as revoking the role entirely, as there was no membership associated with the role.

To remove a role administrator from a role, execute on of these statements:

Removal Type	Statement
Remove role administrator, but retain membership in the role.	**REVOKE ADMIN OPTION FOR ROLE** *role_name* **FROM** *admin_name [,...]*
Remove role administrator along with membership in the role.	**REVOKE ROLE** *role_name* **FROM** *admin_name [,...]*

Example:

This example assumes that both `Mary` and `Sarah` are currently role administrators of the `Sales` role. `Mary` has been granted both membership in the role and the ability to administer the role. `Sarah`, however, has only been granted the ability to administer the role, not membership. Due to the different administration levels granted, executing this statement to revoke administrative rights from the `Sales` role has a different impact on each administrator:

```
REVOKE ADMIN OPTION FOR ROLE Sales FROM Mary, Sarah
```

For `Mary`, this statement results in the loss of her ability to administer the `Sales` role, but retains her membership of the role. For `Sarah`, this statement revokes the `Sales` role completely from her.

See also

- *REVOKE ROLE Statement* on page 288

Removing the Global Role Administrator from a Role

Remove the global role administrator from a role.

Prerequisites

Requires administrative privilege over the role.

Task

A minimum number of role or global role administrators (as defined by the **MIN_ROLE_ADMINS** database option) with a login password must exist for each role at all

times. You can remove the global role administrator from a role as long as this minimum is still met for the role.
To remove the global role administrator from a role, execute:

```
REVOKE ROLE role_name
FROM SYS_MANAGE_ROLES_ROLE
```

See also

- *REVOKE ROLE Statement* on page 288

Minimum Number of Role Administrators

The Minimum Number of Role Administrators (**MIN_ROLE_ADMINS**) option is a configurable value that ensures when dropping roles or users, you never create a scenario where there are no users and roles left with sufficient system privilege to manage the remaining users and roles.

The minimum number of role administrators value applies to the minimum number of role administrators for each role, not the minimum number or role administrators for the total number of roles, and is considered when:

- Creating roles
- Revoking roles
- Dropping users or roles
- Changing a user's password to null

Note: Users or roles without passwords cannot be administrators.

When you attempt to change this value, the system validates that each existing role continues to have at least as many role administrators as defined by the new value. If even one role fails to meet this requirement, the statement fails. Similarly, when dropping users, if the number of remaining administrators would drop below the designated minimum value, the statement fails.

Note: Locked accounts are not considered when counting the number of administrators for a role.

Example 1
MIN_ROLE_ADMINS =2

`Role1` has two administrators and `Role2` has three administrators.

If you attempt to reduce the min_role_admins value to 1, the command succeeds because both roles still have the new designated minimum number of role administrators. However, if you attempt to increase the value to 3, the command fails because `Role1` would no longer have sufficient administrators to meet the new minimum value.

Example 2
MIN_ROLE_ADMINS =4

`Role1` has six administrators and `Role2` has four administrators.

If you attempt to drop a user from `Role1`, the command succeeds because `Role1` still has sufficient administrators to meet the minimum value. However, if you attempt to drop a user from `Role2`, the command fails because `Role2` would no longer have sufficient administrators to meet the minimum value.

See also

- *Automatic Unlocking of User Accounts* on page 129
- *MIN_ROLE_ADMINS Option* on page 303

Setting the Minimum Number of Role Administrators

Set the minimum number of role administrators required to manage each role.

Prerequisites

Requires the SET ANY SECURITY OPTION system privilege to set this option.

Task

The minimum number of role administrators is a configurable database option that you can set to any integer between 1 (the default) and 10. You cannot change this value if so doing results in the number of role administrators for any single role not meeting the new minimum value. You also cannot set this option temporarily.

This value applies to each role, not all roles in total. For example, if there are 20 roles and the minimum number of role administrators is set to two, each of the 20 roles must have a minimum of two role administrators defined, not two role administrators defined to administer the 20 roles in total.

To change the minimum number of role administrators, execute:

```
SET OPTION Public.min_role_admins = value
```

See also

- *Automatic Unlocking of User Accounts* on page 129
- *MIN_ROLE_ADMINS Option* on page 303

DBA User Unable to Administer a Role

Under certain circumstances, it is possible that the DBA user is unable to manage a role.

If the DBA user is unable to manage a role (grant, revoke, or drop a role), it is because:

- The global role administrator has been removed from the role; or
- The DBA user is not defined as a role administrator for the role.

To resolve the issue, grant the global role administrator to the role (recommended) or add the DBA user as a role administrator for the role.

See also

- *GRANT ROLE Statement* on page 272
- *Adding Role Administrators to an Existing Role* on page 14
- *Adding the Global Role Administrator to an Existing Role* on page 14

System Roles

System roles are built-in roles that are automatically created in each newly created database.

System roles:

- Are automatically created in a new database.
- Cannot be dropped.
- Cannot have their default underlying system privileges modified or revoked.
- Additional roles and system privileges can be granted to and revoked from a system role.
- Cannot be granted with administrative rights (WITH ADMIN OPTION or WITH ADMIN ONLY OPTION clauses).
- Have no password assigned, so it is not possible to connect to the database as a grantable system role.
- With the exception of the SYS, dbo, and rs_systabgroup role, do not own objects.

Granting dbo System Role

The dbo system role owns many system stored procedures and views.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

By default, the dbo system role is granted the MANAGE PROFILING system privilege with administrative rights only and the PUBLIC system role with no administrative rights.

It is a member of the SYS system role and SYS_AUTH_RESOURCE_ROLE compatibility role with no administrative rights. It is also a member of the SYS_AUTH_DBA_ROLE compatibility role with full administrative rights.

The dbo system role can be granted to other roles with no administrative rights only (WITH NO ADMIN OPTION clause). The WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are not valid for this role.

To grant the dbo system role, execute:

```
GRANT ROLE dbo TO grantee [,...]
```

See also

- *GRANT ROLE Statement* on page 272

Granting diagnostics System Role

Members of the diagnostics role inherit SELECT, INSERT, UPDATE, DELETE, and ALTER privileges on diagnostic tables and views.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

By default, the diagnostics system role is granted the SYS_AUTH_PROFILE_ROLE compatibility role with no administrative rights and the MANAGE PROFILING system privilege with administrative rights only.

It is a member of the PUBLIC system role with no administrative rights only.

The diagnostics system role can be granted to other roles with no administrative rights only (WITH NO ADMIN OPTION clause). The WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are not valid for this role.

To grant the diagnostics system role, execute:

```
GRANT ROLE diagnostics TO grantee [,...]
```

See also

- *GRANT ROLE Statement* on page 272

Granting PUBLIC System Role

The PUBLIC system role has SELECT permission on the system tables.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

By default, the PUBLIC system role is granted the MANAGE PROFILING system privilege with administrative rights only. It also granted the dba diagnostics, rs_systabgroup, and SA_DEGUG system roles and the SYS_SPATIAL_ADMIN_ROLE compatibility role with no administrative rights.

It is a member of the dbo and SYS system roles, with no administrative rights. As a member of the SYS role, it has read access for some of the system tables and views, so any user of the database can find out information about the database schema. If you want to restrict this access, you can revoke PUBLIC's membership in the SYS system role.

Any new user ID is automatically a member of the PUBLIC system role and inherits any permissions specifically granted to that role.

The PUBLIC system role can be granted to other roles with no administrative rights only (WITH NO ADMIN OPTION clause). The WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are not valid for this role.

To grant the PUBLIC system role, execute:

```
GRANT ROLE PUBLIC TO grantee [,...]
```

See also

- *GRANT ROLE Statement* on page 272

Granting rs_systabgroup System Role

This role owns tables and system procedures required for Replication Server and grants users the underlying system privileges to perform replication server functionality.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

By default, the rs_systabgroup system role is granted the MANAGE PROFILING system privilege with administrative rights only.

It is a member of the PUBLIC system role with no administrative rights only.

The rs_systabgroup system role can be granted to other roles with no administrative rights only (WITH NO ADMIN OPTION clause). The WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are not valid for this role.

To grant the rs_systabgroup system role, execute:

```
GRANT ROLE rs_systabgroup TO grantee [,...]
```

See also

- *GRANT ROLE Statement* on page 272

Granting SYS System Role

The SYS role owns the system tables and views for the database, which contain the full description of database schema, including all database objects and all user IDs.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

By default, the SYS system role is granted the MANAGE PROFILING system privilege with administrative rights only and the dbo and PUBLIC system roles with no administrative rights.

The SYS system role can be granted to other roles with no administrative rights only (WITH NO ADMIN OPTION clause). The WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are not valid for this role.

To grant the SYS system role, execute:

```
GRANT ROLE SYS TO grantee [,...]
```

See also

- *GRANT ROLE Statement* on page 272

Granting SYS_REPLICATION_ADMIN_ROLE

This role is required for performing administration tasks related to replication such as granting replication roles, managing publications, subscriptions, synchronization users and profiles, managing message types, setting replication-related options, and so on.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

By default, the rs_systabgroup system role is granted the MANAGE PROFILING system privilege with administrative rights only.

It is also granted these system privileges with no administrative rights:

- CREATE ANY PROCEDURE
- CREATE ANY TABLE
- DROP ANY TABLE
- DROP ANY PROCEDURE
- MANAGE ANY OBJECT PRIVILEGE
- MANAGE ANY USER
- MANAGE ANY WEB SERVICE
- MANAGE REPLICATION
- MANAGE ROLES
- SERVER OPERATOR
- SELECT ANY TABLE
- SET ANY SYSTEM OPTION
- SET ANY PUBLIC OPTION
- SET ANY USER DEFINED OPTION

This default set of system privileges cannot be revoked from the role. However, unlike other system roles, additional system privileges and roles can be granted and revoked from this role.

The SYS_RUN_REPLICATION_ADMIN_ROLE system role can be granted to other roles with no administrative rights only (WITH NO ADMIN OPTION clause). The WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are not valid for this role.

To grant the SYS_REPLICATION_ADMIN_ROLE system role, execute:

```
GRANT ROLE SYS_REPLICATION_ADMIN_ROLE TO grantee [,...]
```

See also

- *GRANT ROLE Statement* on page 272

Granting SYS_RUN_REPLICATION_ROLE

This role is required for performing replication tasks using **dbremote** and synchronization tasks using **dbmlsync**.

Prerequisites

MANAGE REPLICATION system privilege.

Task

The SYS_RUN_REPLICATION_ROLE system role is active only for users connecting through the **dbremote** or **dbmlsync** utilities.

The SYS_RUN_REPLICATION_ROLE system role is a member of the SYS_AUTH_DBA_ROLE compatibility role with full administrative rights.

It is also granted these system privileges with no administrative rights:

- SELECT ANY TABLE
- SET ANY USER DEFINED OPTION
- SET ANY SYSTEM OPTION
- BACKUP DATABASE
- MONITOR

The SYS_RUN_REPLICATION_ROLE system role can be granted to other roles with no administrative rights only (WITH NO ADMIN OPTION clause). The WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are not valid for this role.

By default, when granting SYS_RUN_REPLICATION_ROLE, the underlying system privileges were inherited by members of the receiving group. To prevent inheritance, the WITH NO SYSTEM PRIVILEGE INHERITANCE clause can be included for this system role only.

This default set of system privileges cannot be revoked from the system role. Additional system privileges and roles can be granted and revoked from this system role.

The minimum number of role administrators (**MIN_ROLE_ADMINS**) database option ensures that a designated number of users always exist in the database who can grant and revoke the MANAGE REPLICATION system privilege to other users.

The SYS_AUTH_DBA_ROLE compatibility role is granted by default to the SYS_RUN_REPLICATION_ROLE system role to address any possible requirements for additional system privileges to perform other replication related authorized tasks over and above the above-noted explicitly granted system privileges. It is recommended, however, that the SYS_AUTH_DBA_ROLE compatibility role be revoked from SYS_RUN_REPLICATION_ROLE system role and those specific additional system privileges or roles identified be explicitly granted to the SYS_RUN_REPLICATION_ROLE system role.

To grant the SYS_RUN_REPLICATION_ROLE system role, execute one of these statements:

Inheritance Type	Statement
With inheritance	**GRANT ROLE SYS_RUN_REPLICATION_ROLE TO** *grantee [,...]*
With no inheritance	**GRANT ROLE SYS_RUN_REPLICATION_ROLE TO** *grantee [,...]* **WITH NO SYSTEM PRIVILEGE INHERITANCE**

See also

- *GRANT ROLE Statement* on page 272

Granting SYS_SPATIAL_ADMIN_ROLE System Role

Grants users the ability to create, alter, drop, or comment on spatial reference systems and spatial units of measure. The SYS_SPATIAL_ADMIN_ROLE is the owner of all spatial objects.

Prerequisites

Requires the MANAGE ROLES system privilege.

Task

By default, the dbo system role is granted the MANAGE PROFILING system privilege with administrative rights only.

It is a member of the PUBLIC system role with no administrative rights only.

The SYS_SPATIAL_ADMIN_ROLE system role can be granted to other roles with no administrative rights only (WITH NO ADMIN OPTION clause). The WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are not valid for this role.

To grant the SYS_SPATIAL_ADMIN_ROLE system role, execute:

```
GRANT ROLE SYS_SPATIAL_ADMIN_ROLE TO grantee [,...]
```

See also

- *GRANT ROLE Statement* on page 272

Revoking a System Role

Revoke a system role from a user or role.

Prerequisites

Requires administrative privilege over the system role being revoked.

Task

To revoke a system role, execute one of these statements:

Administrative Option	Statement
Administrative rights to the role only	**REVOKE ADMIN OPTION FOR ROLE** *role_name* **FROM** *grantee [,...]*
Role membership and all administrative rights to the role	**REVOKE ROLE** *role_name* **FROM** *grantee [,...]*

Examples:

This statement revokes SYS_AUTH_SA_ROLE entirely from `Mary`:

```
REVOKE ROLE SYS_AUTH_SA_ROLE FROM Mary
```

This statement revokes only administrative rights for SYS_AUTH_SSO_ROLE from `Joe`:

```
REVOKE ADMIN OPTION  FOR ROLE SYS_AUTH_SSO_ROLE FROM Mary
```

See also

- *REVOKE ROLE Statement* on page 288

Compatibility Roles

Compatibility roles are like starter roles. They are also present for backward compatibility with pre-16.0 versions that support authority-based security.

You cannot modify the underlying system privileges of compatibility roles. However, you can migrate them to user-defined roles, and then modify the privileges. When you migrate a compatibility role, all grantees of the compatibility role are automatically granted the user-defined role.

For more information on compatibility roles, see *Upgrading to Role-Based Security* in the Migration document appropriate to your operating system.

Granting SYS_AUTH_SA_ROLE

Allows users to perform authorized tasks pertaining to data and system administration responsibilities.

Prerequisites

Administrative privilege over SYS_AUTH_SA_ROLE role.

Task

You can grant this role with or without administrative rights. When granted with administrative rights, a user can manage (grant and revoke) the role, as well as use any of the underlying system privileges. When granted with administrative rights only, a user can manage the role, but not use its underlying system privileges. Finally, when granted with no administrative rights, a user can only use its underlying system privileges.
To grant the SYS_AUTH_SA_ROLE role, execute one of these statements:

Administrative Option	Statement
With full administrative rights	**GRANT ROLE SYS_AUTH_SA_ROLE TO** *grantee [,...]* **WITH ADMIN OPTION**
With administrative rights only	**GRANT ROLE SYS_AUTH_SA_ROLE TO** *grantee [,...]* **WITH ADMIN ONLY OPTION**
With no administrative rights	**GRANT ROLE SYS_AUTH_SA_ROLE TO** *grantee [,...]* **WITH NO ADMIN OPTION**

See also

- *GRANT ROLE Statement* on page 272

System Privileges Granted to SYS_AUTH_SA_ROLE

System privileges granted to the SYS_AUTH_SA_ROLE role. Each system privilege is granted with the **WITH ADMIN OPTION** clause.

- ACCESS SERVER LS system privilege
- ALTER ANY INDEX system privilege
- ALTER ANY MATERIALIZED VIEW system privilege
- ALTER ANY OBJECT system privilege
- ALTER ANY PROCEDURE system privilege
- ALTER ANY SEQUENCE system privilege
- ALTER ANY TEXT CONFIGURATION system privilege

- ALTER ANY TABLE system privilege
- ALTER ANY TRIGGER system privilege
- ALTER ANY VIEW system privilege
- ALTER DATABASE system privilege
- ALTER DATATYPE system privilege
- BACKUP DATABASE system privilege
- CHECKPOINT system privilege
- COMMENT ANY OBJECT system privilege
- CREATE ANY INDEX system privilege
- CREATE ANY MATERIALIZED VIEW system privilege
- CREATE ANY OBJECT system privilege
- CREATE ANY PROCEDURE system privilege
- CREATE ANY SEQUENCE system privilege
- CREATE ANY TABLE system privilege
- CREATE ANY TEXT CONFIGURATION system privilege
- CREATE ANY TRIGGER system privilege
- CREATE ANY VIEW system privilege
- CREATE DATATYPE system privilege
- CREATE EXTERNAL REFERENCE system privilege
- CREATE MATERIALIZED VIEW system privilege
- CREATE MESSAGE system privilege
- CREATE PROCEDURE system privilege
- CREATE PROXY TABLE system privilege
- CREATE TABLE system privilege
- CREATE TEXT CONFIGURATION system privilege
- CREATE VIEW system privilege
- DEBUG ANY PROCEDURE system privilege
- DELETE ANY TABLE system privilege
- DROP ANY INDEX system privilege
- DROP ANY MATERIALIZED VIEW system privilege
- DROP ANY OBJECT system privilege
- DROP ANY PROCEDURE system privilege
- DROP ANY SEQUENCE system privilege
- DROP ANY TABLE system privilege
- DROP ANY TEXT CONFIGURATION system privilege
- DROP ANY VIEW system privilege
- DROP DATATYPE system privilege
- DROP MESSAGE system privilege
- EXECUTE ANY PROCEDURE system privilege

- INSERT ANY TABLE system privilege
- LOAD ANY TABLE system privilege
- MANAGE ANY DBSPACE system privilege
- MANAGE ANY EVENT system privilege
- MANAGE ANY EXTERNAL ENVIRONMENT system privilege
- MANAGE ANY EXTERNAL OBJECT system privilege
- MANAGE ANY MIRROR SERVER system privilege
- MANAGE ANY SPATIAL OBJECT system privilege
- MANAGE ANY STATISTICS system privilege
- MANAGE ANY WEB SERVICE system privilege
- MANAGE MULTIPLEX system privilege
- MANAGE PROFILING system privilege
- MANAGE REPLICATION system privilege
- MONITOR system privilege
- READ CLIENT FILE system privilege
- READ FILE system privilege
- REORGANIZE ANY OBJECT system privilege
- SELECT ANY TABLE system privilege
- SERVER OPERATOR system privilege
- SET ANY PUBLIC OPTION system privilege
- SET ANY SYSTEM OPTION system privilege
- SET ANY USER DEFINED OPTION system privilege
- TRUNCATE ANY TABLE system privilege
- UPDATE ANY TABLE system privilege
- UPGRADE ROLE system privilege
- USE ANY SEQUENCE system privilege
- VALIDATE ANY OBJECT system privilege
- WRITE CLIENT FILE system privilege
- WRITE FILE system privilege

Granting SYS_AUTH_SSO_ROLE

Grant to allow users to perform authorized tasks pertaining to security and access control responsibilities.

Prerequisites

Administrative privilege over SYS_AUTH_SSO_ROLE role.

Task

You can grant this role with or without administrative rights. When granted with administrative rights, a user can manage (grant and revoke) the role, as well as use any of the underlying system privileges. When granted with administrative rights only, a user can

manage the role, but not use its underlying system privileges. Finally, when granted with no administrative rights, a user can only use its underlying system privileges.
To grant the role, execute one of these statements:

Administrative Option	Statement
With full administrative rights	**GRANT ROLE SYS_AUTH_SSO_ROLE TO** *grantee [,...]* **WITH ADMIN OPTION**
With administrative rights only	**GRANT ROLE SYS_AUTH_SSO_ROLE TO** *grantee [,...]* **WITH ADMIN ONLY OPTION**
With no administrative rights	**GRANT ROLE SYS_AUTH_SSO_ROLE TO** *grantee [,...]* **WITH NO ADMIN OPTION**

See also
- *GRANT ROLE Statement* on page 272

System Privileges Granted to SYS_AUTH_SSO_ROLE
System privileges granted to the SYS_AUTH_SSO_ROLE role. Each system privilege is granted with the **WITH ADMIN OPTION** clause.

- ALTER ANY OBJECT OWNER system privilege
- ANY USER system privilege
- CHANGE PASSWORD system privilege
- DROP CONNECTION system privilege
- MANAGE ANY OBJECT PRIVILEGES system privilege
- MANAGE ANY LDAP SERVER system privilege
- MANAGE ANY LOGIN POLICY system privilege
- MANAGE ANY USER system privilege
- MANAGE AUDITING system privilege
- MANAGE ROLES system privilege
- SET ANY SECURITY OPTION system privilege
- SET USER system privilege (granted with the WITH ADMIN ONLY OPTION clause)

Granting SYS_AUTH_DBA_ROLE
Grant to allow users to perform all authorized tasks.

Prerequisites
Administrative privilege over SYS_AUTH_DBA_ROLE role.

Task

This role indirectly grants all compatibility roles, as well as some system roles to a user. It is the union of the underlying system privileges of each of these roles that makes the SYS_AUTH_DBA_ROLE role the "super" role.

You can grant this role with or without administrative rights. When granted with administrative rights, a user can manage (grant and revoke) the role, as well as use any of the underlying system privileges. When granted with administrative rights only, a user can manage the role, but not use its underlying system privileges. Finally, when granted with no administrative rights, a user can only use its underlying system privileges.

Note: If you are migrating from SAP Sybase IQ 15.4 or earlier, the concept of inheritance of the underlying system privileges of this system role represents a change in behavior with SAP Sybase IQ 16.0 or later. For SAP Sybase IQ 15.4 and earlier behavior, use the WITH NO SYSTEM PRIVILEGE INHERITANCE clause.

The WITH ADMIN ONLY OPTION clauses is invalid when using the WITH NO SYSTEM PRIVILEGE INHERITANCE. clause. The WITH NO ADMIN OPTION clause is valid, but not required, as it is semantically equivalent to the WITH NO SYSTEM PRIVILEGE INHERITANCE clause.

To grant the SYS_AUTH_DBA_ROLE role, execute one of these statements:

Administrative Option	Statement
With full administrative rights	**GRANT ROLE SYS_AUTH_DBA_ROLE TO** *grantee [,...]* **WITH ADMIN OPTION**
With administrative rights only	**GRANT ROLE SYS_AUTH_DBA_ROLE TO** *grantee [,...]* **WITH ADMIN ONLY OPTION**
With no administrative rights	**GRANT ROLE SYS_AUTH_DBA_ROLE TO** *grantee [,...]* **WITH NO ADMIN OPTION**
With full administrative rights, **but no system privilege inheritance**	**GRANT ROLE SYS_AUTH_REMOTE_DBA_ROLE** TO *user_ID* **WITH ADMIN OPTION** **WITH NO SYSTEM PRIVILEGE INHERITANCE**

See also

- *GRANT ROLE Statement* on page 272

Roles Granted to SYS_AUTH_DBA_ROLE
Roles granted to the SYS_AUTH_DBA_ROLE role.

These compatibility roles are granted with the WITH ADMIN OPTION clause:

- SYS_AUTH_SA_ROLE
- SYS_AUTH_SSO_ROLE

These compatibility roles are granted with the WITH ADMIN ONLY OPTION clause:

- SYS_AUTH_RESOURCE_ROLE
- SYS_AUTH_BACKUP_ROLE
- SYS_AUTH_VALIDATE_ROLE
- SYS_AUTH_READFILE_ROLE
- SYS_AUTH_PROFILE_ROLE
- SYS_AUTH_READCLIENTFILE_ROLE
- SYS_AUTH_WRITECLIENTFILE_ROLE
- SYS_AUTH_WRITEFILE_ROLE
- SYS_AUTH_USER_ADMIN_ROLE
- SYS_AUTH_SPACE_ADMIN_ROLE
- SYS_AUTH_MULTIPLEX_ADMIN_ROLE
- SYS_AUTH_OPERATOR_ROLE
- SYS_AUTH_PERMS_ADMIN_ROLE

These system roles are granted with the WITH ADMIN ONLY OPTION clause:

- SYS_SPATIAL_ADMIN_ROLE
- diagnostics
- rs_systabgroup
- SYS
- DBO
- PUBLIC

System Privileges Granted to SYS_AUTH_DBA_ROLE
System privileges granted to the SYS_AUTH_DBA_ROLE role.

Through the granting of all compatibility roles and select system roles, these system privileges are indirectly granted to the SYS_AUTH_DBA_ROLE role. The underlying system privileges of the SYS_AUTH_SA_ROLE and SYS_AUTH_SSO_ROLE roles are indirectly granted with the WITH ADMIN OPTION clause, which grants full administrative rights. All other compatibility roles and system roles are indirectly granted with the WITH ADMIN ONLY OPTION clause.

- ACCESS SERVER LS system privilege

- ALTER ANY INDEX system privilege
- ALTER ANY MATERIALIZED VIEW system privilege
- ALTER ANY OBJECT system privilege
- ALTER ANY OBJECT OWNER system privilege
- ALTER ANY PROCEDURE system privilege
- ALTER ANY SEQUENCE system privilege
- ALTER ANY TABLE system privilege
- ALTER ANY TEXT CONFIGURATION system privilege
- ALTER ANY TRIGGER system privilege
- ALTER ANY VIEW system privilege
- ALTER DATABASE system privilege
- ALTER DATATYPE system privilege
- BACKUP DATABASE system privilege
- CHANGE PASSWORD system privilege
- CHECKPOINT system privilege
- COMMENT ANY OBJECT system privilege
- CREATE ANY INDEX system privilege
- CREATE ANY MATERIALIZED VIEW system privilege
- CREATE ANY OBJECT system privilege
- CREATE ANY PROCEDURE system privilege
- CREATE ANY SEQUENCE system privilege
- CREATE ANY TABLE system privilege
- CREATE ANY TEXT CONFIGURATION system privilege
- CREATE ANY TRIGGER system privilege
- CREATE ANY VIEW system privilege
- CREATE DATATYPE system privilege
- CREATE EXTERNAL REFERENCE system privilege
- CREATE MATERIALIZED VIEW system privilege
- CREATE MESSAGE system privilege
- CREATE PROCEDURE system privilege
- CREATE PROXY TABLE system privilege
- CREATE TABLE system privilege
- CREATE TEXT CONFIGURATION system privilege
- CREATE VIEW system privilege
- DEBUG ANY PROCEDURE system privilege
- DELETE ANY TABLE system privilege
- DROP ANY INDEX system privilege
- DROP ANY MATERIALIZED VIEW system privilege
- DROP ANY OBJECT system privilege

- DROP ANY PROCEDURE system privilege
- DROP ANY SEQUENCE system privilege
- DROP ANY TABLE system privilege
- DROP ANY TEXT CONFIGURATION system privilege
- DROP ANY VIEW system privilege
- DROP CONNECTION system privilege
- DROP DATATYPE system privilege
- DROP MESSAGE system privilege
- EXECUTE ANY PROCEDURE system privilege
- LOAD ANY TABLE system privilege
- INSERT ANY TABLE system privilege
- MANAGE ANY DBSPACE system privilege
- MANAGE ANY EVENT system privilege
- MANAGE ANY EXTERNAL ENVIRONMENT system privilege
- MANAGE ANY EXTERNAL OBJECT system privilege
- MANAGE ANY LDAP SERVER system privilege
- MANAGE ANY LOGIN POLICY system privilege
- MANAGE ANY MIRROR SERVER system privilege
- MANAGE ANY OBJECT PRIVILEGES system privilege
- MANAGE ANY SPATIAL OBJECT system privilege
- MANAGE ANY STATISTICS system privilege
- MANAGE ANY USER system privilege
- MANAGE ANY WEB SERVICE system privilege
- MANAGE AUDITING system privilege
- MANAGE MULTIPLEX system privilege
- MANAGE PROFILING system privilege
- MANAGE REPLICATION system privilege
- MANAGE ROLES system privilege
- MONITOR system privilege
- READ CLIENT FILE system privilege
- READ FILE system privilege
- REORGANIZE ANY OBJECT system privilege
- SELECT ANY TABLE system privilege
- SERVER OPERATOR system privilege
- SET ANY PUBLIC OPTION system privilege
- SET ANY SECURITY OPTION system privilege
- SET ANY SYSTEM OPTION system privilege
- SET ANY USER DEFINED OPTION system privilege
- SET USER system privilege (granted with ADMIN ONLY clause)

- TRUNCATE ANY TABLE system privilege
- UPDATE ANY TABLE system privilege
- UPGRADE ROLE system privilege
- USE ANY SEQUENCE system privilege
- VALIDATE ANY OBJECT system privilege
- WRITE CLIENT FILE system privilege
- WRITE FILE system privilege

Revoking a Compatibility Role

Revoke a compatibility role from a user or role.

Prerequisites

Requires administrative privilege over the compatibility role being revoked.

Task

To revoke a compatibility role, execute one of these statements:

Administrative Option	Statement
Administrative rights only	**REVOKE ADMIN OPTION FOR ROLE** *compatibility_role* **FROM** *grantee [,...]*
Membership in the role and any administrative rights	**REVOKE ROLE** *compatibility_role* **FROM** *grantee [,...]*

See also

- *REVOKE ROLE Statement* on page 288

Implications of Migrating Compatibility Roles on System Roles

Some system roles are indirectly granted the system privileges necessary to execute privileged tasks through membership in compatibility roles.

The underlying system privileges of a compatibility role cannot be revoked. It must first be migrated to a user-defined role. Only then can the underlying system privileges be individually revoked from the new role and granted to other user-defined roles per the organization's security requirements and to enforce separation of duties.

Compatibility roles can be migrated automatically or manually. Depending on how migration is done can impact a system role's ability to continue performing authorized tasks.

Automatic Migration

The **ALTER ROLE** statement creates a new user-defined role, automatically grants all underlying system privileges of the compatibility role to the new user-defined role, makes

each member of the compatibility role a member of the new user-defined role, and then drops the compatibility role.

Automatic migration assumes that the destination user-defined role does not already exist and all system privileges are migrated to the same new user-defined role.

Manual Migration

The **CREATE ROLE** and **GRANT** statements let you create new user-defined roles, if needed, and then grant each underlying system privilege to one or more users or roles. Once all underlying system privileges have been granted to at least one other user or role, you can drop the compatibility role.

Members of the compatibility role are not automatically granted membership in the new user-defined role. As a result, when the compatibility role is ultimately dropped, some system roles may no longer be able to perform expected privileged tasks. The affected system role must be granted membership in the new user-defined role or be directly granted the required system privileges in order to be able to continue performing their expected privileged tasks.

Members of the compatibility role are not automatically granted membership in the new user-defined role. As a result, when the compatibility role is ultimately dropped, some system roles may no longer be able to perform expected privileged tasks. The affected system role must be granted membership in the new user-defined role or be directly granted the required system privileges in order to be able to continue performing their expected privileged tasks.

Regardless of the migration method used, going forward, once a compatibility role is dropped, if you revoke a system privilege from the migrated user-defined role and grant it to another user-defined role, to ensure that system roles retain all the system privileges required to execute applicable privileged tasks, you must do one of the following:

- grant each system privilege revoked from the migrated user-defined role directly to the system roles; or
- grant membership in the user-defined role to which the system privileges are granted to the system roles.

The system roles that are members of compatibility roles, and could potentially be impacted by migration are:

System Role	Compatibility Role
dbo	SYS_AUTH_DBA_ROLE SYS_AUTH_RESOURCE_ROLE
SYS_RUN_REPLICATION_ROLE	SYS_AUTH_DBA_ROLE

Migrating a Compatibility Role

Migrate all underlying system privileges of a compatibility role to a user-defined role.

Prerequisites

Administrative privilege over the role being migrated, and the MANAGE ROLES system privilege.

Task

Compatibility roles are immutable, but they can be migrated in their entirety to a new user-defined role. Once migrated, the compatibility role is automatically dropped. This process is systematically equivalent to individually granting each underlying system privilege to a user-defined role, then manually dropping the compatibility role.

During migration:

- A new user-defined role is created.
- All of the system privileges currently granted to the migrating compatibility role are automatically granted to the new user-defined role.
- All users and roles currently granted to the migrating compatibility role are automatically granted to the new user-defined role.
- Administrators of the compatibility role continue to be the administrators of the new migrated role.
- The compatibility role is dropped.

You cannot use **ALTER ROLE** to individually migrate the SYS_AUTH_SA_ROLE and SYS_AUTH_SSO_ROLE compatibility roles. These two compatibility roles are automatically migrated when SYS_AUTH_DBA_ROLE is migrated.

When migrating a compatibility role, the new role name cannot already exist, or begin with the prefix SYS_ and end with the suffix _ROLE.

To migrate a compatibility role, execute one of the following statements:

Compatibility Role	Statement
SYS_AUTH_DBA_ROLE	**ALTER ROLE** *SYS_AUTH_DBA_ROLE* **MIGRATE TO** *new_dba_role_name, new_sa_role_name, new_sso_role_name*
Any other compatibility role	**ALTER ROLE** *compatibility_sys_role_name* **MIGRATE TO** *new_role_name*

Example

The following statement migrates SYS_AUTH_DBA_ROLE to the new roles `Custom_DBA_Role`, `Custom_SA_Role`, and `Custom_SSO_Role`, respectively.

```
ALTER ROLE SYS_AUTH_DBA_ROLE
MIGRATE TO Custom_DBA_Role, Custom_SA_Role, Custom_SSO_Role
```

This statement migrates the SYS_AUTH_OPERATOR_ROLE role to the new role `Custom_Operator_role`.

```
ALTER ROLE SYS_AUTH_OPERATOR_ROLE
MIGRATE TO Custom_Operator_Role
```

In both examples, all users, underlying system privileges, and roles granted to the original roles are automatically migrated to the new roles, then SYS_AUTH_DBA_ROLE, SYS_AUTH_SA_ROLE, SYS_AUTH_SSO_ROLE and SYS_AUTH_OPERATOR_ROLE are dropped.

Dropping a Compatibility Role

All compatibility roles, with the exception of SYS_AUTH_SA_ROLE and SYS_AUTH_SSO_ROLE can be dropped. SYS_AUTH_SA_ROLE and SYS_AUTH_SSO_ROLE are automatically dropped when SYS_AUTH_DBA_ROLE is dropped.

Prerequisites

Administrative privilege over the role being dropped.

Task

The **WITH REVOKE** clause is required only when dropping a compatibility role which is granted to users or roles.

To delete a compatibility role, execute one of the following statements:

Drop Condition	Statement
Compatibility role not currently granted to any user or role.	**DROP ROLE** *role_name*†
Compatibility role currently granted to users or roles.	**DROP ROLE** *role_name*† **WITH REVOKE**

†*role_name* cannot be SYS_AUTH_SA_ROLE or SYS_AUTH_SSO_ROLE.

Views, Procedures and Tables That Are Owned by Roles

Views, procedures, and tables are more easily managed when they are owned by a user-extended role instead of a user.

Make users who need access to a table, view, or stored procedure members of the role that owns the object. This eliminates the need to qualify the object name when accessing.

For example, the table Employees is owned by the role personnel, of which Jeff is a member. When Jeff wants to refer to the Employees table, he need only specify the name of the table in SQL statements, for example:

```
SELECT * FROM EMPLOYEES
```

However, when John, who is not a member of Personnel, wants to refer to the Employees table, he must use the qualified name of the table, for example:

```
SELECT * FROM PERSONNEL.EMPLOYEES
```

Note: Since ownership of database objects is associated with a single user ID, when the owner is a role, ownership of the table is not inherited by members of the role.

System privileges should not be granted to roles that own objects. Instead:

- create distinct roles with specific system privileges granted
- grant users who require the specific system privileges membership to the applicable role
- grant each distinct role to the role that owns the object.

This allows for complete control of the tasks performed by each user. Maintain authorized tasks by granting and revoking membership in the applicable role associated with the object.

For example, the table `Sales` is owned by the `Sales1` role. Users `Mary`, `Bob`, `Joe`, `Laurel`, and `Sally` are granted membership to `Sales1`. Create `Task1_role` and granted it the system privileges necessary to complete a specific task. Grant `Task1_role` to `Mary` and `Bob`. Create `Task2_role`, grant it specific system privileges, and grant it to `Joe` and `Sally`. Finally, grant both `Task1_role` and `Task2_role` to `Sales1`. Though both roles are granted to `Sales1`, the underlying system privileges of `Task1_role` and `Task2_role` are not automatically inherited by the other members of `Sales1`. `Mary` and `Bob` can perform different tasks than `Joe` and `Sally`. Since `Laurel` has not been granted to either `Task1_role` or `Task2_role`, and no system privileges have been granted directly to `Sales1`, `Laurel` can perform no privileged tasks on the `Sales` table. This configuration allows you to maintain and control the tasks that can be performed by each user.

Display Roles Granted

The **sp_displayroles** stored procedure which returns all roles granted to the specified system privilege, system role, user-defined role, or user name, or displays the entire hierarchy tree of roles.

The report includes role name, parent role name, type of grant (with or without administrative privilege) and the level of the role hierarchy.

No system privileges are required to execute the procedure on your own user ID. To execute the procedure on other users requires the MANAGE ROLES system privilege. To execute the procedure for a role or system privilege requires administrative privilege over the role or system privilege specified.

Example

The following statement returns all roles granted to the user issuing the command. In this example, the user logged has been granted the SYS_AUTH_DBA_ROLE compatibility role with administrative rights (for example, GRANT ROLE SYS_AUTH_DBA_ROLE TO User1 WITH ADMIN OPTION;).

```
CALL sp_displayroles();
```

This examples returns the list of system privileges granted to the SYS_SPATIAL_ADMIN_ROLE system role:

```
CALL sp_displayroles( 'SYS_SPATIAL_ADMIN_ROLE' );
```

role_name	parent_role_name	grant_type	role_level
MANAGE ANY SPATIAL OBJECT	(NULL)	NO ADMIN	1

This examples returns the list of system privileges granted to the SYS_SPATIAL_ADMIN_ROLE, including all roles above it in the hierarchy of roles:

```
CALL sp_displayroles( 'SYS_SPATIAL_ADMIN_ROLE', 'expand_up');
```

role_name	parent_role_name	grant_type	role_level
SYS_AUTH_DBA_ROLE	dbo	ADMIN	-3
SYS_AUTH_SSO_ROLE	SYS_AUTH_DBA_ROLE	ADMIN	-3

role_name	parent_role_name	grant_type	role_level
MANAGE ROLES	SYS_AUTH_REMOTE_DBA_ROLE	ADMIN	-2
MANAGE ROLES	SYS_AUTH_SSO_ROLE	ADMIN	-1
MANAGE ROLES	SYS_REPLICATION_ADMIN_ROLE	NO ADMIN	-1
SYS_SPATIAL_ADMIN_ROLE	MANAGE ROLES	ADMIN	0

See also

- *sp_displayroles System Procedure* on page 322

Determine Roles and Privileges Granted to a User

The **sp_has_role** stored function returns an integer value which indicates whether the invoker of the procedure has been granted the specified system privilege or user-defined role.

No system privileges are required to execute the function. When used for permission checking within user-defined stored procedures, this function can display an error message when a user fails a permission check.

- **1 –** indicates the system privilege or user-defined role is granted to the invoking user.
- **0 or `Permission denied: you do not have permission to execute this command/procedure` –** indicates the system privilege or user-defined role is not granted to the invoking user. The error message replaces the value 0 when the throw_error argument is set to 1
- **-1 –** indicates the system privilege or user-defined role specified does not exist. No error message appears, even if the throw_error argument is set to 1.

See also

- *SP_HAS_ROLE Function [System]* on page 325

Privileges

A privilege is a right to perform a privileged operation on the system. For example, altering a table is a privileged operation, depending on the type of alteration you are making.

There are two types of privileges: system privileges and object-level privileges.

System privileges give you the general right to perform a privileged operation, while *object-level privileges* restrict you to performing the operation on a specific object. For example, if you have the ALTER ANY TABLE system privilege, you can alter any table in the system. If you have the ALTER TABLE system privilege, you can only alter tables you own, or tables on which you have been granted the ALTER object-level privilege. They can be granted or revoked, but not created or dropped.

System privileges are built in to the database and can be granted or revoked, but not created or dropped. With the exception of the MANAGE ROLES and UPGRADE ROLE privileges, system privileges cannot be modified. Each system privilege, with the exception of the SET USER system privilege, is granted by default to either the SYS_AUTH_SA_ROLE or SYS_AUTH_SSO_ROLE role, but not both. The SET USER system privilege is granted to both roles.

You grant and revoke system and object-level privileges by using the GRANT and REVOKE statements.

Privileges Versus Permissions

Permission and privilege do not mean the same thing in role-based security. A user may have been granted the privilege required to perform an authorized task, but not have the necessary permission to perform the authorized task on the required object.

A privilege grants a user or role the ability to perform a specific authorized task. Permission, however, refers to the context in which the task is being performed

When performing an authorized task, if a failure occurs, the error message that appears often indicates that the user does not have permission to perform the task, not that the user does not have the privilege to perform the task. Before executing a privileged task or operation, the system verifies that the user has the correct privilege to perform the:

- privileged operation.
- privileged operation on the acted-on. object
- privilege operation in the context they are trying to do it in.

If the user does not have the correct privilege at any level, he or she is said to not have permission to perform the task. The operation fails and an error message appears.

Example

A user has been granted the ALTER privilege only on a text configuration object called `Myconfig`.

Object privilege: The user attempts to alter a text configuration object other than `Myconfig`. The task fails because the ALTER privilege granted to the user is specific to the `Myconfig` text object, not any text object.

Context privilege: The user attempts to drop a prefilter on `Myconfig`. Though the user has been granted the ALTER privilege on `Myconfig`, to drop a prefilter on a text configuration

object requires the ALTER ANY TEXT CONFIGURATION or ALTER ANY OBJECT system privilege, which has not been granted to the user,

System Privileges

System privileges let you control access to authorized system operations. Each privileged database task on the server requires specific system privileges. System privileges can be granted individually to users or roles.

When a system privilege is granted to a role, all members of the role inherit the system privilege. All new members of a role automatically inherit all of the underlying system privileges of a role.

Each system privilege, with the exception of the SET USER system privilege, is granted by default to either the SYS_AUTH_SA_ROLE or SYS_AUTH_SSO_ROLE role, but not both. The exception, SET USER system privilege, is granted in both roles. Some select system privileges are also vested in other predefined system roles.

Individually granting the underlying system privileges of a role is semantically equivalent to granting the role itself. System privileges can be granted to multiple user-defined system roles in any combination to meet the functional security requirements of an organization.

With the exception of MANAGE ROLES and UPGRADE ROLE, system privileges cannot be modified. They can be granted to and revoked from roles and users, but they cannot be dropped or own objects.

System Privileges Listed by Functional Area

A list of system privileges organized by functional area.

Database System Privileges

System privileges pertaining to performing authorized tasks on databases.

See also

- *List All System Privileges* on page 82

ALTER DATABASE System Privilege

Required to alter a database.

The ALTER DATABASE system privilege allows a user to:

- Perform a database upgrade
- Perform cost model calibration
- Load statistics
- Change transaction logs (also requires the SERVER OPERATOR system privilege)
- Change ownership of the database (also requires the MANAGE ANY MIRROR SERVER system privilege)

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

BACKUP DATABASE System Privilege

Allows a user to back up a database on one or more archive devices.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CHECKPOINT System Privilege

Required to force the database server to execute a checkpoint.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP CONNECTION System Privilege

Required to drop any user connections to the database.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

MANAGE PROFILING System Privilege
Required to enable or disable server tracing for application profiling. The DIAGNOSTICS system role is also required to fully utilize diagnostics functionality for user information.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also
- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

MONITOR System Privilege
Required to allow a user to perform monitoring related tasks such as access privileged statistics, run server monitor related procedures, and so on.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also
- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Database Options System Privileges
System privileges pertaining to performing authorized tasks to set database options.

See also
- *List All System Privileges* on page 82

SET ANY PUBLIC OPTION System Privilege
Required to set any PUBLIC system database option that does not require the SET ANY SECURITY OPTION or SET ANY SYSTEM OPTION system privileges.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also
- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291

- *List All System Privileges* on page 82

SET ANY SECURITY OPTION System Privilege

Required to set any PUBLIC security database options.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

SET ANY SYSTEM OPTION System Privilege

Required to set any PUBLIC system database options.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

SET ANY USER DEFINED OPTION System Privilege

Required to set any user-defined options.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Data Type System Privileges

System privileges pertaining to performing authorized tasks on data types.

See also

- *List All System Privileges* on page 82

ALTER DATATYPE System Privilege
Required to alter data types.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE DATATYPE System Privilege
Required to create data types.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP DATATYPE System Privilege
Required to drop data types.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Dbspaces System Privileges
System privileges pertaining to performing authorized tasks on dbspaces.

See also

- *List All System Privileges* on page 82

MANAGE ANY DBSPACE System Privilege

Required to perform management-related tasks on dbspaces.

The MANAGE ANY DBSPACE system privilege allows a user to:

- Issue CREATE, ALTER, DROP, or COMMENT statements on any dbspace
- GRANT or REVOKE the CREATE object-level privilege on any dbspace
- Move data to any dbspace
- Issue a read-only selective restore statement on any dbspace
- Run the database delete file function

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Debugging System Privileges

System privileges pertaining to performing authorized tasks related to debugging.

See also

- *List All System Privileges* on page 82

DEBUG ANY PROCEDURE System Privilege

Required to debug all code in any database object.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Events System Privileges

System privileges pertaining to authorized tasks on events.

See also

- *List All System Privileges* on page 82

MANAGE ANY EVENT System Privilege
Required to create, alter, drop or trigger events.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

External Environment System Privileges
System privileges pertaining to performing authorized tasks on external environments.

See also

- *List All System Privileges* on page 82

CREATE EXTERNAL REFERENCE System Privilege
Required to create external references in the database.

This system privilege is required in addition to any other system privileges required for creating a database object that references an external object.

For example:

- To create an external term breaker or a self-owned text configuration that uses an external term breaker requires the system privilege CREATE TEXT CONFIGURATION in addition to the CREATE EXTERNAL REFERENCE system privilege.
- To create an external procedure or function requires the CREATE PROCEDURE system privilege in addition to the CREATE EXTERNAL REFERENCE system privilege.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

MANAGE ANY EXTERNAL ENVIRONMENT System Privilege
Required to manage external environments.

The MANAGE ANY EXTERNAL ENVIRONMENT system privilege allows a user to:

- Issue ALTER or COMMENT statements on an external environment
- Issue START or STOP statements on an external environment

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

MANAGE ANY EXTERNAL OBJECT System Privilege
Required to issue install, comment on, or remove external objects.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Files System Privileges
System privileges pertaining to authorized tasks for files.

See also

- *List All System Privileges* on page 82

READ CLIENT FILE System Privilege
Required to read a file resident on the client machine.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

READ FILE System Privilege
Required to read a file resident on the server machine.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

WRITE CLIENT FILE System Privilege
Required to write a file resident on the client machine.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

WRITE FILE System Privilege
Required to write a file resident on the server machine.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Indexes System Privileges
System privileges pertaining to authorized tasks for indexes.

See also

- *List All System Privileges* on page 82

ALTER ANY INDEX System Privilege

Required to alter an existing index.

The ALTER ANY INDEX system privilege allows a user to:

- Alter indexes on any table owned by any user
- Issue COMMENT statement on any index owned by any user

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE ANY INDEX System Privilege

Required to create a new index.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

The CREATE ANY INDEX system privilege allows a user to:

- Create indexes on any table owned by any user
- Issue COMMENT statement on any index owned by any user

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP ANY INDEX System Privilege

Required to drop indexes on any table owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

LDAP System Privileges

System privileges pertaining to performing authorized tasks on an LDAP server configuration object.

See also

- *List All System Privileges* on page 82

MANAGE ANY LDAP SERVER System Privilege

Required to issue CREATE, ALTER, or DROP statements on an LDAP server configuration object.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Materialized Views System Privileges

System privileges pertaining to performing authorized tasks on materialized views.

See also

- *List All System Privileges* on page 82

CREATE ANY MATERIALIZED VIEW System Privilege

Required to create materialized views that are owned by any user. It also allows users to issue the COMMENT statement on materialized views owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE MATERIALIZED VIEW System Privilege
Required to create self-owned materialized views. It also allows users to issue the COMMENT statement on self-owned materialized views.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also
- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

ALTER ANY MATERIALIZED VIEW System Privilege
Required to alter materialized views owned by any user. It also allows users to issue the COMMENT statement on materialized views owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also
- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP ANY MATERIALIZED VIEW System Privilege
Required to drop materialized views owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also
- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Messages System Privileges
System privileges pertaining to performing authorized tasks for messages.

See also
- *List All System Privileges* on page 82

CREATE MESSAGE System Privilege

Required to create messages.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP MESSAGE System Privilege

Required to drop messages.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Miscellaneous System Privileges

System privileges pertaining to performing miscellaneous authorized tasks.

See also

- *List All System Privileges* on page 82

ALTER ANY OBJECT System Privilege

Required to alter an object owned by anyone.

The ALTER ANY OBJECT system privilege allows a user to issue these statements:

- ALTER TABLE
- ALTER INDEX
- ALTER JOIN INDEX
- ALTER VIEW
- ALTER MATERIALIZED VIEW
- ALTER PROCEDURE
- ALTER EVENT

- ALTER SEQUENCE
- ALTER FUNCTION
- ALTER DATATYPE
- ALTER MESSAGE
- ALTER TEXT CONFIGURATION
- ALTER TRIGGER
- ALTER STATISTICS
- COMMENT on different objects
- ALTER SPATIAL REFERENCE SYSTEM
- ALTER SPATIAL UNIT OF MEASURE

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

ALTER ANY OBJECT OWNER System Privilege

Required to change the owner of a user table owned by anyone.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

Note: This system privilege applies to table objects only. Owners of other objects, such as procedures, materialized views, etc., cannot be changed.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

COMMENT ANY OBJECT System Privilege

Required to comment on any object owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279

- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE ANY OBJECT System Privilege

Required to create an object owned by anyone.

The CREATE ANY OBJECT system privilege allows a user to issue these statements:

- COMMENT on different objects
- CREATE DATATYPE
- CREATE EVENT
- CREATE FUNCTION
- CREATE INDEX
- CREATE JOIN INDEX
- CREATE MATERIALIZED VIEW
- CREATE MESSAGE
- CREATE PROCEDURE
- CREATE SCHEMA
- CREATE SEQUENCE
- CREATE SPATIAL REFERENCE SYSTEM
- CREATE SPATIAL UNIT OF MEASURE
- CREATE STATISTICS
- CREATE TABLE
- CREATE TEXT CONFIGURATION
- CREATE VIEW

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP ANY OBJECT System Privilege

Required to drop an object owned by anyone.

The DROP ANY OBJECT system privilege allows a user to issue these statements:

- DROP DATATYPE
- DROP EVENT
- DROP FUNCTION

- DROP INDEX
- DROP JOIN INDEX
- DROP MATERIALIZED VIEW
- DROP MESSAGE
- DROP PROCEDURE
- DROP SEQUENCE
- DROP SPATIAL REFERENCE SYSTEM
- DROP SPATIAL UNIT OF MEASURE
- DROP STATISTICS
- DROP TABLE
- DROP TEXT CONFIGURATION
- DROP TRIGGER
- DROP VIEW

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

MANAGE ANY OBJECT PRIVILEGES System Privilege

Required to manage objects.

The MANAGE ANY OBJECT PRIVILEGES system privilege allows a user to perform management-related tasks such as:

- Grant any object-level privilege (INSERT, UPDATE, DELETE, SELECT, ALTER, REFERENCES or EXECUTE) on objects owned by any user
- Revoke any object-level privilege granted by the object owner or another user with MANAGE ANY OBJECT PRIVILEGES system privilege

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

REORGANIZE ANY OBJECT System Privilege
Required to issue the REORGANIZE statement on applicable objects owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

VALIDATE ANY OBJECT System Privilege
Required to validate or check tables, materialized views, indexes or databases in the system store owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Mirror Server System Privileges
System privileges pertaining to authorized tasks for mirrored servers.

See also

- *List All System Privileges* on page 82

MANAGE ANY MIRROR SERVER System Privilege
Required to perform high availability server administrative tasks.

The MANAGE ANY MIRROR SERVER system privilege allows a user to:

- Issue CREATE, ALTER or DROP statement on mirrored servers
- Change mirror server parameters
- Set options on mirror servers
- Execute the ALTER statement to change ownership of a database

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Multiplex System Privileges

Two specific system privileges are required to perform authorized tasks in a multiplex environment.

See also

- *List All System Privileges* on page 82

ACCESS SERVER LS System Privilege

Allows logical server connection using the SERVER logical server context.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

MANAGE MULTIPLEX System Privilege

Allows administrative tasks related to multiplex server management.

The MANAGE MULTIPLEX system privilege allows a user to:

- Issue multiplex-related CREATE, ALTER, DROP, or COMMENT statements on logical server policies
- Issue multiplex-related CREATE, ALTER, DROP, or COMMENT statements on logical servers
- Perform exclusive assignment of a dbspace to logical servers
- Release a populated dbspace from the exclusive use of a logical server

Note: The MANAGE MULTIPLEX system privilege also manages failover configurations, and is required for a manual failover.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279

- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Procedures System Privileges

System privileges pertaining to performing authorized tasks for procedures.

See also

- *List All System Privileges* on page 82

ALTER ANY PROCEDURE System Privilege

Required to alter any stored procedure or function owned by any user.

The ALTER ANY PROCEDURE system privilege allows a user to:

- Alter stored procedures and functions owned by any user
- Issue COMMENT statement on procedures owned by any user

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE ANY PROCEDURE System Privilege

Required to create any stored procedure or function owned by any user.

The CREATE ANY PROCEDURE system privilege allows a user to:

- Create stored procedures and functions owned by any user
- Issue COMMENT statement on procedures owned by any user

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE PROCEDURE System Privilege

Required to create a self-owned stored procedure or function.

The CREATE PROCEDURE system privilege allows a user to:

- Create self-owned stored procedures and functions
- Issue COMMENT statement on self-owned procedures

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP ANY PROCEDURE System Privilege

Required to drop any stored procedure or function owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

EXECUTE ANY PROCEDURE System Privilege

System privilege required to execute any stored procedure or function owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

MANAGE AUDITING System Privilege
Required to run the **sa_audit_string** stored procedure.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Replication System Privileges
System privileges pertaining to performing authorized replication tasks.

See also

- *List All System Privileges* on page 82

MANAGE REPLICATION System Privilege
System privilege required to perform replication-related tasks.

The MANAGE REPLICATION system privilege allows a user to:

- Issue CREATE, ALTER, DROP, or COMMENT PUBLICATION statement
- Issue CREATE, ALTER, DROP, or SYNCHRONIZATION SUBSCRIPTION statement
- Issue CREATE, ALTER, DROP, or SYNCHRONIZATION USER statement
- Issue CREATE, ALTER, DROP, or COMMENT SYNCHRONIZATION PROFILE statement
- Issue CREATE or DROP SUBSCRIPTION statement
- Issue CREATE REMOTE MESSAGE TYPE statement
- Issue DROP REMOTE MESSAGE TYPE statement
- Issue GRANT or REVOKE CONSOLIDATE statement
- Issue GRANT or REVOKE REMOTE statement
- Issue GRANT or REVOKE PUBLISH statement
- Issue LOCK FEATURE statement
- Issue START, STOP, or SYNCHRONIZE SUBSCRIPTION statement
- Issue PASSSTHROUGH statement
- Issue REMOTE RESET statement
- Issue SET REMOTE OPTION statement
- Issue START or STOP SYNCHRONIZATION SCHEMA CHANGE statement
- Issue SYNCHRONIZE PROFILE statement

- Execute SA_SETREMOTEUSER
- Execute SA_SETSUBSCRIPTION

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Roles System Privileges

System privileges pertaining to performing authorized tasks for roles.

See also

- *List All System Privileges* on page 82

MANAGE ROLES System Privilege

Required to create new roles and act as the default administrator of roles.

While the MANAGE ROLES system privilege allows a user to create a new user-defined role, it does not allow them to delete the role. For this, a user requires administrative rights on the role.

Users granted the MANAGE ROLES system privilege serve as default global role administrators on a user-defined role.

If no role administrator is specified during the role creation process, the MANAGE ROLES system privilege (SYS_MANAGE_ROLES_ROLE) is automatically granted to the role with the ADMIN ONLY OPTION clause, which allows the global role administrator to administer the role. If at least one role administrator is specified during the creation process, the MANAGE ROLES system privilege is not granted to the role, and global role administrators will be unable to manage the role.

MANAGE ROLES is the only system privilege with the ability to be granted the ability to administer user-defined roles.

Note: Administration of a role can also be granted directly to users either during the creation of the role or after the fact. When granted directly to a user, the user does not require the MANAGE ROLES system privilege to administer the role.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

UPGRADE ROLE System Privilege

Required to administrate new system privileges introduced when upgrading from a database earlier than 16.0.

By default, the UPGRADE ROLE system privilege is granted to the SYS_AUTH_SA_ROLE role (if it still exists).

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Sequences System Privileges

System privileges pertaining to performing authorized tasks for sequencing.

See also

- *List All System Privileges* on page 82

ALTER ANY SEQUENCE System Privilege

Required to alter any sequence.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE ANY SEQUENCE System Privilege

Required to create any sequence.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291

- *List All System Privileges* on page 82

DROP ANY SEQUENCE System Privilege
Required to drop any sequence.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also
- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

USE ANY SEQUENCE System Privilege
Required to use any sequence.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also
- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Server Operator System Privileges
System privileges pertaining to performing authorized server operator tasks.

See also
- *List All System Privileges* on page 82

SERVER OPERATOR System Privilege
Required to perform server-operator-related tasks.

The SERVER OPERATOR system privilege allows a user to:

- Create databases
- Cache management
- Drop databases
- Start or stop a database
- Start or stop a database engine
- Create, alter, or drop a server

- Create encrypted or decrypted databases
- Create encrypted or decrypted files
- Issue ALTER statement to change transaction logs on a database
- Issue RESTORE statement for a full database restore or to restore the catalog only

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Spatial Objects System Privileges

System privileges pertaining to performing authorized tasks on spatial objects.

See also

- *List All System Privileges* on page 82

MANAGE ANY SPATIAL OBJECT System Privilege

Required to manage any spatial objects.

The MANAGE ANY SPATIAL OBJECT system privilege allows a user to issue:

- Issue CREATE, ALTER, or DROP statements on spatial objects
- Issue CREATE, ALTER, or DROP statements on spatial units of measure
- Issue COMMENT statement on spatial units of measure.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Statistics System Privileges

System privileges pertaining to performing authorized tasks on statistics.

See also

- *List All System Privileges* on page 82

MANAGE ANY STATISTICS System Privilege

Required to issue CREATE, ALTER, DROP, or UPDATE statements on statistics for any table.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Tables System Privileges

System privileges pertaining to performing authorized tasks on tables.

See also

- *List All System Privileges* on page 82

ALTER ANY TABLE System Privilege

Required to alter any table owned by anyone.

The ALTER DATABASE system privilege allows a user to:

- Issue ALTER or TRUNCATE statement on tables, table partitions, or views owned by any user
- Issue COMMENT statement on tables owned by any user
- Issue COMMENT statement on columns on tables owned by any user

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE ANY TABLE System Privilege

Required to create tables owned by any user.

The CREATE ANY TABLE system privilege allows a user to:

- Create tables, including proxy tables, owned by any user

- Issue COMMENT statement on tables owned by any user
- Issue COMMENT statement on columns on tables owned by any user

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE PROXY TABLE System Privilege

Required to create self owned proxy tables.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE TABLE System Privilege

Required to create self owned tables.

The CREATE TABLE system privilege allows a user to:

- Create self-owned tables except proxy tables
- Issue COMMENT statement on self-owned tables
- Issue COMMENT statement on columns on self-owned tables

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DELETE ANY TABLE System Privilege
Required to delete rows from tables, table partitions, or views owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP ANY TABLE System Privilege
Required to drop tables owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

INSERT ANY TABLE System Privilege
Required to insert rows into tables and views owned by anyone.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

LOAD ANY TABLE System Privilege
Required to execute LOAD command for any table where the **-gl** server switch is set to DBA.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

SELECT ANY TABLE System Privilege
Required to query tables, views, or materialized views owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

TRUNCATE ANY TABLE System Privilege
Required to execute TRUNCATE command for any table.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

UPDATE ANY TABLE System Privilege
Required to update rows in tables and views owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Text Configurations System Privileges
System privileges pertaining to performing authorized task on text configurations.

See also

- *List All System Privileges* on page 82

ALTER ANY TEXT CONFIGURATION System Privilege

Required to alter text configurations owned by any user.

The ALTER ANY TEXT CONFIGURATION system privilege allows a user to:

- Issue ALTER statement on text configurations owned by any user
- Issue COMMENT statement on text configuration owned by any user

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE ANY TEXT CONFIGURATION System Privilege

Required to create text configurations owned by other users.

The CREATE ANY TEXT CONFIGURATION system privilege allows a user to:

- Create configurations owned by any user
- Issue COMMENT statement on text configuration owned by any user

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE TEXT CONFIGURATION System Privilege

Required to create self owned text configurations.

The CREATE TEXT CONFIGURATION system privilege allows a user to:

- Create self owned text configurations
- Issue COMMENT statement on self owned text configuration

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP ANY TEXT CONFIGURATION System Privilege

Required to drop text configurations owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Triggers System Privileges

System privileges pertaining to performing authorized task on triggers.

See also

- *List All System Privileges* on page 82

ALTER ANY TRIGGER System Privilege

Required to alter triggers. Users can also issue a COMMENT statement on tables if he or she has the ALTER permission on the table.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE ANY TRIGGER System Privilege

Required to create triggers. Users can also issue a COMMENT statement on tables if he or she has the ALTER permission on the table.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Users and Login Management System Privileges

System privileges pertaining to performing authorized task on users and login policies.

See also

- *List All System Privileges* on page 82

CHANGE PASSWORD System Privilege

Allows users to manage passwords other than their own.

This system privilege can be limited to allow a user to manage passwords for a specific list of users, to manage passwords for any user granted a specific list of roles, or to manage passwords for any existing database user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *Manage Passwords* on page 104
- *GRANT CHANGE PASSWORD Statement* on page 266
- *REVOKE CHANGE PASSWORD Statement* on page 283
- *List All System Privileges* on page 82

MANAGE ANY LOGIN POLICY System Privilege

Required to manage login policies.

The MANAGE ANY LOGIN POLICY system privilege allows a user to:

- Issue CREATE, ALTER, or DROP statement on login policies
- Issue COMMENT statement on login policies

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

MANAGE ANY USER System Privilege

Required to manage users.

The MANAGE ANY USER system privilege allows a user to:

- Issue CREATE, ALTER, or DROP statement on database users (including assigning initial password)
- Define authentication mechanisms for users (Kerberos, Integrated login)
- Issue CREATE or DROP statement on external logins
- Force password change on next login for any user
- Assign a login policy to any user
- Reset the login policy of any user
- Issue COMMENT statement on users, integrated logins, or Kerberos logins.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

SET USER System Privilege

Required to allow a user to temporarily assume the specific roles and system privileges (impersonate) of another user.

Suppose a user who is responsible for performing a key task is unavailable. A backup user is identified. At a minimum, this backup user must have sufficient privileges to complete the task; however, depending on the nature of the task to be performed, if the backup user has additional privileges not available to the original user, there is the potential for these additional privileges to result in the task completing differently than for the original user. Negate this potential by allowing the backup user to temporarily assume the roles and system privileges specific to the unavailable user. The backup user "impersonates" the regular user until the key task is finished.

There are two component to the SET USER system privilege. The first component is the SET USER system privilege itself. It is granted by a third party to provide a user with the ability to impersonate another user. The second component is the SETUSER command, which actually impersonate another user. You cannot issue the command to impersonate a user if you have not been granted the privilege to impersonate.

Tip: SET USER is two words when referring to the system privilege, but one word (SETUSER) when referring to the command to actually impersonate another user. You grant the SET USER system privilege, but you issue the SETUSER command to impersonate.

You can limit the granting of the SET USER system privilege to impersonate by allowing users to impersonate:

- Any user in the database
- Any user within a specified list of users
- Any user who is a member of one of the specified roles

For one user to impersonate another user, the grantee (impersonating) user must have been granted at least all of the roles and system privileges, with the same or higher administrative privileges, as those already granted to the target (impersonated) user. The grantee can have been granted additional roles, system privileges, or higher administrative privileges, but not fewer. While a user is impersonating another user, you cannot grant additional privileges to the impersonated user or revoke existing privileges from the impersonating user if doing so invalidate the "at-least" criteria of the SET USER system privilege.

Validation of the at-least criteria occurs when the SETUSER command to impersonate another user is issued, not when the SET USER system privilege is granted to a user. When the SETUSER command is issued, if the grantee fails to meet any of the at-least requirements, a permission denied error message appears.

When one user impersonates another, the user ID of the target user, not the grantee user, is recorded in the audit logs. However, since the act of impersonation (issuance of the SETUSER command) is also recorded in the audit logs, you can determine whether or not a task was executed by the actual user or an impersonating user.

Use the SET USER system privilege only as a temporary measure. While a user is impersonating another user, any roles or system privileges granted to the grantee user are unavailable until the impersonation is terminated. It is strongly recommended that you terminate an impersonation as soon as the required tasks are completed, to allow the grantee to regain their normal roles and system privileges. If you do not deliberately terminate impersonation, it is automatically terminated as soon as the grantee user ends the current session or successfully begins impersonating a different user.

Scenario 1

Assume the following:

- There are two users, User1 and User2.

- There are two roles, Role1 and Role2.
- Role1 has been granted the CREATE TABLE system privilege.
- Role2 has been granted the CREATE ANY TABLE system privilege.
- User1 has been granted Role1.
- User2 has been granted Role1 and Role2.

A task requiring the CREATE TABLES system privilege needs to be performed.

The task is usually performed by User1, who is unavailable. User2 has been identified as the backup user to carry out the task. Since both User1 and User2 have been granted Role1, User2 has the required system privilege to perform the task as himself or herself. However, since User2 has also been granted Role2, which includes higher system privileges with respect to creating tables, there is the potential for the task to complete differently than if performed by User1.

To negate this possibility, User2 can impersonate User1 to complete the task.

Scenario 2 – Meeting At-Least Requirements for Roles
Assume the following:

- There are two users, User1 and User2.
- There are two roles, Role1 and Rol2.
- User1 has been granted Role1.
- User2 has been granted Role1 and Role2.
- User1 has been granted the SET USER system privilege to impersonate User2.
- User2 has been granted the SET USER system privilege to impersonate User1.

User2 can successfully impersonate User1 because they both have been granted Role1, which meets the at-least criteria. However, User1 cannot successfully impersonate User2 because User1 has not been granted Role2 and does not meet the at-least criteria.

Scenario 3 – Meeting At-Least Requirements for Administrative Options
Assume the following:

- There are two users, User4 and User5.
- User4 has been granted Role1 with the WITH ADMIN OPTION clause.
- User5 has been granted Role1 with the WITH NO ADMIN OPTION clause.
- User4 has been granted the SET USER system privilege to impersonate User5.
- User5 has been granted the SET USER system privilege to impersonate User4.

Even though both users have been granted Role1, User5 cannot successfully impersonate User4 because he or she has fewer administrative rights to Role1 than User4, which fails the at-least requirement. However, User4 can impersonate User5 because he or she has more administrative rights to Role1 than User5, which meets the at- least requirement.

See also

- *Impersonation* on page 110
- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Views System Privileges

System privileges pertaining to performing authorized tasks on views.

See also

- *List All System Privileges* on page 82

ALTER ANY VIEW System Privilege

Required to alter views owned by any user.

The ALTER ANY VIEW system privilege allows a user to:

- Alter views owned by any user
- Issue COMMENT statement on views owned by any user

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE ANY VIEW System Privilege

Required to create views owned by any user.

