Oracle® Enterprise Manager

Cloud Control Security Guide

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Preface

This guide describes how to set up Enterprise Manager Cloud Control 13c security.

The preface covers the following:

- Audience
- Documentation Accessibility
- Related Documents
- Conventions

Audience

This document is intended for administrators who want to set up and manage Enterprise Manager security.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc.

Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support. For information, visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info or visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs if you are hearing impaired.

Related Documents

For the latest releases of these and other Oracle documentation, check the Oracle Technology Network at:

http://www.oracle.com/technetwork/documentation/index.html#em

Oracle Enterprise Manager also provides extensive Online Help. Click **Help** at the top of any Enterprise Manager page to display the online help window.

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.

Convention	Meaning
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

1

Security Overview

This chapter provides a brief overview of security concepts and concerns.
The following topics are discussed:

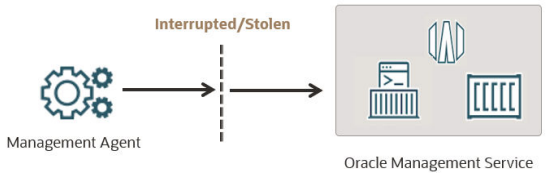
- Security Threats
- Security Principles

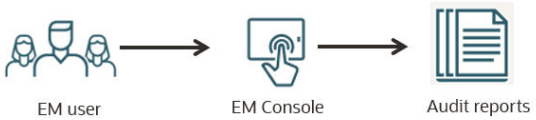
The dynamic and complex nature of today's IT environments, the potential fallout of security breaches in terms of the financial implications and loss of goodwill coupled with stringent regulatory requirements make security a critical area of consideration for both business and IT managers. While security considerations are important for standalone applications, the introduction of distributed system management applications can make it yet more challenging. While standardized security best practices are available for databases and application servers, there aren't any standardized security benchmarks specifically for system management products. However, Enterprise Manager has been evaluated and in the past, has received a third party security certification, by the Common Criteria Recognition Arrangement.

Securing Enterprise Manager requires working closely with System Administrators, Network Administrators, Database Administrators, Application Administrators and the Security team. This document can be used by all concerned parties to identify various security considerations and the best practices for securing Oracle Enterprise Manager deployments. The recommendations in this document are based on our experience with both customer deployments and Oracle's own internal usage of Enterprise Manager.

Security Threats

The following table briefly summarizes the primary security threats to your Enterprise Manager environment.

Threats	Security Consideration	Resolution/Best Practice
Man-in-the-middle attacks	Data confidentiality and integrity	Data Confidentiality and Integrity • Not disclosed to any entities unless they are authorized to access • Not changed, destroyed, or lost in unauthorized or accidental manner Man-in-the-Middle Attacks • Interrupts, intercepts, modifies or fabricates data in transit  **Best Practice:** Secure communication between Enterprise Manager components.
Denial-of-service attacks	Data availability	Data Availability • Available and usable upon demand by an authorized entity Denial-of-Service attacks • Makes Management Repository or OMS unavailable to intended users by flooding them with more requests than they can handle.  **Best Practice:** Secure individual Enterprise Manager components

Threats	Security Consideration	Resolution/Best Practice
Password crack attacks	Authentication	Authentication • The process to verify the identity, usually username and password, claimed by a user Password Crack Attacks • Obtains password from an authentication exchange, then uses the password to log on to Enterprise Manager. Examples: guessing, dictionary and brute force attacks  **Best Practice:** Change passwords and enable password profiles
Exploitation of authorization	Segregation of duties	Exploitation of Authorization • Accesses resources (targets, jobs, templates and so on) not authorized to you Segregation of Duties • No person should be given responsibility for more than one related function **Best Practice:** Follow principle of least privileges
Repudiation	Non-repudiation	Accountability of Actions • Network security: Neither sender nor recipient can later deny having processed the information • Web Application security: No one can later deny the actions he/she has taken in the application Repudiation • Refuses authoring of something that happened  **Best Practice:** Audit Enterprise Manager actions

Security Principles

Underlying all strategies to implement effective system security are the following basic principles:

- Separation of Duties and Principle of Least Privilege
- Encryption
- Monitoring for Suspicious Activity (Auditing)
- Non-repudiation

Separation of Duties and Principle of Least Privilege

The *principle of least privilege* and *separation of duties* are concepts that, although semantically different, are intrinsically related from the standpoint of security. The intent behind both is to **prevent people from having higher privilege levels than they actually need**. Now that their relationship has been framed, let us define the concepts.

- **Principle of Least Privilege**: Users should only have the least amount of privileges required to perform their job and no more. This reduces authorization exploitation by limiting access to Enterprise Manager resources such as targets, jobs, or monitoring templates for which they are not authorized.

  Example: A user whose sole responsibility is to monitor and maintain a human resources database does not need privileges to access and manage Enterprise Manager plug-ins on the Oracle Management Services (OMS).

- **Separation of Duties**: Beyond limiting user privilege level, you also limit user duties, or the specific jobs they can perform with Enterprise Manager. No user should be given responsibility for more than one related function. This limits the ability of a user to perform a malicious action and then cover up that action.

  Example: You have an Enterprise Manager administrator who is responsible for creating user accounts. However, that administrator may create unnecessary accounts, perhaps for unauthorized colleagues to access confidential systems. If that administrator also has the ability to view and erase the audit logs, then there is a potential problem in that it prevents a wayward administrator from being caught. In this situation, you want to separate the account creation duties from the security administration duties. The person who is the account administrator, in this case, should also not be the security administrator.

In order to be effective, the principle of least privilege and separation of duties should be enforced for all Enterprise Manager users in your organization.

Encryption

Encryption is the process of transforming data into an unreadable format using a secret key and an encryption algorithm. For Enterprise Manager, *emkey* is the key to encrypting and decrypting sensitive data within your Enterprise Manager environment. It is important that emkey be accessible only to authorized users.

Monitoring for Suspicious Activity (Auditing)

Whenever an Enterprise Manager administrator makes use of higher-level privileges, such as creating new Super Administrator accounts, you should be able to look at the Enterprise Manager audit logs and tell whether those account creation actions were warranted. Enterprise Manager's audit capabilities allow you to monitor and record all administrator actions that take place. You can perform activities such as:

- Investigating suspicious activity. For example, if a user is frequently accessing systems outside their job responsibilities, then a security administrator might decide to track access to those machines.

- Notify a supervisor of the actions of an unauthorized user. For example, an unauthorized user could be changing or deleting data, or the user has more privileges than expected, which can lead to reassessing user authorizations.

Non-repudiation

Non-repudiation is a method of establishing user action accountability by "proving" that a user performed a specific action: Users cannot falsely deny that they performed that action. Conversely, non-repudiation also protects users from later being accused of having performed a specific action.

With regard to data, non-repudiation, is a way to prove that a given sender actually sent a particular message. Non-repudiation is typically achieved through the use of digital signatures. The originator of a message uses a cryptographic tool to convert plain, readable messages or plaintext into encrypted ciphertext. While the original text is present, its appearance changes into a form that is unintelligible if intercepted. The message recipient likewise uses a cryptographic tool to decrypt the ciphertext into its original readable format.

2

Security Features

This chapter covers the following topics:

- Configuring Authentication
- Configuring Privileges and Role Authorization
- Configuring Secure Communication
- Configuring and Using Target Credentials
- Configuring and Using Cryptograhic Keys
- Configuring and Managing Audit
- Additional Security Considerations
- Privileged Access Management Integration

Configuring Authentication

Enterprise Manager authentication is the process of determining the validity of the user accessing Enterprise Manager. The authentication feature is available across the different interfaces such as Enterprise Manager console and Enterprise Manager Command Line Interface (EM CLI).

Enterprise Manager's authentication framework consists of pluggable authentication schemes that let you use the type of authentication protocol best suited to your environment.

> **Note:**
>
> Oracle Enterprise Manager relies on the underlying WebLogic Server that is part of the OMS stack for external Authentication methods. For this reason, Enterprise Manager can be authenticated using any authentication method that is supported by Oracle WebLogic Server. Note that only some providers have been certified so far although theoretically it should be possible to configure for all.

Supported Authentication Schemes

Enterprise Manager supports the following authentication schemes:

- **Repository-Based Authentication**:

  This scheme involves saving the administrator's username and password in the Enterprise Manager repository and performing validation against these saved values whenever a user logs on to the Enterprise Manager console. An Enterprise Manager user created is also a repository (database) user. By using this option, you can take advantage of all the benefits of Oracle database user management that this authentication method provides such as password control through the password profile, enforced password complexity, password life time, and number of failed attempts allowed. During the password grace period, the

administrator is prompted to change the password but when the password has expired, it must be changed. For more details, refer to Creating a New Administrator.

- **Oracle Access Manager (OAM) Single Sign-On (SSO) Based Authentication**: Oracle Access Manager is the Oracle Fusion Middleware single sign-on solution. The underlying identity stores will be the Enterprise Directory Identity Stores being supported by Oracle Access Manager. This authentication scheme is used for data centers that have standardized on Oracle Access Manager as the central tool for authentication across all enterprise applications. If you want to support protocols such as Kerberos for authentication, you must configure OAM for this. For more information about OAM, see *Oracle® Fusion Middleware Administrator's Guide for Oracle Access Manager 13c Release 1 (11.1.1)*.
- **Enterprise User Security Based Authentication**: The Enterprise User Security (EUS) option enables you to create and store enterprise users and roles for the Oracle database in an LDAP-compliant directory server. After the Enterprise Manager repository is configured with EUS, you can configure Enterprise Manager to use EUS as its authentication mechanism as described in Enterprise User Security Based Authentication. You can register any EUS user as an Enterprise Manager administrator.

  In addition to using EUS to authenticate Enterprise Manager administrators, it can also be used to simplify management of database target credentials. EUS helps centralize the administration of users and roles across multiple databases. If the managed databases are configured with EUS, the process of logging into these databases is simplified. When you drill down to a managed database, Enterprise Manager will attempt to connect to the database using Enterprise Manager credentials. If successful, Enterprise Manager will directly connect you to the database without displaying a logon page.
- **LDAP Authentication Options: Oracle Internet Directory and Microsoft Active Directory**
  - *Oracle Internet Directory (OID) Based Authentication* - Oracle Internet Directory is a LDAP v3 compliant directory built on the Oracle database and is fully integrated into Oracle Fusion Middleware and Oracle Applications. Therefore, it is ideally suited for Oracle environments or enterprises with Oracle database expertise. When using an authentication scheme based on OID as the identity store, you can have your applications authenticate users against the OID.
  - *Microsoft Active Directory Based Authentication* - Microsoft Active Directory is a directory service that provides authentication and authorization functionality in a Windows network. When using a Microsoft Active Directory as an identity store, you can plug in this scheme to have your applications authenticate users against the Microsoft Active Directory.

> **Note:**
>
> Enterprise Manager will support external authentication as long as the specific authentication scheme is supported and integrated with the WebLogic Server.

- **RADIUS Synchronous Authentication**: This scheme can be enabled by setting a property value using either the command line or the UI:

  1. Open a terminal window and execute the following command:

```
$ORACLE_HOME/bin/emctl set property -name
oracle.sysman.db.enable_radius_auth -value true
```

2. When creating a new credential or editing an existing named credential, click the **RADIUS Authentication** checkbox.

- **Security Assertion Markup Language (SAML)**: SAML is a standard that enables seamless, single sign-on (SSO) login into applications. It works by transferring the user's identity from one place (the identity provider) to another (the service provider) through an exchange of digitally signed XML documents. Oracle Enterprise Manager supports SAML version 2.0.

  To configure Enterprise Manager with SAML-based login, follow these steps:

  1. The Service Provider Configuration requires ldap parameters. Run this command from the OMS Home to create the Service Provider metadata (EMGC_OMS1_sp_metadata.xml) for the primary OMS. For example, an OMS Home may be /u01/app/oracle/middleware.

     ```
     <OMS Home>/bin/emctl config auth saml_service_provider -ldap_type oid -
     ldap_host myhost.example.com -ldap_port 3131 -ldap_principal
     "cn=orcladmin" -user_base_dn cn=Users -group_base_dn cn=Groups -
     ldap_credential password -enable_auto_provisioning -use_ssl -
     cert_file /tmp/cert
     ```

     Sample output:

     ```
     Oracle Enterprise Manager Cloud Control 13c Release 5
     Copyright (c) 1996, 2021 Oracle Corporation. All rights reserved.
     Configuring SAML Authentication ... StartedSAML Service Provider
     configured
     Weblogic configuration file modified
     Configuring SAML Authentication ... Successful
     Configuring LDAP Authentication ... Started
     Successfully validated connection to LDAP server
     Configuring LDAP Authentication ... Successful
     Run 'emctl config auth saml_service_provider' in other OMS(s) and
     restart all OMS(s) using 'emctl stop oms -all' and 'emctl start oms'
     ```

  2. Run the following command only in additional OMS(s):

     ```
     emctl config auth saml_service_provider
     ```

     Sample output:

     ```
     Oracle Enterprise Manager Cloud Control 13c Release 5
     Copyright (c) 1996, 2021 Oracle Corporation. All rights reserved.
     Configuring SAML Authentication ... Started
     Weblogic configuration file modified
     Configuring SAML Authentication ... Successful
     ```

  3. Restart the primary and additional OMS(s):

     ```
     emctl stop oms -all
     emctl start oms
     ```

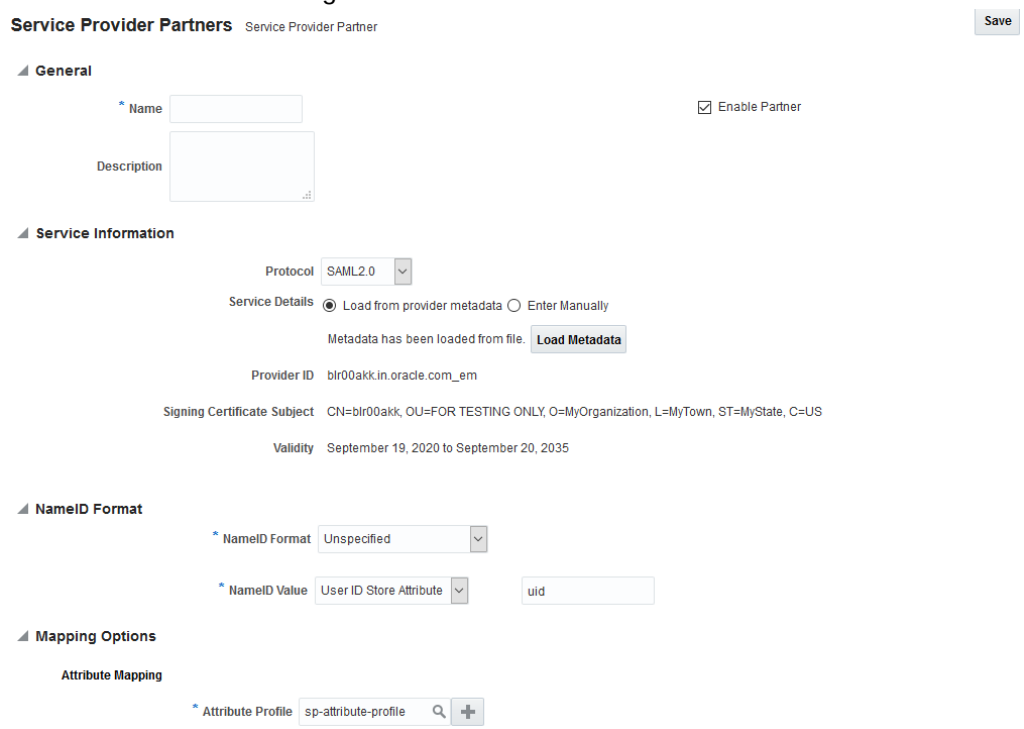
4. Run the following command in the primary OMS:

```
emctl config auth export_saml_metadata
```

Sample output:

```
Oracle Enterprise Manager Cloud Control 13c Release 5
Copyright (c) 1996, 2021 Oracle Corporation. All rights reserved.
Exporting SAML Metadata ... Started
SAML Service Provider metadata is exported to file
/ade/u01/oracle/work/user_projects/domains/EMGC_DOMAIN/
saml_sp_metadata.xml
```

5. Import the Service Provider metadata into your Identity Provider. This varies depending on your provider. For example, if using Configure Oracle Access Management (OAM), login to OAM → Federation → Identity Provider Management → Create Service Provider Partner → Browse and choose the metadata file. Enter the values as shown in the image and then save.



6. Get SAML metadata xml file from Identity Provider and run the following command in the primary OMS:

```
emctl config auth import_saml_identity_provider -idp_metadata /tmp/
dev_oam_saml_metadata.xml
```

Sample output:

```
Oracle Enterprise Manager Cloud Control 13c Release 5
Copyright (c) 1996, 2021 Oracle Corporation. All rights reserved.
Configuring SAML Authentication ... Started
SAML Identity Provider configured
```

```
Configuring SAML Authentication ... Successful
Restart all OMS(s) using 'emctl stop oms -all' and 'emctl start oms'
```

7. Restart the primary and additional OMS(s):

```
emctl stop oms -all


emctl start oms
```

These authentication schemes have been tested in house and some of the external authentication schemes mentioned below can be configured using the `emctl config auth` utility command, which configures the required WebLogic providers as well as set the required OMS properties.

Authenticating schemes where the `emctl` utility command configures the WebLogic authentication providers, the command sets the required configuration parameters and leaves most of the other parameters to the default values. Administrators should ensure the configuration parameters of the WebLogic providers are tuned for performance suited to their environment before going into production. This can be done through the WebLogic Administration Console.

For more information regarding configuring SAML for different identity providers, such as Azure Ad, PingID and IDCS, see EM 13.5: Primary Note on SAML 2.0 Configuration and Issues for SSO login (Doc ID 2976397.2).

Creating a New Administrator

Enterprise Manager allows you to create and manage new administrator accounts. Each administrator account includes its own logon credentials as well as a set of roles and privileges that are assigned to the account. You can also assign a password profile to the administrator. You will need to have Enterprise Manager Super Administrator privileges to create and manage new administrator accounts.

To create, edit, or view an administrator account:

1. From the **Setup** menu, select **Security**, then select **Administrators**. The Administrators page is displayed.
2. Click the appropriate task button on the Administrators page. The Authentication page is displayed.

   Repository Based Authentication is selected as the default authentication method.

Repository Based Authentication

Repository Based Authentication is the default method of Enterprise Manager Authentication. With this authentication method, a new administrator is created in the repository.

> **Note:**
>
> Repository-based authentication is the default authentication method.

On this page, you can specify the type of administrator account being created and select the password profile. The password cannot be changed by the administrator if the **Prevent Password Change** toggle is on.

If the **Expire Password Now** toggle is on, the password for the new administrator account will be set to an expired state. If the password has expired, when the new administrator logs in, the Change Password page is displayed and the administrator is prompted to change the password.

The administrator should enter his current password and the new password and click **Apply**. He can now start using Enterprise Manager.

Creating a New User (Command Line)

The following examples make User1 an Enterprise Manager user, provide a description for the user, and prevent the password from being changed. Only another Super Administrator can change the password. The profile is set as MGMT_ADMIN_USER_PROFILE.

Example 2-1 Command Line

```
emcli create_user
      -name="User1"
      -desc="This is temp hire."
      -prevent_change_password="true"
      -profile="MGMT_ADMIN_USER_PROFILE"
```

Example 2-2 Scripting and Interactive

```
create_user
      (name="User1"
      ,desc="This is temp hire."
      ,prevent_change_password="true"
      ,profile="MGMT_ADMIN_USER_PROFILE")
```

Restoring to the Default Authentication Method

The following sections detail how to restore the default Enterprise Manager authentication methods.

Bypassing the Single Sign-On Logon Page

If the OMS is configured with SSO or OAM or some other authentication method, you may want to by-pass the Single Sign-On or OAM authentication under certain circumstances.To bypass the SSO logon page, connect to the following URL:

1. Connect to `https://ms_host:ms_https_port/em`

   ms_host & ms_https_port are WLS-managed server's hostname & port#. These parameters can be found in the EM_INSTANCE_HOME/emgc.properties file. They are listed as EM_INSTANCE_HOST & MS_HTTPS_PORT in this file.

2. Log in using a repository user's credentials.

Restoring the Default Authentication Method

1. Run the following command on each OMS:

   ```
   emctl config auth repos
   ```

   Sample command output:

```
Oracle Enterprise Manager Cloud Control 13c Release 5
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
Configuring Repos Authentication ... Started
Configuring Repos Authentication ... Successful
If you have updated files like httpd.conf (for example, while installing WebGate),
rollback them.
If this is a multi-OMS environment, execute this command on remaining servers.
After that, restart OMS(s) using: 'emctl stop oms -all' and 'emctl start oms'
```

2. Run the following commands on each OMS:

```
emctl stop oms -all

emctl start oms
```

If you have configured OAM SSO, you need to manually un-install Webgate and remove the Webgate directives from Apache `httpd.conf`.

If you have configured with OSSO, you need to manually remove the OSSO directives from `httpd.conf`.

Deleting an Administrator

To delete an administrator account:

1. From the **Setup** menu, select **Security**, then select **Administrators**. The Administrators page is displayed.
2. Select the administrator that you want to delete, then click **Delete**.
3. On the confirmation page, click **Yes**.

If the administrator has resources assigned the Delete Administrator page appears. Use the Delete Administrator page to specify what happens to administrator-owned objects when removing an administrator from Enterprise Manager. On this page, you can:

- Delete all administrator-owned objects along with the Enterprise Manager administrator. This will delete the administrator and associated job types, jobs, corrective actions, report definitions, reports, and templates. Blackouts will not be deleted.
- Reassign objects to another Enterprise Manager administrator. This will assign the administrator's objects to another administrator. The credentials belonging to the administrator will be deleted from the repository before any reassignment takes place.

Usage Tips

Click **View Objects** to see all objects currently owned by the Enterprise Manager administrator to be deleted.

To reassign the objects to another administrator, enter the name of the new administrator in the **New Owner** text box, or click the flashlight icon to view a list of available administrators.

Only a super administrator can delete other Enterprise Manager administrators. Enterprise Manager will not allow administrators to:

- Delete themselves.
- Delete the management repository owner.

Administrator object reassignments can be handled as follows:

- **Blackouts** can be reassigned to any user who has OPERATOR privileges on all targets affected by the blackout.

- **Jobs** can be reassigned to any administrator. However, ALL credentials associated with the job will be removed, leaving the job in a Suspended state. This requires the new job owner to explicitly set new credentials. Currently running jobs are allowed to continue running. Once the new job owner sets the credentials, the job will revert to a SCHEDULED state.
- **Corrective Actions** can be reassigned to any administrator who has OPERATOR privileges for targets on which the corrective action can operate.
- **Report Definitions** can be reassigned to any administrator.
- **Reports** can be reassigned to any administrator.
- **Monitoring Templates** can be reassigned to any administrator.

Enterprise User Security Based Authentication

Enterprise User Security enables you to create and store Oracle database information as directory objects in an LDAP-compliant directory server such as Oracle Internet Directory (OID) or Microsoft Active Directory. For example, an administrator can create and store enterprise users and roles for the Oracle database in the directory, which helps centralize the administration of users and roles across multiple databases.

> **See Also:**
>
> *Database Enterprise User Security Administrator's Guide*.

If you currently use Enterprise User Security to mange Oracle users and roles for all your Oracle databases, you can also extend this feature to manage Enterprise Manager administrator accounts. Configuring Enterprise Manager for use with Enterprise User Security simplifies the process of logging in to database targets you are managing with the Oracle Enterprise Manager console.

To configure Enterprise Manager for use with Enterprise User Security:

1. Ensure that you have enabled Enterprise User Security for your Oracle Management Repository database, as well as the database targets you will be managing with the Cloud Control console. Refer to *Oracle Database Advanced Security Administrator's Guide* for details.
2. Using the `emctl set property` command, set the following property:

   ```
   oracle.sysman.emSDK.sec.DirectoryAuthenticationType=EnterpriseUser
   ```

   > **Note:**
   >
   > For multiple OMS configurations, the command must be run on each OMS.

   For example:

   ```
   emctl set property -name oracle.sysman.emSDK.sec.DirectoryAuthenticationType -value
   EnterpriseUser
   ```

3. Stop the Oracle Management Service.

   ```
   emctl stop oms -all
   ```

> **See Also:**
>
> Controlling the Oracle Management Service on page 24-4

4. Start the Management Service.

   ```
   emctl start oms
   ```

The next time you use the Oracle Enterprise Manager console to drill down to a managed database, Enterprise Manager will attempt to connect to the database using Enterprise User Security. If successful, Enterprise Manager will connect you to the database without displaying a logon page. If the attempt to use Enterprise User Security fails, Enterprise Manager will prompt you for the database credentials.

Registering Enterprise Users (EUS Users) as Enterprise Manager Users

After you have configured Enterprise Manager to use Enterprise Users (EUS), you can register existing enterprise users as Enterprise Manager Users and grant them the necessary privileges so that they can manage Enterprise Manager effectively.

You can register existing enterprise users by using:

- Enterprise Manager Console
- Enterprise Manager Command Line Interface (EM CLI)

Registering Enterprise Users Using the Enterprise Manager Console

You can use the Enterprise Manager console to register enterprise users by following these steps:

1. Log in to Enterprise Manager as a Super Administrator.
2. From the **Setup** menu, select **Security** then select **Administrators** to display the Administrators page. Since Enterprise Manager has been configured to use Enterprise Users, the first page of the Create Administrator wizard will provide the option to create an administrator based on a registered Oracle Internet Directory user or a normal database user.
3. Select Oracle Internet Directory and click **Continue** to go to the next page in the wizard.
4. Enter the name and e-mail address of the Oracle Internet Directory user or click the flashlight icon to search for a user name in the Oracle Internet Directory.
5. Use the rest of the wizard pages to define the roles, system privileges, and other characteristics of the Enterprise Manager administrator and then click **Finish**. Enterprise Manager displays a summary page that lists the characteristics of the administrator account.
6. Click **Finish** to create the new Enterprise Manager administrator.

   The OID user is now included in the list of Enterprise Manager administrators. You can now verify the account by logging out of the Cloud Control console and logging back in using the OID user credentials on the Single Sign-On logon page.

Registering Enterprise Users Using the Command Line Interface

To register Enterprise Users as Enterprise Manager users using EM CLI, enter the following command:

```
emcli create_user -name=eususer -type=DB_EXTERNAL_USER
```

This command registers the `eususer` as an Enterprise Manager user where `eususer` is an existing Enterprise User.

Oracle Internet Directory (OID)

You can implement an OID-based authentication scheme to have Enterprise Manager authenticate users against the OID.

Running the *emctl config auth oid* command on the OMS creates a WebLogic authentication provider of type *OracleInternetDirectoryAuthenticator* that uses the configuration parameter values specified by the command. Any configuration values not specified retain the default values. Tuning and modification of advanced OID configuration parameters is carried out through the WebLogic Server Administration Console and not the *emctl config auth oid* command.

> **Note:**
>
> In the event you need to perform LDAP troubleshooting, enable LDAP tracing log file (ldap_trace.logATN) generation from the WebLogic Server Console. For more information, see"Troubleshooting Authentication Issues in Enterprise Manager" .

Prerequisites

Oracle Internet Directory LDAP server is set up and running.

WebLogic Administration Server is up and running.

1. Run the *emctl config auth oid* command on each OMS.

   ```
   emctl config auth ad -ldap_host <ldap host> -ldap_port <ldap port>
       -ldap_principal <ldap principal> [-ldap_credential <ldap credential>]
       -user_base_dn <user base DN> -group_base_dn <group base DN> [-user_dn <dn>] [-
   group_dn <dn>]
       [-enable_auto_provisioning] [-auto_provisioning_minimum_role <min_role>] [-
   minimum_privilege <min_priv>]
       [-use_ssl] [-cert_file <cert>] [-trust_cacerts] [-use_anonymous_bind] [-
   keystore_pwd keystone_password]
   ```

   where:

   - `ldap_host`: LDAP host name
   - `ldap_port`: LDAP port
   - `ldap_principal`: The distinguished name (DN) of the LDAP user the WebLogic server should use to connect to the LDAP server.
   - `ldap_credential`: Password for the user specified by *ldap_principal*.
   - `user_base_dn`: The base distinguished name (DN) of the tree in the LDAP directory that contains users.

- `group_base_dn` - The base distinguished name (DN) of the tree in the LDAP directory that contains groups.
- enable_auto_provisioning:If specified, turns on auto provisioning in Enterprise Manager, where external LDAP users do not have to be provisioned manually in Enterprise Manager
- auto_provisioning_minimum_role <min_role>: if specified, auto provisions only those external users in Enterprise Manager who have the min_role granted to them in LDAP
- minimum_privilege <min_priv>: If specified, prevents access to Enterprise Manager to users who do not have the min_priv granted to them.
- use_ssl: Use SSL to connect to the LDAP server
- cert_file <cert>: Use the passed in LDAP server certificate to establish trust while connecting to LDAP server over ssl. Specify this option if the LDAP server has certificate signed by not well-known (or trusted) Certificate Authority. Note: This expects a single certificate. We do not support importing certificate chains. Please import using keytool utility before running this command.
- trust_cacerts: Trust the LDAP server's certificate while connecting to LDAP server. This is typically used if certificate is signed by well known CA
- keystore_pwd <passwd>: The password for the default DemoTrust.jks keystore (if default password has changed) or any custom keystore to which the LDAP server's certificate will be imported as part of validation.
- use_anonymous_bind: If specified, uses anonymous bind to connect to LDAP server

Example:

```
emctl config auth oid -ldap_host "ldaphost" -ldap_port "3060" -ldap_principal
"cn=orcladmin,cn=users,dc=us,dc=oracle,dc=com" -user_base_dn
"cn=users,dc=us,dc=oracle,dc=com" -group_base_dn "cn=groups,dc=us,dc=oracle,dc=com" -
ldap_credential password
```

2. Stop the OMS.

```
emctl stop oms -all
```

3. Restart the OMS.

```
emctl start oms
```

> **Note:**
>
> For Enterprise Manager deployments consisting of multiple OMS instances, *emctl config auth oid* must be run on each OMS. Each OMS must be restarted in order for changes to take effect.

For more information, see How to authenticate Enterprise Manager Cloud Control with LDAP over SSL

Testing the OID Configuration

Use the WebLogic Server Administration Console (**Users and Groups** tab) to check whether the OID configuration has been successful. To navigate to this tab, select **Home**/**Summary of Security Realms**/*myrealm*/**Users and Groups**. From the **Users and Groups** tab, you should see users and groups showing up from the OID.

Microsoft Active Directory Based Authentication

You can implement Microsoft AD-based authentication scheme to have Enterprise Manager authenticate users against the Active Directory.

Running the `emctl config auth ad` command on the OMS creates a WebLogic authentication provider of type *ActiveDirectoryAuthenticator* that uses the configuration parameter values specified by the command. Any configuration values not specified retain the default values. Tuning and modification of advanced AD configuration parameters is carried out through the WebLogic Server Administration Console and not the `emctl config auth ad` command.

Before running the following procedure, ensure the Active Directory LDAP server is up and running.

1. Run the *emctl config auth oid* command on each OMS.

   ```
   emctl config auth ad -ldap_host <ldap host> -ldap_port <ldap port>    -
   ldap_principal <ldap principal> [-ldap_credential <ldap credential>] -user_base_dn
   <user base DN> -group_base_dn <group base DN>
   ```

   where:

   - `ldap_host`: Name of the machine name where Active Directory has been installed.
   - `ldap_port`: Active port where Active Directory is listening for requests.
   - `ldap_principal`: The distinguished name (DN) of the Active Directory user the WebLogic server should use to connect to the LDAP server to ensure the user's validity.
   - `ldap_credential`: Password for the user specified by *ldap_principal*.
   - `user_base_dn`: The users specified as the ldap_principal must have read access to this directory. If the users are located in multiple base DNs, enter the highest, most common DN in this field. This field does not accept multiple entries.
   - `group_base_dn` - The users specified as the ldap_principal must have read access to this directory.

   Example:

   ```
   emctl config auth ad -ldap_host "ldaphost" -ldap_port "3060" -ldap_principal
   "cn=orcladmin" -user_base_dn "cn=users,dc=us,dc=oracle,dc=com" -group_base_dn
   "cn=groups,dc=us,dc=oracle,dc=com" -ldap_credential "my_ldap_password"
   ```

2. Stop the OMS.

   ```
   emctl stop oms -all
   ```

3. Restart the OMS.

   ```
   emctl start oms
   ```

> **Note:**
>
> For Enterprise Manager deployments consisting of multiple OMS instances, *emctl config auth ad* must be run on each OMS. Each OMS must be restarted in order for changes to take effect.

Testing the Microsoft Active Directory Configuration

Use the WebLogic Server Administration Console (**Users and Groups** tab) to check whether the Microsoft Active Directory configuration has been successful. To navigate to this tab, select **Home**/**Summary of Security Realms**/*myrealm*/**Users and Groups**. From the **Users and Groups** tab, you should see users and groups showing up from the Microsoft Active Directory.

External Authorization using External Roles

When configuring Enterprise Manager for external authentication of users, you can also configure it to work with the external authentication provider to manage authorization as well. This is done using external roles. This is useful in many scenarios including, but not limited to, auto-provisioned users where the auto-provisioned user will not have any Enterprise Manager roles granted to them. The idea behind external roles is to create a role in Enterprise Manager with the relevant privileges and have the name of the role match the name of a LDAP group. Users who are part of the LDAP group will automatically be granted privileges in the role once they log on to Enterprise Manager.

To set up external roles, create a role in Enterprise Manager and mark it as external. The name of this role should be the same as an external LDAP group. Set up this role with the necessarily roles and privileges. For example, in Enterprise Manager you can create a role called EM_ADMIN that is marked external. The EM_ADMIN name matches an LDAP group called EM_ADMIN. Assume JohnDoe is a member of the EM_ADMIN LDAP group and is also an Enterprise Manager user. When JohnDoe logs on to Enterprise Manager, he will be granted all the privileges defined in the Enterprise Manager role EM_ADMIN.

Auto Provisioning

Typically the external LDAP users must be created in Enterprise Manager before they can log in to the Enterprise Manager console. Auto provisioning removes that requirement by automatically creating the Enterprise Manager user account upon successful authentication of the user the first time he logs on to Enterprise Manager.

To enable auto provisioning, set the OMS property *oracle.sysman.core.security.auth.autoprovisioning* to *true*.

This parameter can be set using emctl or the console.

This allows the external users to login without being first created as an Enterprise Manager user in the Enterprise Manager repository. Their user account gets created automatically upon the first login. Once this property is set, all external LDAP users will be able to login to Enterprise Manager console. If you want to further restrict the auto provisioning feature to a subset of users, such as only to members of certain LDAP groups, then set another OMS property "oracle.sysman.core.security.auth.autoprovisioning_minimum_role". This property should be set to the LDAP group name whose members should be auto-provisioned For example, if set to "EM_ADMIN", only members of that LDAP group called EM_ADMIN will be able to login to Enterprise Manager and have user accounts automatically created in Enterprise Manager.

Using a Different Name to the External Users Display Name

By default, you must log in to Oracle Enterprise Manager with the user name that is displayed in the Weblogic Console >Security Realms >myrealms >Users and Groups >Users list. After authenticating Oracle Enterprise Manager with external providers, the `cn` values of the external users are listed in Weblogic Console Users list.

In some environments, the cn value is in the form 'FIRST NAME LAST NAME'. If you prefer to use the sAMAccountName or user ID (UID) to login to Oracle Enterprise Manager you must update the provider configurations.

For example, there is a user with the user name 'TEST USER' displayed in the Weblogic Console, but the user wants to login to Oracle Enterprise Manager as 'tuser' which is the sAMAccountName of that user.

> **Note:**
>
> The sAMAccountName is used in this example. To use a UID, replace sAMAccountName with uid in the steps that follow.

1. In the external provider, check the parameter/properties configured for the external user.
2. The value of parameter 'cn' is 'TEST USER'.
3. In the same file, find the parameter that has the value for user as 'tuser' . That parameter may be 'sAMAccountName'.

To use the sAMAccountName of the external users (tuser) to log in to Oracle Enterprise Manager:

1. Back up the `<GCDOMAIN>/config/config.xml` file.
2. On the Weblogic Console, navigate to Security Realms>myrealms>Providers>*External Authenticator*.
3. Click **Lock and Edit** to edit this page.
4. Click the Provider Specific tab.
5. Look for the **User From Name** filter.
6. Change the value of User From Name from `(&(cn=%u)(objectclass=person))` to `(&(sAMAccountName=%u)(objectclass=person))`.
7. Look for **User Name Attribute**.
8. Change the value of **User Name Attribute** from cn to sAMAccountName.
9. Click **Save** then click **Activate Changes**.
10. Restart Oracle Management Server with the `-all` option:

    ```
    <OMS_HOME>/bin>./emctl stop oms -all -force

    <OMS_HOME>/bin>./emctl start oms
    ```

11. Log in to the Weblogic Console >Security Realms >myrealms >Users and Groups >Users list and confirm that the user 'tuser' exist in Users list. Now you can user the user name 'tuser' to log in to Oracle Enterprise Manager.

Updating the Oracle Virtual Directory with User Name Changes

With Oracle Enterprise Manager release 12.1.0.4 and higher, you must perform the following additional steps to update the user name changes in the Oracle Virtual Directory layer:

1. Backup the `<MW_HOME>/oracle_common/common/bin/wlst.sh and <GCDomain>/config/fmwconfig/ovd/default/adapter.os_xml` file.

2. Open the <MW_HOME>/oracle_common/common/bin/wlst.sh file in a text editor and add the following parameter to WLST_PROPERTIES:

```
-Dweblogic.ssl.JSSEEnabled=true -Djavax.net.ssl.keyStore=<MW HOME>/wlserver_10.3/
server/lib/DemoIdentity.jks
-Djavax.net.ssl.keyStorePassword=DemoIdentityKeyStorePassPhrase
-Djavax.net.ssl.trustStore=<MW HOME>/wlserver_10.3/server/lib/DemoTrust.jks
-Djavax.net.ssl.trustStorePassword=DemoTrustKeyStorePassPhrase
-Dweblogic.security.SSL.trustedCAKeyStore=<MW HOME>/wlserver_10.3/server/lib/
DemoTrust.jks
-Dweblogic.security.SSL.ignoreHostnameVerification=true
```

   For example:

```
WLST_PROPERTIES="-Dweblogic.ssl.JSSEEnabled=true
-Djavax.net.ssl.keyStore=/u01/mwr/wlserver_10.3/server/lib/DemoIdentity.jks
-Djavax.net.ssl.keyStorePassword=DemoIdentityKeyStorePassPhrase
-Djavax.net.ssl.trustStore=/u01/mwr/wlserver_10.3/server/lib/DemoTrust.jks
-Djavax.net.ssl.trustStorePassword=DemoTrustKeyStorePassPhrase
-Dweblogic.security.SSL.trustedCAKeyStore=/u01/mwr/wlserver_10.3/server/lib/
DemoTrust.jks
-Dweblogic.security.SSL.ignoreHostnameVerification=true ${WLST_PROPERTIES}
-DORACLE_HOME='${ORACLE_HOME}' -DCOMMON_COMPONENTS_HOME='${COMMON_COMPONENTS_HOME}'"
export WLST_PROPERTIES
```

> **Note:**
>
> If third party or custom certificates are imported to WebLogic Server, you must replace the path in the preceding example with the respective keystores.The custom path is available in the config.xml file.

3. Launch <MW_HOME>/oracle_common/common/bin/wlst.sh..
4. Enter the following command to connect to the admin server:

```
connect('weblogic','<weblogic password>','t3s://<ADMIN SERVER HOSTNAME>:<ADMIN
SERVER PORT>')
```

   For example:

```
connect('weblogic','<weblogic password>','t3s://test01.example.com:7102')
```

5. Enter the following command:

```
$addPlugin(adapterName='ADAPTER_NAME',pluginName='changerdn',pluginClass='oracle.ods.
virtualization.engine.chain.plugins.changeuserrdn.ChangeUserRDN',paramKeys='replaceVa
lue|fromRDN|toRDN',paramValues='true|cn|sAMAccountName')
```

> **Note:**
>
> The name of the LDAP provider on the admin server console must be specified for adapterName parameter in the preceding command.

6. Enter the following command to stop the OMS:

```
<OMS HOME>/bin/emctl stop oms -all -force
```

7. Ensure no process is running from OMS path.

8. Enter the following commands to start the admin server and the OMS:

```
<OMS HOME>/bin/emctl start oms -admin_only
```

Mapping LDAP User Attributes to Enterprise Manager User Attributes

When external authentication is enabled, a flashlight icon appears next to the name field in the *Create User* flow.

> **Note:**
>
> External authentication is enabled when an administrator is first created in Enterprise Manager.

Clicking on the flashlight displays a popup window, giving Enterprise Manager administrators the ability to search for enterprise users in the external LDAP server (for example AD/OID) that have been configured. The user's LDAP attributes are shown as well. This helps the Enterprise Manager administrator to verify external user's attributes before creating them in Enterprise Manager.

When external authentication has been configured, it is often desirable to automatically propagate user information such as email address, department, that is defined for the user in LDAP to the corresponding Enterprise Manager user account. This can be done by setting the OMS property oracle.sysman.core.security.auth.ldapuserattributes_emuserattributes_mappings. This property will contain the mapping between the Enterprise Manager user properties and the corresponding LDAP user attributes that will be used to populate the user properties. The mapping between an Enterprise Manager property and an LDAP attribute is expressed in the format <key>={%attribute%}where:

- **key** - An Enterprise Manager user property. Values for user properties are:

  USERNAME

  EMAIL

  CONTACT

  LOCATION

  DEPARTMENT

  COSTCENTER

  LINEOFBUSINESS

  DESCRIPTION

  Any other values specified for keys will be ignored.

- **attribute** - A user attribute that needs to be fetched from LDAP and is used to set the properties of the user in Enterprise Manager. The attribute should be specified using the following format `{%attribute%}`, for example `{%mail%}`

  The value between % should be a valid attribute in the LDAP server. You can also specify literal strings when specifying attribute values, for example:

  ```
  DESCRIPTION={%firstname% %lastname% employee}
  ```

  In this example, only *firstname* and *lastname* will be fetched from LDAP but the description for the user will be "firstname lastname employee". For example, "John Doe employee".

Another example is `CONTACT={telephone number %phone%}`. If a comma needs to be specified in the literal string value, it needs to be escaped with "\" For example,

```
DESCRIPTION={%lastname% \, %firstname% \, %phone%}
```

This will result in a user with description "Doe, John, 212-454-0000". The other characters that need to be escaped with backslash (\), if specified in the literal string, are ':' and '=', so they should be entered as `\:` or `\=`.

The OMS property *oracle.sysman.core.security.auth.ldapuserattributes_emuserattributes_mappings* should thus be set to a set of comma separated key-attribute pairs.

As an example, let us assume user JOHNDOE exists in LDAP and has the following attributes:

```
uid=johndoe,mail=johndoe@example.com,description=EM LDAP
Admin,postalcode=90210,department=EnterpriseAdmin,telephone=2124540000,displayname=JohnDo
e
```

If you set OMS property:

```
oracle.sysman.core.security.auth.ldapuserattributes_emuserattributes_mappings to
"USERNAME={%uid%},EMAIL={%mail%},CONTACT={%telephone%},DEPARTMENT={%department%},DESCRIPT
ION={%description%},LOCATION={%postalcode%}"
```

then when you select the user from the popup window and hit Ok, the user's attributes are automatically populated in the appropriate fields of the 'Create User' page.

Changing User Display Names in Enterprise Manager

In some LDAP environments, users may have numeric login IDs. Enterprise Manager has the ability to display user-friendly username in when a user logs in using a numeric ID. When they log on to the Enterprise Manager console, the numeric ID is displayed and used everywhere the user's name is shown including audit records. In order to show a more user-friendly name, you can use the OMS property oracle.sysman.core.security.auth.enable_username_mapping to enable the mapping of a an external, more intuitive name than the name shown in Enterprise Manager. You can use emctl to change this property.

```
emctl set property -name "oracle.sysman.core.security.auth.enable_username_mapping" -
value "true"
```

You can also set this using the Enterprise Manager console as well. These are dynamic properties and do not require bouncing the Management Service.

Once enabled, an External User ID field will be added that will contain the name or ID used by the user to log on to Enterprise Manager (this name/ID exists as a valid user in LDAP). The Create Administrator page appears.

For example, if external user 123456 wants to log in and johndoe needs to be shown as logged in user, specify 'johndoe' in the Name field.

User 123456 will still log in as that ID as that user exists in the LDAP server as 123456 but the name 'johndoe' will be shown as his user name in the Enterprise Manager console.

The OMS property *oracle.sysman.core.security.auth.ldapuserattributes_emuserattributes_mappings* can also be used in this environment to automatically populate the user's name and external ID. An extra field called EXTERNALUSERID needs to be set. Using the example above, set the OMS property to the following:

```
"USERNAME={%displayname%},EXTERNALUSERID={%uid%},EMAIL={%mail%},CONTACT="{%telephone%},DE
PARTMENT={%department%},DESCRIPTION={%description%},LOCATION={%postalcode%}"
```

The features described above are available in EM CLI as well. With the OMS properties set, the EM CLI *create_user verb* can be used to create users with their LDAP attributes automatically populated.

Configuring Other LDAP/SSO Providers

Oracle Enterprise Manager currently offers native support for Oracle Internet Directory, Oracle Access Manager, Active Directory and Single Sign-On. Native support allows WebLogic Server and Enterprise Manager to be configured for external authentication using the EMCTL command. For more information on configuring Enterprise with Oracle Internet Directory, see"Oracle Internet Directory (OID)", with Active Directory see "Microsoft Active Directory Based Authentication".

LDAP providers need to be marked 'SUFFICIENT' and should be ahead of the Enterprise Manager Repository authenticator in the list of providers.

For SSO providers, please refer to the requirements of the specific SSO provider configuration. Along with configuring the appropriate authentication providers, certain OMS properties have to be set as well in order for Enterprise Manager to work.

For configuring Enterprise Manager with any other type of LDAP server, the following OMS properties need to be set. You can use emctl or the console to set these properties. The properties need to be set for each OMS.

```
emctl set property -name
"oracle.sysman.core.security.auth.is_external_authentication_enabled" -value
"true"
```

- oracle.sysman.core.security.auth.is_external_authentication_enabled=true.
- oracle.sysman.emSDK.sec.DirectoryAuthenticationType to LDAP

For configuring Enterprise Manager with any other type of SSO solution, along with configuring the weblogic authentication/identity assertion providers, the following OMS properties need to be set.

- oracle.sysman.core.security.auth.is_external_authentication_enabled=true
- oracle.sysman.core.security.sso.type=OTHERSSO
- oracle.sysman.core.security.sso.logout_url=<whatever value was provided for configuring logout on SSO server>
- oracle.sysman.emSDK.sec.DirectoryAuthenticationType=SSO

Configuring Single Sign-on based Authentication

This section covers the following topics:

- Configuring Single-Sign-on with Oracle Access Manager 10g
- Configuring Single-Sign-on with Oracle AS SSO 10g

Configuring Single-Sign-on with Oracle Access Manager 10g

When using an Oracle Access Manager Single Sign-On authentication scheme, the underlying identity stores will consist of Enterprise Directory Identity Stores supported by Oracle Access

Manager. This section provides instructions on how to configure OAM SSO-based authentication schemes.

Prerequisites

Oracle Access Manager is installed.

The Oracle Access Manager Single Sign-On server is configured with Oracle HTTP server, Web Gate, and the Oracle Access Manager Identity Store.

1. Run the *emctl config auth* command. This command needs to be executed on all OMSs (Primary and all additional ones).

   ```
   emctl config auth oam -oid_host <host> -oid_port <port>
   -oid_principal <principal> [-oid_credential <credential>]
   -user_base_dn <dn> -group_base_dn <dn>
   -oam_host <host> -oam_port <port> [-logout_url <url>] [-is_oam10g] [-user_dn <dn>] [-
   group_dn <dn>]
   ```

   Note: Use the `-is_oam10g` option only if the OAM version is 10g.

2. Stop each OMS.

   ```
   emctl stop oms -all
   ```

3. Restart each OMS.

   ```
   emctl start oms
   ```

Configuring Single-Sign-on with Oracle AS SSO 10g

If you are currently using Oracle Application Server Single Sign-On to control access and authorization for your enterprise, you can extend those capabilities to the Enterprise Manager console.

By default, Enterprise Manager displays the main logon page. However, you can configure Enterprise Manager so it uses Oracle Application Server Single Sign-On to authenticate your Enterprise Manager users. Instead of seeing the Enterprise Manager logon page, users will see the standard Oracle Application Server Single Sign-On logon page. From the logon page, administrators can use their Oracle Application Server Single Sign-On credentials to access the Oracle Enterprise Manager 13c Cloud Control console.

> **Note:**
>
> - You can configure Enterprise Manager to use one of the default Oracle Application Server Single Sign-On or Enterprise User Security features, but not both.
> - When Enterprise Manager is configured to use Single Sign-On with Server Load Balancer (SLB), make sure that the correct monitoring settings have been defined.

Partner applications are applications that are designed to delegate authentication to the OracleAS Single Sign-On server. The following sections describe how to configure Enterprise Manager as an OracleAS Single Sign-On Partner Application:

- Registering Enterprise Manager as a Partner Application

- Removing Single Sign-On Configuration
- Registering Single Sign-On Users as Enterprise Manager Administrators
- Registering Single Sign-On Users Using EM CLI
- Bypassing the Single Sign-On Logon Page
- Restoring the Default Authentication Method

Registering Enterprise Manager as a Partner Application

To register Enterprise Manager as a partner application manually, follow these steps:

1. Stop all OMSs by running `emctl stop oms` on each OMS.
2. Enter the following URL to navigate to the SSO Administration page.

   ```
   https://sso_host:sso_port/pls/orasso
   ```

3. Log in as `orcladmin` user and click on **SSO Server Administration**.
4. Click **Administer Partner Applications** and then click **Add Partner Application**.
5. Enter the following information on the Add Partner Application page.

   ```
   Name: <EMPartnerName>
   Home URL: protocol://em_host:em_port
   Success URL: protocol://em_host:em_port/osso_login_success
   Logout URL: protocol://em_host:em_port/osso_logout_success
   Administrator Email: user@example.com
   ```

   Note1: `host`, `port`, and `protocol` refer to the Enterprise Manager host, port and the protocol (http or https) used.

   Note2: The `em_host`, `em_port`, `email` and Enterprise Manager Partner Name must be replaced with the appropriate values and not typed as shown in this example.

6. Go back to Administer Partner Applications page and click on the **Edit** icon for <EMPartnerName>.

   Record the values of ID, Token, Encryption Key, Login URL, Single Sign-Off URL, Home URL and write the following in a file osso.txt:

   ```
   sso_server_version= v1.2
   cipher_key=<value of EncryptionKey>
   site_id=<value of ID>
   site_token=<value of Token>
   login_url=<value of Login URL>
   logout_url=<value of Single Sign-Off URL>
   cancel_url=<value of Home URL>
   sso_timeout_cookie_name=SSO_ID_TIMEOUT
   sso_timeout_cookie_key=9E231B3C1A3A808A
   ```

7. Set the ORACLE_HOME environment variable to WebTier Oracle Home location.

   ```
   setenv ORACLE_HOME /scratch/13c/MWHome/Oracle_WT
   ```

   Then, run the following:

   ```
   $ORACLE_HOME/ohs/bin/iasobf <location of osso.txt> <location of osso.conf>
   ```

8. Run the following command on each OMS:

   ```
   emctl config auth sso -ossoconf <osso.conf file loc> -dasurl <DAS URL> [-unsecure] [-
   domain <domain>]-ldap_host <ldap host> -ldap_port <ldap port> -ldap_principal <ldap
   principal> [-ldap_credential <ldap credential>] -user_base_dn <user base DN> -
   group_base_dn <group base DN> [-logout_url <sso logout url>]
   ```

where ldap_host, ldap_port, ldap_principal and ldap_credential are the details of SSO's LDAP.

The sample output for this command is shown below:

```
Oracle Enterprise Manager Cloud Control 13c Release 12.1.0.3.0
Copyright (c) 1996, 2013 Oracle Corporation.  All rights reserved.
SSO Configuration done successfully. Please restart Admin & Managed Servers.
```

9. Run the following commands on each OMS:

```
emctl stop oms -all
emctl start oms
```

Removing Single Sign-On Configuration

To remove the single sign-on configuration, perform the following:

1. Run the following command on each OMS:

```
emctl config auth repos
```

Sample command output:

```
Oracle Enterprise Manager Cloud Control 13c Release 5
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
Configuring Repos Authentication ... Started
Configuring Repos Authentication ... Successful
```

If you have updated files such as, for example, `httpd.conf` (when installing WebGate) or any other required files should be backed up prior in order to rolled back during this step.If you are using multi-OMS environment, you must execute emctl config auth repos on the remaining servers.

2. Bounce all OMSs by issuing the following on each OMS:

```
emctl stop oms -all
emctl start oms
```

Registering Single Sign-On Users as Enterprise Manager Administrators

After you have configured Enterprise Manager to use the Single Sign-On logon page, you can register any Single Sign-On user as an Enterprise Manager administrator. You can register single sign-on users using:

- Enterprise Manager Graphical User Interface
- Enterprise Manager Command Line Interface

Registering Single Sign-On Users Using the Graphical User Interface

You can use the graphical user interface to register single sign-on users by following these steps:

1. Go the Enterprise Manager Console URL.

   The browser is redirected to the standard Single Sign-On Logon page.

2. Enter the credentials for a valid Single Sign-On user. Note: This step requires that an SSO user is already registered with Enterprise Manager.

   If no SSO user is yet registered as Enterprise Manager user, you can create them using the following procedure:

1. Navigate to Enterprise Manager by connecting to the OMS directly. For example, *https://oms_host:oms_https_port/em*.
2. Log in as a Repository user.
3. From the **Setup** menu, select **Security** then select **Administrator**
4. Create SSO users.

3. Log in to Enterprise Manager as a Super Administrator.
4. From the **Setup** menu, select **Security**, then select **Administrators** to display the Administrators page.

   Because Enterprise Manager has been configured to use Single Sign-On, the first page in the Create Administrator wizard now offers you the option of creating an administrator either as an External User or as Repository User.
5. Select **External User Identity Store** and advance to the next page in the wizard.
6. Enter the name and e-mail address of the External User Identity Store user, or click the flashlight icon to search for a user name in the Oracle Internet Directory.
7. Use the rest of the wizard pages to define the roles, system privileges, and other characteristics of the Enterprise Manager administrator and then click **Finish**.

   Enterprise Manager displays a summary page that lists the characteristics of the administrator account.
8. Click **Finish** to create the new Enterprise Manager administrator.

   The External User Identity Store user is now included in the list of Enterprise Manager administrators. You can now verify the account by logging out of the Cloud Control console and logging back in using the External User Identity Store user credentials on the Single Sign-On logon page.

Registering Single Sign-On Users Using EM CLI

You can use the following EM CLI command to create Single Sign-On users:

```
emcli create_user -name=ssouser -type=EXTERNAL_USER
```

This command creates a user with the name **ssouser** who is authenticated against the single sign-on user.

Argument	Description
-name	Name of the administrator.
-type	The type of user. The default value for this parameter is EM_USER. The other possible values are: • EXTERNAL_USER: Used for single-sign-on based authentication. • DB_EXTERNAL_USER: Used for enterprise user based security authentication.
-password	The password for the newly created administrator.
-roles	The list of roles that can be granted to this administrator.
-email	The list of email addresses for this administrator.
-privilege	The system privileges that can be granted to the administrator. This option can be specified more than once.
-profile	The name of the database profile. This is an optional parameter. The default profile used is DEFAULT.
-desc	The description of the user being added.

Argument	Description
-expired	This parameter is used to set the password to "expired" status. This is an optional parameter and is set to False by default.
-prevent_change_password	When this parameter is set to True, the user cannot change the password. This is an optional parameter and is set to False by default.
-input_file	This parameter allows the administrator to provide the values for any of these arguments in an input file. The format of value is `name_of_argument:file_path_with_file_name`.

Example 1

```
emcli create_user
        -name="new_admin"
        -email="john.doe@example.com;jane.doe@example.com"
        -roles="public"
        -privilege="view_job;923470234ABCDFE23018494753091111"
        -privilege="view_target;<host>.com:host"
```

This example creates an Enterprise Manager administrator named new_admin. This administrator has two privileges: the ability to view the job with ID `923470234ABCDFE23018494753091111` and the ability to view the target `<host>.com:host`. The administrator `new_admin` is granted the PUBLIC role.

Example 2

```
emcli create_user
      -name="User1"
      -type="EXTERNAL_USER"
      -input_file="privilege:/home/user1/priv_file"

      Contents of priv_file are:
        view_target;<host>.com:host
```

This example makes `user1` which has been created externally as an Enterprise Manager user. `user1` will have view privileges on `<host>.com:host`.

Example 3

```
emcli create_user
      -name="User1"
      -desc="This is temp hire."
      -prevent_change_password="true"
      -profile="MGMT_ADMIN_USER_PROFILE"
```

This example sets `user1` as an Enterprise Manager user with some description. The `prevent_change_password` is set to true to indicate that the password cannot be changed by `user1` and the `profile` is set to `MGMT_ADMIN_USER_PROFILE`.

Example 4

```
emcli create_user
      -name="User1"
      -desc="This is temp hire."
      -expire="true"
```

This example sets `user1` as an Enterprise Manager with some description. Since the password is set to expire immediately, when the user logs in for the first time, he is prompted to change the password.

Bypassing the Single Sign-On Logon Page

If the OMS is configured with SSO or OAM or some other authentication method, you may want to by-pass the Single Sign-On or OAM authentication under certain circumstances. To bypass the SSO logon page, connect to the following URL:

1. Connect to `https://ms_host:ms_https_port/em`

   `ms_host` & `ms_https_port` are WLS-managed server's hostname and port. These parameters can be found in the <EM_INSTANCE_HOME>/emgc.properties file. They are listed as EM_INSTANCE_HOST & MS_HTTPS_PORT in this file.

2. Log in using a repository user's credentials.

Restoring the Default Authentication Method

1. Run the following command on each OMS:

   ```
   emctl config auth repos
   ```

   Sample command output:

   ```
   Oracle Enterprise Manager Cloud Control 13c Release 5
   Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
   Configuring Repos Authentication ... Started
   Configuring Repos Authentication ... Successful
   If you have updated files like httpd.conf (for example, while installing WebGate),
   rollback them.
   If this is a multi-OMS environment, execute this command on remaining servers.
   After that, restart OMS(s) using: 'emctl stop oms -all' and 'emctl start oms'
   ```

2. Run the following commands on each OMS:

   ```
   emctl stop oms -all
   emctl start oms
   ```

Configuring Enterprise User Security based Authentication

For instructions on configuring Enterprise Manager for use with Enterprise User Security, see "Enterprise User Security Based Authentication".

Restoring to the Default Authentication Method

The following sections provide instructions on restoring the default authentication method used by Enterprise Manager.

Bypassing the Single Sign-On Logon Page

If the OMS is configured with SSO or OAM or some other authentication method, you may want to by-pass the Single Sign-On or OAM authentication under certain circumstances.To bypass the SSO logon page, connect to the following URL:

1. Connect to `https://ms_host:ms_https_port/em`

ms_host & ms_https_port are WLS-managed server's hostname & port#. These parameters can be found in the EM_INSTANCE_HOME/emgc.properties file. They are listed as EM_INSTANCE_HOST & MS_HTTPS_PORT in this file.

2. Log in using a repository user's credentials.

Restoring the Default Authentication Method

1. Run the following command on each OMS:

```
emctl config auth repos
```

Sample command output:

```
Oracle Enterprise Manager Cloud Control 13c Release 5
Copyright (c) 1996, 2021 Oracle Corporation.  All rights reserved.
Configuring Repos Authentication ... Started
Configuring Repos Authentication ... Successful
If you have updated files like httpd.conf (for example, while installing WebGate),
rollback them.
If this is a multi-OMS environment, execute this command on remaining servers.
After that, restart OMS(s) using: 'emctl stop oms -all' and 'emctl start oms'
```

2. Run the following commands on each OMS:

```
emctl stop oms -all
emctl start oms
```

Configuring Privileges and Role Authorization

Giving the same level of access to all targets to all administrators is dangerous. Also, individually granting access to tens, hundreds, or even thousands of targets to every new member of the group is time consuming. With Enterprise Manager's administrator privileges and roles feature, these tasks can be streamlined and can easily scale as the enterprise grows. Authorization controls the access to the secure resources managed by Enterprise Manager via system, target, and object level privileges and roles. This section describes Enterprise Manager's Authorization model including roles and privileges assigned to each user class.

> **Note:**
>
> An administrator without any privileges or assigned targets should not be able to see monitored targets from within Enterprise Manager. When logging in to Enterprise Manager as a new administrator without any roles or privileges assigned, all targets will be displayed (security issue) unless the EXEMPT ACCESS POLICY privilege is revoked for the Enterprise Manager Super Administrator SYSMAN.
>
> The system privilege EXEMPT ACCESS POLICY allows a user to be exempted from all fine-grained access control policies on any SELECT or DML operation (INSERT, UPDATE, and DELETE). This provides ease of use for administrative activities such as installation and import and export of the database through a non-SYS schema.
>
> Also, regardless of the utility or application that is being used, if a user is granted the EXEMPT ACCESS POLICY privilege, then the user is exempt from VPD and Oracle Label Security policy enforcement. That is, the user will not have any VPD or Oracle Label Security policies applied to their data access.
>
> **To resolve the issue**:
>
> Connect to the Enterprise Manager Repository database as SYS or SYSTEM user and execute the following SQL statement:
>
> ```
> SQL> revoke EXEMPT ACCESS POLICY from sysman;
> ```

Understanding Users, Privileges, and Roles

When an Enterprise Manager administrator adds a user to the system, the primary consideration must be what does this person need to do in order to perform his job? Once the job for this new user is defined and understood, appropriate privileges must be assigned to this user and access granted to the required systems required to complete the job.

Privileges are ultimately granted to administrators to enable them to manage targets in Enterprise Manager. While you can grant specific privileges to individual administrators, tracking and granting privileges on many targets across many administrators easily becomes error-prone and an administrative burden in itself. Our recommendation is to define and use roles to manage the granting of privileges to administrators.

A role is a user-defined set of privileges typically containing the set of privileges that you want to grant to a team of users. A role can contain other roles as well. For example, you can create a First Line Support role containing the privileges needed for the administrators to view and manage incidents on targets. Once this role is created, you can grant this role to the appropriate administrators who will manage these incidents as part of their job responsibility. If you need to change the set of privileges for your administrators, e.g. add new privileges or remove privileges, then all you need to do is update the role. The updated set of privileges in the role is automatically enabled for the administrators to whom the role has been granted. Likewise if new administrators are added, all you need to do is grant them the appropriate role(s) instead of granting them individual privileges. See "Classes of Users" for more information.

Using roles is one big step towards managing privileges. However, there is still the challenge of having to keep the role updated with privileges on new targets as they are added to Enterprise Manager.

Classes of Users

Oracle Enterprise Manager supports different classes of Oracle users, depending upon the environment you are managing and the context in which you are using Oracle Enterprise Manager.

The Enterprise Manager administrators you create and manage in the Enterprise Manager console are granted privileges and roles to log in to the Enterprise Manager console and to manage specific target types and to perform specific management tasks. The default super administrator for the Enterprise Manager console is the SYSMAN user, which is a database user associated with the Oracle Management Repository. You define the password for the SYSMAN account during the Enterprise Manager installation procedure.

By restricting access to privileged users and providing tools to secure communications between Oracle Enterprise Manager 13c components, Enterprise Manager protects critical information in the Oracle Management Repository.

The Management Repository contains management data that Enterprise Manager uses to help you monitor the performance and availability of your entire enterprise. This data provides you with information about the types of hardware and software you have deployed, as well as the historical performance and specific characteristics of the applications, databases, applications servers, and other targets that you manage. The Management Repository also contains information about the Enterprise Manager administrators who have the privileges to access the management data.

You can create and manage multiple Enterprise Manager administrator accounts, or EM users, using the EM interface. Each administrator account includes its own login credentials, as well as a set of roles and privileges that are assigned to the account. There are three classes of users:

- **Super Administrator**: A powerful EM user with special access privileges to targets and other user accounts within the Enterprise Manager environment. The Super Administrator SYSMAN is created by default when Enterprise Manager is installed. A Super Administrator can:
  - Perform the initial setup of Enterprise Manager. For example, defining e-mail configurations and defining global notifications rules.
  - Create other administrators.
  - Add and view all targets discovered in Enterprise Manager.
  - Create Enterprise Manager privileges and roles.
  - View all jobs and reports in the system and edit only jobs or reports that it owns.
  - View its own Named Credentials (cannot view Named Credentials created by other EM users or the SYSMAN user). For more details on Named Credentials, see **Named Credentials**.
  - Manage jobs and deployment procedures that it owns (cannot manage jobs or deployment procedures created by other users).

  Note that secure privileges are not granted to Super Administrators by default, but they can be granted to a private role and that role can be granted to a Super Administrator. For more details, see Private Roles.
- **Administrator**: A regular Enterprise Manager administrator.
- **Repository Owner**: A database administrator for the Management Repository database. This account cannot be modified, duplicated, or deleted.

The types of management tasks that the administrator can perform and targets that he can access depends on the roles, system privileges, resource privileges, and target privileges that he is granted. The Super Administrator can choose to let certain administrators perform only certain management tasks, or access only certain targets, or perform certain management tasks on certain targets. In this way, the Super Administrator can assign the minimum level of privileges that administrators need to do their job.

Reassigning Objects

To reassign objects from one Enterprise Manager administrator to another in preparation for deleting an administrator:

1. Navigate to the Setup > Security > Administrators page.e.
2. Select the administrator to be deleted, then click **View** to see all objects currently owned by the selected administrator.
3. To reassign the objects to another administrator, enter the name of the new administrator in the New Owner text box, or click the flashlight icon to view a list of available administrators.
4. Choose the desired Administrator to whom the objects must be reassigned then complete the operation.

> **Note:**
>
> A super administrator can use the Delete Administrator page to specify what happens to administrator-owned objects when removing an administrator from Enterprise Manager. On this page, a super administrator can:
>
> - Delete all administrator-owned objects along with the Enterprise Manager administrator
> - Reassign objects to another Enterprise Manager administrator

> **Note:**
>
> Only a Super Administrator can delete other Enterprise Manager administrators. Enterprise Manager will not allow administrators to:
>
> - Delete themselves
> - Delete the Management Repository owner

Administrator object reassignments can be handled as follows:

- Blackouts can be reassigned to any user who has OPERATOR privileges on all targets affected by the blackout.
- Jobs can be reassigned to any administrator. However, ALL credentials associated with the job will be removed, leaving the job in a Suspended state. This requires the new job owner to explicitly set new credentials. Currently running jobs are allowed to continue running. After the new job owner sets the credentials, the job will revert to a SCHEDULED state.
- Corrective Actions can be reassigned to any administrator who has OPERATOR privileges for targets on which the corrective action can operate.

- Report Definitions can be reassigned to any administrator.
- Reports can be reassigned to any administrator.
- Monitoring Templates can be reassigned to any administrator.

Aggregate Target Privileges

An Aggregate Target type is a target that has one or more member targets, for example groups, systems, or Real Application Cluster. Aggregate target privileges allows an Administrator to grant different levels of privileges to the member targets and to the Aggregate target. For example, an Administrator may want to grant VIEW privilege on the aggregate group level and FULL to each member target within the group. If the administrator does not grant specific privileges on the aggregate and its members, the default is the same privilege for the aggregate and it members.

For example, you can grant VIEW privilege at a group (Aggregate level) and FULL at the member target level. This allows a DBA granted FULL on a member target to perform full life cycle tasks including delete of the target. The DBA has VIEW privilege on the group, preventing him from deleting the group.

You can view/modify these privilege settings when creating or editing an Enterprise Manager administrator. From the **Setup** menu, select **Security**, and then select **Administrators**. Navigate to the Target Privilege page.

At the bottom of the Target Privileges page, you will find the Target Privileges region.

Check the **Advanced Privilege Settings** option to view settings for the aggregate target types that have been added to the user.

Two additional columns are displayed:

- Manage Aggregate Only Privilege Grants
- Manage Member Only Privilege Grants

Click the **Edit** (pencil) icon to change the privilege grant properties.

Privileges and Roles

Granting users specific privileges provide a basic level of security in Enterprise Manager. They are designed to control access to data and limit the management operations you can perform in Enterprise Manager such as changing monitoring settings or patching targets.