The CREATE ANY VIEW system privilege allows a user to:

- Create views owned by any user
- Issue COMMENT statement on views owned by any user

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

CREATE VIEW System Privilege

Required to create self owned views.

The CREATE VIEW system privilege allows a user to:

- Create self owned views
- Issue COMMENT statement on self owned views

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

DROP ANY VIEW System Privilege

Required to drop a view owned by any user.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

Web Services System Privileges

System privileges pertaining to performing authorized task on Web services.

See also

- *List All System Privileges* on page 82

MANAGE ANY WEB SERVICE System Privilege

Required to manage tasks related to Web services.

The MANAGE ANY WEB SERVICE system privilege allows a user to:

- Issue CREATE, ALTER, or DROP statements on Web services
- Issue COMMENT statement on Web services

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.

See also

- *GRANT System Privilege Statement* on page 279
- *REVOKE System Privilege Statement* on page 291
- *List All System Privileges* on page 82

List All System Privileges

List of all system privileges.

System privileges control the rights of users to perform authorized database tasks.

See also

- *ACCESS SERVER LS System Privilege* on page 62
- *ALTER ANY INDEX System Privilege* on page 54
- *ALTER ANY MATERIALIZED VIEW System Privilege* on page 56
- *ALTER ANY OBJECT System Privilege* on page 57
- *ALTER ANY OBJECT OWNER System Privilege* on page 58
- *ALTER ANY PROCEDURE System Privilege* on page 63
- *ALTER ANY SEQUENCE System Privilege* on page 67
- *ALTER ANY TABLE System Privilege* on page 70
- *ALTER ANY TEXT CONFIGURATION System Privilege* on page 74
- *ALTER ANY TRIGGER System Privilege* on page 75
- *ALTER ANY VIEW System Privilege* on page 80
- *ALTER DATABASE System Privilege* on page 45
- *ALTER DATATYPE System Privilege* on page 49
- *BACKUP DATABASE System Privilege* on page 46
- *CHANGE PASSWORD System Privilege* on page 76
- *CHECKPOINT System Privilege* on page 46
- *COMMENT ANY OBJECT System Privilege* on page 58
- *CREATE ANY INDEX System Privilege* on page 54
- *CREATE ANY MATERIALIZED VIEW System Privilege* on page 55
- *CREATE ANY OBJECT System Privilege* on page 59
- *CREATE ANY PROCEDURE System Privilege* on page 63
- *CREATE ANY SEQUENCE System Privilege* on page 67
- *CREATE ANY TABLE System Privilege* on page 70
- *CREATE ANY TEXT CONFIGURATION System Privilege* on page 74
- *CREATE ANY TRIGGER System Privilege* on page 76

- *CREATE ANY VIEW System Privilege* on page 80
- *CREATE DATATYPE System Privilege* on page 49
- *CREATE EXTERNAL REFERENCE System Privilege* on page 51
- *CREATE MATERIALIZED VIEW System Privilege* on page 56
- *CREATE MESSAGE System Privilege* on page 57
- *CREATE PROCEDURE System Privilege* on page 64
- *CREATE PROXY TABLE System Privilege* on page 71
- *CREATE TABLE System Privilege* on page 71
- *CREATE TEXT CONFIGURATION System Privilege* on page 74
- *CREATE VIEW System Privilege* on page 81
- *DEBUG ANY PROCEDURE System Privilege* on page 50
- *DELETE ANY TABLE System Privilege* on page 72
- *DROP ANY INDEX System Privilege* on page 54
- *DROP ANY MATERIALIZED VIEW System Privilege* on page 56
- *DROP ANY OBJECT System Privilege* on page 59
- *DROP ANY PROCEDURE System Privilege* on page 64
- *DROP ANY SEQUENCE System Privilege* on page 68
- *DROP ANY TABLE System Privilege* on page 72
- *DROP ANY TEXT CONFIGURATION System Privilege* on page 75
- *DROP ANY VIEW System Privilege* on page 81
- *DROP CONNECTION System Privilege* on page 46
- *DROP DATATYPE System Privilege* on page 49
- *DROP MESSAGE System Privilege* on page 57
- *EXECUTE ANY PROCEDURE System Privilege* on page 64
- *LOAD ANY TABLE System Privilege* on page 72
- *INSERT ANY TABLE System Privilege* on page 72
- *MANAGE ANY DBSPACE System Privilege* on page 50
- *MANAGE ANY EVENT System Privilege* on page 51
- *MANAGE ANY EXTERNAL ENVIRONMENT System Privilege* on page 51
- *MANAGE ANY EXTERNAL OBJECT System Privilege* on page 52
- *MANAGE ANY LDAP SERVER System Privilege* on page 55
- *MANAGE ANY LOGIN POLICY System Privilege* on page 76
- *MANAGE ANY MIRROR SERVER System Privilege* on page 61
- *MANAGE ANY OBJECT PRIVILEGES System Privilege* on page 60
- *MANAGE ANY SPATIAL OBJECT System Privilege* on page 69
- *MANAGE ANY STATISTICS System Privilege* on page 70
- *MANAGE ANY USER System Privilege* on page 77
- *MANAGE ANY WEB SERVICE System Privilege* on page 81
- *MANAGE AUDITING System Privilege* on page 65

- *MANAGE MULTIPLEX System Privilege* on page 62
- *MANAGE PROFILING System Privilege* on page 47
- *MANAGE REPLICATION System Privilege* on page 65
- *MANAGE ROLES System Privilege* on page 66
- *MONITOR System Privilege* on page 47
- *READ CLIENT FILE System Privilege* on page 52
- *READ FILE System Privilege* on page 53
- *REORGANIZE ANY OBJECT System Privilege* on page 61
- *SELECT ANY TABLE System Privilege* on page 73
- *SERVER OPERATOR System Privilege* on page 68
- *SET ANY PUBLIC OPTION System Privilege* on page 47
- *SET ANY SECURITY OPTION System Privilege* on page 48
- *SET ANY SYSTEM OPTION System Privilege* on page 48
- *SET ANY USER DEFINED OPTION System Privilege* on page 48
- *SET USER System Privilege* on page 77
- *TRUNCATE ANY TABLE System Privilege* on page 73
- *UPDATE ANY TABLE System Privilege* on page 73
- *UPGRADE ROLE System Privilege* on page 67
- *USE ANY SEQUENCE System Privilege* on page 68
- *VALIDATE ANY OBJECT System Privilege* on page 61
- *WRITE CLIENT FILE System Privilege* on page 53
- *WRITE FILE System Privilege* on page 53

Granting a System Privilege to a User

Allow the granting of specific system privileges to specific users, with or without administrative rights.

Prerequisites

Requires administrative privilege over the system privilege being granted.

Task

Warning! The syntax to grant a system privilege is the same for all system privileges except the CHANGE PASSWORD and SET USER system privileges.

Grant this system privilege using the WITH ADMIN OPTION, WITH NO ADMIN OPTION, or WITH ADMIN ONLY OPTION clause. If you do not specify a clause, the WITH NO ADMIN OPTION clause is used by default.
To grant a system privilege to a user, execute one of these statements:

Administrative Option	Statement
With full administrative rights	**GRANT** *system_privilege* **TO** *grantee [,...]* **WITH ADMIN OPTION**
With administrative rights only	**GRANT** *system_privilege* **TO** *grantee [,...]* **WITH ADMIN ONLY OPTION**
With no administrative rights	**GRANT** *system_privilege* **TO** *grantee [,...]* **WITH NO ADMIN OPTION**

See also

- *GRANT System Privilege Statement* on page 279
- *GRANT CHANGE PASSWORD Statement* on page 266
- *GRANT SET USER Statement* on page 277

Revoking a System Privilege from a User

Revoke a specific system privilege and the right to administer the system privilege from specific users.

Prerequisites

Requires administrative privilege over the system privilege being revoked.

Task

Warning! The syntax to revoke a system privilege applies to all system privileges except the CHANGE PASSWORD and SET USER system privileges.

To revoke a system privilege from a user, execute one of these statements:

Administrative Option	Statement
Administrative rights only	**REVOKE ADMIN OPTION FOR** *system_privilege* **FROM** *grantee [,...]*
System privilege and any administrative rights	**REVOKE** *system_privilege* **FROM** *grantee [,...]*

Example:

Assuming `Mary` and `Joe` were originally granted the BACKUP DATABASE system privilege with administrative rights, execute this statement to remove `Mary's` administrative rights to the system privilege only, leaving her ability to use the system privilege:

```
REVOKE ADMIN OPTION FOR BACKUP DATABASE FROM Mary
```

Execute this statement to remove the system privilege itself and all administrative rights from `Joe`:

```
REVOKE BACKUP DATABASE FROM Joe
```

See also

- *REVOKE System Privilege Statement* on page 291
- *REVOKE CHANGE PASSWORD Statement* on page 283
- *REVOKE SET USER Statement* on page 290

Users and Privileges Granted System Objects

Information about the current users of a database and their privileges is stored in the database system tables, which are accessible through system views.

Most system tables are owned by the SYS user ID. You cannot log in using to the SYS user ID.

The DBA has SELECT access to all system tables, just as to any other tables in the database. The access of other users to some of the tables is limited. For example, only the DBA has access to the `SYS.SYSUSERPERM` table, which contains all information about the privileges of users of the database, as well as the passwords of each user ID. However, `SYS.SYSUSERPERMS` is a view that contains all information in `SYS.SYSUSERPERM` except passwords, and by default, all users have SELECT access to this view. All privileges and role memberships that are automatically set up in a new database for SYS and PUBLIC system roles, and DBA user can be fully modified.

User ID, Role and Privilege Information in System Tables

System tables containing information about user IDs, roles, and privileges.

All tables and views are owned by the SYS role, and their qualified names are SYS.ISYSUSERPERM, SYS.ISYSTABLEPERM, and so on. Execute the appropriate SELECT queries on these tables generate all the user ID and privilege information stored in the database.

Table	Default	Contents
ISYSUSERPERM	SELECT ANY TABLE system privilege	Database-level privileges and password for each user ID
ISYSTABLEPERM	PUBLIC	All privileges on table given by the GRANT commands
ISYSCOLPERM	PUBLIC	All columns with UPDATE privilege given by the GRANT command

Table	Default	Contents
ISYSPROCPERM	PUBLIC	Each row holds one user granted privilege to use one procedure

User ID, Role, and Privilege Information in System Views
System views containing information about user IDs, roles, and privileges.

In addition to this list, there are tables and views containing information about each object in the database.

View	Default	Contents
SYSUSERAUTH	SELECT ANY TABLE system privilege	All information in SYSUSERPERM except user numbers
SYSUSERPERMS	PUBLIC	All information in SYSUSERPERM except passwords
SYSUSERLIST	PUBLIC	All information in SYSUSERAUTH except passwords
SYSTABAUTH	PUBLIC	Information from SYSTABLEPERM in a more readable format
SYSCOLAUTH	PUBLIC	Information from SYSCOLPERM in a more readable format
SYSPROCAUTH	PUBLIC	Information from SYSPROCPERM in a more readable format

Stored Procedure to Map System Privileges to System Roles

The **sp_sys_priv_role_info** stored procedure generates a report that maps each system privilege role to a system role.

A separate row is generated for each system privilege. No system privileges are required to execute the procedure.

Object-Level Privileges

Database object-level privileges can be granted to and revoked from users.

Ownership Privileges of Database Objects

Ownership of a database object carries with it privileges to carry out actions on that object. The creator of a database object may or may not be the owner of that object.

The creator of a database object may not necessarily be its owner. Another user can be designated as owner during the create process. If no owner is specified, the creator is the owner.

The *owner* of a table may modify the structure of that table, for instance, or may grant privileges to other database users to update the information within the table.

Note: The owner of a table can load data if he or she has sufficient privilege or the server was started with the **-gl all** switch on the command line or configuration file. Ownership or the CREATE ANY OBJECT system privilege are insufficient to issue the **LOAD TABLE** command. The INSERT privilege on the table is also required.

A user with the ALTER ANY OBJECT system privilege can modify any database object (regardless of owner) that could be created using the CREATE ANY OBJECT system privilege. A user with the CREATE ANY OBJECT system privilege can create database objects to be owned by other users.

Inheritance of Database Privileges

You can grant database privileges directly to users or it can be inherited through role membership.

Privilege Name	Supported By Database Object	Description
ALL	Tables, Views, Materialized Views	Allows a user to perform all tasks associated with tables, views and materialized views.
ALTER	Tables	Allows a user to alter the structure of a table.
CREATE	Dbspaces	Allows a user to create on the dbspace. The additional privileges required depend on the object that is being created. For example, to create a table, one of CREATE TABLE, CREATE ANY TABLE, or CREATE ANT OBJECT is required.
DELETE	Tables, View	Allows a user to delete rows from the table or view.
EXECUTE	Procedure, User-defined Functions	Allows a user to execute the procedure or user-defined function.
INSERT	Table, Views	Allows a user to insert rows into the table or view.
LOAD	Tables	Allows a user to load the table if the -gl database option is set to anything other than NONE.
REFERENCES	Tables	Create indexes on a table, and to create foreign keys that reference a table

Privilege Name	Supported By Database Object	Description
SELECT	Table, Views	Look at information in a table or view
TRUNCATE	Table, Materialized Views	Allows a user to truncate the table or materialized view.
UPDATE	Tables, Views	Update rows in a table or view.
USAGE	Sequence Generators	Allows a user to evaluate the current or next value in the sequence.

In a multiplex, only write servers can modify table privileges on tables owned by the write server.

Grant and Revoke Object-Level Privileges

Users can be granted or revoked combinations of privileges to define their access to a database objects

Granting the ALTER Privilege on Tables

Grant the privilege to alter the structure of a table. This privilege does not apply to views.

Prerequisites

Requires one of:

- You have been granted the MANAGE ANY OBJECT PRIVILEGE system privilege.
- You have been granted the ALTER object privilege on the table with the WITH GRANT OPTION clause.
- You own the table.

Task

To grant the ALTER privilege, enter:

```
GRANT ALTER
  ON table_name
  TO userID [,...]
```

See also

- *GRANT Object-Level Privilege Statement* on page 271
- *Granting the Right to Administer an Object-Level Privilege* on page 94

Granting the DELETE Privilege on Tables and Views

Grant the privilege to delete all data in a specified table or view.

Prerequisites

Requires one of:

- The MANAGE ANY OBJECT PRIVILEGE system privilege.
- You have been granted the DELETE object privilege on the table with the WITH GRANT OPTION clause.
- You own the table.

Task

To grant the DELETE privilege, enter:

```
GRANT DELETE
  ON table_name
  TO userID [,...]
```

See also

- *GRANT Object-Level Privilege Statement* on page 271
- *Granting the Right to Administer an Object-Level Privilege* on page 94

Granting the INSERT Privilege on Tables and Views

Grant the privilege to insert data into a table or view.

Prerequisites

Requires one of:

- You have been granted the MANAGE ANY OBJECT PRIVILEGE system privilege.
- You have been granted the INSERT object privilege on the table with the WITH GRANT OPTION clause.
- You own the table.

Task

To grant the INSERT privilege, enter:

```
GRANT INSERT
  ON table_name
  TO userID [,...]
```

See also

- *GRANT Object-Level Privilege Statement* on page 271
- *Granting the Right to Administer an Object-Level Privilege* on page 94

Granting the LOAD Privilege on Tables

Grant the privilege to load a specified table.

Prerequisites

Requires one of:

- MANAGE ANY OBJECT PRIVILEGE system privilege.
- You have been granted the LOAD object privilege with the WITH GRANT OPTION clause on the table.
- You own the table.

Task

To grant the LOAD privilege, enter:

```
GRANT LOAD
  ON table_name
  TO userID [,...]
```

See also

- *GRANT Object-Level Privilege Statement* on page 271
- *Granting the Right to Administer an Object-Level Privilege* on page 94

Granting the REFERENCES Privilege on Tables

Grant the privilege to indexes and to foreign keys on a table. This privilege does not apply to views. This privilege can be restricted to a set of columns in the table.

Prerequisites

Requires one of:

- You have been granted the MANAGE ANY OBJECT PRIVILEGE system privilege.
- You have been granted the REFERENCE object privilege on the table with the WITH GRANT OPTION clause.
- You own the table.

Task

To grant the REFERENCES privilege, enter:

```
GRANT REFERENCES column_name
  ON table_name
  TO userID [,...]
```

Example:

This statement grants the REFERENCES privilege to user `Joe` on columns `Col_1` and `Col_2` in the table named `sales_table`:

```
GRANT REFERENCES Col_1, Col_2 ON sales_table
TO Joe
```

See also

- *GRANT Object-Level Privilege Statement* on page 271
- *Granting the Right to Administer an Object-Level Privilege* on page 94

Granting the SELECT Privilege on Tables and Views

Grant the privilege to select data in a table or view, but not to alter it. This privilege can be restricted to a set of columns in the table.

Prerequisites

Requires one of:

- You have been granted the MANAGE ANY OBJECT PRIVILEGE system privilege.
- You have been granted the SELECT object privilege on the table with the WITH GRANT OPTION clause.
- You own the table.

Task

To grant the SELECT privilege, enter:

```
GRANT SELECT column_name
  ON table_name
  TO userID [,...]
```

Example:

This statement grants the SELECT privilege to user `Joe` on columns `Col_1` and `Col_2` in the table named `sales_table`:

```
GRANT SELECT Col_1, Col_2 ON sales_table
TO Joe
```

See also

- *GRANT Object-Level Privilege Statement* on page 271
- *Granting the Right to Administer an Object-Level Privilege* on page 94

Granting the TRUNCATE Privilege on Tables

Grant the privilege to truncate a specified table.

Prerequisites

Requires one of:

- The MANAGE ANY OBJECT PRIVILEGE system privilege.

- You have been granted the TRUNCATE object privilege with the WITH GRANT OPTION clause on the table.
- You own the table.

Task

To grant the TRUNCATE privilege, enter:

```
GRANT TRUNCATE
  ON table_name
  TO userID [,...]
```

See also

- *GRANT Object-Level Privilege Statement* on page 271
- *Granting the Right to Administer an Object-Level Privilege* on page 94

Granting the UPDATE Privilege on Tables and Views

Grant the privilege to modify the data in a table or view. This privilege can be restricted to a set of columns in the table.

Prerequisites

Requires one of:

- You have been granted the MANAGE ANY OBJECT PRIVILEGE system privilege.
- You have been granted the UPDATE object privilege on the table with the WITH GRANT OPTION clause.
- You own the table.

Task

To grant the UPDATE privilege, enter:

```
GRANT UPDATE column_name
  ON table_name
  TO userID [,...]
```

Example:

This statement grants the UPDATE privilege to user `Joe` on columns `Col_1` and `Col_2` in the table named `sales_table`:

```
GRANT UPDATE Col_1, Col_2 ON sales_table
TO Joe
```

See also

- *GRANT Object-Level Privilege Statement* on page 271
- *Granting the Right to Administer an Object-Level Privilege* on page 94

Granting the Right to Administer an Object-Level Privilege

Grant the privilege to allow a user to pass a specific object privilege on to other users.

Prerequisites

At least one of these conditions:

- You created the table.
- You have been granted privileges on the table with the ADMIN OPTION.
- You have been granted LOAD and TRUNCATE object privileges.
- You have been granted the MANAGE ANY OBJECT PRIVILEGE system privilege. If the LOAD or TRUNCATE object privilege is granted using the WITH GRANT OPTION clause, the grantee can then grant the object privilege to other users, but is limited to those tables specified in the original GRANT statement. Under this scenario, the grantee does not need the MANAGE ANY OBJECT PRIVILEGE system privilege.

Task

1. Connect to the database.
2. To grant the right to grant a privilege to another user, enter:

```
GRANT Object_privilege _name
  ON table_name
  TO userID [,...]
  WITH GRANT OPTION
```

Example:

This statement grants the privilege to `Mary` to perform deletes on the table `Sales`:

```
GRANT DELETE ON Sales TO Mary
```

This statement grants the right to `Joe` to both perform deletes on the table `Sales` and grant the DELETE privilege to other users:

```
GRANT DELETE ON Sales TO Joe
WITH GRANT OPTION
```

See also

- *GRANT Object-Level Privilege Statement* on page 271
- *Granting the Right to Administer an Object-Level Privilege* on page 94

Granting the CREATE Privilege on Dbspaces

Grant the privilege to create database objects in the specified dbspace.

Prerequisites

Requires the MANAGE ANY DBSPACE system privilege.

Task

To grant the CREATE privilege, enter:

```
GRANT CREATE
   ON dbspace_name
   TO userID [,...]
```

See also

- *GRANT CREATE Statement* on page 269

Granting the EXECUTE Privilege on Functions and Procedures

Grant the privilege to run a procedure or user-defined function.

Prerequisites

Requires one of:

- The MANAGE ANY OBJECT PRIVILEGE system privilege.
- You own the procedure.

Task

To grant the EXECUTE privilege, enter:

```
GRANT EXECUTE
   ON procedure_name
   TO userID [,...]
```

See also

- *GRANT EXECUTE Statement* on page 270

Granting the USAGE Privilege on Sequence Generators

Grant the privilege to evaluate the current or next value in a sequence.

Prerequisites

Requires one of:

- The MANAGE ANY OBJECT PRIVILEGE system privilege.
- You own the sequence generator.

Task

To grant the USAGE privilege, enter:

```
GRANT USAGE
   ON sequence_name
   TO userID [,...]
```

See also

- *GRANT USAGE ON SEQUENCE Statement* on page 282

Revoking an Object-Level Privilege

Remove the ability of a user to use a specific object-level privilege or grant the privilege to other users.

Prerequisites

Grantor must have at least one of these conditions:

- Be the original grantor of the privilege that is being revoked
- Have the MANAGE ANY OBJECT PRIVILEGE system privilege

Task

If you revoke a privilege from a user who has been granted a privilege with the WITH GRANT OPTION clause, then everyone who that user in turn granted the privilege to also has their privilege revoked. For example, you granted UserA the SELECT privilege with the WITH GRANT OPTION clause. UserA then grants the SELECT privilege to UserB. If you revoke the SELECT privilege from UserA, it is also revoked for UserB.

The **REVOKE** command applies to the object-level privilege itself, not to any administrative right granted on the privilege. Therefore, you cannot revoke administrative rights only and leave the object-level privilege intact. To correctly remove a user's administrative rights only to an object-level privilege, you must first revoke the privilege and then re-grant the privilege without the WITH GRANT OPTION clause.

1. To revoke an object-level privilege, including any administrative privilege, execute:

```
REVOKE object_privilege_name
  ON table_name
  FROM userID [,...]
```

2. (Optional) To then re-grant the object-level privilege without administrative rights, execute:

```
GRANT object_privilege_name
  ON table_name
  TO userID [,...]
```

Example:

This example assumes that `Joe` was granted the right to both perform deletes on the table `Sales`, and grant the DELETE privilege on the table to other users.

This statement revokes all DELETE privileges on the table `Sales`, which by definition includes any administrative rights:

```
REVOKE DELETE ON Sales FROM Joe
```

This statement re-grants the privilege only, with no administrative rights:

```
GRANT DELETE ON Sales TO Joe
```

See also

- *REVOKE Object-Level Privilege Statement* on page 286
- *REVOKE CREATE Statement* on page 285
- *REVOKE EXECUTE Statement* on page 286
- *REVOKE USAGE ON SEQUENCE Statement* on page 295

Privileges Required to Manage Table Objects in a Dbspace

There are specific system privileges required to create or move a table object in a dbspace.

Requires the CREATE privilege on the dbspace. The CREATE privilege in a dbspace can be granted to or revoked from a user or a role. Any member in a role inherits CREATE privilege from the role. By default, CREATE privilege on IQ_SYSTEM_MAIN, IQ_SYSTEM_TEMP, and SYSTEM is granted to PUBLIC. For other IQ main dbspaces, the system administrator must explicitly grant CREATE privilege on the dbspace before a role or user can create or move objects into that dbspace. For example, if a table is to be placed on a new IQ main dbspace, the user must have CREATE privilege on that dbspace. Users must also have CREATE ANY OBJECT privilege to create objects.

Command Line Options That Control Privileges

The database server start-up command **start_iq** includes options that set the privilege level of some database and server functions.

Switches That Start and Stop Databases

The **-gd** option lets you limit the users who can start or stop a database on a running server to those with a certain level of privilege in the database to which he or she is already connected:

- **DBA** – (default value) only users with SERVER OPERATOR system privilege can start an extra database.
- **ALL** – (default in **start_iq** and `default.cfg`) any user can start and stop databases. This setting means that the DBA does not need to issue **START DATABASE** commands. Users still need the privileges to access a particular database once he or she has started it.
- **NONE** – no one can start or stop a database from Interactive SQL on a running server.

Note: If **-gd ALL** is not set when you start the server, only a user with the SERVER OPERATOR system privilege can start additional databases on that server. This means that users cannot connect to databases that are not already started, either at the same time as the server, or since then by a user with the SERVER OPERATOR system privilege. However, it also lets a user without the SERVER OPERATOR system privilege stop a database. For this reason, you may want to change this setting to DBA on production databases.

Switches That Create and Delete Databases

The **-gu** option limits the users who can create and drop databases to those with a certain level of privilege in the database to which he or she is connected.

- **DBA** – only users with SERVER OPERATOR system privilege can create and drop databases.
- **ALL**(default) – any user can create and drop databases.
- **NONE** – no user can create or drop a database.
- **UTILITY_DB** – only those users who can connect to the `utility_db` database can create and drop databases.

Stop Server Switch

The **-gk** option limits the users who can shut down a server with the **dbstop** utility or **STOP ENGINE** command:

- **DBA** (default) – only users with SERVER OPERATOR system privilege can stop the server.
- **ALL** – any user can stop the server.
- **NONE** – no user can shut down the server with the **dbstop** utility or **STOP ENGINE** command.

Switches That Load and Unload Databases

The **-gl** option limits the users who can load data using **LOAD TABLE** to users with a certain level of privilege in the database.

- **DBA** – any user with the LOAD ANY TABLE, ALTER ANY TABLE or ALTER ANY OBJECT system privilege can load data.
- **ALL** (default for **start_iq** and `default.cfg`) – any user can load data.
- **NONE** – data cannot be loaded.

See also

- *-gl iqsrv16 Server Option* on page 309
- *-gu iqsrv16 database server option* on page 309
- *-gk iqsrv16 database server option* on page 308

Revoking the Privilege to Run a Procedure

Remove the privilege to execute or call a specific procedure.

Prerequisites

Revoker must either:

- Be the original grantor of the privilege that is being revoked
- Have the MANAGE ANY OBJECT PRIVILEGE system privilege

Task

To revoke the EXECUTE privilege to run a specific procedure, execute:

```
REVOKE EXECUTE ON procedure_name
FROM grantee [,...]
```

See also

- *REVOKE EXECUTE Statement* on page 286

How User Privilege Conflicts Are Resolved

Roles introduce complexities in the granting of privileges of individual users.

Suppose user `Joe` has been individually granted **SELECT** and **UPDATE** privileges on a specific table. `Joe` is also a member of two roles, one of which has no access to the table at all, and one of which has only **SELECT** access. What are the privileges in effect for `Joe`?

This is how SAP Sybase IQ determines whether a user ID has privilege to carry out a specific action:

1. If the user ID has DBA privileges, he or she can carry out any action in the database. If the user has specific system privileges granted, he or she can have the privileges to carry out only those authorized tasks associated with the system privileges.
2. Otherwise, privilege depends on the privileges assigned to the individual user. If the user ID has been granted privilege to carry out the action, the action is allowed to proceed.
3. If no individual settings have been made for that user, privilege depends on the privileges of each of the roles of which the user is a member. If any of these roles has privilege to carry out the action, the user ID has privilege by virtue of membership in that role, and the action is allowed to proceed.

   If you do not want a specific user to access a particular table, view, or procedure, do not make that user a member of a role that has privileges on that object.

This approach minimizes problems associated with the order in which privileges are set.

Stored Procedure to Display Object-Level Privileges Granted

Execute the **sp_objectpermission** stored procedure to generate a report on object-level privileges granted to the specified role or user name or object privileges granted on the specified object or dbspace.

The report includes the user ID of the privilege grantor and grantee, the object name and owner, the privilege granted and whether the grantee can in turn grant the privilege to other users.

No system privileges are required to execute the procedure on your user ID. To execute **sp_objectpermission** on other users or a dbspace, you must have MANAGE ANY OBJECT PRIVILEGE or MANAGE ANY DBSPACE privilege, respectively.

See also

- *sp_objectpermission System Procedure* on page 367

System Procedure Privileges

There are two security models under which privileged system procedures can run. Each model grants the ability to run the system procedure differently.

Note: The following information applies to SAP Sybase IQ privileged system procedures only, not user-defined stored procedures.

The first model, called the SYSTEM PROCEDURE DEFINER model, runs a privileged system procedure with the privileges of its owner, typically dbo. The second model, called the SYSTEM PROCEDURE INVOKER model, runs a privileged system procedure with the privileges of the person executing it.

To run a privileged system procedure using the SYSTEM PROCEDURE DEFINER model, grant explicit EXECUTE privilege on the procedure. Any system privileges required to run any underlying authorized tasks of the system procedure are automatically inherited from the owner (definer of the system procedure).

For privileged system procedures using the SYSTEM PROCEDURE INVOKER model, the EXECUTE privilege is granted to the PUBLIC role, and since by default every user is a member of the PUBLIC role, every user automatically inherits the EXECUTE privilege. However, since the PUBLIC role is not the owner of the system procedures, and is not granted any system privileges, system privileges required to run any underlying authorized tasks must be granted directly or indirectly to the user.

By default, a new 16.0 database runs all privileged system procedures using the SYSTEM PROCEDURE INVOKER model. By default, a pre-16.0 upgraded database runs privileged system procedures using a combination of both the SYSTEM PROCEDURE DEFINER and SYSTEM PROCEDURE INVOKER models. In the combined model, all pre-16.0 privileged system procedures run using the SYSTEM PROCEDURE DEFINER model, and any privileged system procedures introduced with 16.0 (or any future release) run using the SYSTEM PROCEDURE INVOKER model. The default security model can be overridden during database creation or upgrade, or changed any time thereafter. However, this is not recommended as it may result in loss of functionality on custom stored procedures and applications.

Grant the Ability to Run a Privileged System Procedure

The process by which you grant the ability to run a privileged system procedure is dependant on the security model under which it runs.

For a privileged system procedure using the SYSTEM PROCEDURE DEFINER model, grant EXECUTE privilege on the system procedure to the user:

```
GRANT EXECUTE ON sys_procedure_name
    TO grantee [,...]
```

For a privileged system procedure using the SYSTEM PROCEDURE INVOKER model, grant the underlying system privileges required by the system procedure to the user. Use **sp_proc_priv()** to identify the system privileges required to run a system procedure.

```
GRANT system_privilege_name
    TO grantee [,...]
```

See also

- *GRANT EXECUTE Statement* on page 270

Revoke the Ability to Run a Privileged System Procedure

The process by which you revoke the ability to run a privileged system procedure is dependant on the security model under which it runs.

For a privileged system procedure using the SYSTEM PROCEDURE DEFINER model, revoke the EXECUTE privilege on the system procedure from the user:

```
REVOKE EXECUTE ON sys_procedure_name
    FROM grantee [,...]
```

For a privileged system procedure using the SYSTEM PROCEDURE INVOKER model, revoke the underlying system privileges required by the system procedure from the user:

```
REVOKE system_privilege_name
    FROM grantee [,...]
```

See also

- *REVOKE EXECUTE Statement* on page 286

Determine Security Model Used by a Database

By default, a new 16.0 database runs privileged system procedures using the SYSTEM PROCEDURE INVOKER model only, while a pre-16.0 upgraded database runs privileged system procedures using a combination of both the SYSTEM PROCEDURE DEFINER and SYSTEM PROCEDURE INVOKER models.

However, it is possible to override the defaults during database creation or upgrade. To verify the security model of a database, execute:

```
select IF ((HEXTOINT(substring(db_property('Capabilities'),
1,length(db_property('Capabilities'))-20)) & 8) = 8)
THEN 1
ELSE 0
END IF
```

1 indicates the database is using the SYSTEM PROCEDURE INVOKER model. 0 indicates that the database is using the combined model.

Remember, in the combined model, only pre-16.0 privileged system procedures run using the SYSTEM PROCEDURE DEFINER. Refer to the pre-16.0 privileged system procedures list to identify these system procedures.

A new or upgraded 16.0 database cannot be configured to run all system procedures using the SYSTEM PROCEDURE DEFINER model.

Pre-16.0 Privileged System Procedures

A list of pre-16.0 privileged system procedures.

Pre-16.0 privileged system procedures that use the combined security model

For these privileged system procedures, if the database is configured to run using SYSTEM PROCEDURE DEFINER, you only need EXECUTE privilege on the procedure to run it. If the database is configured to run using SYSTEM PROCEDURE INVOKER, you need the individual privileges that each procedure requires to run successfully. Refer to the documentation for each procedure's required system privileges.

• sa_audit_string	• sp_iqconstraint	• sp_iqmpxincconnpoolinfo
• sa_checkpoint_execute	• sp_iqcontext	• sp_iqmpxincheartbeatinfo
• sa_conn_activity	• sp_iqcopyloginpolicy	• sp_iqmpxinfo
• sa_conn_info	• sp_iqcursorinfo	• sp_iqmpxversioninfo
• sa_conn_list	• sp_iqdatatype	• sp_iqobjectinfo
• sa_conn_properties	• sp_iqdbsize	• sp_iqpkeys
• sa_db_info	• sp_iqdbspace	• sp_iqprocedure
• sa_db_list	• sp_iqdbspaceinfo	• sp_iqprocparm
• sa_db_properties	• sp_iqdbspaceobjectinfo	• sp_iqrebuildindex
• sa_disable_auditing_type	• sp_iqdbstatistics	• sp_iqrename
• sa_disk_free_space	• sp_iqdroplogin	• sp_iqrestoreaction
• sa_enable_auditing_type	• sp_iqemptyfile	• sp_iqrowdensity
• sa_external_library_unload	• sp_iqestdbspaces	• sp_iqsetcompression
• sa_flush_cache	• sp_iqestspace	• sp_iqsharedtempdistrib
• sa_get_user_status	• sp_iqevent	• sp_iqshowcompression
• sa_list_external_library	• sp_iqfile	• sp_iqshowpsexe
• sa_server_option	• sp_iqhelp	• sp_iqspaceinfo
• sa_table_page_usage	• sp_iqindex	• sp_iqspaceused
• sa_text_index_stats	• sp_iqindex_alt	• sp_iqstatistics
• sa_text_index_vocab	• sp_iqindexadvice	• sp_iqstatus
• sa_validate	• sp_iqindexfragmentation	• sp_iqsysmon
• sp_iq_reset_identity	• sp_iqindexinfo	• sp_iqtable
• sp_iqaddlogin	• sp_iqindexmetadata	• sp_iqtablesize
• sp_iqbackupdetails	• sp_iqindexsize	• sp_iqtableuse
• sp_iqbackupsummary	• sp_iqindexuse	• sp_iqtransaction
• sp_iqcardinality_analysis	• sp_iqlmconfig	• sp_iqunusedcolumn
• sp_iqcheckdb	• sp_iqlocks	• sp_iqunusedindex
• sp_iqcheckoptions	• sp_iqmodifyadmin	• sp_iqunusedtable
• sp_iqclient_lookup	• sp_iqmodifylogin	• sp_iqversionuse
• sp_iqcolumn	• sp_iqmpxcheckdqpconfig	• sp_iqview
• sp_iqcolumnuse	• sp_iqmpxdumptlvlog	• sp_iqwho
• sp_iqconnection	• sp_iqmpxfilestatus	• sp_iqworkmon

Pre-16.0 privileged system procedures that run with invoker privileges regardless of the security model

These pre-16.0 privileged system procedures run with the privileges of the user running the procedure, not the owner of the procedure, regardless of the security model setting. This means that in addition to requiring EXECUTE privilege on the system procedure, (by default, granted through membership in PUBLIC role), the user must be granted additional system

privileges required by the system procedure. Refer to the documentation for the required system privileges.

- sa_describe_shapefile
- sa_get_user_status
- sa_locks
- sa_performance_diagnostics
- sa_report_deadlocks
- sa_text_index_stats

Manage Passwords

A user can be granted the ability to manage the password of other users. Password management can be configured to require one or two users to complete a password change.

Passwords in the Database

SAP Sybase IQ 15.0 or later use SHA256 to hash passwords. Passwords are stored in UTF-8.

When passwords are created or changed, they are converted to UTF-8 before being hashed and stored in the database. If the database is unloaded and reloaded into a database with a different character set, existing passwords continue to work. If the server cannot convert from the client's character set to UTF-8, then it is recommended that the password be composed of 7-bit ASCII characters as other characters may not work correctly.

SAP Sybase IQ 12.7 and earlier used a proprietary hash.

Granting the CHANGE PASSWORD System Privilege to a User

Allow a user to manage the password of other users.

Prerequisites

- Requires the CHANGE PASSWORD system privilege granted with administrative rights.
- Each target user specified (target_users_list) is an existing user or user-extended role with a login password.
- Each target role specified (target_roles_list) must be an existing user-extended or user-defined role.

Task

A user can be granted the ability to change the password of any user in the database (ANY) or only specific users (target_users_list) or members of specific roles (ANY WITH ROLES target_roles_list). Administrative rights to the CHANGE PASSWORD system privilege can only be granted when using the ANY clause.

If no clause is specified, ANY, WITH NO ADMIN OPTION is used by default.

When regranting the CHANGE PASSWORD system privilege, the effect of the grant is cumulative. For example, if you grant user1 the privilege limited to user2 and user3, and then regrant the privilege limited to role1, user1 can manage the password of user2, user3, and any member of role1.

If the CHANGE PASSWORD system privilege is regranted to a user with lesser rights than currently granted, the higher rights are retained. For example, if the privilege is granted using the ANY clause and then regranted using the target_users_list clause, the user retains the rights of the ANY clause.

To grant the CHANGE PASSWORD system privilege, execute one of these statements:

Grant TypeUpdated contne	Statement
Any database user, with full administrative rights	**GRANT CHANGE PASSWORD** (**ANY**) **TO** *user_ID* **WITH ADMIN OPTION**
Any database user, with administrative rights only	**GRANT CHANGE PASSWORD** (**ANY**) **TO** *user_ID* **WITH ADMIN ONLY OPTION**
Any database user, with no administrative rights	**GRANT CHANGE PASSWORD** (**ANY**) **TO** *user_ID* **WITH NO ADMIN OPTION**
Specified users, with no administrative rights	**GRANT CHANGE PASSWORD** (*target_users_list*) **TO** *user_ID* **WITH NO ADMIN OPTION**
Any member of specified roles, with no administrative rights	**GRANT CHANGE PASSWORD** (**ANY WITH ROLES** *target_roles_list*) **TO** *user_ID* **WITH NO ADMIN OPTION**
Specified users, or any member of specified roles, with no administrative rights	**GRANT CHANGE PASSWORD** (*target_users_list*), (**ANY WITH ROLES** *target_roles_list*) **TO** *user_ID* **WITH NO ADMIN OPTION**

Example:

This statement grants *Sam* the ability to change the password of any database user:

```
GRANT CHANGE PASSWORD (ANY) TO Sam
or
GRANT CHANGE PASSWORD TO Sam
```

This statement grants *Sally* and *Bob* the ability to change the password for *Jane*, *Joe*, and *Laurel* only:

```
GRANT CHANGE PASSWORD (Jane, Joe, Laurel) TO Sally, Bob
```

This statement grants *Mary* the ability to change the password of any member of the *Sales1* role:

```
GRANT CHANGE PASSWORD (ANY WITH ROLES Sales1) TO Mary
```

This statement grants *Sarah* the ability to change the password of *Joe* or *Sue*, or any member of the *Sales2* role:

```
GRANT CHANGE PASSWORD (Joe, Sue), (ANY WITH ROLES Sales2) TO Sarah
```

This statement grants *Joan* the ability to change the password of any member of the *Marketing1* or *Marketing2* roles:

```
GRANT CHANGE PASSWORD (ANY WITH ROLES Marketing1, Marketing2) TO Joan
```

See also

- *GRANT CHANGE PASSWORD Statement* on page 266

Revoking the CHANGE PASSWORD System Privilege from a User

Remove the ability of a user to manage passwords and administer the system privilege.

Prerequisites

Requires the CHANGE PASSWORD system privilege granted with administrative rights.

Task

The CHANGE PASSWORD system privilege can be granted to a user multiple times, using different clauses. For example, UserA is granted the CHANGE PASSWORD system privilege once using the ANY clause and again with the *target_users_list* clause. In cases of multiple grants, the form of the clause used for the GRANT must be used to revoke it. Continuing with the example, if the system privilege is revoked from UserA using the ANY clause, the grant with the *target_users_list* clause remains in effect. The net effect is that UserA is now limited to managing the passwords of users on the *target_users_list*. Alternately, if the system privilege is revoked from UserA using the *target_users_list* clause, the grant with the ANY clause remains in effect. The net effect in this scenario is that UserA can continue to manage the passwords of any user in the database.

To revoke the CHANGE PASSWORD system privilege, execute one of these statements:

Revoke Type	Description
Administrative rights to system privilege only	**REVOKE ADMIN OPTION FOR CHANGE PASSWORD** (**ANY**) **FROM** *user_ID [,...]*
System privilege to manage password of any database user, including administrative rights	**REVOKE CHANGE PASSWORD** **FROM** *user_ID [,...]*
System privilege to manage password of specified users	**REVOKE CHANGE PASSWORD** (*target_users_list*) **FROM** *user_ID [,...]*
System privilege to manage password of specified roles	**REVOKE CHANGE PASSWORD** (**ANY WITH ROLES** *target_roles_list*) **FROM** *user_ID [,...]*

Example:

Both these statements remove the ability of *Sam* to change the password of any database user:

```
REVOKE CHANGE PASSWORD (ANY) FROM Sam
or
GRANT CHANGE PASSWORD TO Sam
```

Assuming that *Frank* was granted the CHANGE PASSWORD system privilege with the **ANY** and **WITH ADMIN OPTION** clauses, this statement removes only the ability to administer the system privilege from *Frank*. He can continue to change the password of any user in the database.

```
REVOKE ADMIN OPTION FOR CHANGE PASSWORD (ANY) FROM Frank
```

This statement removes the ability of *Sally* and *Bob* to change the password of *Jane*, *Joe*, and *Laurel* only:

```
REVOKE CHANGE PASSWORD (Jane, Joe, Laurel) FROM Sally, Bob
```

This statement removes the ability of *Mary* the ability to change the password of any member of the *Sales1* role:

```
REVOKE CHANGE PASSWORD (ANY WITH ROLES Sales1) FROM Mary
```

This statement removes the ability of *Sarah* to change the password of *Joe* or *Sue*, or any member of the *Sales2* role:

```
REVOKE CHANGE PASSWORD (Joe, Sue), (ANY WITH ROLES Sales2) FROM Sarah
```

This statement removes the ability of *Joan* to change the password of any member of the *Marketing1* or *Marketing2* roles:

```
REVOKE CHANGE PASSWORD (ANY WITH ROLES Marketing1, Markeing2) FROM
Joan
```

See also

- *REVOKE CHANGE PASSWORD Statement* on page 283

Changing a Password – Single Control

A single user can manage the password of another user.

Prerequisites

- Requires the CHANGE PASSWORD system privilege.
- The managing user has been granted the right to change the password of the target user.

Task

At a command prompt, type:

```
ALTER USER userID
IDENTIFIED BY password
```

See also

- *Case-sensitivity of User IDs and Passwords* on page 125
- *ALTER USER Statement* on page 246

Dual Control Password Management Option

The Dual Control Password option requires two administrative users to change the password of a target user, thus ensuring that no single user knows (or controls) the password of the target user.

Two distinct administrative users are required to generate each part of the new password. It is the combination of the two parts that become the new password for the target user. The same user cannot generate both password parts. If the same user attempts to define both password parts, the server displays an error message, and the second password part is not set.

If the server is restarted after the first password part is specified, but before the second password part is specified, the first password part is not lost. When the second password part is specified by a different user, the dual password change process completes successfully. The target user can then log in using the combined password parts.

Once initiated, generation of the dual passwords for the target user can be cancelled by specifying "NULL" as the password, as long as the user has been granted the CHANGE PASSWORD system privilege, and the right to manage the password of the target user.

Each administrative user setting a password part must notify the target user of the new password part and indicate whether it is the first or second part. To use the password, the target

user enters the dual password in first part, second part order. There is a 127-character limit for each part.

If the target user is not logged in when the dual password change process completes, he or she simply logs on. Once the dual password is accepted, the user is immediately prompted to change his or her password. This provides the final level of password security. If the user is already logged in when the dual password change process completes, the user can use the **ALTER USER** or **GRANT CONNECT** statements, or the **sp_password** or **sp_iqpassword** system procedures to change the password. At the prompt for the current password, type the new dual part passwords, not the password originally entered for the current session.

The Change Password Dual Control option is enabled in a login policy.

See also

- *Case-sensitivity of User IDs and Passwords* on page 125
- *ALTER USER Statement* on page 246
- *GRANT CONNECT Statement* on page 268
- *sp_iqpassword Procedure* on page 366

Enabling Dual Control for Changing Passwords

Require input from two administration users to change the password of another user.

Prerequisites

Requires the MANAGE ANY LOGIN POLICY OPTION system privilege.

Task

Dual control for managing passwords is a configurable option of a login policy. By default, it is disabled (OFF).
To enable the option, execute:

```
ALTER LOGIN POLICY policy-name
CHANGE_PASSWORD_DUAL_CONTROL=ON
```

See also

- *ALTER LOGIN POLICY Statement* on page 237
- *CREATE LOGIN POLICY Statement* on page 253

Changing a Password – Dual Control

Two users are required to manage the password of another user.

Prerequisites

- Requires the CHANGE PASSWORD system privilege.
- The managing user has been granted the right to change the password of the target user.

- The CHANGE_PASSWORD_DUAL_CONTROL option is enabled in the login policy of the managing user.

Task

1. At a command prompt, the first managing user types:

   ```
   ALTER USER userID
   IDENTIFIED FIRST BY password_part1
   ```

2. At a command prompt, the second managing user types:

   ```
   ALTER USER userID
   IDENTIFIED LAST BY password_part1
   ```

Example

Assuming login policy *Sales1* has the CHANGE_PASSWORD_DUAL_CONTROL option enabled, *User3* is assigned *Sales1*, and *User1* and *User2* have been granted the necessary privileges to change the password of *User3*, these statements set the two password parts for *User3* to *NewPassPart1* and *NewPassPart2*:

User1 types:

```
ALTER USER user3 IDENTIFIED FIRST BY NewPassPart1
```

User2 types:

```
ALTER USER user3 IDENTIFIED LAST BY NewPassPart2
```

See also

- *Case-sensitivity of User IDs and Passwords* on page 125
- *ALTER USER Statement* on page 246

Impersonation

A user can temporarily assume the roles and system privileges of another user (also known as impersonation) to perform operations, provided he or she already has the minimum required privileges to perform the task to begin with.

For example, suppose User1 is responsible for performing a key task, but he or she is unavailable. User2 has sufficient privileges to complete the task, but has additional privileges not available to User1. If User2 performs the task, it may complete differently than when performed by User1. To avoid this, User2 temporarily assumes the roles and system privileges specific to User1, and performs the task.

Impersonation is achieved by first granting a user the SET USER system privilege, and then issuing the SETUSER statement to initiate the impersonation.

Note: The SET USER system privilege is two words; the SETUSER statement is one word.

When you grant the SET USER system privilege, you can define the scope of impersonation as:

- Any user in the database.
- Any user within a specified list of users (*target_users_list*).
- Any user who is a member of one or more of the specified roles (*target_roles_list*).

To impersonate another user, you must have been granted, at minimum, all of the roles and system privileges with the same or higher administrative privileges, as the user you are impersonating. This is called the *at-least* criteria.

Impersonation criteria validation occurs when the SETUSER statement is executed, not when the SET USER system privilege is granted. This is because roles and system privileges granted to both the impersonator and impersonatee may change over time. If at the moment of SETUSER execution, if the user does not meet all criteria, impersonation does not begin. However, if the all criteria is met on a subsequent SETUSER execution, impersonation begins.

You may ask why, if a user already has all the privileges he or she needs to perform a task that someone else normally performs, the user does not just perform the task as themselves. The reason is that if the impersonating user has more privileges than he or she needs to perform the task, even though the extra privileges are not required for the task, the additional privileges can affect the output of the task. By impersonating the user who normally performs the task, it negates this possibility.

For example, assume the following conditions:

- There are two users, User1 and User2.
- There are two roles, Role1 and Role2.
- Role1 has been granted the CREATE TABLE system privilege.
- Role2 has been granted the CREATE ANY TABLE system privilege.
- User1 has been granted Role1.
- User2 has been granted Role1 and Role2.

A task requiring the CREATE TABLE system privilege must be performed.

The task is usually performed by User1, who is unavailable. User2 has been identified as the backup user to carry out the task.

Since both User1 and User2 have been granted Role1, User2 has the required system privilege to perform the task. However, since User2 has also been granted Role2, which includes higher system privileges with respect to creating tables (the ability to create tables owned by other users), there is the potential for the task to complete differently than if it was performed by User1.

To negate this possibility, instead of User2 running the task, User2 impersonates User1 and completes the task.

Once the SET USER system privilege to impersonate another user is granted, it remains in effect until it is revoked.

Once you issue the SETUSER statement, and successful impersonation begins, it remains in effect until you manually terminated the impersonation, begin impersonating another user, or the current session ends. It is recommended that impersonation be terminated as soon as the required tasks are completed.

While a user is impersonating another user, roles and privileges and their related administrative rights can be granted to or revoked from the impersonator or impersonatee as long as doing so does not violate the criterion behind the impersonation. If the grant or revoke violates the impersonation criteria, an error message appears, and the statement fails.

For example, UserA is successfully impersonating UserB. Someone tries to grant a new role to UserA, but not to UserB. Since this grant would not result in a violation of the criteria for UserA to impersonate UserB (UserA still has at least all of the roles and privileges granted to UserB), the grant is successful. If, however, the new role grant was to UserB instead of UserA, the grant statement would fail because it would result in a violation of the criteria (UserB would have been granted more roles than UserA).

In a Multiplex configuration, if an impersonation is active in a connection present in the coordinator, and an attempt is made to grant or revoke roles and privileges that would violate the impersonation criterion, the connection containing the active impersonation is dropped. Since dropping the connection also terminates the impersonation, violation of criteria is no longer an issue, the **GRANT** or **REVOKE** statement executes successfully.

When you impersonate another user, the user ID of the impersonated user appears in the transaction log, not yours. However, since the SETUSER statement also appears in the transaction log, it is easy to determine whether the task was executed by the actual user or by someone using impersonation.

Understand the Requirements for Impersonation

A user can successfully impersonate another user only if a specific set of criteria is met, also called the *at-least* requirements.

There are four criteria to successful impersonation:

1. The impersonator has been granted the right to impersonate the target user.
2. The impersonator has, at minimum, all the roles and system privileges granted to the target user.
3. The impersonator has been granted the said roles and system privileges with similar or higher administrative rights.

Note: For the purposes of meeting administrative rights criteria, the WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are considered to grant similar administrative rights. They are also considered to grant higher administrative rights than the WITH NO ADMIN OPTION clause. For example, User1 is granted Role1 with the WITH ADMIN OPTION clause, User2 is granted Role1 with the WITH ADMIN ONLY clause, and User3 is granted Role1 with the WITH NO ADMIN OPTION clause. User1

and User2 are said to be granted Role1 with similar administrative rights. User1 and User2 are also said to be granted Role1 with higher administrative rights that User3.

4. If the target user has been granted a system privilege which supports extensions, the clauses used to grant the system privilege to the impersonator are a super-set of those used for the target user. Currently, only the SET USER and CHANGE PASSWORD system privileges support extensions.

Note:

- The ANY clause is considered a super-set of the *target_roles_list* and *target_users_list* clauses. If the target user has been granted the SET USER system privilege with an ANY grant, the impersonator must also have the ANY grant.
- If the target user has been granted the SET USER system privilege with both the *target_roles_list* and *target_users_list* clauses, the impersonator must also have been granted the system privilege with the two clauses, and the target list of each clause must be equal to or a super-set of the corresponding clause grant of the target user. For example, if the target lists of both the impersonator and target user contain User1, User2 and Role1, Role2, respectively, the target list grants for each clause are said to be equal. Alternately, if the target list grants of the impersonator contain User1, User2, Role1, Role2, respectively, while the target list grants of the target user contain User1, Role2 only, the target list grants of the impersonator are said to be a super-set of the target user.
- If the target user has been granted the SET USER system privilege with a single target list clause, the target list of the impersonator must be equal to or a super-set of the list of the target user. For example, the target_user_list of both the impersonator and the target user contain User1 and User2 (equal) or the impersonator list contains User1, User2, while the target user contains User2; User1, User2 (impersonator list) is a super-set of User2 (target user list).
- By definition, a user can always impersonate themselves. Therefore, if the target user has been granted the right to impersonate the impersonator, this does not violate the equal to or a super-set of criteria requirement of the impersonator. For example, User3 is the impersonator and User4 is the target user. The target_user_list for User3 contains User4 and User5. The target_user_list for User4 contains User3 and User5. If you remove the impersonator from the target list, the target list of User3 meets the criteria requirement.

Scenario 1

Assuming that the second and third criterion is met, consider the following scenario:

- There are five users: *User1*, *User2*, *User3*, *User4*, and *User5*.
- There are two roles: *Role1* and *Role2*.
- *User1* was granted the SET USER system privilege with the **ANY** clause.
- *User2* was granted the SET USER system privilege with the *target_users_list* clause for *User1* and *User4*.

- *User3* was granted the SET USER system privilege with the *target_users_list* clause for *User1*, *User2*, *User4* and, *User5*, and the ANY WITH ROLES *target_roles_list* clause for *Role1* and *Role2*.
- *User4* was granted the SET USER system privilege with the **ANY** clause and the *target_roles_list* clause for *Role1*.
- *User5* was granted the SET USER system privilege with the *target_users_list* clause for *User4* and the ANY WITH ROLES *target_roles_list* for *Role1*.

User1 and *User4* can successfully impersonate *User2*, *User3*, and *User5* because each is granted the SET USER system privilege with the **ANY** clause. (Criteria 4).

User1 and *User4* can impersonate each other because they each have the ANY grant. (Criteria 4).

User2, *User3*, and *User5* cannot impersonate *User1* or *User4* because they do not have the ANY grant. (Criteria 4)

User2 cannot impersonate *User3* or *User5* because:

- *User2* is not granted the right to impersonate these users. (Criteria 1)
- The SET USER system privilege is not granted to *User2* with the *target_roles_list* clause. (Criteria 4)

User3 can successfully impersonate *User2* because:

- *User3* is granted the right to impersonate *User2* via the *target_users_list* clause. (Criteria 1)
- The *target_users_list* clause for *User3* is a super-set of *User2*. (Criteria 4) Though *User3* has a grant with the *target_role_list* clause, it is not required to satisfy the requirements for impersonation of *User2* because the latter does not have the same grant.

User3 can successfully impersonate *User5* because:

- *User3* is granted the right to impersonate *User5* via the *target_users_list* clause. (Criteria 1)
- The *target_users_list* clause list for *User3* is a super-set of *User5*. (Criteria 4)
- The *target_roles_list* clause lists for *User3* and *User5* are equivalent. (Criteria 4)

User5 cannot impersonate any other user because:

- *User1* and *User4* have an **ANY** grant (Criteria 4)
- *User2* and *User3* have a grant with a *target_users_list* clause that is not a sub-set of the grant to *User5*. (Criteria 4)
- *User3* has a grant with a *target_roles_list* clause that is not a subset. (Criteria 4)

Scenario 2

Assuming that the first and fourth criteria are met, consider the following:

- There are two users: *User6* and *User7*.
- There are two roles: *Role4* and *Role5*.
- *User6* has been granted *Role4* with the WITH ADMIN OPTION clause, *Role5* with the WITH ADMIN ONLY OPTION clause, and the MANAGE ANY USER system privilege with the WITH ADMIN OPTION clause.
- *User7* has been granted *Role4* with the WITH ADMIN OPTION clause and *Role5* with the WITH NO ADMIN OPTION clause.

User6 can successfully impersonate *User7* because:

- Both *User6* and *User7* are granted *Role4* and *Role5*. It does not matter that *User6* is granted additional privileges (MANAGE ANY USER system privilege). (Criteria 2)
- *User6* is granted *Role4* with equivalent administrative rights as *User7*. *User6* is granted *Role5* with higher administrative rights than *User7*. (Criteria 3)

User7 cannot impersonate *User6* because:

- *User7* is granted *Role4* and *Role5*, but not the MANAGE ANY USER system privilege. (Criteria 2)
- *User7* is granted *Role5* with lower administrative rights than *User6*. (Criteria 3)

Scenario 3

Consider the following:

- There are three users: *User8*, *User9* and *User10*.
- There are two roles: *Role5* and *Role6*.
- *User8* has been granted *Role5* with the WITH ADMIN OPTION clause, and the MANAGE ANY USER system privilege with the WITH ADMIN OPTION clause.
- *User9* and *User10* has been granted *Role5* with the WITH NO ADMIN OPTION clause.
- *User8* has been granted the SET USER system privilege to impersonate *User9* and *User10* with the *target_users_list* clause.
- *User9* as been granted the SET USER system privilege to impersonate *User10* with the *target_users_list* clause.

User8 can successfully impersonate *User9* because:

- *User8* is granted the right to impersonate *User9* via the *target_users_list* clause. (Criteria 1)
- The *target_users_list* clause list for *User8* is a super-set of *User9*. (Criteria 4)
- Both *User8* and *User9* are granted *Role5*, with *User8* granted higher administrative rights to the role than *User9*. (Criteria 2 and 3)

User8 can successfully impersonate *User10* because:

- *User8* is granted the right to impersonate *User10* (Criteria 1)

- Since *User10* is not granted the SET USER system privilege, requirement 4 is not applicable.
- Both *User8* and *User10* are granted *Role5*, with the same administrative rights to the role. (Criteria 2 and 3)

User9 cannot impersonate *User8* because:

- *User9* is not granted the right to impersonate *User8* (Criteria 1)
- Though both *User8* and *User9* are granted *Role5*, the grant for *User9* is with less administrative rights to the role than for *User8*. (Criteria 3)

Validation of criterion occurs when the SETUSER statement is executed, not when the SET USER system privilege is granted. If a user fails to meet any of the criteria when the SETUSER statement is issued, a `permission denied` message appears, and the impersonation does not begin.

Granting the SET USER System Privilege to a User

Allow one user to impersonate another user in the database. The system privilege can be granted with or without administrative rights.

Prerequisites

- Requires the SET USER system privilege granted with administrative rights.
- Each target user specified (target_users_list) is an existing user or user-extended role with a login password.
- Each target role specified (target_roles_list) must be an existing user-extended or user-defined role.

Task

A user can be granted the ability to impersonate any user in the database (**ANY**) or only specific users (*target_users_list*) or members of specific roles (**ANY WITH ROLES** *target_roles_list*). Administrative rights to the SET USER system privilege can only be granted when using the **ANY** clause.

If no clause is specified, **ANY** is used by default.

When regranting the SET USER system privilege to a user, the effect of the grant is cumulative.

If no administrative clause is specified when using the **ANY** clause, **WITH NO ADMIN OPTION** is granted.

WITH NO ADMIN OPTION is the only valid administrative clause with the *target_users_list* or *target_roles_list* clauses.

To grant the SET USER system privilege, execute one of these statements:

Grant Type	Statement
System privilege to impersonate any database user, with full administrative rights	**GRANT SET USER** (**ANY**) TO *user_ID [,...]* **WITH ADMIN OPTION**
System privilege to impersonate any database user, with administrative rights only	**GRANT SET USER** (**ANY**) TO *user_ID [,...]* **WITH ADMIN ONLY OPTION**
System privilege to impersonate any database user, with no administrative rights	**GRANT SET USER** (**ANY**) TO *user_ID [,...]* **WITH NO ADMIN OPTION**
System privilege to impersonate specified users	**GRANT SET USER** (*target_users_list*) TO *user_ID [,...]*
System privilege to impersonate any member of specified roles	**GRANT SET USER** (**ANY WITH ROLES** *target_roles_list*) TO *user_ID [,...]*
System privilege to impersonate specified users and members of specified roles	**GRANT SET USER** (*target_users_list*), (**ANY WITH ROLES** *target_roles_list*) TO *user_ID [,...]*

Example:

Both these statements grant *Sam* the ability to impersonate any database user:

```
GRANT SET USER (ANY) TO Sam
or
GRANT SET USER TO Sam
```

This statement grants *Bob* and *Jeff* the ability to impersonate *Mary*, *Joe*, or *Sue* only.

```
GRANT SET USER (Mary, Joe, Sue) TO Bob, Jeff
```

This statement grants *Mary* the ability to impersonate any member of the *Sales1* role:

```
GRANT SET USER (ANY WITH ROLES Sales1) TO Mary
```

This statement grants *Sarah* the ability to impersonate *Joe* or *Sue*, or any member of the *Sales2* role:

```
GRANT SET USER (Joe, Sue), (ANY WITH ROLES Sales2) TO Sarah
```

This statement grants *Joan* the ability to impersonate any member of the *Marketing1* or *Marketing2* roles:

```
GRANT SET USER (ANY WITH ROLES Marketing1, Marketing2) TO Joan
```

See also

- *GRANT SET USER Statement* on page 277

Start Impersonating Another User

Allow a user to assume the exact roles and system privileges (impersonate) of another user. Once begun, impersonation remains in effect until it is terminated or the current session ends.

Prerequisites

- The impersonator has been granted the right to impersonate the target user.
- The impersonator has, at minimum, all the roles and system privileges granted to the target user.
- The impersonator has been granted the said roles and system privileges with similar or higher administrative rights.

  Note: For the purposes of meeting administrative rights criteria, the WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are considered to grant similar administrative rights. They are also considered to grant higher administrative rights than the WITH NO ADMIN OPTION clause. For example, User1 is granted Role1 with the WITH ADMIN OPTION clause, User2 is granted Role1 with the WITH ADMIN ONLY clause, and User3 is granted Role1 with the WITH NO ADMIN OPTION clause. User1 and User2 are said to be granted Role1 with similar administrative rights. User1 and User2 are also said to be granted Role1 with higher administrative rights that User3.
- If the target user has been granted a system privilege which supports extensions, the clauses used to grant the system privilege to the impersonator are a super-set of those used for the target user. Currently, only the SET USER and CHANGE PASSWORD system privileges support extensions.

  Note:
  - The ANY clause is considered a super-set of the *target_roles_list* and *target_users_list* clauses. If the target user has been granted the SET USER system privilege with an ANY grant, the impersonator must also have the ANY grant.
  - If the target user has been granted the SET USER system privilege with both the *target_roles_list* and *target_users_list* clauses, the impersonator must also have been granted the system privilege with the two clauses, and the target list of each clause must be equal to or a super-set of the corresponding clause grant of the target user. For example, if the target lists of both the impersonator and target user contain User1, User2 and Role1, Role2, respectively, the target list grants for each clause are said to be equal. Alternately, if the target list grants of the impersonator contain User1, User2, Role1, Role2, respectively, while the target list grants of the target user contain User1,

Role2 only, the target list grants of the impersonator are said to be a super-set of the target user.

- If the target user has been granted the SET USER system privilege with a single target list clause, the target list of the impersonator must be equal to or a super-set of the list of the target user. For example, the target_user_list of both the impersonator and the target user contain User1 and User2 (equal) or the impersonator list contains User1, User2, while the target user contains User2; User1, User2 (impersonator list) is a super-set of User2 (target user list).
- By definition, a user can always impersonate themselves. Therefore, if the target user has been granted the right to impersonate the impersonator, this does not violate the equal to or a super-set of criteria requirement of the impersonator. For example, User3 is the impersonator and User4 is the target user. The target_user_list for User3 contains User4 and User5. The target_user_list for User4 contains User3 and User5. If you remove the impersonator from the target list, the target list of User3 meets the criteria requirement.

Task

Validation of the at-least criteria occurs when the SETUSER command is executed. If a user fails to meet any of the at-least requirements, a `permission denied` message appears, and the impersonation does not begin.

At a command prompt, type:

```
SETUSER userID
```

See also

- *SETUSER Statement* on page 298

Verify the Current Impersonation Status of a User

A successful impersonation remains in effect until it is manually terminated or the session is terminated.

To verify the current status of an impersonation, execute this command on a machine on which the SETUSER command was issued:

```
SELECT CURRENT USER
```

The name of the user the machine recognizes as the currently logged in user appears. If it is the expected user for the machine, no impersonation is active on the machine. If an unexpected user name appears, it represents the user currently being impersonated on the machine.

Example

On a connection where Joe is logged in, execute:

```
> select current user
> go
current user
```

```
------------------------------------------------------------------
------------------------------------------------------------
Joe

(1 row affected)

>setuser mary
>go
>select current user
> go
current user
------------------------------------------------------------------
------------------------------------------------------------
Mary
```

Stop Impersonating Another User

End the impersonation of another user on the machine. Once begun, impersonation of another user remains in effect until impersonation is terminated or the current session ends.

Prerequisites

The **SETUSER** command can be used to terminate an impersonation only from the connection where the SETUSER command was originally issued to start the impersonation.

Task

At a command prompt, type:

```
SETUSER
```

See also

- *SETUSER Statement* on page 298

Revoking the SET USER System Privilege from a User

Remove the ability of a user to impersonate other users and administer the system privilege.

Prerequisites

Requires the SET USER system privilege granted with administrative rights.

Task

The SET USER system privilege can be granted to a user multiple times, using different clauses. For example, UserA is granted the SET USER system privilege once using the ANY clause and again with the target_users_list clause. In cases of multiple grants, the form of the clause used for the GRANT must be used to revoke it. Continuing with the example, if the system privilege is revoked from UserA using the ANY clause, the grant with the target_users_list clause remains in effect. The net effect is that UserA is now limited to impersonating users on the target_users_list. Alternately, if the system privilege is revoked from UserA using the target_users_list clause, the grant with the ANY clause remains in

effect. The net effect in this scenario is that UserA can continue to impersonate any user in the database.

Note: These examples assume UserA meets all criteria for successful impersonation.

To revoke the SET USER system privilege, execute one of these statements:

Revoke Type	Description
Administrative rights to system privilege only	**REVOKE ADMIN OPTION FOR SET USER** (**ANY**) **FROM** *user_ID [,...]*
System privilege to impersonate any database user, including administrative rights	**REVOKE SET USER** FROM**FROM** *user_ID [,...]*
System privilege to impersonate specified users	**REVOKE SET USER** (*target_users_list*) **FROM** *user_ID [,...]*
System privilege to impersonate specified roles	**REVOKE SET USER** (**ANY WITH ROLES** *target_roles_list*) **FROM** *user_ID [,...]*

Example:

These statements removes the ability for *Sam* to impersonate any database user:

```
REVOKE SET USER (ANY) FROM Sam
or
REVOKE SET USER FROM Sam
```

This statement removes administrative rights only to the SET USER system privilege from *Frank*. *Frank* can still impersonate any user in the database.

```
REVOKE ADMIN OPTION FOR SET USER (ANY) FROM Frank
```

This statement removes the ability of *Bob* and *Jeff* to impersonate *Mary*, *Joe*, or *Sue* only.

```
REVOKE SET USER (Mary, Joe, Sue) FROM Bob, Jeff
```

This statement removes the ability of *Mary* to impersonate any member of the *Sales1* role:

```
REVOKE SET USER (ANY WITH ROLES Sales1) FROM Mary
```

This statement removes the ability of *Sarah* to impersonate *Joe* or *Sue*, or any member of the *Sales2* role:

```
REVOKE SET USER (Joe, Sue), (ANY WITH ROLES Sales2) FROM Sarah
```

This statement removes the ability of *Joan* to impersonate any member of the *Marketing1* or *Marketing2* roles:

```
REVOKE SET USER (ANY WITH ROLES Marketing1, Markeing2) FROM Joan
```

See also

- *REVOKE SET USER Statement* on page 290

Users

User management includes the creation and deletion of user IDs, as well as management of passwords.