When Enterprise Manager is installed, the SYSMAN user (Super Administrator) is created by default. The SYSMAN Super Administrator can then create other administrator accounts for daily administration work. The SYSMAN account should only be used to perform infrequent system-wide, global configuration tasks.

The Super Administrator should grant the minimum level of privileges required to allow administrators to perform their tasks within Enterprise Manager. For example, the Super Administrator can allow some administrators to view any target and to add any target in the enterprise and other administrators to only perform specific operations such as maintaining and cloning on a target for which they are responsible.

Administrators and Database Privileges

Having DBA privileges on a database allows users to delete other database users, drop tables and perform other administrative operations. Hence, having DBA privileges on a repository database allows an administrator to perform all operations that can be performed as an

Enterprise Manager Super Administrator: The administrator is implicitly treated as a Super Administrator. This is similar to OS authentication supported by the database where OS users with "DBA" privileges can connect to the Oracle server and exercise SYSDBA privileges.

If this level of access is not the intended behavior, Oracle recommends using one of the following:

- The Enterprise Manager repository database needs to be considered as a special database. Do not grant DBA privileges to any users on that database other than to users who have Super Administrator privileges in Enterprise Manager.
- Set up external authentication and migrate Enterprise Manager users to Active Directory or LDAP. This ensures that there are no *shadow* database users for Enterprise Manager application users being created and so DBA privileges cannot be granted to Enterprise Manager users.

> **Note:**
>
> Enterprise Manager administrators should not be given DBA privileges.
>
> In situations where an Enterprise Manager Super Administrator has DBA privileges, SYSMAN will NOT be able to convert that user into a regular (non-Super Administrator) administrator until DBA privileges have are removed.

Granting Privileges

A privilege is a right to perform management actions within Enterprise Manager. Privileges can be divided into two categories:

- Target Privileges
- Resource Privileges

Target Privileges: These privileges allow an administrator to perform operations on a target. As such, there is a defined hierarchy the categorizes target privileges into the following levels:

- FULL: Highest level that includes OPERATOR and VIEW
- OPERATOR: Medium level that permits specific management actions. OPERATOR privilege is also an example of a privilege that can include other privileges. For example, OPERATOR privileges include blackout privileges, and any user granted an OPERATOR target privilege is automatically granted the Blackout Target privilege. See Table C-2 for more information.
- VIEW: Lowest level permitting only view access to targets.

There are two categories of target privileges:

- Privileges applicable to all targets. These privileges allow administrators to perform operations on all components with the Enterprise Manager infrastructure.
- Privileges applicable to a specific target instance. These privileges allow Administrators to perform operations on specific targets in the Enterprise Manager infrastructure.

The Target Privileges page shows a list of privileges granted to all targets. For a detailed list of target privileges, see Privileges..

Resource Privileges: These privileges grant administrator access to a specific functionality within Enterprise Manager. Examples of resource privileges include Backup Configurations,

Cloud Policy, Compliance Framework, Enterprise Manager Plug-in, Job System, Patch Plan, Self Update and Template Collection. For a complete list refer to the Privileges and Roles section of Oracle Enterprise Manager Cloud Control Security Guide.

For example, to grant an administrator the ability to create new named credentials:

1. From the **Setup** menu, select **Security** and then **Administrators**. The *Administrators* page displays.
2. Either edit and existing administrator or create a new administrator to access the *Administrator* wizard.
3. Proceed to the **Resource Privileges** page.
4. From the *Resource Type* column, scroll down to **Named Credential**.
5. From the *Manage Privilege Grants* column, click on the corresponding pencil icon. The *Resource Type Privileges* page displays.
6. Select the privilege **Create new named credential** and click **Continue** to proceed with the administrator creation/edit processes

Fine-grained Access Control

Enterprise Manager implements granular privileges to control access to targets and other resources, enabling administrators to better segregate their duties. For example, consider the provisioning designer and provisioning operator job responsibilities. The former has greater responsibilities (creates components in the Software Library) than the latter (submits deployments). From the Security Console, you can view:

- The list of super administrators
- Administrators with highest number of direct privileges
- Target privileges
- Resource privileges
- The top five Administrators with the highest number of roles
- Roles with the highest number of nested roles

Creating Roles

A role is a collection of Enterprise Manager resource privileges, or target privileges, or both, which you can grant to administrators or to other roles. These roles can be based upon geographic location (for example, a role for Canadian administrators to manage Canadian systems), line of business (for example, a role for administrators of the human resource systems or the sales systems), or any other model. Administrators do not want to perform the task of individually granting access to tens, hundreds, or even thousands of targets to every new member of their group.By creating roles, an administrator needs only to assign the role that includes all the appropriate privileges to his team members instead of having to grant many individual privileges. He can divide workload among his administrators by filtering target access, or filtering access to management tasks, or both. You can also configure Enterprise Manager to work with an external authentication provider to manage authorization as well by using external roles. For more information, see "External Authorization using External Roles".

Out-of-Box Roles: Enterprise Manager Cloud Control 13c comes with predefined roles to manage a wide variety of resource and target types. The following table lists some of the roles along with their function. The number and type of roles displayed depend on the number and type of installed plug-ins. For a complete list of out-of-box roles, see Out-of-Box Roles.

Public Roles: Enterprise Manager creates one role by default called **Public**. This role is unique in that it is automatically assigned to all new non-super administrators when they are created. By default it has no privileges assigned to it. The Public role should be used to define default privileges you expect to assign to a majority of non-super administrators you create. Privileges need not be assigned to Public initially - they can be added at any time. The role may be deleted if your enterprise does not wish to use it. If deleted, it can be added back in later if you later decide to implement it.

Private Roles

Private Roles are a new role type introduced in Enterprise Manager Release 12.1.0.4 and are used to control the granting of sensitive/powerful privileges to administrators or roles. There are certain sensitive privileges which Enterprise Manager does not make available to Super Administrators. Specifically, they are:

- LAUNCH_DP
- FULL_DP
- GET_CREDENTIAL
- EDIT_CREDENTIAL
- FULL_CREDENTIAL
- FULL_JOB

These privileges are particularly sensitive and powerful, which is the reason Enterprise Manager does not grant these privileges to roles. Granting these privileges to roles would also make them available to other Administrators.

To accommodate the granting of these types of privileges in a more secure manner, roles are divided into two categories - system roles and private roles.

- Private roles are managed by administrators with the "create_role" privilege. Administrators granted the "create_role" privilege (Private Role) will maintain the lifecycle of the named credential and job roles, and will allow an administrator to grant these *full job* and *full credential* privileges to other administrators and to roles.
- System roles define all roles accessible to all Administrators with the "manage_system_role" privilege.

A private role can be granted to other administrators and roles via the Enterprise Manager console and EM CLI using the `emcli create_role` verb, and made grantable via `emcli grant_privs` verb.

Example 1:

```
emcli create_role
     -name="my_private_role"
     -type="EM_ROLE"
     -desc="This is a new private role called my_private_role"
     -roles="role1;role2;role3"
     -privilege="full_job;923470234ABCDFE23018494753091111"
     -privilege="FULL_CREDENTIAL;CRED_NAME=cred1:CRED_OWNER=user2"
     -users="USER1;USER2:WITH_ADMIN"
     -private_role[ Optional ]
```

This will create *my_private_role* owned by the logged-in user.

USER1 will be granted this role as WITHOUT_ADMIN option and USER2 will be granted this role as WITH_ADMIN option.

This role will consists FULL_JOB and FULL_CREDENTIAL privileges on respective objects.

The owner of a private role can grant this role to an administrator, and can specify if the other administrator has the right to further grant this private role to another administrator (by using the –WITH_ADMIN option) or to another private role. In effect, the role owner is privately administering access to this role, hence the name "private role." A system role can be granted to a private role, but a private role cannot be granted to a system role.

Verbs where the -WITH_ADMIN option is supported:

create_role -users

modify_role -users

create_user -roles

modify_user -roles

grant_roles -roles

Using Roles to Manage Privileges

Privileges are ultimately granted to administrators to enable them to manage targets in Enterprise Manager. While you can grant specific privileges to individual administrators, tracking and granting privileges on many targets across many administrators easily becomes error-prone and an administrative burden in itself. Our recommendation is to define and use roles to manage the granting of privileges to administrators. A role is a user-defined set of privileges typically containing the set of privileges that you want to grant to a team of users. A role can contain other roles as well. For example, you can create a First Line Support role containing the privileges needed for the administrators to view and manage incidents on targets. Once this role is created, you can grant this role to the appropriate administrators who will manage these incidents as part of their job responsibility. If you need to change the set of privileges for your administrators, e.g. add new privileges or remove privileges, then all you need to do is update the role. The updated set of privileges in the role is automatically enabled for the administrators to whom the role has been granted. Likewise if new administrators are added, all you need to do is grant them the appropriate role(s) instead of granting them individual privileges.

Using roles is one big step towards managing privileges. However, there is still the challenge of having to keep the role updated with privileges on new targets as they are added to Enterprise Manager. Privilege-propagating groups are meant to address this challenge and will be discussed next.

Managing Privileges with Privilege Propagating Groups

To manage the granting of privileges across potentially hundreds or thousands of targets to a large set of administrators, use privilege propagating groups in conjunction with roles. A group is a user-defined collection of targets that you can create in order to manage and monitor the targets collectively as a unit. A privilege propagating group is a special type of group where a privilege that is granted on the group to a user automatically gives him that same privilege to all existing and new members of the group.

Leverage the privilege-propagating nature of Administration Groups

Enterprise Manager administration groups are privilege-propagating in nature. This means that a privilege on the administration group that is granted to a user or a role automatically *propagates* to all members of the group including any subgroups. If a new target is added to an administration group, then because the administration group is privilege-propagating, the user or role that has privileges on the administration group automatically gets privileges on the

newly added target by virtue of it joining the group. No additional work is needed for granting privileges on the new target. Thus granting target privileges is much simpler because all you need to do is a one-time setup of granting privileges on the group to a role.

Create Roles for Different Job Responsibilities

After you have planned the various job responsibilities and mapped these to the corresponding privileges in Enterprise Manager, the next step is to create roles in Enterprise Manager containing privileges required for each job responsibility. In our example below, here are the various roles that need to be created for each job responsibility. Note that when it comes to privileges on targets in the administration group, the recommendation is to grant the privilege on the administration group and not on individual targets in order to leverage the privilege propagating nature of administration groups.

Table 2-1 EXAMPLES OF ROLES YOU CAN CREATE FOR DIFFERENT JOB RESPONSIBILITES*

JOB RESPONSIBILITY	ROLE IN ENTERPRISE MANAGER	PRIVILEGES IN THE ROLE (MINIMUM SET)
Group Administrator Responsible for defining group membership and for granting privileges on the group to other administrators.	GROUP_ADMIN_ROLE	Group Administration on the group
Senior Administrator Responsible for adding and removing targets in Enterprise Manager, and for planning and setting up monitoring settings for targets. He is also responsible for setting up rules related to creating incidents for events and sending notifications.	SENIOR_ADMIN_ROLE	Add Any Target Create Enterprise Rule Set Operator on the group Create on Job System EM_TC_DESIGNER role
Target Owner For the targets he owns, he is responsible for setting monitoring settings, responding to events/ incidents, and for performing maintenance operations	TARGET_OWNER_ROLE	Operator on the Administration Group(s) that he is managing Create on Job System View Any Monitoring Template View on the Template Collection(s) associated with the group(s) he is managing
First Level Support Responsible for responding to events/incidents on targets. As part of operational procedures, he is allowed to blackout a target that is down.	FIRST_LEVEL_SUPPORT	Manage Target Events on the appropriate Administration Group(s) Blackout Target on the appropriate Administration Group(s)

The privileges listed in the table represent the minimum set of privileges in the role. Additional privileges can be added based on other responsibilities. Also note that you will need to have Super Administrator privileges to create roles. Once roles have been defined, you can now grant these roles to your Enterprise Manager administrators. This can be done in several ways:

- Assign roles while creating/editing an Enterprise Manager administrator.
- As part of creating/editing a role, you to choose administrators to whom you would like to grant the role.

- When creating/editing administrators using the Enterprise Manager Command Line tool (EM CLI), you can specify the roles granted to the user. You can also use EM CLI to grant roles directly to an existing user.

As an example, say you want to grant Operator privileges on host targets used by the development team to all members of the development team. You can first ceate a privilege propagating group (Devt-Group) containing the relevant host targets. Then create a role (Devt-Role) and in this role include Operator privileges on Devt-Group. Finally grant the Devt-Role to all members of the development team. This will result in providing all members of the development team Operator privileges on all targets in Devt-Group. As new host targets are added, you can simply add these new targets to Devt-Group and all members of the development team automatically obtain Operator privileges on the newly added targets. The following scenarios provide additional examples of using privilege propagating groups with roles.

We shall step through two use cases which outline when best to use privilege propagating groups, how to create target groups, add member to this group, and assign roles and Administrators to these target groups.

Example1: Granting various teams different levels of access to target groups

Consider a collection of Database Instances and WebLogic Servers within an organization are managed by separate teams within the organization. Both teams are using Enterprise Manager to manage their targets.The DBAs want full access privileges to their Database Instances and view privileges on the WebLogic Servers. Similarly, the WebLogic Server administrators want full privileges on the WebLogic Servers and view privileges on the Database Instances.

To manage privileges across the two teams, first create two privilege propagating groups containing the targets of the respective teams. For example, you can create a target group called DBAGroup containing the database Instances and another target group called WLSGroup containing the Oracle WebLogic Servers. DBAGroup contains the Database Instances that can be modified and managed by DBAs. While the WLSGroup is a group of Web Logic Servers modified and managed by the Web Logic Server administrators . Additionally, the DBAs want to view the Web Logic Server targets and the Web Logic Server technicians want to view the Database Instances. The following steps will show how to set up these target groups, privileges and roles, and how to grant the appropriate roles to the correct Administrator.

Here are the steps to follow:

1. Create a target group. On the console go to Targets->Groups from the drop down menu.
2. Click "Create" from the menu and select "Group" from the drop down menu.
3. Enter the name DBAGroup.

   Enable "Privilege Propagation" group, by checking the box. This allows Administrators to do a one-time grant of privileges on a group to a user and that privilege will automatically be propagated (or applied) to each member of that group.
4. Add the database targets you want to add to the new database group, DBAGroup. This is done by hitting the "Add" button, selecting the Database Instance targets from the list. Click the "Select" button.
5. Select "OK".
6. Your new group, DBAGroup, should be displayed in the list of available groups.
7. Now create a second privilege propagating group, by repeating the steps 1-6, calling it WLSGroup, and adding the appropriate WebLogice Server targets to this group.
8. Your second group, WLSGroup, should be displayed in the list of available groups.

9. Next, create the Roles. A role contains privileges that can be granted to an administrator. Proceed to the Roles page. Go to the Setup->Security->Roles page.
10. Click **Create**.
11. On the Properties page, type the name of your role. In this example we have named it DBA-ROLE. This Role will contain privileges for the DBA team. It will contain Full privilege on all database Instances in the DBAGroup and view privilege on all Web Logic Server Instances in the WLSGroup. Click the "Next" button.
12. On the Roles page, click **Next**.
13. On the "Target Privileges" page, scroll down to the "Target Privileges" section, at the bottom of the page. Click the "Add" button. The list of available targets is displayed. Select the "Group" Target Type, to improve the search. Select the two groups we just created, DBAGroup and WLSGroup.
14. Our two groups will be displayed. For this role, DBA-ROLE, we want to grant "Full" on all databases in the DBAGroup and grant "View" on all WebLogic server targets in the WLSGroup. As the default privilege is "View" we need only modify the DBAGroup privilege for this Role, leaving the WLSGroup, with the default "View" privilege. This is done by selecting the pencil icon, to the right of "View" in the "Manage Target Privilege Grants" column. Click the "Continue" button.
15. Click the privilege "Full", select the "Continue" button.
16. The new privilege will be displayed. Select the "Next" button.
17. Select the "Next" button on the Resource Privilege page.
18. Select the Administrators you want to grant this role, DBA-ROLE too. Select the "Next" button.
19. Review the setting of your new role DBA-ROLE.
20. Next we create our second Role, WLS-ROLE. This Role will allow users granted this role full privilege on all the WebLogic Servers in WLSGroup and view privilege on all Database Instances in the DBAGroup. Repeat Steps 10-19, naming our second Role WLS-ROLE. Proceed to the review page, as displayed below.

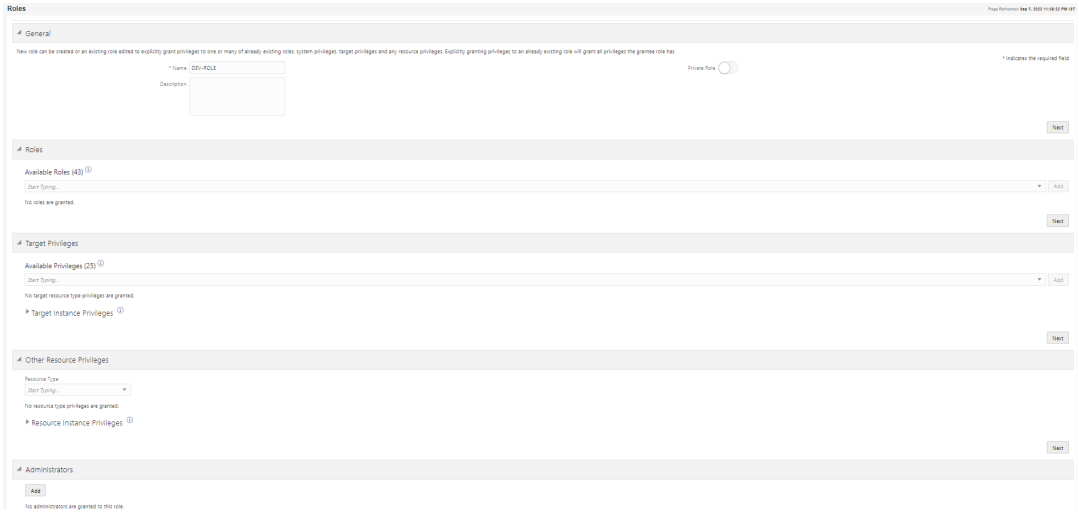
Example 2: Granting developers view access to target database instances.

DBAs within data centers typically provide application developers read-only access to database performance pages in Enterprise Manager in order for them to view firsthand information on the impact of their applications on the underlying database and restrict them from performing any write operations on the database. The DBAs may not want to share database user account information with the developers nor create individual user accounts on every Database Instance.

You can use the 'Connect Target Read-Only' privilege to enable read-only access to a target. To manage the granting of this privilege across many databases to a team of developers, you can create a privilege propagating group, and add the Database Instances to this target group, calling it, for example DevGroup. You create a role, for example DEV-ROLE and grant the privilege, "Connect Target Read-Only" on his Role, in doing so, you assign this Role to each Developer, granting him access to the performance data in those Database Instances. As these engineers do not have individual user accounts on each Database Instance we will create a Named Credential, call it DevCred which contains database user credentials and we will assign this Named Credential to each Developer needing access to the performance data in the Database Instances. The following steps will show you how to set up the target group and assign Roles and Named Credentials to this group.

Here are the steps to follow:

1. Create a group of targets. On the console go to Targets->Groups from the drop down menu.
2. Click "Create" and select "Group" from the drop down menu.
3. Enter the name of your new target group, for this User Case we shall call it DevGroup.
4. Enable "Privilege Propagation" group, by checking the box. This allows Administrators to do a one-time grant privileges on a group to a user and have that privilege be automatically propagated (or applied) to each member of that group. Add the database Targets you want to add to the group. This is done by hitting the "Add" button and selecting the Targets from the list.
5. Select "OK".
6. The new target group, DevGroup, is displayed in the list of available groups.
7. Next, create a view only Role for the Target DevGroup. A Role is a privilege that is granted to an Administrator. Proceed to the Roles page, go to the Setup->Security->Roles page.
8. Click "Create" button.
9. On the General page, type the name of the new Role, DEV-ROLE, click the "Next" button.



10. Click "Next" on the "Roles" page.
11. On the "Target Privileges" page, scroll down to the "Target Privileges" section, at the bottom of the page. Click the "Add" button. The available targets are displayed. Select the "Group" Target Type, to improve the search. Select the group we just created, DevGroup. Click the "Select" button.
12. The target group is displayed. For this role, DEV-ROLE, we want to grant "Connect Target Read-Only" on all databases in the DevGroup. This is done by selecting the pencil icon, to the right of "View" in the "Manage Target Privilege Grants" column.
13. Click the privilege "Connect Target Read-Only", scroll to the bottom of the page. Select the "Continue" button.
14. The new privilege is displayed. Select the "Next" button
15. Select the "Next" button on the Resource Privilege page.
16. Select the Administrators you want to grant this role, DEV-ROLE too. Select the "Next" button.

17. Review the setting of your new role DEV-ROLE.
18. Next we will create a Named Credential. In this case a Named Credential contains the database credentials used to log on to the database. It will be used by the developer to access the database performance pages in Enterprise Manager. Follow the link "Setup"->"Security"->"Named Credential".
19. Click the "Create" button.
20. Enter the Username and Password information that this Named Credential will use to log onto the database. We have selected the following information:

    Credential name: DevCred

    Authenticating Target Type: Database Instance -For this Use Case, we are interested in granting access to the development engineers the database Instances in the DevGroup.

    Credential Type: Database Credentials - For this Use Case, we are supplying the username and password for the target Type specified above.

    Scope: Global - For this User Case, this username and password will apply to every Database. Click the "Test and Save" button.
21. Enter a valid "Test Target Name", and click **Test and Save**.
22. Our new Named Credential will be displayed. To Grant this Named Credential to a one of the development Engineers, click **Manage Access**.
23. Click the "Add Grant" button.
24. Select the Development Engineers you wish to use this Named Credential. Click the "Select" button.
25. The User information is displayed at the bottom of the page. More users may be added, if desired.
26. When this Development Engineer logs into Enterprise Manager they will have access to view necessary data, such as performance information. However, as expected, they are unable to perform any write operation to the databases. If the user does attempt to perform a write operation on any database, the following error is displayed in Enterprise Manager:

    Failed to commit: Enterprise Manager has blocked you from performing the task as you are performing this operation using a READONLY connection.

Entitlement Summary

The Administrators Entitlement page displays all the privileges and roles granted to that Administrator. This page also summarizes an Administrators access to targets as well as displaying the named credentials and secure resources owned by that Administrator. The following fiture shows an example of the Enterprise Manager Administrator Entitlement page. You can access this page by clicking on the dropdown menu, beside the Administrators name, and clicking Entitlement Summary.

Configuring Secure Communication

This section contains the following topics:

- About Secure Communication
- Enabling Security for the Oracle Management Service
- Securing the Oracle Management Agent
- Managing Agent Registration Passwords

- Restricting HTTP Access to the Management Service
- Enabling HSTS Response Headers on Oracle Management Service and Agent Ports
- Configuring the Management Service and Agents to Connect to a Secure Management Repository and Target Databases
- Custom Configurations
- Secure Communication Setup Tools
- Configuring Third Party Certificates

About Secure Communication

Enterprise Manager Framework Security provides safe and secure communication channels between the components of Enterprise Manager. For example, Framework Security provides secure connections between your Oracle Management Service and its Management Agents. Secure communication also protects against network threats such as eavesdropping and ensures confidentiality/integrity by utilizing technologies such as public-key cryptography.

> **See Also:**
>
> *Oracle Enterprise Manager Concepts* for an overview of Enterprise Manager components.

Enterprise Manager Framework Security implements the following types of secure connections between the Enterprise Manager components:

- HTTPS and Public Key Infrastructure (PKI) components, including signed digital certificates, for communications between the Management Service and the Management Agents.

  > **See Also:**
  >
  > For an overview of Public Key Infrastructure features, such as digital certificates and public keys, see the *Oracle® Database 2 Day Security Guide.*

- Oracle Advanced Security for communications between the Management Service and the Management Repository.

  > **See Also:**
  >
  > *Oracle Database Advanced Security Administrator's Guide*

Enabling Security for the Oracle Management Service

To enable Enterprise Manager Framework Security for the Management Service, you use the `emctl secure oms` utility, which is located in the following subdirectory of the Management Service home directory:

```
<OMS_ORACLE_HOME>/bin
```

The `emctl secure oms` utility performs the following actions:

- Generates a Root Key within your Management Repository. The Root Key is used during distribution of Oracle Wallets containing unique digital certificates for your Management Services & Management Agents. An Oracle Wallet is used to store security credentials on Oracle Clients and servers, see oracle Advanced Security Administrators Guide for more information on Oracle Wallets.
- Modifies your WebTier to enable an HTTPS channel between your Management Service and Management Agents, independent from any existing HTTPS configuration that may be present in your WebTier.
- Enables your Management Service to accept requests from Management Agents using Enterprise Manager Framework Security.

To run the `emctl secure oms` utility you must first choose an Agent Registration Password. The Agent Registration password is used to validate that future installation of Oracle Management Agents are authorized to load their data into this Enterprise Manager installation.

To enable Enterprise Manager Framework Security for the Oracle Management Service:

1. Stop the Management Service, the WebTier using the following command:

   ```
   <OMS_ORACLE_HOME>/bin/emctl stop oms
   ```

2. Enter the following command:

   ```
   <OMS_ORACLE_HOME>/bin/emctl secure oms
   ```

3. You will be prompted for the Enterprise Manager Root Password. Enter the `SYSMAN` password.
4. You will be prompted for the Agent Registration Password, which is the password required for any Management Agent attempting to establish secure communication with the Management Service. Specify an Agent Registration Password for the Management Service.
5. Restart the OMS.
6. After the Management Service restarts, test the secure connection to the Management Service by browsing to the following secure URL using the HTTPS protocol:

   ```
   https://hostname.domain:https_console_port/em
   ```

   Note: The Enterprise Manager console URL can be found by running the "emctl status oms -details" command.

   For example:

   ```
   $ emctl status oms -details
   Oracle Enterprise Manager Cloud Control 13c Release 5
   Copyright (c) 1996, 2016 Oracle Corporation. All rights reserved.
   Enter Enterprise Manager Root (SYSMAN) Password :
   ...
   Console URL: https://omshost.example.com:5416/em
   ```

   If the Management Service security has been enabled successfully, your browser displays the Enterprise Manager login page.

Example 2-3 Sample Output of the emctl secure oms Command

```
$ emctl secure oms
Oracle Enterprise Manager Cloud Control 13c Release 5
Copyright (c) 1996, 2016 Oracle Corporation. All rights reserved.
Securing OMS... Started.
```

```
Enter Enterprise Manager Root (SYSMAN) Password :
Enter Agent Registration Password :
Securing OMS... Successful
Restart OMS
```

Configuring the OMS with Server Load Balancer

When you deploy a Management Service that is available behind a Server Load Balancer (SLB), special attention must be given to the DNS host name through which the Management Service will be available. Although the Management Service may run on a particular local host, for example `test01.example.com`, your Management Agents will access the Management Service using the host name that has been assigned to the Server Load Balancer. For example, `oracleoms.example.com`.

As a result, when you enable Enterprise Manager Framework Security for the Management Service, it is important to ensure that the Server Load Balancer host name is embedded into the Certificate that the Management Service uses for SSL communications. This may be done by using `emctl secure oms` and specifying the host name using an extra `-host` parameter as shown below.

> **Note:**
>
> Before running the commands, you must first identify the SLB hostname, port, and ensure that the SLB is configured.

- Enable security on the Management Service by entering the following command:

  ```
  emctl secure oms -host <slb_hostname> [-slb_console_port <slb UI port>] [-
  slb_port <slb upload port>] [other params]
  ```

  Run this command on each OMS. You will need to restart each OMS after running the 'emctl secure oms' command.
- Create virtual servers and pools on the Server Load Balancer.
- Verify that the console can be accessed using the following URL:

  ```
  https://slb_hostname:slb_console_port/em
  ```
- Re-secure the Agents with Server Load Balancer by using the following command:

  ```
  emctl secure agent -emdWalletSrcUrl <SLB Upload or UI URL>
  ```

  For example:

  ```
  $ <AGENT_HOME>/bin/emctl secure agent -emdWalletSrcUrl https://
  slb_hostname:slb_upload_port/em
  ```

It is possible to configure Oracle Enterprise Manager with one load balancer for upload operations and one for console operations. To do this, the pools at both of the SLBs must be configured with respective ports and the OMS must be secured separately for console and upload operations, using the following commands:

```
$emctl secure oms -host <slb_hostname>[-slb_port <slb upload port>] [other
params] $emctl secure console -host <slb_hostname> other params
```

Removing a Server Load Balancer Configuration

If you had previously configured the OMS with an SLB using `emctl secure oms -host` and now want to remove the SLB configuration, run the following command:

```
emctl secure oms -no_slb
```

If you had secured Agents using the SLB hostname they will need to be re-secured using the OMS hostname. To re-secure the Agents, run the following command:

```
emctl secure agent -emdWalletSrcUrl <Upload URL>
```

Creating a New Certificate Authority

You may need to create a new Certificate Authority (CA) if the current CA is expiring, if you want to change the key strength, or if you want to change the signature algorithm. A unique identifier is assigned to each CA. For instance, the CA created during installation may have an identifier as ID 1, subsequent CAs will have the IDs 2,3, and so on. At any given time, the last created CA is active and issues certificates for OMSs and Agents.

1. Run the `emctl secure createca` command on one of the OMS machines.
2. If there are multiple OMSs in your environment, copy `<EM_Instance_Home>/sysman/config/b64LocalCertificate.txt` from the machine on which `emctl secure createca` was run to all other OMS machines at the same location i.e <EM_Instance_Home>/sysman/config/b64LocalCertificate.txt
3. Restart all the OMSs.

Example 2-4 Creating a New Certificate Authority

```
emctl secure createca [-host <hostname>] [-key_strength <strength>] [-cert_validity
<validity>] [-root_dc <root_dc>] [-root_country <root_country>] [-root_email
<root_email>] [-root_state <root_state>] [-root_loc <root_loc>] [-root_org <root_org>] [-
root_unit <root_unit>] [-sign_alg <md5|sha1|sha256|sha384|sha512>] [-cert_validity
<validity>]
Oracle Enterprise Manager 13c Release 5 Cloud Control
Copyright (c) 1996, 2022 Oracle Corporation.  All rights reserved.
Creating CA... Started.
Successfully created CA with ID 2
```

Example 2-5 Viewing Information about a Certificate Authority

```
emcli get_ca_info -ca_id="1;2" -details
Info about CA with ID: 1
CA is not configured
DN: CN=myhost.example.com, C=US
Serial# : 3423643907115516586
Valid From: Tue Mar 16 11:06:20 PDT 2011
Valid Till: Sat Mar 14 11:06:20 PDT 2020
Number of Agents registered with CA ID 1 is 1
myhost.example.com:3872

Info about CA with ID: 2
CA is configured
DN: CN=myhost.example.com, C=US, ST=CA
Serial# : 1182646629511862286
Valid From: Fri Mar 19 05:17:15 PDT 2011
Valid Till: Tue Mar 17 05:17:15 PDT 2020
There are no Agents registered with CA ID 2
```

Administration Credentials Wallet

The WebLogic Administrator and Node Manager passwords are stored in the Administration Credentials Wallet. This is present in the `<MW_HOME>/sysman/config/adminCredsWallet` directory. To recreate Administrator Credentials wallet, run the following command on each machine on which the Management Service is running:

```
emctl secure create_admin_creds_wallet [-admin_pwd <pwd>] [-nodemgr_pwd <pwd>]
```

Viewing the Security Status and OMS Port Information

To view the security status and OMS port information, use the following command

Example 2-6 emctl status oms -details

```
Oracle Enterprise Manager Cloud Control 13c Release 2
Copyright (c) 1996, 2016 Oracle Corporation. All rights reserved.
Console Server Host : test01.example.com
HTTP Console Port : 7802
HTTPS Console Port : 5416
HTTP Upload Port : 7654
HTTPS Upload Port : 4473
EM Instance Home : <MW_HOME>/oracle/work/em/EMGC_OMS1
OMS Log Directory Location : <MW_HOME>/oracle/work/em/EMGC_OMS1/sysman/log
OMS is not configured with SLB or virtual hostname
Agent Upload is locked.
OMS Console is unlocked.
Active CA ID: 2
Console URL: https://test01.example.com:5416/em
Upload URL: https://test01.example.com:4473/empbs/upload

WLS Domain Information
Domain Name : EMGC_DOMAIN
Admin Server Host : test01.example.com
Admin Server HTTPS Port: 7022
Admin Server is RUNNING

Managed Server Information
Managed Server Instance Name: EMGC_OMS1
Managed Server Instance Host: test01.example.com
WebTier is Up
Oracle Management Server is Up
```

Configuring Transport Layer Security

The Oracle Management Service can be configured in TLSv1, TLSv1.1, and TLSv1.2 modes. By default, all three modes are enabled. To configure the OMS to use only one or two modes, do the following:

1. Stop the OMS by entering the following command:

   ```
   <OMS_ORACLE_HOME>/bin/emctl stop oms
   ```

2. Enter a command similar to one of the following commands:

   To restrict the OMS to one particular mode, enter:

   ```
   emctl secure -protocol "TLSv1"
   ```

   To enable more than one mode, use a space delimited list, for example:

```
emctl secure oms -protocol "TLSv1.1 TLSv1.2"
```

3. Restart the OMS with the following command:

```
<OMS_ORACLE_HOME>/bin/emctl start oms
```

Securing the Oracle Management Agent

When you install the Management Agent on a host, you must identify the Management Service that will be used by the Management Agent. To enable Enterprise Manager Framework Security for the Management Agent, use the `emctl secure agent` utility, which is located in the following directory of the Management Agent home directory:

```
<AGENT_INSTANCE_HOME>/bin (UNIX)
<AGENT_INSTANCE_HOME>\bin (Windows)
```

The `emctl secure agent` utility performs the following actions:

- Obtains an Oracle Wallet from the Management Service that contains a unique digital certificate for the Management Agent. This certificate is required in order for the Management Agent to conduct SSL communication with the secure Management Service.
- Obtains an Agent Key for the Management Agent that is registered with the Management Service.
- Configures the Management Agent so it is available on your network over HTTPS and so it uses the Management Service HTTPS upload URL for all its communication with the Management Service.