DBA User

The DBA user is the default user created when a new SAP Sybase IQ database is created.

The password for the DBA user is initially set to "sql." To override the default user name or password during creation, use the **CREATE DATABASE** statement with the DBA USER or DBA PASSWORD clause.

If you elect not to override the default password during creation, it is strongly recommended that you do so as soon as possible thereafter.

By default, the DBA user is automatically granted administrative rights on the SYS_AUTH_DBA_ROLE role, which in turn is granted the SYS_AUTH_SA_ROLE and SYS_AUTH_SSO_ROLE roles. It is the union of these roles which grants the DBA user all system and object-level privileges in the database, and allows DBA to carry out any activity in the database: create tables, change table structures, create new user IDs, revoke privileges from users, and so on.

To ensure database security and accountability, avoid using generic names like "dba" as the first user ID. Use a real user's login name with a strong password instead.

Users Granted the SYS_AUTH_DBA_ROLE Role

Under certain circumstances, the underlying roles of SYS_AUTH_DBA_ROLE role can be dropped and the underlying system privileges of the SYS_AUTH_SA_ROLE and SYS_AUTH_SSO_ROLE roles revoked. However, the SAP Sybase IQ documentation assumes that the DBA user is the database administrator, and all underlying roles and system privileges remain as granted by default.

To guard against loss of password by the active DBA user, create one or more extra DBA accounts (with a randomly generated user name and password) and lock up those credentials. If the active DBA password is lost, use one of the extra credentials to log in to that DBA account, and reset the original account password.

Adding New Users

The DBA can add new users to the database. New users are then granted privileges to carry out authorized tasks on the database. Although DBA responsibilities may be handed over to other

user IDs, the DBA is responsible for the overall management of the database by virtue of the SYS_AUTH_DBA_ROLE role.

The DBA can then create database objects and assign ownership of these objects to other user IDs.

DBA User ID in Case-Sensitive Databases
User IDs and passwords are actually database objects.

Changing the DBA Password

Change the password for the DBA user. The default password for DBA user for all databases is `sql`. You should change this password to prevent unauthorized access to your database.

Prerequisites

Requires the CHANGE PASSWORD system privilege.

Note: If you are using dbisql, it is suggested that you place your permission grants into a command file for reference so you can modify and re-run it if necessary, to re-create the permissions.

Task

To change a user password, execute:

```
ALTER USER userID
IDENTIFIED BY password
```

Example:

This example changes the `DBA` user password to `S&cureAdm1n`:

```
ALTER USER DBA
IDENTIFIED BY S&cureAdm1n
```

See also

- *Case-sensitivity of User IDs and Passwords* on page 125
- *ALTER USER Statement* on page 246

Super-User

Super-users are users that can exercise any system privilege and administer any role; they can perform any privileged operation in the system. Role-based security does not require a super-user to maintain the database, and the DBA user may not be a super-user.

By default, the DBA user can exercise any system privilege, but since it may not be able to administer all user-defined roles, it is not considered a true super-user. SAP Sybase IQ does not automatically create a super-user for a new or migrated database.

To create a super-user, create a user and grant it the SYS_AUTH_DBA_ROLE compatibility role.

Note: If you migrated SYS_AUTH_DBA_ROLE, you must manually grant all of the underlying default system privileges of SYS_AUTH_DBA_ROLE, with administration rights, to create the super-user.

Once the super-user is created, going forward, to maintain the super-user status, all new user-extended and user-defined roles must be granted to the super-user, with administrative rights.

To allow the DBA user to act as a super-user, all new user-extended and user-defined roles must be granted to the DBA user, with administrative rights.

Administrative rights can be granted in the form of a role administrator or a global role administrator.

Increase Password Security

Passwords are an important part of any database security system. There are several options available to increase password security.

Implement a Login Policy

Use a login policy to control the frequency of password changes, to specify the number of login attempts allowed before an account is locked, or to force password expiration. See *Login Policies*.

Implement a Minimum Password Length

By default, passwords can be any length. For greater security, you can enforce a minimum length requirement on all new passwords to disallow short (and therefore easily guessed) passwords. The recommended minimum length is 6. See *MIN_PASSWORD_LENGTH*.

Implement Password Rules

You can implement advanced password rules that include requiring certain types of characters in the password, disallowing password reuse, and expiring passwords. Validation of the rules occurs when a new user ID is created or a password is changed. See *VERIFY_PASSWORD_FUNCTION*.

See also

- *Login Policies* on page 130
- *VERIFY_PASSWORD_FUNCTION Option* on page 305
- *MIN_PASSWORD_LENGTH Option* on page 307

Passwords in the Database

SAP Sybase IQ 15.0 or later use SHA256 to hash passwords. Passwords are stored in UTF-8.

When passwords are created or changed, they are converted to UTF-8 before being hashed and stored in the database. If the database is unloaded and reloaded into a database with a different character set, existing passwords continue to work. If the server cannot convert from the

client's character set to UTF-8, then it is recommended that the password be composed of 7-bit ASCII characters as other characters may not work correctly.

SAP Sybase IQ 12.7 and earlier used a proprietary hash.

Case-sensitivity of User IDs and Passwords

Case-sensitivity of passwords is treated differently from other identifiers.

In SAP Sybase IQ and SQL Anywhere, all passwords in newly-created databases are case-sensitive, regardless of the case-sensitivity of the database. The default user ID is DBA and the password for this user is lowercase *sql*.

When you rebuild an existing database, SAP Sybase IQ and SQL Anywhere determine the case-sensitivity of the password as follows:

- If the database was originally entered in a case-insensitive database, the password remains case-insensitive.
- If the password was originally entered in a case-sensitive database, uppercase and mixed-case passwords remain case-sensitive. If the password was entered in all lowercase, then the password becomes case-insensitive.
- Changes to both existing passwords and new passwords are case-sensitive.

In SAP® Sybase Adaptive Server Enterprise, the case-sensitivity of user IDs and passwords follows the case-sensitivity of the server.

Creating a New User

Create a new user ID.

Prerequisites

Requires the MANAGE ANY USER system privilege.

Task

To create a new user, execute:

```
CREATE USER userID
IDENTIFIED BY password
```

Example:

This statement adds user ID `Joe` to a database with password `welcome`:

```
CREATE USER Joe
IDENTIFIED BY welcome
```

See also

- *CREATE USER Statement* on page 261

Deleting a User

Remove a user ID from the database.

Prerequisites

- Requires the MANAGE ANY USER system privilege.
- The user being deleted does not own any database objects and is not currently connected to the database.

Task

If the user being delete has any external logins defined, the external logins are deleted as part of the process. However, any related objects on remote servers are not removed.
To delete a user, execute:

```
DROP USER userID
```

Note: When dropping a user, any permissions granted by this user will be removed.

Note: If the user being deleted owns any objects in the database, when the **DROP USER** command is issue, the following error message appears, and the command fails:

```
Cannot drop a user that owns tables in runtime system SQLCODE=-128,
ODBC 3  State="42000"
    Line 1, column 1
```

Example:

This statement drops user ID `Joe` from the database:

```
DROP USER Joe
```

See also

- *DROP USER Statement* on page 265

Changing a User's Password

Change the password of another user.

Prerequisites

Requires the CHANGE PASSWORD system privilege.

Task

You can set up password rules (**MIN_PASSWORD_LENGTH** option) and verify that any new password assigned complies with them (**VERIFY_PASSWORD_FUNCTION** option). For example, you might require that passwords must include one digit or cannot be the user ID.

To change a user password, execute:

```
ALTER USER user_ID
IDENTIFIED BY password
```

Example:

This statement assigns the new password `P&ssW0rd` to user `M_Smith`:

```
ALTER USER M_Smith IDENTIFIED BY P&ssW0rd
```

See also

- *Case-sensitivity of User IDs and Passwords* on page 125
- *ALTER USER Statement* on page 246
- *VERIFY_PASSWORD_FUNCTION Option* on page 305
- *MIN_PASSWORD_LENGTH Option* on page 307

Converting a User-Extended Role Back to a User

You can convert a user-extended role back to a regular user.

Prerequisites

Requires administrative rights over the user-extended role being converted.

Task

The user retains any login privileges, system privileges and roles granted to the user-extended role. The user remains as the owner of the objects that were created after the user was extended to act as a role. Any members of the user-extended role are immediately revoked.

A minimum number of role or global role administrators (as defined by the **MIN_ROLE_ADMINS** database option) with a login password must exist for each role at all times. When converting a user-extended role back to a user, all dependent roles of the user-extended role must continue to meet this minimum requirement, or the conversion fails.

To convert a user-extended role back to a user, execute one of these:

Convert Condition	Statement
Role has not been granted any members.	**DROP ROLE FROM USER** *role_name*
Role has been granted members.	**DROP ROLE FROM USER** *role_name* **WITH REVOKE**

See also

- *DROP ROLE Statement* on page 264

Permanently Locking a User Account

To permanently lock a user account, you must assign a login policy with the locked option set to ON to the account. Once disabled, a user cannot connect to the SAP Sybase IQ server.

Prerequisites

- Requires the MANAGE ANY LOGIN POLICY system privilege to create/alter the login policy.
- Requires the MANAGE ANY USER system privilege to assign the login policy to users.

Task

1. Create a login policy with the LOCKED option set to ON.
2. Execute the **ALTER USER** command to assign the login policy to a user account to be disabled.

   Note: You cannot specify multiple user names in the same **ALTER USER** command when assigning a login policy to users.

Examples:

This command creates a new login policy named `lp_locked_users` with the `LOCKED` option set to ON:

```
CREATE LOGIN POLICY lp_locked_users locked=ON
```

These commands assign the `lp_locked_users` login policy to users `John` and `Mary`:

```
ALTER USER john LOGIN POLICY lp_locked_users
```

```
ALTER USER mary LOGIN POLICY lp_locked_users
```

`John` and `Mary` can no longer log in.

See also

- *Automatic Unlocking of User Accounts* on page 129
- *ALTER USER Statement* on page 246
- *CREATE LOGIN POLICY Statement* on page 253

Unlocking User Accounts

Unlock a user account.

Prerequisites

Requires the MANAGE ANY USER system privilege.

Task

The manner in which you unlock an account depends on how it was originally locked.

1. If a user account is locked because it is assigned to a login policy with the locked option set to ON, reassign the user to a login policy with the locked option set to OFF.
2. If a user account is locked because it has exceeded the MAX_FAILED_LOGIN_ATTEMPTS or MAX_DAYS_SINCE_LOGIN, issue the **ALTER USER** statement with the RESET LOGIN POLICY option. Forcing the reset of the login policy reverts the settings of the user's login to the original values in the login policy. This usually clears all locks that are implicitly set due to the user exceeding the failed logins or exceeding the maximum number of days since the last login.

   Note: Resetting the values in the login policy assigned to a user does not reset the values for all users assigned the same login policy.

Example

Assuming that the LOCKED option in login policy `lp` is set to OFF, this example replaces the login policy currently assigned to `John` with login policy `lp`:

```
ALTER USER john LOGIN POLICY lp
```

Assuming the account of `John` is locked because he either exceeded the MAX_FAILED_LOGIN_ATTEMPTS or MAX_DAYS_SINCE_LOGIN, this example forces the reset of the values in the login policy currently assigned to `John`:

```
ALTER USER john RESET LOGIN POLICY
```

See also

- *Automatic Unlocking of User Accounts* on page 129
- *ALTER LOGIN POLICY Statement* on page 237
- *ALTER USER Statement* on page 246

Automatic Unlocking of User Accounts

A lock-down of some or all database services may occur if all administrative users with the MANAGE ANY USER system privilege are locked out of the database due to failed login attempts.

A user account is automatically locked if the user exceeds the maximum failed login attempts limit (MAX_FAILED_LOGIN_ATTEMPTS) value defined in the login policy. Once locked, the user account must be manually unlocked by a user granted the MANAGE ANY USER system privilege. However, if all users with the MANAGE ANY USER system privilege are locked out due to failed login attempts, a potential lock-down of some or all the database services can occur.

To prevent this scenario, use these login policy options:

- **ROOT_AUTO_LOCK_TIME –** defines automatic unlocking period for users with the MANAGE ANY USER system privilege. You can set root_auto_lock_time to a small value (for example, 15 minutes) in the root login policy. There is a server-imposed upper limit of a few hours.
- **AUTO_UNLOCK_TIME –** defines the automatic unlocking period for all other users. Set AUTO_UNLOCK_TIME to UNLIMITED (default) in any login policy, including the root login policy.

Configuration of these values requires the MANAGE ANY LOGIN POLICY system privilege.

Based on the permissions granted to a user, one of these login policy options is verified at the time of unlocking. Automatic unlocking is applicable only to locked accounts due to failed login attempts and not to accounts locked for any other reason. The locked status of a user is verified during log in and if the user has equaled or exceeded the specified automatic unlock period, the user is allowed to login and the FAILED_LOGIN_ATTEMPTS counter is reset to zero.

See also

- *Minimum Number of Role Administrators* on page 20
- *Unlocking User Accounts* on page 128
- *Permanently Locking a User Account* on page 128
- *ALTER LOGIN POLICY Statement* on page 237
- *ALTER USER Statement* on page 246

Login Policies

A *login policy* defines the rules that SAP Sybase IQ follows to establish user connections. Each login policy is associated with a set of options called login policy options.

Login management commands that you execute on any multiplex server are automatically propagated to all servers in the multiplex. For best performance, execute these commands, or any DDL, on the coordinator.

Warning! Migrating databases from version 12.7 removes existing login management settings. You must re-create them after migration.

Modifying the Root Login Policy

You can modify the option values for the root login policy, but you cannot drop the policy.

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

Each new database is created with a default login policy, called the root policy. When you create a user account without specifying a login policy, the user becomes part of the root login policy.

To modify the options of the root login policy, execute:

```
ALTER LOGIN POLICY ROOT {login_policy_options}
```

See also

- *ALTER LOGIN POLICY Statement* on page 237
- *Login Policy Options* on page 254
- *Multiplex Login Policy Configuration* on page 243
- *LDAP Login Policy Options* on page 242

Creating a New Login Policy

Any options that are not explicitly set when creating a login policy inherit their values from the root login policy..

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

Login policy names must be unique. An error message appears if the login policy name already exists.

To create a new login policy, execute:

```
CREATE LOGIN POLICY policy_name {login_policy_options}
```

Example:

This statement creates the `Test1` login policy with PASSWORD_LIVE_TIME option set to 60 days:

```
CREATE LOGIN POLICY Test1
password_life_time=60
```

See also

- *CREATE LOGIN POLICY Statement* on page 253
- *Login Policy Options* on page 254
- *Multiplex Login Policy Configuration* on page 243
- *LDAP Login Policy Options* on page 242

Modifying an Existing Login Policy

Use Interactive SQL to change the options for an existing login policy.

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

To alter the options of an existing login policy, execute:

```
ALTER LOGIN POLICY policy-name {login_policy_options}
```

Example:

This statement alters the LOCKED and MAX_CONNECTIONS options on the `Test1` login policy:

```
ALTER LOGIN POLICY Test1
locked=on
max_connections=5
```

See also

- *ALTER LOGIN POLICY Statement* on page 237
- *Login Policy Options* on page 254
- *Multiplex Login Policy Configuration* on page 243
- *LDAP Login Policy Options* on page 242

Deleting a Login Policy

You cannot delete the root login policy or one currently assigned to a user.

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

1. Verify that no users are currently assigned the login policy to be dropped.
2. To drop a login policy, execute:

   ```
   DROP LOGIN POLICY policy_name
   ```

See also

- *DROP LOGIN POLICY Statement* on page 264

Assigning a Login Policy When Creating a New User

If you do not assign a login policy when creating a user account, the account is assigned the root login policy.

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

Assign a login policy other than the root login policy when creating a new user. A user can be assigned only one login policy at a time.
To assign a login policy, execute:

```
CREATE USER userID
[ IDENTIFIED BY password ]
[ LOGIN POLICY policy-name ]
```

Note: You cannot specify multiple user IDs in the same **CREATE USER** command when assigning a login policy to users.

Example:

This statement creates a user called `Joe` with the password `welcome`, and assigns the login policy `Test2`:

```
CREATE USER Joe
IDENTIFIED BY welcome
LOGIN POLICY Test2
```

See also

- *CREATE USER Statement* on page 261

Assigning a Login Policy to an Existing User

Use Interactive SQL to assign a login policy to an existing user.

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

1. To change the login policy assigned to a user, execute:

   ```
   ALTER USER userID
   LOGIN POLICY policy_name
   ```

2. Have the user log out and back in to apply the new login policy.

See also

- *ALTER USER Statement* on page 246

User Connections

There are several ways to manage user connections.

You can:

- **Limit the number of active logins for a single user –** assign user to a login policy in which the MAX_CONNECTIONS login policy option is set.
- **Lock a user account –** Explicitly – assign user to a login policy in which the LOCKED option is set to ON.

  Implicitly – assign user to a login policy in which the MAX_FAILED_LOGIN_ATTEMPTS option is set. If the user exceeds the set value when attempting to log in, the user account is locked.
- **Set a password expiry condition –** assign user to a login policy in which the PASSWORD_EXPIRY_ON_NEXT_LOGIN login policy option is set. You can also execute the **CREATE USER** or **ALTER USER** statements, including the FORCE PASSWORD CHANGE clause.

Assigning a login policy to a user or forcing a password change requires the MANAGE ANY USER system privilege. Creating or altering a login policy requires the MANAGE ANY LOGIN POLICY system privilege.

Preventing Connection After Failed Login Attempts

Prevent a user from connecting after exceeding the maximum failed login attempts.

Prerequisites

- Requires the MANAGE ANY LOGIN POLICY system privilege to create or alter the login policy.
- Requires the MANAGE ANY USER system privilege to assign the login policy to users.

Task

The system can be set to automatically lock an account if a user fails to enter valid login credentials after a specified number of attempts. Once locked, the user cannot connect, even if valid credentials are subsequently entered; the account remains locked until it is manually unlocked. The MAX_FAILED_LOGIN_ATTEMPTS login policy option controls the number of sequential failed attempts before the user account is locked. You can set this value in a new or existing login policy, including the root login policy, and it then applies to all users assigned the login policy.

1. To set the MAX_FAILED_LOGIN_ATTEMPTS option, either create a new login policy, or modify an existing one.
2. Define a value for the MAX_FAILED_LOGIN_ATTEMPTS option.
3. Assign the login policy to applicable users, as needed.

Example

This example creates a new login policy named `lp`, which automatically locks a user account after five failed attempts:

```
CREATE LOGIN POLICY lp max_failed_login_attempts=5
```

This example modifies an existing login policy named `exist_lp` which automatically locks a user. account after five failed attempts:

```
ALTER LOGIN POLICY lp max_failed_login_attempts=5
```

This example assigns the login policy `lp` to user `John`:

```
ALTER USER John LOGIN POLICY lp
```

Once `John` is assigned the `lp` login policy, he cannot log in if he enters invalid credentials five times in sequence.

See also

- *ALTER LOGIN POLICY Statement* on page 237
- *ALTER USER Statement* on page 246
- *CREATE LOGIN POLICY Statement* on page 253
- *Login Policy Options* on page 239
- *LDAP Login Policy Options* on page 242
- *Multiplex Login Policy Configuration* on page 243

Creating a DBA Recovery Account

Create a DBA recovery account for production systems. The DBA recovery account is a backup, in case you lose the original DBA account password.

1. Create one or more extra DBA accounts, using randomly generated user names and passwords.
2. Lock the credentials in a secure location.

See also

- *CREATE USER Statement* on page 261

Logging in with a DBA Recovery Account

Log in using the DBA recovery account, and reset the original DBA account password.

1. Retrieve the DBA recovery account user name and password from the secure location.
2. Log in using the recovery account.
3. Reset the original DBA account password.
4. Return the DBA recovery account credentials to their secure location.

Manage Connections Using Stored Procedures

There are several stored procedures for managing user connections.

This table lists the procedure available to perform each SAP Sybase IQ login management function.

Stored Procedure	Purpose	System Privilege Required
sa_get_user_status	Retrieve the current status of all existing users	Requires the MANAGE ANY USER system privilege to retrieve the current status of all existing users. Users without the MANAGE ANY USER system privilege can retrieve only their current status.
sp_expireallpasswords	Cause all user passwords to expire immediately	MANAGE ANY USER system privilege
sp_iqaddlogin	Add users, define their passwords, specify login policy, and password expiry on next login	MANAGE ANY USER system privilege
sp_iqcopyloginpolicy	Create a new login policy by copying an existing one	MANAGE ANY LOGIN POLICY system privilege
sp_iqdroplogin	Drop the specified user	MANAGE ANY USER system privilege
sp_iqmodifylogin	Assign a given user to a login policy	MANAGE ANY USER system privilege
sp_iqmodifyadmin	Set an option on a named login policy to a certain value	MANAGE ANY LOGIN POLICY system privilege

Stored Procedure	Purpose	System Privilege Required
sp_iqpassword	Change your own or another user's password	All users can run **sp_iqpassword** to change their own password. However, the CHANGE PASSWORD system privilege is required to change the password of another user.

See also

- *sp_expireallpasswords system procedure* on page 325
- *sp_iqcopyloginpolicy Procedure* on page 336
- *sp_iqdroplogin Procedure* on page 347
- *sp_iqmodifyadmin Procedure* on page 353
- *sp_iqmodifylogin Procedure* on page 354
- *sp_iqpassword Procedure* on page 366
- *sp_iqaddlogin Procedure* on page 328
- *sa_get_user_status system procedure* on page 319

Manage Resources Used by Connections

Building a set of users and roles allows you to manage permissions on a database. Another aspect of database security and management is to limit the resources an individual user can use.

For example, you may want to prevent a single connection from taking too much available memory or CPU resources, and slowing down other database users.

Database Options That Govern User Resources

Database options that control resources are called *resource governors*.

You can set database options using the **SET OPTION** statement.

Resources You Can Manage

- **CURSOR_WINDOW_ROWS –** defines the number of cursor rows to buffer.
- **MAX_CARTESIAN_RESULT –** limits the number of result rows from a query containing a Cartesian join.
- **MAX_IQ_THREADS_PER_CONNECTION –** sets the number of processing threads available to a connection for use in IQ operations

- **TEMP_CACHE_MEMORY_MB –** sets the size of the cache for the SAP Sybase IQ temporary store. (The server option **-iqtc** is the recommended way to set the temp cache size.)
- **QUERY_TEMP_SPACE_LIMIT –** limits the amount of temporary dbspace available to any one query.
- **QUERY_ROWS_RETURNED_LIMIT –** tells the query optimizer to reject queries that might consume too many resources. If the optimizer estimates that the result set from the query will exceed the value of this option, the optimizer rejects the query and returns an error message.

The following database options affect the engine, but have limited impact on SAP Sybase IQ:

- **JAVA_HEAP_SIZE –** sets the maximum size (in bytes) of the memory allocated to Java applications on a per connection basis.
- **MAX_CURSOR_COUNT –** limits the number of cursors for a connection.
- **MAX_STATEMENT_COUNT –** limits the number of prepared statements for a connection.

Database option settings are not inherited through the role structure.

See also

- *SET OPTION Statement* on page 296

Security with Views and Procedures

You can use views and stored procedures to tailor privileges to suit the needs of your enterprise.

For databases that require a high level of security, defining privileges directly on tables has limitations. Any privilege granted to a user on a table applies to the entire table. You may need to assign privileges more precisely than on a table-by-table basis. For example:

- You do not want to give access to personal or sensitive information stored in an employee table to users who need access to other parts of the table.
- You may wish to give sales representatives privileges on a table containing descriptions of sales calls, but limit update privileges to their own calls.

Views Provide Tailored Security

Use views to give users access to only one portion of a table.

You can define a portion in terms of rows or columns. For example, you may want to disallow a group of users from seeing the `Salary` column of an `Employees` table, or you may want to limit a user to see only the rows of a table that he or she have created.

Example 1

The sales manager needs access to information in the database concerning employees in the department. However, there is no reason for the manager to have access to information about employees in other departments.

Create a user ID for the sales manager, create views that provide the information needed, and grant the appropriate privileges to the sales manager user ID.

1. As a user with the MANAGE ANY USER system privilege, create the new user ID using the **GRANT** statement:

```
CONNECT "DBA"
IDENTIFIED by sql;
GRANT CONNECT
TO SalesManager
IDENTIFIED BY sales
```

   Enclose DBA in quotation marks because it is a SQL keyword.

2. Define a view that looks only at sales employees:

```
CREATE VIEW emp_sales AS
SELECT EmployeeID, GivenName, Surname
FROM "DBA".Employees
WHERE DepartmentID = 200
```

   Identify the table as `"DBA".Employees`, with the owner of the table explicitly identified, so that the `SalesManager` user ID can use the view. Otherwise, when `SalesManager` uses the view, the **SELECT** statement refers to a table that the user ID does not recognize.

3. Give SalesManager privilege to look at the view:

```
GRANT SELECT
ON emp_sales
TO SalesManager
```

   Use the same command to grant privilege on a view as to grant privilege on a table.

Example 2

This example creates a view, which allows the Sales Manager to look at a summary of sales orders. This view requires information from more than one table for its definition:

1. Create the view.

```
CREATE VIEW order_summary AS
SELECT OrderDate, Region, SalesRepresentative
FROM "GROUPO".SalesOrders
    KEY JOIN "GROUPO".Customers
```

2. Grant privilege for `SalesManager` to examine this view.

```
GRANT SELECT
ON order_summary
TO SalesManager
```

3. To check that the process has worked properly, connect to the `SalesManager` user ID and look at the views you have created:

```
CONNECT SalesManager IDENTIFIED BY sales ;
SELECT * FROM "GROUPO".emp_sales ;
SELECT * FROM "GROUPO".order_summary ;
```

No privileges have been granted to `SalesManager` to look at the underlying tables. These commands produce privilege errors:

```
SELECT * FROM "DBA".Employees ;
SELECT * FROM "DBA".SalesOrders;
```

These examples show how to use views to tailor SELECT privileges. You can grant INSERT, DELETE, and UPDATE privileges on views in the same way.

Guidelines for Using Views

There are certain restrictions, both on the **SELECT** statements you use to create views, and on your ability to insert into, delete from, or update them.

Restrictions on SELECT Statements

You cannot use an **ORDER BY** clause in the **SELECT** query. A characteristic of relational tables is that there is no significance to the ordering of the rows or columns, and using an **ORDER BY** clause imposes an order on the rows of the view. You can use the **GROUP BY** clause, subqueries, and joins in view definitions.

Scalar value subqueries are supported only within the top-level **SELECT** list (not in a view, a derived table, or a subquery). Sometimes views or derived tables used in the **FROM** clause of the top level **SELECT** are simple enough that they can be "flattened" up into the top level **SELECT**. As a result of this, the preceding rule is actually enforced only for subqueries, nonflattened views, and nonflattened derived tables. For example:

```
CREATE VIEW test_view AS SELECT testkey,(SELECT COUNT(*) FROM
tagtests WHERE tagtests.testkey = testtrd.testkey ) FROM
testtrd
```

```
SELECT * FROM test_view
Msg 21, Level 14, State 0:
SQL Anywhere Error -1005004: Subqueries are allowed only as arguments
of
comparisons, IN, and EXISTS,
-- (opt_Select.cxx 2101)
```

To develop a view, tune the **SELECT** query by itself until it provides exactly the results you need in the format you want. Once you have the correct **SELECT** query, you can add a phrase in front of the query to create the view. For example:

```
CREATE VIEW viewname AS
```

Guidelines for Inserting and Deleting from Views

UPDATE, **INSERT**, and **DELETE** statements are allowed on some views, but not on others, depending on their associated **SELECT** statement.

You cannot update, insert into or delete from views that contain:

- Aggregate functions, such as **COUNT(*)**
- A **GROUP BY** clause in the **SELECT** statement
- A **UNION** operation

In all these cases, there is no way to translate the **UPDATE**, **INSERT**, or **DELETE** into an action on the underlying tables.

Warning! Do not delete views owned by the dbo user ID, which owns system objects. Deleting such views or changing them into tables may cause unexpected problems.

Procedures Provide Tailored Security

Procedures restrict the actions a user may take.

A user may have EXECUTE privilege on a procedure without having any privileges on the table or tables on which the procedure acts.

By default, procedures execute with the privileges of the procedure owner. For a procedure that updates a table, if the procedure owner has UPDATE privileges on the table, the user can execute the procedure. The owner of the procedure can restrict the procedure to execute with the privileges of the user executing the procedure by specifying SQL SECURITY INVOKER to a CREATE/ALTER PROCEDURE statement.

Setting Up Task-Based Security Restrictions

Disallow all access to the underlying tables, and grant privileges to users or roles to execute certain stored procedures. This approach strictly defines how to control database modifications.

To allow users with specific privileges to administer certain tasks using SAP Sybase IQ system procedures:

1. Create a role for each set of authorized tasks to be performed and grant the role the applicable system privileges.
2. Grant each of these roles to a single common role.
3. Grant EXECUTE privileges on the IQ procedure for performing the authorized tasks to the applicable role.
4. When a new user is created who is to be granted authorized tasks, grant the role created for each authorized task to the user.

Granting Users the Privilege to Run Related Stored Procedures

Grant users the system privilege required to run stored procedures. Since most privileges are inherited through role membership, users can inherit the system privilege and the execute privileges for IQ procedures from a role.

Prerequisites

Requires the MANAGE ANY USER or EXECUTE ANY PROCEDURE system privilege.

Task

To grant user `user1` the MANAGE ANY USER system privilege and privileges to execute procedures related to user administration:

1. Create a role `USER_ADMIN_GRP`:

   ```
   CREATE ROLE USER_ADMIN_GRP
   ```

2. Grant the MANAGE ANY USER system privilege to the `USER_ADMIN_GRP` role:

   ```
   GRANT MANAGE ANY USER TO USER_ADMIN_GRP
   ```

3. Grant EXECUTE privilege on SAP Sybase IQ stored procedures for user administration to `USER_ADMIN_GRP`:

   ```
   GRANT EXECUTE on sp_iqaddlogin
   to USER_ADMIN_GRP
   GRANT EXECUTE on sp_iqcopyloginpolicy
   to USER_ADMIN_GRP
   GRANT EXECUTE on sp_iqdroplogin
   to USER_ADMIN_GRP
   GRANT EXECUTE on sp_iqmodifyadmin
   to USER_ADMIN_GRP
   GRANT EXECUTE on sp_iqmodifylogin
   to USER_ADMIN_GRP
   ```

4. Grant the `USER_ADMIN_GRP` role to `user1`. `user1` inherits the MANAGE ANY USER system privilege and the ability to execute the assigned IQ procedures through membership in `USER_ADMIN_GRP` role.

   ```
   GRANT ROLE USER_ADMIN_GRP TO user1
   ```

Related Stored Procedures for Role Access

You may create roles that grant privileges for various related stored procedures.

Role Name	System Privilege Granted	Stored Procedure
OPERATOR_GRP	BACKUP DATABASE DROP CONNECTION CHECKPOINT MONITOR ACCESS SERVER LS	sp_iqbackupdetails sp_iqbackupsummary sp_iqconnection sp_iqsysmon
SPACEAD-MIN_GRP	MANAGE ANY DBSPACE ACCESS SERVER LS	sp_iqdbspace sp_iqdbspaceinfo sp_iqdbspaceobjectinfo sp_iqemptyfile sp_iqestdbspaces sp_iqfile sp_iqobjectinfo sp_iqspaceused

See also

- *sp_iqbackupdetails Procedure* on page 329
- *sp_iqbackupsummary Procedure* on page 331
- *sp_iqconnection Procedure* on page 332
- *sp_iqdbspace Procedure* on page 337
- *sp_iqdbspaceinfo Procedure* on page 339
- *sp_iqdbspaceobjectinfo Procedure* on page 343
- *sp_iqemptyfile Procedure* on page 348
- *sp_iqestdbspaces Procedure* on page 349
- *sp_iqfile Procedure* on page 350
- *sp_iqobjectinfo Procedure* on page 354
- *sp_iqspaceused Procedure* on page 357
- *sp_iqsysmon Procedure* on page 360

Confidentiality of Data

You can secure communications between a client and the SAP Sybase IQ server, or between an SAP Sybase IQ client and the database server using Transport Layer Security (TLS).

SAP Sybase IQ allows you to encrypt your database or columns.

Support of FIPS encryption, Kerberos authentication, and column encryption is included in the separately licensed SAP Sybase IQ Advanced Security Option.

See also

- *Column Encryption in SAP Sybase IQ* on page 196
- *FIPS Support in SAP Sybase IQ* on page 195

Database encryption and decryption

You can use database encryption to make it more difficult for someone to decipher the data in your database. You can choose to secure your database either with simple or with strong encryption.

Note: If your database is encrypted, compressing it with a tool such as WinZip does not result in a file that is significantly smaller than the original database file.

Simple encryption and strong encryption

Simple encryption

Simple encryption is equivalent to obfuscation and makes it more difficult for someone using a disk utility to look at the file to decipher the data in your database. Simple encryption does not require a key to encrypt the database.

Strong encryption

Strong database encryption technology makes a database inoperable and inaccessible without a key (password). An algorithm encodes the information contained in your database and transaction log files so they cannot be deciphered.

In SAP Sybase IQ, the database administrator has control over four aspects of strong encryption, including:

- strong encryption status
- encryption key
- protection of the encryption key
- encryption algorithm

Supported strong encryption algorithms
The algorithm used to implement SAP Sybase IQ strong encryption is AES: a block encryption algorithm chosen as the new Advanced Encryption Standard (AES) for block ciphers by the National Institute of Standards and Technology (NIST).

You can also specify a separate FIPS-approved AES module for strong encryption using the AES_FIPS (128-bit) or AES256_FIPS (256-bit) type. When the database server is started with the -fips option, you can run databases encrypted with AES, AES256, AES_FIPS, or AES256_FIPS strong encryption, but not databases encrypted with simple encryption. Unencrypted databases can also be started on the server when -fips is specified.

The SAP Sybase IQ security option must be installed on any computer used to run a database encrypted with AES_FIPS or AES256_FIPS.

FIPS-certified encryption is not available on all platforms. For a list of supported platforms, see *http://www.sybase.com/detail?id=1061806*.

Note: Separately licensed component required.

FIPS-certified encryption requires a separate license. All strong encryption technologies are subject to export regulations.

Database encryption methods

- **To create an encrypted database –** You can use the following:
  - The Initialization utility (iqinit) in combination with various options to enable strong encryption.
    The iqinit utility -ep and -ek options create a database with strong encryption, allowing you to specify the encryption key in a prompt box or on the command line. The iqinit -ea option sets the encryption algorithm to AES or AES256 (or to AES_FIPS or AES256_FIPS for the FIPS-certified module).
  - CREATE DATABASE statement.
- **To encrypt an existing database –** Although you cannot simply turn strong encryption on or off in an existing database, you can use one of the following to implement strong encryption:
  - Rebuild (unload/reload) an existing database and change the encryption status at that time. You can rebuild the database to unload all the data and schema of an existing database. This creates a new database (at which point you can change a variety of settings including strong encryption status), and reloads the data into the new database. You need to know the key to unload a strongly encrypted database. To rebuild (unload/reload) a database, use one of the following methods:
    - The Unload utility (dbunload)
      The Unload utility (dbunload) with options to create a new database with strong encryption. The -an option creates a new database. To specify strong encryption and the encryption key in a prompt box or on the command line use the -ep or -ek

option. The -ea option sets the encryption algorithm to AES or AES256 (or to AES_FIPS or AES256_FIPS for the FIPS-certified module).
    - The UNLOAD and RELOAD statements
    - The **Unload Database Wizard**.
  - You can use the CREATE ENCRYPTED DATABASE statement or the CREATE ENCRYPTED FILE statement.
- **To encrypt tables, columns, and materialized views –** See Column and table encryption.

See also

- *Column and table encryption* on page 150

Comparison of CREATE ENCRYPTED DATABASE and CREATE ENCRYPTED FILE statements

You should use the CREATE ENCRYPTED DATABASE statement when you have an existing database that you want to encrypt. Use CREATE ENCRYPTED FILE statement only in the case where you have a database you want to encrypt that requires recovery.

You cannot be connected to the database you are encrypting when you execute the statement.

The CREATE ENCRYPTED FILE and CREATE ENCRYPTED DATABASE statements differ from each other as follows:

- The CREATE ENCRYPTED FILE statement must be executed against each of the database-related files independently (transaction log, transaction log mirror, dbspaces, if any), whereas the CREATE ENCRYPTED DATABASE statement automatically encrypts all the database-related files.
- The CREATE ENCRYPTED DATABASE statement cannot be used on a database requiring recovery; the CREATE ENCRYPTED FILE statement can.
- The CREATE ENCRYPTED DATABASE statement cannot be used inside procedures, triggers, or batches. The CREATE ENCRYPTED FILE statement can.
- The CREATE ENCRYPTED DATABASE statement supports the SIMPLE encryption algorithm, but the CREATE ENCRYPTED FILE statement does not.

Creating an encrypted database (SQL)

You can encrypt a database during creation by using the ENCRYPTED clause with the CREATE DATABASE statement.

Prerequisites

By default, you must have the SERVER OPERATOR system privilege. The required privileges can be changed by using the -gu database server option.

Task

This task is different from encrypting an existing database. To encrypt an existing database, use the CREATE ENCRYPTED DATABASE statement.

Warning! For strongly encrypted databases, store a copy of the key in a safe location. If you lose the encryption key, there is no way to access the data—even with the assistance of Technical Support. The database must be discarded and you must create a new database.

1. In Interactive SQL, connect to an existing database.
2. Execute a CREATE DATABASE statement that includes the ENCRYPTED clause and the KEY and ALGORITHM options.

An encrypted database is created.

Creating an encrypted database (iqinit utility)

You can create an encrypted database using the iqinit utility.

Prerequisites

There are no prerequisites for this task.

Task

Warning! For strongly encrypted databases, store a copy of the key in a safe location. If you lose the encryption key, there is no way to access the data—even with the assistance of Technical Support. The database must be discarded and you must create a new database.

Run the iqinit utility to create a database.

- To encrypt the database with simple encryption, include the -ea simple option.
- To encrypt the database with strong encryption, include -ek or -ep options to specify the encryption key.

An encrypted database is created.

Next

When starting or connecting to the database, you must specify the encryption key.

Creating an encrypted copy of an existing database (SQL)

You can create an encrypted copy of a database by using the CREATE ENCRYPTED DATABASE statement. This statement creates a copy of the file (in this case, in encrypted form), and does not overwrite the original database file.

Prerequisites

By default, you must have the SERVER OPERATOR system privilege to execute the CREATE ENCRYPTED DATABASE statement. The required privileges can be changed by using the -gu database server option.

The database you are encrypting must not be running.

Task

Warning! For strongly encrypted databases, store a copy of the key in a safe location. If you lose the encryption key, there is no way to access the data—even with the assistance of Technical Support. The database must be discarded and you must create a new database.

1. In Interactive SQL, connect to an existing database, other than the one you are encrypting.
2. Encrypt the database using the CREATE ENCRYPTED DATABASE statement.

When you execute a CREATE ENCRYPTED DATABASE statement, you do not encrypt (overwrite) the file; you create a copy of the file in encrypted form. If there are transaction logs, transaction log mirrors, or dbspaces associated with the database, encrypted copies of those files are made as well.

Decrypting a database (SQL)

You can decrypt a database using the CREATE DECRYPTED DATABASE statement. This statement creates a copy of the file (in decrypted form) and does not overwrite the original database file.

Prerequisites

By default, you must have the SERVER OPERATOR system privilege to execute the CREATE DECRYPTED TABLE DATABASE statement. The required privileges can be changed by using the -gu database server option.

The database you are encrypting must not be running.

Task

If you have a database that requires recovery and you want to decrypt it to send it to Technical Support, you must use the CREATE DECRYPTED FILE statement. Any database-related files such as transaction logs and transaction log mirrors, and dbspace files, must also be decrypted using this statement.

1. In Interactive SQL, connect to a database other than the one you want to decrypt.
2. Execute a CREATE DECRYPTED DATABASE statement.

When you execute a CREATE DECRYPTED DATABASE statement, you do not decrypt (overwrite) the file; you create a copy of the file in decrypted form. If there are transaction logs, transaction log mirrors, or dbspaces associated with the database, decrypted copies of those files are made as well.

Encryption keys

It is best to choose an encryption key value that cannot be easily guessed. The key can be of arbitrary length, but generally the longer the key, the better because a shorter key is easier to

guess than a longer one. As well, including a combination of numbers, letters, and special characters decreases the chances of someone guessing the key.

Encryption keys are always case sensitive, and they cannot contain leading or trailing spaces or semicolons.

You must supply this key each time you want to start the database. Lost or forgotten keys result in completely inaccessible databases.

You can choose whether the encryption key is entered at a command prompt (the default) or into a prompt box. Choosing to enter the key in a prompt box provides an extra measure of security because the key is never visible in plain sight. Clients are required to specify the key each time they start the database. If the database administrator starts the database, clients never need to have access to the key.

Warning! For strongly encrypted databases, store a copy of the key in a safe location. If you lose the encryption key, there is no way to access the data—even with the assistance of Technical Support. The database must be discarded and you must create a new database.

Changing the encryption key for a database

You can change the encryption key for an encrypted database, or for a database for which table encryption has been enabled, by using the CREATE ENCRYPTED DATABASE statement. Changing the encryption key does not overwrite the existing file, but creates a copy of the file encrypted with the new key.

Prerequisites

By default, you must have the SERVER OPERATOR system privilege to execute the CREATE ENCRYPTED DATABASE statement. The required privileges can be changed by using the -gu database server option.

Task

Change the encryption key for an encrypted database using the CREATE ENCRYPTED DATABASE statement.

The encryption key is changed.

Security and performance issues

Performance of SAP Sybase IQ is slower when the database is encrypted. The performance impact depends on how often pages are read from or written to disk, and can be minimized by ensuring that the server is using an adequate cache size.

You can increase the starting size of the cache with the -c option when you start the server. For operating systems that support dynamic resizing of the cache, the cache size that is used may be restricted by the amount of memory that is available; to increase the cache size, increase the available memory.

Column and table encryption

If you only want to encrypt portions of your database, you can choose to encrypt columns or tables.

Column encryption can be performed on any column in any table at any time. Table encryption requires that the database have table encryption enabled. Table encryption is enabled at database creation (initialization) time.

- **To encrypt tables –** You can use the following:
  - Initialization utility (iqinit).
  - CREATE DATABASE statement.
  - ALTER DATABASE statement.
  - CREATE ENCRYPTED TABLE DATABASE statement.
- **To encrypt columns –** ENCRYPT function.
- **To encrypt materialized views –** ALTER MATERIALIZED VIEW statement.

Column encryption

To encrypt columns in your database, use the ENCRYPT function. The ENCRYPT function uses the same AES strong encryption algorithm that is used for database encryption to encrypt values that are passed to it.

Encrypted data can be decrypted with the DECRYPT function. You must use the same key that was specified in the ENCRYPT function. Both of these functions return LONG BINARY values. If you require a different data type, you can use the CAST function to convert the value to the required data type.

The ENCRYPT and DECRYPT functions also support raw encryption. You can encrypt data inside the database server into a format that can be exported and decrypted outside of the server.

If database users need to access the data in decrypted form, but you do not want them to have access to the encryption key, you can create a view that uses the DECRYPT function. This allows users to access the decrypted data without knowing the encryption key. If you create a view or stored procedure that uses the table, you can use the SET HIDDEN parameter of the ALTER VIEW and ALTER PROCEDURE statements to ensure that users cannot access the encryption key by looking at the view or procedure definition.

Column encryption example

The following example uses triggers to encrypt a column that stores passwords in a table called user_info. The user_info table is defined as follows:

```
CREATE TABLE user_info (
   employee_ID INTEGER NOT NULL PRIMARY KEY,
   user_name CHAR(80),
   user_pwd CHAR(80) );
```

Two triggers are added to the database to encrypt the value in the user_pwd column, either when a new user is added or an existing user's password is updated.

- The encrypt_new_user_pwd trigger fires each time a new row is added to the user_info_table:

```
CREATE TRIGGER encrypt_new_user_pwd
BEFORE INSERT
ON user_info
REFERENCING NEW AS new_pwd
FOR EACH ROW
BEGIN
    SET new_pwd.user_pwd=ENCRYPT(new_pwd.user_pwd, '8U3dkA');
END;
```

- The encrypt_updated_pwd trigger fires each time the user_pwd column is updated in the user_info table:

```
CREATE TRIGGER encrypt_updated_pwd
BEFORE UPDATE OF user_pwd
ON user_info
REFERENCING NEW AS new_pwd
FOR EACH ROW
BEGIN
    SET new_pwd.user_pwd=ENCRYPT(new_pwd.user_pwd, '8U3dkA');
END;
```

Add a new user to the database:

```
INSERT INTO user_info
VALUES ( '1', 'd_williamson', 'abc123');
```

If you issue a SELECT statement to view the information in the user_info table, the value in the user_pwd column is binary data (the encrypted form of the password) and not the value abc123 that was specified in the INSERT statement.

If this user's password is changed, then the encrypt_updated_pwd trigger fires and the encrypted form of the new password appears in the user_pwd column.

```
UPDATE user_info
SET user_pwd='xyz'
WHERE employee_ID='1';
```

The original password can be retrieved by issuing the following SQL statement. This statement uses the DECRYPT function and the encryption key to decrypt the data, and the CAST function to convert the value from a LONG BINARY to a CHAR value:

```
SELECT CAST (
   DECRYPT( user_pwd, '8U3dkA' )
   AS CHAR(100))
   FROM user_info
   WHERE employee_ID = '1';
```

Raw encryption

Raw encryption allows you to encrypt data inside the database server into a format that can be exported and decrypted outside of the database server. The encrypted format is referred to as **raw**. To encrypt data in the raw format, you must specify the encryption key, the initialization

vector, and optionally a padding format. To decrypt the data, you must specify the same parameter values.

You can also use the DECRYPT function to decrypt the data inside the database server.

Raw encryption is useful when:

- **You want to prevent database users from having access to the data –** You can use raw encryption to encrypt sensitive data that you do not want even your database administrators to have access to, and then decrypt the data using a client application without the use of the database server. Raw encryption is not recommended when the data needs to be encrypted and decrypted only by the database server.
- **You cannot use TLS encryption –** You can use raw encryption instead of TLS encryption. Unlike TLS encryption, raw encryption cannot prevent replay or person-in-the-middle attacks, nor can it authenticate database servers.

Example

You need to send data from the binary_data column of the SensitiveData table in your database to a client that does not use databases. Because the data is sensitive, you encrypt the data into raw format using the following SQL statement:

```
SELECT ENCRYPT( binary_data, 'TheEncryptionKey','AES(FORMAT=RAW)',
'ThisIsTheIV' )FROM SensitiveData;
```

You copy the encrypted data to the client along with an application that can decrypt the contents. You also provide the encryption key (TheEncryptionKey) and the initialization vector (ThisIsTheIV) to the client to use with the application. The client uses the application to decrypt the data and view it.

Table encryption

Table encryption allows you to encrypt tables or materialized views with sensitive data without the performance impact that encrypting the entire database might cause. When table encryption is enabled, table pages for the encrypted table, associated index pages, and temporary file pages are encrypted. The transaction log pages that contain transactions on encrypted tables are also encrypted.

To encrypt tables in your database, you must have table encryption enabled. Enabling table encryption must be done at database initialization. To see whether table encryption is enabled, query the EncryptionScope database property using the DB_PROPERTY function, as follows:

```
SELECT DB_PROPERTY( 'EncryptionScope' );
```

If the return value is TABLE, table encryption is enabled.

To see the encryption algorithm in effect for table encryption, query the Encryption database property using the DB_PROPERTY function, as follows:

```
SELECT DB_PROPERTY( 'Encryption' );
```

Performance impact of table encryption

For encrypted tables, each table page is encrypted when written to the disk, and is decrypted when read in from the disk. This process is invisible to applications. However, there may be a slight negative impact on performance when reading from, or writing to, encrypted tables. Encrypting or decrypting existing tables can take a long time, depending on the size of the table.

Index pages for indexes on columns in an encrypted table are also encrypted, as are transaction log pages containing transactions on the encrypted table, and all pages in the temporary file for the database. All other database and transaction log pages are unencrypted.

Encrypted tables can contain compressed columns. In this case, the data is compressed before it is encrypted.

Encrypting tables does not impact storage requirements.

Starting a database that has table encryption enabled

Starting a database that has table encryption enabled is the same as starting an encrypted database. For example, if the database is started with the -ek option, a key must be specified. If the database is started with the -ep option, you are prompted for the key.

Enabling table encryption in a database (SQL)

Create a database with table encryption by using the CREATE DATABASE statement, or enable table encryption in an existing database by using the CREATE ENCRYPTED TABLE DATABASE statement.

Prerequisites

By default, you must have the SERVER OPERATOR system privilege to execute the CREATE DATABASE statement and the CREATE ENCRYPTED TABLE DATABASE statement. The required privileges can be changed by using the -gu database server option.

Task

Table encryption must be enabled and configured at database creation time. If your database does not have table encryption enabled, or if you have database encryption in effect, using the CREATE ENCRYPTED TABLE DATABASE statement creates a copy of the database with table encryption enabled, and does not overwrite the original database file.

Create a database with table encryption, or enable table encryption on an existing database.

Option	Action
Create a database with table encryption	Create a database with the CREATE DATABASE statement, and specify a key and an encryption algorithm.

Option	Action
Enable table encryption for an existing database	Create a copy of the database with the CREATE ENCRYPTED TABLE DATABASE statement, and specify a key.

Table encryption is enabled.

Next

You create an encrypted table by using the CREATE TABLE statement, or by altering an existing table to be encrypted by using the ALTER TABLE statement. When you encrypt a table, the key and/or algorithm specified when enabling table encryption is used.

Enabling table encryption in a database (iqinit utility)

You can enable table encryption during the creation of a database, using the command line.

Prerequisites

Table encryption must be enabled and configured at database creation time. You must re-create the database with table encryption enabled if your database does not have table encryption enabled, or if you have database encryption in effect.

Task

Create a database with the iqinit -et and -ek options, and specify a key and an encryption algorithm.

Table encryption is enabled.

Encrypting a table

You can create an encrypted table using the CREATE TABLE statement, or encrypt an existing table using the ALTER TABLE statement.

Prerequisites

To use the CREATE TABLE statement, you must have one of the following system privileges:

CREATE TABLE
CREATE ANY TABLE
CREATE ANY OBJECT

To use the ALTER TABLE statement, you must be the owner of the table being altered or have one of the following privileges:

ALTER privilege on the table
ALTER ANY TABLE

ALTER ANY OBJECT

To encrypt tables in your database, table encryption must already be enabled in the database.

Task

When you encrypt a table, the encryption algorithm and key that were specified at database creation time are used.

You can either create a table with encryption, or encrypt an existing table.

Option	Action
Create a table with encryption	Create a table using the ENCRYPTED clause of the CREATE TABLE statement.
Encrypt an existing table	Encrypt a table with the ENCRYPTED clause of the ALTER TABLE statement.

The table is encrypted.

IPv6 Support

SAP Sybase IQ supports Internet Protocol version 6 (IPv6), which contains addressing and control information to route packets over the Internet.

IPv6 supports two^{128} unique IP addresses, which is a substantial increase over the number of addresses supported by its predecessor IPv4. SAP Sybase IQ supports both IPv4 and IPv6 addresses anywhere you can specify an IP address on the client or server.

ODBC classes support the use of IPv6 addresses for remote data access. JDBC classes do not support the use of IPv6 addresses for remote data access.

Setting up transport-layer security

The following steps provide an overview of the tasks required to set up transport-layer security.

1. Obtain digital certificates.
   You need identity files and certificate files. The server identity file contains the server's private key and should be stored securely with the database. You distribute the server certificate file to your clients.
   You can buy certificates from a certificate authority or you can use the Certificate creation utility (createcert). SAP Sybase IQ also provides functionality to create certificates, which is especially useful for development and testing.
2. If you are setting up transport-layer security for SAP Sybase IQ client/server applications:
   - **Start the SAP Sybase IQ database server with transport-layer security –** Use the -ec database server option to specify the type of security, the server identity file name, and the password to protect the server's private key.

If you also want to allow unencrypted connections over shared memory, specify the -es option.

TDS connections do not use the TLS protocol. To prevent unencrypted connections from using the TDS protocol, specify the tcpip option -x tcpip(TDS=NO).

- **Configure client applications to use transport-layer security –** Specify the path and file name of trusted certificates using the Encryption connection parameter [ENC].

3. If you are setting up transport-layer security for SAP Sybase IQ web services:
   - **Start the SAP Sybase IQ database server with transport-layer security –** Use the -xs database server option to specify the type of security, the server identity file name, and the password to protect the server's private key.
   - **Configure browsers or other web clients to trust certificates –** Encrypt SAP Sybase IQ web services.
4. If you are setting up an SAP Sybase IQ multiplex database server:

   INC and MIPC connections determine which TLS connection parameters to use from the contents of the -ec server option.

   Set the TRUSTED_CERTIFICATES_FILE option to the appropriate Certificate Authority.

Digital certificates

You need digital certificates to set up transport-layer security. You can obtain certificates from a certificate authority, or you can create them using the Certificate Creation utility (createcert).

Certificate Creation utility

You can use the Certificate Creation utility (createcert), to generate X.509 certificate files using RSA.

Certificate Viewer utility

You can use the Certificate Viewer utility, viewcert, to read X.509 certificates using RSA.

Certificates for server authentication

You can follow the same process to create certificate files for server authentication. In each case, you create an identity file and a certificate file.

For server authentication, you create a server identity file and a certificate file to distribute to clients.

Certificate configurations

The certificate can be self-signed or signed by a commercial or enterprise Certificate Authority.

- **Self-signed certificates –** Self-signed server certificates can be used for simple setups.
- **Enterprise root certificates –** An enterprise root certificate can be used to sign server certificates to improve data integrity and extensibility for multi-server deployments.

You can store the private key used to sign server certificates in a secure central location.

For server authentication, you can add database servers without reconfiguring clients.

- **Commercial Certificate Authorities –** You can use a third-party Certificate Authority instead of an enterprise root certificate. Commercial Certificate Authorities have dedicated facilities to store private keys and create high-quality server certificates.

Self-signed root certificates

Self-signed root certificates can be used for simple setups involving a single database server.

Tip: Use enterprise level certificate chains or commercial certificate authorities if you require multiple server identity files. Certificate authorities provide extensibility and a higher level of certificate integrity with dedicated facilities to store root private keys.

- **Certificate –** For server authentication certificates, the self-signed certificate is distributed to clients. It is an electronic document including identity information, the public key of the server, and a self-signed digital signature.
- **Identity file –** For server authentication certificates, the identity file is stored securely with a database server. It is a combination of the self-signed certificate (that is distributed to clients) and the corresponding private key. The private key gives the database server the ability to decrypt messages sent by the client in the initial handshake.

Certificate chains

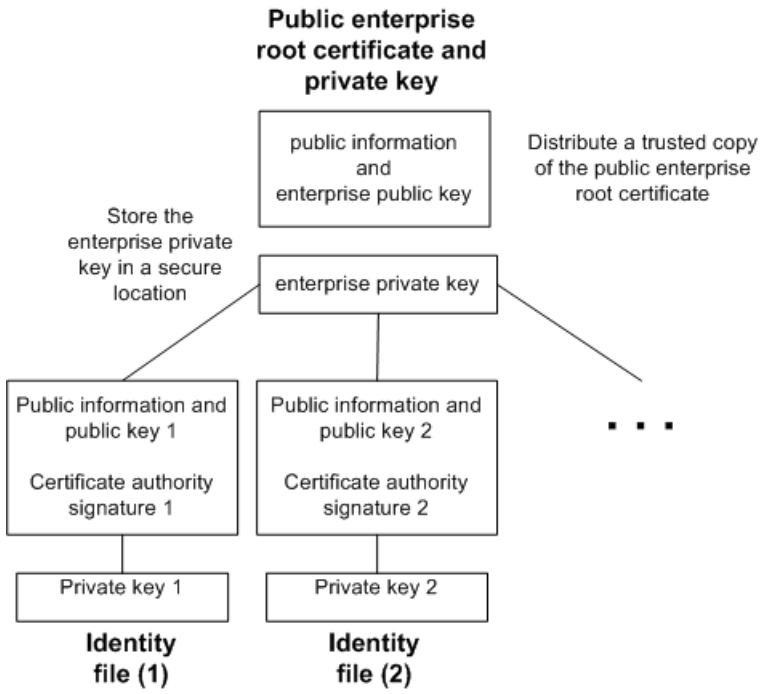
If you require multiple identity files, you can improve security and extensibility by using certificate chains instead of self-signed certificates. Certificate chains require a Certificate Authority or an enterprise root certificate to sign identities.

Benefits of using certificate chains

Certificate chains provide the following advantages:

- **Extensibility –** For server authentication, you can configure clients to trust any certificate signed by an enterprise root certificate or Certificate Authority. If you add a new database server, clients do not require a copy of the new certificate.
- **Security –** The enterprise root certificate's private key is not in the identity file. Storing the root certificate's private key in a high-security location, or using a Certificate Authority with dedicated facilities, protects the integrity of server authentication.

The following diagram provides the basic enterprise root certificate architecture.



Using certificates in a multi-server environment
To create certificates used in a multi-server environment:

- Generate a public enterprise root certificate and enterprise private key.
  Store the enterprise private key in a secure location, preferably a dedicated facility.
  For server authentication, you distribute the public enterprise root certificate to clients.
- Use the enterprise root certificate to sign identities.
  Use the public enterprise root certificate and enterprise private key to sign each identity.
  For server authentication, the identity file is used for the server.

You can also use a third-party Certificate Authority to sign your server certificates. Commercial Certificate Authorities have dedicated facilities to store private keys and create high-quality server certificates.

Enterprise root certificates
Enterprise root certificates improve data integrity and extensibility for multi-server deployments.

You can store the private key used to create trusted certificates in a dedicated facility.
For server authentication, you can add servers without reconfiguring clients.

To set up enterprise root certificates, you create the enterprise root certificate and the enterprise private key that you use to sign identities.

Signed identity files

You can use an enterprise root certificate to sign server identity files.

For server authentication, you generate identity files for each server. Since these certificates are signed by an enterprise root certificate, you use the createcert -s option.

Globally-signed certificates

A commercial Certificate Authority is an organization that is in the business of creating high-quality certificates and using these certificates to sign your certificate requests.

Globally-signed certificates have the following advantages:

- For inter-company communication, common trust in an outside, recognized authority may increase confidence in the security of the system. A Certificate Authority must guarantee the accuracy of the identification information in any certificate that it signs.
- Certificate Authorities provide controlled environments and advanced methods to generate certificates.
- The private key for the root certificate must remain private. Your organization may not have a suitable place to store this crucial information, whereas a Certificate Authority can afford to design and maintain dedicated facilities.

Setting up globally signed certificates

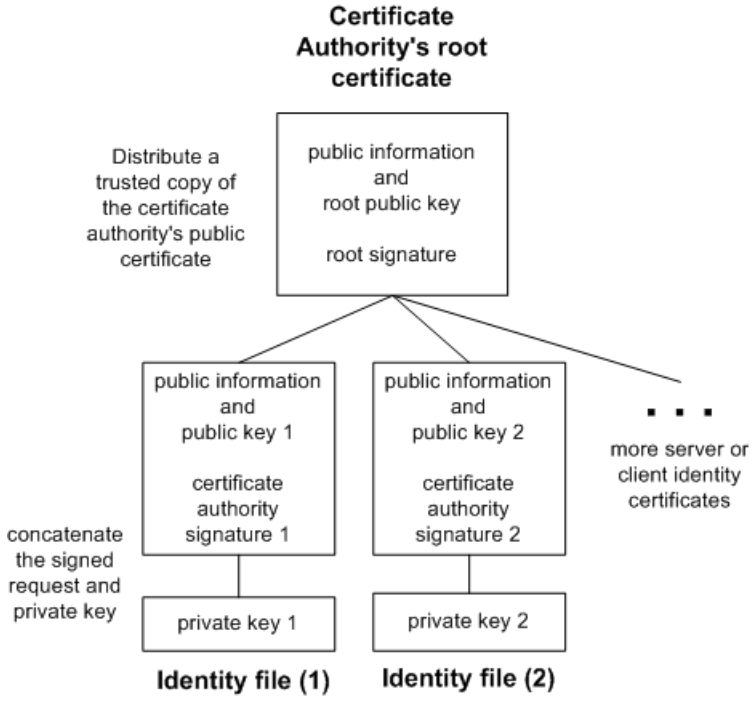
To set up globally signed identity files, you:

- Create a certificate request using the createcert utility with the -r option.
- Use a Certificate Authority to sign each request. You can combine the signed request with the corresponding private key to create the server identity file.

Note: You might be able to globally sign an enterprise root certificate. This is only applicable if your Certificate Authority generates certificates that can be used to sign other certificates.

Globally signed identity files

You can use globally signed certificates directly as server identity files. The following diagram shows the configuration for multiple identity files:



You reference the server identity file and the password for the private key on the iqsrv16command line.

Client trust setup for the certificate authority's certificate

For server authentication, you must ensure that clients contacting your server trust the root certificate in the chain. For globally signed certificates, the root certificate is the Certificate Authority's certificate.

Note: When using a globally signed certificate, each client must verify field values to avoid trusting certificates that the same Certificate Authority has signed for other clients.

Utility Database Server Security

SAP Sybase IQ includes a phantom database, called the *utility database*, that has no physical representation.

There is no database file for this database, and the database can contain no data. The utility database can run on any SAP Sybase IQ server. In Sybase Control Center, the server for the utility database is known as the Utility Server.

The utility database permits a narrow range of specialized functions. It is provided so that you can execute database file manipulation statements such as **CREATE DATABASE** and **DROP DATABASE** without first connecting to a physical database.

You can also retrieve database and connection properties from the utility database. These properties apply to databases you create when connected to the utility database.

One of your configuration tasks is to set up security for the utility database and its server. You must decide:

- Who can connect to the utility database, and
- Who can execute file administration statements.

Defining the Utility Database Name When Connecting

Specify the database name to start the utility database.

You cannot specify a database file when starting the utility database, because no database file is associated with that database. You must specify the database name when connecting. Specify `utility_db` as the database name when connecting.

For example:

```
dbisqlc -c "uid=dba;pwd=sql;eng=myserver;dbn=utility_db"
```

Note: When you connect to the utility database to create an IQ database having Windows raw partitions, note that there is a syntax difference in the IQ PATH. For example, to specify a Windows raw partition on device I: for the utility database, you can use the specification "\\.\I:" On other IQ databases, you must double the slash characters, so that the same device would be specified "\\\\.\\I:". The backslash character is treated as an escape character in IQ databases but as a normal character in the utility database.

Defining the Utility Database Password

Define the user ID `DBA` for the utility database.

1. Use a text editor to open the file `util_db.ini`, which is stored in the server executable directory.

Because this directory is on the server, you can control access to the file, and thereby control who has access to the password.

2. In this line, replace "password" with the password you want to use:

```
[UTILITY_DB]
PWD=password
```

Use of the utility_db security level relies on the physical security of the computer hosting the database server, since the `util_db.ini` file can be easily read using a text editor.

Permission to Execute File Administration Statements

A separate level of security, which controls the creating and dropping of databases, provides additional database security. The **-gu** database server command line option controls who can execute the file administration statements.

There are four levels of permission for the use of file administration statements: `all`, `none`, `DBA`, and `utility_db`. The `utility_db` level permits a user who can connect to the utility database to use the file administration statements.

Table 1. Permissions for Role Administration

-gu Switch Value	Effect	Applies To
all	Anyone can execute file administration statements	Any database including the utility database
none	No one can execute file administration statements	Any database including the utility database
DBA	Only users with the SERVER OPERATOR system privilege can execute file administration statements	Any database including the utility database
utility_db	Only the users who can connect to the utility database can execute file administration statements	Only the utility database

Examples

On Sun, HP, Linux, and Windows platforms, to permit only the user knowing the utility database password to connect to the utility database and create or delete databases, start the server at the command line:

```
start_iq -n testsrv -gu utility_db
```

On AIX, to permit only the user knowing the utility database password to connect to the utility database and create or delete databases, start the server at the command line:

```
start_iq -n testsrv -gu utility_db -iqmt 256
```

Assuming that the utility database password was set to `IQ&Mine49` during installation, this command starts the Interactive SQL utility as a client application, connects to the server named `testsrv`, loads the utility database, and connects the user:

```
dbisql -c "uid=DBA;pwd=IQ&Mine49;dbn=utility_db;eng=testsrv"
```

Executing this statement successfully connects you to the utility database, and you can now create and delete databases.

Note: The database name, user ID, and password are case-sensitive. Make sure that you specify the same case in the dbisql command and the `util_db.ini` file.

Data Security

Since databases may contain proprietary, confidential, or private information, ensuring that the database and the data in it are designed for security is very important.

System Secure Features

System secure features are features that you can make inaccessible to databases running on a database server.

When a feature is secured (made inaccessible), it is unavailable for use by client applications, database-defined stored procedures, triggers, and events. Secure feature settings apply to all databases running on the database server. Secure features are useful when you need to start a database that could contain embedded logic that you are uncertain of, such as a virus, or when you want to lock down the database server in situations where the database server or the database is hosted by a third-party vendor. The -sf database server option allows you to specify which features you want to secure for databases running on the database server.

Secure Feature Keys

A `system secure feature key` is created by specifying the -sk database server option when creating the database server. Use the sa_server_option system procedure to alter whether features are secured or unsecured once the database server is running.

Once you have created a system secure feature key, you can create `customized secure feature keys` that are assigned to a specific users, limiting users' access to only the features secured by the administrator for that key.

Note: The system secure feature key cannot be dropped unless a customized secure feature key has been created that has both the manage_features and manage_keys secure features enabled.

Customized secure feature keys are managed by select system procedures.

Creating secure feature keys

To control the database features available to users, use the secure features database server option (-sf) to specify the features that users are prevented from accessing on the database server.

Prerequisites

- Requires the SERVER OPERATOR system privilege
- Access to the manage_keys feature.

Task

Use the -sk database server option to create a system secure feature key. Use the sp_create_secure_feature_key system procedure to create a customized secure feature key.

Secure feature settings apply to all databases running on a database server.

The secure features option (-sf) controls the availability of such features as:

- server-side backups
- external stored procedures
- remote data access
- web services

The -sk option specifies a system secure feature key that can be used to manage access to secure features for a database server. If you want to alter the list of secured features once the database server is running, use the sa_server_option system procedure. To alter a customized secure feature key once the database server is running, use the sp_alter_secure_feature_key system procedure.

1. At a command prompt, start the database server using the -sf and -sk options.
   For example, the following command starts the database server and secures all features. The command also includes a key that can be used later to allow access to secured features for a connection.
   ```
   dbsrv16 -n secure_server -sf all -sk someSystemKey c:\mydata.db
   ```
2. Connect to the database server:
   ```
   dbisql -c
   "UID=DBA;PWD=sql;Host=myhost;Server=secure_server;DBN=demo"
   ```
3. Call the sp_use_secure_feature_key system procedure to specify that the secure feature key for the connection is the same as that specified by the -sk option:
   ```
   CALL sp_use_secure_feature_key ( 'system' , 'someSystemKey' );
   ```
4. To change the secure features of the system secure feature key, use the sa_server_option system procedure. For example:
   ```
   CALL sa_server_option( 'SecureFeatures', '-remote_data_access' );
   ```

5. Create a customized secure feature key for the user Bob, that allows Bob to send emails:
```
CALL sp_create_secure_feature_key ( 'bobsKey' , 'anotherAuthKey' ,
'sa_send_email' );
```
6. After logging into the database, Bob must run the following command to send emails:
```
CALL sp_use_secure_feature_key ( 'bobsKey' , 'anotherAuthKey' );
```

Users of databases running on the database server secure_server are prevented from accessing all secured features except the remote_data_access feature. The user Bob, however, also has access to the sa_send_email feature.

See also

- *-sk iqsrv16 database server option* on page 311
- *-sf iqsrv16 database server option* on page 312
- *sp_alter_secure_feature_key System Procedure* on page 371
- *sp_create_secure_feature_key System Procedure* on page 321
- *sp_drop_secure_feature_key System Procedure* on page 372
- *sp_list_secure_feature_keys System Procedure* on page 373
- *sp_use_secure_feature_key System Procedure* on page 373

External Authentication

SAP Sybase IQ supports LDAP and Kerberos external authentication methods.

LDAP User Authentication with SAP Sybase IQ

You can integrate SAP Sybase IQ into any existing enterprise-wide directory access framework based on Lightweight Directory Access Protocol (LDAP), a widely accepted international standard.

Integration of SAP Sybase IQ with LDAP user authentication supports:

- Authentication using searched distinguished name (DN)
- Failover to a secondary LDAP server for high availability
- Automatic failback to previously failed servers
- Integration with OpenLDAP third-party libraries
- Secure communication with LDAP servers
- Efficient design for frequent, short-lived connections
- Extensibility to multiple domains and multiple LDAP servers

License Requirements for LDAP User Authentication

The Advanced Security Option (IQ_SECURITY) protects your environment against unauthorized access, and is required to allow LDAP user authentication with SAP Sybase IQ.

LDAP Server Configuration Object

SAP Sybase IQ uses a configuration object called LDAP server to allow LDAP user authentication.

Despite its name, the LDAP server is a configuration object that resides on the SAP Sybase IQ server, rather than an actual server. Its sole function is to provide a connection to a physical LDAP server to allow LDAP user authentication. Any configuration of the LDAP server configuration object applies only to the SAP Sybase IQ side of the LDAP user authentication equation. LDAP server configuration object configuration settings are never written to the physical LDAP server.

Note: For the purposes of clarity in this documentation, LDAP server configuration object refers to the SAP Sybase IQ internal configuration object. LDAP server refers to the external entity.

Failover Capabilities When Using LDAP User Authentication

To support failover functionality, you can create a primary and a secondary LDAP server configuration object.

Each LDAP server configuration object connects to a single LDAP server and can be designated as a primary or secondary server. In the event the designated primary LDAP server configuration object is cannot connect to the LDAP server, the designated secondary LDAP server configuration object is used for user authentication. You can manually manage fail over and fail back using with SQL statements or be performed automatically by SAP Sybase IQ when it detects a change is appropriate.

Define primary and secondary LDAP server configuration objects in the login policy. For failover to occur, you must define both a primary and a secondary LDAP server configuration object. If only a primary LDAP server configuration object is defined in a login policy, failover does not occur. If a secondary LDAP server configuration object is defined with no primary LDAP server configuration object, the secondary LDAP server configuration object behaves as the primary LDAP server configuration object, and failover does not occur.

When designating the secondary LDAP server configuration object, you must configure the LDAP server configuration object to connect to the correct failover LDAP server. In the event of a failover, if the secondary LDAP server configuration object cannot connect to the secondary LDAP server, LDAP user authentication in SAP Sybase IQ will be unavailable.

Workflow to Enable LDAP User Authentication

There is distinct workflow to enabling LDAP user authentication with SAP Sybase IQ.

1. Add LDAP User Authentication as a Login Method.
2. Create an LDAP Server Configuration Object.
3. Validate the LDAP Server Configuration Object.
4. Define the LDAP user authentication login policy options in any login policy (including root) assigned to any user using LDAP user authentication.
5. Assign am LDAP user authentication enabled login policy to an existing user to use LDAP user authentication.
6. Once configuration is complete, execute the **sa_get_ldapserver_status** stored procedure to verify that each LDAP server database connection is in a READY or ACTIVE state.
7. Verify that users can log in using LDAP user authentication

Manage LDAP User Authentication with SAP Sybase IQ

Management includes the creation, modification and option maintenance of the LDAP server configuration object to facilitate LDAP user authentication.

Adding LDAP User Authentication as a Login Method

To enable LDAP user authentication, you must add the value `LDAPUA` to the LOGIN_MODE database option.

Prerequisites

Requires the SET ANY SECURITY OPTION system privilege.

Task

Once set, LDAP user authentication is immediately available.
To add the LDAPUA value to the LOGIN_MODE option, execute:

```
SET OPTION PUBLIC.login_mode = LDAPUA
```

See also

- *LOGIN_MODE Option* on page 302

Allowing Standard Authentication in an LDAP User Authentication Only Environment

Allow select users to authenticate using standard authentication in an environment that supports only LDAP user authentication.

If LDAP user authentication is the only authentication method allowed to access the SAP Sybase IQ database, these circumstances may create a scenario in which no user is permitted to log on:

- Of no login policy exists with LDAP user authentication enabled;
- If no users are assigned to a login policy with LDAP user authorization enabled; or
- If all user accounts assigned to a login policy with LDAP user authentication are locked.

You may not be able to prevent this scenario; however, there is a method that allows a select number of users to log in to SAP Sybase IQ database using standard authentication. This method is intended as a temporary solution when LOGIN_MODE configuration prevents all users from connecting to the database.

When granting the select users access using standard authentication, ensure that at least one of those users has the SET ANY SECURITY OPTION or MANAGE ANY LOGIN POLICY system privileges to allow them to permanently resolve the issue. Depending on the underlying cause of the inability of any users to log in using LDAP user authentication, one or both of these system privileges might be required to permanently resolve the issue. You can specify a maximum of five user IDs, separated by semicolons, and enclosed in double quotation marks.

Grant standard authentication access only after the lockdown problem has occurred; you need not set it in advance. It does not need to be set in advance. To allow select users to log in using standard authentication, execute the **start_iq** utility with the **–al** *user-id-list* command line switch. Once granted, at the credentials prompt, the user enters his or her standard authentication user name and password.

Include the **-al** switch at either the server or database level. At the server level, the **-al** switch remains in effect until the next time the server is restarted. At the database level, the **-al** switch remains in effect until the next time the database is stopped and restarted.

To allow standard authentication, execute one of these commands:

Level	Statement
Server	**start_iq -al** *"user1,user2,user3" server_name.cfg database-name.db*
Database	**start_iq** *servername.cfg database_name.db* **-al** *"user1,user2,user3"*

Example:

This example assumes that login_mode is set to “LDAPUA”. This command allows users `Alice`, `Bob`, and `Carol` to authenticate using standard authentication on `database1` on `server1`:

```
start_iq -al  "alice;bob;carol" server1.cfg database1.db
```

See also

- *-al iqsrv16 Server Option* on page 304
- *-al iqsrv16 Database Option* on page 305

Setting the TLS Connection Trusted Relationship

Define the location and file name that contains the trusted relationship to be used for the Transport Layer Security (TLS) connections to the external LDAP server for user authentication.

Prerequisites

Requires the SET ANY SECURITY OPTION system privilege.

Task

During LDAP user authentication, SAP Sybase IQ acts as a client to the LDAP server, and must have access to the file that contains the name of the certificate authority (CA) that signed the TLS certificate. The path and file name to the CA are stored in the public-only TRUSTED_CERTIFICATES_FILE database security option. By default, this option is set to NULL (disabled), meaning that no outbound connections can be started because there are no trusted CA. Once set, this value takes effect immediately.

The list of trusted CAs that sign server certificates may be shared in a location in a Windows environment on the local C: drive for all SAP Sybase applications on that machine.

To set the TRUSTED_CERTIFICATES_FILE database security option, execute:

```
SET OPTION PUBLIC.TRUSTED_CERTIFICATES_FILE = 'path/filename'
```

Example

This example sets the path to the trusted certificates file to `C:\sybase\shared`, in a file called `\trusted.txt`:

```
SET OPTION PUBLIC.TRUSTED_CERTIFICATES_FILE = 'C:\sybase\shared
\trusted.txt'
```

See also

- *TRUSTED_CERTIFICATES_FILE Option* on page 304

Creating an LDAP Server Configuration Object

Create a new LDAP server configuration object to allow LDAP user authentication.

Prerequisites

Requires the MANAGE ANY LDAP SERVER system privilege.

Task

The LDAP server configuration object provides a connection between SAP Sybase IQ and a physical LDAP serve. If you are using multiple LDAP servers, particularly for failover, set up a separate LDAP server configuration object for each LDAP server. The parameters of the LDAP server configuration object are stored in the `ISYSLDAPSERVER` (system view SYSLDAPSERVER) system table. To automatically activate the connection to the LDAP server upon creation, use the WITH ACTIVATE clause.

1. Identify the values for the applicable SEARCH DN attributes to be defined for the new LDAP server configuration object.

Table 2. SEARCH DN Attributes

Attribute	Valid Values
URL	Specify the host (by name or by IP address), port number, and search to be performed to lookup the DN for a given user ID or enter NULL. **Note:** See *Syntax and Parameters for the LDAP Server Configuration Object URL* for supported syntax.
ACCESS ACCOUNT	The distinguished name for a user connecting to the external LDAP server.
IDENTIFIED BY	The password associated with the ACCESS ACCOUNT distinguished name.
IDENTIFIED BY ENCRYPTED	The encrypted password associated with the ACCESS ACCOUNT distinguished name.

2. Identify the values for the applicable LDAPUA server attributes for the new LDAP server configuration object.

Table 3. LDAPUA Attributes

Attribute	Valid Values
SEARCH DN	All attributes defined from SEARCH DN Attributes (see step 1).
AUTHENTICATION URL	Specify the host (by name or by IP address), port number, and search to be performed to lookup the DN for a given user ID or enter NULL. **Note:** See *Syntax and Parameters for the LDAP Server Configuration Object URL* for supported syntax.
CONNECTION TIMEOUT	Specifies the connection timeout value for both DN searches and authentication between SAP Sybase IQ and the external LDAP server. Specified in milliseconds, the default value is 10 seconds.
CONNECTION RETRIES	Specifies the number of retries on connections from SAP Sybase IQ to the LDAP server for both DN searches and authentication. The valid range of values is 1 – 60, with a default value of 3.
TLS	Defines whether the TLS or Secure LDAP protocol is used for connections to the LDAP server both for DN searches and authentication. The valid settings are ON and OFF (default). **Note:** See *Enabling Secure LDAP* and *Setting the TLS Connection Trusted Relationship*.

3. Execute the **CREATE LDAP SERVER** command, specifying the applicable attributes and clauses. For example:

```
CREATE LDAP SERVER secure_primary
SEARCH DN
     URL 'ldaps://my_LDAPserver:636/dc=MyCompany,dc=com??sub?cn=*'
     ACCESS ACCOUNT 'cn=myadmin, cn=Users, dc=mycompany, dc=com'
     IDENTIFIED BY 'Secret99Password'
AUTHENTICATION URL 'ldaps://my_LDAPserver:636/'
CONNECTION TIMEOUT 3000
CONNECTION RETRIES 3
TLS OFF
WITH ACTIVATE
```

See also

- *Syntax and Parameters for the LDAP Server Configuration Object URL* on page 180
- *Enabling Secure LDAP* on page 180
- *CREATE LDAP SERVER Statement* on page 250
- *Editing LDAP Server Configuration Object Attributes* on page 175
- *Setting the TLS Connection Trusted Relationship* on page 170

Validating an LDAP Server Configuration Object

Validate changes to the attribute of an existing LDAP server configuration object.

Prerequisites

Requires the MANAGE ANY LDAP SERVER system privilege.

Task

The **VALIDATE LDAP SERVER** command is useful for an administrator when setting up a new LDAP server configuration object or when diagnosing connection issues between SAP Sybase IQ and the LDAP server. Any connection established by the VALIDATE LDAP SERVER statement is temporary and closed at the end of the execution of the statement.

To use the userID with the search to validate the existence of the user on the LDAP server, include the **CHECK** clause. Specify the userID and the *user-dn-string* to be compared.

1. Identify the SEARCH DN attributes of the LDAP server configuration object to be validated.

Table 4. SEARCH DN Attributes

Attribute	Valid Values
URL	Specify the host (by name or by IP address), port number, and search to be performed to lookup the DN for a given user ID or enter NULL. **Note:** See *Syntax and Parameters for the LDAP Server Configuration Object URL* for supported syntax.
ACCESS ACCOUNT	The distinguished name for a user connecting to the external LDAP server.
IDENTIFIED BY	The password associated with the ACCESS ACCOUNT distinguished name.
IDENTIFIED BY ENCRYPTED	The encrypted password associated with the ACCESS ACCOUNT distinguished name.

2. Identify the LDAPUA attributes of the LDAP server configuration object to be validated.

Table 5. LDAPUA Attributes

Attribute	Valid Values
SEARCH DN	All attributes defined from SEARCH DN Attributes (see step 1).

Attribute	Valid Values
AUTHENTICATION URL	Specify the host (by name or by IP address), port number, and search to be performed to lookup the DN for a given user ID or enter NULL. **Note:** See *Syntax and Parameters for the LDAP Server Configuration Object URL* for supported syntax.
CONNECTION TIMEOUT	Specifies the connection timeout value for both DN searches and authentication between SAP Sybase IQ and the external LDAP server. Specified in milliseconds, the default value is 10 seconds.
CONNECTION RETRIES	Specifies the number of retries on connections from SAP Sybase IQ to the LDAP server for both DN searches and authentication. The valid range of values is 1 – 60, with a default value of 3.
TLS	Defines whether the TLS or Secure LDAP protocol is used for connections to the LDAP server both for DN searches and authentication. The valid settings are ON and OFF (default). **Note:** See *Enabling Secure LDAP* and *Setting the TLS Connection Trusted Relationship*.

3. Execute the **VALIDATE LDAP SERVER** command with the applicable attributes.

For example, assume the LDAP server configuration object named `apps_primary` was created as follows and the `SET OPTION PUBLIC.login_mode` is set to `'Standard,LDAPUA'`:

```
CREATE LDAP SERVER apps_primary
SEARCH DN
    URL 'ldap://my_LDAPserver:389/dc=MyCompany,dc=com??sub?cn=*'
    ACCESS ACCOUNT 'cn=myadmin, cn=Users, dc=mycompany, dc=com'
    IDENTIFIED BY 'Secret99Password'
AUTHENTICATION URL 'ldap://my_LDAPserver:389/'
CONNECTION TIMEOUT 3000
WITH ACTIVATE
```

This statement validates the existence of a userID `myusername` by comparing it to the expected user distinguished name (enclosed in quotation marks) on the LDAP server configuration object name `apps_primary` using the optional CHECK clause:

```
VALIDATE LDAP SERVER apps_primary
CHECK myusername 'cn=myusername,cn=Users,dc=mycompany,dc=com'
```

See also

- *Enabling Secure LDAP* on page 180
- *Syntax and Parameters for the LDAP Server Configuration Object URL* on page 180
- *VALIDATE LDAP SERVER Statement* on page 299

- *Editing LDAP Server Configuration Object Attributes* on page 175
- *Setting the TLS Connection Trusted Relationship* on page 170

Activating an LDAP Server Configuration Object

Activate an LDAP server configuration object by setting the connection state to READY. This enables LDAP user authentication.

Prerequisites

Requires the MANAGE ANY LDAP SERVER system privilege.

Task

LDAP server configuration object attribute values are read from the `ISYSLDAPSERVER` system table and applied to new connections to the LDAP server and incoming authentication requests to the SAP Sybase IQ server. Upon successful authentication of a user, the connection state to the LDAP server changes to ACTIVE.
To activate an LDAP server configuration object, execute:

```
ALTER LDAP SERVER LDAP_server_name
WITH ACTIVATE
```

See also

- *ALTER LDAP SERVER Statement* on page 235
- *LDAP Server Configuration Object States* on page 179

Editing LDAP Server Configuration Object Attributes

Modify the existing attributes on an LDAP server. Any changes to the attributes are applied on subsequent connections. Any connection already open when the change is applied does not immediately reflect the change.

Prerequisites

Requires the MANAGE ANY LDAP SERVER system privilege.

Task

1. Identify the existing SEARCH DN attributes to be modified.

Table 6. SEARCH DN Attributes

Attribute	Valid Values
URL	Specify the host (by name or by IP address), port number, and search to be performed to lookup the DN for a given user ID or enter NULL. **Note:** See *Syntax and Parameters for the LDAP Server Configuration Object URL* for supported syntax.
ACCESS ACCOUNT	The distinguished name for a user connecting to the external LDAP server.
IDENTIFIED BY	The password associated with the ACCESS ACCOUNT distinguished name.
IDENTIFIED BY ENCRYPTED	The encrypted password associated with the ACCESS ACCOUNT distinguished name.

2. Identify the existing LDAPUA attributes to be modified.

Table 7. LDAPUA Attributes

Attribute	Valid Values
SEARCH DN	All attributes defined from SEARCH DN Attributes (see step 1).
AUTHENTICATION URL	Specify the host (by name or by IP address), port number, and search to be performed to lookup the DN for a given user ID or enter NULL. **Note:** See *Syntax and Parameters for the LDAP Server Configuration Object URL* for supported syntax.
CONNECTION TIMEOUT	Specifies the connection timeout value for both DN searches and authentication between SAP Sybase IQ and the external LDAP server. Specified in milliseconds, the default value is 10 seconds.
CONNECTION RETRIES	Specifies the number of retries on connections from SAP Sybase IQ to the LDAP server for both DN searches and authentication. The valid range of values is 1 – 60, with a default value of 3.
TLS	Defines whether the TLS or Secure LDAP protocol is used for connections to the LDAP server both for DN searches and authentication. The valid settings are ON and OFF (default). **Note:** See *Enabling Secure LDAP* and *Setting the TLS Connection Trusted Relationship*.

3. Identify the server clauses to be used.

Clause	Description
WITH SUSPEND	Puts the LDAP server into maintenance mode
WITH ACTIVATE	Puts the LDAP server in a READY state and enables LDAP authentication
WITH REFRESH	Reinitializes LDAP user authentication

4. Execute the **ALTER LDAP SERVER** command with the applicable parameters and clauses, for example:

```
ALTER LDAP SERVER apps_primary
AUTHENTICATION URL 'ldap://my_LDAPserver:1066/'
CONNECTION RETRIES 10
WITH ACTIVATE
```

See also

- *Syntax and Parameters for the LDAP Server Configuration Object URL* on page 180
- *Enabling Secure LDAP* on page 180
- *ALTER LDAP SERVER Statement* on page 235
- *Setting the TLS Connection Trusted Relationship* on page 170
- *Validating an LDAP Server Configuration Object* on page 173

Refreshing an LDAP Server Configuration Object

Reinitialize the LDAP server. The command fails if the connection state of the LDAP server is not in an ACTIVE or READY state.

Prerequisites

Requires the MANAGE ANY LDAP SERVER system privilege.

Task

When refreshing an LDAP server, all connections to the LDAP server are closed and the option values on the LDAP server are reread from the `ISYSLDAPSERVER` system table. The values are then applied to all new connections to the LDAP server and all incoming user authentication requests to the SAP Sybase IQ server. Execution of the REFRESH command does not change the connection state of the LDAP server, nor does it change any existing connections from a client to the SAP Sybase IQ server.

To ensure that any changes are used when a user next authenticates, it is recommended that you refresh the LDAP server after making any changes to the TRUSTED_CERTIFICATES_FILE database option or to the contents of the file specified by the TRUSTED_CERTIFICATES_FILE database option.

To refresh the LDAP server, execute:

```
ALTER LDAP SERVER LDAP_server_name
WITH REFRESH
```

See also

- *ALTER LDAP SERVER Statement* on page 235
- *LDAP Server Configuration Object States* on page 179

Suspending an LDAP Server Configuration Object

Put an LDAP server into maintenance mode. All connections to the LDAP server are closed and LDAP user authentication is no longer available.

Prerequisites

Requires the MANAGE ANY LDAP SERVER system privilege.

Task

To suspend an LDAP server, execute:

```
ALTER LDAP SERVER LDAP_server_name
WITH SUSPEND
```

See also

- *ALTER LDAP SERVER Statement* on page 235
- *LDAP Server Configuration Object States* on page 179

Deleting an LDAP Server Configuration Object

Delete an LDAP server configuration object that is not in a READY or ACTIVE state.

Prerequisites

Requires the MANAGE ANY LDAP SERVER system privilege.

Task

The DROP statement fails when it is issued against an LDAP server configuration object that is in a READY or ACTIVE state. The DROP statement also fails if a login policy exists with a reference to the LDAP server configuration object being dropped. To ensure any references to the LDAP server configuration object are removed from all login policies before being dropped, include the WITH DROP ALL REFERENCES clause. To override the server state check and put the database object into maintenance mode regardless of its current state, include the WITH SUSPEND clause when dropping an LDAP server configuration object.

Dropping an LDAP server configuration object removes the named object from the `ISYSLDAPSERVER` system table

To drop an LDAP server configuration object, execute this command, including the applicable clauses:

```
DROP LDAP SERVER LDAP_Server_name
WITH SUSPEND
WITH DROP ALL REFERENCES
```

Example:

This example drops the LDAP server configuration object named `ldapserver1` regardless of its current state and removes any references to `ldapserver1` in all login policies:

```
DROP LDAP SERVER ldapserver1
WITH DROP ALL REFERENCES
WITH SUSPEND
```

This **DROP LDAP SERVER** command fails if the LDAP server configuration object named `ldapserver2` is referenced in any login policies because the WITH DROP ALL REFERENCES clause is not included:

```
DROP LDAP SERVER ldapserver1
WITH SUSPEND
```

See also

- *DROP LDAP SERVER Statement* on page 263
- *LDAP Server Configuration Object States* on page 179

LDAP Server Configuration Object States

List of possible states of an LDAP server configuration object.

The state of an LDAP server configuration object is maintained persistently on writeable databases in the `ISYSLDAPSERVER` system table to provide visibility for administrators into LDAP user authentication. If an LDAP server configuration object is restarted, the state at the time of shutdown is retained. This permits maintenance on an LDAP server configuration object to remain in force throughout restarts. With read-only databases, state changes are not stored persistently – they occur only in memory, and are lost when the database is shut down. The connection state is set at start-up using the value from a read-only database, and transient state changes may occur in memory to provide LDAP user authentication.

The possible states of an LDAP server configuration object include:

- **RESET –** one or more attributes on the LDAP server configuration object have been entered or modified since last activation.
- **READY –** the LDAP server configuration object is ready to accept connections.
- **ACTIVE –** the LDAP server configuration object has performed at least one successful LDAP user authentication.
- **FAILED –** there is a problem connecting to the LDAP server configuration object.
- **SUSPENDED –** the LDAP server configuration object is in maintenance mode, and is unavailable for LDAP user authentication.

Enabling Secure LDAP

Secure LDAP uses TLS certificate authentication to provide protection against spoofing.

Use of a TLS certificate provides the client connection to the LDAP server with proof that the server is who it says it is.

Enabling Secure LDAP on an LDAP server configuration object can take one of two forms:

- **ldaps:// –** on the LDAP server configuration object, use ldaps:// when defining the SEARCH DN URL or AUTHENTICATION URL attributes and set the TLS attribute to OFF.
- **TLS parameter –** on the LDAP server configuration object, use ldap:// when defining the SEARCH DN URL attribute and set the TLS attribute to ON.

Note: Current versions of Active Directory (AD), Tivoli, SunONE Oracle DS, and OpenLDAP support both options. Older versions may only support one option. For compatibility with all versions, both options are supported by SAP Sybase IQ.

Syntax and Parameters for the LDAP Server Configuration Object URL

The URL identifies the host (by name or by IP address), port number, and search to be performed when executing a secure distinguished name (DN) lookup to the LDAP server.

While the syntax of the URL can take one of two forms depending on how the secure connection to the LDAP server is to be made, the underlying parameters of the URL are the same for each form.

- **ldaps:// –** on the LDAP server configuration object, use ldaps:// when defining the SEARCH DN URL or AUTHENTICATION URL attributes and set the TLS attribute to OFF.

  ```
  ldapurl::=ldaps://host:[port]/[node]?[attributes]? [base | one | sub]? [filter]
  ```

- **TLS parameter –** on the LDAP server configuration object, use ldap:// when defining the SEARCH DN URL attribute and set the TLS attribute to ON.

  ```
  ldapurl::=ldap://host:[port]/[node]?[attributes]? [base | one | sub]? [filter]
  ```

Parameter	Description
host	The host name of the LDAP server.
port	The port number of the LDAP server.
node	The node in the object hierarchy at which to start the search.

Parameter	Description
attributes	A list of attributes returned in the result set. Each LDAP server may support a different attribute based on the schemas used by the LDAP server. However, for each LDAP server, only the first attribute is used and should return the distinguished name (DN) of the user.
base | one | sub	Qualifies the search criteria. base – Specifies a search of the base node. one – Specifies a search of node and one sublevel. sub – Specifies a search of node and all sublevels.
filter	Specifies the attribute or attributes used to search for a database user's distinguished name (DN). The filter can be simple, such as "uid=*," or compound, such as "(uid=*)(ou=group)." The attributes in the filter are dependent on the LDAP server schema. LDAP user authentication replaces each wildcard character (*) with the database user ID when searching for a DN.

The URL is initially defined as one of the server attributes when creating an LDAP server configuration object and can be changed at any time. There are no default values for these parameters. Creating or modifying the LDAP server configuration object requires the MANAGE ANY LDAP SERVER system privilege.

Note: Current versions of Active Directory (AD), Tivoli, SunONE Oracle DS, and OpenLDAP support both options. Older versions may only support one option. For compatibility with all versions, both options are supported by SAP Sybase IQ.

LDAP User Authentication Login Policy Options

There are several login policy options that are specific to LDAP user authentication. You must define these options in any login policy (including root) assigned to any user using LDAP user authentication.

You can define the options that are specific to LDAP server database objects when initially creating a login policy, or you can add them to existing policies, including the root login policy. The MANAGE ANY LOGIN POLICY system privilege is required to set these login policy options.

Modifying the Root Login Policy

You can modify the option values for the root login policy, but you cannot drop the policy.

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

Each new database is created with a default login policy, called the root policy. When you create a user account without specifying a login policy, the user becomes part of the root login policy.

To modify the options of the root login policy, execute:

```
ALTER LOGIN POLICY ROOT {login_policy_options}
```

See also

- *LDAP User Authentication Login Policy Options* on page 181
- *ALTER LOGIN POLICY Statement* on page 237

Modifying an Existing Login Policy

Use Interactive SQL to change the options for an existing login policy.

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

To alter the options of an existing login policy, execute:

```
ALTER LOGIN POLICY policy-name {login_policy_options}
```

Example:

This statement alters the LOCKED and MAX_CONNECTIONS options on the `Test1` login policy:

```
ALTER LOGIN POLICY Test1
locked=on
max_connections=5
```

See also

- *LDAP User Authentication Login Policy Options* on page 181
- *ALTER LOGIN POLICY Statement* on page 237

Creating a New Login Policy

Any options that are not explicitly set when creating a login policy inherit their values from the root login policy..

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

Login policy names must be unique. An error message appears if the login policy name already exists.

To create a new login policy, execute:

```
CREATE LOGIN POLICY policy_name {login_policy_options}
```

Example:

This statement creates the `Test1` login policy with PASSWORD_LIVE_TIME option set to 60 days:

```
CREATE LOGIN POLICY Test1
password_life_time=60
```

See also

- *LDAP User Authentication Login Policy Options* on page 181
- *CREATE LOGIN POLICY Statement* on page 253

Assigning a Login Policy to an Existing User

Use Interactive SQL to assign a login policy to an existing user.

Prerequisites

Requires the MANAGE ANY LOGIN POLICY system privilege.

Task

1. To change the login policy assigned to a user, execute:

   ```
   ALTER USER userID
   LOGIN POLICY policy_name
   ```

2. Have the user log out and back in to apply the new login policy.

See also

- *ALTER USER Statement* on page 246

Manage Users and Passwords with LDAP User Authentication

To log in to SAP Sybase IQ using LDAP user authentication, each user must have an active user ID and password on the external LDAP server as well as an active user ID on the SAP Sybase IQ server.

When creating a new user in SAP Sybase IQ, though not required, it is recommended that you specify a password to ensure that the new user account is not left unprotected until the first LDAP user authentication login.

The first time a new user logs on or an existing user logs in after a password change, the password in the SAP Sybase IQ database is automatically overwritten with the corresponding user password defined on the external LDAP server. Therefore, all maintenance required on SAP Sybase IQ passwords for user using LDAP user authentication should always be done on the external LDAP server, not the SAP Sybase IQ server.

As a result of this automatic password synchronization, for users granted the ability to use Standard authentication (the password defined in the SAP Sybase IQ database), when

attempting to log on when using Standard authentication, they should continue to use their LDAP server credentials.

Display Current Status Information for a User

The **sa_get_user_status** stored procedure generates a report about the current status of a user.

Information includes connection and failed login information as well as whether the user has been locked out and if so, why. If the user is authenticated using LDAP user authentication, the output includes the user's distinguished name and the date and time that the distinguished name was found.

The MANAGE ANY USER system privilege is required to run this stored procedure. A user without the MANAGE ANY USER system privilege can obtain user information by creating and executing a cover procedure owned by a user with MANAGE ANY USER system privilege.

See also

- *sa_get_user_status system procedure* on page 319

Display Current Status for an LDAP Server Configuration Object

The **sa_get_ldapserver_status** stored procedure generates a report on the current status of an LDAP server configuration object.

Status information includes the LDAP server configuration object name, object identifier, current state, and the date and time of the last state change.

No system privileges are required to run this stored procedure.

See also

- *sa_get_ldapserver_status System Procedure* on page 318

Kerberos authentication

The Kerberos login feature allows you to maintain a single user ID and password for database connections, operating system, and network logins. The Kerberos login is more convenient for users and permits a single security system for database and network security. Its advantages include:

- The user does not need to provide a user ID or password to connect to the database.
- Multiple users can be mapped to a single database user ID.
- The name and password used to log in to Kerberos do not have to match the database user ID and password.

Kerberos is a network authentication protocol that provides strong authentication and encryption using secret-key cryptography. Users already logged in to Kerberos can connect to a database without providing a user ID or password.

Kerberos can be used for authentication. To delegate authentication to Kerberos you must:

- configure the server and database to use Kerberos logins.
- create mapping between the user ID that logs in to the computer or network, and the database user.

Warning! There are important security implications to consider when using Kerberos logins as a single security solution.

SAP Sybase IQ does not include the Kerberos software; it must be obtained separately. The following components are included with the Kerberos software:

- **Kerberos libraries –** These are referred to as the Kerberos Client or GSS (Generic Security Services)-API runtime library. These Kerberos libraries implement the well-defined GSS-API. The libraries are required on each client and server computer that intends to use Kerberos. The built-in Windows SSPI interface can be used instead of a third-party Kerberos client library if you are using Active Directory as your KDC.

  SSPI can only be used by SAP Sybase IQ clients in the Kerberos connection parameter. SAP Sybase IQ database servers cannot use SSPI—they need a supported Kerberos client other than SSPI.
- **A Kerberos Key Distribution Center (KDC) server –** The KDC functions as a storehouse for users and servers. It also verifies the identification of users and servers. The KDC is typically installed on a server computer not intended for applications or user logins.

SAP Sybase IQ supports Kerberos authentication from DBLib, ODBC, OLE DB, and ADO.NET clients, and Sybase Open Client and jConnect clients. Kerberos authentication can be used with SAP Sybase IQ transport layer security encryption, but SAP Sybase IQ does not support Kerberos encryption for network communications.

Windows uses Kerberos for Windows domains and domain accounts. Active Directory Windows Domain Controllers implement a Kerberos KDC. A third-party Kerberos client or runtime is still required on the database server computer for authentication in this environment, but the Windows client computers can use the built-in Windows SSPI interface instead of a third-party Kerberos client or runtime.

Kerberos clients

Kerberos authentication is available on several platforms. For a list of tested Kerberos clients, see *http://www.sybase.com/detail?id=1061807*.

The following table lists the default names and locations of the keytab and GSS-API files used by the supported Kerberos clients.

Note: SSPI can only be used by SAP Sybase IQ clients in the Kerberos connection parameter. SAP Sybase IQ database servers cannot use SSPI—they need a supported Kerberos client other than SSPI.

Kerberos client	Default keytab file	GSS-API library file name	Notes
Windows MIT Kerberos client	`C:\WINDOWS\krb5kt`	`gssapi32.dll` or `gssapi64.dll`	The KRB5_KTNAME environment variable can be set before starting the database server to specify a different keytab file.
Windows CyberSafe Kerberos client	`C:\Program Files\CyberSafe\v5srvtab`	`gssapi32.dll` or `gssapi64.dll`	The CSFC5KTNAME environment variable can be set before starting the database server to specify a different keytab file.
Unix MIT Kerberos client	`/etc/krb5.keytab`	`libgssapi_krb5.so` [1]	The KRB5_KTNAME environment variable can be set before starting the database server to specify a different keytab file.
Unix CyberSafe Kerberos client	`/krb5/v5srvtab`	`libgss.so` [1]	The CSFC5KTNAME environment variable can be set before starting the database server to specify a different keytab file.
Unix Heimdal Kerberos client	`/etc/krb5.keytab`	`libgssapi.so.1` [1]	

[1] These file names may vary depending on your operating system and Kerberos client version.

Setting up a Kerberos system to use with SAP Sybase IQ

You can configure Kerberos authentication to be used with SAP Sybase IQ.

Prerequisites

You must be logged in to your computer using Kerberos authentication.

Task

Kerberos is a network authentication protocol that provides strong authentication and encryption using secret-key cryptography.

1. If necessary, install and configure the Kerberos client software, including the GSS-API runtime library, on both the client and server.

   On Windows client computers using an Active Directory Key Distribution Center (KDC), SSPI can be used and you do not need to install the Kerberos client.
2. If necessary, create a Kerberos principal in the Kerberos KDC for each user.

   A Kerberos principal is a Kerberos user ID in the format *user*/*instance*@*REALM*, where /*instance* is optional. If you are already using Kerberos, the principal should already exist, so you do not need to create a Kerberos principal for each user.

   Principals are case sensitive and must be specified in the correct case. Mappings for multiple principals that differ only in case are not supported (for example, you cannot have mappings for both jjordan@MYREALM.COM and JJordan@MYREALM.COM).
3. Create a Kerberos principal in the KDC for the SAP Sybase IQ database server.

   The default Kerberos principal for the database server has the format *server-name*@*REALM*, where *server-name* is the SAP Sybase IQ database server name. To use a different server principal, use the -kp server option. Principals are case significant, and *server-name* cannot contain multibyte characters, or the characters /, \, or @.

   You must create a server service principal within the KDC because servers use a keytab file for KDC authentication. The keytab file is protected and encrypted.
4. Securely extract and copy the keytab for the principal *server-name*@*REALM* from the KDC to the computer running the SAP Sybase IQ database server. The default location of the keytab file depends on the Kerberos client and the platform. The keytab file's permissions should be set so that the SAP Sybase IQ server can read it, but unauthorized users do not have read permission.

The Kerberos system is authenticated and configured to be used with SAP Sybase IQ.

Next

Configure your SAP Sybase IQ database server and database to use Kerberos.

Configuring SAP Sybase IQ databases to use Kerberos

You can configure SAP Sybase IQ databases to use Kerberos logins.

Prerequisites

You must have the SET ANY PUBLIC OPTION and MANAGE ANY USER system privileges.

You must already have Kerberos configured before SAP Sybase IQ can use it.

Task

The Kerberos login feature allows you to maintain a single user ID and password for database connections, operating systems, and network logins.

1. Start the SAP Sybase IQ database server with the -krb or -kr option to enable Kerberos authentication, or use the -kl option to specify the location of the GSS-API library and enable Kerberos.
2. Change the public or temporary public option login_mode to a value that includes Kerberos. As database options apply only to the database in which they are found, different databases can have a different Kerberos login setting, even if they are loaded and running on the same database server. For example:

   ```
   SET OPTION PUBLIC.login_mode = 'Kerberos,Standard';
   ```

   Warning! Setting the login_mode database option to Kerberos restricts connections to only those users who have been granted a Kerberos login mapping. Attempting to connect using a user ID and password generates an error unless you are a user with SYS_AUTH_DBA_ROLE system role.
3. Create a database user ID for the client user. You can use an existing database user ID for the Kerberos login, as long as that user has the correct privileges. For example:

   ```
   CREATE USER "kerberos-user"
   IDENTIFIED BY abc123;
   ```
4. Execute a GRANT KERBEROS LOGIN TO statement to create a mapping from the client's Kerberos principal to an existing database user ID. For example:

   ```
   GRANT KERBEROS LOGIN TO "pchin@MYREALM.COM"
   AS USER "kerberos-user";
   ```

   To connect when a Kerberos principal is used that does not have a mapping, ensure the Guest database user ID exists and has a password.
5. Ensure the client user has already logged on (has a valid Kerberos ticket-granting ticket) using their Kerberos principal and that the client's Kerberos ticket has not expired. A Windows user logged in to a domain account already has a ticket-granting ticket, which allows them to authenticate to servers, providing their principal has enough permissions.

   A ticket-granting ticket is a Kerberos ticket encrypted with the user's password that is used by the Ticket Granting Service to verify the user's identity.
6. Connect from the client, specifying the KERBEROS connection parameter (Often KERBEROS=YES, but KERBEROS=SSPI or KERBEROS=*GSS-API-library-file* can also be used). If the user ID or password connection parameters are specified, they are ignored. For example:

   ```
   dbisql -c "KERBEROS=YES;Server=my_server_princ"
   ```

The SAP Sybase IQ database is configured to use Kerberos authentication.

Next

You can use Kerberos authentication to connect from a client. Optionally, you can create a Kerberos login mapping.

Connections from a Sybase Open Client or a jConnect application

To connect from a Sybase Open Client or jConnect application:

- Set up Kerberos authentication.
- Configure SAP Sybase IQ to use Kerberos.
- Set up Sybase Open Client or jConnect as you would for Kerberos authentication with Adaptive Server Enterprise. The server name must be the SAP Sybase IQ server's name and is case significant. You cannot connect using an alternate server name from Sybase Open Client or jConnect.

Using SSPI for Kerberos logins on Windows

In a Windows domain, SSPI can be used on Windows-based computers without a Kerberos client installed on the client computer. Windows domain accounts already have associated Kerberos principals.

Prerequisites

You must already have Kerberos configured before SAP Sybase IQ can use it. You must already have your SAP Sybase IQ database server and database configured to use Kerberos.

Task

SSPI can only be used by SAP Sybase IQ clients in the Kerberos connection parameter. SAP Sybase IQ database servers cannot use SSPI—they need a supported Kerberos client other than SSPI.

Connect to the database from the client computer. For example:

```
dbisql -c "KERBEROS=SSPI;Server=my_server_princ"
```

When Kerberos=SSPI is specified in the connection string, a Kerberos login is attempted.

A connection attempt using the following SQL statement also succeeds, providing the user has logged on with a user profile name that matches a Kerberos login mapping for the default database on a database server:

```
CONNECT USING 'KERBEROS=SSPI';
```

You can use SSPI for Kerberos authentication on Windows.

Troubleshooting: Kerberos connections

If you get unexpected errors when attempting to enable or use Kerberos authentication, it is recommended that you enable additional diagnostic messages on the database server and client.

Specifying the -z option when you start the database server, or using `CALL sa_server_option( 'DebuggingInformation', 'ON' )` if the server is already running includes additional diagnostic messages in the database server message log. The LogFile connection parameter writes client diagnostic messages to the specified file.

As an alternative to using the LogFile connection parameter, you can run the Ping utility (dbping) with the -z parameter. The -z parameter displays diagnostic messages that should help identify the cause of the connection problem.

Difficulties starting the database server

Symptom	Common solutions
"Unable to load Kerberos GSS-API library" message	• Ensure a Kerberos client is installed on the database server computer, including the GSS-API library. • The database server -z output lists the name of the library that it is attempting to load. Verify the library name is correct. If necessary, use the -kl option to specify the correct library name. • Ensure the directory and any supporting libraries is listed in the library path (%PATH% on Windows). • If the database server -z output states the GSS-API library was missing entry points, then the library is not a supported Kerberos Version 5 GSS-API library.

Symptom	Common solutions
"Unable to acquire Kerberos credentials for server name "*server-name*"" message	• Ensure there is a principal for *server-name*@*REALM* in the KDC. Principals are case sensitive, so ensure the database server name is in the same case as the user portion of the principal name. • Ensure the name of the SAP Sybase IQ server is the primary/user portion of the principal. • Ensure that the server's principal has been extracted to a keytab file and the keytab file is in the correct location for the Kerberos client. • If the default realm for the Kerberos client on the database server computer is different from the realm in the server principal, use the -kr option to specify the realm in the server principal.
"Kerberos login failed" client error	• Check the database server diagnostic messages. Some problems with the keytab file used by the server are not detected until a client attempts to authenticate.

Troubleshooting Kerberos client connections

If the client got an error attempting to connect using Kerberos authentication:

Symptom	Common solutions
"Kerberos logins are not supported" error and the LogFile includes the message "Failed to load the Kerberos GSS-API library"	• Ensure a Kerberos client is installed on the client computer, including the GSS-API library. • The file specified by LogFile lists the name of the library that it is attempting to load. Verify that the library name is correct, and use the Kerberos connection parameter to specify the correct library name, if necessary. • Ensure that the directory including any supporting libraries is listed in the library path (%PATH% on Windows). • If the LogFile output states the GSS-API library was missing entry points, then the library is not a supported Kerberos Version 5 GSS-API library.
"Kerberos logins are not supported" error	• Ensure the database server has enabled Kerberos logins by specifying one or more of the -krb, -kl, or -kr server options. • Ensure Kerberos logins are supported by SAP Sybase IQ on both the client and server platforms.
"Kerberos login failed" error	• Ensure the user is logged into Kerberos and has a valid ticket-granting ticket that has not expired. • Ensure the client computer and server computer both have their time synchronized to within less than 5 minutes.
"Login mode 'Kerberos' not permitted by login_mode setting" error	• The public or temporary public database option setting for the login_mode option must include the value Kerberos to allow Kerberos logins.

Symptom	Common solutions
"The login ID '*client-Kerberos-principal*' has not been mapped to any database user ID"	• The Kerberos principal must be mapped to a database user ID using the GRANT KERBEROS LOGIN statement. Note the full client principal including the realm must be provided to the GRANT KERBEROS LOGIN statement, and principals which differ only in the instance or realm are treated as different. • Alternatively, if you want any valid Kerberos principal which has not be explicitly mapped to be able to connect, create the guest database user ID with a password using GRANT CONNECT.

Security concerns: Temporary public options for added security

Setting the value of the login_mode option for a given database to allow a combination of Standard, Integrated, Kerberos, and LDAPUA logins using the SET OPTION statement permanently enables the specified types of logins for that database. For example, the following statement permanently enables standard and integrated logins:

```
SET OPTION PUBLIC.login_mode = 'Standard,Integrated';
```

If the database is shut down and restarted, the option value remains the same and integrated logins remain enabled.

Setting the login_mode option using SET TEMPORARY OPTION still allows user access via integrated logins, but only until the database is shut down. The following statement changes the option value temporarily:

```
SET TEMPORARY OPTION PUBLIC.login_mode = 'Standard,Integrated';
```

If the permanent option value is Standard, the database will revert to that value when it is shut down.

Setting temporary public options can provide additional security for your database. When you add integrated, Kerberos, or LDAPUA logins to your database, the database relies on the security of the operating system on which it is running. If the database is copied to another computer, access to the database reverts to the SAP Sybase IQ security model.

Security concerns: Copied database files

If the database file can be copied, use the temporary public login_mode option for integrated and Kerberos logins. If the file is copied, the integrated and Kerberos logins are not supported by default.

If a database contains sensitive information, the computer where the database files are stored should be protected from unauthorized access. Otherwise, the database files could be copied and unauthorized access to the data could be obtained on another computer. To increase database security:

- Make passwords complex and difficult to guess.
- Set the PUBLIC.login_mode database option to Standard. To enable integrated or Kerberos logins, only the temporary public option should be changed each time the server is started. This ensures that only Standard logins are allowed if the database is copied.
- Strongly encrypt the database file using the AES encryption algorithm. The encryption key should be complex and difficult to guess.

Licensing Requirements for Kerberos

The Advanced Security Option (IQ_SECURITY) protects your environment against unauthorized access, and is required to use Kerberos authentication with SAP Sybase IQ.

Advanced Security Options in SAP Sybase IQ

The SAP® Sybase® IQ Advanced Security Option supports column encryption, Federal Information Processing Standards (FIPS)-approved network encryption technology, and LDAP and Kerberos authentication for database connections, operating system logins, and network logins. The Advanced Security Option is a separately licensed SAP Sybase IQ option.

FIPS Support in SAP Sybase IQ

SAP Sybase IQ supports Federal Information Processing Standards (FIPS)-approved encryption technology. FIPS is supported on all platforms supported by SAP Sybase IQ.

The main impact of FIPS support for SAP Sybase IQ is that encryption can be nondeterministic, which is the default behavior. A nondeterministic algorithm is one in which the same input yields different output values each time. This means that when you use a key to encrypt a string, the encrypted string is different each time. The algorithm, however, can still decrypt the nondeterministic result using the key. This feature makes analyzing the encryption algorithm more difficult, and encryption more secure.

Support of FIPS is part of the separately licensed SAP Sybase IQ Advanced Security Option.

Both RSA and FIPS security are included with SAP Sybase IQ. RSA encryption requires no separate libraries, but FIPS requires two optional libraries: `dbfips11.dll` and `sbgse2.dll`. The library `sbgse2.dll` is provided by Certicom. Both security models require certificates. The `rsaserver` certificate is named `rsaserver.id`.

FIPS also requires this registry setting, which is set automatically by the SAP Sybase IQ installation utility:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Certicom\libsb]
"expectedtag"=hex:5b,0f,4f,a6,e2,4a,ef,3b,
44,07,05,2e,b0,49,02,71,1f,d9,91,b6
```

Licensing Requirements for FIPS Support

The Advanced Security Option (IQ_SECURITY) is required to use FIPS authentication with SAP Sybase IQ.

FIPS-certified encryption technology

You can use FIPS-certified security algorithms to encrypt your database files, or to encrypt communications for database client/server communication, web services, and .

Federal Information Processing Standard (FIPS) 140-2 specifies requirements for security algorithms. FIPS 140-2 is granted by the American and Canadian governments through the

National Institute of Standards and Testing (NIST) and the Canadian Communications Security Establishment (CSE).

SAP Sybase IQ uses a FIPS-certified module for encryption from Certicom. On Windows (desktop and Windows Mobile) and Unix platforms, SAP Sybase IQ uses Certicom Security Builder GSE (FIPS Module v2.0). This is number 542 on the page *http://csrc.nist.gov/cryptval/140-1/140val-all.htm*.

Enforcing FIPS

Optionally, you can enforce the use of FIPS-certified encryption on the client or server with a FIPS option. When you set the FIPS option to on, all secure communications must be FIPS-certified. If someone tries to use non-FIPS RSA encryption, it is automatically upgraded to FIPS-certified RSA encryption. The FIPS option can be set on the client or server on which you want FIPS-certified encryption to be enforced. SAP Sybase IQ has a -fips command line option, and clients have a fips option that can be set with the encryption connection parameter.

Column Encryption in SAP Sybase IQ

SAP Sybase IQ supports user-encrypted columns.

Strong encryption of the SAP Sybase IQ database file uses a 128-bit algorithm and a security key. The data is unreadable and virtually undecipherable without the key. The algorithm supported is described in FIPS-197, the Federal Information Processing Standard for the Advanced Encryption Standard.

SAP Sybase IQ supports user-encrypted columns with the **AES_ENCRYPT** and **AES_DECRYPT** functions and the **LOAD TABLE ENCRYPTED** clause. These functions permit explicit encryption and decryption of column data via calls from the application. Encryption and decryption key management is the responsibility of the application.

Certain database options affect column encryption.

See also

- *Database Options for Column Encryption* on page 223

Licensing Requirements for Column Encryption

The Advanced Security Option (IQ_SECURITY) is required to use user-encrypted columns with SAP Sybase IQ.

Definitions of Encryption Terms

Definitions of terms used when describing encryption of stored data.

- plaintext – data in its original, intelligible form. Plaintext is not limited to string data, but is used to describe any data in its original representation.

- ciphertext – data in an unintelligible form that preserves the information content of the plaintext form.
- encryption – a reversible transformation of data from plaintext to ciphertext. Also known as enciphering.
- decryption – the reverse transformation of ciphertext back to plaintext. Also known as deciphering.
- key – a number used to encrypt or decrypt data. Symmetric-key encryption systems use the same key for both encryption and decryption. Asymmetric-key systems use one key for encryption and a different (but mathematically related) key for decryption. The SAP Sybase IQ interfaces accept character strings as keys.
- Rijndael – pronounced “reign dahl.” A specific encryption algorithm that supports a variety of key and block sizes. The algorithm was designed to use simple whole-byte operations and thus is relatively easy to implement in software.
- AES – the Advanced Encryption Standard, a FIPS-approved cryptographic algorithm for the protection of sensitive (but unclassified) electronic data. AES adopted the Rijndael algorithm with restrictions on the block sizes and key lengths. AES is the algorithm supported by SAP Sybase IQ.

Data Types for Encrypted Columns

The data types supported for encrypted columns and working with these data types.

Supported Data Types

The first parameter of the **AES_ENCRYPT** function must be one of the supported data types.

CHAR	NUMERIC
VARCHAR	FLOAT
TINYINT	REAL
SMALLINT	DOUBLE
INTEGER	DECIMAL
BIGINT	DATE
BIT	TIME
BINARY	DATETIME
VARBINARY	TIMESTAMP
UNSIGNED INT	SMALLDATETIME
UNSIGNED BIGINT	

The LOB data type is not currently supported for SAP Sybase IQ column encryption.

Preservation of Data Types

SAP Sybase IQ ensures that the original data type of plaintext is preserved when decrypting data, if the **AES_DECRYPT** function is given the data type as a parameter, or is within a **CAST** function.

SAP Sybase IQ compares the target data type of the **CAST** function with the data type of the originally encrypted data. If the two data types do not match, you see a -1001064 error that includes details about the original and target data types.

For example, given an encrypted `VARCHAR(1)` value and this valid decryption statement:

```
SELECT AES_DECRYPT ( thecolumn, 'theKey',
VARCHAR(1) ) FROM thetable
```

If you attempt to decrypt the data using:

```
SELECT AES_DECRYPT ( thecolumn, 'theKey',
SMALLINT ) FROM thetable
```

the error returned is:

```
Decryption error: Incorrect CAST type smallint(5,0)
for decrypt data of type varchar(1,0).
```

This data type check is made only when the **CAST** or the data type parameter are supplied. Otherwise, the query returns the ciphertext as binary data.

When using the **AES_ENCRYPT** function on literal constants, as in this statement:

```
INSERT INTO t (cipherCol) VALUES (AES_ENCRYPT (1, 'key'))
```

the data type of 1 is ambiguous; it can be a `TINYINT`, `SMALLINT`, `INTEGER`, `UNSIGNED INT`, `BIGINT`, `UNSIGNED BIGINT`, or possibly other data types.

You should explicitly use the **CAST** function to resolve any potential ambiguity, as in:

```
INSERT INTO t (cipherCol)
VALUES ( AES_ENCRYPT (CAST (1 AS UNSIGNED INTEGER), 'key'))
```

Explicitly converting the data type using the **CAST** function when encrypting data prevents problems using the **CAST** function when the data is decrypted.

There is no ambiguity if the data being encrypted is from a column, or if the encrypted data was inserted by **LOAD TABLE**.

Effect of Different Data Types on Ciphertext

To produce identical ciphertext for different datatypes, cast the input of **AES_ENCRYPT** to the same data type to produce identical ciphertext.

The ciphertext produced by **AES_ENCRYPT** differs for two different data types given the same input value and same key. A join of two ciphertext columns that holds encrypted values of two different data types may therefore not return identical results.

For example, assume:

```
CREATE TABLE tablea(c1 int, c2 smallint);
INSERT INTO tablea VALUES (100,100);
```

The value `AES_ENCRYPT(c1, 'key')` differs from `AES_ENCRYPT(c2,'key')` and the value `AES_ENCRYPT(c1,'key')` differs from `AES_ENCRYPT(100,'key')`.

To resolve this issue, cast the input of **AES_ENCRYPT** to the same data type. For example, the results of these code fragments are the same:

```
AES_ENCRYPT(c1, 'key');
```

```
AES_ENCRYPT(CAST(c2 AS INT), 'key');
```

```
AES_ENCRYPT(CAST(100 AS INT), 'key');
```

See also

- *AES_ENCRYPT Function [String]* on page 199

AES_ENCRYPT Function [String]

Encrypts the specified values using the supplied encryption key, and returns a `VARBINARY` or `LONG VARBINARY`.

Syntax

AES_ENCRYPT(*string-expression*, *key*)

Parameters

string-expression – the data to be encrypted. You can also pass binary values to **AES_ENCRYPT**. This parameter is case-sensitive, even in case-insensitive databases.

key – the encryption key used to encrypt the *string-expression*. To obtain the original value, also use the same key to decrypt the value. This parameter is case-sensitive, even in case-insensitive databases.

As you should for most passwords, choose a key value that is difficult to guess. Choose a value that is at least 16 characters long, contains a mix of uppercase and lowercase letters, and includes numbers and special characters. You need this key each time you want to decrypt the data.

Warning! Protect your key; store a copy of your key in a safe location. If you lose your key, encrypted data becomes completely inaccessible and unrecoverable.

Usage

AES_ENCRYPT returns a `VARBINARY` value, which is at most 31 bytes longer than the input *string-expression*. The value returned by this function is the ciphertext, which is not human-readable. You can use the **AES_DECRYPT** function to decrypt a *string-expression* that was encrypted with the **AES_ENCRYPT** function. To successfully decrypt a *string-expression*, use

the same encryption key and algorithm used to encrypt the data. If you specify an incorrect encryption key, an error is generated.

If you are storing encrypted values in a table, the column should be of data type `VARBINARY` or `VARCHAR`, and greater than or equal to 32 bytes, so that character set conversion is not performed on the data. (Character set conversion prevents data decryption.) If the length of the `VARBINARY` or `VARCHAR` column is fewer than 32 bytes, the **AES_DECRYPT** function returns an error.

The result data type of an **AES_ENCRYPT** function may be a `LONG BINARY`. If you use **AES_ENCRYPT** in a **SELECT INTO** statement, you must have an Unstructured Data Analytics Option license, or use **CAST** and set **AES_ENCRYPT** to the correct data type and size.

Standards and Compatibility

- SQL – vendor extension to ISO/ANSI SQL grammar.
- Sybase – not supported by Adaptive Server Enterprise.

See also

- *AES_DECRYPT Function [String]* on page 202
- *Encryption and Decryption Example* on page 225
- *LOAD TABLE ENCRYPTED Clause* on page 203
- *Effect of Different Data Types on Ciphertext* on page 198
- *Data Types for Encrypted Columns* on page 197

REPLACE Function [String]

Replaces all occurrences of a substring with another substring.

Syntax

```
REPLACE ( original-string, search-string, replace-string )
```

Parameters

If any argument is NULL, the function returns NULL.

Parameter	Description
original-string	The string to be searched. This string can be any length.
search-string	The string to be searched for and replaced with *replace-string*. This string is limited to 255 bytes. If *search-string* is an empty string, the original string is returned unchanged.

Parameter	Description
replace-string	The replacement string, which replaces *search-string*. This can be any length. If *replace-string* is an empty string, all occurrences of *search-string* are deleted.

Returns
LONG VARCHAR

LONG NVARCHAR

Note: The result data type is a `LONG VARCHAR`. If you use **REPLACE** in a **SELECT INTO** statement, you must have an Unstructured Data Analytics Option license or use **CAST** and set **REPLACE** to the correct data type and size.

Examples
The following statement returns the value “xx.def.xx.ghi:”

```
SELECT REPLACE( 'abc.def.abc.ghi', 'abc', 'xx' ) FROM iq_dummy
```

The following statement generates a result set containing **ALTER PROCEDURE** statements which, when executed, repair stored procedures that reference a table that has been renamed. (To be useful, the table name must be unique.)

```
SELECT REPLACE(
  replace(proc_defn,'OldTableName','NewTableName'),
  'create procedure',
  'alter procedure')
FROM SYS.SYSPROCEDURE
WHERE proc_defn LIKE '%OldTableName%'
```

Use a separator other than the comma for the **LIST** function:

```
SELECT REPLACE( list( table_id ), ',', '--')
FROM  SYS.ISYSTAB
WHERE table_id <= 5
```

Usage
The result data type of a **REPLACE** function is a `LONG VARCHAR`. If you use **REPLACE** in a **SELECT INTO** statement, you must have an Unstructured Data Analytics Option license, or use **CAST** and set **REPLACE** to the correct data type and size.

There are two ways to work around this issue:

- Declare a local temporary table, then perform an **INSERT**:

  ```
  DECLARE local temporary table #mytable
    (name_column char(10)) on commit preserve rows;
  INSERT INTO #mytable SELECT REPLACE(name,'0','1')   FROM
  dummy_table01;
  ```

- Use **CAST**:

```
SELECT CAST(replace(name, '0', '1') AS Char(10)) into #mytable
from dummy_table01;
```

If you need to control the width of the resulting column when *replace-string* is wider than *search-string*, use the **CAST** function. For example,

```
CREATE TABLE aa(a CHAR(5));
INSERT INTO aa VALUES('CCCCC');
COMMIT;
SELECT a, CAST(REPLACE(a,'C','ZZ') AS CHAR(5)) FROM aa;
```

Standards and Compatibility

- SQL—Vendor extension to ISO/ANSI SQL grammar.
- Sybase—Compatible with Adaptive Server Enterprise.

AES_DECRYPT Function [String]

Decrypts the string using the supplied key, and returns, by default, a `VARBINARY` or `LONG BINARY`, or the original plaintext type.

Syntax

AES_DECRYPT(*string-expression*, *key* [, *data-type*])

Parameters

string-expression – the string to be decrypted. You can also pass binary values to this function. This parameter is case sensitive, even in case-insensitive databases.

key – the encryption key required to decrypt the *string-expression*. To obtain the original value that was encrypted, the key must be the same encryption key that was used to encrypt the *string-expression*. This parameter is case-sensitive, even in case-insensitive databases.

Warning! Protect your key; store a copy of your key in a safe location. If you lose your key, the encrypted data becomes completely inaccessible and unrecoverable.

data-type – this optional parameter specifies the data type of the decrypted *string-expression* and must be the same data type as the original plaintext.

If you do not use a **CAST** statement while inserting data using the **AES_ENCRYPT** function, you can view the same data using the **AES_DECRYPT** function by passing `VARCHAR` as the *data-type*. If you do not pass *data-type* to **AES_DECRYPT**, `VARBINARY` data type is returned.

Usage

You can use the **AES_DECRYPT** function to decrypt a *string-expression* that was encrypted with the **AES_ENCRYPT** function. This function returns a `VARBINARY` or `LONG VARBINARY` value with the same number of bytes as the input string, if no data type is specified. Otherwise, the specified data type is returned.

To successfully decrypt a *string-expression*, you must use the same encryption key that was used to encrypt the data. An incorrect encryption key returns an error.

Example

Decrypt the password of a user from the `user_info` table.

```
SELECT AES_DECRYPT(user_pwd, '8U3dkA', CHAR(100))
FROM user_info;
```

Standards and Compatibility

- SQL – vendor extension to ISO/ANSI SQL grammar.
- Sybase – not supported by Adaptive Server Enterprise.

See also

- *AES_ENCRYPT Function [String]* on page 199
- *Encryption and Decryption Example* on page 225
- *LOAD TABLE ENCRYPTED Clause* on page 203
- *Data Types for Encrypted Columns* on page 197

LOAD TABLE ENCRYPTED Clause

The **LOAD TABLE** statement supports the column-spec keyword **ENCRYPTED**.

The *column-specs* must follow the column name in a **LOAD TABLE** statement in this order:

- *format-specs*
- *null-specs*
- *encrypted-specs*

Syntax

```
| ENCRYPTED(data-type 'key-string' [, 'algorithm-string' ] )
```

Parameters

- *data-type* – the data type that the input file field should be converted to as input to the **AES_ENCRYPT** function. *data-type* should be the same as the data type of the output of the **AES_DECRYPT** function.
- *key-string* – the encryption key used to encrypt the data. This key must be a string literal. To obtain the original value, use the same key to decrypt the value. This parameter is case-sensitive, even in case-insensitive databases.

  As you should for most passwords, choose a key value that cannot be easily guessed. Choose a value for that is at least 16 characters long, contains a mix of uppercase and lowercase letters, and includes numbers and special characters. You will need this key each time you want to decrypt the data.

Warning! Protect your key; store a copy of your key in a safe location. A lost key results in the encrypted data becoming completely inaccessible, from which there is no recovery.

- *algorithm-string* – the algorithm used to encrypt the data. This parameter is optional, but data must be encrypted and decrypted using the same algorithm. Currently, AES is the default, as it is the only supported algorithm. AES is a block encryption algorithm chosen as the new Advanced Encryption Standard (AES) for block ciphers by the National Institute of Standards and Technology (NIST).

Usage

The **ENCRYPTED** column specification allows you to specify the encryption key and, optionally, the algorithm to use to encrypt the data that is loaded into the column. The target column for this load should be `VARBINARY`. Specifying other data types returns an error.

LOAD TABLE ENCRYPTED Example

```
LOAD TABLE table_name
(
plaintext_column_name,
a_ciphertext_column_name
NULL('nil')
ENCRYPTED(varchar(6),'tHefiRstkEy') ,
another_encrypted_column
ENCRYPTED(bigint,'thEseconDkeY','AES')
)
FROM '/path/to/the/input/file'
FORMAT ascii
DELIMITED BY ';'
ROW DELIMITED BY '\0xa'
QUOTES OFF
ESCAPES OFF
```

where the format of the input file for the **LOAD TABLE** statement is:

```
a;b;c;
d;e;f;
g;h;i;
```

See also

- *AES_ENCRYPT Function [String]* on page 199
- *AES_DECRYPT Function [String]* on page 202
- *Encryption and Decryption Example* on page 225
- *Data Types for Encrypted Columns* on page 197

LOAD TABLE Statement

Imports data into a database table from an external file.

Syntax

```
LOAD [ INTO ] TABLE [ owner.]table-name
   ... ( load-specification [, …] )
```

```
   ...  { FROM | USING [ CLIENT ] FILE }
   { 'filename-string' | filename-variable } [, …]
   ... [ CHECK CONSTRAINTS { ON | OFF } ]
   ... [ DEFAULTS { ON | OFF } ]
   ... [ QUOTES OFF ]
   ... ESCAPES OFF
   ... [ FORMAT { ascii | binary | bcp } ]
   ... [ DELIMITED BY 'string' ]
   ... [ STRIP { OFF | RTRIM } ]
   ... [ WITH CHECKPOINT { ON | OFF } ]
   ... [ BYTE ORDER { NATIVE | HIGH | LOW } ]
   ... [ LIMIT number-of-rows ]
   ... [ NOTIFY number-of-rows ]
   ... [ ON FILE ERROR { ROLLBACK | FINISH | CONTINUE } ]
   ... [ PREVIEW { ON | OFF } ]
   ... [ ROW DELIMITED BY 'delimiter-string' ]
   ... [ SKIP number-of-rows ]
   ... [ HEADER SKIP number [ HEADER DELIMITED BY 'string' ] ]
   ... [ WORD SKIP number ]
   ... [ ON PARTIAL INPUT ROW { ROLLBACK | CONTINUE } ]
   ... [ IGNORE CONSTRAINT constraint-type [, …] ]
   ... [ MESSAGE LOG 'string' ROW LOG 'string' [ ONLY LOG log-what
[, …] ]
   ... [ LOG DELIMITED BY 'string' ]

load-specification:
   { column-name [ column-spec ]
      | FILLER ( filler-type ) }

column-spec:
   { ASCII ( input-width )
   | BINARY [ WITH NULL BYTE ]
   | PREFIX { 1 | 2 | 4 }
   | 'delimiter-string'
   | DATE [ FORMAT ] ( input-date-format ) [, input-date-format, …]
   | DATETIME [ FORMAT ] ( input-datetime-format [, input-datetime-
format, …]  )
   | ENCRYPTED ( data-type 'key-string' [, 'algorithm-string' ] )
   | DEFAULT default-value }
   [ NULL ( { BLANKS | ZEROS | 'literal',  …} )

filler-type:
   { input-width
   | PREFIX { 1 | 2 | 4 }
   | 'delimiter-string'
   }

constraint-type:
   { CHECK integer
   | UNIQUE integer
   | NULL integer
   | FOREIGN KEYinteger
   | DATA VALUE integer
   | ALL integer
   }
```

```
log-what:
   { CHECK
   | ALL
   | NULL
   | UNIQUE
   | DATA VALUE
   | FOREIGN KEY
   | WORD
   }
```

Parameters

- **FROM –** identifies one or more files from which to load data. To specify more than one file, use a comma to separate each `filename-string`. The *filename-string* is passed to the server as a string. The string is therefore subject to the same formatting requirements as other SQL strings.

  To indicate directory paths on Windows, the backslash character \ must be represented by two backslashes. Therefore, the statement to load data from the file `c:\temp\input.dat` into the `Employees` table is:

  ```
  LOAD TABLE Employees
  FROM 'c:\\temp\\input.dat' ...
  ```

  The path name is relative to the database server, not to the client application. If you are running the statement on a database server on some other computer, the directory names refers to directories on the server machine, not on the client machine. When loading a multiplex database, use absolute (fully qualified) paths in all file names. Do not use relative path names.

  Because of resource constraints, SAP Sybase IQ does not guarantee that all the data can be loaded. If resource allocation fails, the entire load transaction is rolled back. The files are read one at a time, and processed in the order specified in the FROM clause. Any SKIP or LIMIT value only applies in the beginning of the load, not for each file.

  The LOAD TABLE FROM clause is deprecated, but may be used to specify a file that exists on the server. This example loads data from the file a.inp on a client computer.