To enable Enterprise Manager Framework Security for the Management Agent:

1. Ensure that your Management Service and the Management Repository are up and running.
2. Stop the Management Agent:

   ```
   emctl stop agent
   ```

3. Enter the following command:

   ```
   emctl secure agent
   ```

   The `emctl secure agent` utility prompts you for the Agent Registration Password, authenticates the password against the Management Service, and reconfigures the Management Agent to use Enterprise Manager Framework Security.

   Example 2-7 shows sample output of the `emctl secure agent` utility.

4. Restart the Management Agent:

   ```
   emctl start agent
   ```

5. Confirm that the Management Agent is secure by checking the Management Agent home page.

> **Note:**
>
> You can also check if the Agent Management is secure by running the `emctl status agent -secure` command, or by checking the Agent and Repository HTTPS URLs in the output of the `emctl status agent` command.

In the Management Agent home page , the **Secure Upload** field indicates whether or not Enterprise Manager Framework Security has been enabled for the Management Agent.

Example 2-7 Sample Output of the emctl secure agent Utility

```
emctl secure agent
Oracle Enterprise Manager 13c Release 2 Cloud Control.
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
Securing agent...   Started
Securing agent...   Successful.
```

Example 2-8 Sample Output of the emctl status agent secure Command

```
$ emctl status agent -secure
Oracle Enterprise Manager Cloud Control 13c Release 2
Copyright (c) 1996, 2016 Oracle Corporation. All rights reserved.
Checking the security status of the Agent at location set in <MW_HOME>/oracle/work/
agentStateDir/sysman/config/emd.properties... Done.
Agent is secure at HTTPS Port 1838.
Checking the security status of the OMS at http://test01.example.com:7654/empbs/
upload/... Done.
OMS is secure on HTTPS Port 4473
```

Managing Agent Registration Passwords

Enterprise Manager uses the Agent Registration password to validate that installations of Oracle Management Agents are authorized to load their data into the Oracle Management Service.

The Agent Registration password is created during installation when security is enabled for the Oracle Management Service. You can add/edit/delete registration passwords directly from the Enterprise Manager console.

> **Note:**
>
> If you want to avoid new Agents from being registered with the OMS, delete all registration passwords.'

Using the Cloud Control Console to Manage Agent Registration Passwords

You can use the Cloud Control Console to manage your existing registration passwords or create additional registration passwords:

1. From the **Setup** menu, select **Security**, then select **Registration Passwords**.
2. Enterprise Manager displays the Registration Passwords page. Registration password specified during install appears in the Registration Passwords table with description *<Initial Agent Registration Password>*.
3. Use the Registration Passwords page to change your registration password, create additional registration passwords, or remove registration passwords associated with the current Management Repository.

When you create or edit an Agent Registration Password on the Registration Passwords page, you can determine whether the password is persistent and available for multiple Management Agents or to be used only once or for a predefined period of time.

For example, if an administrator requests to install a Management Agent on a particular host, you can create a one-time-only password that the administrator can use to install and configure one Management Agent.

On the other hand, you can create a persistent password that an administrator can use for the next two weeks before it expires and the administrator must ask for a new password.

Using emctl to Add a New Agent Registration Password

To add a new Agent Registration Password, use the following `emctl` command on the machine on which the Management Service has been installed:

```
emctl secure setpwd [sysman pwd] [new registration pwd]
```

The `emctl secure setpwd` command requires that you provide the password of the Enterprise Manager super administrator user, `sysman`, to authorize the addition of the Agent Registration Password.

As with other security passwords, you should change the Agent Registration Password on a regular and frequent basis to prevent it from becoming too widespread.

Restricting HTTP Access to the Management Service

It is important that only secure Management Agent installations that use the Management Service HTTPS channel are able to upload data to your Management Repository and Cloud Control console is accessible via HTTPS only.

To restrict access so Management Agents can upload data to the Management Service only over HTTPS:

1. Stop the Management Service, the WebTier:

   ```
   cd <OMS_ORACLE_HOME>/bin
   emctl stop oms
   ```

2. Enter the following command to prevent Management Agents from uploading data to the Management Service over HTTP:

   ```
   emctl secure lock -upload
   ```

   To lock the console and prevent HTTP access to the console, enter the following command:

   ```
   emctl secure lock -console
   ```

   To lock both, enter either of the following commands:

   ```
   emctl secure lock or
   emctl secure lock -upload -console
   ```

   To lock both the console access and uploads from Agents while enabling security on the Management Service, enter the following command:

   ```
   emctl secure oms -lock [other options]
   ```

3. Restart the Management Service, the WebTier, and the other application server components:

   ```
   emctl start oms
   ```

4. Verify that you cannot access the OMS upload URL using the HTTP protocol:

   For example, navigate to the following URL:

```
http://hostname.domain:4889/empbs/upload
```

You should receive an error message similar to the following:

```
Forbidden
You are not authorised to access this resource on the server.
```

Note: The HTTP upload port number can be found using the `emctl status oms -details` command. Search for "HTTP Upload Port"

5. Verify that you can access the OMS Upload URL using the HTTPS protocol:

   For example, navigate to the following URL:

   ```
   https://hostname.domain:4888/empbs/upload
   ```

   You should receive the following message, which confirms the secure upload port is available to secure Management Agents:

   ```
   Http XML File receiver
   Http Recceiver Servlet active!
   ```

Example 2-9 Sample Output of the emctl secure lock Command

```
emctl secure lock
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
OMS Console is locked. Access the console over HTTPS ports.
Agent Upload is locked. Agents must be secure and upload over HTTPS port.
Restart OMS
```

Example 2-10 Sample Output of the emctl secure unlock Command

```
emctl secure unlock
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
OMS Console is unlocked. HTTP ports too can be used to access console.
Agent Upload is unlocked. Unsecure Agents may upload over HTTP.
Restart OMS
```

To allow the Management Service to accept uploads from unsecure Management Agents, use the following command:

```
emctl secure unlock -upload
```

Note:

- The OMS need to be stopped before running 'secure unlock', and then restarted afterwards.
- To unlock the console and allow HTTP access to the console, enter the following command:

  ```
  emctl secure unlock -console
  ```

- To unlock both, enter either of the following command:

  ```
  emctl secure unlock
  emctl secure unlock -console -upload
  ```

> **Note:**
>
> The Oracle Management Service is locked (both console & upload) by default beginning with Enterprise Manager 13c.

Enabling HSTS Response Headers on Oracle Management Service and Agent Ports

Starting Enterprise Manager *version 13c Release 5 Update 03 (13.5.0.3)*, the HSTS header is available in Oracle Management Agent response by default. Use the steps below to enable the HTTP Strict Transport Security (HSTS) response headers on the WebLogic Server and Oracle HTTP Server / API Gateway ports of Oracle Management Service:

Topics

- Enabling HSTS Response Headers on OMS WebLogic Server Port
- Enabling HSTS Response Headers on OMS API Gateway Port for Enterprise Manager *24ai Release 1*
- Enabling HSTS Response Headers on OMS Oracle HTTP Server Port for Enterprise Manager *13c Release 5*
- Verifying that HSTS Response Header is Enabled

Enabling HSTS Response Headers on OMS WebLogic Server Port

1. Run the command below on each OMS Home to enable HSTS on OMS:
   a. Retrieve the existing value of `JAVA_EM_ARGS`:

      ```
      <OMS HOME>/bin>emctl get property -name JAVA_EM_ARGS
      ```

   b. Append the value **`-Dweblogic.http.headers.enableHSTS=true`** to the existing `JAVA_EM_ARGS` retrieved in the previous step:

      ```
      <OMS HOME>/bin>emctl set property -name JAVA_EM_ARGS -value
      "<existing_value_of_JAVA_EM_ARGS> -
      Dweblogic.http.headers.enableHSTS=true" -module emoms -oms_name
      local_oms -sysman_pwd <sysman_password>
      ```

      Consider the following response while retrieving the value of `JAVA_EM_ARGS`:

      ```
      <OMS HOME>/bin>emctl get property -name JAVA_EM_ARGSOracle Enterprise
      Manager Cloud Control 13c Release 5Copyright (c) 1996, 2021 Oracle
      Corporation. All rights reserved.SYSMAN password:Value for property
      JAVA_EM_ARGS for oms local_oms is -XX:+HeapDumpOnOutOfMemoryError
            -XX:HeapDumpPath=/app/oracle/mw/13.5/null/sysman/log/oms_heap_dump
            -XX:OnOutOfMemoryError=/app/oracle/mw/13.5/bin/
      heap_dump_rolling.sh
      ```

Then, run the following command to append **-Dweblogic.http.headers.enableHSTS=true** to the value of `JAVA_EM_ARGS`:

```
<OMS HOME>/bin>emctl set property -name JAVA_EM_ARGS -value "-
XX:+HeapDumpOnOutOfMemoryError
      -XX:HeapDumpPath=/app/oracle/mw/13.5/null/sysman/log/oms_heap_dump
      -XX:OnOutOfMemoryError=/app/oracle/mw/13.5/bin/
heap_dump_rolling.sh -Dweblogic.http.headers.enableHSTS=true" -module
emoms -oms_name local_oms -sysman_pwd <sysman_password>
```

2. Restart the OMS:

```
<OMS HOME>/bin>emctl stop oms -all -force
<OMS HOME>/bin>emctl start oms
```

However, if you want to enable the HSTS to the OMS (Webtier OHS/API Gateway), then you can restart the OMS after implementing that section.

Enabling HSTS Response Headers on OMS API Gateway Port for Enterprise Manager *24ai Release 1*

1. Run below command to enable the HSTS at API Gateway:

```
<OMS_HOME>/bin/emctl set webtier_property -name enableHsts -value true
```

2. Restart the OMS:

```
<OMS HOME>/bin>emctl stop oms -all -force
<OMS HOME>/bin>emctl start oms
```

Enabling HSTS Response Headers on OMS Oracle HTTP Server Port for Enterprise Manager *13c Release 5*

1. Locate the below files for the OHS port of OMS, and take a backup of each file:
   - *<EM_INSTANCE_BASE>*`/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/ohs(n)/moduleconf/httpd_em.conf`
   - *<EM_INSTANCE_BASE>*`/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/ohs(n)/ssl.conf`
   - *<EM_INSTANCE_BASE>*`/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/ohs(n)/httpd.conf.emctl_secure`
   - *<EM_INSTANCE_BASE>*`/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/ohs(n)/ssl.conf.emctl_secure`
   - *<EM_INSTANCE_BASE>*`/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/ohs(n)/moduleconf/ssl_bip.conf` (SSL Configuration file for BIP, if exists)

   In case of a multi-OMS setup, the above files are present only on the primary OMS Server where the Admin Server is running. Update each of them.
   - *<EM_INSTANCE_BASE>*`/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/instances/ohs(n)/moduleconf/httpd_em.conf`

- *<EM_INSTANCE_BASE>*/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/instances/ohs(n)/ssl.conf
- *<EM_INSTANCE_BASE>*/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/instances/ohs(n)/httpd.conf.emctl_secure
- *<EM_INSTANCE_BASE>*/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/instances/ohs(n)/ssl.conf.emctl_secure
- *<EM_INSTANCE_BASE>*/user_projects/domains/GCDomain/config/fmwconfig/components/OHS/instances/ohs(n)/moduleconf/ssl_bip.conf (SSL Configuration file for BIP, if exists)

2. Restart the OMS:

```
<OMS HOME>/bin>emctl stop oms -all -force
<OMS HOME>/bin>emctl start oms
```

Verifying that HSTS Response Header is Enabled

Run the following command to check if HSTS is enabled at the port level:

```
$curl -s -D- https://<HOSTNAME>:<SSL PORT>/ --insecure | grep Strict
```

Example output:

```
Output:
Strict-Transport-Security: max-age=31536000; includeSubDomains;
    preload
```

Configuring the Management Service and Agents to Connect to a Secure Management Repository and Target Databases

Topics:

- **Enabling Oracle Advanced Security for the Management Repository**
- **Enabling Oracle Advanced Security for the OMS to Connect to the Management Repository**
- **Enabling Oracle Advanced Security for Management Agents to Connect to Target Databases**
- **Enabling Oracle Advanced Security for the OMS to Connect to Target Databases**

Enabling Oracle Advanced Security for the Management Repository

To ensure that your database is secure and that only encrypted data is transferred between your database server and other sources, review the security documentation available for your database version. Go to Oracle Database Documentation, select your database version from the drop-down, and click the **Security** section to locate the *Database Security Guide*. Configure your repository database to encrypt data that is sent over a network.

The following instructions provide an example of how your Management Repository database may be configured for communication with the Management Service:

1. Locate the `sqlnet.ora` configuration file in the database Oracle Home directory `<ORACLE_HOME>/network/admin`.
2. Examine the following entries in the `sqlnet.ora` file:

   ```
   sqlnet.encryption_server
   sqlnet.encryption_types_server
   sqlnet.crypto_checksum_server
   sqlnet.crypto_checksum_types_server
   ```

   For example, the `sqlnet.ora` file entries may look like this:

   ```
   sqlnet.encryption_server=ACCEPTED
   sqlnet.encryption_types_server=(AES256)
   sqlnet.crypto_checksum_server=REQUESTED
   sqlnet.crypto_checksum_types_server=(SHA256)
   ```

   These parameters indicate that network data can be encrypted and it shows the data encryption and data integrity parameters used.

   Note that the possible values for `sqlnet.encryption_server` and `sqlnet.crypto_checksum_server` are: `REJECTED`, `ACCEPTED`, `REQUESTED`, or `REQUIRED`.

   `REJECTED` indicates you do not want encryption to be enabled.

   `ACCEPTED` indicates that encryption is possible if requested by the client.

   `REQUESTED` indicates that encryption is possible if the client accepts it.

   `REQUIRED` indicates that encryption must be enabled.

   If any values are set to `REJECTED`, data encryption is not possible. Any other values depend on the client setup as well.

   Make a note of these values. You will use this information when configuring the OMS.

   Note that in order for the repository database to also be a *managed* target, you must complete the steps in **Enabling Oracle Advanced Security for the OMS to Connect to Target Databases**.

Enabling Oracle Advanced Security for the OMS to Connect to the Management Repository

If you have enabled the encryption of data sent over a network for your Management Repository database, then use the following procedure to also enable this for the Oracle Management Service (OMS):

1. Stop the primary OMS and any other OMS instances, if a multi-OMS system:

   ```
   <OMS_ORACLE_HOME>/bin/emctl stop oms -all -force
   ```

2. Based on the value set on the repository side, add the following value(s) in **all** `<GC_INST>/em/EMGC_OMS<n>/emgc.properties` files, where <n> indicates OMS instance number in the case of multi-node OMS setup, for example, EMGC_OMS2:

   ```
   oracle.sysman.core.conn.enableEncryption=true
   oracle.net.encryption_client=<see table below>
   oracle.net.encryption_types_client=<see table below>
   ```

```
oracle.net.crypto_checksum_client=<see table below>
oracle.net.crypto_checksum_types_client=<see table below>
```

The possible properties that can be set for the OMS are listed in the table below:

Property	Possible Values	Default OMS Values	Description
oracle.net.encryption_client	REJECTED, ACCEPTED, REQUESTED, and REQUIRED.	REQUESTED	Defines the client/OMS encryption. This parameter must be set to ACCEPTED, REQUESTED or REQUIRED to use secure connections. If it is set to REJECTED, data encryption is not possible. If sqlnet.encryption_server parameter is: • ACCEPTED, then set oracle.net.encryption_client to REQUESTED or REQUIRED. • REQUESTED or REQUIRED, then set oracle.net.encryption_client to ACCEPTED, REQUESTED or REQUIRED
oracle.net.encryption_types_client	A combination of one or more of the following values: (AES128), (AES192), (AES256), (3DES168), (3DES112), (DES56C), (DES40C), (RC4_256), (RC4_128), and (RC4_40, RC4_56)	(AES256, AES192, AES128, 3DES168, 3DES112, DES56C, DES40C, RC4_256, RC4_128, RC4_40, RC4_56)	Defines the different types of encryption algorithms the client/OMS supports. Set this parameter to the same type the sqlnet.encryption_types_server parameter is set to on your repository database sqlnet.ora.

Property	Possible Values	Default OMS Values	Description
oracle.net.crypto_checksum_client	REJECTED, ACCEPTED, REQUESTED, and REQUIRED	REQUESTED	Defines the client/OMS checksum. This parameter must be set to ACCEPTED, REQUESTED or REQUIRED to use secure connections. If it is set to REJECTED, data encryption is not possible. If the oracle.net.crypto_checksum_server is: • ACCEPTED, then set oracle.net.crypto_checksum_client to REQUESTED or REQUIRED. • REQUESTED or REQUIRED, then set oracle.net.crypto_checksum_client to ACCEPTED, REQUESTED or REQUIRED
oracle.net.crypto_checksum_types_client	A combination of one or more of the following values: (SHA1), (SHA256), (MD5), (SHA384), and (SHA512)	(MD5, SHA1, SHA256)	This property defines the different types of checksums algorithms the client/OMS supports. This parameter is set to the same type the sqlnet.crypto_checksum_types_server is set to on the repository database sqlnet.ora. **Note**: Starting with Oracle Enterprise Manager 13c Release 5 Update 25 (13.5.0.25), the default OMS values are (MD5, SHA1, SHA256). The default values are (MD5, SHA1) for the earlier versions.

3. Restart the OMS:

```
<OMS_HOME>/bin/emctl start oms
```

Note that in order for the repository database to also be a *managed* target, you must complete the steps in **Enabling Oracle Advanced Security for the OMS to Connect to Target Databases**.

Enabling Oracle Advanced Security for Management Agents to Connect to Target Databases

If you have enabled the network encryption of data for your Management Repository database or any target database, you must also enable this for the management agents monitoring these databases.

If a management agent is not specifically configured for certain types of encryption and integrity algorithms, the JDBC default values are honored. See the table below for these default values.

To set different types of encryption and integrity algorithms values, follow these steps:

1. Set the properties with the agent using the command:

```
<AGENT_HOME>/bin/emctl setproperty agent -name <Property Name> -value
"<Value>"
```

where the property names and values are listed below.

Property	Possible Values	Default Agent Values	Description
connectionEncryptionLevel	REJECTED, ACCEPTED, REQUESTED, and REQUIRED.	ACCEPTED	Defines the client/agent encryption. This parameter must be set to ACCEPTED, REQUESTED or REQUIRED to use secure connections. If it is set to REJECTED, data encryption is not possible. If the sqlnet.encryption_server parameter is: • ACCEPTED, then set connectionEncryptionLevel to REQUESTED or REQUIRED. • REQUESTED or REQUIRED, then set connectionEncryptionLevel to ACCEPTED, REQUESTED or REQUIRED
connectionEncryptionType	(AES128), (AES192) and (AES256)	NULL Client and server negotiate.	Defines the different types of encryption algorithms the client/agent supports. Set this parameter to the same type(s) the sqlnet.encryption_types_server parameter is set to on your repository database sqlnet.ora. For example, <AGENT_HOME>/bin/emctl setproperty agent -name connectionEncryptionType -value "AES128,AES192,AES256"

Property	Possible Values	Default Agent Values	Description
connectionChecksumLevel	REJECTED, ACCEPTED, REQUESTED, and REQUIRED.	ACCEPTED	Defines the client/agent checksum. This parameter must be set to ACCEPTED, REQUESTED or REQUIRED to use secure connections. If it is set to REJECTED, data encryption is not possible. If the oracle.net.crypto_checksum_server parameter is: • ACCEPTED, then set connectionChecksumLevel to REQUESTED or REQUIRED. • REQUESTED or REQUIRED, then set connectionChecksumLevel to ACCEPTED, REQUESTED or REQUIRED
connectionChecksumType	(SHA256), (SHA384), and (SHA512)	NULL Client and server negotiate.	This property defines the different types of checksums algorithms the client/agent supports. Set this parameter to the same type(s) the sqlnet.crypto_checksum_types_server is set to on the repository database sqlnet.ora. For example, <AGENT_HOME>/bin/emctl setproperty agent -name connectionChecksumType -value "SHA256,SHA384,SHA512"

2. Restart the management agent:

```
<AGENT_HOME>/bin/emctl stop agent

<AGENT_HOME>/bin/emctl start agent
```

Enabling Oracle Advanced Security for the OMS to Connect to Target Databases

Perform the following steps to enable network data encryption between a target database and the OMS:

1. Enable a target database network data encryption. See **Enabling Oracle Advanced Security for the Management Repository**.
2. Enable encryption for the OMS:

a. Set the `enableEncryption` value for the OMS:

```
emctl set property -name oracle.sysman.core.conn.enableEncryption -
value TRUE -sysman_pwd <your_sysman_password>
```

b. Based on the value set on the repository side, set the different types of checksum algorithms the client supports using this command:

```
<OMS_HOME>/bin/emctl set property -name
oracle.sysman.core.conn.crypto_checksum_types_client -value
"<repository checksum type>"
```

Examples:

If the `sqlnet.ora` parameter `sqlnet.crypto_checksum_types_server=(SHA256)`, set the OMS value:

```
<OMS_HOME>/bin/emctl set property -name
oracle.sysman.core.conn.crypto_checksum_types_client -value "SHA256"
```

If the `sqlnet.ora` parameter is set to multiple values such as `sqlnet.crypto_checksum_types_server=(SHA256,SHA384,SHA512)`, set the OMS value:

```
<OMS_HOME>/bin/emctl set property -name
oracle.sysman.core.conn.crypto_checksum_types_client -value
"SHA256,SHA384,SHA512"
```

c. Restart the OMS and any other OMS instances, if a multi-OMS system:

```
<OMS_ORACLE_HOME>/bin/emctl stop oms -all -force


<OMS_HOME>/bin/emctl start oms
```

d. Set these additional OMS properties if the default values are not your required setup, using the following command:

```
emctl set property -name <property> -value "<value>"
```

The additional possible security properties that should be set for the OMS are listed in table below:

Property	Possible Values	Default OMS Values	Description
oracle.net.encryption_client	REJECTED, ACCEPTED, REQUESTED, and REQUIRED.	REQUESTED	Defines the client/OMS encryption. This parameter must be set to ACCEPTED, REQUESTED or REQUIRED to use secure connections. If it is set to REJECTED, data encryption is not possible. If sqlnet.encryption_server parameter is: • ACCEPTED, then set oracle.net.encryption_client to REQUESTED or REQUIRED. • REQUESTED or REQUIRED, then set oracle.net.encryption_client to ACCEPTED, REQUESTED or REQUIRED
oracle.sysman.core.conn.encryption_types_client	A combination of one or more of the following values: (AES128), (AES192), (AES256), (3DES168), (3DES112), (DES56C), (DES40C), (RC4_256), (RC4_128), and (RC4_40, RC4_56)	(AES256, AES192, AES128, 3DES168, 3DES112, DES56C, DES40C, RC4_256, RC4_128, RC4_40, RC4_56)	Defines the different types of encryption algorithms the client/OMS supports. Set this parameter to the same type the sqlnet.encryption_types_server parameter is set to on your repository database sqlnet.ora.
oracle.net.crypto_checksum_client	REJECTED, ACCEPTED, REQUESTED, and REQUIRED	REQUESTED	Defines the client/OMS checksum. This parameter must be set to ACCEPTED, REQUESTED or REQUIRED to use secure connections. If it is set to REJECTED, data encryption is not possible. If the oracle.net.crypto_checksum_server is: • ACCEPTED, then set oracle.net.crypto_checksum_client to REQUESTED or REQUIRED. • REQUESTED or REQUIRED, then set oracle.net.crypto_checksum_client to ACCEPTED, REQUESTED or REQUIRED

Property	Possible Values	Default OMS Values	Description
oracle.sysman.core.conn.crypto_checksum_types_client	A combination of one or more of the following values: (SHA1), (SHA256), (MD5), (SHA384), and (SHA512)	(MD5, SHA1, SHA256)	This property defines the different types of checksums algorithms the client/OMS supports. This parameter is set to the same type the sqlnet.crypto_checksum_types_server is set to on the repository database sqlnet.ora. **Note**: Starting with Oracle Enterprise Manager 13c Release 5 Update 25 (13.5.0.25), the default OMS values are (MD5, SHA1, SHA256). The default values are (MD5, SHA1) for the earlier versions.

Custom Configurations

Configuring Custom Certificates for WebLogic Server

WebLogic Servers installed as part of Enterprise Manager Cloud control (Administration Server and Managed Servers) are configured with a default identity keystore (DemoIdentity.jks) and a default trust keystore (DemoTrust.jks). In addition, WebLogic Server trusts the CA certificates in the JDK cacerts file. This default keystore configuration is appropriate for testing and development purposes. However, these keystores should not be used in a production environment.

Default Demo Certificate configured for WLS has a key length of 512 bits. If Microsoft's Security update for minimum certificate key length (KB2661254) has been applied on the browser m/c, the WebLogic Admin Console will not be accessible on Internet Explorer. If you want to access WebLogic Admin Console using Internet Explorer, please configure custom certificate for WLS.

The following sections step you through configuring custom Weblogic Server certificates:

1. Create a Java KeyStore or Wallet for each OMS
2. Import Custom CA Certificates into the Agents Monitoring Trust Store
3. Configure the Custom Certificate for each WLS

> **Note:**
>
> This procedure is applicable to Enterprise Manager 12c Cloud Control (12.1.0.2) and higher.

Create a Java KeyStore or Wallet for each OMS

1. Create a java keystore (JKS) for each OMS in the environment.

Regardless of whether the OMS is configured with a server load balancer or not, specify the OMS machine name for CN (Example: CN=myoms.example.com) while generating the Certificate Signing Request (CSR). The OMS machine name can be found from the value of EM_INSTANCE_HOST property in <EM_INSTANCE_HOME>/emgc.properties.

Make a note of the keystore password, private key entry's alias, and private key password of each keystore.

Note: Use only the signature algorithms supported by WLS.

2. Copy the keystores to corresponding OMS machines or place them in a location accessible from OMS machines.

   Example: The keystores are `/scratch/oms1.jks`, `/scratch/oms2.jks` , `/scratch/oms3.jks`

3. Write the CA certificates to individual files (one CA certificate per file). Either copy these certificate files to the OMS machines or place them in a location accessible from the OMS machines.

   Example: The filenames are `/scratch/ca1cert.cer`, `/scratch/ca2cert.cer`, `/scratch/ca3cert.cer`

Import Custom CA Certificates into the Agents Monitoring Trust Store

Execute the following steps on Management Agents running on the OMS machines which are installed along with the OMS.

> **Note:**
>
> Only required on Agents installed along with OMS and not on any other Agents.

1. Stop the Agent

   ```
   <Agent_Instance_Home>/bin/emctl stop agent
   ```

2. Import the custom CA certificate into Agent:

   ```
   <Agent_Instance_Home>/bin/emctl secure add_trust_cert_to_jks
   -trust_certs_loc <ca_cert_file>
   -alias <certalias> [-password <montrust_jks_pwd>]
   ```

   Example:

   ```
   <Agent_Instance_Home>/bin/emctl secure add_trust_cert_to_jks -trust_certs_loc /
   scratch/ca1cert.cer
   -alias ca1certalias [-password welcome]
   ```

   Repeat this step for each CA involved in issuing the custom certificate.

   Specify different alias each time.

3. Start the Agent.

   ```
   <Agent_Instance_Home>/bin/emctl
   ```

Configure the Custom Certificate for each WLS

Execute the following steps on each OMS:

1. Stop the OMS.

```
<OMS_Home>/bin/emctl stop oms
```

2. Run the following cmd:

```
emctl secure wls
(-jks_loc <loc> -jks_pvtkey_alias <alias> [-jks_pwd <pwd>] [-jks_pvtkey_pwd <pwd>] |
-wallet <loc>)
Specify jks_loc,jks_pvtkey_alias or wallet
```

Example:

```
<OMS_OH>/bin/emctl secure wls
-jks_loc /scratch/oms1.jks -jks_pvtkey_alias pvtkey1alias

<OMS_OH>/bin/emctl secure wls -wallet /scratch/omswallet
```

3. Stop the OMS.

```
<OMS_Home>/bin/emctl stop oms -all
```

4. Start the OMS.

> **Note:**
>
> Above steps need to be repeated on all the Management Services.

```
<OMS_Home>/bin/emctl start oms
```

Rolling back the WebLogic Servers to Demonstration Certificate

If you need to switch to using the default WebLogic demonstration certificates, execute the following steps on each OMS.

1. Stop the OMS.

```
<OMS_Home>/bin/emctl stop oms
```

2. Run the following command:

```
<OMS_Home>/bin/emctl secure wls -use_demo_cert
```

3. Stop the OMS.

```
<OMS_Home>/bin/emctl stop oms -all
```

4. Start the OMS.

```
<OMS_Home>/bin/emctl start oms
```

> **Note:**
>
> The above steps need to be excuted on all Management Services.

Configuring Custom Certificates for OMS Console Access

To configure the third party certificate for HTTPS WebTier Virtual Host:

1. Create a wallet for each OMS in the Cloud. Specify the host name of the machine where the OMS is installed or the Load Balancer Name if the OMS is behind the Server Load Balancer for Common Name.
2. Run the following command on each OMS and the restart that OMS:

```
emctl secure console -wallet <location of custom wallets> -self_signed [-host]
```

> **Note:**
>
> One of the arguments `-wallet` or `-self_signed` is mandatory.

> **Note:**
>
> Only Single-Sign-On (SSO) wallets are supported.

Configuring Custom Certificates for OMS Upload Access

You can configure the third party certificate for the HTTPS Upload Virtual Host in two ways:

Method I

1. Create a wallet for each OMS in the Cloud.
2. While creating the wallet, specify the host name of the machine where the OMS is installed or the Load Balancer Name if the OMS is behind the Load Balancer for Common Name.
3. Write the certificates of all the Certificate Authorities in the certificate chain (like the Root Certificate Authority, Intermediate Certificate Authority) into a file named `trusted_certs.txt`.
4. Download or copy the `trusted_certs.txt` file to the host machines on which each Agent that is communicating with the OMS is running.
5. Import the custom CA certificate(s) as trust certificate(s) for Agent by running the following command:

```
emctl secure add_trust_cert -trust_certs_loc <location of the trusted_certs.txt file>
```

6. Restart the Agent.
7. Secure the OMS and restart it.

```
emctl secure oms -wallet <location of wallet> -trust_certs_loc <loc of
trusted_certs.txt> [any other options]
```

Method 2

1. Create a wallet for each OMS in the Cloud.
2. Specify the host name of the machine where the OMS is installed or the Load Balancer Name if the OMS is behind the Server Load Balancer for Common Name (CN).
3. Write the certificates of all the Certificate Authorities in the certificate chain (like the Root Certificate Authority, Intermediate Certificate Authority) into a file named `trusted_certs.txt`.
4. Secure the OMS.

```
emctl secure oms -wallet <location of wallet> -trust_certs_loc <loc of
trusted_certs.txt> [any other options]
```

5. Restart the OMS.
6. Either re-secure the Agent by running the `emctl secure agent` command (should be run on all Agents) or import the trust points by running the `emctl secure` command.

> **Note:**
>
> The trusted certs file (trusted_certs.txt) should contain only certificates in base64 format and not any special characters or comments..

Secure Communication Setup Tools

The following emctl commands are used to secure various components of the Enterprise Manager infrastructure.

emctl secure oms

```
emctl secure oms [-reg_pwd <registration password>]
        [-host <hostname>] [-ms_hostname <Managed Server hostname>]
        [-slb_port <SLB HTTPS upload port>] [-slb_console_port <ty6 HTTPS console port>]
[-no_slb]
        [-secure_port <OHS HTTPS upload Port>] [-upload_http_port <OHS HTTP upload port>]
        [-reset] [-console] [-force_newca]
        [-lock_upload] [-lock_console] [-unlock_upload] [-unlock_console]
        [-wallet <wallet_loc> -trust_certs_loc <certs_loc>]
        [-key_strength <strength>] [-sign_alg <md5|sha1|sha256|sha384|sha512>]
        [-cert_validity <validity>] [-protocol <protocol>]
        [-root_dc <root_dc>] [-root_country <root_country>] [-root_email <root_email>]
        [-root_state <root_state>] [-root_loc <root_loc>] [-root_org <root_org>] [-
root_unit <root_unit>]
```

Parameter	Description
reg_pwd	The Management Agent registration password.
host	The host name to be used in the certificate used by the Oracle Management Service. You may need to use the SLB host name if there is an SLB before the Management Service.
reset	A new certificate authority will be created. All the Agents and Oracle Management Services need to be resecured.
secure_port	Specify this to change HTTPS Upload port on WebTier.
upload_http_port	Specify this to change HTTP Upload port on WebTier
slb_port	This parameter is required when Server Load Balancer is used. It specifies the secure upload port configured in the Server Load Balancer.
slb_console_port	This parameter is required when Server Load Balancer is used. It specifies the secure console port configured in the Server Load Balancer.
no_slb	Remove SLB configuration.
root_dc	The domain component used in the root certificate. The default value is com.
root_country	The country to be used in the root certificate. The default value is US.
root_state	The state to be used in the root certificate. The default value is CA.

Parameter	Description
root_loc	The location to be used in the root certificate. The default value is EnterpriseManager on <hostname>.
root_org	The organization name to be used in the root certificate. The default value is EnterpriseManager on <hostname>.
root_unit	The organizational unit to be used in the root certificate. The default value is EnterpriseManager on <hostname>.
root_email	The email address to be used in the root certificate. The default value is EnterpriseManager@<hostname>.
wallet	This is the location of the wallet containing the third party certificate. This parameter should be specified while configuring third party certificates.
trust_certs_loc	The location of the `trusted_certs.txt` (required when third party certificates are used).
key_strength	The strength of the key to be used. Valid values are 512, 1024, 2048, and 4096. **Note**: For the IBM AIX Platform, the maximum allowed key_strength is 2048 bits.
cert_validity	The number of days for which the self-signed certificate is valid. The valid range is between 1 to 3650.
protocol	This parameter is used to configure Oracle Management Service in TLSv1-only or SSLv3-only or mixed mode (default). Valid values are the allowed values as per **Apache's SSLProtocol** directive. Note: The key_strength and cert_validity parameters are applicable only when the -wallet option is not used.
force_newca	If specified, any Agents that are still configured with an older Certificate Authority are ignored.
ms_hostname	Managed Server's hostname.
sign_alg	Signature algorithm.
lock	Locks the Upload
lock_console	Locks the Console
console	If specified, the certificate is recreated for the HTTPS console port as well.

emctl secure agent

Secures the agent against an OMS. The registration password (or password file) must be provided.

```
emctl secure agent <registration password> [-passwd_file <absolute path to file>]
```

emctl secure wls

```
emctl secure wls (-jks_loc <loc> -jks_pvtkey_alias <alias> | -wallet <loc> | -
use_demo_cert)
Specify jks_loc,jks_pvtkey_alias or wallet or use_demo_cert
        [-jks_pwd <pwd>] [-jks_pvtkey_pwd <pwd>]
        -jks_loc : Location of JKS containing the custom cert for Admin & Managed Servers
        -jks_pvtkey_alias : JKS's private key alias
        -jks_pwd : JKS's keystore password
        -jks_pvtkey_pwd : JKS's private key password
        -wallet : Location of wallet containing the custom cert for Admin & Managed
```

```
Servers
        -use_demo_cert: Configure the demo cert for Admin & Managed Servers
```

emctl status oms -details

```
emctl status oms -details
```

Configuring Third Party Certificates

You can configure third party certificates for:

- HTTPS Console Users
- HTTPS Upload Virtual Host

> **Note:**
>
> Only Single Sign-On wallets are supported.