  ```
  LOAD TABLE t1(c1,c2,filler(30))
  USING CLIENT FILE 'c:\\client-data\\a.inp'
  QUOTES OFF ESCAPES OFF
  IGNORE CONSTRAINT UNIQUE 0, NULL 0
  MESSAGE LOG 'c:\\client-data\\m.log'
  ROW LOG 'c:\\client-data\\r.log'
  ONLY LOG UNIQUE
  ```

- **USING –** USING FILE loads one or more files from the server. This clause is synonymous with specifying the FROM *filename* clause. USING CLIENT FILE bulk loads one or more files from a client. The character set of the file on the client side must be the same as the server collation. SAP Sybase IQ serially processes files in the file list. Each file is locked in read mode as it is processed, then unlocked. Client-side bulk loading incurs no

administrative overhead, such as extra disk space, memory or network-monitoring daemon requirements, but does forces single threaded processing for each file.

When bulk loading large objects, the USING CLIENT FILE clause applies to both primary and secondary files.

During client-side loads, the IGNORE CONSTRAINT log files are created on the client host and any error while creating the log files causes the operation to roll back.

Client-side bulk loading is supported by Interactive SQL and ODBC/JDBC clients using the Command Sequence protocol. It is not supported by clients using the TDS protocol. For data security over a network, use Transport Layer Security. To control who can use client-side bulk loads, use the secure feature (-sf) server startup switch, the **ALLOW_READ_CLIENT_FILE** database option, and/or the READCLIENTFILE access control.

- **CHECK CONSTRAINTS –** evaluates check constraints, which you can ignore or log. CHECK CONSTRAINTS defaults to ON.

  Setting CHECK CONSTRAINTS OFF causes SAP Sybase IQ to ignore all check constraint violations. This can be useful, for example, during database rebuilding. If a table has check constraints that call user-defined functions that are not yet created, the rebuild fails unless this option is set to OFF.

  This option is mutually exclusive to the following options. If any of these options are specified in the same load, an error results:

  - IGNORE CONSTRAINT ALL
  - IGNORE CONSTRAINT CHECK
  - LOG ALL
  - LOG CHECK

- **DEFAULTS –** uses a column's default value. This option is ON by default. If the DEFAULTS option is OFF, any column not present in the column list is assigned NULL.

  The setting for the DEFAULTS option applies to all column DEFAULT values, including AUTOINCREMENT.

- **QUOTES –** indicates that input strings are enclosed in quote characters. QUOTES is an optional parameter and is ON by default. The quote character is either an apostrophe (single quote) or a quotation mark (double quote). The first such character encountered in a string is treated as the quote character for the string. String data must be terminated with a matching quote.

  With QUOTES ON, column or row delimiter characters can be included in the column value. Leading and ending quote characters are assumed not to be part of the value and are excluded from the loaded data value.

  To include a quote character in a value with QUOTES ON, use two quotes. For example, this line includes a value in the third column that is a single quote character:

```
'123 High Street, Anytown', '(715)398-2354',''''
```

With STRIP turned on (the default), trailing blanks are stripped from values before they are inserted. Trailing blanks are stripped only for non-quoted strings. Quoted strings retain their trailing blanks. Leading blank or TAB characters are trimmed only when the setting is ON.

The data extraction facility provides options for handling quotes (**TEMP_EXTRACT_QUOTES**, **TEMP_EXTRACT_QUOTES_ALL**, and **TEMP_EXTRACT_QUOTE**). If you plan to extract data to be loaded into an IQ main store table and the string fields contain column or row delimiter under default ASCII extraction, use the **TEMP_EXTRACT_BINARY** option for the extract and the FORMAT binary and QUOTES OFF options for **LOAD TABLE**.

Limits:

- QUOTES ON applies only to column-delimited ASCII fields.
- With QUOTES ON, the first character of a column delimiter or row terminator cannot be a single or double quote mark.
- QUOTES ON forces single threaded processing for a given file.
- The QUOTES option does not apply to loading binary large object (BLOB) or character large object (CLOB) data from the secondary file, regardless of its setting. A leading or trailing quote is loaded as part of CLOB data. Two consecutive quotes between enclosing quotes are loaded as two consecutive quotes with the QUOTES ON option.
- Adaptive Server Enterprise BCP does not support the QUOTES option. All field data is copied in or out equivalent to the QUOTES OFF setting. As QUOTES ON is the default setting for the SAP Sybase IQ **LOAD TABLE** statement, you must specify QUOTES OFF when importing ASE data from BCP output to an SAP Sybase IQ table.

Exceptions:

- If **LOAD TABLE** encounters any nonwhite characters after the ending quote character for an enclosed field, this error is reported and the load operation is rolled back:

  ```
  Non-SPACE text found after ending quote character for
  an enclosed field.
  SQLSTATE: QTA14    SQLCODE: -1005014L
  ```

- With QUOTES ON, if a single or double quote is specified as the first character of the column delimiter, an error is reported and the load operation fails:

  ```
  Single or double quote mark cannot be the 1st character
  of column delimiter or row terminator with QUOTES option
  ON.
  SQLSTATE: QCA90    SQLCODE: -1013090L
  ```

- **ESCAPES –** if you omit a *column-spec* definition for an input field and ESCAPES is ON (the default), characters following the backslash character are recognized and interpreted as special characters by the database server. You can include newline characters as the combination \n, and other characters as hexadecimal ASCII codes, such as \x09 for the tab

character. A sequence of two backslash characters (\\ ) is interpreted as a single backslash. For SAP Sybase IQ, you must set ESCAPES OFF.

- **FORMAT –** SAP Sybase IQ supports ASCII and binary input fields. The format is usually defined by the *column-spec* described above. If you omit that definition for a column, by default SAP Sybase IQ uses the format defined by this option. Input lines are assumed to have ascii (the default) or **binary** fields, one row per line, with values separated by the column delimiter character.

  SAP Sybase IQ also accepts data from BCP character files as input to the **LOAD TABLE** command.

  - The BCP data file loaded into SAP Sybase IQ tables using the **LOAD TABLE FORMAT BCP** statement must be exported (BCP OUT) in cross-platform file format using the -c option.
  - For FORMAT BCP, the default column delimiter for the **LOAD TABLE** statement is <tab> and the default row terminator is <newline>.
  - For FORMAT BCP, the last column in a row must be terminated by the row terminator, not by the column delimiter. If the column delimiter is present before the row terminator, then the column delimiter is treated as a part of the data.
  - Data for columns that are not the last column in the load specification must be delimited by the column delimiter only. If a row terminator is encountered before a column delimiter for a column that is not the last column, then the row terminator is treated as a part of the column data.
  - Column delimiter can be specified via the DELIMITED BY clause. For FORMAT BCP, the delimiter must be less than or equal to 10 characters in length. An error is returned, if the delimiter length is more than 10.
  - For FORMAT BCP, the load specification may contain only column names, NULL, and ENCRYPTED. An error is returned, if any other option is specified in the load specification.

    For example, these **LOAD TABLE** load specifications are valid:

    ```
    LOAD TABLE x( c1, c2 null(blanks), c3 )
    FROM 'bcp_file.bcp'
    FORMAT BCP
    ...
    ```

    ```
    LOAD TABLE x( c1 encrypted(bigint,'KEY-ONE','aes'), c2, c3 )
    FROM 'bcp_file.bcp'
    FORMAT BCP
    ...
    ```

- **DELIMITED BY –** if you omit a column delimiter in the *column-spec* definition, the default column delimiter character is a comma. You can specify an alternative column delimiter by providing a single ASCII character or the hexadecimal character representation. The DELIMITED BY clause is:

  ```
  ... DELIMITED BY '\x09' ...
  ```

  To use the newline character as a delimiter, you can specify either the special combination '\n' or its ASCII value '\x0a'. Although you can specify up to four characters in the column-

spec *delimiter-string*, you can specify only a single character in the DELIMITED BY clause.

- **STRIP –** determines whether unquoted values should have trailing blanks stripped off before they are inserted. The **LOAD TABLE** command accepts these STRIP keywords:
  - **STRIP OFF –** do not strip off trailing blanks.
  - **STRIP RTRIM –** strip trailing blanks.
  - **STRIP ON –** deprecated. Use STRIP RTRIM.

  With STRIP turned on (the default), SAP Sybase IQ strips trailing blanks from values before inserting them. This is effective only for VARCHAR data. STRIP OFF preserves trailing blanks.

  Trailing blanks are stripped only for unquoted strings. Quoted strings retain their trailing blanks. If you do not require blank sensitivity, you can use the FILLER option as an alternative to be more specific in the number of bytes to strip, instead of all the trailing spaces. STRIP OFF is more efficient for SAP Sybase IQ, and it adheres to the ANSI standard when dealing with trailing blanks. (CHAR data is always padded, so the STRIP option only affects VARCHAR data.)

  The STRIP option applies only to variable-length non-binary data and does not apply to ASCII fixed-width inserts. For example, assume this schema:

```
CREATE TABLE t( c1 VARCHAR(3) );
LOAD TABLE t( c1 ',' ) ........ STRIP RTRIM    // trailing blanks
trimmed

LOAD TABLE t( c1 ',' ) ........ STRIP OFF      // trailing blanks
not trimmed

LOAD TABLE t( c1 ASCII(3) ) ... STRIP RTRIM    // trailing blanks
not trimmed
LOAD TABLE t( c1 ASCII(3) ) ... STRIP OFF      // trailing blanks
trimmed

LOAD TABLE t( c1 BINARY ) ..... STRIP RTRIM    // trailing blanks
trimmed
LOAD TABLE t( c1 BINARY ) ..... STRIP OFF      // trailing blanks
trimmed
```

  Trailing blanks are always trimmed from binary data.

- **WITH CHECKPOINT –** determines whether SAP Sybase IQ performs a checkpoint. This option is useful only when loading SQL Anywhere tables in an SAP Sybase IQ database.

  The default setting is OFF. If this clause is set to ON, a checkpoint is issued after successfully completing and logging the statement. If the server fails after a connection commits and before the next checkpoint, the data file used to load the table must be present for the recovery to complete successfully. However, if WITH CHECKPOINT ON is

specified, and recovery is subsequently required, the data file need not be present at the time of recovery.

The data files are required, regardless of what is specified for this clause, if the database becomes corrupt and you need to use a backup and apply the current log file.

Warning! If you set the database option CONVERSION_ERROR to OFF, you may load bad data into your table without any error being reported. If you do not specify WITH CHECKPOINT ON, and the database needs to be recovered, the recovery may fail as CONVERSION_ERROR is ON (the default value) during recovery. It is recommended that you do not load tables when CONVERSION_ERROR is set to OFF and WITH CHECKPOINT ON is not specified.

See also *CONVERSION_ERROR Option [TSQL]*.

- **BYTE ORDER –** specifies the byte order during reads. This option applies to all binary input fields. If none are defined, this option is ignored. SAP Sybase IQ always reads binary data in the format native to the machine it is running on (default is NATIVE). You can also specify:
  - HIGH when multibyte quantities have the high order byte first (for big endian platforms like Sun, IBM AIX, and HP).
  - LOW when multibyte quantities have the low order byte first (for little endian platforms like Windows).
- **LIMIT –** specifies the maximum number of rows to insert into the table. The default is 0 for no limit. The maximum is 2^{31} - 1 (2147483647) rows.
- **NOTIFY –** specifies that you be notified with a message each time the specified number of rows is successfully inserted into the table. The default is 0, meaning no notifications are printed. The value of this option overrides the value of the NOTIFY_MODULUS database option.
- **ON FILE ERROR –** specifies the action SAP Sybase IQ takes when an input file cannot be opened because it does not exist or you have incorrect permissions to read the file. You can specify one of the following:
  - **ROLLBACK –** aborts the entire transaction (the default).
  - **FINISH –** finishes the insertions already completed and ends the load operation.
  - **CONTINUE –** returns an error but only skips the file to continue the load operation.

  Only one ON FILE ERROR clause is permitted.
- **PREVIEW –** displays the layout of input into the destination table including starting position, name, and data type of each column. SAP Sybase IQ displays this information at the start of the load process. If you are writing to a log file, this information is also included in the log

- **ROW DELIMITED BY delimiter-string –** specifies a string up to 4 bytes in length that indicates the end of an input record. You can use this option only if all fields within the row are any of the following:

  - Delimited with column terminators
  - Data defined by the DATE or DATETIME *column-spec* options
  - ASCII fixed length fields

  Always include ROW DELIMITED BY to insure parallel loads. Omitting this clause from the LOAD specification may cause SAP Sybase IQ to load serially rather than in parallel.

  You cannot use this option if any input fields contain binary data. With this option, a row terminator causes any missing fields to be set to NULL. All rows must have the same row delimiters, and it must be distinct from all column delimiters. The row and field delimiter strings cannot be an initial subset of each other. For example, you cannot specify "*" as a field delimiter and "*#" as the row delimiter, but you could specify "#" as the field delimiter with that row delimiter.

  If a row is missing its delimiters, SAP Sybase IQ returns an error and rolls back the entire load transaction. The only exception is the final record of a file where it rolls back that row and returns a warning message. On Windows, a row delimiter is usually indicated by the newline character followed by the carriage return character. You might need to specify this as the *delimiter-string* (see above for description) for either this option or FILLER.

- **SKIP –** defines the number of rows to skip at the beginning of the input tables for this load. The maximum number of rows to skip is 2^{31} - 1 (2147483647). The default is 0. SKIP runs in single-threaded mode as it reads the rows to skip.

- **HEADER SKIP…HEADER DELIMITED BY –** specifies a number of lines at the beginning of the data file, including header rows, for **LOAD TABLE** to skip. All **LOAD TABLE** column specifications and other load options are ignored, until the specified number of rows is skipped.

  - The number of lines to skip is greater than or equal to zero.
  - Lines are determined by a 1 to 4 character delimiter string specified in the HEADER DELIMITED BY clause. The default HEADER DELIMITED BY string is the '\n' character.
  - The HEADER DELIMITED BY string has a maximum length of four characters. An error is returned, if the string length is greater than four or less than one.
  - When a non-zero HEADER SKIP value is specified, all data inclusive of the HEADER DELIMITED BY delimiter is ignored, until the delimiter is encountered the number of times specified in the HEADER SKIP clause.
  - All **LOAD TABLE** column specifications and other load options are ignored, until the specified number of rows has been skipped. After the specified number of rows has been skipped, the **LOAD TABLE** column specifications and other load options are applied to the remaining data.

  - The "header" bytes are ignored only at the beginning of the data. When multiple files are specified in the USING clause, HEADER SKIP only ignores data starting from the first row of the first file, until it skips the specified number of header rows, even if those rows exist in subsequent files. **LOAD TABLE** does not look for headers once it starts parsing actual data.
  - No error is reported, if **LOAD TABLE** processes all input data before skipping the number of rows specified by HEADER SKIP.

- **WORD SKIP –** allows the load to continue when it encounters data longer than the limit specified when the word index was created.

  If a row is not loaded because a word exceeds the maximum permitted size, a warning is written to the `.iqmsg` file. WORD size violations can be optionally logged to the MESSAGE LOG file and rejected rows logged to the ROW LOG file specified in the **LOAD TABLE** statement.

  - If the option is not specified, **LOAD TABLE** reports an error and rolls back on the first occurrence of a word that is longer than the specified limit.
  - *number* specifies the number of times the "`Words exceeding the maximum permitted word length not supported`" error is ignored.
  - 0 (zero) means there is no limit.

- **ON PARTIAL INPUT ROW –** specifies the action to take when a partial input row is encountered during a load. You can specify one of the following:

  - CONTINUE issues a warning and continues the load operation. This is the default.
  - ROLLBACK aborts the entire load operation and reports the error.

    ```
    Partial input record skipped at EOF.
    SQLSTATE: QDC32    SQLSTATE: -1000232L
    ```

- **IGNORE CONSTRAINT –** specifies whether to ignore CHECK, UNIQUE, NULL, DATA VALUE, and FOREIGN KEY integrity constraint violations that occur during a load and the maximum number of violations to ignore before initiating a rollback. Specifying each *constrainttype* has the following result:

  - **CHECK limit –** if *limit* specifies zero, the number of CHECK constraint violations to ignore is infinite. If CHECK is not specified, the first occurrence of any CHECK constraint violation causes the **LOAD** statement to roll back. If *limit* is nonzero, then the *limit* +1 occurrence of a CHECK constraint violation causes the load to roll back.
  - **UNIQUE *limit* –** if *limit* specifies zero, then the number of UNIQUE constraint violations to ignore is infinite. If *limit* is nonzero, then the *limit* +1 occurrence of a UNIQUE constraint violation causes the load to roll back.
  - **NULL *limit* –** if *limit* specifies zero, then the number of NULL constraint violations to ignore is infinite. If *limit* is nonzero, then the *limit* +1 occurrence of a NULL constraint violation causes the load to roll back.

- **FOREIGN KEY *limit* –** if *limit* specifies zero, the number of FOREIGN KEY constraint violations to ignore is infinite. If *limit* is nonzero, then the *limit* +1 occurrence of a FOREIGN KEY constraint violation causes the load to roll back.
- **DATA VALUE *limit* –** f the database option CONVERSION_ERROR = ON, an error is reported and the statement rolls back. If *limit* specifies zero, then the number of DATA VALUE constraint violations (data type conversion errors) to ignore is infinite. If *limit* is nonzero, then the *limit* +1 occurrence of a DATA VALUE constraint violation causes the load to roll back.
- **ALL *limit* –** if the database option `CONVERSION_ERROR = ON`, an error is reported and the statement rolls back. If *limit* specifies zero, then the cumulative total of all integrity constraint violations to ignore is infinite. If *limit* is nonzero, then load rolls back when the cumulative total of all ignored UNIQUE, NULL, DATA VALUE, and FOREIGN KEY integrity constraint violations exceeds the value of *limit*. For example, you specify this IGNORE CONSTRAINT option:

  ```
  IGNORE CONSTRAINT NULL 50, UNIQUE 100, ALL 200
  ```

  The total number of integrity constraint violations cannot exceed 200, whereas the total number of NULL and UNIQUE constraint violations cannot exceed 50 and 100, respectively. Whenever any of these limits is exceeded, the LOAD TABLE statement rolls back.

  Note: A single row can have more than one integrity constraint violation. Every occurrence of an integrity constraint violation counts towards the limit of that type of violation.

  Set the IGNORE CONSTRAINT option limit to a nonzero value if you are logging the ignored integrity constraint violations. Logging an excessive number of violations affects the performance of the load

If CHECK, UNIQUE, NULL, or FOREIGN KEY is not specified in the IGNORE CONSTRAINT clause, then the load rolls back on the first occurrence of each of these types of integrity constraint violation.

If DATA VALUE is not specified in the IGNORE CONSTRAINT clause, then the load rolls back on the first occurrence of this type of integrity constraint violation, unless the database option `CONVERSION_ERROR = OFF`. If `CONVERSION_ERROR = OFF`, a warning is reported for any DATA VALUE constraint violation and the load continues.

When the load completes, an informational message regarding integrity constraint violations is logged in the `.iqmsg` file. This message contains the number of integrity constraint violations that occurred during the load and the number of rows that were skipped.

- **MESSAGE LOG –** specifies the names of files in which to log information about integrity constraint violations and the types of violations to log. Timestamps indicating the start and completion of the load are logged in both the MESSAGE LOG and the ROW LOG files.

Both MESSAGE LOG and ROW LOG must be specified, or no information about integrity violations is logged.

- If the ONLY LOG clause is not specified, no information on integrity constraint violations is logged. Only the timestamps indicating the start and completion of the load are logged.
- Information is logged on all integrity constraint-type violations specified in the ONLY LOG clause or for all word index-length violations if the keyword WORD is specified.
- If constraint violations are being logged, every occurrence of an integrity constraint violation generates exactly one row of information in the MESSAGE LOG file.

  The number of rows (errors reported) in the MESSAGE LOG file can exceed the IGNORE CONSTRAINT option limit, because the load is performed by multiple threads running in parallel. More than one thread might report that the number of constraint violations has exceeded the specified limit.
- If constraint violations are being logged, exactly one row of information is logged in the ROW LOG file for a given row, regardless of the number of integrity constraint violations that occur on that row.

  The number of distinct errors in the MESSAGE LOG file might not exactly match the number of rows in the ROW LOG file. The difference in the number of rows is due to the parallel processing of the load described above for the MESSAGE LOG.
- The MESSAGE LOG and ROW LOG files cannot be raw partitions or named pipes.
- If the MESSAGE LOG or ROW LOG file already exists, new information is appended to the file.
- Specifying an invalid file name for the MESSAGE LOG or ROW LOG file generates an error.
- Specifying the same file name for the MESSAGE LOG and ROW LOG files generates an error.

Various combinations of the IGNORE CONSTRAINT and MESSAGE LOG options result in different logging actions.

Table 8. LOAD TABLE Logging Actions

IGNORE CONSTRAINT Specified?	MESSAGE LOG Specified?	Action
yes	yes	All ignored integrity constraint violations are logged, including the user specified limit, before the rollback.
no	yes	The first integrity constraint violation is logged before the rollback.
yes	no	Nothing is logged.

IGNORE CONSTRAINT Specified?	MESSAGE LOG Specified?	Action
no	no	Nothing is logged. The first integrity constraint violation causes a rollback.

Tip: Set the IGNORE CONSTRAINT option limit to a nonzero value, if you are logging the ignored integrity constraint violations. If a single row has more than one integrity constraint violation, a row for each violation is written to the MESSAGE LOG file. Logging an excessive number of violations affects the performance of the load.

- **LOG DELIMITED BY –** specifies the separator between data values in the ROW LOG file. The default separator is a comma.

  SAP Sybase IQ no longer returns an error message when FORMAT BCP is specified as a **LOAD TABLE** clause. In addition, these conditions are verified and proper error messages are returned

  - If the specified load format is not ASCII, BINARY, or BCP, SAP Sybase IQ returns the message "`Only ASCII, BCP and BINARY are supported LOAD formats.`"
  - If the **LOAD TABLE** column specification contains anything other than column name, NULL, or ENCRYPTED, then SAP Sybase IQ returns the error message "`Invalid load specification for LOAD ... FORMAT BCP.`"
  - If the column delimiter or row terminator size for the FORMAT BCP load is greater than 10 characters, then SAP Sybase IQ returns the message "`Delimiter '%2' must be 1 to %3 characters in length.`" (where %3 equals 10).

    Messages corresponding to error or warning conditions which can occur for FORMAT BCP as well as FORMAT ASCII are the same for both formats.
  - If the load default value specified is AUTOINCREMENT, IDENTITY, or GLOBAL AUTOINCREMENT, SAP Sybase IQ returns the error "`Default value %2 cannot be used as a LOAD default value. %1`"
  - If the **LOAD TABLE** specification does not contain any columns that need to be loaded from the file specified, SAP Sybase IQ returns the error "`The LOAD statement must contain at least one column to be loaded from input file.`" and the **LOAD TABLE** statement rolls back.
  - If a load exceeds the limit on the maximum number of terms for a text document with TEXT indexes, SAP Sybase IQ returns the error "`Text document exceeds maximum number of terms. Support up to 4294967295 terms per document.`"

Examples

- **Example 1 –** load data from one file into the `Products` table on a Windows system. A tab is used as the column delimiter following the `Description` and `Color` columns:

```
LOAD TABLE Products
( ID ASCII(6),
FILLER(1),
Name   ASCII(15),
FILLER(1),
Description   '\x09',
Size   ASCII(2),
FILLER(1),
Color   '\x09',
Quantity   PREFIX 2,
UnitPrice   PREFIX 2,
FILLER(2) )
FROM 'C:\\mydata\\source1.dmp'
QUOTES OFF
ESCAPES OFF
BYTE ORDER LOW
NOTIFY 1000
```

- **Example 2 –** load data from a file `a.inp` on a client computer:

```
LOAD TABLE t1(c1,c2,filler(30))
USING CLIENT FILE 'c:\\client-data\\a.inp'
QUOTES OFF ESCAPES OFF
IGNORE CONSTRAINT UNIQUE 0, NULL 0
MESSAGE LOG 'c:\\client-data\\m.log'
ROW LOG 'c:\\client-data\\r.log'ONLY LOG UNIQUE
```

- **Example 3 –** load data from two files into the `product_new` table (which allows NULL values) on a UNIX system. The tab character is the default column delimiter, and the newline character is the row delimiter:

```
LOAD TABLE product_new
( id,
name,
description,
size,
color   '\x09'   NULL( 'null', 'none', 'na' ),
quantity   PREFIX 2,
unit_price   PREFIX 2 )
FROM '/s1/mydata/source2.dump',
'/s1/mydata/source3.dump'
QUOTES OFF
ESCAPES OFF
FORMAT ascii
DELIMITED BY '\x09'
ON FILE ERROR CONTINUE
ROW DELIMITED BY '\n'
```

- **Example 4 –** ignore 10 word-length violations; on the 11th, deploy the new error and roll back the load:

```
load table PTAB1(
       ck1         ','  null ('NULL') ,
```

```
       ck3fk2c2    ','  null ('NULL') ,
       ck4         ','  null ('NULL') ,
       ck5         ','  null ('NULL') ,
       ck6c1       ','  null ('NULL') ,
       ck6c2       ','  null ('NULL') ,
       rid         ','  null ('NULL')  )
FROM 'ri_index_selfRI.inp'
       row delimited by '\n'
       LIMIT 14   SKIP 10
       IGNORE CONSTRAINT UNIQUE 2, FOREIGN KEY 8
       word skip 10 quotes off escapes off strip
       off
```

- **Example 5 –** load data into table `t1` from the **BCP** character file `bcp_file.bcp` using the **FORMAT BCP** load option:

```
LOAD TABLE t1 (c1, c2, c3)
FROM 'bcp_file.bcp'
FORMAT BCP
...
```

- **Example 6 –** load default values 12345 into `c1` using the **DEFAULT** load option, and load `c2` and `c3` with data from the `LoadConst04.dat` file:

```
LOAD TABLE t1 (c1 DEFAULT '12345 ', c2, c3, filler(1))
FROM 'LoadConst04.dat'
STRIP OFF
QUOTES OFF
ESCAPES OFF
DELIMITED BY ',';
```

- **Example 7 –** load `c1` and `c2` with data from the file `bcp_file.bcp` using the **FORMAT BCP** load option and set `c3` to the value 10:

```
LOAD TABLE t1 (c1, c2, c3 DEFAULT '10')
FROM 'bcp_file.bcp'
FORMAT BCP
QUOTES OFF
ESCAPES OFF;
```

- **Example 8 –** this code fragment ignores one header row at the beginning of the data file, where the header row is delimited by '&&':

```
LOAD TABLE
...HEADER SKIP 1 HEADER DELIMITED by '&&'
```

- **Example 9 –** this code fragment ignores 2 header rows at the beginning of the data file, where each header row is delimited by '\n':

```
LOAD TABLE
...HEADER SKIP 2
```

- **Example 10 –** load a file into a RLV-enabled table.

  Load data into RLV-enabled table `rvt1` from the **BCP** character file `bcp_file.bcp` using the **FORMAT BCP** load option:

```
LOAD TABLE rvt1 (c1, c2, c3)
FROM 'bcp_file.bcp'
FORMAT BCP
...
```

Usage

The **LOAD TABLE** statement allows efficient mass insertion into a database table from a file with ASCII or binary data.

The **LOAD TABLE** options also let you control load behavior when integrity constraints are violated and to log information about the violations.

You can use **LOAD TABLE** on a temporary table, but the temporary table must have been declared with **ON COMMIT PRESERVE ROWS**, or the next **COMMIT** removes the rows you have loaded.

LOAD TABLE supports loading of large object (LOB) data.

SAP Sybase IQ supports loading from both ASCII and binary data, and it supports both fixed- and variable-length formats. To handle all of these formats, you must supply a *load-specification* to tell SAP Sybase IQ what kind of data to expect from each "column" or field in the source file. The *column-spec* lets you define these formats:

- ASCII with a fixed length of bytes. The *input-width* value is an integer indicating the fixed width in bytes of the input field in every record.
- Binary or non-binary fields that use a number of PREFIX bytes (1, 2, or 4) to specify the length of the input.

  There are two parts related to a **PREFIX** clause:
  - Prefix value – always a binary value.
  - Associated data bytes – always character format; never binary format.

  If the data is unloaded using the extraction facility with the `TEMP_EXTRACT_BINARY` option set ON, you must use the **BINARY WITH NULL BYTE** parameter for each column when you load the binary data.
- Variable-length characters delimited by a separator. You can specify the terminator as hexadecimal ASCII characters. The *delimiter-string* can be any string of up to 4 characters, including any combination of printable characters, and any 8-bit hexadecimal ASCII code that represents a nonprinting character. For example, specify:
  - '\x09' to represent a tab as the terminator.
  - '\x00' for a null terminator (no visible terminator as in "C" strings).
  - '\x0a' for a newline character as the terminator. You can also use the special character combination of '\n' for newline.

  Note: The delimiter string can be from 1 to 4 characters long, but you can specify only a single character in the **DELIMITED BY** clause. For **BCP**, the delimiter can be up to 10 characters.
- DATE or DATETIME string as ASCII characters. You must define the *input-date-format* or *input-datetime-format* of the string using one of the corresponding formats for the date

and datetime data types supported by SAP Sybase IQ. Use **DATE** for date values and **DATETIME** for datetime and time values.

Table 9. Formatting Dates and Times

Option	Meaning
yyyy or YYYY yy or YY	Represents number of year. Default is current year.
mm or MM	Represents number of month. Always use leading zero or blank for number of the month where appropriate, for example, '05' for May. DATE value must include a month. For example, if the **DATE** value you enter is 1998, you receive an error. If you enter '03', SAP Sybase IQ applies the default year and day and converts it to '1998-03-01'.
dd or DD jjj or JJJ	Represents number of day. Default day is 01. Always use leading zeros for number of day where appropriate, for example, '01' for first day. J or j indicates a Julian day (1 to 366) of the year.
hh HH	Represents hour. Hour is based on 24-hour clock. Always use leading zeros or blanks for hour where appropriate, for example, '01' for 1 am. '00' is also valid value for hour of 12 a.m.
nn	Represents minute. Always use leading zeros for minute where appropriate, for example, '08' for 8 minutes.
ss[.ssssss]	Represents seconds and fraction of a second.
aa	Represents the a.m. or p.m. designation.
pp	Represents the p.m. designation only if needed. (This is an incompatibility with SAP Sybase IQ versions earlier than 12.0; previously, “pp” was synonymous with “aa”.)
hh	SAP Sybase IQ assumes zero for minutes and seconds. For example, if the **DATETIME** value you enter is '03', SAP Sybase IQ converts it to '03:00:00.0000'.
hh:nn or hh:mm	SAP Sybase IQ assumes zero for seconds. For example, if the time value you enter is '03:25', SAP Sybase IQ converts it to '03:25:00.0000'.

Table 10. Sample DATE and DATETIME Format Options

Input data	Format specification
12/31/98	**DATE** ('MM/DD/YY')
19981231	**DATE** ('YYYYMMDD')
123198140150	**DATETIME** ('MMDDYYhhnnss')
14:01:50 12-31-98	**DATETIME** ('hh:nn:ss MM-DD-YY')
18:27:53	**DATETIME** ('hh:nn:ss')

Input data	Format specification
12/31/98 02:01:50AM	**DATETIME** ('MM/DD/YY hh:nn:ssaa')

SAP Sybase IQ has built-in load optimizations for common date, time, and datetime formats. If your data to be loaded matches one of these formats, you can significantly decrease load time by using the appropriate format.

You can also specify the date/time field as an ASCII fixed-width field (as described above) and use the FILLER(1) option to skip the column delimiter.

The NULL portion of the *column-spec* indicates how to treat certain input values as NULL values when loading into the table column. These characters can include BLANKS, ZEROS, or any other list of literals you define. When specifying a NULL value or reading a NULL value from the source file, the destination column must be able to contain NULLs.

ZEROS are interpreted as follows: the cell is set to NULL if (and only if) the input data (before conversion, if ASCII) is all binary zeros (and not character zeros).

- If the input data is character zero, then:
  1. NULL (ZEROS) never causes the cell to be NULL.
  2. NULL ('0') causes the cell to be NULL.
- If the input data is binary zero (all bits clear), then:
  1. NULL (ZEROS) causes the cell to be NULL.
  2. NULL ('0') never causes the cell to be NULL.

For example, if your **LOAD** statement includes `col1 date('yymmdd') null(zeros)` and the date is 000000, you receive an error indicating that 000000 cannot be converted to a `DATE`(4). To get **LOAD TABLE** to insert a NULL value in `col1` when the data is 000000, either write the NULL clause as `null('000000')`, or modify the data to equal binary zeros and use NULL(ZEROS).

If the length of a `VARCHAR` cell is zero and the cell is not NULL, you get a zero-length cell. For all other data types, if the length of the cell is zero, SAP Sybase IQ inserts a NULL. This is ANSI behavior. For non-ANSI treatment of zero-length character data, set the **NON_ANSI_NULL_VARCHAR** database option.

Use the **DEFAULT** option to specify a load default column value. You can load a default value into a column, even if the column does not have a default value defined in the table schema. This feature provides more flexibility at load time.

- The **LOAD TABLE DEFAULTS** option must be ON in order to use the default value specified in the **LOAD TABLE** statement. If the **DEFAULTS** option is OFF, the specified load default value is not used and a NULL value is inserted into the column instead.
- The **LOAD TABLE** command must contain at least one column that needs to be loaded from the file specified in the **LOAD TABLE** command. Otherwise, an error is reported and the load is not performed.

- The specified load default value must conform to the supported default values for columns and default value restrictions. The **LOAD TABLE DEFAULT** option does not support **AUTOINCREMENT**, **IDENTITY**, or **GLOBAL AUTOINCREMENT** as a load default value.
- The **LOAD TABLE DEFAULT** *default-value* must be of the same character set as that of the database.
- Encryption of the default value is not supported for the load default values specified in the **LOAD TABLE DEFAULT** clause.
- A constraint violation caused by evaluation of the specified load default value is counted for each row that is inserted in the table.

Another important part of the *load-specification* is the **FILLER** option. This option indicates you want to skip over a specified field in the source input file. For example, there may be characters at the end of rows or even entire fields in the input files that you do not want to add to the table. As with the *column-spec* definition, **FILLER** specifies ASCII fixed length of bytes, variable length characters delimited by a separator, and binary fields using PREFIX bytes.

Standards

- SQL—Vendor extension to ISO/ANSI SQL grammar.
- Sybase—Not applicable.

Permissions

The permissions required to execute a **LOAD TABLE** statement depend on the database server **-gl** command line option, as follows:

- **-gl ALL –** You must be the owner of the table, have ALTER or LOAD permission on the table, or have the ALTER ANY TABLE, LOAD ANY TALBE, or ALTER ANY OBJECT system privilege.
- **-gl DBA –** You must have the ALTER ANY TABLE, LOAD ANY TABLE, or ALTER ANY OBJECT system privilege.
- **-gl NONE –** Execution of the **LOAD TABLE** statement is not permitted.

For more information on the **-gl** command line option, please refer *Utility Guide > start_iq Database Server Startup Utility > start_iq Server Options*.

LOAD TABLE also requires a write lock on the table.

String Comparisons on Encrypted Text

If data is case-insensitive, or uses a collation other than ISO_BINENG, you must decrypt ciphertext columns to perform string comparisons.

When performing comparisons on strings, the distinction between equal and identical strings is important for many collations and depends on the **CASE** option of **CREATE DATABASE**. In a database that is set to **CASE RESPECT** and uses the ISO_BINENG collation, the defaults for SAP Sybase IQ, equality, and identity questions are resolved the same way.

Identical strings are always equal, but equal strings may not be identical. Strings are identical only if they are represented using the same byte values. When data is case-insensitive or uses a collation where multiple characters must be treated as equal, the distinction between equality and identity is significant. ISO1LATIN1 is such a collation.

For example, the strings “ABC” and “abc” in a case-insensitive database are not identical but are equal. In a case-sensitive database, they are neither identical nor equal.

The ciphertext created by the Sybase encryption functions preserves identity but not equality. In other words, the ciphertext for “ABC” and “abc” will never be equal.

To perform equality comparisons on ciphertext when your collation or **CASE** setting does not allow this type of comparison, your application must modify the values within that column into some canonical form, where there are no equal values that are not also identical values. For example, if your database is created with **CASE IGNORE** and the ISO_BINENG collation and your application applies UCASE to all input values before placing them into the column, then all equal values are also identical.

Database Options for Column Encryption

Certain SAP Sybase IQ database option settings affect column encryption and decryption; the default settings are not optimal for most column encryption operations.

Protect Ciphertext from Accidental Truncation

To prevent accidental truncation of the ciphertext output of the encrypt function (or accidental truncation of any other character or binary string), set the STRING_RTRUNCATION database option.

```
SET OPTION STRING_RTRUNCATION = 'ON'
```

When `STRING_RTRUNCATION` is ON (the default), the engine raises an error whenever a string would be truncated during a load, insert, update, or **SELECT INTO** operation. This is ISO/ANSI SQL behavior and is a recommended practice.

When explicit truncation is required, use a string expression such as **LEFT**, **SUBSTRING**, or **CAST**.

Setting `STRING_RTRUNCATION` OFF forces silent truncation of strings.

The **AES_DECRYPT** function also checks input ciphertext for valid data length, and checks text output to verify both the resulting data length and the correctness of the supplied key. If you supply the data type argument, the data type is checked as well.

Preserve Ciphertext Integrity

Set `ASE_BINARY_DISPLAY` to preserve ciphertext integrity.

```
SET OPTION ASE_BINARY_DISPLAY = 'OFF'
```

When `ASE_BINARY_DISPLAY` is OFF (the default), the system leaves binary data unmodified, and in its raw binary form.

When ASE_BINARY_DISPLAY is ON, the system converts binary data into its hexadecimal string display representation. Temporarily set the option ON only if you need to show data to an end user, or if you need to export the data to another external system, where raw binary may become altered in transit.

Prevent Misuse of Ciphertext

Set CONVERSION_MODE to prevent implicit data type conversions of encrypted data that result in semantically meaningless operations.

The CONVERSION_MODE database option restricts implicit conversion between binary data types (BINARY, VARBINARY, and LONG BINARY) and other nonbinary data types (BIT, TINYINT, SMALLINT, INT, UNSIGNED INT, BIGINT, UNSIGNED BIGINT, CHAR, VARCHAR, and LONG VARCHAR) on various operations:

```
SET TEMPORARY OPTION CONVERSION_MODE = 1
```

Setting CONVERSION_MODE to 1 restricts implicit conversion of binary data types to any other nonbinary data type on **INSERT** and **UPDATE** commands, and in queries. The restrict binary conversion mode also applies to **LOAD TABLE** default values and **CHECK** constraint.

The CONVERSION_MODE option default value of 0 maintains the implicit conversion behavior of binary data types in versions of SAP Sybase IQ earlier than 12.7.

CONVERSION_MODE Option

Restricts implicit conversion between binary data types (BINARY, VARBINARY, and LONG BINARY) and other non-binary data types (BIT, TINYINT, SMALLINT, INT, UNSIGNED INT, BIGINT, UNSIGNED BIGINT, CHAR, VARCHAR, and LONG VARCHAR) on various operations.

Allowed Values

0, 1

Default

0

Scope

Option can be set at the database (PUBLIC) or user level. When set at the database level, the value becomes the default for any new user, but has no impact on existing users. When set at the user level, overrides the PUBLIC value for that user only. No system privilege is required to set option for self. System privilege is required to set at database level or at user level for any user other than self.

Requires the SET ANY PUBLIC OPTION system privilege to set this option. Can be set temporary for an individual connection or for the PUBLIC role. Takes effect immediately.

Description

The default value of 0 maintains implicit conversion behavior prior to version 12.7. Setting CONVERSION_MODE to 1 restricts implicit conversion of binary data types to any other non-binary data type on **INSERT**, **UPDATE**, and in queries. The restrict binary conversion mode also applies to **LOAD TABLE** default values and **CHECK** constraint. The use of this option prevents implicit data type conversions of encrypted data that would result in semantically meaningless operations.

Users must be specifically licensed to use the encrypted column functionality of the SAP Sybase IQ Advanced Security Option.

Implicit Conversion Restrictions

The CONVERSION_MODE option restrict binary mode value of 1 (CONVERSION_MODE = 1) restricts implicit conversion for these operations:

- **LOAD TABLE** with **CHECK** constraint or default value
- **INSERT...SELECT**, **INSERT...VALUE**, and **INSERT...LOCATION**
- Certain types of **UPDATE**
- Certain types of **INSERT** and **UPDATE** via updatable cursor
- All aspects of queries in general

Encryption and Decryption Example

An example using the **AES_ENCRYPT** and **AES_DECRYPT** functions, written in commented SQL.

```
--   This example of aes_encrypt and aes_decrypt function use is
presented in three parts:
--
-- Part I: Preliminary description of target tables and users as DDL
-- Part II: Example schema changes motivated by introduction of
encryption
-- Part III: Use of views and stored procedures to protect encryption
keys
--


--   Part I: Define target tables and users

--   Assume two classes of user, represented here by the instances
--   PrivUser and NonPrivUser, assigned to groups reflecting
differing
--   privileges.

--   The initial state reflects the schema prior to the introduction
--   of encryption.

--   Set up the starting context: There are two tables with a common
key.
--   Some columns contain sensitive data, the remaining columns do
```

```
not.
--   The usual join column for these tables is sensitiveA.
--   There is a key and a unique index.

    grant connect to PrivUser identified by 'verytrusted' ;
    grant connect to NonPrivUser identified by 'lesstrusted' ;

    grant connect to high_privileges_group ;
    create role high_privileges_group ;
    grant role high_privileges_group to PrivUser ;

    grant connect to low_privileges_group ;
    create role low_privileges_group ;
    grant role low_privileges_group to NonPrivUser ;

    create table DBA.first_table
                    (sensitiveA char(16) primary key
                    ,sensitiveB numeric(10,0)
                    ,publicC    varchar(255)
                    ,publicD    date
                    )  ;


--   There is an implicit unique HG (HighGroup) index enforcing the
primary key.

    create table second_table
                    (sensitiveA char(16)
                    ,publicP integer
                    ,publicQ tinyint
                    ,publicR varchar(64)
                    )  ;

    create hg index second_A_HG on second_table ( sensitiveA ) ;

--   TRUSTED users can see the sensitive columns.

    grant select ( sensitiveA, sensitiveB, publicC, publicD )
        on DBA.first_table to PrivUser ;
    grant select ( sensitiveA, publicP, publicQ, publicR )
        on DBA.second_table to PrivUser ;

--   Non-TRUSTED users in existing schema need to see sensitiveA to
be
--   able to do joins, even though they should not see sensitiveB.

    grant select ( sensitiveA, publicC, publicD )
        on DBA.first_table to NonPrivUser ;
    grant select ( sensitiveA, publicP, publicQ, publicR )
        on DBA.second_table to NonPrivUser ;

--   Non-TRUSTED users can execute queries such as

    select I.publicC, 3*II.publicQ+1
    from DBA.first_table I, DBA.second_table II
    where I.sensitiveA = II.sensitiveA and I.publicD IN
```

```
( '2006-01-11' ) ;

--   and

    select count(*)
    from DBA.first_table I, DBA.second_table II
    where I.sensitiveA = II.sensitiveA and SUBSTR(I.sensitiveA,4,3)
    BETWEEN '345' AND '456' ;

--   But only TRUSTED users can execute the query

    select I.sensitiveB, 3*II.publicQ+1
    from DBA.first_table I, DBA.second_table II
    where I.sensitiveA = II.sensitiveA and I.publicD IN
( '2006-01-11' ) ;


--   Part II: Change the schema in preparation for encryption
--
--    The DBA introduces encryption as follows:
--
--    For applicable tables, the DBA changes the schema, adjusts
access
--    permissions, and updates existing data. The encryption
--    keys used are hidden in a subsequent step.


--   DataLength comparison for length of varbinary encryption result
--   (units are Bytes):
--
--    PlainText CipherText    Corresponding Numeric Precisions
--
--            0       16
--      1 -  16       32      numeric(1,0)   - numeric(20,0)
--     17 -  32       48      numeric(21,0)  - numeric(52,0)
--     33 -  48       64      numeric(53,0)  - numeric(84,0)
--     49 -  64       80      numeric(85,0)  - numeric(116,0)
--     65 -  80       96      numeric(117,0) - numeric(128,0)
--     81 -  96      112
--     97 - 112      128
--    113 - 128      144
--    129 - 144      160
--    145 - 160      176
--    161 - 176      192
--    177 - 192      208
--    193 - 208      224
--    209 - 224      240

--   The integer data types tinyint, small int, integer, and bigint
--   are varbinary(32) ciphertext.

--   The exact relationship is
--   DATALENGTH(ciphertext) =
--   (((DATALENGTH(plaintext)+ 15) / 16) + 1) * 16

--   For the first table, the DBA chooses to preserve both the
```

```
plaintext and
--   ciphertext forms. This is not typical and should only be done if
the
--   database files are also encrypted.

--   Take away NonPrivUser's access to column sensitiveA and transfer
--   access to the ciphertext version.

--   Put a unique index on the ciphertext column. The ciphertext
--   itself is indexed.

--   NonPrivUser can select the ciphertext and use it.

--   PrivUser can still select either form (without paying decrypt
costs).

    revoke select ( sensitiveA ) on DBA.first_table from
NonPrivUser ;
    alter table DBA.first_table add encryptedA varbinary(32) ;
    grant select ( encryptedA ) on DBA.first_table to PrivUser ;
    grant select ( encryptedA ) on DBA.first_table to NonPrivUser ;
    create unique hg index first_A_unique on first_table
( encryptedA ) ;
    update DBA.first_table
        set encryptedA = aes_encrypt(sensitiveA, 'seCr3t')
        where encryptedA is null ;
    commit

--   Now change column sensitiveB.

    alter table DBA.first_table add encryptedB varbinary(32) ;
    grant select ( encryptedB ) on DBA.first_table to PrivUser ;
    create unique hg index first_B_unique on first_table
( encryptedB ) ;
    update DBA.first_table
        set encryptedB = aes_encrypt(sensitiveB,
        'givethiskeytonoone') where encryptedB is null ;
    commit

--   For the second table, the DBA chooses to keep only the
ciphertext.
--   This is more typical and encrypting the database files is not
required.

    revoke select ( sensitiveA ) on DBA.second_table from
NonPrivUser ;
    revoke select ( sensitiveA ) on DBA.second_table from PrivUser ;
    alter table DBA.second_table add encryptedA varbinary(32) ;
    grant select ( encryptedA ) on DBA.second_table to PrivUser ;
    grant select ( encryptedA ) on DBA.second_table to NonPrivUser ;
    create unique hg index second_A_unique on second_table
( encryptedA ) ;
    update DBA.second_table
        set encryptedA = aes_encrypt(sensitiveA, 'seCr3t')
        where encryptedA is null ;
    commit
```

```
    alter table DBA.second_table drop sensitiveA ;

--   The following types of queries are permitted at this point,
before
--   changes are made for key protection:

--   Non-TRUSTED users can equi-join on ciphertext; they can also
select
--   the binary, but have no way to interpret it.

    select I.publicC, 3*II.publicQ+1
    from DBA.first_table I, DBA.second_table II
    where I.encryptedA = II.encryptedA and I.publicD IN
( '2006-01-11' ) ;

--   Ciphertext-only access rules out general predicates and
expressions.
--   The following query does not return meaningful results.
--
--   NOTE: These four predicates can be used on the varbinary
containing
--   ciphertext:
--      = (equality)
--      <> (inequality)
--      IS NULL
--      IS NOT NULL

    select count(*)
    from DBA.first_table I, DBA.second_table II
    where I.encryptedA = II.encryptedA and SUBSTR(I.encryptedA,4,3)
        BETWEEN '345' AND '456' ;

--   The TRUSTED user still has access to the plaintext columns that
--   were retained. Therefore, this user does not need to call
--   aes_decrypt and does not need the key.

    select count(*)
    from DBA.first_table I, DBA.second_table II
    where I.encryptedA = II.encryptedA and SUBSTR(I.sensitiveA,4,3)
        BETWEEN '345' AND '456' ;


--   Part III: Protect the encryption keys

--   This section illustrates how to grant access to the plaintext,
but
--   still protect the keys.

--   For the first table, the DBA elected to retain the plaintext
columns.
--   Therefore, the following view has the same capabilities as the
trusted
--   user above.
--   Assume group_member is being used for additional access control.

--   NOTE: In this example, NonPrivUser still has access to the
```

```
ciphertext
--   encrypted in the base table.

    create view DBA.a_first_view (sensitiveA, publicC, publicD)
        as
            select
            IF group_member('high_privileges_group',user_name()) = 1
                 THEN sensitiveA
                 ELSE NULL
              ENDIF,
              publicC,
              publicD
            from first_table ;

    grant select on DBA.a_first_view to PrivUser ;
    grant select on DBA.a_first_view to NonPrivUser ;

--   For the second table, the DBA did not keep the plaintext.
--   Therefore, aes_decrypt calls must be used in the view.
--   IMPORTANT: Hide the view definition with ALTER VIEW, so that no
one
--   can discover the key.

    create view DBA.a_second_view
(sensitiveA,publicP,publicQ,publicR)
        as
            select
            IF group_member('high_privileges_group',user_name()) = 1
                 THEN aes_decrypt(encryptedA,'seCr3t', char(16))
                 ELSE NULL
              ENDIF,
              publicP,
              publicQ,
              publicR
            from second_table ;

    alter view DBA.a_second_view set hidden ;
    grant select on DBA.a_second_view to PrivUser ;
    grant select on DBA.a_second_view to NonPrivUser ;

--   Likewise, the key used for loading can be protected in a stored
     procedure.
--   By hiding the procedure (just as the view is hidden), no-one can
see
--   the keys.

    create procedure load_first_proc(@inputFileName varchar(255),
                        @colDelim varchar(4) default '$',
                        @rowDelim varchar(4) default '\n')
        begin
            execute immediate with quotes
                'load table DBA.second_table
                (encryptedA encrypted(char(16),' ||
              '''' || 'seCr3t' || '''' || '),publicP,publicQ,publicR)
' ||
                ' from ' || '''' || @inputFileName || '''' ||
```

```
                ' delimited by ' || '''' || @colDelim || '''' ||
                ' row delimited by ' || '''' || @rowDelim || '''' ||
                ' quotes off escapes off' ;
        end
    ;

    alter procedure DBA.load_first_proc set hidden ;

--   Call the load procedure using the following syntax:

    call load_first_proc('/dev/null', '$', '\n') ;

--   Below is a comparison of several techniques for protecting the
--   encryption keys by using user-defined functions (UDFs), other
views,
--   or both. The first and the last alternatives offer maximum
performance.

--   The second_table is secured as defined earlier.


--   Alternative 1:
--   This baseline approach relies on restricting access to the
entire view.

     create view

DBA.second_baseline_view(sensitiveA,publicP,publicQ,publicR)
        as
            select
            IF group_member('high_privileges_group',user_name()) = 1
                 THEN aes_decrypt(encryptedA,'seCr3t', char(16))
                 ELSE NULL
              ENDIF,
              publicP,
              publicQ,
              publicR
            from DBA.second_table ;

     alter view DBA.second_baseline_view set hidden ;
     grant select on DBA.second_baseline_view to NonPrivUser ;
     grant select on DBA.second_baseline_view to PrivUser ;


--   Alternative 2:
--     Place the encryption function invocation within a user-defined
--   function (UDF).
--    Hide the definition of the UDF. Restrict the UDF permissions.
--    Use the UDF in a view that handles the remainder of the security
--      and business logic.
--    Note: The view itself does not need to be hidden.

     create function DBA.second_decrypt_function(IN datum
varbinary(32))
            RETURNS char(16) DETERMINISTIC
            BEGIN
```

```
                RETURN aes_decrypt(datum,'seCr3t', char(16));
            END  ;

     grant execute on DBA.second_decrypt_function to PrivUser ;
     alter function DBA.second_decrypt_function set hidden ;

     create view

DBA.second_decrypt_view(sensitiveA,publicP,publicQ,publicR)
        as
                select
               IF group_member('high_privileges_group',user_name())
= 1
                     THEN second_decrypt_function(encryptedA)
                     ELSE NULL
                  ENDIF,
                  publicP,
                 publicQ,
                 publicR
                from DBA.second_table ;

     grant select on DBA.second_decrypt_view to NonPrivUser ;
     grant select on DBA.second_decrypt_view to PrivUser ;

--  Alternative 3:
--    Sequester only the key selection in a user-defined function.
--    This function could be extended to support selection of any
--  number of keys.
--    This UDF is also hidden and has restricted execute privileges.
--    Note: Any view that uses this UDF therefore does not compromise
-- the key values.

     create function DBA.second_key_function()
              RETURNS varchar(32) DETERMINISTIC
              BEGIN
                return 'seCr3t' ;
              END

     grant execute on DBA.second_key_function to PrivUser ;
     alter function DBA.second_key_function set hidden ;

     create view
DBA.second_key_view(sensitiveA,publicP,publicQ,publicR)
                as
                    select
                      IF
group_member('high_privileges_group',user_name()) = 1
                         THEN
aes_decrypt(encryptedA,second_key_function(),
                         char(16))
                         ELSE NULL
                       ENDIF,
                       publicP,
                       publicQ,
                       publicR
                    from DBA.second_table ;
```

```
     grant select on DBA.second_key_view to NonPrivUser ;
     grant select on DBA.second_key_view to PrivUser ;


--  Alternative 4:
--    The recommended alternative is to separate the security logic
--   from the business logic by dividing the concerns into two views.
--    Only the security logic view needs to be hidden.
--   Note: The performance of this approach is similar to that of the
first
-- alternative.

     create view

DBA.second_SecurityLogic_view(sensitiveA,publicP,publicQ,publicR)
            as
                select
               IF group_member('high_privileges_group',user_name())
= 1
                     THEN aes_decrypt(encryptedA,'seCr3t', char(16))
                     ELSE NULL
                  ENDIF,
                  publicP,
                  publicQ,
                  publicR
                from DBA.second_table ;

     alter view DBA.second_SecurityLogic_view set hidden ;

     create view

DBA.second_BusinessLogic_view(sensitiveA,publicP,publicQ,publicR)
            as
                select
                  sensitiveA,
                  publicP,
                  publicQ,
                  publicR
                from DBA.second_SecurityLogic_view ;

     grant select on DBA.second_BusinessLogic_view to NonPrivUser ;
     grant select on DBA.second_BusinessLogic_view to PrivUser ;

-- End of encryption example
```

See also

- *AES_ENCRYPT Function [String]* on page 199
- *AES_DECRYPT Function [String]* on page 202
- *LOAD TABLE ENCRYPTED Clause* on page 203

Kerberos Authentication Support in SAP Sybase IQ

SAP Sybase IQ supports Kerberos authentication, a login feature that allows you to maintain a single user ID and password for both database connections and operating system and network logins.

You can use your Kerberos credentials to connect to the database without specifying a user ID or password.

Kerberos authentication is part of the separately licensed SAP Sybase IQ Advanced Security Option.

Licensing Requirements for Kerberos

The Advanced Security Option (IQ_SECURITY) protects your environment against unauthorized access, and is required to use Kerberos authentication with SAP Sybase IQ.

LDAP User Authentication Support in SAP Sybase IQ

You can integrate SAP Sybase IQ into any existing enterprise-wide directory access framework based on Lightweight Directory Access Protocol (LDAP), a widely accepted international standard.

License Requirements for LDAP User Authentication

The Advanced Security Option (IQ_SECURITY) protects your environment against unauthorized access, and is required to allow LDAP user authentication with SAP Sybase IQ.

Appendix: SQL Reference

Reference material for SQL statements, database options, functions, and system procedures mentioned in this document.

SQL Statements

Interactive SQL statements customize and modify the database.

ALTER LDAP SERVER Statement

Any changes to an LDAP server configuration object are applied on subsequent connections. Any connection already started when the change is applied does not immediately reflect the change.

Syntax

```
ALTER LDAP SERVER ldapua-server-name
   { ldapua-server-attribs
   | [ WITH ( SUSPEND | ACTIVATE | REFRESH ) ] }

ldapua-server-attribs:
   SEARCH DN
      URL { 'URL_string' | NULL }
      | ACCESS ACCOUNT { 'DN_string' | NULL }
      | IDENTIFIED BY ( 'password' | NULL }
      | IDENTIFIED BY ENCRYPTED { encrypted-password | NULL }
   | AUTHENTICATION URL { 'URL_string' | NULL }
   | CONNECTION TIMEOUT timeout_value
   | CONNECTION RETRIES retry_value
   | TLS { ON | OFF }
```

Parameters

- **URL –** identifies the host (by name or by IP address), port number, and the search to be performed for the DN lookup for a given user ID. This value is validated for correct LDAP URL syntax before it is stored in the `ISYSLDAPSERVER` system table. The maximum size for this string is 1024 bytes.
- **ACCESS ACCOUNT –** user created in the LDAP server for use by SAP Sybase IQ, not a user within SAP Sybase IQ. The distinguished name (DN) for this user is used to connect to the LDAP server. This user has permissions within the LDAP server to search for DNs by user ID in the locations specified by the SEARCH DN URL. The maximum size for this string is 1024 bytes.
- **IDENTIFIED BY –** provides the password associated with the ACCESS ACCOUNT user. The password is stored using symmetric encryption on disk. Use the value NULL to

clear the password and set it to none. The maximum size of a clear text password is 255 bytes.

- **IDENTIFIED BY ENCRYPTED –** configures the password associated with the ACCESS ACCOUNT distinguished name in an encrypted format. The binary value is the encrypted password and is stored on disk as is. Use the value NULL to clear the password and set it to none. The maximum size of the binary is 289 bytes. The encrypted key should be a valid varbinary value. Do not enclose the encrypted key in quotation marks.
- **AUTHENTICATION URL –** identifies the host (by name or IP address) and the port number of the LDAP server to use for authentication of the user. This is the value defined for URL_string and is validated for correct LDAP URL syntax before it is stored in `ISYSLDAPSERVER` system table. The DN of the user obtained from a prior DN search and the user password bind a new connection to the authentication URL. A successful connection to the LDAP server is considered proof of the identity of the connecting user. The maximum size for this string is 1024 bytes.
- **CONNECTION TIMEOUT –** specifies the connection timeout from SAP Sybase IQ to the LDAP server for both DN searches and authentication. This value is in milliseconds, with a default value of 10 seconds.
- **CONNECTION RETRIES –** specifies the number of retries on connections from SAP Sybase IQ to the LDAP server for both DN searches and authentication. The valid range of values is 1– 60, with a default value of 3.
- **TLS –** defines whether the TLS or Secure LDAP protocol is used for connections to the LDAP server for both DN searches and authentication. When set to ON, the TLS protocol is used and the URL would being with "ldap://" When set to OFF (or not specified), Secure LDAP protocol is used and the URL begins with “ldaps://”. When using the TLS protocol, specify the database security option TRUSTED_CERTIFICATES_FILE with a file name containing the certificate of the Certificate Authority (CA) that signed the certificate used by the LDAP server.
- **WITH ACTIVATE –** activates the LDAP server configuration object for immediate use upon creation. This permits the definition and activation of LDAP User Authentication in one statement. The LDAP server configuration object state changes to READY when WITH ACTIVATE is used.

Examples

- **Example 1 –** suspends the LDAP server configuration object named `apps_primary`:

```
ALTER LDAP SERVER apps_primary SUSPEND
```

- **Example 2 –** changes the LDAP server configuration object named `apps_primary` to use a different URL for authentication on host `fairfax`, sets the port number to `1066`, sets the number of connection retries to `10`, and finally activates the LDAP server configuration object:

```
ALTER LDAP SERVER apps_primary
AUTHENTICATION URL 'ldap://my_LDAPserver:1066/'
CONNECTION RETRIES 10
WITH ACTIVATE
```

Usage

In addition to resetting LDAP server configuration object values for attributes, the **ALTER LDAP SERVER** statement allows an administrator to make manual adjustments to a server's state and behavior by putting the LDAP server configuration object in maintenance mode and returning it to service from maintenance mode.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

Requires the MANAGE ANY LDAP SERVER system privilege.

ALTER LOGIN POLICY Statement

Changes existing login policies or configures logical server access.

Syntax

Syntax 1

```
ALTER LOGIN POLICY policy-name
   { { ADD | DROP | SET } LOGICAL SERVER ls-assignment-list
   [ LOGICAL SERVER ls-override-list ])

ls-assignment-list:
   { { ls-name, ...}
   | ALL
   | COORDINATOR
   | SERVER
   | NONE
   | DEFAULT }

ls-override-list:
   { ls-name, ...}

ls-name:
   { OPEN | user-defined-ls-name }
```

Syntax 2

```
ALTER LOGIN POLICY policy-name policy-option

policy-option:
   policy-option-name = policy-option-value

policy-option-value:
```

```
   { UNLIMITED | DEFAULT | value }

policy-option-name:
  AUTO_UNLOCK_TIME
    | CHANGE_PASSWORD_DUAL_CONTROL
    | DEFAULT_LOGICAL_SERVER
    | LOCKED
    | MAX_CONNECTIONS
    | MAX_DAYS_SINCE_LOGIN
    | MAX_FAILED_LOGIN_ATTEMPTS
    | MAX_NON_DBA_CONNECTIONS
    | PASSWORD_EXPIRY_ON_NEXT_LOGIN
    | PASSWORD_GRACE_TIME
    | PASSWORD_LIFE_TIME
    | ROOT_AUTO_UNLOCK_TIME
    | LDAP_PRIMARY_SERVER
    | LDAP_SECONDARY_SERVER
    | LDAP_AUTO_FAILBACK_PERIOD
    | LDAP_FAILOVER_TO_STD
    | LDAP_REFRESH_DN
```

Parameters

- **policy-name –** the name of the login policy. Specify root to modify the root login policy.
- **policy-option-name –** the name of the policy option. See *Login Policy Options* and *LDAP Login Policy Options* for details on each option.
- **policy-option-value –** the value assigned to the login policy option. If you specify UNLIMITED, no limits are used. If you specify DEFAULT, the default limits are used. See *Login Policy Options* and *LDAP Login Policy Options* for supported values for each option.

Applies to

Simplex and multiplex.

Examples

- **Example 1 –** see *Logical Server Access Configuration* and *Multiplex Login Policy Configuration* :
- **Example 2 –** sets the password_life_time value to `UNLIMITED` and the max_failed_login_attempts value to `5` in the `Test1` login policy:

```
ALTER LOGIN POLICY Test1
password_life_time=UNLIMITED
max_failed_login_attempts=5;
```

Usage

If you do not specify a policy option, values for this login policy are taken from the root login policy. New policies do not inherit the MAX_NON_DBA_CONNECTIONS and ROOT_AUTO_UNLOCK_TIME policy options.

All new databases include a root login policy. You can modify the root login policy values, but you cannot delete the policy.

Permissions

Requires the MANAGE ANY LOGIN POLICY system privilege.

Login Policy Options

Available options for root and user-defined login policies.

Option	Description
AUTO_UN-LOCK_TIME	The time period after which locked accounts not granted the MANAGE ANY USER system privilege are automatically unlocked. This option can be defined in any login policy, including the root login policy. • **Values –** 0 – UNLIMITED • **Default –** UNLIMITED • **Applies to –** All users not granted the MANAGE ANY USER system privilege.
CHANGE_PASS-WORD_DUAL_CON-TROL	Requires input from two users, each granted the CHANGE PASSWORD system privilege, to change the password of another user. • **Values –** ON, OFF • **Default –** OFF • **Applies to –** All users.

Option	Description

DEFAULT_LOGICAL_SERVER	If the connection string specifies no logical server, the user connects to the DEFAULT_LOGICAL_SERVER option specified in the user's login policy.
	• **Values –**
	  • Name of an existing user-defined logical server
	  • ALL – allows access to all logical servers.
	  • AUTO – value of the default logical server in the root login policy.
	  • COORDINATOR – the current coordinator node.
	  • NONE – denies access to any multiplex server.
	  • OPEN – use alone or with the name of a user-defined logical server. Allows access to all multiplex nodes that are not members of any user-defined logical servers.
	  • SERVER – allows access to all of the multiplex nodes, subject to the semantics of the SERVER logical server.
	• **Default –** AUTO
	• **Applies to –** All users. Requires MANAGE MULTIPLEX system privilege.

LOCKED	If set ON, users cannot establish new connections. This setting temporarily denies access to login policy users. Logical server overrides for this option are not allowed. • **Values –** ON, OFF • **Default –** OFF • **Applies to –** All users except those with the MANAGE ANY USER system privilege.
MAX_CONNECTIONS	The maximum number of concurrent connections allowed for a user. You can specify a per-logical-server setting for this option. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users except those with the SERVER OPERATOR or DROP CONNECTION system privilege.

Option	Description
MAX_DAYS_SINCE_LOGIN	The maximum number of days that can elapse between two successive logins by the same user. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users except those with the MANAGE ANY USER system privilege.
MAX_FAILED_LOGIN_ATTEMPTS	The maximum number of failed attempts, since the last successful attempt, to log into the user account before the account is locked. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users.
MAX_NON_DBA_CONNECTIONS	The maximum number of concurrent connections that a user without SERVER OPERATOR or DROP CONNECTION system privileges can make. This option is supported only in the root login policy. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users except those with the SERVER OPERATOR or DROP CONNECTION privilege.
PASSWORD_EXPIRY_ON_NEXT_LOGIN	If set ON, the user's password expires at the next login. • **Values –** ON, OFF • **Default –** OFF • **Applies to –** All users. **Note:** This functionality is not currently implemented when logging in to Sybase Control Center. A user will not be prompted to change their password. He or she will be prompted, however, when logging in to SAP Sybase IQ outside of Sybase Control Center (for example, using Interactive SQL).
PASSWORD_GRACE_TIME	The number of days before password expiration during which login is allowed but the default post_login procedure issues warnings. • **Values –** 0 – 2147483647 • **Default –** 0 • **Applies to –** All users.

Option	Description
PASS-WORD_LIFE_TIME	The maximum number of days before a password must be changed. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users.
ROOT_AUTO_UN-LOCK_TIME	The time period after which locked accounts granted the MANAGE ANY USER system privilege are automatically unlocked. This option can be defined only in the root login policy. • **Values –** 0 – UNLIMITED • **Default –** 15 • **Applies to –** All users granted the MANAGE ANY USER system privilege.

LDAP Login Policy Options

Available login policy options for LDAP user authentication

Option	Description
LDAP_PRI-MARY_SERV-ER	Specifies the name of the primary LDAP server. • **Values –** n/a • **Default –** None • **Applies to –** All users.
LDAP_SECON-DARY_SERV-ER	Specifies the name of the secondary LDAP server. • **Values –** n/a • **Default –** None • **Applies to –** All users.
LDAP_AU-TO_FAIL-BACK_PERIOD	Specifies the time period, in minutes, after which automatic failback to the primary server is attempted. • **Values –** 0 - 2147483647 • **Default –** 15 minutes • **Applies to –** All users.

Option	Description
LDAP_FAIL-OVER_TO_STD	Permits authentication with standard authentication when authentication with the LDAP server fails due to system resources, network outage, connection timeouts, or similar system failures. However, it does not permit an actual authentication failure returned from an LDAP server to fail over to standard authentication. • **Values –** ON, OFF • **Default –** ON • **Applies to –** All users.
LDAP_RE-FRESH_DN	Updates the ldap_refresh_dn value in the `ISYSLOGINPOLICYOPTION` system table with the current time, stored in Coordinated Universal Time (UTC). Each time a user authenticates with LDAP, if the value of ldap_refresh_dn in `ISYSLOGINPOLICYOPTION` is more recent than the value of user_dn in `ISYSUSER`, a search for a new user DN occurs. The user_dn value is then updated with the new user DN and the user_dn_changed_at value is again updated to the current time. • **Values –** NOW • **Initial value for ROOT policy –** NULL • **Initial value for user-defined login policy –** Current time stored in UTC • **Applies to –** All users.

Multiplex Login Policy Configuration

Configure login policies for multiplex servers.

Example

This example overrides the login policy settings on a logical server, increasing the maximum number of connections on logical server `ls1`:

```
ALTER LOGIN POLICY lp1 max_connections=20 LOGICAL SERVER ls1;
```

Usage

Applies only to multiplex.

Any login management commands you execute on any multiplex server automatically propagate to all servers in the multiplex. For best performance, execute these commands, or any DDL, on the coordinator.

An override at the logical server level override means that a particular login policy option has different settings for different logical servers. `SYS.ISYSIQLSLOGINPOLICYOPTION` stores login policy option values for logical-server override. For each logical-server override of a login policy option, a corresponding row exists in `ISYSIQLSLOGINPOLICYOPTION`.

Logical Server Access Configuration

Configure logical server access.

Example 1

Assume that the root login policy allows access to logical servers `ls4` and `ls5` and login policy `lp1` exists with no logical server assignment. The statement below effectively assigns login policy `lp1` to logical servers `ls4` and `ls5`.

Assign logical server `ls1` to login policy `lp1`:

```
ALTER LOGIN POLICY lp1 ADD LOGICAL SERVER ls1
```

Example 2

This statement allows access of logical servers `ls2` and `ls3` from login policy `lp1`:

```
ALTER LOGIN POLICY lp1 ADD LOGICAL SERVER ls2, ls3
```

Example 3

Modify login policy `lp1` to allow access to `ls3` and `ls4`only:

```
ALTER LOGIN POLICY lp1 ADD LOGICAL SERVER ls4
```

```
ALTER LOGIN POLICY lp1 DROP LOGICAL SERVER ls1, ls2
```

or:

```
ALTER LOGIN POLICY lp1 SET LOGICAL SERVER ls3, ls4
```

Example 4

Modify login policy`lp1` to deny access to any logical servers:

```
ALTER LOGIN POLICY lp1 SET LOGICAL SERVER NONE
```

Example 5

Drop current logical server assignments of login policy`lp1` and allow it to inherit the logical server assignments of the root login policy:

```
ALTER LOGIN POLICY lp1 SET LOGICAL SERVER DEFAULT
```

Usage

ADD, DROP, or SET clauses let you configure the logical server assignments of a login policy:

- **ADD –** adds new logical server assignments to a login policy.
- **DROP –** deletes existing logical server assignments from a login policy.
- **SET –** replaces all logical server assignments for a login policy with a new set of logical server.

Use only one ADD, DROP, or SET clause. Use SERVER, NONE, and DEFAULT clauses only with the SET clause. Specify a particular logical server name only once per ls-assignment list or ls-override list.

An error is returned if:

- Any logical server specified with the ADD clause is already assigned to the login policy.
- Any logical server specified with the DROP clause is currently not assigned to the login policy.
- Logical server assignment change may cause a membership overlap among assigned logical servers.

`SYS.ISYSIQLOGINPOLICYLSINFO` stores logical server assignment information. For each logical-server override of a login policy option, a corresponding row exists in `ISYSIQLOGINPOLICYLSINFO`.

ALTER ROLE Statement

Migrates a compatibility role to a user-defined system role, then automatically drops the compatibility role.

Note: You cannot use the ALTER ROLE statement to migrate SYS_AUTH_SA_ROLE or SYS_AUTH_SSO_ROLE. These roles are automatically migrated when SYS_AUTH_DBA_ROLE is migrated.

Syntax

Syntax 1 – To migrate SYS_AUTH_DBA_ROLE

```
ALTER ROLE predefined_sys_role_name
   MIGRATE TO new_role_name [, new_sa_role_name, new_sso_role_name]
```

Syntax 2 – To migrate all other compatibility roles

```
ALTER ROLE predefined_sys_role_name
   MIGRATE TO new_role_name
```

Parameters

- **predefined_sys_role_name –** the name of a compatibility role that still exists (has not already been dropped) in the database.
- **new_role_name –** the name of the new role cannot begin with the prefix SYS_ or end with the suffix _ROLE.
- **new_sa_role_name –** required only when migrating SYS_AUTH_DBA_ROLE. The new role to which the underlying system privileges of SYS_AUTH_SA_ROLE are to be migrated to cannot already exist in the database, and the new role name cannot begin with the prefix SYS_ or end with the suffix _ROLE.
- **new_sso_role_name –** required only when migrating SYS_AUTH_DBA_ROLE. The new role to which the underlying system privileges of SYS_AUTH_SSO_ROLE are to be migrated to cannot already exist in the database, and the new role name cannot begin with the prefix SYS_ or end with the suffix _ROLE.

Examples

- **Example 1 –** migrates SYS_AUTH_DBA_ROLE to the new roles `Custom_DBA`, `Custom_SA`, and `Custom_SSO` respectively. It then automatically migrates all users, underlying system privileges, and roles granted to SYS_AUTH_DBA_ROLE to the applicable new roles. Finally, it drops SYS_AUTH_DBA_ROLE, SYS_AUTH_SA_ROLE, and SYS_AUTH_SSO_ROLE.

```
ALTER ROLE SYS_AUTH_DBA_ROLE
MIGRATE TO Custom_DBA, Custom_SA, Custom_SSO
```

- **Example 2 –** migrates SYS_AUTH_OPERATOR_ROLE role to the new role `Operator_role`. It then automatically migrates all users, underlying system privileges, and roles granted to SYS_AUTH_OPERATOR_ROLE to the new role and drops SYS_AUTH_OPERATOR_ROLE.

```
ALTER ROLE SYS_AUTH_OPERATOR_ROLE
MIGRATE TO Operator_role
```

Usage

During the migration process:

- A new user-defined role is created.
- All of the system privileges currently granted to the migrating predefined role are automatically granted to the new user-defined role.
- All users and roles currently granted to the migrating predefined role are automatically granted to the new user-defined role.
- The compatibility role is dropped.

Since no role administrator was specified during the migration process, only global role administrators can manage the new role. Use the CREATE ROLE statement to add role administrators with appropriate administrative rights to the role.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

Requires the MANAGE ROLES system privilege granted with administrative rights.

ALTER USER Statement

Changes user settings.

Syntax

Syntax 1 – Change the definition of a database user

```
ALTER USER user-name
    | [ IDENTIFIED BY password ]
```

```
    | [ LOGIN POLICY policy-name ]
    | [ FORCE PASSWORD CHANGE { ON | OFF } ]
```

Syntax 2 – Refresh the Distinguished Name (DN) for an LDAP user

```
ALTER USER user-name
    REFRESH DN
```

Syntax 3 – Revert a user's login policy to the original values

```
ALTER USER user-name
    RESET LOGIN POLICY
```

Syntax 4 – Change a user's password when CHANGE_PASSWORD_DUAL_CONTROL is enabled in a user's login policy.

```
ALTER USER user-name
    IDENTIFIED [ FIRST | LAST ] BY password_part
```

Parameters

- **user-name –** name of the user.
- **IDENTIFIED BY –** the password for the user. Clause is not supported (ERROR) when CHANGE_PASSWORD_DUAL_CONTROL option is enabled in a user's login policy
- **IDENTIFIED[FIRST | LAST] BY –** clause mandatory when CHANGE_PASSWORD_DUAL_CONTROL option is enabled in a target user's login policy. FIRST | LAST keyword specifies the part of the dual password part being defined.
- **policy-name –** name of the login policy to assign the user. No change is made if you do not specify a login policy. No change is made if the LOGIN POLICY clause is not specified.
- **FORCE PASSWORD CHANGE –** controls whether the user must specify a new password upon logging in. This setting overrides the PASSWORD_EXPIRY_ON_NEXT_LOGIN option setting in the user's login policy.

  Note: This functionality is not currently implemented when logging in to Sybase Control Center. A user will not be prompted to change their password. He or she will be prompted, however, when logging in to SAP Sybase IQ outside of Sybase Control Center (for example, using Interactive SQL).

- **RESET LOGIN POLICY –** reverts the settings of the user's login to the original values in the login policy. This usually clears all locks that are implicitly set due to the user exceeding the failed logins or exceeding the maximum number of days since the last login. When you reset a login policy, a user can access an account that has been locked for exceeding a login policy option limit such as MAX_FAILED_LOGIN_ATTEMPTS or MAX_DAYS_SINCE_LOGIN.
- **REFRESH DN –** clears the saved DN and timestamp for a user, which is used during LDAP authentication.

Examples

- **Example 1 –** alters a user named `SQLTester`. The password is set to `welcome`. The `SQLTester` user is assigned to the `Test1` login policy and the password does not expire on the next login:

```
ALTER USER SQLTester
IDENTIFIED BY welcome
LOGIN POLICY Test1
FORCE PASSWORD CHANGE OFF
```

- **Example 2 –** clears the distinguished name (DN) and timestamp for a user named `Mary` used for LDAP authentication:

```
ALTER USER Mary REFRESH DN
```

- **Example 3 –** sets the password for user3 to PassPart1PassPart2. This assumes that `user1` and `user2` have the CHANGE PASSWORD system privilege and the change_password_dual_control option is enabled (ON) in the login policy for `user3`:

  User1 enters:

```
ALTER USER user3 IDENTIFIED FIRST BY PassPart1
```

  User2 enters:

```
ALTER USER user3 IDENTIFIED LAST BY PassPart2
```

  Once set, user3 logs on by entering the password `PassPart1PassPart2`.

Usage

User IDs and passwords cannot:

- Begin with white space, single quotes, or double quotes
- End with white space
- Contain semicolons

Passwords cannot exceed 255 characters.

If you set the `PASSWORD_EXPIRY_ON_NEXT_LOGIN` value to ON, the passwords of all users assigned to this login policy expire immediately when he or she next logs in. You can use the **ALTER USER** and **LOGIN POLICY** clauses to force users to change their passwords at the next login.

If the CHANGE_PASSWORD_DUAL CONTROL login policy option is disable (OFF) during the dual password change process:

- the target user will be unable to log in with the single password part already defined. The **ALTER USER** command must be reissued using single password control syntax.

- If the option is disabled after the dual password change process is complete, but before the target user logs in, there is no impact on the target user. The target user must log in using both password parts.

If the target user is already logged in when the dual password change process occurs, the user cannot change their password in the current session until both parts of the new password are set. Once the dual password change process is complete, the target user can use **GRANT CONNECT**, **ALTER USER**, **sp_password**, or **sp_iqpassword** to the password without first logging out. The prompt to enter the current password, use the new dual control password, not the password originally entered for the current session.

The **GRANT CONNECT** statement is not supported during for the dual password change process to set either password part. However, once the dual password change process is complete, the target user can use the **GRANT CONNECT** statement, **ALTER USER**, **sp_password**, or **sp_iqpassword** to change their password without first logging out.

As soon as both parts of the password are successfully specified by users with the CHANGE PASSWORD system privilege, the password for the target user is automatically expired. This forces the target user to change the password the next time he or she logs in.

The encryption algorithm used for hashing the user passwords is FIPS-certified encryption support:

- The DLL is called **dbfips10.dll**
- The HASH function accepts the algorithms: **SHA1_FIPS SHA256_FIPS**
- If the **-fips** server option is specified and an algorithm that is not FIPS-certified is given to the HASH function, the database server uses **SHA1_FIPS** instead of **SHA1**, **SHA256_FIPS** instead of **SHA256**, and returns an error if **MD5** is used (**MD5** is not a FIPS-certified algorithm).
- If the **-fips** option is specified, the database server uses SHA256_FIPS for password hashing.

Standards

- SQL – Vendor extension to ISO/ANSI SQL grammar.
- Sybase – Not supported by Adaptive Server Enterprise.

Permissions

- To change own password – None required.
- To change the password of any user – Requires the CHANGE PASSWORD system privilege.
- To use the **LOGIN POLICY**, **FORCE PASSWORD CHANGE**, **RESET LOGIN POLICY**, or **REFRESH DN** clauses requires the MANAGE ANY USER system privilege.

CREATE LDAP SERVER Statement

Creates a new LDAP server configuration object for LDAP user authentication. Parameters defined during the creation of an LDAP server configuration object are stored in the ISYSLDAPSERVER (system view SYSLDAPSERVER) system table.

Syntax

```
CREATE LDAP SERVER ldapua-server-name
   [ ldapua-server-attribs ]
   [ WITH ACTIVATE ]

ldapua-server-attribs:
   SEARCH DN
      URL { 'URL_string' | NULL }
      | ACCESS ACCOUNT { 'DN_string' | NULL }
      | IDENTIFIED BY ( 'password' | NULL }
      | IDENTIFIED BY ENCRYPTED { encrypted-password | NULL }
   | AUTHENTICATION URL { 'URL_string' | NULL }
   | CONNECTION TIMEOUT timeout_value
   | CONNECTION RETRIES retry_value
   | TLS { ON | OFF }
```

Parameters

- **URL –** identifies the host (by name or by IP address), port number, and the search to be performed for the DN lookup for a given user ID. This value is validated for correct LDAP URL syntax before it is stored in the ISYSLDAPSERVER system table. The maximum size for this string is 1024 bytes.
- **ACCESS ACCOUNT –** user created in the LDAP server for use by SAP Sybase IQ, not a user within SAP Sybase IQ. The distinguished name (DN) for this user is used to connect to the LDAP server. This user has permissions within the LDAP server to search for DNs by user ID in the locations specified by the SEARCH DN URL. The maximum size for this string is 1024 bytes.
- **IDENTIFIED BY –** provides the password associated with the ACCESS ACCOUNT user. The password is stored using symmetric encryption on disk. Use the value NULL to clear the password and set it to none. The maximum size of a clear text password is 255 bytes.
- **IDENTIFIED BY ENCRYPTED –** configures the password associated with the ACCESS ACCOUNT distinguished name in an encrypted format. The binary value is the encrypted password and is stored on disk as is. Use the value NULL to clear the password and set it to none. The maximum size of the binary is 289 bytes. The encrypted key should be a valid varbinary value. Do not enclose the encrypted key in quotation marks.
- **AUTHENTICATION URL –** identifies the host (by name or IP address) and the port number of the LDAP server to use for authentication of the user. This is the value defined

for URL_string and is validated for correct LDAP URL syntax before it is stored in ISYSLDAPSERVER system table. The DN of the user obtained from a prior DN search and the user password bind a new connection to the authentication URL. A successful connection to the LDAP server is considered proof of the identity of the connecting user. The maximum size for this string is 1024 bytes.

- **CONNECTION TIMEOUT –** specifies the connection timeout from SAP Sybase IQ to the LDAP server for both DN searches and authentication. This value is in milliseconds, with a default value of 10 seconds.
- **CONNECTION RETRIES –** specifies the number of retries on connections from SAP Sybase IQ to the LDAP server for both DN searches and authentication. The valid range of values is 1– 60, with a default value of 3.
- **TLS –** defines whether the TLS or Secure LDAP protocol is used for connections to the LDAP server for both DN searches and authentication. When set to ON, the TLS protocol is used and the URL would being with "ldap://" When set to OFF (or not specified), Secure LDAP protocol is used and the URL begins with “ldaps://”. When using the TLS protocol, specify the database security option TRUSTED_CERTIFICATES_FILE with a file name containing the certificate of the Certificate Authority (CA) that signed the certificate used by the LDAP server.
- **WITH ACTIVATE –** activates the LDAP server configuration object for immediate use upon creation. This permits the definition and activation of LDAP User Authentication in one statement. The LDAP server configuration object state changes to READY when WITH ACTIVATE is used.

Examples

- **Example 1 –** sets the search parameters, the authentication URL, and sets a three second timeout, and activates the server so it can begin authenticating users. It connects to the LDAP server without TLS or SECURE LDAP protocols.

```
SET OPTION PUBLIC.login_mode = ‘Standard,LDAPUA’
CREATE LDAP SERVER apps_primary
SEARCH DN
    URL 'ldap://my_LDAPserver:389/dc=MyCompany,dc=com??sub?cn=*'
    ACCESS ACCOUNT 'cn=aseadmin, cn=Users, dc=mycompany, dc=com'
    IDENTIFIED BY 'Secret99Password'
AUTHENTICATION URL 'ldap://my_LDAPserver:389/'
CONNECTION TIMEOUT 3000
WITH ACTIVATE
```

- **Example 2 –** uses the same search parameters as example 1, but specifies “ldaps” so that a Secure LDAP connection is established with the LDAP server on host my_LDAPserver, port 636. Only LDAP clients using the Secure LDAP protocol may now connect on this port. The database security option TRUSTED_CERTIFICATE_FILE must be set with a file name containing the certificate of the certificate authority (CA) that signed the certificate used by the LDAP server at "ldaps://my_LDAPserver:636". During the handshake with the LDAP server, the certificate presented by the LDAP server is checked

by the SAP Sybase IQ server (the LDAP client) to ensure that it is signed by one of the certificates listed in the file. This establishes trust by the client that the server is who it says it is. The ACCESS ACCOUNT and IDENTIFIED BY parameters establish trust by the LDAP server that the client is who it says it is.

Note: The TLS parameter must be OFF when Secure LDAP is used instead of TLS protocol.

```
SET OPTION PUBLIC.login_mode = 'Standard,LDAPUA'
SET OPTION PUBLIC.trusted_certificates_file = '/mycompany/shared/
trusted.txt'
CREATE LDAP SERVER secure_primary
SEARCH DN
    URL  'ldaps://my_LDPAserver:636/dc=MyCompany,dc=com??sub?
cn=*'
    ACCESS ACCOUNT 'cn=aseadmin, cn=Users, dc=mycompany, dc=com'
    IDENTIFIED BY 'Secret99Password'
AUTHENTICATION URL 'ldaps://my_LDAPserver:636/'
CONNECTION TIMEOUT 3000
TLS OFF
WITH ACTIVATE
```

- **Example 3 –** establishes the TLS protocol on port 389. It also requires database security option TRUSTED_CERTIFICATE_FILE to be set with a file name and provides the same type of security as example 2. In this example, the TLS protocol is ON to facilitate wider support by LDAP server vendors.

Note: Check the requirements of all your LDAP servers when deciding how to configure Secure LDAP or TLS for an SAP Sybase IQ server.

```
SET OPTION PUBLIC.login_mode = 'Standard,LDAPUA'
SET OPTION PUBLIC.trusted_certificates_file = '/mycompany/shared/
trusted.txt'
CREATE LDAP SERVER tls_primary
SEARCH DN
   URL  'ldap://my_LDAPserver:389/dc=MyCompany,dc=com??sub?cn=*'
    ACCESS ACCOUNT 'cn=aseadmin, cn=Users, dc=mycompany, dc=com'
    IDENTIFIED BY 'Secret99Password'
AUTHENTICATION URL 'ldap://my_LDAPserver:389/'
CONNECTION TIMEOUT 3000
TLS ON
WITH ACTIVATE
```

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

Requires the MANAGE ANY LDAP SERVER system privilege.

CREATE LOGIN POLICY Statement

Creates a login policy in the database.

Syntax

```
CREATE LOGIN POLICY policy-name policy-option

policy-option:
   policy-option-name = policy-option-value

policy-option-value:
   { UNLIMITED | DEFAULT | value }

policy-option-name:
  AUTO_UNLOCK_TIME
    | CHANGE_PASSWORD_DUAL_CONTROL
    | DEFAULT_LOGICAL_SERVER
    | LOCKED
    | MAX_CONNECTIONS
    | MAX_DAYS_SINCE_LOGIN
    | MAX_FAILED_LOGIN_ATTEMPTS
    | MAX_NON_DBA_CONNECTIONS
    | PASSWORD_EXPIRY_ON_NEXT_LOGIN
    | PASSWORD_GRACE_TIME
    | PASSWORD_LIFE_TIME
    | ROOT_AUTO_UNLOCK_TIME
    | LDAP_PRIMARY_SERVER
    | LDAP_SECONDARY_SERVER
    | LDAP_AUTO_FAILBACK_PERIOD
    | LDAP_FAILOVER_TO_STD
    | LDAP_REFRESH_DN
```

Parameters

- **policy-name –** the name of the login policy. Specify root to modify the root login policy.
- **policy-option-name –** the name of the policy option. See *Login Policy Options* and *LDAP Login Policy Options* for details on each option.
- **policy-option-value –** the value assigned to the login policy option. If you specify UNLIMITED, no limits are used. If you specify DEFAULT, the default limits are used. See *Login Policy Options* and *LDAP Login Policy Options* for supported values for each option.

Applies to

Simplex and multiplex.

Examples

- **Example 1 –** creates the `Test1` login policy. This login policy has an unlimited password life and allows the user a maximum of five attempts to enter a correct password before the account is locked.

```
CREATE LOGIN POLICY Test1
password_life_time=UNLIMITED
max_failed_login_attempts=5;
```

Usage

If you do not specify a policy option, values for this login policy are taken from the root login policy. New policies do not inherit the MAX_NON_DBA_CONNECTIONS and ROOT_AUTO_UNLOCK_TIME policy options.

Permissions

Requires MANAGE ANY LOGIN POLICY system privilege.

The following system privileges can override the noted login policy options:

Exception System Privilege	Login Policy Option
SERVER OPERATOR or DROP CONNECTION system privilege	MAX_NON_DBA_CONNS MAX_CONNECTIONS
MANAGE ANY USER system privilege	LOCKED MAX_DAYS_SINCE_LOGIN

Login Policy Options

Available options for root and user-defined login policies.

Option	Description
AUTO_UNLOCK_TIME	The time period after which locked accounts not granted the MANAGE ANY USER system privilege are automatically unlocked. This option can be defined in any login policy, including the root login policy. • **Values –** 0 – UNLIMITED • **Default –** UNLIMITED • **Applies to –** All users not granted the MANAGE ANY USER system privilege.

Option	Description
CHANGE_PASSWORD_DUAL_CONTROL	Requires input from two users, each granted the CHANGE PASSWORD system privilege, to change the password of another user. • **Values –** ON, OFF • **Default –** OFF • **Applies to –** All users.

DEFAULT_LOGICAL_SERVER	If the connection string specifies no logical server, the user connects to the DEFAULT_LOGICAL_SERVER option specified in the user's login policy.
	• **Values –**
	  • Name of an existing user-defined logical server
	  • ALL – allows access to all logical servers.
	  • AUTO – value of the default logical server in the root login policy.
	  • COORDINATOR – the current coordinator node.
	  • NONE – denies access to any multiplex server.
	  • OPEN – use alone or with the name of a user-defined logical server. Allows access to all multiplex nodes that are not members of any user-defined logical servers.
	  • SERVER – allows access to all of the multiplex nodes, subject to the semantics of the SERVER logical server.
	• **Default –** AUTO
	• **Applies to –** All users. Requires MANAGE MULTIPLEX system privilege.

LOCKED	If set ON, users cannot establish new connections. This setting temporarily denies access to login policy users. Logical server overrides for this option are not allowed. • **Values –** ON, OFF • **Default –** OFF • **Applies to –** All users except those with the MANAGE ANY USER system privilege.

Option	Description
MAX_CONNECTIONS	The maximum number of concurrent connections allowed for a user. You can specify a per-logical-server setting for this option. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users except those with the SERVER OPERATOR or DROP CONNECTION system privilege.
MAX_DAYS_SINCE_LOGIN	The maximum number of days that can elapse between two successive logins by the same user. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users except those with the MANAGE ANY USER system privilege.
MAX_FAILED_LOGIN_ATTEMPTS	The maximum number of failed attempts, since the last successful attempt, to log into the user account before the account is locked. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users.
MAX_NON_DBA_CONNECTIONS	The maximum number of concurrent connections that a user without SERVER OPERATOR or DROP CONNECTION system privileges can make. This option is supported only in the root login policy. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users except those with the SERVER OPERATOR or DROP CONNECTION privilege.
PASSWORD_EXPIRY_ON_NEXT_LOGIN	If set ON, the user's password expires at the next login. • **Values –** ON, OFF • **Default –** OFF • **Applies to –** All users. **Note:** This functionality is not currently implemented when logging in to Sybase Control Center. A user will not be prompted to change their password. He or she will be prompted, however, when logging in to SAP Sybase IQ outside of Sybase Control Center (for example, using Interactive SQL).

Option	Description
PASSWORD_GRACE_TIME	The number of days before password expiration during which login is allowed but the default post_login procedure issues warnings. • **Values –** 0 – 2147483647 • **Default –** 0 • **Applies to –** All users.
PASSWORD_LIFE_TIME	The maximum number of days before a password must be changed. • **Values –** 0 – 2147483647 • **Default –** UNLIMITED • **Applies to –** All users.
ROOT_AUTO_UNLOCK_TIME	The time period after which locked accounts granted the MANAGE ANY USER system privilege are automatically unlocked. This option can be defined only in the root login policy. • **Values –** 0 – UNLIMITED • **Default –** 15 • **Applies to –** All users granted the MANAGE ANY USER system privilege.

LDAP Login Policy Options

Available login policy options for LDAP user authentication

Option	Description
LDAP_PRIMARY_SERVER	Specifies the name of the primary LDAP server. • **Values –** n/a • **Default –** None • **Applies to –** All users.
LDAP_SECONDARY_SERVER	Specifies the name of the secondary LDAP server. • **Values –** n/a • **Default –** None • **Applies to –** All users.

Option	Description
LDAP_AUTO_FAILBACK_PERIOD	Specifies the time period, in minutes, after which automatic failback to the primary server is attempted. • **Values –** 0 - 2147483647 • **Default –** 15 minutes • **Applies to –** All users.
LDAP_FAILOVER_TO_STD	Permits authentication with standard authentication when authentication with the LDAP server fails due to system resources, network outage, connection timeouts, or similar system failures. However, it does not permit an actual authentication failure returned from an LDAP server to fail over to standard authentication. • **Values –** ON, OFF • **Default –** ON • **Applies to –** All users.
LDAP_REFRESH_DN	Updates the ldap_refresh_dn value in the `ISYSLOGINPOLICYOPTION` system table with the current time, stored in Coordinated Universal Time (UTC). Each time a user authenticates with LDAP, if the value of ldap_refresh_dn in `ISYSLOGINPOLICYOPTION` is more recent than the value of user_dn in `ISYSUSER`, a search for a new user DN occurs. The user_dn value is then updated with the new user DN and the user_dn_changed_at value is again updated to the current time. • **Values –** NOW • **Initial value for ROOT policy –** NULL • **Initial value for user-defined login policy –** Current time stored in UTC • **Applies to –** All users.

Multiplex Login Policy Configuration

Configure login policies for multiplex servers.

Example

This example overrides the login policy settings on a logical server, increasing the maximum number of connections on logical server `ls1`:

```
ALTER LOGIN POLICY lp1 max_connections=20 LOGICAL SERVER ls1;
```

Usage

Applies only to multiplex.

Any login management commands you execute on any multiplex server automatically propagate to all servers in the multiplex. For best performance, execute these commands, or any DDL, on the coordinator.

An override at the logical server level override means that a particular login policy option has different settings for different logical servers. `SYS.ISYSIQLSLOGINPOLICYOPTION` stores login policy option values for logical-server override. For each logical-server override of a login policy option, a corresponding row exists in `ISYSIQLSLOGINPOLICYOPTION`.

CREATE ROLE Statement

Creates a new role, extends an existing user to act as a role, or manages role administrators on a role.

Syntax

```
CREATE [ OR REPLACE ] ROLE { role_name | FOR USER userID }
    [ WITH ADMIN [ ONLY ] admin_name [...,], [ SYS_MANAGE_ROLES_ROLE ]
```

Parameters

- **role_name –** unless you are using the OR REPLACE clause, *role_name* cannot already exist in the database.
- **OR REPLACE –** *role_name* must already exist in the database. If *role_name* does not already exist, a new user-defined role is created. All current administrators are replaced by those specified in the *admin_name [..]* clause as follows:
  - All existing role administrators granted the WITH ADMIN OPTION not included on the new role administrators list become members of the role with no administrative rights on the role.
  - All existing role administrators granted the WITH ADMIN ONLY OPTION not included on the new role administrators list are removed as members of the role.

  When using the OR REPLACE clause, if an existing role administrator is included on the new role administrators list he or she retains his or her original administrative rights if they are higher than the replacement rights. For example, User A is an existing role administrator originally granted WITH ADMIN rights on the role. New role administrators are granted WITH ADMIN ONLY rights. If User A is included on this list, User A retains the higher WITH ADMIN rights.
- **FOR USER –** when using the FOR USER clause without the OR REPLACE, *userID* must be the name of an existing user that currently does not have the ability to act as a role.
- **admin_name –** list of users to be designated administrators of the role.

- **WITH ADMIN –** each *admin_name* specified is granted administrative privileges over the role in addition to all underlying system privileges. WITH ADMIN clause is not valid when SYS_MANAGE_ROLES_ROLE is included on the list.
- **WITH ADMIN ONLY –** each *admin_name* specified is granted administrative privileges only over the role, not the underlying system privileges.
- **SYS_MANAGE_ROLES_ROLE –** allows global role administrators to administer the role. Can be specified in conjunction with the WITH ADMIN ONLY clause.

Examples

- **Example 1 –** creates the role `Sales`. Only global role administrator can administer the role.

```
CREATE ROLE Sales
```

- **Example 2 –** extends the existing user `Jane` to act as a role.

```
CREATE OR REPLACE ROLE FOR USER Jane
```

- **Example 3 –** creates the role `Finance` with `Mary` and `Jeff` as role administrators with administrative rights to the role. Global role administrators cannot administer this role.

```
CREATE ROLE Finance
WITH ADMIN Mary, Jeff
```

- **Example 3 –** creates the role `Marketing` with `Mary` and `Jeff` as role administrators. Global role administrators can also manage this role.

```
CREATE ROLE Finance
WITH ADMIN ONLY Mary, Jeff, SYS_MANAGE_ROLES_ROLE
```

- **Example 4 –** `Finance` is an existing role with `Harry` and `Susan` as role administrators with administrative rights. You want to keep `Susan` as an administrator, replace `Harry`, and add the global role administrator. The new role administrators will have administrative rights only.

  This statement keeps `Susan` as an administrator, but `Susan` retains administrative rights to the role since the original administrative rights granted were higher. `Harry` is replaced by `Bob` and `Sarah`, with administrative rights only, and the global role administrator is added to the role. `Harry` remains a member of the role, but has no administrative rights.

```
CREATE OR REPLACE ROLE Finance
WITH ADMIN ONLY Susan, Bob, Sarah, SYS_MANAGE_ROLE_ROLE
```

Usage

If you specify role administrators (*admin_name*), but do not include the global role administrator (SYS_MANAGE_ROLES_ROLE), global role administrators will be unable to manage the new role. Therefore, it is recommended that you not specify role administrators during the creation process. Use the OR REPLACE clause to add them afterwards.

If you do not specify an ADMIN clause, the default WITH ADMIN ONLY clause is used and the default administrator is the global roles administrator (SYS_MANAGE_ROLES_ROLE).

When replacing role administrators, if the role has a global role administrator, it must be included on the new role administrators list or it is removed from the role.

However, when using the WITH ADMIN clause to grant role administrators, since the clause is not valid for global role administrators, you must use the **GRANT ROLE** statement to re-add the global role administrator (SYS_MANAGE_RILES_ROLE) to the role. Failure to perform this grant means global role administrators are unable to manage the role.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

- Create a new role – Requires the MANAGE ROLES system privilege.
- OR REPLACE clause – Requires the MANAGE ROLES system privilege along with administrative rights over the role being replaced.

CREATE USER Statement

Creates a user.

Syntax

```
CREATE USER   user-name   [ IDENTIFIED BY password ]
    [ LOGIN POLICY policy-name ]
    [ FORCE PASSWORD CHANGE { ON | OFF } ]
```

Parameters

- **user-name –** name of the user.
- **IDENTIFIED BY –** the password for the user.
- **policy-name –** name of the login policy to assign the user. No change is made if you do not specify a login policy.
- **FORCE PASSWORD CHANGE –** controls whether the user must specify a new password upon logging in. This setting overrides the PASSWORD_EXPIRY_ON_NEXT_LOGIN option setting in the user's login policy.

  Note: This functionality is not currently implemented when logging in to Sybase Control Center. A user will not be prompted to change their password. He or she will be prompted, however, when logging in to SAP Sybase IQ outside of Sybase Control Center (for example, using Interactive SQL).

- **password –** You do not have to specify a password for the user. A user without a password cannot connect to the database. This is useful if you are creating a role and do not want anyone to connect to the database using the role user ID. A user ID must be a valid identifier. User IDs and passwords cannot:
  - Begin with white space, single quotes, or double quotes
  - End with white space
  - Contain semicolons

  A password can be either a valid identifier, or a string (maximum 255 characters) placed in single quotes. Passwords are case-sensitive. The password should be composed of 7-bit ASCII characters, as other characters may not work correctly if the database server cannot convert them from the client's character set to UTF-8.

  You can use the VERIFY_PASSWORD_FUNCTION option to specify a function to implement password rules (for example, passwords must include at least one digit). If you do use a password verification function, you cannot specify more than one user ID and password in the **GRANT CONNECT** statement.

  The encryption algorithm used for hashing the user passwords is FIPS-certified encryption support:

  - The DLL is called dbfips10.dll
  - The HASH function accepts the algorithms: SHA1_FIPS SHA256_FIPS
  - If the -fips server option is specified and an algorithm that is not FIPS-certified is given to the HASH function, the database server uses SHA1_FIPS instead of SHA1, SHA256_FIPS instead of SHA256, and returns an error if MD5 is used (MD5 is not a FIPS-certified algorithm).
  - If the -fips option is specified, the database server uses SHA256_FIPS for password hashing.

Examples

- **Example 1 –** creates a user named `SQLTester` with the password welcome. The `SQLTester` user is assigned to the `Test1` login policy and the password expires on the next login:

```
CREATE USER SQLTester IDENTIFIED BY welcome
LOGIN POLICY Test1
FORCE PASSWORD CHANGE ON;
```

Standards

- SQL – Vendor extension to ISO/ANSI SQL grammar.
- Sybase – Not supported by Adaptive Server Enterprise.

Permissions

Requires the MANAGE ANY USER system privilege.

DROP LDAP SERVER Statement

Removes the named LDAP server configuration object from the `SYSLDAPSERVER` system view after verifying that the LDAP server configuration object is not in a READY or ACTIVE state.

Syntax

```
DROP LDAP SERVER ldapua-server-name
    [ WITH DROP ALL REFERENCES ] [ WITH SUSPEND ]
```

Parameters

- **WITH DROP ALL REFERENCES –** allows the removal of an LDAP server configuration object from service that has a reference in a login policy.
- **WITH SUSPEND –** allows an LDAP server configuration object to be dropped even if in a READY or ACTIVE state.

Examples

- **Example 1 –** assuming that references to the LDAP server configuration object have been removed from all login policies, the following two sets of commands are equivalent. Using the WITH DROP ALL REFERENCES and WITH SUSPEND parameters eliminates the need to execute an **ALTER LDAP SERVER** statement before the **DROP LDAP SERVER** statement:

  ```
  DROP LDAP SERVER ldapserver1 WITH DROP ALL REFERENCES WITH SUSPEND
  ```

  is equivalent to

  ```
  ALTER LDAP SERVER ldapserver1 WITH SUSPEND DROP LDAP SERVER
  ldapserver1 WITH DROP ALL REFERENCES
  ```

Usage

The **DROP LDAP SERVER** statement fails when it is issued against an LDAP server configuration object that is in a READY or ACTIVE state. This ensures that an LDAP server configuration object in active use cannot be accidentally dropped. The **DROP LDAP SERVER** statement also fails if a login policy exists with a reference to the LDAP server configuration object.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

Requires the MANAGE ANY LDAP SERVER system privilege.

DROP LOGIN POLICY Statement

Removes a login policy from the database.

Syntax

DROP LOGIN POLICY *policy-name*

Examples

- **Example 1 –** create and then delete the `Test11` login policy:

```
CREATE LOGIN POLICY Test11;
DROP LOGIN POLICY Test11 ;
```

Usage

A **DROP LOGIN POLICY** statement fails if you attempt to drop a policy that is assigned to a user. You can use either the **ALTER USER** statement to change the policy assignment of the user or **DROP USER** to drop the user.

Permissions

Requires the MANAGE ANY LOGIN POLICY system privilege.

DROP ROLE Statement

Removes a user-defined role from the database or converts a user-extended role to a regular user.

Syntax

DROP ROLE [FROM USER] *role_name*
    [**WITH REVOKE**]

Parameters

- **role_name –** must be the name of a role that already exists in the database.
- **FROM USER –** required to convert a user-extended role back to act as a regular user rather than remove it from the database. The *role_name* must exist in the database.

  The user retains any login privileges, system privileges, and roles granted to the user-extended role and becomes the owner of any objects owned by the user-extended role. Any users granted to the user-extended are immediately revoked.

- **WITH REVOKE –** required when dropping a standalone or user-extended role to which users have been granted the underlying system privileges of the role with either the WITH ADMIN OPTION or WITH NO ADMIN OPTION clause.

Examples

- **Example 1 –** converts a user-extended role named `Joe` that has not been granted to other users or roles back to a regular user:

```
DROP ROLE FROM USER Joe
```

- **Example 2 –** drops a user-extended role named `Jack` that has not been granted to other users or roles from the database:

```
DROP ROLE Jack
```

- **Example 3 –** converts a user-extended role named `Sam` that has been granted to other user or roles back to a regular role:

```
DROP ROLE FROM USER Sam
WITH REVOKE
```

- **Example 4 –** drops a standalone role named `Sales2` that has been granted to other users or roles from the database:

```
DROP ROLE Sales2
WITH REVOKE
```

Usage

A user-defined role can be dropped from the database or converted back to a regular user at any time as long as all dependent roles left meet the minimum required number of administrative users with active passwords.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

- Requires administrative rights over the role being dropped.
- If the role being dropped owns objects, none are in use by any user in any session at the time the DROP statement is executed.

DROP USER Statement

Removes a user.

Syntax

```
DROP USER user-name
```

Parameters

- **user-name –** name of the user to remove.

Examples

- **Example 1 –** drops the user `SQLTester` from the database:

```
DROP USER SQLTester
```

Standards

- SQL – ISO/ANSI SQL compliant.
- Sybase – Not supported by Adaptive Server Enterprise.

Permissions

Requires the MANAGE ANY USER system privilege.

Note: When dropping a user, any objects owned by this user and any permissions granted by this user will be removed.

GRANT CHANGE PASSWORD Statement

Allows users to manage passwords for other users and administer the CHANGE PASSWORD system privilege.

Syntax

```
GRANT CHANGE PASSWORD ( target_user_list | ANY | ANY WITH ROLES
target_role_list  )
   TO userID [,...]
   [ WITH ADMIN [ONLY] OPTION | WITH NO ADMIN OPTION]
```

Parameters

- **target_user_list –** users the grantee has the potential to impersonate. The list must consist of existing users or user-extended roles with login passwords. Separate the userIDs in the list with commas.
- **ANY –** all database users with login passwords become potential target users to manage passwords for each grantee.
- **ANY WITH ROLES *target_role_list* –** list of target roles for each grantee. Any users who are granted any of the target roles become potential target users for each grantee. The *target_role_list* must consist of existing roles and the users who are granted said roles must consist of database users with login passwords. Use commas to separate multiple userIDs.

- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.
- **WITH ADMIN OPTION –** (valid with the ANY clause only) The user can both manage passwords and grant the CHANGE PASSWORD system privilege to another user.
- **WITH ADMIN ONLY OPTION –** (valid with the ANY clause only) The user can grant the CHANGE PASSWORD system privilege to another user, but cannot manage passwords of other users.
- **WITH NO ADMIN OPTION –** the user can manage passwords, but cannot grant the CHANGE PASSWORD system privilege to another user.

Examples

- **Example 1 –** grants `Sally` and `Laurel` the ability to mange the password of `Bob`, `Sam`, and `Peter`:

```
GRANT CHANGE PASSWORD (Bob, Sam, Peter) TO (Sally, Laurel)
```

- **Example 2 –** grants `Mary` the right to grant the CHANGE PASSWORD system privilege to any user in the database. However, since the system privilege is granted with the WITH ADMIN ONLY OPTION clause, `Mary` cannot manage the password of any other user.

```
GRANT CHANGE PASSWORD (ANY) TO Mary WITH ADMIN ONLY OPTION
```

- **Example 3 –** grants `Steve` and `Joe` the ability to manage the password of any member of `Role1` or `Role2`:

```
GRANT CHANGE PASSWORD (ANY WITH ROLES Role1, Role2) TO Steve, Joe
```

Usage

A user can be granted the ability to mange the password of any user in the database (ANY) or only specific users (*target_users_list*) or members of specific roles (ANY WITH ROLES *target_roles_list*). Administrative rights to the CHANGE PASSWORD system privilege can only be granted when using the ANY clause.

If no clause is specified, ANY is used by default. If no administrative clause is specified in the grant statement, the WITH NO ADMIN OPTION clause is used.

By default, the CHANGE PASSWORD system privilege is granted to the SYS_AUTH_SA_ROLE compatibility role with the WITH NO ADMIN OPTION clause and to the SYS_AUTH_SSO_ROLE compatibility role with the ADMIN ONLY OPTION clause, if they exist.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

- Requires the CHANGE PASSWORD system privilege granted with administrative rights.
- Each target user specified (target_users_list) is an existing user or user-extended role with a login password.
- Each target role specified (target_roles_list) must be an existing user-extended or user-defined role.

GRANT CONNECT Statement

Grants CONNECT privilege to a user.

Syntax

```
GRANT CONNECT
   TO userID [,...]
   IDENTIFIED BY password [,...]
```

Parameters

- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

Examples

- **Example 1 –** creates two new users for the database named `Laurel` and `Hardy`:

```
GRANT CONNECT TO Laurel, Hardy
IDENTIFIED BY Stan, Ollie
```

- **Example 2 –** creates user `Jane` with no password:

```
GRANT CONNECT TO Jane
```

- **Example 3 –** changes the password for `Bob` to `newpassword`:

```
GRANT CONNECT TO Bob IDENTIFIED BY newpassword
```

Usage

GRANT CONNECT can be used to create a new user or also be used by any user to change their own password.

Tip: Use the **CREATE USER** statement rather than the **GRANT CONNECT** statement to create users.

If you inadvertently enter the user ID of an existing user when you are trying to add a new user, you are actually changing the password of the existing user. You do not receive a warning because this behavior is considered normal.

The stored procedures **sp_addlogin** and **sp_adduser** can also be used to add users. These procedures display an error if you try to add an existing user ID.

Note: Use system procedures, not **GRANT** and **REVOKE** statements to add and remove user IDs.

A user without a password cannot connect to the database. This is useful when you are creating groups and you do not want anyone to connect to the role user ID. To create a user without a password, do not include the IDENTIFIED BY clause.

When specifying a password, it must be a valid identifier Passwords have a maximum length of 255 bytes. If the **VERIFY_PASSWORD_FUNCTION** database option is set to a value other than the empty string, the **GRANT CONNECT TO** statement calls the function identified by the option value. The function returns NULL to indicate that the password conforms to rules. If the `VERIFY_PASSWORD_FUNCTION` option is set, you can specify only one *userid* and *password* with the **GRANT CONNECT** statement.

Invalid names for database user IDs and passwords include those that:

- Begin with white space or single or double quotes
- End with white space
- Contain semicolons

Standards

- SQL – Other syntaxes are vendor extensions to ISO/ANSI SQL grammar.
- Sybase – The security model is different in Adaptive Server Enterprise and SAP Sybase IQ, so other syntaxes differ.

Permissions

- If you are creating a new user, you must have the MANAGE ANY USER system privilege.
- Any user can change his or her own password.
- If you are changing another user's password, you must have the CHANGE PASSWORD system privilege.

Note: If you are changing another user's password, the other user cannot be connected to the database.

See also

- *CREATE USER Statement* on page 261

GRANT CREATE Statement

Grants CREATE privilege on a specified dbspace to the specified users and roles.

Syntax

```
GRANT CREATE
  ON dbspace_name
  TO userID [,...]
```

Parameters

- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

Examples

- **Example 1 –** grants users `Lawrence` and `Swift` `CREATE` privilege on dbspace *DspHist*:

```
GRANT CREATE ON DspHist
TO LAWRENCE, SWIFT
```

- **Example 2 –** grants `CREATE` privilege on dbspace `DspHist` to users `Fiona` and `Ciaran`:

```
GRANT CREATE ON DspHist TO Fiona, Ciaran
```

Standards

- SQL – other syntaxes are vendor extensions to ISO/ANSI SQL grammar.
- Sybase – the security model is different in Adaptive Server Enterprise and SAP Sybase IQ, so other syntaxes differ.

Permissions

Requires the MANAGE ANY DBSPACE system privilege.

GRANT EXECUTE Statement

Grants EXECUTE privilege on a procedure or user-defined function.

Syntax

```
GRANT EXECUTE
  ON [ owner.] {procedure-name | user-defined-function-name }
  TO userID [,...]
```

Parameters

- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

Standards

- SQL – syntax is a Persistent Stored Module feature.
- Sybase – the security model is different in Adaptive Server Enterprise and SAP Sybase IQ, so other syntaxes differ.

Permissions

Requires one of:

- MANAGE ANY OBJECT PRIVILEGE system privilege.
- You own the procedure.

GRANT Object-Level Privilege Statement

Grants database object-level privileges on individual tables or views to a user or role.

Syntax

```
GRANT object-level-privilege [, …]
   ON [ owner.]object-name
   TO userID [,...]
   [ WITH GRANT OPTION ]

object-level-privilege:
   ALL [ PRIVILEGES ]
   | ALTER
   | DELETE
   | INSERT
   | LOAD
   | REFERENCE [ ( column-name [, …] ) ]
   | SELECT [ ( column-name [, …] ) ]
   | TRUNCATE
   | UPDATE [ ( column-name, …) ] }
```

Parameters

- **userID –** must be the name of an existing user or immutable role. The list must consist of existing users with login passwords. Separate the userIDs in the list with commas.
- **ALL –** grants all privileges to users
- **ALTER –** users can alter this table with the **ALTER TABLE** statement. This privilege is not allowed for views.
- **DELETE –** users can delete rows from this table or view.
- **INSERT –** users can insert rows into the named table or view.
- **LOAD –** users can load data into the named table or view.
- **REFERENCES –** users can create indexes on the named tables, and foreign keys that reference the named tables. If column names are specified, then users can reference only those columns. REFERENCES privileges on columns cannot be granted for views, only for tables.

- **SELECT –** users can look at information in this view or table. If column names are specified, then the users can look at only those columns. SELECT permissions on columns cannot be granted for views, only for tables.
- **TRUNCATE –** users can truncate the named table or view.
- **UPDATE –** users can update rows in this view or table. If column names are specified, users can update only those columns. UPDATE privileges on columns cannot be granted for views, only for tables. To update a table, users must have both SELECT and UPDATE privilege on the table.
- **WITH GRANT OPTION –** the named user ID is also given privileges to grant the same privileges to other user IDs.

Usage

You can list the table privileges, or specify ALL to grant all privileges at once.

Standards

- SQL – Syntax is an entry-level feature.
- Sybase – Syntax is supported in Adaptive Server Enterprise.

Permissions

Requires one of:

- MANAGE ANY OBJECT PRIVILEGE system privilege
- You have been granted the specific object privilege with the WITH GRANT OPTION clause on the table.
- You own of the table.

GRANT ROLE Statement

Grants roles to users or other roles, with or without administrative rights.

Syntax

```
GRANT ROLE role_name [, …]
    TO grantee [, …]
    [ {WITH NO ADMIN | WITH ADMIN [ ONLY ] } OPTION ]
    [ WITH NO SYSTEM PRIVILEGE INHERITANCE ]

role_name:
    dbo†††
    | diagnostics†††
    | PUBLIC†††
    | rs_systabgroup†††
    | SA_DEBUG†††
    | SYS†††
```

```
    | SYS_AUTH_SA_ROLE
    | SYS_AUTH_SSO_ROLE
    | SYS_AUTH_DBA_ROLE††
    | SYS_AUTH_RESOURCE_ROLE †
    | SYS_AUTH_BACKUP_ROLE†
    | SYS_AUTH_VALIDATE_ROLE †
    | SYS_AUTH_WRITEFILE_ROLE
    | SYS_AUTH_WRITEFILECLIENT_ROLE
    | SYS_AUTH_READFILE_ROLE
    | SYS_AUTH_READFILECLIENT_ROLE
    | SYS_AUTH_PROFILE_ROLE
    | SYS_AUTH_USER_ADMIN_ROLE
    | SYS_AUTH_SPACE_ADMIN_ROLE
    | SYS_AUTH_MULTIPLEX_ADMIN_ROLE
    | SYS_AUTH_OPERATOR_ROLE
    | SYS_AUTH_PERMS_ADMIN_ROLE
    | SYS_REPLICATE_ADMIN_ROLE†††
    | SYS_RUN_REPLICATE_ROLE†††
    | SYS_SPATIAL_ADMIN_ROLE†††
    | user-defined role name
```

- The WITH NO SYSTEM PRIVILEGE INHERITANCE clause can be used when granting select compatibility roles to other roles. It prevents automatic inheritance of the compatibility role's underlying system privileges by members of the role. When granted to user-extended roles, the WITH NO SYSTEM PRIVILEGE INHERITANCE clause applies to members of the role only. The user acting as a role automatically inherits the underlying system privileges regardless of the clause.
- The WITH NO ADMIN OPTION WITH NO SYSTEM PRIVILEGE INHERITANCE and WITH NO SYSTEM PRIVILEGE INHERITANCE clauses are semantically equivalent.
- †The WITH ADMIN OPTION or WITH ADMIN ONLY clauses can not be specified in combination with the WITH NO SYSTEM PRIVILEGE INHERITANCE clause when granting the SYS_AUTH_BACKUP_ROLE, SYS_AUTH_RESOURCE_ROLE, or SYS_AUTH_VALIDATE_ROLE roles.
- ††The WITH ADMIN OPTION clause can only be specified in combination with the WITH NO SYSTEM PRIVILEGE INHERITANCE clause when granting the SYS_AUTH_DBA_ROLE or SYS_RUN_REPLICATION_ROLE roles.
- †††The WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are not supported for system roles.

Parameters

- **role_name –** must already exist in the database. Separate multiple role names with commas.
- **grantee –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

- **WITH NO ADMIN OPTION –** each *grantee* is granted the underlying system privileges of each *role_name*, but cannot grant *role_name* to another user.
- **WITH ADMIN ONLY OPTION –** each *userID* is granted administrative privileges over each *role_name*, but not the underlying system privileges of *role_name*.
- **WITH ADMIN OPTION –** each userID is granted the underlying system privileges of each *role_name*, along with the ability to grant *role_name* to another user.
- **WITH NO SYSTEM PRIVILEGE INHERITANCE –** the underlying system privileges of the granting role are not inherited by the members of the receiving role. However, if the receiving role is a user-extended role, the underlying system privileges are granted to the extended user.

Examples

- **Example 1 –** grants `Sales_Role` to `Sally`, with administrative privileges, which means she can grant or revoke `Sales_Role` to other users as well as perform any authorized tasks granted by the role:

```
GRANT ROLE Sales_Role TO Sally WITH ADMIN OPTION
```

- **Example 2 –** grants the compatibility role SYS_AUTH_PROFILE_ROLE to the role `Sales_Admin` with no administrative rights. `Sales_Admin` is a standalone role and `Mary` and `Peter` have been granted `Sales_Admin`. Since SYS_AUTH_PROFILE_ROLE is an inheritable compatibility role, `Mary` and `Peter` are granted the underlying system privileges of `Sales_Role`. Since the role is granted with no administrative rights, they cannot grant or revoke the role.

```
GRANT ROLE SYS_AUTH_PROFILE_ROLE TO Sales_Role WITH NO ADMIN
OPTION
```

- **Example 3 –** grants the compatibility role SYS_AUTH_BACKUP_ROLE to `Tom` with no administrative rights. `Tom` is a user-extended role to which `Betty` and Laurel have been granted. Since `SYS_AUTH_BACKUP_ROLE` is a non-inheritable compatibility role, the underlying system privileges of the role are not granted to Betty and Laurel. However, since `Tom` is an extended user, the underlying system privileges are granted directly to `Tom`.

```
GRANT ROLE SYS_AUTH_BACKUP_ROLE TO Tom
WITH NO SYSTEM PRIVILEGE INHERITANCE
```

Usage

Use of the WITH ADMIN OPTION or WITH ADMIN ONLY OPTION clause allows the grantee to grant or revoke the role, but does not allow the grantee to drop the role.

By default, if no administrative clause is specified in the grant statement, each compatibility role is granted with these default administrative rights:

WITH ADMIN OPTION	WITH ADMIN ONLY OPTION	WITH NO ADMIN OPTION
SYS_AUTH_SA_ROLE SYS_AUTH_SSO_ROLE	SYS_AUTH_DBA_ROLE	SYS_AUTH_RESOURCE_ROLE SYS_AUTH_BACKUP_ROLE SYS_AUTH_VALIDATE_ROLE SYS_AUTH_WRITEFILE_ROLE SYS_AUTH_WRITEFILECLIENT_ROLE SYS_AUTH_READFILE_ROLE SYS_AUTH_READFILECLIENT_ROLE SYS_AUTH_PROFILE_ROLE SYS_AUTH_USER_ADMIN_ROLE SYS_AUTH_SPACE_ADMIN_ROLE SYS_AUTH_MULTIPLEX_ADMIN_ROLE SYS_AUTH_OPERATOR_ROLE SA_DEBUG SYS_RUN_REPLICATION_ROLE

The SYS_AUTH_PERMS_ADMIN_ROLE role grants these underlying roles with these default administrative rights:

WITH ADMIN OPTION	WITH NO ADMIN OPTION
SYS_AUTH_BACKUP_ROLE	MANAGE ROLES
SYS_AUTH_OPERATOR_ROLE	MANAGE ANY OBJECT PRIVILEGE
SYS_AUTH_USER_ADMIN_ROLE	CHANGE PASSWORD
SYS_AUTH_SPACE_ADMIN_ROLE	
SYS_AUTH_MULTIPLEX_ADMIN_ROLE	
SYS_AUTH_RESOURCE_ROLE	
SYS_AUTH_VALIDATE_ROLE	
SYS_AUTH_PROFILE_ROLE	
SYS_AUTH_WRITEFILE_ROLE	
SYS_AUTH_WRITEFILECLIENT_ROLE	
SYS_AUTH_READFILE_ROLE	
SYS_AUTH_READFILECLIENT_ROLE	

Standards

- SQL – Other syntaxes are vendor extensions to ISO/ANSI SQL grammar.
- Sybase – Syntax is supported in Adaptive Server Enterprise.

Permissions

- Requires MANAGE ROLES system privilege to grant these system roles:
  - dbo
  - diagnostics
  - PUBLIC
  - rs_systabgroup
  - SA_DEBUG SYS
  - SYS
  - SYS_REPLICATION_ADMIN_ROLE
  - SYS_RUN_REPLICATION_ROLE
  - SYS_SPATIAL_ADMIN_ROLE
- Requires administrative privilege over the role to grant these roles:
  - SYS_AUTH_SA_ROLE
  - SYS_AUTH_SSO_ROLE
  - SYS_AUTH_DBA_ROLE
  - SYS_AUTH_RESOURCE_ROLE
  - SYS_AUTH_BACKUP_ROLE

- SYS_AUTH_VALIDATE_ROLE
- SYS_AUTH_WRITEFILE_ROLE
- SYS_AUTH_WRITEFILECLIENT_ROLE
- SYS_AUTH_READFILE_ROLE
- SYS_AUTH_READFILECLIENT_ROLE
- SYS_AUTH_PROFILE_ROLE
- SYS_AUTH_USER_ADMIN_ROLE
- SYS_AUTH_SPACE_ADMIN_ROLE
- SYS_AUTH_MULTIPLEX_ADMIN_ROLE
- SYS_AUTH_OPERATOR_ROLE
- SYS_AUTH_PERMS_ADMIN_ROLE
- <user-defined role name>

GRANT SET USER Statement

Grants the ability for one user to impersonate another user and to administer the SET USER system privilege.

Syntax

```
GRANT SET USER ( target_users_list
      | ANY
      | ANY WITH ROLES target_roles_list )
  TO userID [,...]
  [ WITH ADMIN [ ONLY ] OPTION | WITH NO ADMIN OPTION ]
```

Parameters

- **target_users_list –** must consist of existing users with login passwords and is the potential list of target users who can no longer be impersonated by grantee users. Separate the user IDs in the list with commas.
- **ANY –** the potential list of target users for each grantee consists of all database users with login passwords.
- **ANY WITH ROLES *target_roles_list* –** the *target_role_list* must consist of existing roles, and the potential list of target users for each grantee must consist of database users with login passwords that have a subset of roles in *target_role_list*. Separate the list of roles with commas.
- **userID –** each *userID* must be the name of an existing user or immutable role. The list must consist of existing users with login passwords. Separate the userIDs in the list with commas.
- **WITH ADMIN OPTION –** (valid in conjunction with the ANY clause only) The user can both issue the SETUSER command to impersonate another user and grant the SET USER system privilege to another user.

- **WITH ADMIN ONLY OPTION –** (valid in conjunction with the ANY clause only) The user can grant the SET USER system privilege to another user, but cannot issue the SETUSER command to impersonate another user.
- **WITH NO ADMIN OPTION –** the user can issue the SETUSER command to impersonate another user, but cannot grant the SET USER system privilege to another user.

Examples

- **Example 1 –** grants `Sally` and `Laurel` the ability to impersonate `Bob`, `Sam`, and `Peter`:

```
GRANT SET USER (Bob, Sam, Peter) TO (Sally, Laurel)
```

- **Example 2 –** grants `Mary` the right to grant the SET USER system privilege to any user in the database. However, since the system privilege is granted with the WITH ADMIN ONLY OPTION clause, `Mary` cannot impersonate any other user.

```
GRANT SET USER (ANY) TO Mary WITH ADMIN ONLY OPTION
```

- **Example 3 –** grants `Steve` and `Joe` the ability to impersonate any member of `Role1` or `Role2`:

```
GRANT SET USER (ANY WITH ROLES Role1, Role2) TO Steve, Joe
```

Usage

A user can be granted the ability to impersonate any user in the database (ANY) or only specific users (*target_users_list*) or members of specific roles (ANY WITH ROLES *target_roles_list*). Administrative rights to the SET USER system privilege can only be granted when using the ANY clause.

If no clause is specified, ANY is used by default. If no administrative clause is specified in the grant statement, the WITH NO ADMIN OPTION clause is used.

If regranting the SET USER system privilege to a user, the effect of the regrant is cumulative.

By default, the SET USER system privilege is granted to the SYS_AUTH_SSO_ROLE compatibility role with the WITH NO ADMIN OPTION clause, if they exist.

The granting of the SET USER system privilege to a user only grants the potential to impersonate another user. Validation of the *at-least* criteria required to successfully impersonate another user does no occur until the **SETUSER** statement is issued.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

- Requires the SET USER system privilege granted with administrative rights.
- Each target user specified (target_users_list) is an existing user or user-extended role with a login password.
- Each target role specified (target_roles_list) must be an existing user-extended or user-defined role.

GRANT System Privilege Statement

Grants specific system privileges to users or roles, with or without administrative rights.

Syntax

```
GRANT system_privilege_name [, …]
   TO userID [, …]
   [ { WITH NO ADMIN | WITH ADMIN [ ONLY ] } OPTION ]
```

Parameters

- **system_privilege –** must be the name of an existing system privilege.
- **userID –** must be the name of an existing user or immutable role. The list must consist of existing users with login passwords. Separate multiple userIDs with commas.
- **WITH NO ADMIN OPTION –** the user can manage the system privilege, but cannot grant the system privilege to another user.
- **WITH ADMIN ONLY OPTION –** If the WITH ADMIN ONLY OPTION clause is used, each *userID* is granted administrative privileges over each *system_privilege*, but NOT the *system_privilege* itself.
- **WITH ADMIN OPTION –** each *userID* is granted administrative privileges over each *system_privilege* in addition to all underlying system privileges of *system_privilege*.

Examples

- **Example 1 –** grants the DROP CONNECTION system privilege to `Joe` with administrative privileges:

  ```
  GRANT DROP CONNECTION TO Joe WITH ADMIN OPTION
  ```

- **Example 2 –** grants the CHECKPOINT system privilege to `Sally` with no administrative privileges:

  ```
  GRANT CHECKPOINT TO Sally WITH NO ADMIN OPTION
  ```

- **Example 3 –** grants the MONITOR system privilege to `Jane` with administrative privileges only:

  ```
  GRANT MONITOR TO Jane WITH ADMIN ONLY OPTION
  ```

Usage

By default, if no administrative clause is specified in the grant statement, the WITH NO ADMIN OPTION clause is used.

Standards

- SQL – Other syntaxes are vendor extensions to ISO/ANSI SQL grammar.
- Sybase – Syntax is supported in Adaptive Server Enterprise.

Permissions

Requires administrative privilege over the system privilege being granted.

List of All System Privileges

A list of all system privileges.

System privileges control the rights of users to perform authorized database tasks.

The following is a list of available system privileges:

- ACCESS SERVER LS system privilege
- ALTER ANY INDEX system privilege
- ALTER ANY MATERIALIZED VIEW system privilege
- ALTER ANY OBJECT system privilege
- ALTER ANY OBJECT OWNER system privilege
- ALTER ANY PROCEDURE system privilege
- ALTER ANY SEQUENCE system privilege
- ALTER ANY TABLE system privilege
- ALTER ANY TEXT CONFIGURATION system privilege
- ALTER ANY TRIGGER system privilege
- ALTER ANY VIEW system privilege
- ALTER DATABASE system privilege
- ALTER DATATYPE system privilege
- BACKUP DATABASE system privilege
- CHANGE PASSWORD system privilege
- CHECKPOINT system privilege
- COMMENT ANY OBJECT system privilege
- CREATE ANY INDEX system privilege
- CREATE ANY MATERIALIZED VIEW system privilege
- CREATE ANY OBJECT system privilege
- CREATE ANY PROCEDURE system privilege
- CREATE ANY SEQUENCE system privilege
- CREATE ANY TABLE system privilege

- CREATE ANY TEXT CONFIGURATION system privilege
- CREATE ANY TRIGGER system privilege
- CREATE ANY VIEW system privilege
- CREATE DATATYPE system privilege
- CREATE EXTERNAL REFERENCE system privilege
- CREATE MATERIALIZED VIEW system privilege
- CREATE MESSAGE system privilege
- CREATE PROCEDURE system privilege
- CREATE PROXY TABLE system privilege
- CREATE TABLE system privilege
- CREATE TEXT CONFIGURATION system privilege
- CREATE VIEW system privilege
- DEBUG ANY PROCEDURE system privilege
- DELETE ANY TABLE system privilege
- DROP ANY INDEX system privilege
- DROP ANY MATERIALIZED VIEW system privilege
- DROP ANY OBJECT system privilege
- DROP ANY PROCEDURE system privilege
- DROP ANY SEQUENCE system privilege
- DROP ANY TABLE system privilege
- DROP ANY TEXT CONFIGURATION system privilege
- DROP ANY VIEW system privilege
- DROP CONNECTION system privilege
- DROP DATATYPE system privilege
- DROP MESSAGE system privilege
- EXECUTE ANY PROCEDURE system privilege
- LOAD ANY TABLE system privilege
- INSERT ANY TABLE system privilege
- MANAGE ANY DBSPACE system privilege
- MANAGE ANY EVENT system privilege
- MANAGE ANY EXTERNAL ENVIRONMENT system privilege
- MANAGE ANY EXTERNAL OBJECT system privilege
- MANAGE ANY LDAP SERVER system privilege
- MANAGE ANY LOGIN POLICY system privilege
- MANAGE ANY MIRROR SERVER system privilege
- MANAGE ANY OBJECT PRIVILEGES system privilege
- MANAGE ANY SPATIAL OBJECT system privilege
- MANAGE ANY STATISTICS system privilege
- MANAGE ANY USER system privilege

- MANAGE ANY WEB SERVICE system privilege
- MANAGE AUDITING system privilege
- MANAGE MULTIPLEX system privilege
- MANAGE PROFILING system privilege
- MANAGE REPLICATION system privilege
- MANAGE ROLES system privilege
- MONITOR system privilege
- READ CLIENT FILE system privilege
- READ FILE system privilege
- REORGANIZE ANY OBJECT system privilege
- SELECT ANY TABLE system privilege
- SERVER OPERATOR system privilege
- SET ANY PUBLIC OPTION system privilege
- SET ANY SECURITY OPTION system privilege
- SET ANY SYSTEM OPTION system privilege
- SET ANY USER DEFINED OPTION system privilege
- SET USER system privilege (granted with ADMIN ONLY clause)
- TRUNCATE ANY TABLE system privilege
- UPDATE ANY TABLE system privilege
- UPGRADE ROLE system privilege
- USE ANY SEQUENCE system privilege
- VALIDATE ANY OBJECT system privilege
- WRITE CLIENT FILE system privilege
- WRITE FILE system privilege

GRANT USAGE ON SEQUENCE Statement

Grants the USAGE system privilege on a specified sequence to a user or role.

Syntax

```
GRANT USAGE ON SEQUENCE sequence-name
   TO userID [,...]
```

Parameters

- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

Standards

- SQL – syntax is a Persistent Stored Module feature.

- Sybase – the security model is different in Adaptive Server Enterprise and SAP Sybase IQ, so other syntaxes differ.

Permissions

Requires one of:

- MANAGE ANY OBJECT PRIVILEGE system privilege.
- You own the sequence.

REVOKE CHANGE PASSWORD Statement

Removes the ability of a user to manage passwords and administer the system privilege.

Syntax

```
REVOKE [ ADMIN OPTION FOR ] CHANGE PASSWORD
   [(target_user_list
      | ANY
      | ANY WITH ROLES target_role_list )]
   FROM userID [,...]
```

Parameters

- **target_user_list –** users the grantee has the potential to impersonate. The list must consist of existing users or user-extended roles with login passwords. Separate the userIDs in the list with commas.
- **ANY –** all database users with login passwords become potential target users to manage passwords for each grantee.
- **ANY WITH ROLES *target_role_list* –** list of target roles for each grantee. Any users who are granted any of the target roles become potential target users for each grantee. The *target_role_list* must consist of existing roles and the users who are granted said roles must consist of database users with login passwords. Use commas to separate multiple userIDs.
- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

Examples

- **Example 1 –** removes the ability of `Joe` to manage the passwords of `Sally` or `Bob`:

```
REVOKE CHANGE PASSWORD (Sally, Bob) FROM Joe
```

- **Example 2 –** if the CHANGE PASSWORD system privilege was originally granted to `Sam` with the WITH ADMIN OPTION clause, this example removes the ability of `Sam` to grant the CHANGE PASSWORD system privilege to another user, but still allows `Sam` to manage passwords for those users specified in the original **GRANT CHANGE PASSWORD** statement. However, if the CHANGE PASSWORD system privilege was originally

granted to `Sam` with the WITH ADMIN ONLY OPTION clause, this example removes all permissions to the system privilege from `Sam`.