Configuring a Third Party Certificate for HTTPS Console Users

To configure the third party certificate for HTTPS WebTier Virtual Host:

1. Create a wallet for each OMS. Specify the host name of the machine where the OMS is installed or the Load Balancer Name if the OMS is behind the Server Load Balancer for Common Name.
2. Run the following command on each OMS and the restart that OMS:

   ```
   emctl secure console -wallet <location of custom wallets> -self_signed [-host]
   ```

   > **Note:**
   >
   > One of the arguments `-wallet` or `-self_signed` is mandatory.

   > **Note:**
   >
   > Only single-sign-on wallets are supported.

Configuring Third Party Certificate for HTTPS Upload Virtual Host

You can configure the third party certificate for the HTTPS Upload Virtual Host in two ways:

Method I

1. Create a wallet for each OMS.
2. While creating the wallet, specify the host name of the machine where the OMS is installed or the Load Balancer Name if the OMS is behind the Load Balancer for Common Name.

3. Write the certificates of all the Certificate Authorities in the certificate chain (like the Root Certificate Authority, Intermediate Certificate Authority) into a file named `trusted_certs.txt`.
4. Download or copy the `trusted_certs.txt` file to the host machines on which each Agent that is communicating with the OMS is running.
5. Run the add_trust_cert command on each Agent and then restart that Agent.

   ```
   emctl secure add_trust_cert -trust_certs_loc <location of the trusted_certs.txt file>
   ```

6. Secure the OMS and restart it.

   ```
   emctl secure oms -wallet <location of wallet> -trust_certs_loc <loc of
   trusted_certs.txt> [any other options]
   ```

Method 2

1. Create a wallet for each OMS in the Cloud.
2. Specify the host name of the machine where the OMS is installed or the Load Balancer Name if the OMS is behind the Server Load Balancer for Common Name (CN).
3. Write the certificates of all the Certificate Authorities in the certificate chain (like the Root Certificate Authority, Intermediate Certificate Authority) into a file named `trusted_certs.txt`.
4. Restart the OMS after it has been secured.

   ```
   emctl secure oms -wallet <location of wallet> -trust_certs_loc <loc of
   trusted_certs.txt> [any other options]
   ```

5. Either re-secure the Agent by running the `emctl secure agent` command (should be run on all Agents) or import the trust points by running the `emctl secure add_trust_cert -trust_certs_loc <location of the trusted_certs.txt file>` command. The `-trust_certs_loc` parameter must contain the path and the filename of the `trusted_certs.txt` file.

> **Note:**
>
> This file must only contain certificates in base64 format and no special characters or empty lines.

For more information, see How to Configure the Enterprise Manager Management Service (OMS) with Secure Socket Layer (SSL) Certificates.

Configuring and Using Target Credentials

The following topics are discussed in this section:

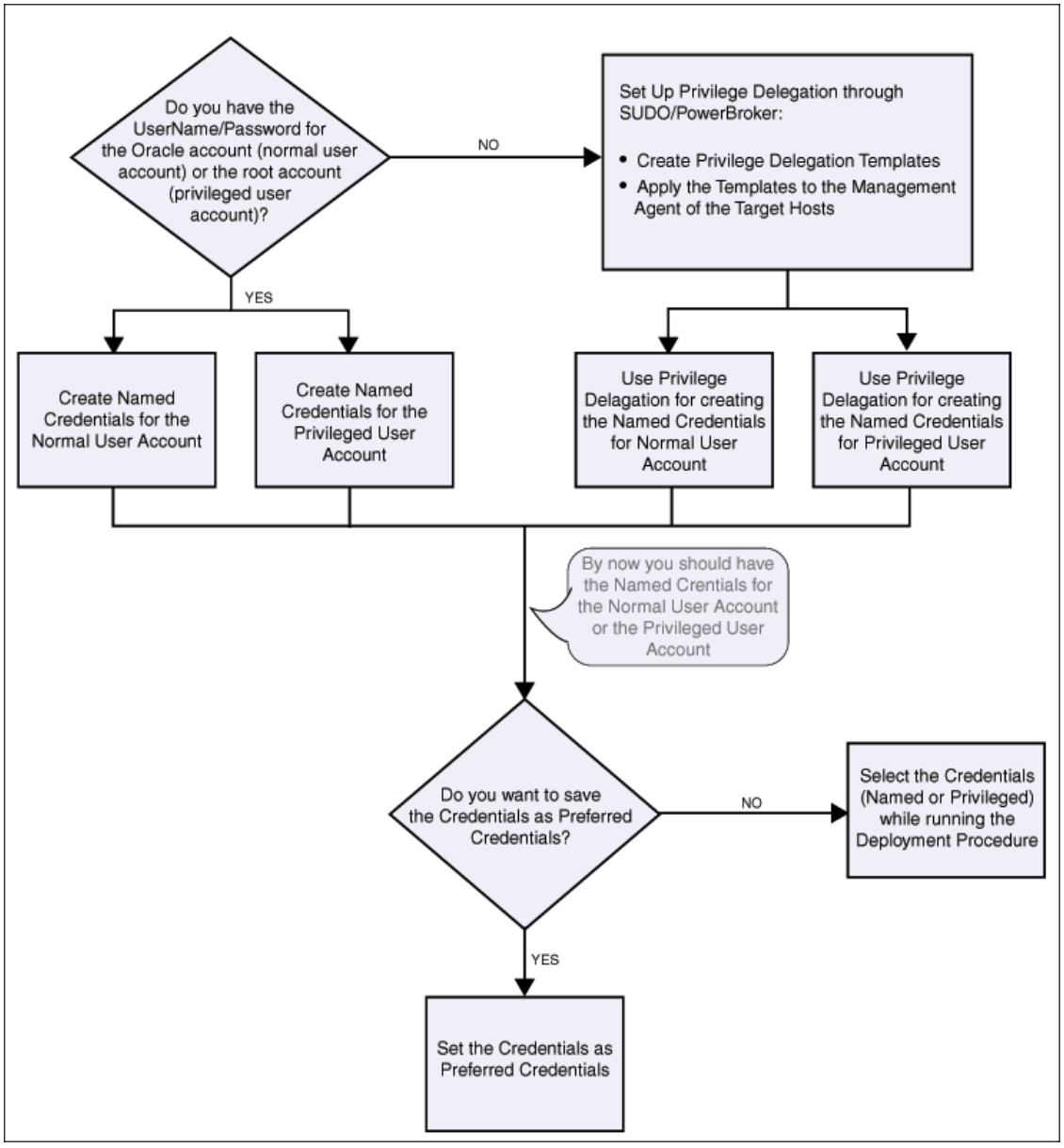
- Credential Subsystem
- Pluggable Authentication Modules (PAM) Support
- Sudo and Powerbroker Support

During a Zero Downtime (ZDT) maintenance period, no credentials can be created, updated, or deleted by using the EM CLI commands `create_credential_set`, `delete_credential_set`, and `update_credential_set`. Additionally, in the same maintenance period, the monitoring

credentials cannot be set or cleared using either the Enterprise Manager console or the EM CLI commands `set_monitoring_credential` and `clear_monitoring_credential`.

Credential Subsystem

Credentials like user names and passwords are typically required to access targets such as databases, application servers, and hosts. The following flow chart illustrates the typical credential setup workflow.



Credentials are encrypted and stored in Enterprise Manager. The credential subsystem supports, in addition to basic username-password, strong authentication schemes such as PKI, SSH keys and Kerberos. SSH key based host authentication, used by jobs, deployment procedures and other Enterprise Manger subsystems, is now supported.

By using appropriate credentials, you can:

- Collect metrics in the background as well as real-time
- Perform jobs such as backup, patching, and cloning
- Perform real-time target administration such as start, and stop
- Connect to My Oracle Support

Based on their usage, credentials can be classified into the following categories:

- **Named Credentials**
- Privileged Credentials
- Monitoring Credentials
- Preferred Credentials

Named Credentials

Credentials are stored within Enterprise Manager as "named" entities. Administrators define and store credentials within Enterprise Manager and refer to the credential by a credential name.The advantages of saving the credentials are:

- You do not have to expose the credential details to all the users.
- It saves your time and effort as you do not have to specify the user name and password every time for each Oracle home or host machine, you can instead select a named profile that has used the saved credentials.

Named Credentials can be a username/password pair like the operating system login credentials, or Oracle home owner credentials primarily used for performing operations such as running jobs, patching and other system management tasks. For example, an administrator can store the username and password they want to use for patching as "MyPatchingCreds". He can later submit a patching job that uses "MyPatchingCreds" to patch a production databases.

Typical Scenarios for Using Named Credentials

- In data centers where only senior DBAs have knowledge of higher privileged credential, *sys* credentials for database, for example, they can store these credentials in named credential and share these with the junior administrators. Junior administrators can perform their jobs using the named credentials without knowing what the actual credentials are.
- In data centers where administrators have the same credentials for a target. They can create one named credential containing those credentials and share the named credential with appropriate personnel. This simplifies credential maintenance (changing passwords, for example) by eliminating the need to several copies of named credentials containing the same credentials.

> **Note:**
>
> For a video tutorial on using named credentials, see:
>
> *Oracle Enterprise Manager 13c: Create and Use Named Credentials*
>
> `https://apex.oracle.com/pls/apex/f?p=44785:24:0::NO:24:P24_CONTENT_ID,P24_PREV_PAGE:5460,1`

There are two category scopes of named credentials:

- **Global Named Credential**

  A global named credential is an entity, containing authentication information for a target type. A global named credential can be applied to any Enterprise Manager target type at the time of its creation or, at a later time. Global named credentials consist of the credential type (also known as the authentication scheme) and the credential properties (also known as the authentication parameters).

  Each target type may have one or more credential types,

  For example:

  hostA has password based (requiring username/password) and SSH key (requiring public/private key pair) credential type and database *instanceA* has password based and Kerberos based credential type.

  Credential properties consist of the information needed for the credential type and may also contain parameters, if being used for Privilege Delegation, PDP, for more information about PDP, see the section on Privilege Delegation, for possible commands and parameters.

  As global named credentials are initially set up as independent entities, an Enterprise Manger administrator can associate this type of credential with a target type at a later time.

- **Target Named Credentials**

  A target named credential is an entity, containing credential information applied to a specific target. A target named credential can be applied to an Enterprise Manager target and is applied at the time of creation. This entity will also contain a credential type (whether it is username/password or public/private key pair) along with credential parameters (In the case of PDP settings, the location of the PDP utility being used and the parameters and command to be run) for a target type.

Access Control

In order to create a named credential an administrator must have the CREATE_CREDENTIAL privilege. Once the administrator with the CREATE_CREDENTIAL privilege creates a named credential, he is considered the owner of that named credential. The owner of a named credential can share access to the named credential at any time. He is considered the grantor administrator. The administrator granted access to the named credential is the grantee administrator. The owner can share access to the named credential by granting the appropriate level of privilege to one or many grantee administrators. The type of privilege granted by the owner of the named credential depends on the level of access needed by the grantee administrator. The following privilege levels are available for all named credentials:

- **VIEW**: The VIEW privilege is the default privilege level. Grantee administrators with VIEW privilege on a named credential will be able to use that named credential to run jobs, patching operations and other system management activities within Enterprise Manager. The grantee administrator will also be able to view the non-sensitive details (for example, SUDO or PowerBroker and the commands being used) and username of the named credential. The grantee administrator will not be able to view any sensitive information of the named credential such as the password and public/private key.
- **EDIT**: The EDIT privilege level also contains VIEW level privileges. Grantee administrators with EDIT privilege on a named credential can use that named credential to run jobs, patch operations and other management activities within Enterprise Manager. The grantee administrator will also be able to change the sensitive information such as the password, or the public/private key pair of that named credential. The grantee administrator can change

both the Credential Type (such as Host or SSH key) of the named credential as well as the username for the credential. The authenticating target type cannot be changed.

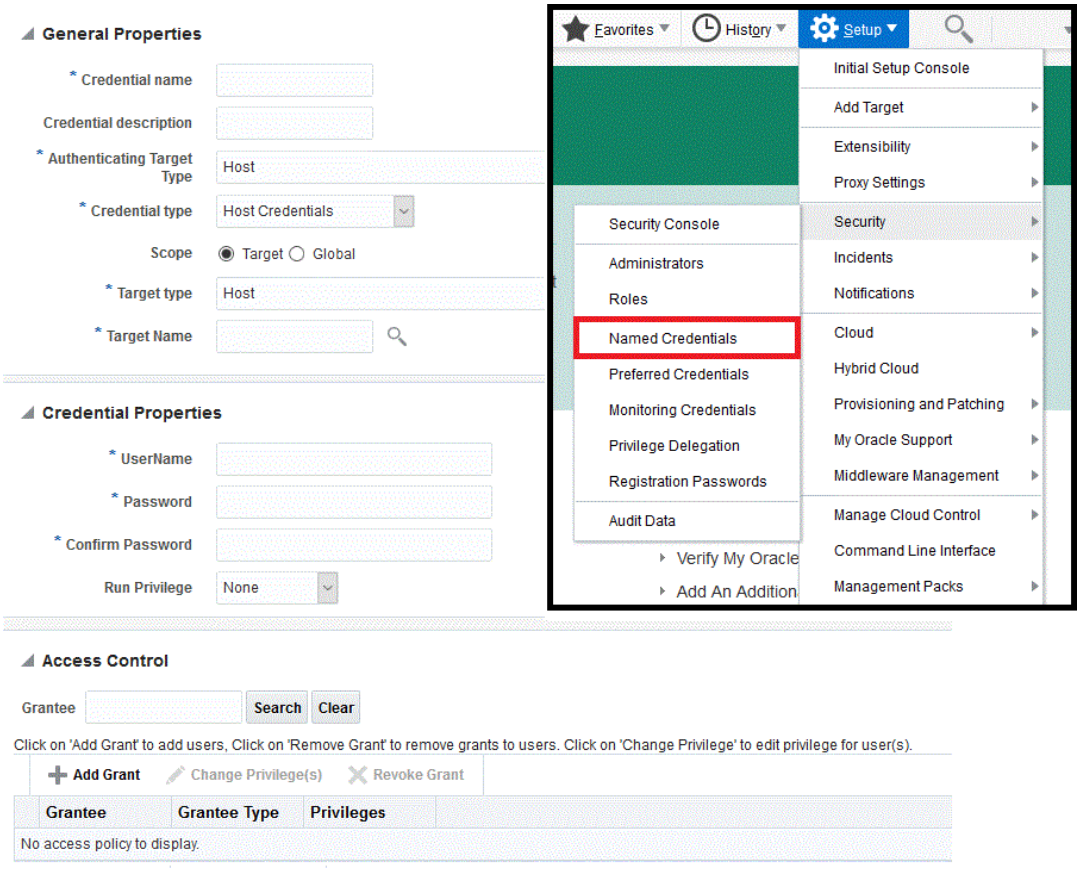
- **FULL**: The FULL privilege contains both VIEW and EDIT. Grantee administrators with FULL privilege on a named credential will be able to use that named credential for running jobs, patching operations and other management activities within Enterprise Manager. The grantee administrator will also be able to change the named credential username, sensitive information such as the password or the public/private key pair, and Credential Type (Host, SSH key etc). An administrator with FULL privilege on a named credential will also be able to delete that named credential.

Creating Named Credentials

You must have the *Named Credential* resource privilege to create named credentials.

To create named credentials, follow these steps:

1. In Cloud Control, from the **Setup** menu, select **Security**, then select **Named Credentials**.
2. On the Named Credentials page, click **Create**.
3. On the Create Credentials page, in the General Properties section, provide the following details:
   a. Enter a unique **Credential Name**, and provide a description.
   b. Select **Host** as the Authentication Target Type, and **Host Credentials** as the Credential type
   c. Select **Global** to use the same credentials for all the targets.
4. On the Create Credentials page, in the Credential Properties section, enter the **UserName** and **Password** required to access the host machine, and from the Run Privilege drop down list, do one of the following:
   - Select **None**, if you are using operating system host credentials (like *Oracle*) or the Oracle Home Owner credentials.
   - When you do not have access to the operating system host credentials or the `root` credentials of the host machine, then select **Sudo** or **PowerBroker** to `SUDO` (or `pbrun`) to the host machine using the credentials of another operating system user. To use the credentials of other users, in the **Run As** field, you need to enter operating system host credentials (like *Oracle*) or Oracle Home owner credentials of the host user.



5. On the Create Credentials page, in the Access Control section, click **Add Grant** to grant privileges on the named profile to the selected Administrators or roles. By default the selected Administrator is granted View privilege.

> **Note:**
>
> To enable Administrators (or users) to access, and leverage an OMS Agent Filesystem Software Library Location, the owner of the Named Credential must ensure that an explicit View privilege is granted to all the Administrators accesssing the OMS Agent location. To do so, you can either click **Add Grant** and add the names of the administrators while creating the Named Credential as mentioned in this section, or edit an existing Named Credential to grant privileges to other Administrators (or users) by following these steps:
>
> a. In Cloud Control, from the **Setup** menu, select **Security**, then select **Named Credentials**.
>
> b. On the Named Credentials page, click **Manage Access**.
>
> c. On the Manage Access page, click **Add Grant** to add a user, or **Change Privilege** to edit the privileges of an existing user.
>
> d. Click **Save.**
>
> For example, if you have a Cloud Plug-in installed, and are using the Cloud features in Enterprise Manager, then ensure that the `CLOUD_ENGINE_USER` is also granted **View** privileges on credentials associated with Software Library. Since the `CLOUD_ENGINE_USER` is a hidden user account, the owner of the named credential will not be able to grant him View privileges from the Enterprise Manager UI. To handle this situation, (especially on a Windows host where OMS Agent Filesystem is the recommended approach for setting up Software Library) you can run the following EMCLI commands:
>
> ```
> emcli login -username=<username> -password=<password>
> emcli grant_privs -name=CLOUD_ENGINE_USER -
> privilege="GET_CREDENTIAL;CRED_NAME=<>:CRDED_OWNER=<>"
> ```

To change the privilege, select the administrator, and click **Change Privilege**. In the Select Privilege dialog box, change the privilege to **Edit** or **Full**, and then click **OK**.

6. After entering all the details, click **Test and Save.** If the host credentials are correct, then the test is successful and the credentials get saved.

Enterprise Manager Administrators will be able to grant privileges to other administrators while creating the credential or by granting the privileges when editing the credential.

From the Named Credential page, you can **Create** a new named credential, **Edit** an existing credential, **Manage Access** (grant/revoke privileges), **Delete**, **Test**, **View References**, or click the *Query by Example* icon to filter the list of named credentials.

Only the credential owner can manage access their credentials. When a credential owner views references, he can see all references even if not owned by him. Whereas a user who does not own the credential, will see only their own references.

Access Control for Named Credentials

> **Note:**
>
> You must have the Named Credentials resource privilges in order to create a named credential.

The access control model for named credentials adhere to the following rules:

- Only named credential owners can grant privileges on named credentials they have created to other Enterprise Manager grantee administrators.
- Enterprise Manager Super Administrators cannot obtain any privileges on a newly created named credential until he is explicitly granted privileges on the named credential.
- Enterprise Manager administrators regardless of privilege level, cannot see the sensitive fields such as passwords and private keys from the console UI. This is achieved by replacing password with "*" characters.
- Named credential privileges cannot be assigned to a role. This eliminates back door entry by Enterprise Manager Super Administrators to grant themselves privileges on the credentials for which they do not have explicit access.
- An Enterprise Manager grantee administrator cannot view other administrators' credentials unless an explicit grant is provided by the owner. Even Enterprise Manager Super Administrators cannot view other users' named credentials by default.
- Any Enterprise Manager administrator can create his own named credentials and, by default, has FULL privileges on the named credentials owned.

Authentication Scheme

An authentication scheme is the type of authentication supported by a target type. For example, a host can support a username/password-based authentication, Public Key authentication or Kerberos authentication. In fact, each target type in an enterprise may support different authentication schemes. To accommodate the many authentication schemes that can exist in a managed environment, Enterprise Manger allows you to configure the credentials for these authentication schemes.

> **Note:**
>
> All the credentials owned by an Enterprise Manager administrator will be deleted if that administrator is deleted from Enterprise Manager. All references and grants to grantee administrators of that named credential will also be deleted. Since access to a named credential is not granted to a Super Administrator, by default, a super administrator cannot re-assign a named credential owned by another administrator, by default.

Privileged Credentials

Privileged Credentials specify root users' authentication information on a system. Privileged credentials are the root account details used to perform privileged actions like executing root scripts. Privileged credentials are intended for privileged or power users. You must set up privileged credentials to perform typical root user actions with SUDO privileges.

Creating Privileged Credentials

To create privileged credentials, follow these steps:

1. Create the Named credentials using the steps mentioned in Creating Named Credentials.
2. On the Named Credentials page, select the credential, and then click **Edit**.
3. On the Edit Credential Properties page, in the Credential Properties section, edit the existing **UserName** and **Password** required to access the host machine, and from the Run Privilege drop down list, do one of the following:
   - Select **None**, if you are using operating system host credentials (like *Oracle*) or the Oracle Home Owner credentials.
   - When you do not have access to the operating system host credentials or the `root` credentials of the host machine, then select **Sudo** or **PowerBroker** to `sudo` (or `pbrun`) to the host machine using the credentials of another operating system user. To use the credentials of other users, in the **Run As** field, you need to enter operating system host credentials (like *Oracle*) or Oracle Home owner credentials of the host user.

Monitoring Credentials

Monitoring credentials are used only by the Management Agent during the monitoring of specific types of targets. Targets requiring monitoring credentials will be displayed in the console. When targets are added to Enterprise Manager an administrator with the correct privilege will set up the monitoring credentials. An administrator must have the ADD_TARGET privilege to discover a target, and to enter the credentials for that target, he needs the CONFIGURE_TARGET privilege. Monitoring credentials are stored in the repository and propagated to the Agent. If the credentials are not set, the target will appear in the broken or down state, there will also be Metric Collection errors as the Agents will be unable to monitor without credentials.

To create or edit a monitoring credentials, from the **Setup** menu, choose **Security** and then **Monitoring Credentials**.

To modify monitoring credentials, select the desired target type and click **Manage Monitoring Credentials**. The monitoring credentials page for the selected target type displays. Alternatively, you can also modify monitoring credentials using EM CLI, as shown in the following example.

```
./emcli set_monitoring_credential -target_name=mytarget.myco.com
-target_type=host -cred_type=HostCreds -set_name=Bob
-attributes="HostUserName:dwwolf;HostPassword:xxxxx:PDPTYPE:SUDO;RUNAS:root"
```

Preferred Credentials

Preferred credentials are used to simplify access to managed targets by storing the login information for those targets in the Management Repository. For example, for a database target one may have multiple logins, but store a preferred username/password credential to log in to perform specific operations. With preferred credentials, administrators can access an Enterprise Manager target that recognizes those credentials without being prompted to log in to the target, as the login happens automatically with those preferred credentials. Preferred credentials can also be used to carry out administrative operations using the job system. Unlike named credentials, which defines an independent entity, containing the username/password or public/private key, along with a Credential Type and optional parameters, which can be granted to grantee administrators by a named credential owner, a preferred credential

is set up by each administrator for any target that they wish to access in a more convenient way.

To create a preferred credential:

1. From the Setup menu, select **Security** and then **Preferred Credentials**. The Preferred Credentials page displays.
2. Choose a target type from the list.
3. Click **Manage Preferred Credentials**. The Preferred Credentials page for the selected target type displays.

Example: An Enterprise Manager target owner defines two preferred credential sets for a host target: One named *HostCredNormal* and the other is named *HostCredPriv*. For simple operations he uses *HostCredNormal* as it uses a regular user (*myusername*/*password*) such as oracle/oracle123. However, he uses *HostCredPriv* for more privileged operations on that host as it uses the root user (*root*/*rootpasswd*). When submitting jobs, depending on the job, he could use either of these credential sets.

- **Default Preferred Credentials**: Default credentials are configured for a specific target type and is available for all the targets of that target type. It will be overridden by target preferred credentials.
- **Normal Host Credentials** (*HostCredNormal* in the example). Perform normal administrative operations.
- **Privileged Host Credentials** (*HostCredPriv* in the example). Perform privileged operations requiring root access.
- **Target Preferred Credentials**: Target preferred credentials are credentials set for a specific target. Target preferred credentials could be used by applications such as the job system, notifications, or patching. For example, if the administrator chooses to use target preferred credentials while submitting a job, then that target preferred credential set for the target (target credentials) will be used. If the target preferred credential is not present, then the default preferred credential (for the target type) will be used. If the default preferred credentials are not present, the job will fail. If not specified preferred credentials refer to preferred target credentials.

For example, to set the host preferred credentials, from the **Setup** menu, choose **Security** and then **Preferred Credential**. In the Preferred Credentials page, select the **Host** target type from the table and click **Manage Preferred Credentials**. The Host Preferred Credentials are displayed.

On this page, you can set both default and explicit preferred credentials for the host target types.

Global Preferred Credentials

Beginning with Enterprise Manager Release 12.1.0.4, preferred credentials can be globally scoped. Global preferred credentials provide a convenient way to implement system-wide credentials by allowing an administrator (with required privileges) to apply these credentials to all users for a specific target or to apply them to all users for a target type.

The following graphic shows the Host Preferred Credentials page. Settings on the *My Preferences* tab refer to the preferred credentials set by an administrator to apply to a specific target or target type.

Settings on the *Global Preferences* tab refer to the preferred credentials set by an Administrator (with required privileges) to apply to all users for a specific target or to apply to all users for all target types.

Required Privileges

The following privileges are required to use Global Preferred Credentials:

- *OPERATOR_ TARGET*: Required to use a Global Preferred Credential.
- *FULL_TARGET*: Required to set target-specific scope at the Global Preferences level.
- *FULL_ANY_TARGET*: Required to set target type scope at the Global Preferences level.

Hierarchy of Credential Preference

Preferred credentials are resolved in specific order. User-scoped preferences will always takes precedence. Enterprise Manager first searches at the target level, searching first for the preferred credential for that target name. If not found, it then searches for the target type (default) preferred credential. If these user-scoped preferences are not found, Enterprise Manager then repeats the same search at the Global scope, searching first for the target name preferred credential then target type (default) preferred credential.

Enterprise Manager provides a Credential Hierarchy table that depicts the hierarchy determining which preferred credential is used by the system.

The credential search order is always the same and continues until a preferred credential is found: If credentials are not found at one level, Enterprise Manager moves to the next level in the sequence as shown in the following table.

User/Target	User 1	User 2	User 3	...	All Users
Target 1					
Target 2					
Target 3		Level 1			Level 3
.					
.					
.					
All Targets		Level 2			Level 4

This example illustrates the hierarchy of preferred credentials chosen to complete a job if none is explicitly chosen during job execution. The order in which the preferred credential is chosen is always the same. In this example we will assume the job is running as User 2. The following order is always observed until a preferred credential is set at that level.

- Level 1 - My Preferences, Target Preferred Credential
- Level 2 - My Preferences, Default (Target Type) Preferred Credential
- Level 3 - Global Preferences Target Preferred Credential
- Level 4 - Global Preferences, Default (Target Type) Preferred Credential

It is assumed that the credential has been tested during setup. If a credential is not set at a specific level, the credential sub-system moves on to the next level (checking from level 1 to level 4) until a credential is found. The first credential found is the credential used for the job. Credentials set at subsequent levels are ignored.

Users preferences (preferred credentials), if set, always override *global* preferences.

Saving Preferred Credentials for Hosts and Oracle Homes

To save the credentials as preferred credentials in Enterprise Manager, follow these steps:

1. In Enterprise Manager, from the Setup menu, select **Security**, then select **Preferred Credentials**. The Preferred Credentials page displays.
2. On the Preferred Credentials page, select either **Host** or **Oracle Home** from the list of target types, and click **Manage Preferred Credentials**.

   Note: For setting up preferred credentials for virtual server targets, select **Oracle VM Server** as the target type and click the **Set Credentials.**

   - If you select **Host** for provisioning tasks, then the **Host Preferred Credentials** page appears.
   - On the Host Preferred Credentials page, in the Target Preferred Credentials section, select the host target on which you want to provision, and click **Set**.
3. On the Preferred Credentials page, from the table, select either **Host** or **Oracle Home**, and click **Manage Preferred Credentials**.
   - If you select Oracle Home for patching tasks, then the Oracle Home Preferred Credentials page appears.
   - On the Oracle Home Preferred Credentials page, in the Target Preferred Credentials section, select the Oracle home you want to patch. Ensure that you set both Normal and Privileged credentials for the targets selected, and click **Set**.

Saving Preferred Credentials to Access My Oracle Support

To register the My Oracle Support credentials as preferred credentials in Enterprise Manager, follow these steps:

1. In Enterprise Manager, from the **Setup** menu, select **My Oracle Support**, and then, click **Set Credentials**.
2. On the My Oracle Support page, provide the My Oracle Support credentials, and click **Apply**.

Oracle recommends you to register the My Oracle Support credentials as preferred credentials in Enterprise Manager so that you do not have to explicitly provide the credentials every time you access the My Oracle Support console, which is integrated within the Enterprise Manager console.

Managing Credentials Using EM CLI

You can manage passwords using EM CLI verbs. Using EM CLI, you can perform such actions as:

- Change the database user password in both the target database and Enterprise Manager.

  ```
  emcli update_db_password -change_at_target=Yes|No -change_all_reference=Yes|No
  ```

- Update a password which has already been changed at the host target.

  ```
  emcli update_host_password -change_all_reference=Yes|No
  ```

- Set preferred credentials for given users.

  ```
  emcli set_preferred_credential
  -set_name="set_name"
  -target_name="target_name"
  ```

```
-target_type="ttype"
-credential_name="cred_name"
[-credential_owner ="owner]"
```

And

```
emcli set_preferred_credential
-set_name="set_name"
-target_name="target_name"
-target_type="ttype"
-credential_name="cred_name"
[-credential_owner ="owner]"
```

- Determine if a specific target type has perferred credentials configured for it..

```
bin/emcli list -res=PreferredCredentials -bind="TargetType = 'host'
```

For a complete list of credential management verbs, refer to the *Enterprise Manager Command Line Interface* guide.

Host Authentication Features

This section covers the following topics:

- Setting Up SSH Key-based Host Authentication
- Setup Example Session
- Setting Up Host Preferred Credentials Using SSH Key Credentials
- Authenticating host credentials
- Configuring the PAM "emagent" Service
- Sudo and PowerBroker Support
- Creating a Privilege Delegation Setting

Setting Up SSH Key-based Host Authentication

Secure Shell or SSH allows data to be exchanged over the network using a secure channel between two devices. SSH is used primarily on Linux and Unix based systems. SSH was designed as a replacement for FTP, telnet and other unsecure remote shells, which send information, notably passwords in plaintext, leaving them open for interception. The encryption used by SSH provides confidentiality and integrity of data over an insecure network. SSH also protects the system against DNS spoofing attacks. This makes SSH a better choice in production environments over telnet/FTP and other username/password based authentications.

You can configure Enterprise Manager to use SSH while performing management operations, thus allowing Enterprise Manager administrators to leverage the security features provided by SSH along with the management capabilities of Enterprise Manager. When authenticating in this mode, the Agent acts as a Java SSH client and connect to the host using the username/password provided in the credential.

Enterprise Manager allows you to store a public-private key pair for administrators and allows them to view and install the public key on the hosts. Administrators can then submit jobs/patching operations in which they specify the credential that refers to the private key to perform the operation. The OMS passes the private key to the Agent along with the commands and the command parameters. Agent invokes the Java SSH client and attempts to connect to the host using the private key. Since the host already has the public key installed, it identifies the private key and successfully authenticates the Agent's Java SSH client. The Agent can now run the commands through the SSH client on the host to perform the requested operations.The

username used in the communication must be a valid OS user on both the host and the OMS. This is the username used in the named credential and not the username of the administrator invoking the operation.

Setup Example Session

To generate, manage, or convert SSH authentication keys, you use the *SSH-keygen* utility available on UNIX systems. This utility SSH-keygen tool provides different options to create with different strengths RSA keys for SSH protocol version 1 and RSA or DSA keys for use by SSH protocol version 2.

> **Note:**
>
> The procedure shown in this example assumes that you have a firm understanding of SSH setup procedures and user and host equivalence using public private key pair using SSH.

You are now ready to add the credential to Enterprise Manager.

1. From the **Setup** menu, select **Security**, then select **Named Credentials**.
2. On the Named Credentials page, click **Create**. The Create Credential page displays.
3. Enter a Credential Name. For example, SSHCRED1.
4. Select **Host** from the **Authenticating Target Type** drop-down menu.
5. Select **SSH Key Credentials** from the **Credential Type** drop-down menu.
6. Ensure that the SSH private key/public key files have been copied to the host on which the browser is running. Doing so makes navigating to the files from within the console easier when you click **Browse** in the next step.
7. From the **Credential Properties** region, enter a **UserName**. This username is a valid OS user that resides on both the Host and the OMS.
8. From the **Credential Properties** region, click **Browse** for **Public Key** and **Private Key** to upload the generated public key/private key files.
9. Click **Test and Save** to verify the credentials and save them. The new named credential will appear.