```
REVOKE ADMIN OPTION FOR CHANGE PASSWORD FROM Sam
```

Usage

Depending on how the CHANGE PASSWORD system privilege was initially granted, using the ADMIN OPTION FOR clause when revoking the CHANGE PASSWORD system privilege has different results. If the CHANGE PASSWORD system privilege was originally granted with the WITH ADMIN OPTION clause, including the ADMIN OPTION FOR clause in the revoke statement revokes only the ability to administer the CHANGE PASSWORD system privilege (that is, grant the system privilege to another user). The ability to actually manage passwords for other users remains. However, if the CHANGE PASSWORD system privilege was originally granted with the WITH ADMIN ONLY OPTION clause, including the ADMIN OPTION FOR clause in the revoke statement is semantically equivalent to revoking the entire CHANGE PASSWORD system privilege. Finally, if the CHANGE PASSWORD system privilege was originally granted with the WITH NO ADMIN OPTION clause, and the ADMIN OPTION FOR clause is included in the revoke statement, nothing is revoked because there were no administrative rights granted in the first place.

You can revoke the CHANGE PASSWORD system privilege from any combination of users and roles granted.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

Requires the CHANGE PASSWORD system privilege granted with administrative rights.

REVOKE CONNECT Statement

Removes a user from the database.

Syntax

```
REVOKE CONNECT
   FROM userID [,...]
```

Parameters

- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

Usage

Use system procedures or CREATE USER and DROP USER statements, not **GRANT** and **REVOKE** statements, to add and remove user IDs.

You cannot revoke the connect privileges from a user if he or she owns database objects, such as tables. Attempting to do so with a **REVOKE** statement, or **sp_droplogin** or **sp_iqdroplogin** stored procedure returns an error such as `Cannot drop a user that owns tables in runtime system.`

Standards

ANSI SQL – compliance level: Transact-SQL extension.

Permissions

Requires the MANAGE ANY USER system privilege.

Note: If revoking **CONNECT** permissions or revoking table permissions from another user, the target user cannot be connected to the database.

REVOKE CREATE Statement

Removes CREATE permissions on the specified dbspace from the specified user IDs.

Syntax

```
REVOKE CREATE ON dbspace-name
   FROM userID [,...]
```

Parameters

- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

Examples

- **Example 1 –** revokes the CREATE privilege on dbspace `DspHist` from user `Smith`:

  ```
  REVOKE CREATE ON DspHist FROM Smith
  ```

- **Example 2 –** revokes the CREATE permission on dbspace `DspHist` from user ID `fionat` from the database:

  ```
  REVOKE CREATE ON DspHist FROM fionat
  ```

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

Requires the MANAGE ANY DBSPACE system privilege.

REVOKE EXECUTE Statement

Removes EXECUTE permissions that were given using the **GRANT** statement.

Syntax

```
REVOKE  EXECUTE ON  [ owner.]procedure-name
    FROM  userID [,...]
```

Parameters

- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

Standards

- SQL—Syntax is a Persistent Stored Module feature.
- Sybase—Syntax is supported by Adaptive Server Enterprise. User management and security models are different for v and SAP Sybase IQ.

Permissions

You either:

- Own the procedure, or
- Have been granted the MANAGE ANY OBJECT PRIVILEGE system privilege.

REVOKE Object-Level Privilege Statement

Removes object-level privileges that were given using the **GRANT** statement.

Syntax

```
REVOKE { object-level-privilege [,...]
     [ owner.]table-name
    FROM userID [,...]

object-level-privilege:
    ALL [ PRIVILEGES ]
    | ALTER
    | DELETE
    | INSERT
    | LOAD
    | REFERENCE [ ( column-name [, …] ) ]
    | SELECT [ ( column-name [, …] ) ]
    | TRUNCATE
    | UPDATE [ ( column-name, …) ] }
```

Parameters

- **userID –** must be the name of an existing user or immutable role. The list must consist of existing users with login passwords. Separate the userIDs in the list with commas.
- **ALL –** grants all privileges to users
- **ALTER –** users can alter this table with the **ALTER TABLE** statement. This privilege is not allowed for views.
- **DELETE –** users can delete rows from this table or view.
- **INSERT –** users can insert rows into the named table or view.
- **LOAD –** users can load data into the named table or view.
- **REFERENCES –** users can create indexes on the named tables, and foreign keys that reference the named tables. If column names are specified, then users can reference only those columns. REFERENCES privileges on columns cannot be granted for views, only for tables.
- **SELECT –** users can look at information in this view or table. If column names are specified, then the users can look at only those columns. SELECT permissions on columns cannot be granted for views, only for tables.
- **TRUNCATE –** users can truncate the named table or view.
- **UPDATE –** users can update rows in this view or table. If column names are specified, users can update only those columns. UPDATE privileges on columns cannot be granted for views, only for tables. To update a table, users must have both SELECT and UPDATE privilege on the table.

Examples

- **Example 1 –** prevents user `Dave` from inserting into the `Employees` table:

```
REVOKE INSERT ON Employees FROM Dave
```

- **Example 2 –** prevents user `Dave` from updating the `Employees` table:

```
REVOKE UPDATE ON Employees FROM Dave
```

Standards

- SQL–Syntax is an entry-level feature.
- Sybase–Syntax is supported in Adaptive Server Enterprise.

Permissions

You either:

- Own the table, or
- Have the MANAGE ANY OBJECT PRIVILEGE system privilege granted with the GRANT OPTION clause.

REVOKE ROLE Statement

Removes a users membership in a role or his or her ability to administer the role.

Syntax

```
REVOKE [ ADMIN OPTION FOR ] ROLE  role_name [,...]
    FROM grantee [,...]

role_name:
    dbo†††
    | diagnostics†††
    | PUBLIC†††
    | rs_systabgroup†††
    | SA_DEBUG†††
    | SYS†††
    | SYS_AUTH_SA_ROLE
    | SYS_AUTH_SSO_ROLE
    | SYS_AUTH_DBA_ROLE
    | SYS_AUTH_RESOURCE_ROLE
    | SYS_AUTH_BACKUP_ROLE
    | SYS_AUTH_VALIDATE_ROLE
    | SYS_AUTH_WRITEFILE_ROLE
    | SYS_AUTH_WRITEFILECLIENT_ROLE
    | SYS_AUTH_READFILE_ROLE
    | SYS_AUTH_READFILECLIENT_ROLE
    | SYS_AUTH_PROFILE_ROLE
    | SYS_AUTH_USER_ADMIN_ROLE
    | SYS_AUTH_SPACE_ADMIN_ROLE
    | SYS_AUTH_MULTIPLEX_ADMIN_ROLE
    | SYS_AUTH_OPERATOR_ROLE
    | SYS_AUTH_PERMS_ADMIN_ROLE
    | SYS_REPLICATE_ADMIN_ROLE†††
    | SYS_RUN_REPLICATE_ROLE†††
    | SYS_SPATIAL_ADMIN_ROLE†††
    | user-defined role name
```

†††The ADMIN OPTION FOR clause is not supported for system roles.

Parameters

- **role_name –** must already exist in the database. Separate multiple role names with commas.
- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.
- **ADMIN OPTION FOR –** each *userID* must have been granted administrative privilege over the specified *role_name*.

Note: This clause revokes administrative privileges of the role only, not membership in the role, unless the role was originally granted with the WITH ADMIN ONLY OPTION clause. For roles granted with the WITH ADMIN ONLY OPTION clause, the ADMIN OPTION FOR clause is optional as it is semantically equivalent to revoking membership in a role in its entirety.

Examples

- **Example 1 –** revokes the user-defined (standalone) role `Role1` from `User1`:

  ```
  REVOKE ROLE Role1 FROM User1
  ```

  After you execute this command, `User1` no longer has the rights to perform any authorized tasks using any system privileges granted to `Role1`.

- **Example 2 –** revokes the ability for `User1` to administer the compatibility role SYS_AUTH_WRITEFILE_ROLE:

  ```
  REVOKE ADMIN OPTION FOR ROLE SYS_AUTH_WRITEFILE_ROLE FROM User1
  ```

  User1 retains the ability to perform any authorized tasks granted by SYS_AUTH_WRITEFILE_ROLE.

Standards

- SQL – Other syntaxes are vendor extensions to ISO/ANSI SQL grammar.
- Sybase – Syntax is supported in Adaptive Server Enterprise.

Permissions

Requires the MANAGE ROLES system privilege to revoke these roles:

- diagnostics
- dbo
- PUBLIC
- rs_systabgroup
- SA_DEBUG
- SYS
- SYS_RUN_REPLICATE_ROLE
- SYS_SPATIAL_ADMIN_ROLE

Requires administrative privilege over the role to revoke these roles:

- SYS_AUTH_SA_ROLE
- SYS_AUTH_SSO_ROLE
- SYS_AUTH_DBA_ROLE
- SYS_AUTH_RESOURCE_ROLE

- SYS_AUTH_BACKUP_ROLE
- SYS_AUTH_VALIDATE_ROLE
- SYS_AUTH_WRITEFILE_ROLE
- SYS_AUTH_WRITEFILECLIENT_ROLE
- SYS_AUTH_READFILE_ROLE
- SYS_AUTH_READFILECLIENT_ROLE
- SYS_AUTH_PROFILE_ROLE
- SYS_AUTH_USER_ADMIN_ROLE
- SYS_AUTH_SPACE_ADMIN_ROLE
- SYS_AUTH_MULTIPLEX_ADMIN_ROLE
- SYS_AUTH_OPERATOR_ROLE
- SYS_AUTH_PERMS_ADMIN_ROLE
- <user-defined role name>

REVOKE SET USER Statement

Removes the ability for one user to impersonate another user and to administer the SET USER system privilege.

Syntax

```
REVOKE [ ADMIN OPTION FOR ] SETUSER
   (target_user_list
      | ANY
      | ANY WITH ROLES target_role_list ])
 FROM userID [,...]
```

Parameters

- **target_user_list –** must consist of existing users with login passwords and is the potential list of target users who can no longer be impersonated by grantee users. Separate the user IDs in the list with commas.
- **ANY –** the potential list of target users for each grantee consists of all database users with login passwords.
- **ANY WITH ROLES *target_role_list* –** the *target_role_list* must consist of existing roles, and the potential list of target users for each grantee must consist of database users with login passwords that have a subset of roles in *target_role_list*. Separate the list of roles with commas.
- **userID –** each *userID* must be the name of an existing user or immutable role. The list must consist of existing users with login passwords. Separate the userIDs in the list with commas.

Examples

- **Example 1 –** stops `Bob` from being able to impersonate `Sally` or `Bob`:

```
REVOKE SET USER (Sally, Bob) FROM Bob
```

- **Example 2 –** if the SET USER system privilege was originally granted to `Sam` with the WITH ADMIN OPTION clause, this example removes the ability of `Sam` to grant the SET USER system privilege to another user, but still allows `Sam` to impersonate those users already granted to him or her. However, if the SET USER system privilege was originally granted to `Sam` with the WITH ADMIN ONLY OPTION clause, this example removes all permissions to the system privilege from `Sam`.

```
REVOKE ADMIN OPTION FOR SET USER FROM Sam
```

Usage

Depending on how the SET USER system privilege was initially granted, using the ADMIN OPTION FOR clause when revoking the SET USER system privilege has different results. If you the SET USER system privilege was originally granted with the WITH ADMIN OPTION clause, including the ADMIN OPTION FOR clause in the revoke statement revokes only the ability to administer the SET USER system privilege (that is, grant the system privilege to another user). The ability to actually impersonate another user remains. However, if the SET USER system privilege was originally granted with the WITH ADMIN ONLY OPTION clause, including the ADMIN OPTION FOR clause in the revoke statement is semantically equivalent to revoking the entire SET USER system privilege. Finally, if the SET USER system privilege was originally grant with the WITH NO ADMIN OPTION clause, and the ADMIN OPTION FOR clause is included in the revoke statement, nothing is revoked because there were no administrative system privileges granted in the first place.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

Requires the SET USER system privilege granted with administrative rights.

REVOKE System Privilege Statement

Removes specific system privileges from specific users and the right to administer the privilege.

Syntax

```
REVOKE [ ADMIN OPTION FOR ] system_privilege [,...]
   FROM userID [,...]
```

Parameters

- **system_privilege –** must be an existing system privilege.
- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.
- **ADMIN OPTION FOR –** each *system_privilege* must currently be granted to each *userID* specified with administrative privileges.

  Note: This clause revokes only the administrative privileges of the system privilege; the system privilege itself remains granted. However, if the system privilege was originally granted with the WITH ADMIN ONLY OPTION clause, the ADMIN OPTION FOR clause completely revokes the system privilege. Under this scenario, use of the ADMIN OPTION FOR clause is not required to revoke administrative privileges.

Examples

- **Example 1 –** revokes the BACKUP DATABASE system privilege from user `Jim`:

  ```
  REVOKE BACKUP DATABASE FROM Jim
  ```

- **Example 2 –** assuming the BACKUP DATABASE system privilege was originally granted to user `Jim` with the WITH ADMIN OPTION clause, this example revokes the ability to administer the BACKUP DATABASE system privilege from user `Jim`. The ability to perform tasks authorized by the system privilege remains. However, if the BACKUP DATABASE system privilege was originally granted to user `Jim` with the WITH ADMIN ONLY OPTION clause, this example removes all permissions to the system privilege from user `Jim`.

  ```
  REVOKE ADMIN OPTION FOR BACKUP DATABASE FROM Jim
  ```

Usage

Depending on how the system privilege was initially granted, using the ADMIN OPTION FOR clause when revoking a system privilege has different results. If you the system privilege was originally granted with the WITH ADMIN OPTION clause, including the ADMIN OPTION FOR clause in the revoke statement revokes only the ability to administer the system privilege (that is, grant the system privilege to another user). The ability to actually use the system privilege remains. However, if the system privilege was originally granted with the WITH ADMIN ONLY OPTION clause, including the ADMIN OPTION FOR clause in the revoke statement is semantically equivalent to revoking the entire system privilege. Finally, if the system privilege was originally grant with the WITH NO ADMIN OPTION clause, and the ADMIN OPTION FOR clause is included in the revoke statement, nothing is revoked because there were no administrative system privileges granted in the first place.

Standards

- SQL – other syntaxes are vendor extensions to ISO/ANSI SQL grammar.
- Sybase – syntax is not supported by Adaptive Server Enterprise.

Permissions

Requires administrative privilege over the system privilege being revoked.

List of All System Privileges

A list of all system privileges.

System privileges control the rights of users to perform authorized database tasks.

The following is a list of available system privileges:

- ACCESS SERVER LS system privilege
- ALTER ANY INDEX system privilege
- ALTER ANY MATERIALIZED VIEW system privilege
- ALTER ANY OBJECT system privilege
- ALTER ANY OBJECT OWNER system privilege
- ALTER ANY PROCEDURE system privilege
- ALTER ANY SEQUENCE system privilege
- ALTER ANY TABLE system privilege
- ALTER ANY TEXT CONFIGURATION system privilege
- ALTER ANY TRIGGER system privilege
- ALTER ANY VIEW system privilege
- ALTER DATABASE system privilege
- ALTER DATATYPE system privilege
- BACKUP DATABASE system privilege
- CHANGE PASSWORD system privilege
- CHECKPOINT system privilege
- COMMENT ANY OBJECT system privilege
- CREATE ANY INDEX system privilege
- CREATE ANY MATERIALIZED VIEW system privilege
- CREATE ANY OBJECT system privilege
- CREATE ANY PROCEDURE system privilege
- CREATE ANY SEQUENCE system privilege
- CREATE ANY TABLE system privilege
- CREATE ANY TEXT CONFIGURATION system privilege
- CREATE ANY TRIGGER system privilege
- CREATE ANY VIEW system privilege
- CREATE DATATYPE system privilege

- CREATE EXTERNAL REFERENCE system privilege
- CREATE MATERIALIZED VIEW system privilege
- CREATE MESSAGE system privilege
- CREATE PROCEDURE system privilege
- CREATE PROXY TABLE system privilege
- CREATE TABLE system privilege
- CREATE TEXT CONFIGURATION system privilege
- CREATE VIEW system privilege
- DEBUG ANY PROCEDURE system privilege
- DELETE ANY TABLE system privilege
- DROP ANY INDEX system privilege
- DROP ANY MATERIALIZED VIEW system privilege
- DROP ANY OBJECT system privilege
- DROP ANY PROCEDURE system privilege
- DROP ANY SEQUENCE system privilege
- DROP ANY TABLE system privilege
- DROP ANY TEXT CONFIGURATION system privilege
- DROP ANY VIEW system privilege
- DROP CONNECTION system privilege
- DROP DATATYPE system privilege
- DROP MESSAGE system privilege
- EXECUTE ANY PROCEDURE system privilege
- LOAD ANY TABLE system privilege
- INSERT ANY TABLE system privilege
- MANAGE ANY DBSPACE system privilege
- MANAGE ANY EVENT system privilege
- MANAGE ANY EXTERNAL ENVIRONMENT system privilege
- MANAGE ANY EXTERNAL OBJECT system privilege
- MANAGE ANY LDAP SERVER system privilege
- MANAGE ANY LOGIN POLICY system privilege
- MANAGE ANY MIRROR SERVER system privilege
- MANAGE ANY OBJECT PRIVILEGES system privilege
- MANAGE ANY SPATIAL OBJECT system privilege
- MANAGE ANY STATISTICS system privilege
- MANAGE ANY USER system privilege
- MANAGE ANY WEB SERVICE system privilege
- MANAGE AUDITING system privilege
- MANAGE MULTIPLEX system privilege
- MANAGE PROFILING system privilege

- MANAGE REPLICATION system privilege
- MANAGE ROLES system privilege
- MONITOR system privilege
- READ CLIENT FILE system privilege
- READ FILE system privilege
- REORGANIZE ANY OBJECT system privilege
- SELECT ANY TABLE system privilege
- SERVER OPERATOR system privilege
- SET ANY PUBLIC OPTION system privilege
- SET ANY SECURITY OPTION system privilege
- SET ANY SYSTEM OPTION system privilege
- SET ANY USER DEFINED OPTION system privilege
- SET USER system privilege (granted with ADMIN ONLY clause)
- TRUNCATE ANY TABLE system privilege
- UPDATE ANY TABLE system privilege
- UPGRADE ROLE system privilege
- USE ANY SEQUENCE system privilege
- VALIDATE ANY OBJECT system privilege
- WRITE CLIENT FILE system privilege
- WRITE FILE system privilege

REVOKE USAGE ON SEQUENCE Statement

Removes USAGE privilege on a specified sequence.

Syntax

```
REVOKE USAGE ON SEQUENCE sequence-name
   FROM userID [,...]
```

Parameters

- **userID –** must be the name of an existing user or role that has a login password. Separate multiple userIDs with commas.

Standards

- SQL – syntax is a Persistent Stored Module feature.
- Sybase – the security model is different in Adaptive Server Enterprise and SAP Sybase IQ, so other syntaxes differ.

Permissions

Requires one of:

- MANAGE ANY OBJECT PRIVILEGE system privilege.
- You own the sequence.

SET OPTION Statement

Changes options that affect the behavior of the database and its compatibility with Transact-SQL. Setting the value of an option can change the behavior for all users or an individual user, in either a temporary or permanent scope.

Syntax

```
SET [ EXISTING ] [ TEMPORARY ] OPTION
   … [ userid. | PUBLIC.]option-name = [ option-value ]
```

Parameters

- **option-value –** a host-variable (indicator allowed), string, identifier, or number. The maximum length of *option-value* when set to a string is 127 bytes.

  If *option-value* is omitted, the specified option setting is deleted from the database. If it was a personal option setting, the value used reverts to the PUBLIC setting.

  Note: For all database options that accept integer values, SAP Sybase IQ truncates any decimal *option-value* setting to an integer value. For example, the value 3.8 is truncated to 3.

- **EXISTING –** option values cannot be set for an individual user ID unless there is already a PUBLIC user ID setting for that option.
- **TEMPORARY –** changes the duration that the change takes effect. Without the TEMPORARY clause , an option change is permanent: it does not change until it is explicitly changed using **SET OPTION**.

  When the TEMPORARY clause is applied using an individual user ID, the new option value is in effect as long as that user is logged in to the database.

  When the TEMPORARY clause is used with the PUBLIC user ID, the change is in place for as long as the database is running. When the database is shut down, TEMPORARY options for the PUBLIC user ID revert to their permanent value.

  If a TEMPORARY option is deleted, the option setting reverts to the permanent setting.

Examples

- **Example 1 –** set the DATE_FORMAT option:

  ```
  SET OPTION public.date_format = 'Mmm dd yyyy'
  ```

- **Example 2 –** set the WAIT_FOR_COMMIT option to on:

  ```
  SET OPTION wait_for_commit = 'on'
  ```

- **Example 3 –** embedded SQL examples:

```
EXEC SQL SET OPTION :user.:option_name = :value;
EXEC SQL SET TEMPORARY OPTION Date_format = 'mm/dd/yyyy';
```

Usage

The classes of options are:

- General database options
- Transact-SQL compatibility database options

Specifying either a user ID or the `PUBLIC` user ID determines whether the option is set for an individual user, a role represented by *userid*, or the `PUBLIC` user ID (the role to which all users are a member). If the option applies to a role ID, option settings are not inherited by members of the role—the change is applied only to the role ID. If no role is specified, the option change is applied to the currently logged-in user ID that issued the **SET OPTION** statement. For example, this statement applies an option change to the `PUBLIC` user ID:

```
SET OPTION Public.login_mode = standard
```

In Embedded SQL, only database options can be set temporarily.

Changing the value of an option for the PUBLIC user ID sets the value of the option for any user that has not set its own value. Option values cannot be set for an individual user ID unless there is already a PUBLIC user ID setting for that option.

Temporarily setting an option for the PUBLIC user ID, as opposed to setting the value of the option permanently, offers a security advantage. For example, when the **LOGIN_MODE** option is enabled, the database relies on the login security of the system on which it is running. Enabling the option temporarily means a database relying on the security of a Windows domain is not compromised if the database is shut down and copied to a local machine. In that case, the temporary enabling of **LOGIN_MODE** reverts to its permanent value, which might be Standard, a mode in which integrated logins are not permitted.

Warning! Changing option settings while fetching rows from a cursor is not supported, as it can lead to unpredictable behavior. For example, changing the DATE_FORMAT setting while fetching from a cursor returns different date formats among the rows in the result set. Do not change option settings while fetching rows.

Standards

- SQL—Vendor extension to ISO/ANSI SQL grammar.
- Sybase—Not supported by Adaptive Server Enterprise. SAP Sybase IQ does support some Adaptive Server Enterprise options using the **SET** statement.

Permissions

No specific system privileges are required to set your own options.

The SET ANY PUBLIC OPTION system privilege is required to set database options for another user.

The SET ANY SYSTEM OPTION system privilege is required to set a SYSTEM option for the PUBLIC user ID.

The SET ANY SECURITY OPTION system privilege is required to set a SECURITY option for the PUBLIC user ID.

SETUSER Statement

Allows a user to temporarily assume the roles and system privileges of another user (also known as impersonation) to perform operations, provided they already have the minimum required privileges to perform the task to begin with.

Note: The SET USER system privilege is two words; the SETUSER statement is one word.

Syntax

```
SETUSER userID
```

Parameters

- **UserID –** must be the name of an existing user or role that has a login password.

Usage

At-least criteria validation occurs when the SETUSER statement is executed, not when the SET USER system privilege is granted.

To terminate a successful impersonation, issue the SETUSER statement without specifying a userID.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

1. The impersonator has been granted the right to impersonate the target user.
2. The impersonator has, at minimum, all the roles and system privileges granted to the target user.
3. The impersonator has been granted the said roles and system privileges with similar or higher administrative rights.

   Note: For the purposes of meeting administrative rights criteria, the WITH ADMIN OPTION and WITH ADMIN ONLY OPTION clauses are considered to grant similar administrative rights. They are also considered to grant higher administrative rights than the WITH NO ADMIN OPTION clause. For example, User1 is granted Role1 with the

WITH ADMIN OPTION clause, User2 is granted Role1 with the WITH ADMIN ONLY clause, and User3 is granted Role1 with the WITH NO ADMIN OPTION clause. User1 and User2 are said to be granted Role1 with similar administrative rights. User1 and User2 are also said to be granted Role1 with higher administrative rights that User3.

4. If the target user has been granted a system privilege which supports extensions, the clauses used to grant the system privilege to the impersonator are a super-set of those used for the target user. Currently, only the SET USER and CHANGE PASSWORD system privileges support extensions.

Note:

- The ANY clause is considered a super-set of the *target_roles_list* and *target_users_list* clauses. If the target user has been granted the SET USER system privilege with an ANY grant, the impersonator must also have the ANY grant.
- If the target user has been granted the SET USER system privilege with both the *target_roles_list* and *target_users_list* clauses, the impersonator must also have been granted the system privilege with the two clauses, and the target list of each clause must be equal to or a super-set of the corresponding clause grant of the target user. For example, if the target lists of both the impersonator and target user contain User1, User2 and Role1, Role2, respectively, the target list grants for each clause are said to be equal. Alternately, if the target list grants of the impersonator contain User1, User2, Role1, Role2, respectively, while the target list grants of the target user contain User1, Role2 only, the target list grants of the impersonator are said to be a super-set of the target user.
- If the target user has been granted the SET USER system privilege with a single target list clause, the target list of the impersonator must be equal to or a super-set of the list of the target user. For example, the target_user_list of both the impersonator and the target user contain User1 and User2 (equal) or the impersonator list contains User1, User2, while the target user contains User2; User1, User2 (impersonator list) is a super-set of User2 (target user list).
- By definition, a user can always impersonate themselves. Therefore, if the target user has been granted the right to impersonate the impersonator, this does not violate the equal to or a super-set of criteria requirement of the impersonator. For example, User3 is the impersonator and User4 is the target user. The target_user_list for User3 contains User4 and User5. The target_user_list for User4 contains User3 and User5. If you remove the impersonator from the target list, the target list of User3 meets the criteria requirement.

VALIDATE LDAP SERVER Statement

Validates changes to the settings of existing LDAP server configuration objects before applying them.

Syntax

```
VALIDATE LDAP SERVER [ ldapua-server-name | ldapua-server-attribs  ]
   [ CHECK userid [ user-dn-string ] ]
```

```
ldapua-server-attribs:
   SEARCH DN
              URL { 'URL_string' | NULL }
              | ACCESS ACCOUNT { 'DN_string' | NULL }
              | IDENTIFIED BY ( 'password' | NULL }
              | IDENTIFIED BY ENCRYPTED { encrypted-password | NULL }

   | AUTHENTICATION URL { 'URL_string' | NULL }
   | CONNECTION TIMEOUT timeout_value
   | CONNECTION RETRIES retry_value
   | TLS { ON | OFF }
```

Parameters

- **ldapua-server-name –** identifies the LDAP server configuration object.
- **URL –** identifies the host (by name or by IP address), port number, and the search to be performed for the DN lookup for a given user ID. This value is validated for correct LDAP URL syntax before it is stored in the `ISYSLDAPSERVER` system table. The maximum size for this string is 1024 bytes.
- **ACCESS ACCOUNT –** a user created on the LDAP server for use by SAP Sybase IQ, not a user within SAP Sybase IQ. The distinguished name (DN) for this user is used to connect to the LDAP server. This user has permissions within the LDAP server to search for DNs by user ID in the locations specified by the SEARCH DN URL. The maximum size for this string is 1024 bytes.
- **IDENTIFIED BY –** provides the password associated with the ACCESS ACCOUNT user. The password is stored using symmetric encryption on disk. Use the value NULL to clear the password and set it to none. The maximum size of a clear text password is 255 bytes.
- **IDENTIFIED BY ENCRYPTED –** configures the password associated with the ACCESS ACCOUNT distinguished name in an encrypted format. The binary value is the encrypted password and is stored on disk as is. Use the value NULL to clear the password and set it to none. The maximum size of the binary is 289 bytes
- **AUTHENTICATION URL –** identifies the host (by name or IP address) and the port number of the LDAP server to use for authentication of the user. This is the value defined for <URL_string> and is validated for correct LDAP URL syntax before it is stored in `ISYSLDAPSERVER` system table. The DN of the user obtained from a prior DN search and the user password bind a new connection to the authentication URL. A successful connection to the LDAP server is considered proof of the identity of the connecting user. The maximum size for this string is 1024 bytes.
- **CONNECTION TIMEOUT –** specifies the connection timeout from SAP Sybase IQ to the LDAP server for both DN searches and authentication. This value is in milliseconds, with a default value of 10 seconds.

- **CONNECTION RETRIES –** specifies the number of retries on connections from SAP Sybase IQ to the LDAP server for both DN searches and authentication. The valid range of values is 1 – 60, with a default value of 3.
- **TLS –** defines whether the TLS or Secure LDAP protocol is used for connections to the LDAP server for both DN searches and authentication. When set to ON, the TLS protocol is used and the URL begins with "ldap://" When set to OFF (or not specified), Secure LDAP protocol is used and the URL begins with “ldaps://”. When using the TLS protocol, specify the database security option TRUSTED_CERTIFICATES_FILE with a file name containing the certificate of the Certificate Authority (CA) that signed the certificate used by the LDAP server.
- **CHECK userID –** the userID whose existence is validated on the LDAP server.
- **user-dn-string –** compares a user's DN value with the user ID for verification purposes.

Examples

- **Example 1 –** assume the apps_primary LDAP server configuration object was created as follows:

```
SET OPTION PUBLIC.login_mode = 'Standard,LDAPUA'
CREATE LDAP SERVER apps_primary
SEARCH DN
    URL 'ldap://my_LDAPserver:389/dc=MyCompany,dc=com??sub?cn=*'
    ACCESS ACCOUNT 'cn=aseadmin, cn=Users, dc=mycompany, dc=com'
    IDENTIFIED BY 'Secret99Password'
AUTHENTICATION URL 'ldap://my_LDAPserver:389/'
CONNECTION TIMEOUT 3000
WITH ACTIVATE
```

  This statement validates the existence of a userID `myusername` by using the optional CHECK clause to compare the userID to the expected user distinguished name (enclosed in quotation marks) on the `apps_primary` LDAP server configuration object.

```
VALIDATE LDAP SERVER apps_primary
CHECK myusername 'cn=myusername,cn=Users,dc=mycompany,dc=com'
```

- **Example 2 –** the name of the LDAP server configuration object does not have to defined in the **VALIDATE LDAP SERVER** statement if you include the search attributes:

```
VALIDATE LDAP SERVER
SEARCH DN
   URL  'ldap://my_LDAPserver:389/dc=MyCompany,dc=com??sub?cn=*'
    ACCESS ACCOUNT 'cn=aseadmin, cn=Users, dc=mycompany, dc=com'
    IDENTIFIED BY 'Secret99Password'
AUTHENTICATION URL 'ldap://my_LDAPserver:389/'
CONNECTION TIMEOUT 3000
CHECK myusername 'cn=myusername,cn=Users,dc=mycompany,dc=com'
```

Usage

This statement is useful for an administrator when setting up a new server to use LDAP user authentication, and for diagnosing problems between the LDAP server configuration object and the external LDAP server. Any connection made by the **VALIDATE LDAP SERVER** statement is temporary and is closed by the end of the statement.

When validating the LDAP server configuration object by name, definitions from prior **CREATE LDAP SERVER** and **ALTER LDAP SERVER** statements are used. Alternately, when *ldapua-server-attributes* are specified instead of the LDAP server configuration object name, the specified attributes are validated. When *ldapua-server-attributes* are specified, the URLs are parsed to identify syntax errors, and statement processing stops is a syntax error is detected,

Whether using an LDAP server configuration object name or a successfully parsed set of *ldapua-server-attributes*, a connection to the external LDAP server is attempted. If the parameter ACCESS ACCOUNT and a password are specified, the values are used to establish the connection to the SEARCH DN URL. This the SEARCH DN URL, ACCESS ACCOUNT, and ACCESS ACCOUNT password.

When using the optional CHECK clause, the userID is used in the search to validate the existence of the user on the external LDAP server. When the expected DN value for a given user is known, the value can be specified, and is compared with the result of the search to determine success or failure.

Standards

ANSI SQL – Compliance level: Transact-SQL extension.

Permissions

Requires the MANAGE ANY LDAP SERVER system privilege.

Database Options

Database options customize and modify database behavior.

LOGIN_MODE Option

Controls the use of integrated logins for the database.

Allowed Values

- Standard – the default setting, which does not permit integrated logins. An error occurs if an integrated login connection is attempted.
- Mixed – both integrated logins and standard logins are allowed.

- Integrated – all logins to the database must be made using integrated logins.
- Kerberos – all logins to the database must be made using Kerberos logins.
- LDPAUA – all logins to the database must be made using LDAP logins.

Note: Mixed is equivalent to "Standard,Integrated".

Default
Standard

Scope
Option can be set at the database (PUBLIC) level only.

Requires the SET ANY SECURITY OPTION system privilege to set this option. Takes effect immediately.

Description
Values are case-insensitive:

Warning!

- Restricting the `LOGIN_MODE` to a single mode in a mixed environment (for example, Integrated only or LDAPUA only) restricts connections to only those users who have been granted the corresponding login mapping. Attempting to connect using other methods generates an error. The only exceptions to this are users with full administrative rights (SYS_AUTH_DBA_ROLE or SYS_AUTH_SSO_ROLE).
- Restricting the `LOGIN_MODE` to LDAPUA only may result in a configuration where no users can connect to the server if no user or login policy exists that permits LDAPUA. Use the command line switch **-al***user-id-list* with the **start_iq** utility to recover from this situation.

MIN_ROLE_ADMINS Option

Configures of the minimum number of required administrators for all roles.

Allowed Values
1 – 10

Default
1

Scope
Option can be set at the database (PUBLIC) level only.

Requires the SET ANY SECURITY OPTION system privilege to set this option. Takes effect immediately.

Description
This options sets the minimum number of required administrators for all roles. This value applies to the minimum number of role administrators for each role, not the minimum number or role administrators for the total number of roles. When dropping roles or users, this value ensures that you never create a scenario where there are no users and roles left with sufficient system privilege to manage the remaining users and roles.

TRUSTED_CERTIFICATES_FILE Option

Specifies the trust relationship for outbound Transport Layer Security (TLS) connections made by LDAP User Authentication, INC, and MIPC connections.

Allowed Values
A valid network path to the location of a TXT file containing the list of trusted certificate authorities that sign server certificates.

Default
NULL, meaning that no outbound TLS connection can be started because there are no trusted certificate authorities.

Scope
Option can be set at the database (PUBLIC) level only.

Requires the SET ANY SECURITY OPTION system privilege to set this option. Takes effect immediately.

Description
This option identifies the path to the location of the list of trusted certificate authorities. The list must be stored in a TXT file. The file may be shared in a location in a Windows environment on the local drive to be used by all SAP Sybase applications on that machine.

-al iqsrv16 Server Option

Extends LOGIN_MODE for LDAPUA only to a select number of users using Standard authentication

Syntax

```
-al "user1;user2;user3" server_name.cfg database-name.db
```

Remarks

- Up to five user IDs can be specified, separated by semi-colons, and enclosed in double quotation marks.
- When run at the server level, the **-al** switch remains in effect until the next time the server is restarted.

-al iqsrv16 Database Option

Extends LOGIN_MODE for LDAPUA only to a select number of users using Standard authentication

Syntax

```
-al "user1;user2;user3" server_name.cfg database_name.db
```

Remarks

- Up to five user IDs can be specified, separated by semi-colons, and enclosed in double quotation marks.
- When run a t the database level, it remains in effect until the next time the database is stopped/started.

VERIFY_PASSWORD_FUNCTION Option

Specifies a user-supplied authentication function that can be used to implement password rules.

Allowed Values

String

Default

" (the empty string). (No function is called when a password is set.)

Scope

Option can be set at the database (PUBLIC) or user level. When set at the database level, the value becomes the default for any new user, but has no impact on existing users. When set at the user level, overrides the PUBLIC value for that user only. No system privilege is required to set option for self. System privilege is required to set at database level or at user level for any user other than self.

Requires the SET ANY SECURITY OPTION system privilege to set this option. Can be set temporary for an individual connection or for the PUBLIC role. Takes effect immediately.

Description

When the `VERIFY_PASSWORD_FUNCTION` option value is set to a valid string, the statement **GRANT CONNECT TO** *userid* **IDENTIFIED BY** *password* calls the function specified by the option value.

The option value requires the form *owner.function_name* to prevent users from overriding the function.

The function takes two parameters:

- *user_name* VARCHAR(128)
- *new_pwd* VARCHAR(255)

The return value type is VARCHAR(255).

If VERIFY_PASSWORD_FUNCTION is set, you cannot specify more than one userid and password with the **GRANT CONNECT** statement.

Example

The following sample code defines a table and a function and sets some login policy options. Together they implement advanced password rules that include requiring certain types of characters in the password, disallowing password reuse, and expiring passwords. The function is called by the database server with the verify_password_function option when a user ID is created or a password is changed. The application can call the procedure specified by the post_login_procedure option to report that the password should be changed before it expires.

```
-- only DBA should have privileges on this table
CREATE TABLE DBA.t_pwd_history(
        pk          INT         DEFAULT AUTOINCREMENT PRIMARY KEY,
        user_name   CHAR(128),  -- the user whose password is set
        pwd_hash    CHAR(32) ); -- hash of password value to detect
                                -- duplicate passwords

-- called whenever a non-NULL password is set
-- to verify the password conforms to password rules
CREATE FUNCTION DBA.f_verify_pwd( uid     VARCHAR(128),
                                  new_pwd VARCHAR(255) )
RETURNS VARCHAR(255)
BEGIN
    -- enforce password rules
    -- enforce minimum length (can also be done with
    -- min_password_length option)
    IF length( new_pwd ) < 6 THEN
        RETURN 'password must be at least 6 characters long';
    END IF;

    -- number of lowercase characters IN new_pwd
    SELECT count(*) INTO num_lower_chars
       FROM pwd_chars WHERE CAST( c AS BINARY ) BETWEEN 'a' AND 'z';

    -- enforce rules based on characters contained in new_pwd
    IF ( SELECT count(*) FROM pwd_chars WHERE c BETWEEN '0' AND '9' )
          < 1 THEN
        RETURN 'password must contain at least one numeric digit';
    ELSEIF length( pwd_alpha_only ) < 2 THEN
        RETURN 'password must contain at least two letters';
    ELSEIF num_lower_chars = 0
          OR length( pwd_alpha_only ) - num_lower_chars = 0 THEN
        RETURN 'password must contain both upper- and lowercase
characters';
    END IF;

    -- not the same as any user name
    -- (this could be modified to check against a disallowed words
```

```
table)
    IF EXISTS( SELECT * FROM SYS.SYSUSER
                      WHERE lower( user_name ) IN
( lower( pwd_alpha_only ),
                                                lower( new_pwd ) ) ) THEN
        RETURN 'password or only alphabetic characters in password '
||
               'must not match any user name';
    END IF;

    -- not the same as any previous password for this user
    IF EXISTS( SELECT * FROM t_pwd_history
                      WHERE user_name = uid
                     AND pwd_hash = hash( uid || new_pwd, 'md5' ) ) THEN
        RETURN 'previous passwords cannot be reused';
    END IF;

    -- save the new password
    INSERT INTO t_pwd_history( user_name, pwd_hash )
        VALUES( uid, hash( uid || new_pwd, 'md5' ) );

    RETURN( NULL );
END;

ALTER FUNCTION DBA.f_verify_pwd SET HIDDEN;
GRANT EXECUTE ON DBA.f_verify_pwd TO PUBLIC;
SET OPTION PUBLIC.verify_password_function = 'DBA.f_verify_pwd';


-- All passwords expire in 180 days. Expired passwords can be changed
-- by the user using the NewPassword connection parameter.
ALTER LOGIN POLICY DEFAULT password_life_time = 180;

-- If an application calls the procedure specified by the
-- post_login_procedure option, then the procedure can be used to
-- warn the user that their password is about to expire. In
particular,
-- Interactive SQL calls the post_login_procedure.
ALTER LOGIN POLICY DEFAULT password_grace_time = 30;
```

To turn the option off, set it to the empty string:

```
SET OPTION PUBLIC.VERIFY_PASSWORD_FUNCTION = ''
```

MIN_PASSWORD_LENGTH Option

Sets the minimum length for new passwords in the database.

Allowed Values
Integer greater than or equal to zero

The value is in bytes. For single-byte character sets, this is the same as the number of characters.

Default
3 characters

Scope
Option can be set at the database (PUBLIC) level only.

Requires the SET ANY SECURITY OPTION system privilege to set this option. Takes effect immediately.

Description
This option imposes a minimum length on all new passwords for greater security. Existing passwords are not affected.

Example
Set the minimum length for new passwords to 6 bytes:

```
SET OPTION PUBLIC.MIN_PASSWORD_LENGTH = 6
```

-gk iqsrv16 database server option

Sets the privileges required to stop the database server.

Syntax

```
iqsrv16 -gk { DBA | all | none } ...
```

Allowed values

- **DBA –** Only users with the SERVER OPERATOR system privilege can stop the database server. This is the default for the network server.
- **all –** No privileges are required to shut down the database server.
- **none –** The database server cannot be stopped.

Applies to
All operating systems and database servers.

Remarks
The -gd database server option applies to the dbstop utility as well as to the following statements:

- ALTER DATABASE *dbname* FORCE START statement.
- STOP DATABASE statement

-gl iqsrv16 Server Option

Set the permission required to load data using **LOAD TABLE**.

Syntax

-gl level

Remarks

The **LOAD TABLE** statement reads files from the database server machine. To control access to the file system using these statements, the **-gl** command-line switch allows you to control the level of database permission that is required to use these statements. *level* is either:

- DBA – only users with the LOAD ANY TABLE, ALTER ANY TABLE or ALTER ANY OBJECT system privilege can load data.
- ALL – all users can load data.
- NONE – data cannot be loaded.

You can use either uppercase and lowercase syntax for the options.

The default settings are **all** for servers started with **start_iq** and **dba** for other servers. SAP Sybase recommends that, for consistency with earlier versions, you use the **all** value on all systems. The **all** setting is used in the `iqdemo.cfg` and `default.cfg` configuration files.

-gu iqsrv16 database server option

Sets the privilege required for executing database file administration statements such as for creating or dropping databases.

Syntax

```
iqsrv16 -gu { all | none | DBA | utility_db } ...
```

Allowed values

-gu option	Effect	Applies to
`all`	*This option is deprecated.* Anyone can execute file administration statements.	Any database including utility database
`none`	Executing file administration statements is not allowed.	Any database including utility database
`DBA`	Only users with the SERVER OPERATOR system privilege can execute file administration statements	Any database including utility database

-gu option	Effect	Applies to
utility_db	Only the users who can connect to the utility database can execute file administration statements	Only the utility database

Default
DBA

Applies to
All operating systems and database servers.

Remarks
Restricts the users who can execute the following database file administration statements:

- ALTER DATABASE dbfile ALTER TRANSACTION LOG
- CREATE DATABASE statement
- CREATE DECRYPTED DATABASE statement
- CREATE DECRYPTED FILE statement
- CREATE ENCRYPTED DATABASE statement
- CREATE ENCRYPTED FILE statement
- DROP DATABASE statement
- RESTORE DATABASE statement.

When utility_db is specified, these statements can only be run from the utility database. When DBA is specified, these statements can only be run by a user with the SERVER OPERATOR system privilege. When none is specified, no user can execute these statements.

Examples

To prevent the use of the file administration statements, start the database server using the none privilege level of the -gu option. The following command starts a database server and names it TestSrv. It loads the `mytestdb.db` database, but prevents anyone from using that server to create or delete a database, or execute any other file administration statement regardless of their resource creation rights, or whether they can load and connect to the utility database.

```
iqsrv16 -n TestSrv -gu none c:\mytestdb.db
```

To permit only the users knowing the utility database password to execute file administration statements, start the server by running the following command.

```
iqsrv16 -n TestSrv -su secret -gu utility_db
```

The following command starts Interactive SQL as a client application, connects to the server named TestSrv, loads the utility database, and connects the user.

```
dbisql -c
"UID=DBA;PWD=secret;DBN=utility_db;Host=host1;Server=TestSrv"
```

Having executed the above command successfully, the user connects to the utility database, and can execute file administration statements.

-sk iqsrv16 database server option

Specifies a system secure feature key that can be used to allow access to features that are secured for the database server.

Syntax

```
iqsrv16 -sk key ...
```

Applies to

All operating systems and database servers.

Remarks

When you secure features for a database server by using the -sf option, you can also include the -sk option, which specifies a key that can be used with the sp_use_secure_feature_key system procedure to allow access to secured features for a connection. That connection can also use the sa_server_option system procedure to modify the features or feature sets that are secured for all databases running on the database server.

The key must be a non-empty string of at least six characters, and it cannot contain double quotes, control characters (any character less than 0x20), or backslashes. There is a limit of 1000 secure feature keys per database.

If the value for the authorization_key parameter of the sp_use_secure_feature_key system procedure is set to any value other than the one specified by -sk, no error is given and the features specified by -sf remain secured for the connection.

If you specify -sk without -sf, only the default secure features are enabled, but you can use the system secure feature key while the database server is running to change the secure feature settings.

Example

The following command starts a database server named secure_server with the backup feature secured. The key specified by the -sk option can be used later to allow access to these features for a specific connection.

```
iqsrv16 -n secure_server -sf backup -sk j978kls12
```

Setting the authorization_key parameter to the value specified by -sk for a connection to a database running on the secure_server database server allows that connection to perform backups or change the features that are secured on the secure_server database server:

```
CALL sp_use_secure_feature_key ( 'MyKey' , 'j978kls12' );
```

The user can then secure all features for databases running on secure_server by executing the following statement:

```
CALL sa_server_option( 'SecureFeatures', 'all' );
```

-sf iqsrv16 database server option

Controls whether users have access to features for databases running on the current database server. A secured feature can only be accessed by a user with appropriate privileges, while an unsecured feature can be accessed by all users.

Syntax

```
iqsrv16 -sf feature-list ...
```

```
feature-list :
feature-name | feature-set [ ,feature-name | feature-set ] ...
```

Feature set	Included features (feature sets in bold)
none	All features are unsecured except manage_features, manage_keys, and disk_sandbox.
manage_server	processor_affinity
manage_security	manage_features manage_keys manage_disk_sandbox
server_security	disk_sandbox trace_system_event

Feature set	Included features (feature sets in bold)
all	**client –** read_client_file write_client_file **remote –** remote_data_access send_udp send_email web_service_client **local –** • **local_call –** cmdshell external_procedure java • **local_db –** backup restore database dbspace • **local_env –** getenv • **local_io –** create_trace_file read_file write_file directory sp_list_directory sp_create_directory sp_copy_directory sp_move_directory sp_delete_directory sp_copy_file

Feature set	Included features (feature sets in bold)
	sp_move_file sp_delete_file • **local_log –** request_log console_log webclient_log

Parameters

- **none –** Specifies that no features are secured.
- **manage_server –** Prevents users from accessing all database server-related features. This set consists of the following features:
  - **processor_affinity –** Prevents users from changing the processor affinity (the number of logical processors being used) of the database server.
- **manage_security –** Prevents users from accessing features that allow the management of database server security. By default, these features are secured.
  - **manage_features –** Prevents users from modifying the list of features that can be secured on the database server.
  - **manage_keys –** Prevents the creation, modification, deletion, or listing of secure feature keys.

    A user that has access to the manage_keys feature but not the manage_features feature cannot define a key with more secure features than those assigned to the user.
  - **manage_disk_sandbox –** Prevents users from temporarily changing disk sandbox settings by using the sa_server_option system procedure or the sa_db_option system procedure. The manage_disk_sandbox secure feature cannot be turned off for all databases or users—it can only be turned off for individual connections by using the sp_use_secure_feature_key system procedure.
- **server_security –** Prevents users from accessing features that can temporarily bypass security settings. By default, these features are secured.
  - **disk_sandbox –** Prevents users from performing read-write file operations on the database outside the directory where the main database file is located.
  - **trace_system_event –** Prevents users from creating user-defined trace events.
- **all –** Prevents users from accessing the following groups:
  - **client –** Prevents users from accessing all features that allow access to client-related input and output. This feature controls access to the client computing environment. This set consists of the following features:

    - **read_client_file –** Prevents the use of statements that can cause a client file to be read. For example, the READ_CLIENT_FILE function and the LOAD TABLE statement.
    - **write_client_file –** Prevents the use of all statements that can cause a client file to be written to. For example, the UNLOAD statement and the WRITE_CLIENT_FILE function.
- **remote –** Prevents users from accessing all features that allow remote access or communication with remote processes. This set consists of the following features:
    - **remote_data_access –** Prevents the use of any remote data access services, such as proxy tables.
    - **send_udp –** Prevents the ability to send UDP packets to a specified address by using the sa_send_udp system procedure.
    - **send_email –** Prevents the use of email system procedures, such as xp_sendmail.
    - **web_service_client –** Prevents the use of web service client stored procedure calls (stored procedures that issue HTTP requests).
- **local –** Prevents users from accessing all local-related features. This feature controls access to the server computing environment. This set consists of the `local_call`, `local_db`, `local_io`, and `local_log` feature subsets.
    - **local_call –** Prevents users from accessing all features that provide the ability to execute code that is not directly part of the database server and is not controlled by the database server. This set consists of the following features:
        - **cmdshell –** Prevents the use of the xp_cmdshell procedure.
        - **external_procedure –** Prevents the use of external stored procedures. This setting does not disable the use of the xp_* system procedures (such as xp_cmdshell, xp_readfile, and so on) that are built into the database server. Separate feature control options are provided for these system procedures.
        - **external_procedure_v3 –** See the User-Defined Functions guide.
        - **java –** Prevents the use of Java-related features, such as Java procedures.
    - **local_db –** Prevents users from accessing all features related to database files. This set consists of the following features:
        - **backup –** Prevents the use of the BACKUP statement, and with it, the ability to run server-side backups. You can still perform client-side backups by using the dbbackup utility.
        - **restore –** Prevents the use of the RESTORE DATABASE statement.
        - **database –** Prevents the use of the CREATE DATABASE, ALTER DATABASE, DROP DATABASE, CREATE ENCRYPTED FILE, CREATE DECRYPTED FILE, CREATE ENCRYPTED DATABASE, and CREATE DECRYPTED DATABASE statements.

    - **dbspace –** Prevents the use of the CREATE DBSPACE, ALTER DBSPACE, and DROP DBSPACE statements.
- **local_env –** Prevents users from accessing all features related to environment variables. This set consists of the following features:
    - **getenv –** Prevents users from reading the value of any environment variable.
- **local_io –** Prevents users from accessing all features that allow direct access to files and their contents. This set consists of the following features:
    - **create_trace_file –** Prevents the use of statements that create an event tracing target.
    - **read_file –** Prevents the use of statements that can cause a local file to be read. For example, the xp_read_file system procedure, the LOAD TABLE statement, and the use of OPENSTRING(FILE...). The alternate names load_table and xp_read_file are deprecated.
    - **write_file –** Prevents the use of all statements that can cause a local file to be written to. For example, the UNLOAD statement and the xp_write_file system procedure. The alternate names unload_table and xp_write_file are deprecated.
    - **delete_file –** Prevents the use of all statements that can cause a local file to be deleted. For example, securing this feature causes the dbbackup utility to fail if the -x or -xo options are specified.
    - **directory –** Prevents the use of directory class proxy tables. This feature is disabled when remote_data_access is disabled.
    - **sp_list_directory –** Prevents the use of the sp_list_directory system procedure.
    - **sp_create_directory –** Prevents the use of the sp_create_directory system procedure.
    - **sp_copy_directory –** Prevents the use of the sp_copy_directory system procedure.
    - **sp_move_directory –** Prevents the use of the sp_move_directory system procedure.
    - **sp_delete_directory –** Prevents the use of the sp_delete_directory system procedure.
    - **sp_copy_file –** Prevents the use of the sp_copy_file system procedure.
    - **sp_move_file –** Prevents the use of the sp_move_file system procedure.
    - **sp_delete_file –** Prevents the use of the sp_delete_file system procedure.
- **local_log –** Prevents users from accessing all logging features that result in creating or writing data directly to a file on disk. This set consists of the following features:
    - **request_log –** Prevents the ability to change the request log file name and also prevents the ability to increase the limits of the request log file size or number of files. You can specify the request log file and limits on this file in the command to start the database server; however, they cannot be changed once the database server is started. When request log features are disabled, you can still turn

request logging on and off and reduce the maximum file size and number of request logging files.

- **console_log –** Prevents the ability to change the database server message log file name using the ConsoleLogFile option of the sa_server_option system procedure. Securing this feature also prevents the ability to increase the maximum size of the log file using the ConsoleLogMaxSize option of the sa_server_option system procedure. You can specify a server log file and its size when starting the database server.
- **webclient_log –** Prevents the ability to change the web service client log file name using the WebClientLogFile option of the sa_server_option system procedure. You can specify a web service client log file when starting the database server.

Applies to

All operating systems and database servers.

Remarks

This option allows the owner of the database server to control whether users have access to features for databases running on the database server. The -sk option allows the owner of the database server to create a system secure feature key that prevents users from accessing features specified by the -sf option.

If you start a database without specifying a system secure feature key, the default secure features are secured, and you cannot change the secure feature settings for the database server or any databases running on it. You cannot create the system secure feature key later—you must shut down the database server and specify a system secure feature key when you restart it.

The *feature-list* is a comma-separated list of feature names or feature sets to secure for the database server. Securing a feature makes it inaccessible to all database users other than administrators. Specifying a feature set secures all the features included in the set. To secure one or more, but not all, of the features in the feature set, specify the individual feature name.

Note: Sub-features of feature sets that are secured by default, cannot be unsecured from the command line. In other words the following command will not work:

```
-sf manage_security, -manage_keys
```

Use *feature-name* to indicate that the feature should be secured (made inaccessible), and –*feature-name* or *feature-name*– to indicate that the feature should be unsecured (accessible to all database users). For example, the following command indicates that only dbspace features are accessible to all users:

```
iqsrv16 -n secure_server -sf all,-dbspace
```

Example

The following command starts a database server named secure_server with access to the request log and with all remote data access features secured. The key specified by the -sk option can be used later with the sp_use_secure_feature_key system procedure to make these features accessible to all users on the current connection.

```
iqsrv16 -n secure_server -sf remote,-request_log -sk j978kls12
```

If a user connected to a database running on the secure_server database server uses the sp_use_secure_feature_key system procedure with the authorization_key parameter set to the same value as that specified by -sk, that connection has access to the remote data access features:

```
CALL sp_use_secure_feature_key ( 'MyKey' , 'j978kls12' );
```

The following command secures all features, with the exception of local database features:

```
iqsrv16 -n secure_server -sf all,-local_db
```

Procedures and Functions

Use the system-supplied stored functions and procedures in SAP Sybase IQ databases to retrieve system information.

sa_get_ldapserver_status System Procedure

Determines the current status of the LDAP server configuration object.

Syntax

sa_get_ldapserver_status()

Arguments

None

Result Set

Column Name	Data Type	Description
ldsrv_id	UNSIGNED BIGINT	A unique identifier for the LDAP server configuration object that is the primary key and is used by the login policy to refer to the LDAP server.
ldsrv_name	CHAR(128)	The name assigned to the LDAP server configuration object.

Column Name	Data Type	Description
ldsrv_state	CHAR(9)	Read-only state of the LDAP server: 1 – RESET 2 – READY 3 – ACTIVE 4 – FAILED 5 – SUSPENDED A numeric value is stored in system table; a corresponding text value appears in the system view.
ldsrv_last_state_change	TIMESTAMP	Indicates the time the last state change occurred. The value is stored in Coordinated Universal Time (UTC), regardless of the local time zone of the LDAP server.

Remarks

To see SYSLDAPSERVER column values before a checkpoint occurs and the contents of memory are written to the catalog on disk. The updates to the catalog columns ldsrv_state and ldsrv_last_state_change occur asynchronously during checkpoint to the LDAP server object as the result of an event that changes the LDAP server object state, such as a failed connection due to a failed LDAP directory server. The LDAP server object state reflects the state of the LDAP directory server.

Privileges

None.

sa_get_user_status system procedure

Allows you to determine the current status of users.

Syntax

```
sa_get_user_status( )
```

Result set

Column name	Data type	Description
user_id	UNSIGNED INTEGER	A unique number identifying the user.

Column name	Data type	Description
user_name	CHAR(128)	The name of the user.
connections	INTEGER	The current number of connections by this user.
failed_logins	UNSIGNED INTEGER	The number of failed login attempts made by the user.
last_login_time	TIMESTAMP	The local time that the user last logged in.
locked	TINYINT	Indicates if the user account is locked.
reason_locked	LONG VARCHAR	The reason the account is locked.
user_dn	CHAR(1024)	The Distinguished Name (DN) for a user ID connecting to an LDAP server.
user_dn_cached_at	TIMESTAMP	The local time that the DN was stored.
password_change_state	BIT	A value that indicates whether a dual password change is in progress (0=No, 1=Yes). The default is 0.
password_change_first_user	UNSIGNED INTEGER	The user_id of the user who set the first part of a dual password; otherwise NULL.
password_change_second_user	UNSIGNED INTEGER	The user_id of the user who set the second part of a dual password; otherwise NULL.
user_dn	CHAR(1024)	The distinguished name (DN) of the user.
user_dn_cached_at	TIMESTAMP	The date and time the distinguished name was found.

Remarks

This procedure returns a result set that shows the current status of users. In addition to basic user information, the procedure includes a column indicating if the user has been locked out

and a column with a reason for the lockout. Users can be locked out for the following reasons: locked due to policy, password expiry, or too many failed attempts.

If the user is authenticated using LDAP User Authentication, the output includes the user's distinguished name and the date and time that the distinguished name was found.

Privileges

You can view information about yourself; no privilege is required. You must have the MANAGE ANY USER system privilege to view information about other users.

Side effects

None

Example

The following example uses the sa_get_user_status system procedure to return the status of database users.

```
CALL sa_get_user_status;
```

sp_create_secure_feature_key System Procedure

Creates a new secure feature key.

Syntax

```
sp_create_secure_feature_key (
    name,
    auth_key,
    features )
```

Arguments

- **name –** the VARCHAR (128) name for the new secure feature key. This argument cannot be NULL or an empty string.
- **auth_key –** the CHAR (128) authorization key for the secure feature key. The authorization key must be a non-empty string of at least six characters.
- **features –** the LONG VARCHAR comma-separated list of secure features that the new key can enable. Specifying "-" before a feature means that the feature is not re-enabled when the secure feature key is set.

Remarks

This procedure creates a new secure feature key that can be given to any user. The system secure feature key is created using the -sk database server option.

Privileges

To use this procedure, you must be the database server owner and have the manage_keys feature enabled on the connection.

sp_displayroles System Procedure

Displays all roles granted to a user-defined role or a user, or displays the entire hierarchical tree of roles.

Syntax

```
dbo.sp_displayroles(
 [user_role_name],
 [display_mode],
 [grant_type] )
```

Arguments

- **user_role_name –** valid values are:
  - A valid system privilege name or system privilege role name
  - A valid user-defined role name
  - A valid user name

  By default, if no argument is specified, the current login user is used.
- **display_mode –** valid values are:
  - **EXPAND_UP** – shows all roles granted the input role or system privilege; that is the role hierarchy tree for the parent levels.
  - **EXPAND_DOWN** – shows all roles or system privileges granted to the input role or user; that is, the role hierarchy tree for the child levels,

  If no argument is specified (default), only the directly granted roles or system privileges appear.
- **grant_type –** valid values are:
  - **ALL** – shows all roles or system privileges granted.
  - **NO_ADMIN** – shows all roles or system privileges granted with the WITH NO ADMIN OPTION or WITH ADMIN OPTION clause.
  - **ADMIN** – shows all roles or system privileges granted with the WITH ADMIN OPTION or WITH ADMIN ONLY OPTION clause.

  If no argument is specified, **ALL** is used.

Result Set

Column Name	Data Type	Description
role_name	char(128)	Lists role/system privilege name.
parent_role_name	char(128)	Lists role name of the parent.

Column Name	Data Type	Description
grant_type	char(10)	Lists grant type.
role_level	smallint	For `Expand_down` mode, 1 indicates directly granted roles; 2 indicates the next hierarchy below, and so on. For `Expand_up` mode, 0 indicates the roles to which the specified role is granted; -1 indicates the next hierarchy above, and so on.

Remarks

For Name = System privilege name, the results show the system privilege name instead of the system privilege role name.

For Mode = Expand_down, parent_role_name is NULL for level 1 (directly granted roles). If no mode is specified (default), role_level is 1 and parent_role_name is NULL, since only directly granted roles appear.

For Name = User name, with Mode = expand_up, no results are returned since a user resides at the top level in any role hierarchy. Similarly, if Name = an immutable system privilege name, with Mode = Expand_down, no results are returned because an immutable system privilege resides at the bottom level in any role hierarchy.

For default Mode, parent_role_name column is NULL and role_level is 1.

Privileges

For users and extended users:

- No system privilege is required to execute this procedures against themselves.
- MANAGE ROLES system privilege is required to execute this procedure for other users.

For roles and system privileges:

- Administrative privilege over the role or system privilege is required to execute this procedure.
- Role administrators can execute this procedure for roles they administer.

Example

This example assumes these GRANT statements have been executed:

```
GRANT SERVER OPERATOR TO r4;
GRANT BACKUP DATABASE TO r3 WITH ADMIN OPTION;
GRANT DROP CONNECTION TO r3 WITH ADMIN ONLY OPTION;
GRANT MONITOR TO r2;GRANT CHECKPOINT TO r1;
GRANT ROLE r2 TO r1 WITH ADMIN OPTION;
GRANT ROLE r3 TO r2 WITH NO ADMIN OPTION;
```

```
GRANT ROLE r4 TO r3 WITH ADMIN ONLY OPTION;
GRANT ROLE r1 TO user1;
GRANT ROLE r1 TO r7;
GRANT ROLE r7 TO user2 WITH ADMIN OPTION;
GRANT BACKUP DATABASE TO user2 WITH ADMIN ONLY OPTION;
```

`sp_displayroles( 'user2', 'expand_down', 'ALL' )` produces output similar to:

role_name	parent_role_name	grant_type	role_level
r7	NULL	ADMIN	1
PUBLIC	NULL	NO ADMIN	1
BACKUP DATABASE	NULL	ADMIN ONLY	1
dbo	PUBLIC	NO ADMIN	2
r1	r7	NO ADMIN	2
r2	r1	ADMIN	3
CHECKPOINT	r1	NO ADMIN	3
r3	r2	NO ADMIN	4
MONITOR	r2	NO ADMIN	4
r4	r3	ADMIN ONLY	5
BACKUP DATABASE	r3	ADMIN	5
DROP CONNECTION	r3	ADMIN ONLY	5

`sp_displayroles( 'user2', 'expand_down', 'NO_ADMIN' )` produces output similar to:

role_name	parent_role_name	grant_type	role_level
r7	NULL	ADMIN	1
PUBLIC	NULL	NO ADMIN	1
dbo	PUBLIC	NO ADMIN	2
r1	r7	NO ADMIN	2
r2	r1	ADMIN	3

role_name	parent_role_name	grant_type	role_level
CHECKPOINT	r1	NO ADMIN	3
r3	r2	NO ADMIN	4
MONITOR	r2	NO ADMIN	4
BACKUP DATABASE	r3	ADMIN	5

`sp_displayroles( 'r3', 'expand_up', 'NO_ADMIN' )` produces out put similar to:

role_name	parent_role_name	grant_type	role_level
r1	r7	NO ADMIN	-2
r2	r1	ADMIN	-1
r3	r2	NO ADMIN	0

`sp_displayroles( 'r1', 'NO_ADMIN', 'expand_up')` produces output similar to:

role_name	parent_role_name	grant_type	role_level
r1	r7	NO ADMIN	0

sp_expireallpasswords system procedure

Immediately expires all user passwords.

Syntax1

```
call sp_expireallpasswords
```

Syntax2

```
sp_expireallpasswords
```

Privileges

Requires the MANAGE ANY USER system privilege.

SP_HAS_ROLE Function [System]

Returns an integer value indicating whether the invoking user has been granted a specified system privilege or user-defined role. When used for permission checking within user-defined

stored procedures, **SP_HAS_ROLE** returns an error message when a user fails a permission check.

Syntax

dbo.sp_has_role(*[rolename]*, *[grant_type]*, *[throw_error]*)

Parameters

Parameters	Description
rolename	The name of a system privilege or user-defined role.
grant_type	Valid values are: ADMIN and NO ADMIN. If NULL or not specified, NO ADMIN is used by default.
throw_error	Valid values are: • **1** – display error message specified if system privilege or user-defined role is not granted to invoking user. • **0** – (default) do not display error message if specified system privilege or user-defined role is not granted to invoking user.

Returns

Value	Description
1	System privilege or user-defined role is granted to invoking user.
0 or `Permission denied: you do not have permission to execute this command/procedure.`	System privilege or user-defined role is not granted to invoking user. The error message replaces the value 0 when the `throw_error` argument is set to 1.
-1	The system privilege or user-defined role specified does not exist. No error message appears, even if the `throw_error` argument is set to 1.

Remarks

If the value of the `grant_type` argument is ADMIN, the function checks whether the invoking user has administrative privileges for the system privilege. If the value of the `grant_type` argument is NO ADMIN, the function checks whether the invoking user has privileged use of the system privilege or role.

If the `grant_type` argument is not specified, NO ADMIN is used by default and output indicates only whether the invoking user has been granted, either directly or indirectly, the specified system privilege or user-defined role.

If the `rolename` and `grant_type` arguments are both NULL and the `throw_error` argument is 1, you see an error message. You may find this useful for those stored procedures where an error message appears after certain values are read from the catalog tables rather than after the checking the presence of certain system privileges for the invoking user.

Note: A permission denied error message is returned if the arguments `rolename` and `grant_type` are set to NULL and `throw_error` is set to 1, or if all three arguments are set to NULL.

Example 1
Consider the following scenario:

- `u1` has been granted the CREATE ANY PROCEDURE system privilege with the WITH NO ADMIN OPTION clause.
- `u1` has not been granted the CREATE ANY TABLE system privilege.
- `u1` has been granted the user-defined role `Role_A` with the WITH ADMIN ONLY OPTION clause.
- `Role_B` exists, but has not been granted to `u1`
- The role `Role_C` does not exist.

Based on the above scenario, this command

- `sp_has_role 'create any procedure'`

  returns the value 1, which indicates `u1` has been granted the CREATE ANY PROCEDURE system privilege.
- `sp_has_role 'create any table'`

  returns the value 0, which indicates `u1` has not been granted the CREATE ANY TABLE system privilege. No error message is returned because the `throw_error` argument is not specified.
- `sp_has_role 'create any procedure','admin',1`

  returns the `Permission denied` error message (throw_error=1). Even though `u1` has been granted the CREATE ANY PROCEDURE system privilege, `u1` has not been granted administrative rights to the system privilege.
- `sp_has_role 'Role_A'`

  returns the value 1, which indicates `u1` has been granted role `Role_A`.
- `sp_has_role 'Role_A','admin',1`

  returns the value 1, which indicates `u1` has been granted role `Role_A` with administrative rights.
- `sp_has_role 'Role_B'`

  returns the value 0, which indicates `u1` has not been granted the role `ROLE_B`. No error message is returned because the `throw_error` argument is not specified.

- `sp_has_role 'Role_C'`

  returns the value -1, which indicates the role `ROLE_C` does not exist.
- `sp_has_role 'Role_C',NULL,1`

  returns the value -1, which indicates the role `ROLE_C` does not exist.

sp_iqaddlogin Procedure

Adds a new SAP Sybase IQ user account to the specified login policy.

Syntax1

```
call sp_iqaddlogin ('username_in', 'pwd',
[ 'password_expiry_on_next_login '] [ , 'policy_name '] )
```

Syntax2

```
sp_iqaddlogin 'username_in', 'pwd', [ 'password_expiry_on_next_login ']
[ , 'policy_name ']
```

Syntax3

```
sp_iqaddlogin username_in, pwd, [ password_expiry_on_next_login ] [ ,
policy_name ]
```

Usage

Parameter	Description
username_in	The user's login name. Login names must conform to the rules for identifiers
pwd	The user's password. Passwords must conform to rules for passwords, that is, they must be valid identifiers.
password_expiry_on_next_login	(Optional) Specifies whether user's password expires as soon as this user's login is created. Default setting is OFF (password does not expire).
policy_name	(Optional) Creates the user under the named login policy. If unspecified, user is created under the root login policy.

A username_in/pwd created using **sp_iqaddlogin** and set to expire in one day is valid all day tomorrow and invalid on the following day. In other words, a login created today and set to expire in *n* days are not usable once the date changes to the *(n+1)*th day.

Privileges

Requires the MANAGE ANY USER system privilege.

Description

Adds a new SAP Sybase IQ user account, assigns a login policy to the user and adds the user to the ISYSUSER system table. If the user already has a user ID for the database but is not in `ISYSUSER`, (for example, if the user ID was added using the **GRANT CONNECT** statement or Sybase Control Center), **sp_iqaddlogin** adds the user to the table.

If you do not specify a login policy name when calling the procedure, SAP Sybase IQ assigns the user to the root login policy.

Note: If the maximum number of logins for a login policy is unlimited, then a user belonging to that login policy can have an unlimited number of connections.

The first user login forces a password change and assigns a login policy to the newly created user. Use **CREATE USER** to create new users, although, for backward compatibility, **sp_iqaddlogin** is still supported.

Examples

These calls add the user `rose` with a password `irk324` under the login policy named `expired_password`. This example assumes the expired_password login policy already exists.