Example 2-11 Setting Up SSH key-based Authentication

```
$ ssh-keygen -t rsa
```

The command options instruct the utility to generate SSH keys (RSA key pair).

```
Generating public/private rsa key pair.
Enter file in which to save the key (/home/myhome/.ssh/id_rsa):
```

The path specified is the standard path to the location where SSH keys are stored ($HOME/.ssh).

```
Enter passphrase (empty for no passphrase)
```

Important: passphrase is not supported for use with SSH keys in named credentials.

```
Enter same passphrase again: (empty for no passphrase)
Your identification has been saved in /home/admin1/.ssh/id_rsa.
Your public key has been saved in /home/admin1/.ssh/id_rsa.pub.
```

```
The key fingerprint is:
bb:da:59:7a:fc:24:c6:9a:ee:dd:af:da:1b:1b:ed:7f admin1@myhost2170474
```

The ssh-regkey utility has now generated two files in the .ssh directory.

```
$ ls  id_rsa  id_rsa.pub
```

To permit access to the host without having SSH prompt for a password, copy the public key to the authorized_keys file on that system.

```
$ cp id_rsa.pub  authorized_keys
```

From this point, all keys listed in that file are allowed access.

Next, perform a remote logon using SSH. The system will not prompt you for a password.

```
$ ssh myhost
The authenticity of host 'myhost (10.229.147.184)' can't be established.
RSA key fingerprint is de:a0:2a:d5:23:f0:8a:72:98:74:2c:6f:bf:ad:5b:2b.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'myhost,10.229.147.184' (RSA) to the list of known hosts.
Last login: Mon Aug 29 16:48:45 2012 from anotherhost.example.com
$
```

> **Note:**
>
> To view an instructional video Oracle Enterprise Manager 13c: Create SSH Key Named Credentials, go to:
>
> ```
> https://apex.oracle.com/pls/apex/f?
> p=44785:24:0::NO:24:P24_CONTENT_ID,P24_PREV_PAGE:5724,1
> ```

Setting Up Host Preferred Credentials Using SSH Key Credentials

Enterprise Manager provides out-of-box support (12.1.0.4) for the use of SSH key credentials to be available and used as preferred credentials. SSH key credential sets are used to authenticate against targets. The introduction of SSH key credential sets is useful when a user name and password credential is unknown or when considering alternative security options. SSH keys use encryption methods which provide more confidentiality and integrity of data over an otherwise potentially insecure network. Providing this support out of the box, eliminates the Administrator from creating a custom SSH key credential and facilitates ease of use.

> **Note:**
>
> SSH Credentials are not supported for Windows operating systems.

To set SSH credentials as preferred credential:

1. From the **Setup** menu, select **Security** and then select **Preferred Credentials**.
2. Select the 'Agent' or 'Host' target type and then click **Manage Preferred Credential**.

   The Agent Preferred Credentials Setting page displays. See Preferred Credentials.

This page will default to the page that was last referenced by the administrator. To set the preferred credential, click the **My Preferences** tab, as shown in the image below.

3. Under the Default Preferred Credential region, which sets the preferred credential for all targets of the selected target type, an Agent Target Type was chosen. See above graphic.

   Select **Host Credentials** and then click **Set**.

   A dialog displays listing the current choice of available Name Credentials most appropriate for this Agent Target Type. For this Administrator. Select the **SSH Credential**, and click **Save**.

The Default Preferred Credential will then display the credential which will be used for all targets of type Host for this Administrator. The below image shows that the Credential Set = Host Credential; the Target Username = test, which indicates the OS user who is used in the Named Credential.

This setting means that all Agent connections, by this administrator, will use this credential set to authenticate with all Agents.

Authenticating host credentials

The Enterprise Manager Agent can use two methods to authenticate OS credentials:

- Traditional Authentication
- PAM Authentication

With *traditional authentication*, credentials submitted by users are compared with entries in the system's password database -- that is, against entries found in `/etc/passwd` and related files, and in remote extensions to those files as defined by OS-specific configuration such as `/etc/nsswitch.conf` or `/etc/netsvc.conf`.

With *PAM authentication*, the Agent uses a feature of the operating system called PAM, or Pluggable Authentication Modules, to validate the credentials submitted by users. PAM is a framework that allows administrators to specify which of a wide range of authentication mechanisms (such as LDAP, Kerberos, RADIUS) should be used by PAM-aware applications. An application identifies itself to PAM using a service-name. If the administrator has configured a PAM definition for that service-name, then the rules in that definition are applied for that application's authentication requests. If not, then the rules for a special default service-name, "other", are used.

The Enterprise Manager Agent identifies itself to PAM using the service name "emagent". If the administrator has explicitly defined an "emagent" PAM service, then the agent will attempt only PAM authentication -- if the method or methods defined for the "emagent" service do not accept a set of credentials, then the operation associated with those credentials will fail.

If the administrator has **not** explicitly defined an "emagent" PAM service, then the Agent will first attempt traditional authentication; if that attempt fails, then it will attempt PAM authentication, using the "other" service definition. If either the traditional or PAM authentication attempt succeeds, then the operation associated with the credentials will proceed.

Configuring the PAM "emagent" Service

PAM is a complex and open-ended framework, and general advice on configuring it is beyond the scope of this document. Typically, though, a customer who wants Enterprise Manager to authenticate host credentials using PAM will already have some other service defined to use the same PAM rules, and that other service's definition can form the basis for the emagent one.

For example, suppose a customer's Oracle Enterprise Linux host has already been configured for its SSH daemon to use a mix of Kerberos and local authentication when accepting

connections. The SSHD service definition file, `/etc/pam.d/sshd`, might have the following set of authentication rules:

```
auth        sufficient    pam_fprintd.so
auth        sufficient    pam_unix.so nullok
auth        requisite     pam_succeed_if.so uid >= 500 quiet
auth        sufficient    pam_krb5.so use_first_pass
auth        required      pam_deny.so
```

Here, if the customer has access to a fingerprint scanner attached to the host, authenticate based on that. If finger print authentication does not work, try traditional authentication. If that fails, **and** if the user's UID is 500 or higher, try kerberos authentication. If that fails, too, then fail the entire authentication.")

The customer might decide that Enterprise Manager should follow the same authentication process, but exclude the fingerprint-scanner check, since Enterprise Manager will not generally have access to the user's finger when it needs to run a job or collect an authenticated metric. So she would create a new service definition file, `/etc/pam.d/emagent`, and include all the same "auth" lines as in the SSHD definition above, except for the pam_fprintd.so one:

```
auth        sufficient    pam_unix.so nullok
auth        requisite     pam_succeed_if.so uid >= 500 quiet
auth        sufficient    pam_krb5.so use_first_pass
auth        required      pam_deny.so
```

Details of the authentication methods to be used will vary from customer to customer, and the exact method of configuration will vary from platform to platform. But this general approach to defining an Agent PAM service definition should generally be useful: identify an existing service to use as your base, copy that service's definition, and remove any rules that are not appropriate for Enterprise Manager's use.

Sudo and PowerBroker Support

Privilege Delegation, PDP, allows an administrator to perform privileged activities with the privileges of another user. Enterprise Manager uses two authentication utility tools to achieve Privilege Delegation, they are Sudo and PowerBroker.

Sudo: Sudo allows a permitted user to execute a command as the super user or another user, as specified in the sudoers file. If the invoking user is root or if the target user is the same as the invoking user, no password is required. Otherwise, sudo requires that users authenticate themselves with a password by default. Once a user has been authenticated, a timestamp is updated and the user may then use sudo without a password for a short period of time (5 minutes unless overridden in sudoers). sudo determines who is an authorized user by consulting the `/etc/sudoers` file. For more information, see the manual page on sudo (`man sudo`) on Unix. Enterprise Manager authenticates the user using sudo, and executes the script as sudo. For example, if the command to be executed is foo -arg1 -arg2, it will be executed as sudo -S foo -arg1 -arg2.

> **Note:**
>
> The certified SUDO versions are 1.6.7 to 1.6.9. Also, note that SUDO 1.7.2 and higher versions are also supported. The certified PBRUN versions are 4.0.8 and 5.x. Higher versions of these utilities may continue to work unless some fundamental changes have been introduced to their behavior.

PowerBroker: BeyondTrust PowerBroker enables UNIX system administrators to specify the circumstances under which other people may run certain programs such as root (or other important accounts). The result is that responsibility for such actions as adding user accounts, fixing line printer queues, and so on, can be safely assigned to the appropriate people, without disclosing the root password. The full power of root is thus protected from potential misuse or abuse-for example, modifying databases or file permissions, erasing disks, or more subtle damage. BeyondTrust PowerBroker can access existing programs as well as its own set of utilities that execute common system administration tasks. Utilities being developed to run on top of BeyondTrust PowerBroker can manage passwords, accounts, backups, line printers, file ownership or removal, rebooting, logging people out, killing their programs, deciding who can log in to where from where, and so on. They can also provide TCP/IP, Load Balancer, cron, NIS, NFS, FTP, rlogin, and accounting subsystem management. Users can work from within a restricted shell or editor to access certain programs or files as root. See your PowerBroker documentation for detailed setup and configuration information.

> **Note:**
>
> PowerBroker 7.1.1 has been tested and is the recommended minimum version.

Enterprise Manager Privilege Delegation uses these tools (Sudo and PowerBroker), together with the use of Named Credentials, to provide a framework to allow Administrators to perform privileged activities.

There are many operations within an organization, where an administrator will need elevated privileges to perform specific tasks. For example, for all the provisioning and patching tasks in Enterprise Manager, Named Credentials must be set up for normal operating system user account (oracle) and Named credentials for privileged user accounts (root). If you do not have access to either of these accounts, then you can use SUDO or PowerBroker access to switch users to perform the tasks. Privilege

Delegation offers the following advantages:

- You have the flexibility to use either SUDO or PowerBroker within the same framework.
- Using the framework, you can now run PowerBroker in a password-less or password-protected mode.
- You can create a template with these Privilege Delegation settings and reuse that template for multiple hosts. This not only allows you to standardize Privilege Delegation setting across your enterprise, but also facilitates and simplifies the process of configuring and management of Privilege Delegation Settings.
- You can use the Privilege Delegation settings not only for deployment procedures, but also for jobs in Enterprise Manager.

The following example explains the different users in the Privilege Delegation process:

Example: Consider three users:

User1 – called EMUSER, is an Enterprise Manager Admin logged into either Enterprise Manager or EM CLI

User2 – called OSUSER1, is a target host OS user.

User3 – called OSUSER2, is a target host OS user.

EMUSER has a Named Credential for OSUSER1. In which sudo is configured. The Named credential says run as OSUSER2.

The Internal steps for the Privilege Delegation would be as follows:

1. Log in to a system as OSUSER1
2. Authenticate using OSUSER1's password
3. Launch sudo to become OSUSER2
4. Run the specified command as OSUSER2.

When the command specified is run. It's as if OSUSER2 has logged in. For example if the “id" command is run, it would display as OSUSER2.

Authentication Utility Tools Configuration

The authentication utility tools supported by Enterprise Manager are sudo and pbrun. These tools reside on the target host with the management Agent and before correct operation, must be configured appropriately. The following section outlines these tools and their associated configuration file.

Administrators can set up sudo or pbrun, based on their configuration file entries to assign specific Enterprise Manager functional privileges to their OS users. The Management Agent uses a trusted executable called nmosudo, using the nmosudo executable the Agent verifies, via a cryptographic handshake, the source of the request. Then based on the configuration files of sudo or pbrun, allows a less privileged user to run nmosudo as a more privileged user.

Enterprise Manager guarantees that the nmosudo executable only honors requests to run remote operation requests from the OMS via the Agent. nmosudo will not run the remote operation if it cannot validate that the request came from the Agent. Thus, it will not be possible for user 'johndoe' to invoke nmosudo directly from the command line and run a Perl script as user 'oracle'.

In Enterprise Manager Cloud Control 12c Release 1 (12.1.0.1) [with or without Bundle Patch 1], nmosudo was located in the agent instance directory. For example, /u01/oracle/agent/agent_inst/bin/nmosudo.

In Enterprise Manager Cloud Control 12c Release 2 (12.1.0.2) and subsequent releases, this location has changed. Now, nmosudo is present in the sbin directory, which is in the agent base directory. For example, /u01/oracle/agent/sbin/nmosudo.

Sudo Configuration

> **Note:**
>
> The certified SUDO versions are 1.6.7 to 1.6.9. Also, note that SUDO 1.7.2 and higher versions are also supported.
>
> For more information, see the man page on sudo (man sudo) on Unix.

Sample entries for the sudo configuration file (/etc/sudoers) are shown below. The general format for the files is as follows:

```
root ALL=(ALL) ALL
```

This means that the root user can execute from ALL terminals, acting as ALL users, and run ALL commands.

Sample 1

```
# Sample /etc/sudoers file should have following entry
# If you do not have access to oracle and root accounts,
# then add the following entries into the file:
#usage:
#[user] [terminal]=[as other user] [command]

#where: user =  the user
terminal =  terminal from where user can run sudo #    cmd
#  as other user = which user the first user may act #    as
#  command = which commands can be run which using #    sudo

johndoe ALL=(oracle) /u01/oracle/agent/sbin/nmosudo *
johndoe ALL=(root) /u01/oracle/agent/sbin/nmosudo *

#Where, the user johndoe can access sudo from any terminal #to run as oracle the nmosudo
executable with all commands, #passed from the console.
```

Sample 2

```
# If you have access to the oracle account,
# but not to the root account,
# then only add the following entry into the file:
johndoe ALL=(root) /u01/oracle/agent/sbin/nmosudo  *

#Where, the user johndoe can access sudo from any terminal #to run as root the nmosudo
executable with all commands, #passed from the console.
```

> **Note:**
>
> This example illustrates how the SUDOERS file can be configured to allow users to restrict only a subset of commands.
>
> All commands that are executed thru Enterprise Manager using SUDO will be prefixed with the following:
>
> ```
> <AGENT_HOME>/sbin/nmosudo DEFAULT_PLGUIN DEFAULT_FUNCTIONALITY
> DEFAULT_SUBACTION DEFAULT_ ACTION <Command-to-executed-with-args>
> ```
>
> Customers can use this to restrict the list of commands they want users to use.
>
> For example, if *johndoe* is allowed to execute only root.sh as root, the following can be added to the SUDOERS file
>
> ```
> johndoe ALL=(root) <AGENT_HOME>/sbin/nmosudo DEFAULT_PLUGIN
> DEFAULT_FUNCTIONALITY DEFAULT_SUBACTION DEFAULT_ACTION root.sh
> ```

Sample 3

```
ALL=(ALL)/u01/oracle/agent/sbin/nmosudo DEFAULT_PLUGIN DEFAULT_FUNCTIONALITY
DEFAULT_SUBACTION DEFAULT_ACTION perl -e exit 0,/u01/oracle/agent/sbin/nmosudo
DEFAULT_PLUGIN DEFAULT_FUNCTIONALITY DEFAULT_SUBACTION DEFAULT_ACTION id

This example allows the user to perform a basic PERL test, and run only id command.
```

Powerbroker Configuration

BeyondTrust PowerBroker enables UNIX system administrators to specify the circumstances under which other users may run certain programs such as root (or other important accounts).

The result is that responsibility for such actions as adding user accounts, fixing line printer queues, and so on, can be safely assigned to the appropriate people, without disclosing the root password. The full power of root is thus protected from potential misuse or abuse-for example, modifying databases or file permissions, erasing disks, or more subtle damage. BeyondTrust PowerBroker can access existing programs as well as its own set of utilities that execute common system administration tasks. Utilities being developed to run on top of BeyondTrust PowerBroker can manage passwords, accounts, backups, line printers, file ownership or removal, rebooting, logging people out, killing their programs, deciding who can log in to where from where, and so on. They can also provide TCP/IP, Load Balancer, cron, NIS, NFS, FTP, rlogin, and accounting subsystem management. Users can work from within a restricted shell or editor to access certain programs or files as root. See your PowerBroker documentation for detailed setup and configuration information.

> **Note:**
>
> PowerBroker 7.1.1 has been tested and is the recommended minimum version.

If you want to use pbrun authentication utility, then before editing a Deployment Procedure, update the /etc/pb.conf file to allow a normal user to switch to another user who has the privileges to run the Deployment Procedure.A sample PowerBroker configuration file (/etc/pb.conf) would contain:

Sample:

```
if(user=="johndoe") if(command=="/u01/oracle/agent/sbin/nmosudo *" )
// /u01/oracle/agent/ Agent Home location


{
        switch (requestuser)
        {
                case "root":
                        runuser="root";
                        break;
                case "oracle":
                        runuser="oracle";
                        break;
                default:
                reject;
        }
        accept;
}
```

The above example allows user johndoe to execute all commands passed from the console via nmosudo as root and as oracle. Refer to sudo/PowerBroker documentation for detailed configuration information.

Privilege Needed for Creating a Privilege Delegation

Enterprise Manager allows you to create Privilege Delegation settings either by creating the setting directly on a host target, or by creating a Privilege Delegation Setting Template that you can apply to multiple hosts.

- VIEW: Administrators with View privileges on these host targets will be able to view those privilege delegation settings.

- FULL: Administrators with Full privileges on host targets can create privilege delegation settings for that host.

Enterprise Manager Super Administrators can configure privilege delegation settings for any host target.

Creating a Privilege Delegation

The use of Privilege Delegation can be invoked using any of the following methods:

- Cloud Control console
- EM CLI
- Privilege Delegation template

Privilege Delegation Templates: Enterprise Manager allows for a default Privilege Delegation template to be set and also for that template to be applied to multiple hosts. This prevents an Administrator from having to apply a Privilege Delegation setting on a host-by-host basis, especially when the same Privilege Delegation setting is being applied to all host targets. This feature is particularly useful when many host targets have been simultaneously added to Enterprise Manager. This feature is also available via EM CLI by using the set_default_privilege_delegation_setting verb.

Setting Privilege Delegation from Cloud Control

To set Privilege Delegation from the Cloud Control console:

1. From the **Setup** menu, select **Security**, then select P**rivilege Delegation**.
2. On the Manage Privilege Delegation Settings page, select the host name, and then click **Edit**. This Edit Host Privilege Delegation dialog displays.
3. Select **Sudo** or **PowerBroker**, and specify the location where SUDO or PowerBroker is located (for PowerBroker, you can optionally provide the password prompt) to configure the host with a Privilege Delegation setting.
4. Click **Save**.

Setting Privilege Delegation Templates from Cloud Control

You can apply Privilege Delegation settings on a per host basis or to multiple hosts simultaneously. Enterprise Manager allows you to define a default Privilege Delegation template that applies Privilege Delegation settings to multiple hosts. Templates are particularly useful when many host targets have been added simultaneously to Enterprise Manager. This functionality is also available via EM CLI by using the *set_default_privilege_delegation_setting* verb. See "Setting Privilege Delegation via EM CLI" for more information.

1. In Cloud Control, from the **Setup** menu, select **Security**, then select **Privilege Delegation**. The Manage Privilege Delegation page displays.
2. Click the **Templates** tab to display the Manage Privilege Delegation Templates page.
3. Click **Create**. The **Create Template** dialog displays.
4. Select a privilege delegation type, either **Sudo** or **PowerBroker**.
5. Enter a name for the template and specify the location where SUDO or PowerBroker is located (for PowerBroker, you can optionally provide the password prompt), and click Save.

For example, if you select SUDO, and if sudo is located in the /usr/sbin/directory, then in the Sudo Command field you need to enter /usr/sbin/sudo -E -u %RUNAS% %COMMAND%.

> **Note:**
>
> If you do not apply the privilege delegation template to a target, and if you configure a step in the deployment procedure to run in Privilege Delegation mode, then the deployment procedure for that target runs the step in normal mode instead.

Once you have created a privilege delegation setting, you must apply this setting to selected targets. This setting can be applied to one more hosts or to a composite (Group) target (the group must contain at least one host target). You can apply a Privilege Delegation setting using the Cloud Control console. From the **Setup** menu, choose **Security** and then **Privilege Delegation**.

Setting Privilege Delegation via EM CLI

The following examples create a setting named *sudo_setting*. The setting is of type SUDO, and the Sudo path used is `/usr/local/bin/sudo`. Sudo arguments are:

```
-S -u %RUNAS%%COMMAND%
```

Example 1 - Command-Line

```
emcli create_privilege_delegation_setting
      -setting_name=sudo_setting
      -setting_type=SUDO
      -settings="SETTINGS:/usr/local/bin/sudo -S -u %RUNAS% %COMMAND%"
```

Example 2 - Scripting and Interactive

```
create_privilege_delegation_setting
       (setting_name="sudo_setting",
        setting_type="SUDO",
        settings="SETTINGS:/usr/local/bin/sudo -S -u %RUNAS% %COMMAND%")
```

The following examples create a setting named pb_setting. The setting is of type POWERBROKER, and the PowerBroker path used is `/etc/pbrun`. Arguments are:

```
%RUNAS%%PROFILE%%COMMAND%
```

Example 3 - Command-Line

```
emcli create_privilege_delegation_setting
      -setting_name="pb_setting"
      -setting_type="POWERBROKER"
      -settings="SETTINGS,/etc/pbrun %RUNAS% %PROFILE% %COMMAND%"
      -separator="settings=;"
      -subseparator="settings=,"
```

Example 4 - Scripting and Interactive

```
create_privilege_delegation_setting
      (setting_name=pb_setting
      ,setting_type=POWERBROKER
      ,settings="SETTINGS,/etc/pbrun %RUNAS% %PROFILE% %COMMAND%"
      ,separator="settings=;"
      ,subseparator="settings=,")
```

The following examples are similar to examples 3 and 4, except that they also add arguments PASSWORD_PROMPT_STRING and Password.

Example 5 - Command-Line

```
emcli create_privilege_delegation_setting
      -setting_name="pb_setting"
      -setting_type="POWERBROKER"
      -settings="SETTINGS,/etc/pbrun %RUNAS% %PROFILE% %COMMAND%";
       PASSWORD_PROMPT_STRING,password:"
      -separator="settings=;"
      -subseparator="settings=,"
```

Example 6 - Scripting and Interactive

```
create_privilege_delegation_setting
      (setting_name=pb_setting
      ,setting_type=POWERBROKER
      ,settings="SETTINGS,/etc/pbrun %RUNAS% %PROFILE% %COMMAND%";
       PASSWORD_PROMPT_STRING,password:"
      ,separator="settings=;"
      ,subseparator="settings=,")
```

Testing Privilege Delegation Settings

After creating a privilege delegation template and before applying it to a *deployment procedure*, Oracle recommends you to test the privilege delegation setting.

The following is an example that describes how you can register your credentials as preferred credentials, and also choose to run as another user, and then test the settings by creating a job that checks whether a command is being as normal user or as another user using privilege delegation mechanism.

1. In Cloud Control, from the **Setup** menu, select **Security**, then select **Preferred Credentials.**. The Preferred Credentials page displays.
2. On the Manage Privilege Delegation Settings page, from the Related Links section, click **Preferred Credentials.**
3. Select **Host** from the **Target Type** list and click **Manage Preferred Credentials**. The Host Preferred Credentials page displays.
4. From the Target Preferred Credentials region, select the **host**, and then click **Set**.
5. In the Select Named Credential dialog box, specify the normal user name, the normal password, and the Run as user name that you want to switch over to using the privilege delegation mechanism. Then click **Test and Save**.
6. After registering the credentials as preferred credentials, from the Enterprise menu, select **Jobs**, and then click **Job Activity**.
7. On the Job Activity page, from the Create Job list, select OS Command, and click **Go**.
8. On the Create OS Command Job page, in the General tab, specify a name for the job. Then, from the Target section, click **Add** to add the host on which you want to run the OS command.
9. In the Parameters tab, for Command, specify the command id.
10. Click **Submit**.
11. On the Job Activity page, click the job name you just created. Cloud Control displays the status of the job. Click the status column to view its results.

Cloud Control performs the command as the user referenced in the preferred credential.

Agent Support for PowerBroker

The Enterprise Manager Agent supports privilege delegation using Powerbroker as long as pbrun can be invoked with its STDIN, STDOUT and STDERR not on the TTY. You can verify this by executing the pbrun command configured with the Agent, with its STDIN, STDOUT and STDER redirected to files.

In some PowerBroker configurations with this restriction, you will see pbrun errors with the text:"Cannot read ConfirmUser oracle password: no tty" This error may vary with the version of PowerBroker you are using. In Enterprise Manager, you will see errors from any operations performed through the Agent that require PowerBroker (Jobs, secure fetchlet invocations, credential verification operations etc.). You can find the pbrun command configured with the Agent in the following directory:

```
/agent_inst/sysman/config/emd.properties
```

The property name that will hold this command template is: EMPDP_SETTINGS_POWERBROKER. In the following example, the above property defines the following template:

```
EMPDP_SETTINGS_POWERBROKER=/usr/local/bin/pbrun -u %RUNAS% %COMMAND%
```

Starting an Agent Using Sudo or PowerBroker Credentials

When performing Agent control operations (such as starting or stopping the Agent) from the Cloud Control console, Enterprise Manager makes a secure shell (SSH) connection to the machine where the Agent is installed in order to carry out the operation. Beginning with Enterprise Manager Release 12.1.0.4, Agent control operations can be performed using Sudo or PowerBroker credentials. For example, an administrator can navigate to the Agent home page and, from the **Agent** menu, perform Agent control operations.

Using sudo allows a permitted user to execute a command as the super user or another user, as specified by the security policy, which is defined in the config file for sudo, typically located at /etc/sudoers. If the invoking user is root or if the target user is the same as the invoking user, no password is required. Otherwise, sudo requires that users authenticate themselves with a password by default. Once a user has been authenticated, a timestamp is updated and the user may then use sudo without a password for a short period of time (5 minutes unless overridden in /etc/sudoers). sudo determines who is an authorized user by consulting the /etc/sudoers file, this file can also be configured to specify sudo access to certain commands.

Creating a Privilege Delegation Setting

Enterprise Manager allows you to create privilege delegation settings either by creating the setting directly on a host target, or by creating a Privilege Delegation Setting Template that you can apply to multiple hosts.

Administrators with Full privileges on host targets can create privilege delegation settings for that host. Administrators with View privileges on these host targets will be able to view those privilege delegation settings. Enterprise Manager Super Administrators can configure privilege delegation settings for any host target.

To create a privilege delegation setting directly on a host:

1. From the **Setup** menu, select **Security**, then select **Privilege Delegation**. The Manage Privilege Delegation screen is displayed
2. Select a host from the table and click **Edit**. The Edit Host Privilege Delegation Settings dialog displays.

3. Select a privilege delegation type (Sudo or PowerBroker).
4. Enter the privilege delegation command to be used and, in the case of PowerBroker, the optional Password Prompt.
5. Click **Save** to apply the settings to the host.

   Once you have created a privilege delegation setting, you must apply this setting to selected targets. This setting can be applied to one more hosts or to a composite (Group) target (the group must contain at least one host target). You can apply a Privilege Delegation setting using the Enterprise Manager console. From the **Setup** menu, choose **Security** and then **Privilege Delegation**.

Configuring and Testing OCI Credentials

To enable access to Oracle Cloud Infrastructure (OCI) from Oracle Enterprise Manager (OEM), you must configure and test OCI account credentials as global named credentials. This is the first step to ensure that the credentials are properly configured, functional, and ready for managing OCI resources through OEM.

First, define a global named credential for your Oracle Cloud Infrastructure account. Next, test if it is successful in establishing a connection with Oracle Cloud Infrastructure.

1. Define a Global Named Credential in Enterprise Manager for OCI in *Oracle Enterprise Manager Administrator's Guide*
2. Test OCI Credentials

Test OCI Credentials

The OCI credentials used for connecting with Oracle Cloud Infrastructure from Enterprise Manager are saved as named credentials in Enterprise Manager. You can test the proper working of the credentials by testing the connectivity to OCI by specifying the required parameters as follows:

1. Locate your OCI credentials in the Named Credentials page. From Enterprise Manager menu, click **Setup**, select **Security**, and navigate to **Named Credentials**. The Named Credentials page opens.
2. Select the named credentials that correspond to the OCI credentials that you want to test, and click **Test**.

   The Test Options dialog box opens.
3. Enter the **Realm Domain** for accessing the OCI account, for example, `oraclecloud.com`. Alternatively, click the search icon and select one from the options available.
4. Enter the **Region Identifier** for the region in which your OCI account data is available, for example, `us-phoenix-1`. Alternatively, click the search icon and select one from the options available.
5. In the **Connection From** section, select one of the below connection configurations:
   - **Oracle Management Server**: Select this option to use the agent installed in the OMS host to communicate with OCI to perform the test.
   - **Oracle Management Agent**: If you select this option, the **Agent** field is activated. Click the search icon to select the agent. The Select Agent dialog box opens. From the list of agents available, select the right registered EM agent to test the connection.
6. Optionally, if you want to use a proxy to communicate with OCI, then in the **HTTP Proxy Settings** section, enable the check box **Use Proxy**.

- In the **Host** field, enter the proxy server host name or its IP address.
- In the **Port** field, enter the port number associated with the proxy configuration.

7. Click **Test** to validate the connection. Enterprise Manager uses the specified parameters to attempt communication with OCI and display the test result.

A successful test confirms that the credentials are correctly configured and operational. If the test fails, error message provides guidance on whether it is due to incorrect credentials or network connectivity.

Configuring and Using Cryptograhic Keys

To protect the integrity of sensitive data in Enterprise Manager, a signing on verification method known as the `emkey` is used. Encryption key is the master key that is used to encrypt/decrypt sensitive data, such as passwords and preferred credentials that are stored in the Repository. The emkey is generated during repository creation time and is originally stored in repository database. During installation of the first OMS, emkey is copied to the Credential Store and removed from the repository database, that is emkey is secured out-of-the-box. A backup is created in `OMS_ORACLE_HOME/sysman/config/emkey.ora`.

If the emkey is corrupted and the backup emkey.ora file is lost, all the encrypted information in repository becomes useless. Hence, it is strongly recommended to create a backup of this file on some other machine, so that in case the OMS machine crashes or emkey gets corrupted, the backed up file can be used for recovering the environment.

When starting up, OMS reads the `emkey` from Credential Store and repository. If the `emkey` is not found or is corrupted, it fails to start. By storing the key separately from Enterprise Manager schema, we ensure that the sensitive data such as Named Credentials in the Repository remain inaccessible to the schema owner and other SYSDBA users (Privileged users who can perform maintenance tasks on the database) in the Repository. Moreover, keeping the key separate from the schema will ensure that sensitive data remain inaccessible while Repository backups are accessed. Further, the schema owner should not have access to the OMS/ Repository Oracle homes.

Repository Encryption Algorithm

Beginning with Enterprise Manager Cloud Control Release 12.1.0.2, the Advanced Encryption Standard (AES) algorithm is used to encrypt data in the Enterprise Manager Repository. The encryption key size is 256 bits.

Prior to release 12.1.0.2, Triple Data Encryption Standard (3DES) was the encryption algorithm used to encrypt repository data.

Configuring the emkey

The `emkey` is an encryption key that is used to encrypt and decrypt sensitive data in Enterprise Manager such as host passwords, database passwords and others. The emkey.ora file is a copy of `emkey` should be kept in a safe location for restoration purposes.

During startup, the Oracle Management Service checks the status of the `emkey`. If the `emkey` has been properly configured, the OMS uses it for encrypting and decrypting data. If the emkey has not been configured properly, the following error message is displayed.

Example 2-12 emctl start oms Command

```
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
emctl start oms
```

```
Starting HTTP Server ...
Starting Oracle Management Server ...
Checking Oracle Management Server Status ...
Oracle Management Server is not functioning because of the following reason:
The Em Key is not configured properly. Run "emctl status emkey" for more details.
```

emctl Commands

The `emctl` commands related to `emkey` are given below:

- emctl status emkey
- emctl config emkey -copy_to_credstore
- emctl config emkey -remove_from_repos
- emctl config emkey -copy_to_file_from_credstore -admin_host <host> -admin_port <port> -admin_user <username> [-admin_pwd <pwd>] [-repos_pwd <pwd>] -emkey_file <emkey file>
- emctl config emkey -copy_to_file_from_repos (-repos_host <host> -repos_port <port> -repos_sid <sid> | -repos_conndesc <conn desc>) -repos_user <username> [-repos_pwd <pwd>] [-admin_pwd <pwd>] -emkey_file <emkey file>
- emctl config emkey -copy_to_credstore_from_file -admin_host <host> -admin_port <port> -admin_user <username> [-admin_pwd <pwd>] [-repos_pwd <pwd>] -emkey_file <emkey file>
- emctl config emkey -copy_to_repos_from_file (-repos_host <host> -repos_port <port> -repos_sid <sid> | -repos_conndesc <conn desc>) -repos_user <username> [-repos_pwd <pwd>] [-admin_pwd <pwd>] -emkey_file <emkey file>

  Examples: Use example 1 if your environment is configured with a service name. for all else use example 2.

  ```
  Example 1
  emctl config emkey -copy_to_repos_from_file -repos_conndesc
  '"(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCP)(HOST=<>)(PORT=<>)))
  (CONNECT_DATA=(SERVICE_NAME=<>)))"' -repos_user <> [-repos_pwd <pwd> ] [-admin_pwd
  <pwd>] -emkey_file < emkey file>

  Example 2
  emctl config emkey -copy_to_repos_from_file -repos_host <host> -repos_port <port> -
  repos_sid <sid> -repos_user <username> [-repos_pwd <pwd> ] [-admin_pwd <pwd>] -
  emkey_file <emkey file>
  ```

emctl status emkey

This command shows the health or status of the `emkey`. Depending on the status of the `emkey`, the following messages are displayed:

- When the `emkey` has been correctly configured in the Credential Store and Repository, the following message is displayed.
- When the `emkey` has been correctly configured in the Credential Store and has been removed from the Management Repository, the following message is displayed.
- When the `emkey` is corrupted in the Credential Store and removed from the Management Repository, the following message is displayed.

Example 2-13 emctl status emkey - Example 1

```
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
The EmKey is configured properly, but is not secure. Secure the EMKey by running "emctl
config emkey -remove_from_repos"
```

Example 2-14 emctl status emkey - Example 2

```
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
The EMKey is configured properly.
```

Example 2-15 emctl status emkey - Example 3

```
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
The EMKey is not configured properly or is corrupted in the credential store and does
not exist in the Management Repository. To correct the problem:
1) Get the backed up emkey.ora file.
2) Configure the emkey by running "emctl config emkey -copy_to_credstore_from_file"
```

emctl config emkey -copy_to_credstore

This command copies the emkey from the Management Repository to the Credential Store.

Example 2-16 Sample Output of the emctl config emkey -copy_to_credstore Command

```
emctl config emkey -copy_to_credstore
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
The EMKey has been copied to the Credential Store.
```

emctl config emkey -copy_to_file_from_credstore

This command copies the emkey from the Credential Store to a specified file.

Example 2-17 Sample Output of the emctl config emkey -copy_to_file_from_credstore Command

```
emctl config emkey -copy_to_file_from_credstore -admin_host <host> -admin_port
<port> -admin_user <username> [-admin_pwd <pwd>] [-repos_pwd <pwd>] -emkey_file
<emkey file>
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
The EMKey has been copied to file.
```

emctl config emkey -copy_to_file_from_repos

This command copies the emkey from the Management Repository to a specified file.

Example 2-18 Sample Output of the emctl config emkey -copy_to_file_from_repos Command

```
emctl config emkey -copy_to_file_from_repos (-repos_host <host> -repos_port <port>
-repos_sid <sid> | -repos_conndesc <conn desc>) -repos_user <username> [-repos_pwd
<pwd>] [-admin_pwd <pwd>] -emkey_file <emkey file>
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
The EMKey has been copied to file.
```

Note: Either repos_host, repos_port, repos_sid OR repos_conndesc needs to be specified.

emctl config emkey -copy_to_credstore_from_file

The command removes the emkey from the repository: It secures the emkey, which is the out-of-the-box configuration.

Example 2-19 Sample Output of the emctl config emkey -copy_to_credstore_from_file Command

```
emctl config emkey -copy_to_credstore_from_file -admin_host <host> -admin_port <port> -
admin_user <username> [-admin_pwd <pwd>] [-repos_pwd <pwd>] -emkey_file <emkey file>
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
The EMKey has been copied to the Credential Store.
```

emctl config emkey -copy_to_repos_from_file

This command copies the emkey from a specified file to the repository.

Example 2-20 Sample Output of the emctl config emkey -copy_to_repos_from_file Command

```
emctl config emkey -copy_to_repos_from_file (-repos_host <host> -repos_port <port>
-repos_sid <sid> | -repos_conndesc <conn desc>) -repos_user <username> [-repos_pwd
<pwd>] [-admin_pwd <pwd>] -emkey_file <emkey file>
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
The EMKey has been copied to the Management Repository. This operation will cause
the EMKey to become unsecure.
After the required operation has been completed, secure the EMKey by running "emctl
config emkey -remove_from_repos".
```

emctl config emkey -remove_from_repos

This command removes the emkey from the repository.

Example 2-21 Sample Output of emctl config emkey -remove_from_repos Command

```
emctl config emkey -remove_from_repos
Oracle Enterprise Manager 13c Release 2 Cloud Control
Copyright (c) 1996, 2016 Oracle Corporation.  All rights reserved.
The EMKey has been removed from the Management Repository.
```

> **Note:**
>
> If the emkey is corrupted in the Credential Store, you will not be able to remove it from the Management Repository.

Install and Upgrade Scenarios

This section explains the install and upgrade scenarios for emkey.

Installing the Management Repository

A new emkey is generated as a strong random number when the Management Repository is created.

Installing the First Oracle Management Service

When the Oracle Management Service is installed, the Installer copies the emkey to Credential Store and removes it from repository (emkey is secured out-of-box).

Upgrading from 10.2 or 11.1 to 12.1

The Management Repository is upgraded as usual. When upgrading the OMS, the `omsca` (OMS Configuration Assistant) copies the emkey to Credential Store and removes from repository. `omsca` reads the emkey from emkey.ora file present in the old OMS Oracle Home and copies it to Credential Store.

Recreating the Management Repository

When the Management Repository is recreated, a new emkey is generated. This new key will not be in synchronization with the emkey existing in the Credential Store. Follow these steps to synchronize the key:

1. Copy the new emkey to Credential Store by using the `emctl config emkey -copy_to_credstore` command.
2. Take a backup by entering the `emctl config emkey -copy_to_file_from_repos` command or the `emctl config emkey -copy_to_file_from_credstore` command.
3. Secure the emkey by using the `emctl config emkey -remove_from_repos` command.

Configuring and Managing Audit

All operations performed by Enterprise Manager users such as creating users, granting privileges, starting a remote job like patching or cloning, need to be audited to ensure compliance with the Sarbanes-Oxley Act of 2002 (SAS 70). This act defines standards an auditor must use to assess the contracted internal controls of a service organization. Auditing an operation enables an administrator to monitor, detect, and investigate problems and enforce enterprise wide security policies.

Irrespective of how the user has logged into Enterprise Manager, when auditing is enabled, each user action is audited and the audit details are stored in a record.

Auditing Credentials

For Enterprise Manager 13c, BASIC auditing is enabled by default, thus creating an audit trail of credentials being created, edited, accessed, associated and deleted. Named credentials are first-class security objects on which privileges can be granted or revoked. This means that multiple Enterprise Manager administrators will be able to use and modify the credential objects. Because credentials are sensitive data that can be used to perform various operations on the systems, there is a need to audit the operations on credentials.

Enterprise Manger supports auditing all credential operation, but first needs to be enabled. The auditing information includes, but is not limited to, the current username, credential name, operation performed, operation status success or failure. The audit logs contain information about the credential owner, action initiator, credential name, user name, and target name, job names along with the date time of the operation. Credential fields like password, private keys are never logged.

The following operations are audited:

- **Creating a Named Credential**: Creating new Enterprise Manager credentials will be audited.
- **Editing a Named Credential**: Editing a credential may consist of changing the username and/or the sensitive credential attributes. Credential edits may also include changing the authentication scheme for the credential.
- **Delete a Named Credential**: Deleting a credential from Enterprise Manager will be audited.
- **Associating a Named Credential**: A named credential can be set as a preferred credential for a credential set at the target level or at target type level. The named credential can also be reference directly from a job. All operations involving the setting of the named credentials as preferred credentials and using it in a job or deployment procedure will be audited.
- **Accessing a Named Credential**: Enterprise Manager subsystems request credentials from the credential store to perform various system management tasks

Default Audit Actions

By default, whenever a user logs in or out of Enterprise Manager, the action is audited. The following list shows the Enterprise Manager infrastructure operations that are also audited by default.

- Apply Update
- Change MGMT_VIEW User Password
- Change Repository Password
- Configure Authentication
- Copy EM Key to Repository
- Remove EM Key from Repository
- Create Custom CA
- Remove Update
- Secure Console
- Secure Lock
- Secure OMS

Configuring the Enterprise Manager Audit System

You can configure the Enterprise Manager Audit System by using the following EM CLI commands:

- `enable_audit`: Enables auditing for all user operations.
- `disable_audit`: Disables auditing for all user operations.
- `show_operations_list`: Shows a list of the user operations being audited.
- `show_audit_settings`: Shows the audit status, operation list, externalization service details, and purge period details.
- update_audit_settings: Updates the current audit settings in the repository.

Configuring the Audit Data Export Service

Audit data needs to be protected and maintained for several years. The volume of audit data may become very large and impact the performance of the system. To limit the amount of data stored in the repository, the audit data must be externalized or archived at regular intervals. The archived audit data is stored in an XML file complying with the ODL format. To externalize the audit data, the `EM_AUDIT_EXTERNALIZATION` API is used. Records of the format <file-prefix>.NNNNN.xml, where NNNN is a number, are generated. The numbers start with 00001 and continue to 99999.

You can set up the audit externalization service for exporting audit data into the file system by using the `update_audit_setting -externalization_switch` command.

The externalization of audit system data is performed by the *EM Audit Externalization Service* job. By default, this job is scheduled to run once daily. You can view current status of this job from the Repository Scheduler Jobs Status area in the Enterprise Manager console, as shown in the following graphic.

To access this page, from the **Setup** menu, select **Manage Cloud Control**, and then **Repository**.

Updating the Audit Settings

The `update_audit_settings` command updates the current audit settings in the repository and restarts the Management Service.

- `-audit_switch`: Enables auditing across Enterprise Manager. The possible values are `ENABLE/DISABLE`. Default value is `DISABLE`.
- `-operations_to_enable`: Enables auditing for specified operations. Enter **All** to enable all operations.
- `-operations_to_disable`: Disables auditing for specified operations. Enter **All** to disable all operations.
- `-externalization_switch`: Enables the audit data export service. The possible values are `ENABLE/DISABLE`. Default value is `DISABLE`.
- `-directory`: The database directory that is mapped to the OS directory where the export service archives the audit data files.
- `-file_prefix`: The file prefix to be used by the export service to create the file in which audit data is to be stored.
- `-file_size`: The size of the file on which the audit data is to be stored. The default value is 5000000 bytes.
- `data_retention_period`: The period for which the audit data is to be retained inside the repository. The default value is 365 days.

Example 2-22 Usage of the update_audit_setting command

```
emcli update_audit_settings
      -audit_switch="ENABLE/DISABLE"
      -operations_to_enable="name of the operations to enable, for all oprtations
       use ALL"
      -operations_to_disable="name of the operations to disable, for all
       oprtations use ALL"
      -externalization_switch="ENABLE/DISABLE"
      -directory="directory_name (DB Directory)"
```

```
-file_prefix="file_prefix"
-file_size="file_size (Bytes)"
-data_retention_period="data_retention_period (Days)"
```

Searching the Audit Data

You can search for audit data that has been generated over a specified period. You can also search for the following:

- Audit details of a specific user operation or all user operations.
- Audit details of operations with a Success or Failure status or All operations.

From the **Setup** menu, select **Security** and then **Audit Data**. The Audit Data page is displayed. Specify the search criteria in the fields and click **Go**. The results are displayed in the Summary table.

To view the details of each record that meets the search criteria, select Detailed in the View drop-down list. To drill down to the full record details, click on the **Timestamp**.

List of Operations Audited

For a complete list of audit operations supported by Enterprise Manager, use the EM CLI `show_operations_list` verb.

Example 2-23 EM CLI `show_operations_list`

```
> emcli show_operations_list

Operation ID                      Operation Name           Infrastructure Operation
ADD_AGENT_REGISTRATION_PASSWORD      Add Registration Password
NO
ADD_CS_TARGET_ASSOC                  Add Standard-Target Association
NO
SECURITY_AUTH_CONFIG                 Configure Authentication
YES

.

.

.

UPDATE_PASSWORD                      Update Password
NO
```

Auditing the Infrastructure

Beginning with Oracle Enterprise Manger Cloud Control 12c, basic and Infrastructure auditing is enabled by default for Enterprise Manager. In Enterprise Manager, there are over 150 options for auditing. Audit infrastructure operations are always enabled and cannot be turned off. An enhanced Auditing page makes it easy to quickly view the privilege grants on a regular basis and also keep track of which users exercised what privileges, this improves user accountability. Infrastructure activities are audited out of the box, these include updates, downloads, OMS password changes and emkey copy and removes from the Repository.

Also, the search capability of all Audit actions have been enhanced to improved, via the Cloud Control console, you can search for a subset of Audited operations and filter to see operations from specific client hosts and client types(browser or CLI). This provides more efficient ways for audit officers to locate specific operations of interest.

The following table lists all auditable events. Those auditable events shown as enabled are Infrastructure audit events and are turned on out-of-box and cannot be disabled.

Table 2-2 Auditable Events

Event	Enabled/Disabled (By Default)
Apply Update	Enabled
Change MGMT_VIEW User Password	Enabled
Change Repository Password	Enabled
Configure Authentication	Enabled
Copy Enterprise Manager Key to Repository	Enabled
Create Custom CA	Enabled
Enterprise Manager Login	Enabled
Enterprise Manager Logout	Enabled
Remove Enterprise Manager Key from Repository	Enabled
Remove Update	Enabled
Secure Console	Enabled
Secure Lock	Enabled
Secure OMS	Enabled
Secure WebLogic Server	Enabled
Access Named Credential	Disabled
Add Registration Password	Disabled
Add Software Library Storage	Disabled
Add Standard-Target Association	Disabled
Add entity to Template Collection	Disabled
Apply Monitoring Template	Disabled
Associate Template Collection to Admin Group	Disabled
Attach Metric Extension	Disabled
Audit Export Settings	Disabled
Audit Settings	Disabled
Change Connector Settings	Disabled
Change Password	Disabled
Change Preferred Credentials	Disabled
Clear Manual Rule Violation	Disabled
Configure Connector	Disabled
Create Administration Groups	Disabled
Create Change Management Setting	Disabled
Create Connector	Disabled
Create Credential Set	Disabled
Create Custom Configuration Specification	Disabled
Create Custom Configuration Specification Parser	Disabled
Create Custom Target Type	Disabled
Create Facet	Disabled

Table 2-2 (Cont.) Auditable Events

Event	Enabled/Disabled (By Default)
Create Facet Parameter	Disabled
Create Facet Pattern	Disabled
Create Framework	Disabled
Create Metric Extension	Disabled
Create Monitoring Template	Disabled
Create Named Credential	Disabled
Create Real-time Monitoring Rule	Disabled
Create Resolution state	Disabled
Create Role	Disabled
Create Rule	Disabled
Create Rule Set	Disabled
Create Standard	Disabled
Create Template Collection	Disabled
Create User	Disabled
Database Login	Disabled
Database Logout	Disabled
Database Restart	Disabled
Database Shutdown	Disabled
Database Startup	Disabled
Delete Administration Groups	Disabled
Delete Credential Set	Disabled
Delete Custom Configuration Specification	Disabled
Delete Custom Configuration Specification Parser	Disabled
Delete Facet	Disabled
Delete Facet Parameter	Disabled
Delete Facet Pattern	Disabled
Delete Framework	Disabled
Delete Job	Disabled
Delete Management Connector	Disabled
Delete Metric Extension	Disabled
Delete Monitoring Template	Disabled
Delete Named Credential	Disabled
Delete Real-time Monitoring Rule	Disabled
Delete Registration Password	Disabled
Delete Resolution state	Disabled
Delete Role	Disabled
Delete Rule	Disabled
Delete Rule Set	Disabled
Delete Software Library Entity	Disabled

Table 2-2 (Cont.) Auditable Events

Event	Enabled/Disabled (By Default)
Delete Software Library Folder	Disabled
Delete Standard	Disabled
Delete Target	Disabled
Delete Template Collection	Disabled
Delete Update	Disabled
Delete User	Disabled
Deploy Custom Configuration Specification	Disabled
Detach Metric Extension	Disabled
Disable Rule	Disabled
Disable Rule Set	Disabled
Disable Standard-Target Association	Disabled
Disassociate Template Collection from Admin Group	Disabled
Download Update	Disabled
Edit Framework	Disabled
Edit Job	Disabled
Edit Monitoring Template	Disabled
Edit Registration Password	Disabled
Edit Rule	Disabled
Edit Rule Set	Disabled
Edit Standard	Disabled
Edit Standard-Target Association	Disabled
Edit Template Collection	Disabled
Enable Rule	Disabled
Enable Rule Set	Disabled
Enable Standard-Target Association	Disabled
Execute Command As Agent	Disabled
File Transfer Job	Disabled
Get File Job	Disabled
Grant Privilege	Disabled
Grant Role	Disabled
Import Facet	Disabled
Import Framework	Disabled
Import Real-time Monitoring Rule	Disabled
Import Rule	Disabled
Import Standard	Disabled
Include Action To Monitor	Disabled
Include Filter Facet	Disabled
Include Monitoring Facet	Disabled
Job Execution	Disabled

Table 2-2 (Cont.) Auditable Events

Event	Enabled/Disabled (By Default)
Mark informational update as read	Disabled
Modify Administration Groups	Disabled
Modify Change Management Setting	Disabled
Modify Custom Configuration Specification	Disabled
Modify Facet	Disabled
Modify Facet Content	Disabled
Modify Facet Parameter	Disabled
Modify Facet Pattern	Disabled
Modify Metric Settings	Disabled
Modify Named Credential	Disabled
Modify Real-time Monitoring Rule	Disabled
Modify Resolution state	Disabled
Modify Role	Disabled
Modify User	Disabled
Move Software Library Entity	Disabled
Publish Metric Extension	Disabled
Purge Software Library Storage	Disabled
Put File As Agent	Disabled
Put File Job	Disabled
Refresh from Enterprise Manager Store	Disabled
Registration Password Usage	Disabled
Remote Operation Job	Disabled
Remove Action From Monitor	Disabled
Remove Change Management Setting	Disabled
Remove Filter Facet	Disabled
Remove Monitoring Facet	Disabled
Remove Privilege Delegation Setting	Disabled
Remove Software Library Storage	Disabled
Remove Standard-Target Association	Disabled
Remove entity from Template Collection	Disabled
Rename Template Collection	Disabled
Reorder Rule	Disabled
Reorder Rule Set	Disabled
Resume Job	Disabled
Resync Agent	Disabled
Resync Repository	Disabled
Retry Job	Disabled
Revoke Privilege	Disabled
Revoke Role	Disabled

Table 2-2 (Cont.) Auditable Events

Event	Enabled/Disabled (By Default)
Save Monitoring Settings	Disabled
Set Privilege Delegation Setting	Disabled
Stop Job	Disabled
Submit Job	Disabled
Subscribe Update Type	Disabled
Suppress Violation	Disabled
Suspend Job	Disabled
Target Login	Disabled
Target Logout	Disabled
Undeploy Custom Configuration Specification	Disabled
Unsubscribe Update Type	Disabled
Unsuppress Violation	Disabled
Update Database Password	Disabled
Update Metric Extension	Disabled
Update Password	Disabled
Update is available	Disabled

WebLogic Server Auditable Events

The following WebLogic Server events can be audited:

- Domain update
- Domain login
- Domain logout

To audit these events, enter the following EM CLI command:

```
emcli update_audit_settings
     -operations_to_enable="WEBLOGIC_DOMAIN_UPDATE_INVOKE;WEBLOGIC_DOMAIN
     _LOGIN;WEB_LOGIC_DOMAIN_LOGOUT"
```

> **Note:**
>
> only super administrators have permission to view the audited WebLogic Server data.

Additional Security Considerations

After you enable security for the Enterprise Manager components and framework, there are additional security considerations. This section provides the following topics:

- Changing Oracle Account Passwords
- Responding to Browser-Specific Security Certificate Alerts

Changing Oracle Account Passwords

This section describes the commands used to change the SYSMAN, MGMT_VIEW, and EUS_ENGINE_USER passwords.

Changing the SYSMAN User Password

The SYSMAN user account is used by the Oracle Management Server to login into the Oracle Management Repository to store and query all activity. The password is stored encrypted. If the SYSMAN password changes at the OMR it must also be changed at the OMS, to ensure proper functioning of Enterprise Manager Cloud Control for all operations. This includes other SYSMAN users such as:

- SYSMAN_STB
- SYSMAN_TYPES
- SYSMANUPGR_OPSS

> **Note:**
>
> From 12c onwards, directly modifying the password for SYSMAN or any other repository user at the Repository Database is not recommended. Hence, ensure that the passwords are changed only using one of the methods listed below.

If the current SYSMAN password is known

1. Stop all OMS instances running emctl stop oms.

   ```
   OMS_Home/bin/emctl stop oms
   ```

   If JVMD and/or ADP is configured, stop the JVMD/ADP engines:

   ```
   emctl extended oms jvmd stop -all
   ```

   ```
   emctl extended oms adp stop -all
   ```

   Execute the same command on all the OMS machines including the primary OMS machine. Do not include '-all' as the Admin Server needs to be up during this operation.

2. Modify the SYSMAN password on the primary OMS server (where the Admin server is configured):

   ```
   cd <OMS_HOME>/bin
   ```

   ```
   emctl config oms -change_repos_pwd [-old_pwd <old_pwd>] [-new_pwd <new_pwd>]
   [-use_sys_pwd [-sys_pwd <sys_pwd>]]
   ```

   ```
   emctl config oms -change_repos_pwd'
   ```

   Command Parameters

Parameter	Description
-change_repos_pwd	Used to change the SYSMAN password.
-old_pwd	This is the current SYSMAN password.

Parameter	Description
-new_pwd	This is the new password.
-use_sys_pwd	This parameter is optional and is used to connect to the database as a SYS user. Use this option if SYSMAN account on the database has expired/locked.
-sys_pwd	This is the password for the SYS user. Required only if -use_sys_pwd is specified

Command Behavior:

> **Note:**
>
> The above command will prompt you for the current password of the SYSMAN user and the new password.
>
> The password will be modified at the Repository Database and the monitoring credentials for the 'OMS and Repository' target.
>
> Along with the SYSMAN password, this command will modify the password for the EM users (SYSMAN_MDS, SYSMAN_OPSS, SYSMAN_APM, SYSMAN_RO) created in the Repository Database.

Sample Command Output

```
emctl config oms -change_repos_pwd
Oracle Enterprise Manager Cloud Control 12c Release 12.1.0.1.0
Copyright (c) 1996, 2011 Oracle Corporation. All rights reserved.
Enter Repository User's Current Password :
Enter Repository User's New Password :

Changing passwords in backend ...
Passwords changed in backend successfully.
Updating repository password in Credential Store...
Successfully updated Repository password in Credential Store.
Restart all the OMSs using 'emctl stop oms -all' and 'emctl start oms'.
Successfully changed repository password.
```

3. Stop the Admin server on the primary OMS machine and re-start all the OMS:

```
cd <OMS_HOME>/bin

emctl stop oms -all
```

4. Restart all the Management Services:

```
cd <OMS_HOME>/bin

emctl start oms
```

If the current SYSMAN password is unknown

1. Stop all the OMS:

```
cd <OMS_HOME>/bin

emctl stop oms
```

Execute the same command on the primary OMS machine as well. Do not include '-all' as the Admin Server needs to be up during this operation.

In addition, check and complete the following steps:

- If JVMD and/or ADP is configured, stop the JVMD/ADP engines:
  ```
  emctl extended oms jvmd stop -all
  ```
  ```
  emctl extended oms adp stop -all
  ```

2. Modify the SYSMAN password:

   ```
   cd <OMS_HOME>/bin
   ```
   ```
   emctl config oms -change_repos_pwd -use_sys_pwd -sys_pwd <sys user password> -new_pwd <new sysman password>
   ```

   > **Note:**
   >
   > The '-use_sys_pwd' is used to connect to the database as a SYS user and modify the SYSMAN password in the Repository database.
   >
   > The current SYSMAN password is not prompted for and only the new password needs to be entered. This will allow the reset of the old password to the new password entered.
   >
   > The password will be modified at the Repository Database and the monitoring credentials for the 'OMS and Repository' target.
   >
   > Along with the SYSMAN password, this command will modify the password for the EM users (SYSMAN_MDS, SYSMAN_OPSS, SYSMAN_APM, SYSMAN_RO) created in the Repository Database.

3. Stop the Admin server on the primary OMS machine and re-start all the OMS:

   ```
   cd <OMS_HOME>/bin
   ```
   ```
   emctl stop oms -all
   ```
   ```
   emctl start oms
   ```

Changing the MGMT_VIEW User Password

To change the password of the `MGMT_VIEW` user, you have to use the following command:

```
emctl config oms -change_view_user_pwd [-user_pwd <user_pwd>] [-auto_generate]
```

Parameter	Description
`-change_view_user_pwd`	Used to change MGMT_VIEW user's password.
`-user_pwd`	The new password for theMGMT_VIEW user.
`-auto_generate`	If this option is specified, the password is auto-generated.

1. Stop all OMSs.

   ```
   <OMS_HOME>/bin/emctl stop oms
   ```

2. On one of the OMSs, run the following command:

```
<OMS_HOME>/bin/emctl config oms -change_view_user_pwd [-old_pwd <old_pwd>] [ -
new_pwd <new_pwd>]
```

3. Restart the AdminServer and all the OMSs.

```
emctl stop oms -all

emctl start oms
```

When you change the password of the `MGMT_VIEW` user by using the `emctl` command, the monitoring credentials for the Management Service target, which is set to `MGMT_VIEW`, does not get updated. You have to change the password manually.

1. Go to the Enterprise Manager Console URL.
2. Enter the credentials for a valid Single Sign-On user.
3. From the Setup menu, select **Security**, and then **Monitoring Credentials**.
4. Select the **Target Type** as `Oracle Management Service` and click `Manage Monitoring Credentials`.
5. In the monitoring credentials page for the Oracle Management Service target type, update the password for `MGMT_VIEW` manually to the new password and save the changes.
6. Click **Save**.

Changing the EUS_ENGINE_USER User Password

To change the password of the `EUS_ENGINE_USER` user if it's not managed by RUEI, you have to connect to the database using SQL*plus and use the `password` command:

1. Open a terminal window and connect to the database:

```
$ sqlplus EUS_ENGINE_USER@database
```

2. Use the password command:

```
SQL> password

Changing password for EUS_ENGINE_USER
Old password:
New password:
Retype new password:
Password changed
```

Responding to Browser-Specific Security Certificate Alerts

When you connect to Enterprise Manager via HTTPS, the Management Service presents your browser with a certificate to verify the identity of the Management Service. This certificate has been verified by a third party that your computer trusts. When a Web browser encounters an untrusted certificate, it generates security alert messages. The security alert dialog boxes appear because Enterprise Manager's certificate is issued by a Certificate Authority which the browser does not trust.

You can choose to ignore the warnings and continue with your Enterprise Manager session, or you can import the CA certificates into the browser's list of trusted "root" certificates to eliminate the certificate security alerts in future browser sessions.

Third Party Certificate Workflow

The following high-level steps are involved in setting up Enterprise Manager to use third party certificates.

Step 1: Generate a wallet and have it certified by a third party authority such as Entrust, Verisign, Thwate, or DigiCert.

Step 2: Configure the custom wallets to each OMS. For instructions, see Configuring a Third Party Certificate for HTTPS Console Users

Step 3: Add the certificate to the browser's list of trusted root certificates to eliminate further browser certificate warnings. The following sections describe how to respond to browser-specific security alert dialog boxes when you are using Enterprise Manager in a secure environment. Note: Step 3 is not required for well-known certificate authorities such as Verisign or Entrus.

- Responding to the Internet Explorer Security Alert Dialog Box
- Responding to the Internet Explorer Security Alert Dialog Box
- Responding to the Mozilla Firefox New Site Certificate Dialog Box
- Responding to the Google Chrome Security Alert Dialog Box
- Responding to Safari Security Dialog Box

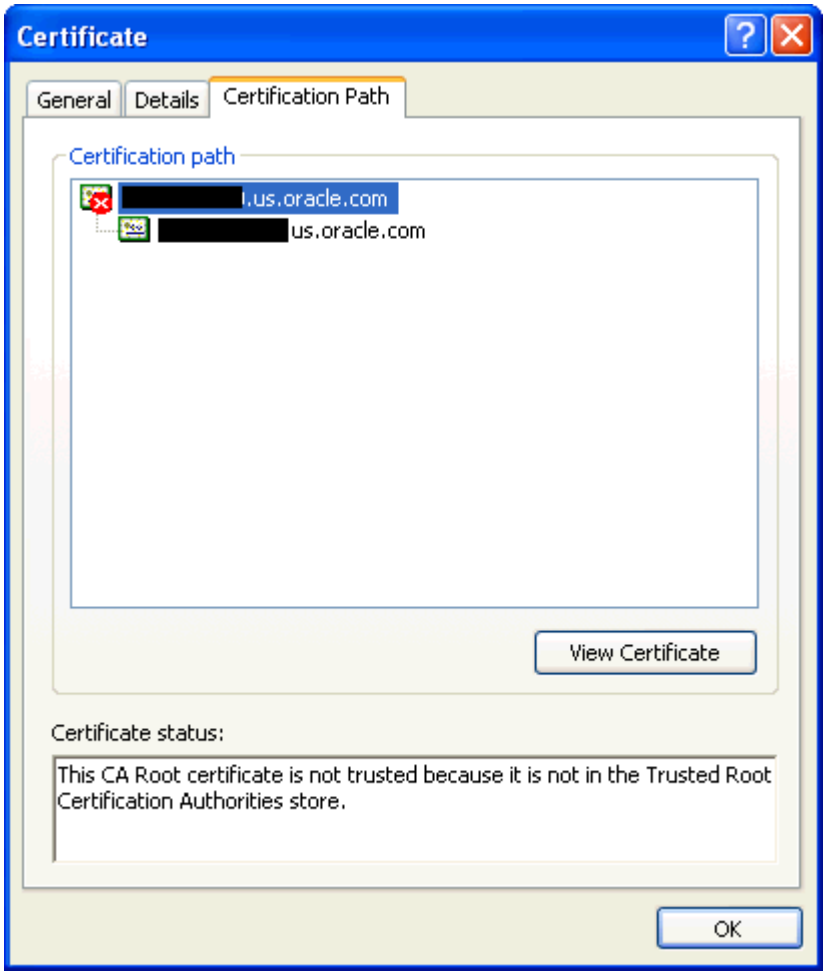
Responding to the Internet Explorer Security Alert Dialog Box

Security is enabled by default for the Management Service. However, if you have not enabled the more extensive security features of your web tier, you will likely receive the following warning: "There is a problem with this Web site's security certificate." This occurs because Enterprise Manager's certificate is issued by a Certificate Authority which the browser does not trust.

When Internet Explorer displays the certificate warning page, use the following instructions to install the certificate and avoid viewing this page again in future Enterprise Manager sessions:

1. From the certificate warning page, click **Continue to this Web site (not recommended).**

   Internet Explorer displays a Security Warning dialog.
2. Click **Yes**. Internet Explorer may display a **Security Alert** dialog if you have not selected **In the future, do not show this warning.** in a previous Internet Explorer session. Click **OK** to dismiss the dialog.
3. The Enterprise Manager console logon page displays.
4. At the top of the browser, click **Certificate Error** to display the **Certificate** pop-up.
5. Click **View Certificates**. The Certificates dialog appears.
6. Click the **Certificate Path** tab and select the first entry in the list of certificates as shown in the following graphic.



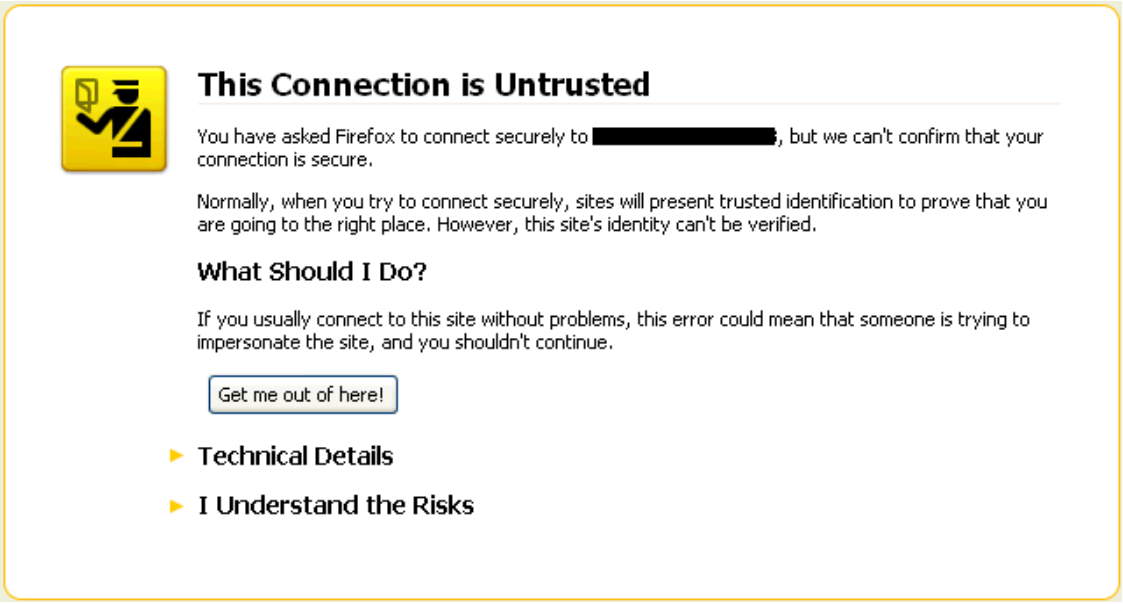
7. Click **View Certificate** to display a second Certificate dialog box.
8. Click **Install Certificate** to display the Certificate Import wizard.
9. Accept the default settings in the wizard, click **Finish** when you are done.

   Internet Explorer displays a Security Warning asking if you want to install the certificate. Click **Yes**. Internet Explorer will display a message stating that the certificate was imported successfully.
10. Click **OK** to close each of the security dialog boxes and click **Yes** on the Security Alert dialog box to continue with your browser session.

    You should no longer receive the **Security Alert** dialog box in any future connections to Enterprise Manager when you use this browser.

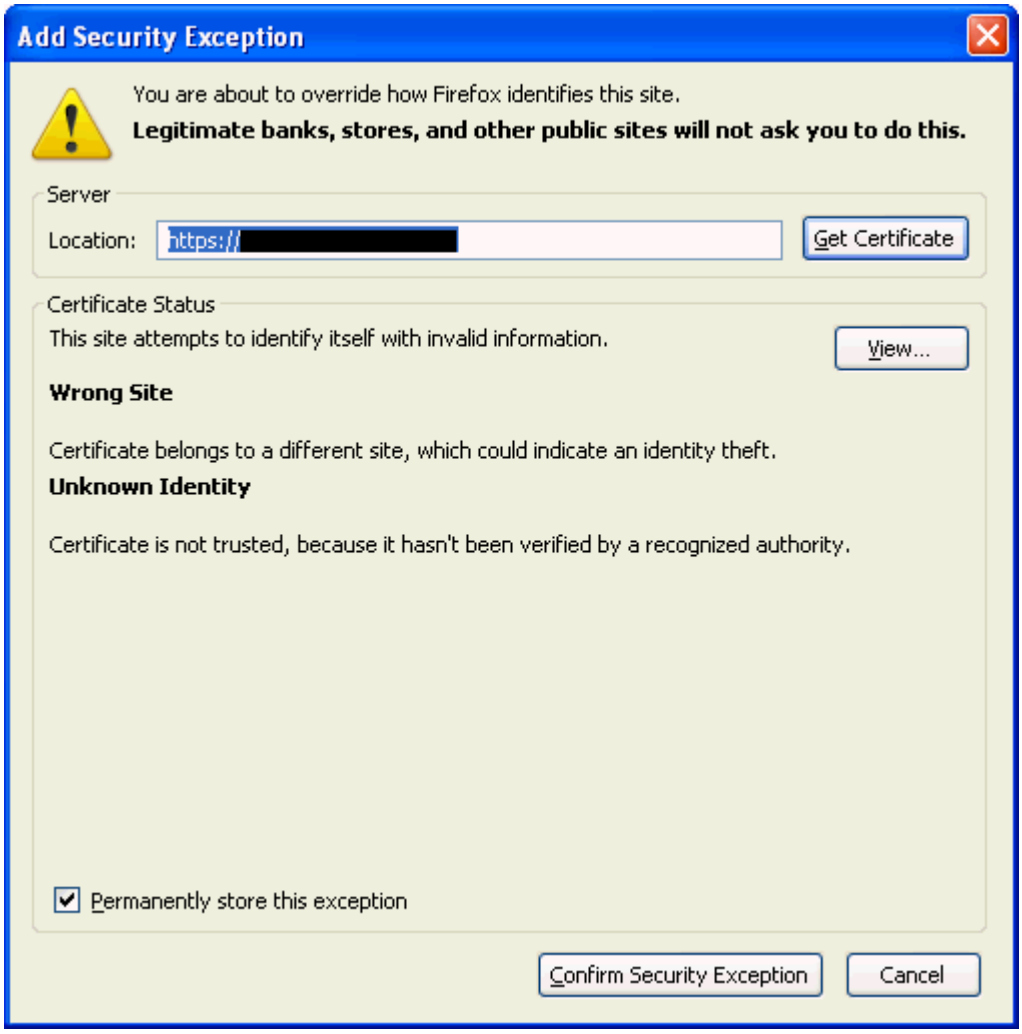
Responding to the Mozilla Firefox New Site Certificate Dialog Box

Firefox will also issue a connection warning when Enterprise Manager's certificate is issued by a Certificate Authority which the browser does not trust. When you first attempt to display the Cloud Control console using the HTTPS URL in Mozilla Firefox, you will receive a warning because the connection is untrusted.