```
call sp_iqaddlogin('rose', 'irk324', 'ON', 'expired_password')
```

```
sp_iqaddlogin 'rose','irk324', 'ON', 'expired_password'
```

sp_iqbackupdetails Procedure

Shows all the dbfiles included in a particular backup.

Syntax

sp_iqbackupdetails *backup_id*

Parameters

Table 11. Parameters

Parameter	Description
backup_id	Specifies the backup operation transaction identifier.

Note: You can obtain the backup_id value from the `SYSIQBACKUPHISTORY` table by executing the query:

```
select * from sysiqbackuphistory
```

Privileges

No specific system privileges are required to run this procedure.

Description
sp_iqbackupdetails returns:

Table 12. sp_iqbackupdetails Columns

Column Name	Description
backup_id	Identifier for the backup transaction.
backup_time	Time of the backup.
backup_type	Type of backup: “Full,” “Incremental since incremental,” or “Incremental since full.”
selective_type	Subtype of backup: "All inclusive," "All RW files in RW dbspaces," "Set of RO dbspace/file."
depends_on_id	Identifier for previous backup that the backup depends on.
dbspace_id	Identifier for the dbspace being backed up.
dbspace_name	Name of the dbspace from SYSIQBACKUPHISTORYDETAIL. If dbspace name matches the dbspace name in SYSDBSPACE for a given dbspace_id. Otherwise “null.”
dbspace_rwstatus	“ReadWrite” or “Read Only.”
dbspace_createid	Dbspace creation transaction identifier.
dbspace_alterid	Alter DBSPACE read-write mode transaction identifier.
dbspace_online	Status “Online” or “Offline.”
dbspace_size	Size of dbspace, in KB, at time of backup.
dbspace_backup_size	Size of data, in KB, backed up in the dbspace.
dbfile_id	Identifier for the dbfile being backed up.
dbfile_name	The logical file name, if it was not renamed after the backup operation. If renamed, “null.”
dbfile_rwstatus	“ReadWrite” or “Read Only.”
dbfile_createid	Dbfile creation transaction identifier.
dbfile_alterid	Alter DBSPACE alter FILE read-write mode transaction identifier
dbfile_size in MB	Size of the dbfile, in KB.
dbfile_backup_size	Size of the dbfile backup, in KB.

Column Name	Description
dbfile_path	The dbfile path from SYSBACKUPDETAIL, if it matches the physical file path (“file_name”) in SYSDBFILE for a given dbspace_id and the dbfile_id. Otherwise “null.”

Example

Sample output from **sp_iqbackupdetails**:

```
backup_id   backup_time             backup_type   selective_type   d
epends_on_id
      883   2008-09-23 13:58:49.0   Full          All
inclusive                0

dbspace_id   dbspace_name   dbspace_rwstatus   dbspace_createid
         0   system         ReadWrite                         0

dbspace_alterid   dbspace_online dbspace_size dbspace_backup_size
dbfile_id
              0              0        2884              2884        0

dbfile_name dbfile_rwstatus dbfile_createid dbfile_alterid
dbfile_size
     system       ReadWrite                0              0      2884
```

```
dbfile_backup_size dbfile_path
              2884  C:\\Documents and Settings\\All Users\\SybaseIQ\
\demo\\iqdemo.db
```

sp_iqbackupsummary Procedure

Summarizes backup operations performed.

Syntax

sp_iqbackupsummary [*timestamp or backup_id*]

Parameters

- **timestamp or backup_id –** specifies the interval for which to report backup operations. If you specify a timestamp or a backup ID, only those records with backup_time greater than or equal to the time you enter are returned. If you specify no timestamp, the procedure returns all the backup records in `ISYSIQBACKUPHISTORY`.

Privileges

No specific system privileges are required to run this procedure.

Description

Table 13. sp_iqbackupsummary Columns

Column Name	Description
backup_id	Identifier for the backup transaction
backup_time	Time of the backup
backup_type	Type of backup: “Full,” “Incremental since incremental,” or “Incremental since full”
selective_type	Subtype of backup: "All Inclusive," "All RW files in RW dbspaces," "Set of RO dbspace/file"
virtual_type	Type of virtual backup: “Non-virtual,” “Decoupled,” or “Encapsulated”
depends_on_id	Identifier for backup that the backup depends on
creator	Creator of the backup
backup_size	Size, in KB, of the backup
user_comment	User comment
backup_command	The backup statement issued (minus the comment)

Example

Sample output of **sp_iqbackupsummary**:

```
backup_id   backup_time             backup_type   selective_type   v
irtual_type
     883   2008-09-23 13:58:49.0   Full          All inclusive    Non
virtual

depends_on_id   creator   backup_size   user_comment   backup_command
           0   DBA              10864              backup database to
                                                          'c:\\\\temp
\\\\b1'
```

sp_iqconnection Procedure

Shows information about connections and versions, including which users are using temporary dbspace, which users are keeping versions alive, what the connections are doing inside SAP Sybase IQ, connection status, database version status, and so on.

Syntax

sp_iqconnection [*connhandle*]

Applies to
Simplex and multiplex.

Usage
connhandle is equal to the `Number` connection property and is the ID number of the connection. The **connection_property** system function returns the connection ID:

```
SELECT connection_property ( 'Number' )
```

When called with an input parameter of a valid *connhandle*, **sp_iqconnection** returns the one row for that connection only.

Privileges
Requires the DROP CONNECTION, MONITOR or SERVER OPERATOR system privilege. Users without one of these system privileges must be granted `EXECUTE` permission to run the stored procedure.

Description
sp_iqconnection returns a row for each active connection. The columns ConnHandle, Name, Userid, LastReqTime, ReqType, CommLink, NodeAddr, and LastIdle are the connection properties Number, Name, Userid, LastReqTime, ReqType, CommLink, NodeAddr, and LastIdle respectively, and return the same values as the system function **sa_conn_info**. The additional columns return connection data from the SAP Sybase IQ side of the SAP Sybase IQ engine. Rows are ordered by ConnCreateTime.

The column MPXServerName stores information related to internode communication (INC), as shown:

Server Where Run	MPXServerName Column Content
Simplex server	NULL (All connections are local/user connections)
Multiplex coordinator	• NULL for local/user connections • Contains value of secondary node's server name (source of connection) for every INC connection (either on-demand or dedicated heartbeat connection)
Multiplex secondary	• NULL for local/user connections • Contains value of coordinator's server name (source of connection).

In Java applications, specify SAP Sybase IQ-specific connection properties from TDS clients in the RemotePWD field. This example, where **myconnection** becomes the IQ connection name, shows how to specify IQ specific connection parameters:

```
p.put("RemotePWD",",,CON=myconnection");
```

Column Name	Description
ConnHandle	The ID number of the connection.
Name	The name of the server.
Userid	The user ID for the connection.
LastReqTime	The time at which the last request for the specified connection started.
ReqType	A string for the type of the last request.
IQCmdType	The current command executing on the SAP Sybase IQ side, if any. The command type reflects commands defined at the implementation level of the engine. These commands consist of transaction commands, DDL and DML commands for data in the IQ store, internal IQ cursor commands, and special control commands such as **OPEN** and **CLOSE DB**, **BACKUP**, **RESTORE**, and others.
LastIQCmdTime	The time the last IQ command started or completed on the IQ side of the SAP Sybase IQ engine on this connection.
IQCursors	The number of cursors open in the IQ store on this connection.
LowestIQCursorState	The IQ cursor state, if any. If multiple cursors exist on the connection, the state that appears is the lowest cursor state of all the cursors; that is, the furthest from completion. Cursor state reflects internal SAP Sybase IQ implementation detail and is subject to change in the future. For this version, cursor states are: NONE, INITIALIZED, PARSED, DESCRIBED, COSTED, PREPARED, EXECUTED, FETCHING, END_OF_DATA, CLOSED and COMPLETED. As suggested by the names, cursor state changes at the end of the operation. A state of PREPARED, for example, indicates that the cursor is executing.
IQthreads	The number of SAP Sybase IQ threads currently assigned to the connection. Some threads may be assigned but idle. This column can help you determine which connections are using the most resources.
TxnID	The transaction ID of the current transaction on the connection. This is the same as the transaction ID in the `.iqmsg` file by the BeginTxn, CmtTxn, and PostCmtTxn messages, as well as the Txn ID Seq logged when the database is opened.
ConnCreateTime	The time the connection was created.

Column Name	Description
TempTableSpaceKB	The number of kilobytes of IQ temporary store space in use by this connection for data stored in IQ temp tables.
TempWorkSpaceKB	The number of kilobytes of IQ temporary store space in use by this connection for working space such as sorts, hashes, and temporary bitmaps. Space used by bitmaps or other objects that are part of indexes on SAP Sybase IQ temporary tables are reflected in TempTableSpaceKB.
IQConnID	The ten-digit connection ID included as part of all messages in the `.iqmsg` file. This is a monotonically increasing integer unique within a server session.
satoiq_count	An internal counter used to display the number of crossings from the SQL Anywhere side to the IQ side of the SAP Sybase IQ engine. This might be occasionally useful in determining connection activity. Result sets are returned in buffers of rows and do not increment satoiq_count or iqtosa_count once per row.
iqtosa_count	An internal counter used to display the number of crossings from the IQ side to the SQL Anywhere side of the SAP Sybase IQ engine. This might be occasionally useful in determining connection activity.
CommLink	The communication link for the connection. This is one of the network protocols supported by SAP Sybase IQ, or is local for a same-machine connection.
NodeAddr	The node for the client in a client/server connection.
LastIdle	The number of ticks between requests.
MPXServerName	If an INC connection, the varchar(128) value contains the name of the multiplex server where the INC connection originates. NULL if not an INC connection.
LSName	The logical server name of the connection. NULL if logical server context is unknown or not applicable.
INCConnName	The name of the underlying INC connection for a user connection. The data type for this column is varchar(255). If **sp_iqconnection** shows an INC connection name for a suspended user connection, that user connection has an associated INC connection that is also suspended.
INCConnSuspended	The value "Y" in this column indicates that the underlying INC connection for a user connection is in a suspended state. The value "N" indicates that the connection is not suspended.

Example

sp_iqconnection

```
ConnHandle      Name    Userid                 LastReqTime   ReqType
=== ================== ======  ==========================   =======
 1  'SQL_DBC_100525210' 'DBA'   '2011-03-28  09:29:24.466'  'OPEN'
```

```
           IQCmdType    LastIQCmdTime      IQCursors  LowestIQCursorState
====================    ==============     =========  ===================
'IQUTILITYOPENCURSOR'  2011-03-28 09:29:24.0       0             'NONE'


IQthreads   TxnID          ConnCreateTime TempTableSpaceKB TempWorkSpaceKB
=========  =======  ====================  =============== ===============
        0  3352568  2011-03-28 09:29:20.0               0               0


IQconnID satoiq_count iqtosa_count CommLink NodeAdd LastIdle MPXServerName
======== ============ ============ ======== ======= ======== ============
      34           43            2  'local'      ''      244  (NULL)

LSName      INCConnName                  INCConnSuspended
==========  ===================          ================
Finance_LS  'IQ_MPX_SERVER_P54'          'Y'
```

sp_iqcopyloginpolicy Procedure

Creates a new login policy by copying an existing one.

Syntax1

```
call sp_iqcopyloginpolicy ('existing-policy-name', 'new-policy-name' )
```

Syntax2

```
sp_iqcopyloginpolicy 'existing-policy-name', 'new-policy-name'
```

Usage

Table 14. Parameters

Parameter	Description
existing policy name	The login policy to copy.
new policy name	Name of the new login policy to create (CHAR(128)).

Privileges

Requires the MANAGE ANY LOGIN POLICY system privilege.

Examples

Creates a new login policy named *lockeduser* by copying the login policy option values from the existing login policy named *root*:

```
call sp_iqcopyloginpolicy ('root','lockeduser')
```

sp_iqdbspace Procedure

Displays detailed information about each IQ dbspace.

Syntax

```
sp_iqdbspace [ dbspace-name ]
```

Applies to

Simplex and multiplex.

Privileges

Requires MANAGE ANY DBSPACE system privilege. Users without MANAGE ANY DBSPACE system privilege must be granted EXECUTE permission.

Description

Use the information from **sp_iqdbspace** to determine whether data must be moved, and for data that has been moved, whether the old versions have been deallocated.

Column Name	Description
DBSpaceName	Name of the dbspace as specified in the **CREATE DBSPACE** statement. Dbspace names are always case-insensitive, regardless of the **CREATE DATABASE...CASE IGNORE** or **CASE RESPECT** specification.
DBSpaceType	Type of the dbspace (MAIN, SHARED_TEMP, TEMPORARY, or RLV).
Writable	T (writable) or F (not writable).
Online	T (online) or F (offline).
Usage	Percent of dbspace currently in use by all files in the dbspace.
TotalSize	Total size of all files in the dbspace in the units B (bytes), K (kilobytes), M (megabytes), G (gigabytes), T (terabytes), or P (petabytes).
Reserve	Total reserved space that can be added to all files in the dbspace.
NumFiles	Number of files in the dbspace.
NumRWFiles	Number of read/write files in the dbspace.
Stripingon	F (Off).
StripeSize	Always 1, if disk striping is on.
BlkTypes	Space used by both user data and internal system structures.
OkToDrop	"Y" indicates the dbspace can be dropped; otherwise "N".

Values of the BlkTypes block type identifiers:

Identifier	Block Type
A	Active version
B	Backup structures
C	Checkpoint log
D	Database identity
F	Free list
G	Global free list manager
H	Header blocks of the free list
I	Index advice storage
M	Multiplex CM*
O	Old version
R	RLV free list manager
T	Table use
U	Index use
N	Column use
X	Drop at checkpoint

*The multiplex commit identity block (actually 128 blocks) exists in all IQ databases, even though it is not used by simplex databases.

Example

Displays information about dbspaces:

```
sp_iqdbspace;
```

Note: The following example shows objects in the `iqdemo` database to better illustrate output. `iqdemo` includes a sample user dbspace named `iq_main` that may not be present in your own databases.

DBSpaceName	DBSpaceType	Writable	Online	Usage	Total Size	Reserve	Num Files	Num RWFiles	Stripingon	Stripe Size	Blk Types	Ok To Drop
IQ_MAIN	MAIN	T	T	55	75M	200 M	1	1	T	1K	1H, 5169 A, 190	N
IQ__ SYSTEM_ MAIN	MAIN	T	T	21	300 M	50M	1	1	F	8K	1H, 7648 F, 32D, 128 M	N
IQ_SYSTEM_ TEMP	TEMPORARY	T	T	1	100 M	50M	1	1	F	8K	1H, 64F, 32A	N

sp_iqdbspaceinfo Procedure

Displays the size of each object and subobject used in the specified table. Not supported for RLV dbspaces.

Syntax

```
sp_iqdbspaceinfo [ dbspace-name ] [ , owner_name ] [ , object_name ] [ , object-type  ]
```

Applies to

Simplex and multiplex.

Privileges

Requires the BACKUP DATABASE, SERVER OPERATOR, or MANAGE ANY DBSPACE system privileges. Users without one of these system privileges must be granted `EXECUTE` permission.

Usage

Parameter	Description
dbspace_name	If specified, **sp_iqdbspaceinfo** displays one line for each table that has any component in the specified dbspace. Otherwise, the procedure shows information for all dbspaces in the database.
owner_name	Owner of the object. If specified, **sp_iqdbspaceinfo** displays output only for tables with the specified owner. If not specified, **sp_iqdbspaceinfo** displays information on tables for all users in the database.
object_name	Name of the table. If not specified, **sp_iqdbspaceinfo** displays information on all tables in the database.
object_type	Valid **table** objects.

All parameters are optional, and any parameter may be supplied independent of another parameter's value.

The **sp_iqdbspaceinfo** stored procedure supports wildcard characters for interpreting *dbspace_name*, *object_name*, and *owner_name*. It shows information for all dbspaces that match the given pattern in the same way the **LIKE** clause matches patterns inside queries.

Description

The procedure returns no results if you specify an RLV dbspace.

sp_iqdbspaceinfo shows the DBA the amount of space used by objects that reside on each dbspace. The DBA can use this information to determine which objects must be relocated before a dbspace can be dropped. The subobject columns display sizes reported in integer quantities followed by the suffix B, K, M, G, T, or P, representing bytes, kilobytes, megabytes, gigabytes, terabytes, and petabytes, respectively.

For tables, **sp_iqdbspaceinfo** displays subobject sizing information for all subobjects (using integer quantities with the suffix B, K, M, G, T, or P) sorted by *dbspace_name*, *object_name*, and *owner_name*.

Table 15. sp_iqdbspaceinfo Columns

Column Name	Description
dbspace_name	Name of the dbspace.

Column Name	Description
object_type	Type of the object (**table** or **joinindex** only).
owner	Name of the owner of the object.
object_name	Name of the object on the dbspace.
object_id	Global object ID of the object.
id	Table id of the object.
columns	Size of column storage space on the given dbspace.
indexes	Size of index storage space on the given dbspace. Does not use system-generated indexes (for example, HG indexes in unique constraints or FP indexes).
metadata	Size of storage space for metadata objects on the given dbspace.
primary_key	Size of storage space for primary key related objects on the given dbspace.
unique_constraint	Size of storage space for unique constraint-related objects on the given dbspace.
foreign_key	Size of storage space for foreign-key-related objects on the given dbspace.
dbspace_online	Indicates if the dbspace is online (**Y**) or offline (**N**).

If you run sp_iqdbspaceinfo against a server you have started with the -r switch (read-only), you see the error `Msg 13768, Level 14, State 0: SQL Anywhere Error -757: Modifications not permitted for read-only database`. This behavior is expected. The error does not occur on other stored procedures such as `sp_iqdbspace`, `sp_iqfile`, `sp_iqdbspaceobjectinfo` or `sp_iqobjectinfo`.

Examples

Note: These examples show objects in the `iqdemo` database to better illustrate output. `iqdemo` includes a sample user dbspace named `iq_main` that may not be present in your own databases.

Displays the size of all objects and subobjects in all tables in all dbspaces in the database:

```
sp_iqdbspaceinfo
```

```
dbspace_name    object_type  owner   object_name     object_id  id
  columns
iq_main        table       DBA     emp1            3689     741   96K
iq_main        table       DBA     iq_dummy        3686     740   24K
iq_main        table       DBA     sale            3698     742   96K
iq_main         table        GROUPO  Contacts          3538     732
```

```
   288K
iq_main         table        GROUPO  Customers         3515     731
   240K
iq_main        table       GROUPO  Departments      3632    738   72K
iq_main         table        GROUPO  Employees         3641     739
   408K
iq_main         table        GROUPO  FinancialCodes    3612     736
   72K
iq_main        table       GROUPO  FinancialData    3621    737   96K
iq_main         table        GROUPO  Products
 3593     735   272K
iq_main         table        GROUPO  SalesOrderItems   3580     734
   120K
iq_main         table        GROUPO  SalesOrders       3565     733
   144K

indexes  metadata  primary_key  unique_constraint  foreign_key  dbsp
ace_online
0B       1.37M     0B           0B                 0B           Y
0B       464K      0B           0B                 0B           Y
0B       1.22M     0B           0B                 0B           Y
0B       5.45M     24K          0B                 48K          Y
48K      4.63M     24K          0B                 0B           Y
0B       1.78M     24K          0B                 48K          Y
0B       8.03M     24K          0B                 48K          Y
0B       1.53M     24K          0B                 0B           Y
0B       2.19M     24K          0B                 48K          Y
192K     4.67M     24K          0B                 0B           Y
0B       2.7M      24K          0B                 104K         Y
0B       3.35M     24K          0B                 144K         Y
```

Displays the size of all objects and subobjects owned by a specified user in a specified dbspace in the database:

```
sp_iqdbspaceinfo iq_main,GROUPO
```

```
dbspace_name    object_type  owner   object_name     object_id  id
  columns
iq_main         table        GROUPO  Contacts          3538     732
   288K
iq_main         table        GROUPO  Customers         3515     731
   240K
iq_main        table       GROUPO  Departments      3632    738   72K
iq_main         table        GROUPO  Employees         3641     739
   408K
iq_main         table        GROUPO  FinancialCodes    3612     736
   72K
iq_main        table       GROUPO  FinancialData    3621    737   96K
iq_main         table        GROUPO  Products          3593     735
   272K
iq_main         table        GROUPO  SalesOrderItems   3580     734
   120K
iq_main         table        GROUPO  SalesOrders       3565     733
   144K

indexes  metadata  primary_key  unique_constraint  foreign_key  dbsp
```

```
ace_online
0B        5.45M     24K           0B                  48K           Y
48K       4.63M     24K           0B                  0B            Y
0B        1.78M     24K           0B                  48K           Y
0B        8.03M     24K           0B                  48K           Y
0B        1.53M     24K           0B                  0B            Y
0B        2.19M     24K           0B                  48K           Y
192K      4.67M     24K           0B                  0B            Y
0B        2.7M      24K           0B                  104K          Y
0B        3.35M     24K           0B                  144K          Y
```

Displays the size of a specified object and its subobjects owned by a specified user in a specified dbspace in the database:

```
sp_iqdbspaceinfo iq_main,GROUPO,Departments
```

```
dbspace_name    object_type  owner   object_name     object_id  id
  columns
iq_main        table       GROUPO  Departments      3632    738   72K

indexes  metadata  primary_key  unique_constraint  foreign_key  dbsp
ace_online
0B        1.78M     24K           0B                  48K           Y
```

sp_iqdbspaceobjectinfo Procedure

Lists objects and subobjects of type table (including columns, indexes, metadata, primary keys, unique constraints, foreign keys, and partitions) for a given dbspace. Not supported for RLV dbspaces.

Syntax

sp_iqdbspaceobjectinfo [*dbspace-name*] [, *owner_name*] [, *object_name*] [, *object-type*]

Privileges

No specific system privilege required.

Usage

All parameters are optional and any parameter may be supplied independent of the value of other parameters.

Table 16. Parameters

Parameter	Description
dbspace-name	If specified, **sp_iqdbspaceobjectinfo** displays output only for the specified dbspace. Otherwise, it shows information for all dbspaces in the database.

Parameter	Description
owner-name	Owner of the object. If specified, **sp_iqdbspaceobjectinfo** displays output only for tables with the specified owner. If not specified, **sp_iqdbspaceobjectinfo** displays information for tables for all users in the database.
object-name	Name of the table. If not specified, **sp_iqdbspaceobjectinfo** displays information for all tables in the database.
object-type	Valid object types for **table** objects.

The **sp_iqdbspaceobjectinfo** stored procedure supports wildcard characters for interpreting *dbspace_name*, *object_name*, and *owner_name*. It displays information for all dbspaces that match the given pattern in the same way as the **LIKE** clause matches patterns inside queries.

Description

The procedure returns no results if you specify an RLV dbspace.

For tables, **sp_iqdbspaceobjectinfo** displays summary information for all associated subobjects sorted by dbspace_name, owner and object_name.

sp_iqdbspaceobjectinfo displays the following information, based on the input parameter values:

Table 17. sp_iqdbspaceobjectinfo columns

Column Name	Description
dbspace_name	Name of the dbspace.
dbspace_id	Identifier of the dbspace.
object_type	Table.
owner	Name of the owner of the object.
object_name	Name of the table object on the dbspace.
object_id	Global object ID of the object.
id	Table ID of the object.
columns	Number of table columns which are located on the given dbspace. If a column or one of the column-partitions is located on a dbspace, it is counted to be present on that dbspace. The result is shown in the form n/N (n out of total N columns of the table are on the given dbspace).

Column Name	Description
indexes	Number of user-defined indexes on the table which are located on the given dbspace. Shown in the form n/N (n out of total N indexes on the table are on the given dbspace). This does not contain indexes which are system-generated, such as FP indexes and HG indexes in the case of unique constraints.
metadata	Boolean field (Y/N) that denotes whether the metadata information of the subobject is also located on this dbspace.
primary_key	Boolean field (1/0) that denotes whether the primary key of the table, if any, is located on this dbspace.
unique_constraint	Number of unique constraints on the table that are located on the given dbspace. Appears in the form n/N (n out of total N unique constraints on the table are in the given dbspace).
foreign_key	Number of foreign_keys on the table that are located on the given dbspace. Appears in the form n/N (n out of total N foreign keys on the table are in the given dbspace).
partitions	Number of partitions of the table that are located on the given dbspace. Appears in the form n/N (n out of total N partitions of the table are in the given dbspace).

Examples

These examples show objects in the `iqdemo` database to better illustrate output. `iqdemo` includes a sample user dbspace named `iq_main` that may not be present in your own databases.

Displays information about a specific dbspace in the database:

```
sp_iqdbspaceobjectinfo iq_main
```

```
dbspace_name  dbspace_id object_type  owner   object_name  object_i
d  id  columns
iq_main       16387      table        DBA     emp1           3689
   741  4/4
iq_main       16387      table        DBA     iq_dummy       3686
   740  1/1
iq_main       16387      table        DBA     sale           3698
   742  4/4
iq_main       16387      table        GROUPO  Contacts       3538
   732  12/12
iq_main       16387      table        GROUPO  Customers      3515
   731  10/10
iq_main       16387      table        GROUPO  Departments    3632
   738  3/3
iq_main       16387      table        GROUPO  Employees      3641
   739  21/21
```

```
iq_main       16387      table        GROUPO  FinancialCodes 3612
   736  3/3
iq_main       16387      table        GROUPO  FinancialData  3621
   737  4/4
iq_main       16387      table        GROUPO  Products       3593
   735  8/8
iq_main       16387      table        GROUPO  SalesOrderItems3580
   734  5/5
iq_main       16387      table        GROUPO  SalesOrders    3565
   733  6/6

indexes  metadata  primary_key  unique_constraint  foreign_key  part
itions
0/0      Y                   0  0/0                0/0          0/0
0/0      Y                   0  0/0                0/0          0/0
0/0      Y                   0  0/0                0/0          0/0
0/0      Y                   1  0/0                1/1          0/0
1/1      Y                   1  0/0                0/0          0/0
0/0      Y                   1  0/0                1/1          0/0
0/0      Y                   1  0/0                1/1          0/0
0/0      Y                   1  0/0                0/0          0/0
0/0      Y                   1  0/0                1/1          0/0
4/4      Y                   1  0/0                0/0          0/0
0/0      Y                   1  0/0                2/2          0/0
0/0      Y                   1  0/0                3/3          0/0
```

Displays information about the objects owned by a specific user in a specific dbspace in the database:

```
sp_iqdbspaceobjectinfo iq_main,GROUPO
```

```
dbspace_name  dbspace_id object_type  owner   object_name    object_
id  id  columns
iq_main       16387      table        GROUPO  Contacts       3538
     732 2/12
iq_main       16387      table        GROUPO  Customers      3515
     731 10/10
iq_main       16387      table        GROUPO  Departments    3632
     738 3/3
iq_main       16387      table        GROUPO  Employees      3641
     739 21/21
iq_main       16387      table        GROUPO  FinancialCodes 3612
     736 3/3
iq_main       16387      table        GROUPO  FinancialData  3621
     737 4/4
iq_main       16387      table        GROUPO  Products       3593
     735 8/8
iq_main       16387      table        GROUPO  SalesOrderItems3580
     734 5/5
iq_main       16387      table        GROUPO  SalesOrders    3565
     733 6/6

indexes  metadata  primary_key  unique_constraint  foreign_key  part
itions
0/0      Y                   1  0/0                1/1          0/0
1/1      Y                   1  0/0                0/0          0/0
```

```
0/0      Y                    1  0/0                  1/1          0/0
0/0      Y                    1  0/0                  1/1          0/0
0/0      Y                    1  0/0                  0/0          0/0
0/0      Y                    1  0/0                  1/1          0/0
4/4      Y                    1  0/0                  0/0          0/0
0/0      Y                    1  0/0                  2/2          0/0
0/0      Y                    1  0/0                  3/3          0/0
```

In this example, the commands move all tables on `dbspace_x` to `dbspace_y`.

```
SELECT 'ALTER TABLE ' || owner || '.' ||
object_name || ' MOVE TO dbspace_y;'
FROM sp_iqdbspaceobjectinfo()
WHERE object_type = 'table' AND
dbspace_name = 'dbspace_x';
```

The following **ALTER TABLE** commands are the result:

```
ALTER TABLE DBA.dt1 MOVE TO dbspace_y;
ALTER TABLE DBA.dt2 MOVE TO dbspace_y;
ALTER TABLE DBA.dt3 MOVE TO dbspace_y;
```

sp_iqdroplogin Procedure

Drops an SAP Sybase IQ user account.

Syntax1

call sp_iqdroplogin (‘*userid*’)

Syntax2

sp_iqdroplogin ‘*userid*’

Syntax3

sp_iqdroplogin *userid*

Syntax4

sp_iqdroplogin (‘*userid*’)

Privileges

Requires the MANAGE ANY USER system privilege. Users without MANAGE ANY USER system privilege must be granted `EXECUTE` permission.

Usage

Table 18. Parameters

Parameter	Description
userid	ID of the user to drop.

Description
sp_iqdroplogin drops the specified user.

Examples
These commands all remove the user `rose`:

```
sp_iqdroplogin 'rose'
```

```
sp_iqdroplogin rose
```

```
call sp_iqdroplogin ('rose')
```

sp_iqemptyfile Procedure

Empties a dbfile and moves the objects in the dbfile to another available read-write dbfile in the same dbspace. Not available for files in an RLV dbspace.

Syntax

```
sp_iqemptyfile ( logical-file--name )
```

Privileges
Requires at least one system privilege from each group:

Group 1	Group 2
BACKUP DATABASE	INSERT ANY TABLE
SERVER OPERATOR	UPDATE ANY TABLE
ALTER DATABASE	DELETE ANY TABLE
	ALTER ANY TABLE
	LOAD ANY TABLE
	TRUNCATE ANY TABLE
	ALTER ANY OBJECT

Users without the required system privileges must be granted `EXECUTE` permission to run the stored procedure.

Description
sp_iqemptyfile empties a dbfile. The dbspace must be read-only before you can execute the **sp_iqemptyfile** procedure. The procedure moves the objects in the file to another available read-write dbfile in the same dbspace. If there is no other read-write dbfile available, then SAP Sybase IQ displays an error message.

Note: In a multiplex environment, you can run **sp_iqemptyfile** only on the coordinator. There must be one read-write dbspace available for the procedure to succeed.

If the dbfile is in an RLV dbspace, then this error message displays:

```
Cannot empty files in an rlv store dbspace.
```

Example

Empties dbfile **dbfile1**:

```
sp_iqemptyfile 'dbfile1'
```

sp_iqestdbspaces Procedure

Estimates the number and size of dbspaces needed for a given total index size.

Syntax

```
sp_iqestdbspaces ( db_size_in_bytes, iq_page_size,
min_#_of_bytes, max_#_of_bytes )
```

Privileges

Requires the MANAGE ANY DBSPACE or ALTER DATABASE system privileges. Users without one of these system privileges must be granted `EXECUTE` permission.

Description

Displays information about the number and size of dbspace segments based on the size of the database, the IQ page size, and the range of bytes per dbspace segment. This procedure assumes that the database was created with the default block size for the specified IQ page size; otherwise, the returned estimated values are incorrect.

Table 19. sp_iqestdbspaces Parameters

Name	Datatype	Description
db_size_in_bytes	`decimal(16)`	Size of the database in bytes.
iq_page_size	`smallint`	The page size defined for the IQ segment of the database (must be a power of 2 between 65536 and 524288; the default is 131072).
min_#_of_bytes	`int`	The minimum number of bytes per dbspace segment. The default is 20,000,000 (20MB).
max_#_of_bytes	`int`	The maximum number of bytes per dbspace segment. The default is 2,146,304,000 (2.146GB).

Usage

sp_iqestdbspaces reports several recommendations, depending on how much of the data is unique:

Recommendation	Description
min	If there is little variation in data, you can choose to create only the dbspace segments of the sizes recommended as **min**. These recommendations reflect the best possible compression on data with the least possible variation.
avg	If your data has an average amount of variation, create the dbspace segments recommended as **min**, plus additional segments of the sizes recommended as **avg**.
max	If your data has a high degree of variation (many unique values), create the dbspace segments recommended as **min**, **avg**, and **max**.
spare	If you are uncertain about the number of unique values in your data, create the dbspace segments recommended as **min**, **avg**, **max**, and **spare**. You can always delete unused segments after loading your data, but creating too few can cost you some time.

sp_iqfile Procedure

Displays detailed information about each dbfile in a dbspace.

Syntax

sp_iqfile [*dbspace-name*]

Applies to

Simplex and multiplex.

Privileges

Requires the MANAGE ANY DBSPACE system privilege. Users without the MANAGE ANY DBSPACE system privilege must be granted `EXECUTE` permission.

Description

sp_iqfile displays the usage, properties, and types of data in each dbfile in a dbspace. You can use this information to determine whether data must be moved, and for data that has been moved, whether the old versions have been deallocated.

Column Name	Description
DBSpaceName	Name of the dbspace as specified in the **CREATE DBSPACE** statement. Dbspace names are always case-insensitive, regardless of the **CREATE DATABASE**...**CASE IGNORE** or **CASE RESPECT** specification.
DBFileName	Logical file name.
Path	Location of the physical file or raw partition.
SegmentType	Type of dbspace (`MAIN`, `TEMPORARY`, or `RLV`).
RWMode	Mode of the dbspace: always read-write (RW).
Online	T (online) or F (offline).
Usage	Percent of dbspace currently in use by this file in the dbspace. When run against a secondary node in a multiplex configuration, this column displays NA.
DBFileSize	Current size of the file or raw partition. For a raw partition, this size value can be less than the physical size.
Reserve	Reserved space that can be added to this file in the dbspace.
StripeSize	Always 1, if disk striping is on.
BlkTypes	Space used by both user data and internal system structures.
FirstBlk	First IQ block number assigned to the file.
LastBlk	Last IQ block number assigned to the file.
OkToDrop	"Y" indicates the file can be dropped; otherwise "N".

Identifier	Block Type
A	Active Version
B	Backup Structures
C	Checkpoint Log
D	Database Identity
F	Free list
G	Global Free list Manager
H	Header Blocks of the Free List
I	Index Advice Storage

Identifier	Block Type
M	Multiplex CM*
O	Old Version
R	RLV Free list manager
T	Table Use
U	Index Use
N	Column Use
X	Drop at Checkpoint

*The multiplex commit identity block (actually 128 blocks) exists in all IQ databases, even though it is not used by simplex databases.

Example

Displays information about the files in the dbspaces:

```
sp_iqfile;
```

```
sp_iqfile;
DBSpaceName,DBFileName,Path,SegmentType,RWMode,Online,
Usage,DBFileSize,Reserve,StripeSize,BlkTypes,FirstBlk,
LastBlk,OkToDrop

'IQ_SYSTEM_MAIN','IQ_SYSTEM_MAIN','/sun1-c1/users/smith/mpx/m/
mpx_db.iq','MAIN','RW','T','21','
2.92G','0B','1K','1H,76768F,32D,19A,185O,128M,34B,32C'
,1,384000,'N'

'mpx_main1','mpx_main1','/sun1-c1/users/smith/mpx/m/
mpx_main1.iq','MAIN','RW','T','1'
,'100M','0B','1K','1H',1045440,1058239,'N'

'IQ_SHARED_TEMP','sharedfile1_bcp','/sun1-c1/users/smith/mpx/m/
f1','SHARED_TEMP','RO','T','0',
'50M','0B','1K','1H',1,6400,'N'

'IQ_SHARED_TEMP','sharedfile2_bcp','/sun1-c1/users/smith/mpx/m/
f2','SHARED_TEMP','RO','T','0',
'50M','0B','1K','1H',1045440,1051839,'N'

'IQ_SYSTEM_TEMP','IQ_SYSTEM_TEMP','/sun1-c1/users/smithmpx/m/
mpx_db.iqtmp','TEMPORARY','RW',
'T','1','2.92G','0B','1K','1H,64F,33A',1,384000,'N'
```

sp_iqmodifyadmin Procedure

Sets an option on a named login policy to a certain value. If no login policy is specified, the option is set on the root policy. In a multiplex, **sp_iqmodifyadmin** takes an optional parameter that is the multiplex server name.

Syntax1

```
call sp_iqmodifyadmin ('policy_option_name', 'value_in' ,
['login_policy_name'] )
```

Syntax2

```
sp_iqmodifyadmin 'policy_option_name', 'value_in' ,'login_policy_name '
```

Syntax3

```
sp_iqmodifyadmin policy_option_name, value_in, ,login_policy_name
```

Syntax 4

```
sp_iqmodifyadmin 'policy_option_name',
'value_in' ,'login_policy_name ' ,'server_name '
```

Usage

Table 20. Parameters

Parameter	Description
policy_option_name	The login policy option to be changed.
value_in	New value for the login policy option.
login_policy_name	Policy for which the login policy option is to be changed.

Permissions

Requires the MANAGE ANY LOGIN POLICY system privilege.

Examples

Sets the login option `locked` to ON for the policy named *lockeduser*:

```
call sp_iqmodifyadmin ('locked','on','lockeduser')
```

Sets the login option `locked` to ON for the policy named *lockeduser* on the multiplex server named `Writer1`:

```
call sp_iqmodifyadmin ('locked','on','lockeduser','Writer1')
```

sp_iqmodifylogin Procedure

Assigns a user to a login policy.

Syntax1

```
call sp_iqmodifylogin 'userid', ['login_policy_name']
```

Syntax2

```
sp_iqmodifylogin 'userid', ['login_policy_name']
```

Privileges

Requires the MANAGE ANY USER system privilege.

Usage

Table 21. Parameters

Parameter	Description
userid	Variable that holds the name of the account to modify.
login_policy_name	(Optional) Specifies the name of the login policy to which the user will be assigned. If no login policy name is specified, the user is assigned to the root login policy.

Examples

Assigns user `joe` to a login policy named `expired_password`:

```
sp_iqmodifylogin 'joe', 'expired_password'
```

Assigns user `joe` to the root login policy:

```
call sp_iqmodifylogin ('joe')
```

sp_iqobjectinfo Procedure

Returns partitions and dbspace assignments of database objects and subobjects.

Syntax

```
sp_iqobjectinfo [ owner_name ]  [ , object_name ] [ , object-type ]
```

Privileges

No specific system privilege is required to run this procedure.

Usage

Table 22. Parameter

Parameter	Description
owner_name	Owner of the object. If specified, **sp_iqobjectinfo** displays output only for tables with the specified owner. If not specified, **sp_iqobjectinfo** displays information on tables for all users in the database.
object_name	Name of the table. If not specified, **sp_iqobjectinfo** displays information on all tables in the database.
object-type	Valid **table** object types. If the object-type is a table, it must be enclosed in quotation marks.

All parameters are optional, and any parameter may be supplied independent of the value of another parameter.

Use input parameters with **sp_iqobjectinfo**; you can query the results of the **sp_iqobjectinfo** and it performs better if you use input parameters rather than using predicates in the **WHERE** clause of the query. For example, Query A is written as:

```
SELECT COUNT(*) FROM sp_iqobjectinfo()
WHERE owner = 'DBA'
AND object_name = 'tab_case510'
AND object_type = 'table'
AND sub_object_name is NULL
AND dbspace_name = 'iqmain7'
AND partition_name = 'P1'
```

Query B is Query A rewritten to use **sp_iqobjectinfo** input parameters:

```
SELECT COUNT(*) FROM sp_iqobjectinfo('DBA','tab_case510','table')
WHERE sub_object_name is NULL
AND dbspace_name = 'iqmain7'
AND PARTITION_NAME = 'P1'
```

Query B returns results faster than Query A. When the input parameters are passed to **sp_iqobjectinfo**, the procedure compares and joins fewer records in the system tables, thus doing less work compared to Query A. In Query B, the predicates are applied in the procedure itself, which returns a smaller result set, so a smaller number of predicates is applied in the query.

The **sp_iqobjectinfo** stored procedure supports wildcard characters for interpreting *owner_name*, *object_name*, and *object_type*. It shows information for all dbspaces that match the given pattern in the same way the **LIKE** clause matches patterns inside queries.

Description

Returns all the partitions and the dbspace assignments of a particular or all database objects (of type table) and its subobjects. The subobjects are columns, indexes, primary key, unique constraints, and foreign keys.

Table 23. sp_iqobjectinfo columns

Column Name	Description
owner	Name of the owner of the object.
object_name	Name of the object (of type table) located on the dbspace.
sub_object_name	Name of the object located on the dbspace.
object_type	Type of the object (column, index, primary key, unique constraint, foreign key, partition, or table).
object_id	Global object ID of the object.
id	Table ID of the object.
dbspace_name	Name of the dbspace on which the object resides. The string "[multiple]" appears in a special meta row for partitioned objects. The [multiple] row indicates that multiple rows follow in the output to describe the table or column.
partition_name	Name of the partition for the given object.

Examples

Note: These examples show objects in the `iqdemo` database to better illustrate output. `iqdemo` includes a sample user dbspace named `iq_main` that may not be present in your own databases.

Displays information about partitions and dbspace assignments of a specific database object and subobjects owned by a specific user:

```
sp_iqobjectinfo GROUPO,Departments
```

```
owner   object_name  sub_object_name                object_type  obj
ect_id  id
GROUPO  Departments  (NULL)                          table         3
632     738
GROUPO  Departments  DepartmentID                    column        3
633     738
GROUPO  Departments  DepartmentName                  column        3
634     738
GROUPO  Departments  DepartmentHeadID                column        3
635     738
GROUPO  Departments  DepartmentsKey                  primary
key   83       738
GROUPO  Departments  FK_DepartmentHeadID_EmployeeID  foreign
```

```
key   92       738

dbspace_name     partition_name
iq_main          (NULL)
iq_main          (NULL)
iq_main          (NULL)
iq_main          (NULL)
iq_main          (NULL)
iq_main          (NULL)
```

Displays information about partitions and dbspace assignments of a specific database object and subobjects owned by a specific user for *object-type* **table**:

```
sp_iqobjectinfo DBA,sale,'table'
```

```
owner  object_name  sub_object_name  object_type  object_id  id
DBA    sale          (NULL)           table          3698     742
DBA    sale          prod_id          column         3699     742
DBA    sale          month_num        column         3700     742
DBA    sale          rep_id           column         3701     742
DBA    sale          sales            column         3702     742

dbspace_name      partition_name
iq_main           (NULL)
iq_main           (NULL)
iq_main           (NULL)
iq_main           (NULL)
iq_main           (NULL)
```

sp_iqspaceused Procedure

Shows information about space available and space used in the IQ store, IQ temporary store, RLV store, and IQ global and local shared temporary stores.

Syntax

```
sp_iqspaceused(out mainKB            unsigned bigint,
               out mainKBUsed        unsigned bigint,
               out tempKB            unsigned bigint,
               out tempKBUsed        unsigned bigint,
               out shTempTotalKB     unsigned bigint,
               out shTempTotalKBUsed unsigned bigint,
               out shTempLocalKB     unsigned bigint,
               out shTempLocalKBUsed unsigned bigint,
               out rlvLogKB          unsigned bigint,
               out rlvLogKBUsed      unsigned bigint)
```

Applies to
Simplex and multiplex.

Privileges
Requires the ALTER DATABASE, MANAGE ANY DBSPACE, or MONITOR system privileges. Users without one of these system privileges must be granted `EXECUTE` permission.

Usage
sp_iqspaceused returns several values as unsigned bigint out parameters. This system stored procedure can be called by user-defined stored procedures to determine the amount of main, temporary, and RLV store space in use.

Description
sp_iqspaceused returns a subset of the information provided by **sp_iqstatus**, but allows the user to return the information in SQL variables to be used in calculations.

If run on a multiplex database, this procedure applies to the server on which it runs. Also returns space used on IQ_SHARED_TEMP.

Column Name	Description
mainKB	The total IQ main store space, in kilobytes.
mainKBUsed	The number of kilobytes of IQ main store space used by the database. Secondary multiplex nodes return '(Null)'.
tempKB	The total IQ temporary store space, in kilobytes.
tempKBUsed	The number of kilobytes of total IQ temporary store space in use by the database.
shTempTotalKB	The total IQ global shared temporary store space, in kilobytes.
shTempLocalKB	The total IQ local shared temporary store space, in kilobytes.
shTempLocalKBUsed	The number of kilobytes of IQ local shared temporary store space in use by the database.
rlvLogKB	The total RLV store space, in kilobytes.
rlvLogKBUsed	The number of kilobytes of RLV store space in use by the database.

Example
sp_iqspaceused requires seven output parameters. Create a user-defined stored procedure **myspace** that declares the seven output parameters, then calls **sp_iqspaceused**:

```
  create or replace procedure dbo.myspace()
begin
     declare mt unsigned bigint;
     declare mu unsigned bigint;
     declare tt unsigned bigint;
     declare tu unsigned bigint;
     declare gt unsigned bigint;
     declare gu unsigned bigint;
     declare lt unsigned bigint;
     declare lu unsigned bigint;
     declare tt_t unsigned bigint;
     declare mt_t unsigned bigint;
     declare gt_t unsigned bigint;
     declare lt_t unsigned bigint;
     call sp_iqspaceused(mt,mu,tt,tu,gt,gu,lt,lu);
     if (tt = 0) then
        set tt_t = 0;
     else
        set tt_t = tu*100/tt;
     end if;
     if (mt = 0) then
        set mt_t = 0;
     else
        set mt_t = mu*100/mt;
     end if;
     if (gt = 0) then
        set gt_t = 0;
     else
        set gt_t = gu*100/gt;
     end if;
     if (lt = 0) then
        set lt_t = 0;
     else
        set lt_t = lu*100/lt;
     end if;
  select cast(mt/1024 as unsigned bigint) as mainMB,
         cast(mu/1024 as unsigned bigint) as mainusedMB, mt_t as
mainPerCent,
         cast(tt/1024 as unsigned bigint) as tempMB,
         cast(tu/1024 as unsigned bigint) as tempusedMB, tt_t as
tempPerCent,
         cast(gt/1024 as unsigned bigint) as shTempTotalKB,
        cast(gu/1024 as unsigned bigint) as shTempTotalKBUsed, gt_t
as globalshtempPerCent,
         cast(lt/1024 as unsigned bigint) as shTempLocalMB,
        cast(lu/1024 as unsigned bigint) as shTempLocalKBUsed, lt_t
as localshtempPerCent;
end
```

To display the output of **sp_iqspaceused**, execute **myspace**:

```
myspace
```

sp_iqsysmon Procedure

Monitors multiple components of SAP Sybase IQ, including the management of buffer cache, memory, threads, locks, I/O functions, and CPU utilization.

Batch Mode Syntax

```
sp_iqsysmon start_monitor
sp_iqsysmon stop_monitor [, "section(s)" ]
or
sp_iqsysmon "time-period" [, "section(s)" ]
```

File Mode Syntax

```
sp_iqsysmon start_monitor, 'filemode' [, "monitor-options" ]
sp_iqsysmon stop_monitor
```

Privileges

Requires the MONITOR system privilege. Users without the MONITOR system privilege must be granted `EXECUTE` permission to run the stored procedure.

Batch Mode Usage

Parameter	Description
start_monitor	Starts monitoring.
stop_monitor	Stops monitoring and displays the report.
time-period	The time period for monitoring, in the form HH:MM:SS.
section(s)	The abbreviation for one or more sections to be shown by **sp_iqsysmon**. If you specify more than one section, separate the section abbreviations using spaces, and enclose the list in single or double quotes. The default is to display all sections. For sections related to the IQ store, you can specify main or temporary store by prefixing the section abbreviation with "m" or "t", respectively. Without the prefix, both stores are monitored. For example, if you specify "mbufman", only the IQ main store buffer manager is monitored. If you specify "mbufman tbufman" or "bufman", both the main and temporary store buffer managers are monitored.

Report Section or IQ Component	Abbreviation
Buffer manager	(m/t)bufman
Buffer pool	(m/t)bufpool
Prefetch management	(m/t)prefetch
Free list management	(m/t)freelist
Buffer allocation	(m/t)bufalloc
Memory management	memory
Thread management	threads
CPU utilization	cpu
Transaction management	txn
Server context statistics	server
Catalog statistics	catalog

Note: The SAP Sybase IQ components Disk I/O and Lock Manager are not currently supported by **sp_iqsysmon**.

File Mode Usage

Parameter	Description
start_monitor	Starts monitoring.
stop_monitor	Stops monitoring and writes the remaining output to the log file.
filemode	Specifies that **sp_iqsysmon** is running in file mode. In file mode, a sample of statistics appear for every interval in the monitoring period. By default, the output is written to a log file named *dbname.connid-iqmon*. Use the **file_suffix** option to change the suffix of the output file. See the *monitor_options* parameter for a description of the **file_suffix** option.
monitor_options	The *monitor _options* string

The *monitor _options* string can include one or more options:

Table 24. monitor_options string options

monitor_options String Option	Description
-interval *seconds*	Specifies the reporting interval, in seconds. A sample of monitor statistics is output to the log file after every interval. The default is every 60 seconds, if the **-interval** option is not specified. The minimum reporting interval is 2 seconds. If the interval specified for this option is invalid or less than 2 seconds, the interval is set to 2 seconds. The first display shows the counters from the start of the server. Subsequent displays show the difference from the previous display. You can usually obtain useful results by running the monitor at the default interval of 60 seconds during a query with performance problems or during a time of day that generally has performance problems. A very short interval may not provide meaningful results. The interval should be proportional to the job time; 60 seconds is usually more than enough time.
-file_suffix *suffix*	Creates a monitor output file named `dbname.connid-suffix`. If you do not specify the **-file_suffix** option, the suffix defaults to `iqmon`. If you specify the **-file_suffix** option and do not provide a suffix or provide a blank string as a suffix, no suffix is used.
-append or **-truncate**	Directs **sp_iqsysmon** to append to the existing output file or truncate the existing output file, respectively. Truncate is the default. If both options are specified, the option specified later in the string takes precedence.

monitor_options String Option	Description
-section *section(s)*	Specifies the abbreviation of one or more sections to write to the monitor log file. The default is to write all sections. The abbreviations specified in the sections list in file mode are the same abbreviations used in batch mode. When more than one section is specified, spaces must separate the section abbreviations. If the **-section** option is specified with no sections, none of the sections are monitored. An invalid section abbreviation is ignored and a warning is written to the IQ message file.

Usage Syntax Examples

Syntax	Result
sp_iqsysmon start_monitor sp_iqsysmon stop_monitor	Starts the monitor in batch mode and displays all sections for the main and temporary stores
sp_iqsysmon start_monitor sp_iqsysmon stop_monitor “mbufman mbufpool”	Starts the monitor in batch mode and displays the Buffer Manager and Buffer Pool statistics for themain store
sp_iqsysmon “00:00:10”, “mbufpool memory”	Runs the monitor in batch mode for 10 seconds and displays the consolidated statistics at the end of the time period
sp_iqsysmon start_monitor, ‘filemode’, “-interval 5 -sections mbufpool memory” sp_iqsysmon stop_monitor	Starts the monitor in file mode and writes statistics for Main Buffer Pool and Memory Manager to the log file every 5 seconds

Description

The **sp_iqsysmon** stored procedure monitors multiple components of SAP Sybase IQ, including the management of buffer cache, memory, threads, locks, I/O functions, and CPU utilization.

The **sp_iqsysmon** procedure supports two modes of monitoring:

- Batch mode –
  In batch mode, **sp_iqsysmon** collects the monitor statistics for the period between starting and stopping the monitor or for the time period specified in the *time-period* parameter. At the end of the monitoring period, **sp_iqsysmon** displays a list of consolidated statistics.

sp_iqsysmon in batch mode is similar to the SAP® Sybase Adaptive Server Enterprise procedure **sp_sysmon**.

- File mode –
  In file mode, **sp_iqsysmon** writes the sample statistics in a log file for every interval period between starting and stopping the monitor.
  The first display in file mode shows the counters from the start of the server. Subsequent displays show the difference from the previous display.
  sp_iqsysmon in file mode is similar to the **IQ UTILITIES** command **START MONITOR** and **STOP MONITOR** interface.

Batch Mode Examples

Prints monitor information after 10 minutes:

```
sp_iqsysmon "00:10:00"
```

Prints only the Memory Manager section of the **sp_iqsysmon** report after 5 minutes:

```
sp_iqsysmon "00:05:00", memory
```

Starts the monitor, executes two procedures and a query, stops the monitor, then prints only the Buffer Manager section of the report:

```
sp_iqsysmon start_monitor
go
execute proc1
go
execute proc2
go
select sum(total_sales) from titles
go
sp_iqsysmon stop_monitor, bufman
go
```

Prints only the Main Buffer Manager and Main Buffer Pool sections of the report after 20 minutes:

```
sp_iqsysmon "00:02:00", "mbufman mbufpool"
```

File Mode Examples

Truncates and writes information to the log file every 2 seconds between starting the monitor and stopping the monitor:

```
sp_iqsysmon start_monitor, 'filemode', '-interval 2'
.
.
.
sp_iqsysmon stop_monitor
```

Appends output for only the Main Buffer Manager and Memory Manager sections to an ASCII file with the name `dbname.connid-testmon`. For the database `iqdemo`, writes results in the file `iqdemo.2-testmon`:

```
sp_iqsysmon start_monitor, 'filemode',
"-file_suffix testmon -append -section mbufman memory"
```

```
.
.
.
sp_iqsysmon stop_monitor
```

Example

Run the monitor in batch mode for 10 seconds and display the consolidated statistics at the end of the time period

```
sp_iqsysmon "00:00:10", "mbufpool memory"

==============================
Buffer Pool (Main)
==============================
STATS-
NAME          TOTAL  NONE  BTREEV  BTREEF  BV  VDO  DBEXT  DBID  SORT
MovedToMRU        0     0       0       0   0    0      0     0     0
MovedToWash       0     0       0       0   0    0      0     0     0
RemovedFromLRU    0     0       0       0   0    0      0     0     0
RemovedFromWash   0     0       0       0   0    0      0     0     0
RemovedInScanMode 0     0       0       0   0    0      0     0     0

STORE  GARRAY  BARRAY  BLKMAP  HASH  CKPT  BM  TEST  CMID  RIDCA  LOB
0      0       0       0       0     0     0   0     0     0      0
0      0       0       0       0     0     0   0     0     0      0
0      0       0       0       0     0     0   0     0     0      0
0      0       0       0       0     0     0   0     0     0      0
0      0       0       0       0     0     0   0     0     0      0

STATS-NAME                    VALUE
Pages                         127    ( 100.0 %)
InUse                         4      ( 3.1 %)
Dirty                         1      ( 0.8 %)
Pinned                        0      ( 0.0 %)
Flushes                       0
FlushedBufferCount            0
GetPageFrame                  0
GetPageFrameFailure           0
GotEmptyFrame                 0
Washed                        0
TimesSweepersWoken            0

washTeamSize                  0
WashMaxSize                   26    ( 20.5 %)
washNBuffers                  4      ( 3.1 %)
washNDirtyBuffers             1      ( 0.8
%)
                  washSignalThreshold           3       ( 2.4 %)
washNActiveSweepers           0
washIntensity                 1

==============================
Memory Manager
==============================
STATS-NAME                  VALUE
```

```
MemAllocated                  43616536     (  42594 KB)
MemAllocatedMax               43735080     (  42710 KB)
MemAllocatedEver              0            (      0 KB)
MemNAllocated                 67079
MemNAllocatedEver             0
MemNTimesLocked               0
MemNTimesWaited               0            (   0.0 %)
```

sp_iqpassword Procedure

Changes a user's password.

Syntax1

```
call sp_iqpassword ('caller_password', 'new_password' [, 'user_name'])
```

Syntax2

```
sp_iqpassword 'caller_password', 'new_password' [, 'user_ name']
```

Privileges

- None to set your own password.
- The CHANGE PASSWORD system privilege is required to set other users' passwords.

Usage

Table 25. Parameters

Parameter	Description
caller_password	Your password. When you are changing your own password, this is your old password. When a user with the CHANGE PASSWORD system privielge is changing another user's password, caller_password is the of the user making the change.
new_password	New password for the user, or for *loginname*.
user_name	Login name of the user whose password is being changed by by another user with CHANGE PASSWORD system privilege. Do not specify user_name when changing your own password.

Description

A user password is an identifier. Any user can change his or her own password using **sp_iqpassword**. The CHANGE PASSWORD system privilege is required to change the password of any existing user.

Identifiers have a maximum length of 128 bytes. They must be enclosed in double quotes or square brackets if any of these conditions are true:

- The identifier contains spaces.
- The first character of the identifier is not an alphabetic character (as defined below).
- The identifier contains a reserved word.
- The identifier contains characters other than alphabetic characters and digits.

  Alphabetic characters include the alphabet, as well as the underscore character (_), at sign (@), number sign (#), and dollar sign ($). The database collation sequence dictates which characters are considered alphabetic or digit characters.

Examples

Changes the password of the logged-in user from irk103 to exP984:

```
sp_iqpassword 'irk103', 'exP984'
```

If the logged-in user has the CHANGE PASSWORD system privilege or `joe`, the password of user `joe` from `eprr45` to `pdi032`:

```
call sp_iqpassword ('eprr45', 'pdi932', 'joe')
```

sp_objectpermission System Procedure

Generates a report on object permissions granted to the specified role, or user name, or the object permissions granted on the specified object or dbspace.

Syntax

```
dbo.sp_objectpermission (
[object_name],
[object_owner],
[object_type] )
```

Arguments

Arguments	Description
object_name	The name of an object or dbspace or a user or a role. If not specified, object permissions of the current user are reported. Default value is NULL.
object_owner	The name of the object owner for the specified object name. The object permissions of the specified object owned by the specified object owner are displayed. This parameter must be specified to obtain the object permissions of an object owned by another user or role. Default value is NULL.

Arguments	Description
object_type	Valid values are: • TABLE* • VIEW • MATERIALIZED VIEW • SEQUENCE • PROCEDURE • FUNCTION • DBSPACE • USER **Note:** *Column-level object permissions also appear. If no value is specified, permissions on all object types are returned. Default value is NULL.

Result Set

Column Name	Data Ttype	Description
grantor	char(128)	The user ID of the grantor
grantee	char(128)	The user ID of the grantee
object_name	char(128)	The name of the object
owner	char(128)	The name of the object owner
object_type	char(20)	The type of object
column_name	char(128)	The name of the column
permission	char(20)	The name of the permission
grantable	char(1)	Whether or not the permission is grantable

Remarks

All arguments are optional and can generate these reports:

- If input is an object (table, view, procedure, function, sequence, and so on), procedure displays list of all roles and user that have different object permission on the object.
- If input is a role or user, procedure displays list of all object privileges granted to the role or input. When executing **sp_objectpermission** to display object permissions of a user or a role, the object permissions that are inherited through role grants also.
- If input is a dbspace name, procedure displays list of all user or roles that have CREATE permission on the specified dbspace.

- By default, object type is NULL and the object permissions for all existing object types matching the specified object name appear.

Privileges

- Any user can execute **sp_objectpermission** to obtain all the object permissions granted to him- or herself,
- Object owners can execute **sp_objectpermission** to obtain the object permissions for self-owned objects.
- MANAGE ANY OBJECT PRIVILEGE system privilege is required to obtain object permissions that are granted:
  - On objects owned by other users
  - To other users

  .
- MANAGE ANY OBJECT PRIVILEGE system privilege or role administrator is required to obtain object permissions that are granted:
  - On objects owned by a role
  - To a role.
- MANAGE ANY DBSPACE system privilege required to obtain permissions of a dbspace.

Example

The following GRANT statements are executed:

```
GRANT SERVER OPERATOR TO r4;
GRANT BACKUP DATABASE TO r3 WITH ADMIN OPTION;
GRANT DROP CONNECTION TO r3 WITH ADMIN ONLY OPTION;
GRANT MONITOR TO r2;GRANT CHECKPOINT TO r1;
GRANT ROLE r2 TO r1 WITH ADMIN OPTION;
GRANT ROLE r3 TO r2 WITH NO ADMIN OPTION;
GRANT ROLE r4 TO r3 WITH ADMIN ONLY OPTION;
```

Consider these object permissions:

- `r5` owns a table named `test_tab` and a procedure named `test_proc` in the database.
- `u5`, which has administrative rights over `r5`, grants the following permissions:
  - GRANT SELECT ON r5.test_tab TO r2 WITH GRANT OPTION;
  - GRANT SELECT (c1), UPDATE (c1) ON r5.test_tab TO r6 WITH GRANT OPTION;
  - GRANT EXECUTE ON r5.test_proc TO r3;
- `u6`, which has administrative rights over `r6`, grants the following permissions:
  - GRANT SELECT (c1), REFERENCES (c1) ON r5.test_tab TO r3;

If `sp_objectpermission( 'r1' )` is executed, output is similar to:

grantor	grantee	object_name	owner	object_type	column_name	permission	grantable
u5	r2	test_tab	r5	TABLE	NULL	SELECT	Y
u6	r3	test_tab	r5	COLUMN	c1	SELECT	N
u6	r3	test_tab	r5	COLUMN	c1	REFERENCES	N
u6	r3	test_proc	r5	PROCEDURE	NULL	EXECUTE	N

If `sp_objectpermission( 'test_tab', 'r5', 'table' )` is executed, output is similar to:

granter	grantee	object_name	owner	object_type	column_name	permission	grantable
u5	r2	test_tab	r5	TABLE	NULL	SELECT	Y
u5	r6	test_tab	r5	COLUMN	c1	SELECT	Y
u5	r6	test_tab	r5	COLUMN	c1	UPDATE	Y
u6	r3	test_tab	r5	COLUMN	c1	SELECT	N
u6	r3	test_tab	r5	COLUMN	c1	REFERENCES	N

sp_sys_priv_role_info System Procedure

Generates a report to map a system privilege to the corresponding system role. A single row is returned for each system privilege.

Syntax

sp_sys_priv_role_info()

Result Set

Column Name	Data Type	Description
sys_priv_name	char(128)	The name of the system privilege
sys_priv_role_name	char(128)	The role name corresponding to the system privilege.
sys_priv_id	unsigned int	The id of the system privilege.

Privileges
none

sp_alter_secure_feature_key System Procedure

Alters a previously-defined secure feature key by modifying the authorization key and/or the feature list.

Syntax

```
sp_alter_secure_feature_key (
    name,
    auth_key,
    features )
```

Arguments

- **name –** the VARCHAR (128) name for the secure feature key you want to alter. A key with the given name must already exist.
- **auth_key –** the CHAR (128) authorization key for the secure feature key. The authorization key must be either a non-empty string of at least six characters, or NULL, indicating that the existing authorization key is not to be changed.
- **features –** the LONG VARCHAR, comma-separated list of secure features that the key can enable. The feature_list can be NULL, indicating that the existing feature_list is not to be changed.

Remarks
This procedure allows you to alter the authorization key or feature list of an existing secure feature key.

Privileges
To use this procedure, you must be the database server owner and have the manage_keys feature enabled on the connection.

sp_create_secure_feature_key System Procedure

Creates a new secure feature key.

Syntax

```
sp_create_secure_feature_key (
    name,
    auth_key,
    features )
```

Arguments

- **name –** the VARCHAR (128) name for the new secure feature key. This argument cannot be NULL or an empty string.
- **auth_key –** the CHAR (128) authorization key for the secure feature key. The authorization key must be a non-empty string of at least six characters.
- **features –** the LONG VARCHAR comma-separated list of secure features that the new key can enable. Specifying "-" before a feature means that the feature is not re-enabled when the secure feature key is set.

Remarks

This procedure creates a new secure feature key that can be given to any user. The system secure feature key is created using the -sk database server option.

Privileges

To use this procedure, you must be the database server owner and have the manage_keys feature enabled on the connection.

sp_drop_secure_feature_key System Procedure

Deletes a secure feature key.

Syntax

```
sp_drop_secure_feature_key ( name )
```

Arguments

- **name –** the VARCHAR (128) name of the secure feature key to drop.

Remarks

If the named key does not exist, an error is returned. If the named key exists, it is deleted as long as it is not the last secure feature key that is allowed to manage secure features and secure feature keys. For example, the system secure feature key cannot be dropped until there is another key that has the manage_features and manage_keys secure features enabled.

Privileges

To use this procedure, you must be the database server owner and have the manage_keys feature enabled on the connection.

sp_list_secure_feature_keys System Procedure

Returns information about the contents of a directory.

Syntax

```
sp_list_secure_feature_keys ( )
```

Result Set

Column Name	Data Type	Description
name	VARCHAR(128)	The name of the secure feature key.
features	LONG VARCHAR	The secure features enabled by the secure feature key.

Remarks

This procedures returns the names of existing secure feature keys, as well as the set of secure features that can be enabled by each key.

If the user has the manage_features and manage_keys secure features enabled, then the procedure returns a list of all secure feature keys.

If the user only has the manage_keys secure feature enabled, then the procedure returns keys that have the same features or a subset of the same features that the current user has enabled.

Privileges

To use this procedure, you must be the database server owner and have the manage_keys feature enabled on the connection.

sp_use_secure_feature_key System Procedure

Enables an existing secure feature key.

Syntax

```
sp_use_secure_feature_key (
    name,
    sfkey)
```

Arguments

- **name –** the VARCHAR (128) name of the secure feature key to be enabled.

- **sfkey –** the CHAR (128) authorization key for the secure feature key being enabled. The authorization key must be at least six characters.

Remarks

This procedure enables the secure features that are turned on by the specified secure feature key.

Privileges

None.

Appendix: Startup and Connection Parameters

Reference material for startup options and connection parameters for the **start_iq** utility.

-ec iqsrv16 database server option

Uses transport-layer security or simple encryption to encrypt all command sequence communication protocol packets (such as DBLib and ODBC) transmitted to and from all clients. TDS packets aren't encrypted.

Syntax

```
iqsrv16 -ec encryption-options ...
```

```
encryption-options :
```

```
{ NONE |
   SIMPLE |
   TLS ( [ FIPS={ Y | N }; ]
   IDENTITY=server-identity-filename;
   IDENTITY_PASSWORD=password ) }, ...
```

Allowed values

- **NONE –** accepts connections that aren't encrypted.
- **SIMPLE –** accepts connections that are encrypted with simple encryption. This type of encryption is supported on all platforms, and on previous versions of the database server and clients. Simple encryption doesn't provide server authentication, RSA encryption, or other features of transport-layer security.
- **TLS –** accepts connections that are encrypted with RSA encryption. The TLS parameter accepts the following arguments:
  - **FIPS –** For FIPS-certified RSA encryption, specify `FIPS=Y`. RSA FIPS-certified encryption uses a separate certified library, but is compatible with version 9.0.2 or later clients specifying RSA.

    For a list of FIPS-certified components, see *http://www.sybase.com/detail?id=1061806*.

    The algorithm must match the encryption used to create your certificates.
  - ***server-identity-filename* –** is the path and file name of the server identity certificate. If you are using FIPS-certified RSA encryption, you must generate your certificates using the RSA algorithm.

- ***password*** – is the password for the server private key. You specify this password when you create the server certificate.

Applies to

NONE and SIMPLE apply to all servers and operating systems.

TLS applies to all servers and operating systems.

For information about supporting FIPS-certified encryption, see *http://www.sybase.com/detail?id=1061806*.

Remarks

You can use this option to secure communication packets between client applications and the database server using transport-layer security.

The -ec option instructs the database server to accept only connections that are encrypted using one of the specified types. You must specify at least one of the supported parameters in a comma-separated list. Connections over the TDS protocol, which include Java applications using jConnect, are always accepted and are never encrypted, regardless of the usage of the -ec option. Setting the TDS protocol option to NO disallows these unencrypted TDS connections.

By default, communication packets aren't encrypted, which poses a potential security risk. If you are concerned about the security of network packets, use the -ec option. Encryption affects performance only marginally.

If the database server accepts simple encryption, but does not accept unencrypted connections, then any non-TDS connection attempts using no encryption automatically use simple encryption.

Starting the database server with `-ec SIMPLE` tells the database server to only accept connections using simple encryption. TLS connections (RSA and RSA FIPS-certified encryption) fail, and connections requesting no encryption use simple encryption.

If you want the database server to accept encrypted connections over TCP/IP, but also want to be able to connect to the database from the local computer over shared memory, you can specify the -es option with the -ec option when starting the database server.

The `dbrsa16.dll` file contains the RSA code used for encryption and decryption. The file `dbfips16.dll` contains the code for the FIPS-certified RSA algorithm. When you connect to the database server, if the appropriate file cannot be found, or if an error occurs, a message appears in the database server messages window. The server doesn't start if the specified types of encryption cannot be initiated.

The client's and the server's encryption settings must match or the connection fails except in the following cases:

- If -ec SIMPLE is specified on the database server, but -ec NONE is not, then connections that do not request encryption can connect and automatically use simple encryption.

- If the database server specifies RSA and the client specifies FIPS-certified encryption, or vice versa, the connection succeeds. In these cases, the Encryption connection property returns the value specified by the database server.

Note: Separately licensed component required.

FIPS-certified encryption requires a separate license. All strong encryption technologies are subject to export regulations.

Example

The following example specifies that connections with no encryption and simple encryption are allowed.

```
iqsrv16 -ec NONE,SIMPLE -x tcpip c:\mydemo.db
```

The following example starts a database server that uses the RSA server certificate `rsaserver.id`.

```
iqsrv16 -ec TLS(IDENTITY=rsaserver.id;IDENTITY_PASSWORD=test) -x
tcpip c:\mydemo.db
```

The following example starts a database server that uses the FIPS-approved RSA server certificate `rsaserver.id`.

```
iqsrv16 -ec TLS(FIPS=Y;IDENTITY=rsaserver.id;IDENTITY_PASSWORD=test)
-x tcpip c:\mydemo.db
```

-es iqsrv16 database server option

Allows unencrypted connections over shared memory.

Syntax

```
iqsrv16 -ec encryption-options -es ...
```

Applies to

All servers and operating systems.

Remarks

This option is only effective when specified with the -ec option. The -es option instructs the database server to allow unencrypted connections over shared memory. Connections over TCP/IP must use an encryption type specified by the -ec option. This option is useful in situations where you want remote clients to use encrypted connections, but for performance reasons you also want to access the database from the local computer with an unencrypted connection.

Example

The following example specifies that connections with simple encryption and unencrypted connections over shared memory are allowed.

```
iqsrv16 -ec SIMPLE -es -x tcpip c:\mydemo.db
```

TDS Communication Parameter

Controls whether the server allows TDS connections.

Usage
TCP/IP, NamedPipes (server side only)

Values
YES, **NO**

Default
YES

Description
To disallow TDS connections to a database server, set TDS to NO. To ensure that only encrypted connections are made to your server, these port options are the only way to disallow TDS connections.

Example
The following command starts a database server that uses the TCP/IP protocol, but disallows connections from Open Client or jConnect applications.

```
start_iq -x tcpip(TDS=NO) ...
```

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