When Firefox displays the Untrusted Connection page, use the following instructions to install the certificate and avoid viewing this page again in future Enterprise Manager sessions:

1. Review the instructions and information. Click **I Understand the Risks**. Firefox displays additional information and the opportunity to add the certificate.
2. Click **Add Exception...** . Firefox displays the **Add Security Exception** dialog.



3. Ensure that the **Permanently store this exception** option is selected.

   You should no longer receive the New Site Certificate dialog box when using the current browser.

4. Click **Confirm Security Exception**. The Enterprise Manager console displays.

You will no longer receive the untrusted connection warning in any future connections to Enterprise Manager when you use this browser

Responding to the Google Chrome Security Alert Dialog Box

Google Chrome issues a warning if the security certificate of the Website is not trusted. When you first attempt to display the Cloud Control console using the HTTPS URL in Google Chrome, you will receive a warning because the connection is mistrusted.

When Google Chrome displays the Untrusted Connection page, use the following instructions to install the certificate and avoid viewing this page again in future Enterprise Manager sessions:

> **Note:**
>
> Installing a certificate using this method on Google Chrome may still lead to performance degradation. To solve this issue, the best option is to obtain a trusted certificate from a vendor of your choice.

1. Click on the crossed out lock pad icon on the left hand side of the URL address bar.
2. Click **Certificate Information** in the menu.
3. Select the **Certification Path** tab.
4. Select the OMS host name (a red cross icon).
5. Click **View Certificate.**
6. Select the **Details** tab.
7. Click **Copy to File...**
8. Save the certificate on your Desktop. For example, you can save it as:

   ```
   adc1110000.cer
   ```

9. From the Google Chrome menu, go to **Tools**, click **Settings**, and then select **Show Advanced Settings.**
10. Click **Manage Certificates.**
11. Select the **Trusted Root Certification Authority** tab.
12. Click **Import.**

    A wizard guides you through the process of importing the saved certificate.

    A warning window displays a message that the certificate you are importing cannot be verified and asks if you want to continue. Click **Yes** to proceed.
13. Check if the saved certificate appears in the **Trusted Root Certification Authority** table.
14. Restart the Google Chrome browser and load the Enterprise Manager URL. If the **Certificate Error** icon is not visible in the address bar, then the certificate is valid and trusted.

Responding to Safari Security Dialog Box

Safari does not support the option to install a certificate individually. To solve this issue, you have to obtain a trusted certificate from a vendor of your choice.

Privileged Access Management Integration

Introduction

Privileged Access Management (PAM) solutions eliminate the need for hard-coded application credentials embedded in applications, scripts, or configuration files, and allow highly sensitive passwords to be centrally stored, logged, and managed within the Vault. This unique approach enables organizations to comply with internal and regulatory compliance requirements of periodic password replacement, and monitor and audit privileged access across all systems, databases, and applications.

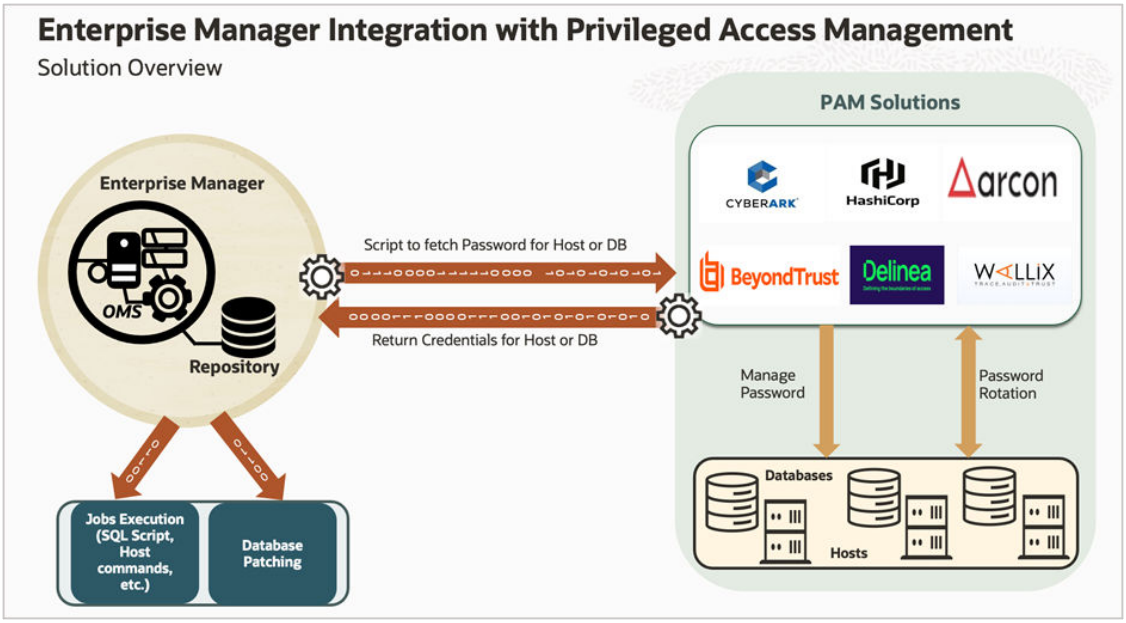
PAM solutions help provide secure privileged access to critical assets like database and hosts by centrally managing account passwords. PAM solutions provide access rules for both privileged and non-privileged accounts to control who can use those accounts to log on to your assets. As Enterprise Manager (EM) customers incorporate different PAM providers like CyberArk, Centrify, HashiCorp, Oracle Key Vault, etc. Now, we have an extensible Enterprise Manager credential framework that is integrated with PAM providers. This integration allows you to perform tasks such as active database management, database patching, and running host commands in a manner that is compliant with security compliance policies.

The PAM integration with EM provides:

- PAM solutions provide an external store where credentials are stored and can serve to extend EM's credentials framework, thereby offering an abstraction layer through the integration.
- The database or host credentials that are either stored in the repository or in PAM Store need to be supplied to the subsystems in EM using methods such as Jobs and deployment procedures as required.
- PAM is a secure system so the integration with EM should support token-based authorization for secure access.
- Since the credentials for database and hosts are stored in PAM and there are multiple PAM providers in the market, EM provides the ability to register the PAM script to securely retrieve the credentials.
- A data model to create a mapping that allows to create an EM Credential type out of the attributes of the credential fetched from the credential store.
- This integration allows you to either create a new PAM based named credentials for EM to retrieve the credentials from an external store or modify an existing named credentials to retrieve the credentials from an external store.
- EM provides the ability to effectively retrieve the password for databases or hosts from PAM to perform activities such as executing jobs and patching databases using fleet maintenance through EM in a manner compliant with their security policies.

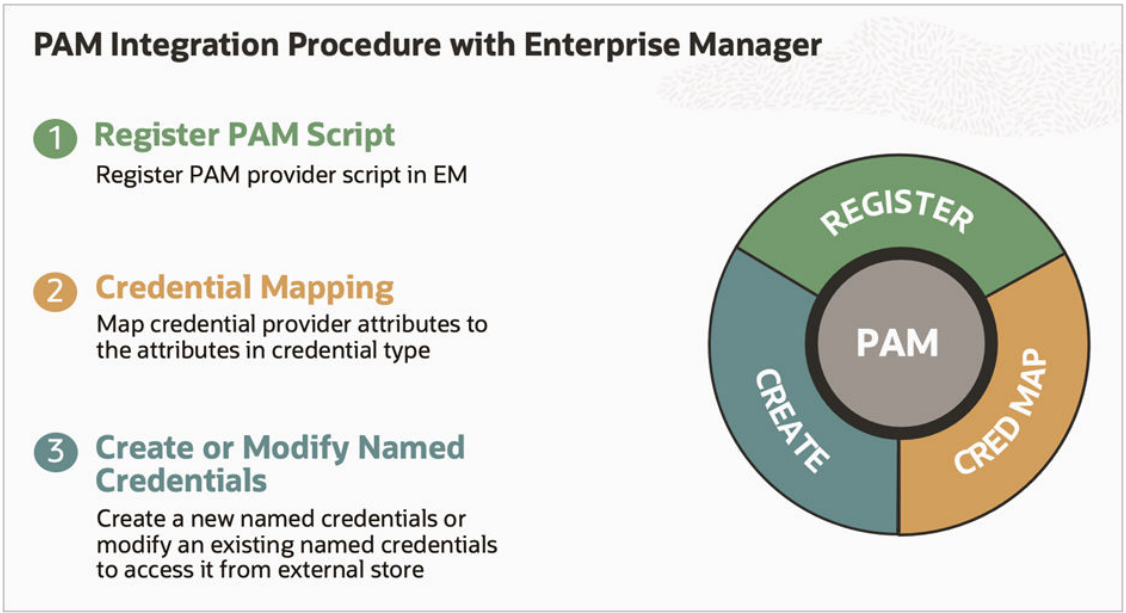
> **Note:**
>
> PAM integration with Enterprise Manager only works with Names Credentials.

The diagram below depicts how EM interacts with PAM to retrieve the credentials for database or host from an external store to carry out functionalities in EM such as executing jobs on host or database and database patching using Fleet Maintenance.



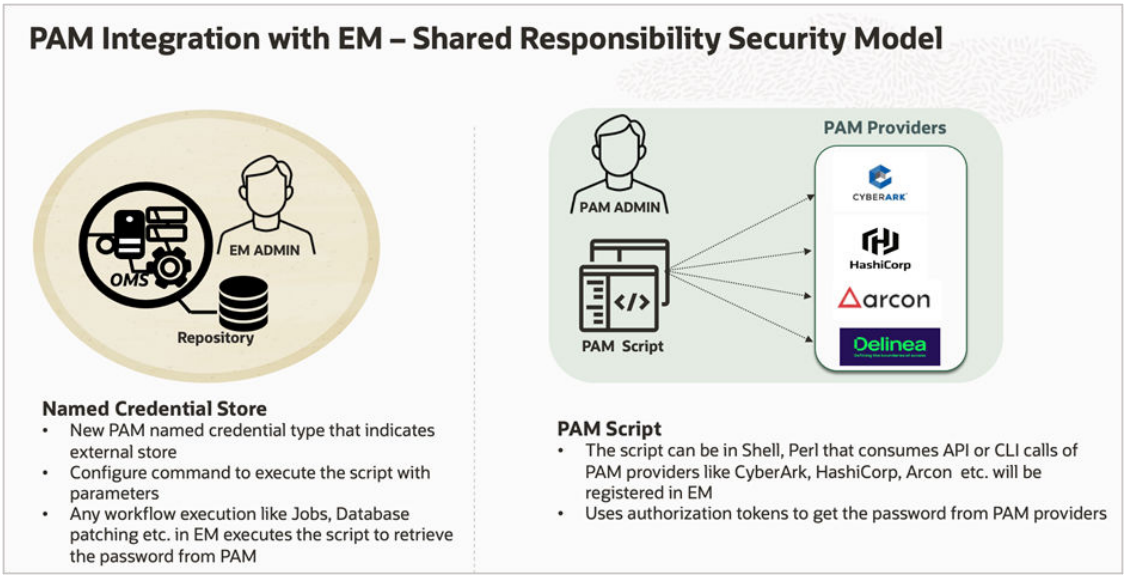
Using the PAM integration, EM retrieves database and host credentials that are now stored in the external PAM store. To accomplish this, you need to write the integration script that will be registered in EM with all the PAM attributes. When EM requires the database or hosts credentials for using in workflows like database patching or running jobs, the credential framework interacts with the external PAM provider and retrieves the password for database or hosts and passes that credential object to the underlying workflows.

PAM integration with EM consists of three simple steps for all PAM providers.



Understanding the User Roles

Two types of administrators are involved in the integration of the PAM solution: EM Administrator and PAM Security Administrator. The shared ownership of the PAM integration solution with EM is depicted below:



PAM Security Administrator Role

A PAM security team should guide the EM administrator team to build a script and provide the necessary parameters required for the script execution. This script is required in order to access the PAM provider using REST end points and retrieve credentials for databases or hosts at runtime. The script can be written in Shell or Perl.

EM Administrator Role

An EM Administrator, predefined in EM, configures the PAM script in Enterprise Manager by running the emcli commands.

Prerequisites

Minimum EM version: Oracle Enterprise Manager 13c Release 5 Update 14 (13.5.0.14).

Configuration

Step 1: Develop a script to access PAM credentials

As a **PAM Security Administrator,** work with your Security or PAM team to develop a script for PAM tools such as CyberArk, and HashiCorp. This custom script connects to a PAM system and retrieves the necessary credentials. The script must meet the following requirements:

- Written in Shell or Perl. Binary files are not supported.
- Can use any method to fetch credentials like REST or command line tool.

- Each credential stored in the PAM system can be referred to using a unique identifier, called a *Credential Key*. The *Credential Key* should also be passed on as an argument to the script. You can decide how the argument should be passed, for example any of the formats listed below:

```
sh getcreds.sh -k CredKey
```

```
sh getcreds.sh -credkey CredKey
```

```
sh getcreds.sh CredKey
```

- Credentials or authentication tokens required to authenticate a PAM system should be passed through STDIN as `key:value` pair, not specified in the script. Use one of the ways as shown below:

  1. Script requires just auth token to authenticate with PAM system: On execution of script it should prompt for auth token which is then passed through STDIN:

     ```
     sh getcreds.sh -k CredKey
     authtoken:token
     ```

  2. Script requires PAM user and password to authenticate with PAM system: On execution of script it should prompt for PAM User & Password which is then passed through STDIN:

     ```
     pamuser:user
     pampassword:password
     ```

  3. Script requires PAM user, password, certificate path and certificate key to authenticate with PAM system: On execution of script it should prompt for PAM user & password with certificate details:

     ```
     pamuser:user
     pampassword:password
     pamcertpath:path
     pamcertkey:key
     ```

     A script built to accept certain input parameters securely through STDIN can be configured as is in Enterprise Manager, so when EM executes the script it passes values for such input parameters through STDIN.

- The script should fetch and print the credentials in a *name:value* format as shown below.

```
sh getcreds.sh -k EMDB/sysman
pamuser:user
pampassword:password
```

In above example, *EMDB/sysman* is the *Credential key* and *user/password* is the credential fetched from the PAM system.

- Script should capture error/exception during execution. The errors should be formatted as string, and should be written to STDERR for EM to read and show it in GUI and in calling subsystem processes.
- The script will be run in any of the OMS hosts in a multi-oms setup, so all the required software installation and configuration required for script execution should be done on all the OMS hosts.

Step 2: Register the PAM Provider with EM

As an **EM Administrator**, register the PAM provider with EM using the EM CLI command `emcli config_cred_provider`.

This is a new verb that allows the credential provider to be configured with the required attributes.

```
emcli config_cred_provider
[-provider_name=\"provider name\"]
[-provider_type=\"provider type\"]
[-access_cred_type=\"cred type\"]
-params="params"
[-refparams="params"]
[-input_file="FILE:file_path"]
[-separator="separator:attribute_name:character"]
[-subseparator="subseparator:attribute_name:character"]
```

Options:

- `-provider_name`: Name of the provider to configure and should contain only alphabets, numbers, hyphen(-) and underscore(_) and not exceed 64 characters.
- `-provider_type`: Credential provider type. Current allowed value is `ScriptProvider`.
- `-access_cred_type`: The type of credential that is required to authenticate against this credential provider.

  Example: In case of using PAM user credentials to authenticate with PAM system then create named credentials of type "*Host Credentials* using the PAM user and password and provide `-access_cred_type="HostCreds"` and then map the named credential to PAM provider created using `set_credprovider_cred`.
- `-params` : Comma separated set of *name=value* pairs. It can be used in conjunction with `-input_file` to specify tags to file paths that contain longer content.

  Example:

  ```
  -params="Command:sh %ScriptFile% -key
  %CredKey%;StdInVars:CACertLoc,AuthToken;ScriptFileExt:sh;Script:getCyberArk
  Password"
  ```

  – Example commands that need to be run to fetch credential from PAM depending on the script type being used:

  * `sh %ScriptFile% -key %CredKey%`

  * `perl %ScriptFile% -k %CredKey%`

`ScriptFile` and `CredKey` are mandatory keywords, while `%ScriptFile%` will be replaced by the script file name (in OMS file system), and `%CredKey%` will be replaced by the credential key provided while creating the named credential.

- `StdInVars`: list of input parameters separated by comma that needs to be passed through standard input

  Example:

  ```
  StdInVars:AuthToken;
  StdInVars:CACertLoc,AuthToken;
  ```

- `ScriptFileExt`: supported script file extensions:
  - `sh`
  - `pl`
- `Script`: tag pointing to the actual script file path which will be defined in the parameter `input_file`.

- `-input_file`: to specify tag pointing to actual file path.

  Example:

  ```
  -input_file="getCyberArkPassword:/u01/app/pam_scripts/getcreds.sh"
  ```

- `-refparams`: Comma separated set of name=value pairs. Can be used to map input parameters to integration script to any of three below mentioned OMS properties:
  - *"oracle.sysman.core.security.auth.cred_provider_prop1"*
  - *"oracle.sysman.core.security.auth.cred_provider_prop2"*
  - *"oracle.sysman.core.security.auth.cred_provider_prop3"*

Example:

```
sh getcreds.sh -k CredKey
pamuser:user
pampassword:password
authtoken:token


./emcli config_cred_provider
-provider_name="CyberArk"
-provider_type=ScriptProvider \
-params="Command:sh %ScriptFile% -k
%CredKey%;StdInVars:CACertLoc,AuthToken;ScriptFileExt:sh;Script:getCyberArkPas
sword"\
-input_file="getCyberArkPassToken:/u01/app/pam_scripts/getcreds.sh"\
-
refparams="AuthToken:oracle.sysman.core.security.auth.cred_provider_prop1,CACe
rtLoc:oracle.sysman.core.security.auth.cred_provider_prop2"
```

Once the script is registered in EM, it is stored in the repository table *EM_NC_CREDPROVIDER_PARAMS* and you can run a `select` query to see the data. Here is an example of a query:

```
SELECT * FROM EM_NC_CREDPROVIDER_PARAMS;
```

> **Note:**
>
> If you would like to re-create the PAM provider registration with EM, you can use the emcli `delete_cred_provider` command and then execute the emcli `config_cred_provider` command to re-create it.

Step 3: Create the Credentials Attributes Mappings

Credentials mappings map the keys in the script output (user and password in this example) to credential attributes like `HostUserName` and `HostPassword`. Store an attribute mapping to convert stored attributes to those required by credential type. In order to find the credential type attribute names, run the following command:

```
emcli get_credtype_metadata -authtargettype=<authenticating target type> -
credtype=<credential type>
```

For example, the following command lists the attribute names for `HostCreds` credential type and host target type.

```
emcli get_credtype_metadata -authtargettype=host -credtype=HostCreds
```

Run the following command to create the credentials mappings:

```
emcli store_cred_mapping
-mapper_name="mapper name"
-mapper_desc="mapper description"
-cred_type="cred type"
-attributesmap="attributes map"
```

Options:

- `-mapper_name`: Name of mapper.
- `-mapper_desc`: Description of mapper
- `-cred_type`: Type of credential that this mapping is intended for.
- `-attributesmap`: Comma separated set of `name=value` pairs that maps attributes stored in the credential provider to attributes of the specified credential type.

Here are some examples of mappings for a host and a database:

- Host

  ```
  emcli store_cred_mapping
  -mapper_name="PAMtoHostCreds"
  -mapper_desc="Map PAM credential attributes to HostCreds type"
  ```

```
-auth_target_type=host -cred_type="HostCreds"
-attributesmap="user:HostUserName;pass:HostPassword"
```

- Database

```
emcli store_cred_mapping
-mapper_name="PAMtoDBCreds"
-mapper_desc="Map PAM credential attributes to DBCreds type"
-auth_target_type=oracle_database
-cred_type="DBCreds"
-attributesmap="user:DBUserName;pass:DBpassword"
```

Once the credential mapping is created this information is stored in the EM repository tables *EM_NC_CRED_MAPPERS* and *EM_NC_CRED_MAPPER_COLUMNS*.

Here is an example to check in repository database:

```
SELECT m.mapper_name, m.cred_type_name, mc.storage_attr, mc.cred_attr
FROM EM_NC_CRED_MAPPERS m, EM_NC_CRED_MAPPER_COLUMNS mc
WHERE mc.mapper_guid = m.mapper_guid
ORDER BY m.mapper_name;
```

> **Note:**
>
> If you would like to re-create the credential mapping, you can use the emcli `delete_cred_mapping` command and then execute the emcli `store_cred_mapping` command to re-create it.

Case 1: If the username is not passed while creating the PAM based named credentials, then it should be returned in the script output as shown below.

Example: If you don't pass the database username in the attributes while creating PAM based named credentials, then it should be returned in the script and mapped using the `store_cred_mapping` command for Enterprise Manager to understand.

```
./emcli create_named_credential
-cred_name=OEM_SYSPAM -auth_target_type=oracle_database
-cred_type=DBCreds
-alt_cred_storage
-cred_provider=PAM360
-cred_key="HRDB/sys"
-cred_mapping=PAM360toDBCreds
-attributes="DBRole:SYSDBA"
```

```
if [[ $stat == $sstat ]]; then
        pswd=$(echo $gpwd_resp | jq -r '.operation.Details.PASSWORD')
        echo "user:${acc}"
        echo "pass:${pswd}"
```

```
./emcli store_cred_mapping
-mapper_name="PAM360toDBCreds"
-mapper_desc="Map PAM 360 credential attributes to DBCreds type"
-auth_target_type=oracle_database
```

```
-cred_type="DBCreds"
-attributesmap="user:DBUserName;pass:DBpassword"
```

Case 2: If the username is passed while creating the PAM based named credential, then the script can be built just to return the password as shown below:

Example: If you pass the DB username in the attributes while creating PAM based named credentials, then only the password can be returned in the script and maped using the `store_cred_mapping` command for Enterprise Manager to understand.

```
./emcli create_named_credential
-cred_name=OEM_SYSPAMD
-auth_target_type=oracle_database
-cred_type=DBCreds
-alt_cred_storage
-cred_provider=PAM360
-cred_key="HRDB/sys"
-cred_mapping=PAM360toDBCreds
-attributes="DBUserName:sys;DBRole:SYSDBA"
```

```
if [[ $stat == $sstat ]]; then
        pswd=$(echo $gpwd_resp | jq -r '.operation.Details.PASSWORD')
        echo "pass:${pswd}"
```

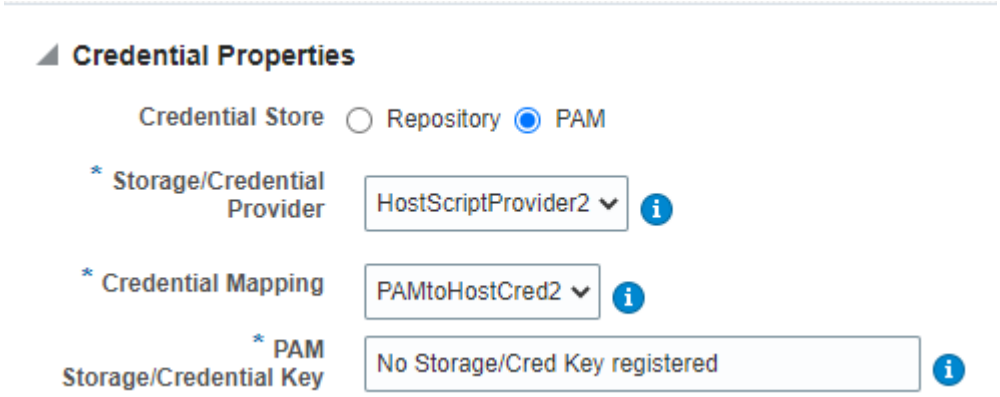
```
./emcli store_cred_mapping
-mapper_name="PAM360toDBCreds"
-mapper_desc="Map PAM 360 credential attributes to DBCreds type"
-auth_target_type=oracle_database
-cred_type="DBCreds"
-attributesmap="pass:DBpassword"
```

Step 4: Create or Modify the Named Credentials

Starting with Oracle Enterprise Manager 13c Release 5 Update 20 (13.5.0.20) credentials can be created using the CLI or the UI.

To create credentials using the UI, from the **Settings** drop-down menu, go to **Security**, and click **Named Credentials**. Click **Create**, and select the **PAM** radio button for the **Credential Properties** options.

> **Note:**
>
> To have the **PAM** option available in the UI, make sure to complete steps 2 and 3:
>
> - Step 2: Register the PAM Provider with EM
> - Step 3: Create the Credentials Attributes Mappings



Follow the steps bellow to create the credentials as an `EM Administrator`, using the CLI:

1. Use an EM CLI verb to create the new credentials in EM with an alternate credential storage type. The following example creates the named credential ssh1 based on the SSH key named credentials for host *myhost.example.com*. It indicates that the credential attributes are stored in the OracleKeyVault credential provider at the location emssh1 and that the mapping named OKVSSHCreds can map the attributes required for the HostSSHCreds credential type.

   ```
   emcli create_named_credential
   -cred_name=ssh1
   -auth_target_type=host
   -cred_type=HostSSHCreds
   -target_name="myhost.example.com"
   -target_type=host
   -cred_scope=instance
   -alt_cred_storage
   -cred_provider=<PAM Provider>
   -cred_key=emssh1
   -cred_mapping=OKVSSHCreds
   ```

2. Modify the Named Credentials as needed. Similar to *create_named_cred*, the *modify_named_credential* verb also takes the additional parameters : *alt_cred_storage, cred_provider, cred_key, cred_mapping*

   The following example modifies the named credential ssh1 based on the SSH key named credentials for host *myhost.example.com*. It indicates that the credential attributes are stored in the *OracleKeyVault* credential provider at the location *emssh1* and that the mapping named *OKVSSHCreds* can map the attributes required for the *HostSSHCreds* credential type.

   ```
   emcli modify_named_credential
   -cred_name=<credential name>
   -auth_target_type=host
   -cred_type=HostSSHCreds
   -target_name="myhost.example.com"
   -target_type=host
   -cred_scope=instance
   -alt_cred_storage
   -cred_provider=OracleKeyVault-cred_key=emssh1
   -cred_mapping=OKVSSHCreds
   ```

   Examples:

   ```
   emcli modify_named_credential
   -cred_name=ORACLE
   -cred_type=HostCreds
   ```

```
-target_type=host
-cred_scope=global
-alt_cred_storage
-cred_provider=PAM360
-cred_key="DBHost/oracle"
-cred_mapping=PAM360toHostCreds


emcli modify_named_credential
-cred_name=OEM_SYS
-cred_type= DBCreds
-auth_target_type=oracle_database
-cred_scope=global
-alt_cred_storage
-cred_provider=PAM360
-cred_key="HRDB/sys"
-cred_mapping=PAM360TODBCREDS
```

The credential name, type and owner, and storage provider and key, and mapper name are stored in the EM repository tables *EM_NC_CRED_MAPPERS* and *EM_NC_CREDS*.

Here is an example of a query of this data:

```
SELECT c.cred_owner, c.cred_type_name, c.cred_name, c.storage_provider,
c.storage_key, m.mapper_name
FROM EM_NC_CREDS c, EM_NC_CRED_MAPPERS m
WHERE c.cred_name IN ('MANIDB_SYSMAN', 'DBSNMP_LOCAL')
AND c.storage_cred_mapper_guid = m.mapper_guid (+)
```

3. Validate the stored credential by querying the registered and configured PAM provider. The list_cred_mappings is a new verb that shows the result of the earlier store_cred_mapping requests. The list_credential_providers is a new verb that shows the result of the earlier config_cred_provider request.

```
emcli list_credential_providers
```

Lists the configured credential providers.

```
emcli list_cred_mappings
-cred_type="cred_type" [-cred_owner="cred_owner"]
```

Lists the configured credential mappings for a given credential type (and optional credential owner).

Options:

- `-cred_type`: lists the credential type for which the mappings are requested

At the completion of these steps, the PAM provider is registered with EM and either a new credential or a modified existing named credential is set up to use the external storage type.

Configuration of Multi-OMS Environments

PAM integration allows the use of the predefined OMS properties mentioned below to set the input parameters of the integration script. However, these OMS properties are local to each OMS and it is required to set values for the properties on each OMS as needed in the multi-OMS environment.

- oracle.sysman.core.security.auth.cred_provider_prop1
- oracle.sysman.core.security.auth.cred_provider_prop2

- oracle.sysman.core.security.auth.cred_provider_prop3

```
$ emctl set property
-name "oracle.sysman.core.security.auth.cred_provider_prop1"
-value "<value provided by your internal security team>"
```

The rest of the setup steps should be executed only **once** from one of the OMS servers:

1. `config_cred_provider` (Step 2): should be executed only once from one of the OMS servers, and the script content will be stored in the database as a CLOB. The executable script is created in an internal EM directory on each OMS, whenever a PAM credential is invoked.
2. `store_cred_mapping` (Step 3): should be executed only once from one of the OMS servers. The contents of the mapping is stored in the EM repository database, and will be used while processing the script output.
3. `create_named_credential`/`modify_named_credential` (Step 4): should be executed from one of the OMS servers

PAM configurations suported in EM

Case 1

Use global OMS properties to store script input parameters to authenticate with PAM system (In case a dedicated PAM user to be used for authentication with PAM system).

- "oracle.sysman.core.security.auth.cred_provider_prop1"
- "oracle.sysman.core.security.auth.cred_provider_prop2"
- "oracle.sysman.core.security.auth.cred_provider_prop3"

Example:

```
sh getcreds.sh -k CredKey
pamuser:user
pampassword:password
authtoken:token
```

```
./emcli config_cred_provider-provider_name="CyberArk"\
-provider_type=ScriptProvider\
-params="Command:sh %ScriptFile% -k
%CredKey%;StdInVars:CACertLoc,AuthToken;ScriptFileExt:sh;Script:getCyberArkPas
sword"\
-input_file="getCyberArkPassToken:/u01/app/pam_scripts/getcreds.sh"\
-
refparams="AuthToken:oracle.sysman.core.security.auth.cred_provider_prop1,CACe
rtLoc:oracle.sysman.core.security.auth.cred_provider_prop2"
```

Case 2

Use of named credential to store PAM authentication details like PAM User Credentials (In case an individual PAM credentials to be used to authenticate with PAM system).

1. Script when executed prompts to enter PAM user details:

```
sh getcreds.sh
-k CredKey
pamuser:user
pampassword:password
```

2. Create a config cred provider with access cred type as *HostCreds*:

```
./emcli config_cred_provider-provider_name="CyberArk"\
-provider_type=ScriptProvider\
-access_cred_type="HostCreds"\
-params="Command:sh %ScriptFile% -k
%CredKey%;StdInVars:CACertLoc,AuthToken;ScriptFileExt:sh;Script:getCyberArk
Password"\
-input_file="getCyberArkPassToken:/u01/app/pam_scripts/getcreds.sh"\
-refparams="AuthToken:oracle.sysman.core.security.auth.cred_provider_prop1"
```

3. Create a named credential to store PAM user details:

```
emcli create_named_credential
-cred_name="PAMCreds"
-auth_target_type=host
-cred_type=HostCreds
-attributes="HostUserName:pam_username;HostPassword:pam_password"
```

4. Set credential to be used for cred provider:

```
emcli set_credprovider_cred
-provider_name= CyberArk
-cred_name="PAMCreds"
```

Typical Use cases

The PAM integration with EM provides a key benefit for the Database Lifecyle Management capabilities, the patching with Fleet Maintenance in particular. This integration allows the use of named credentials stored with PAM to be used during patching tasks.

Patching with Fleet Maintenance

Here are some examples of use cases you can try using Fleet Maintenance. For more information, see Database Fleet Maintenance

Frequently Asked Questions about PAM Integration with Enterprise Manager

This section provides answers to the following frequently asked questions about PAM Integration with Enterprise Manager

- What are the components of a PAM integration script?
- How does Enterprise Manager read errors occurring in the PAM integration script?
- How does the PAM integration script get stored within EM and how does EM handle tamperings of the script?

- How to map the script output to an Enterprise Manager credential object?
- What are the parameters to be passed in the config_cred_provider emcli command?
- What are the available global parameters to be used with the PAM integration feature in EM?
- What are the file permissions to be set on the script to register a PAM provider in EM?
- How to avoid long running times of the PAM integration script?
- How To Integrate third party PAM Users to OEM Credentials?
- How To Integrate Cyberark PAM Users to OEM Credentials?
- How To Install and config PAM 360 and configure users?
- How To Integrate third party PAM Hashi Crop Users to OEM Credentials?

What are the components of a PAM integration script?

PAM Integration Script Includes: Inputs, processing logic and outputs:

- **Inputs**: parameters passed to the script by Enterprise Manager.
- **Body**: processing logic depends on PAM product/solution.
- **Outputs**: script output for Enterprise Manager to read and map to credential object.

As mentioned above, Enterprise Manager only understands PAM integration script inputs and outputs.

1. Inputs to script are configured while creating the PAM credential provider using the `emcli config_cred_provider` command.
2. Map script output to Enterprise Manager credential object using the `emcli store_cred_mapping` command.

How does Enterprise Manager read errors occurring in the PAM integration script?

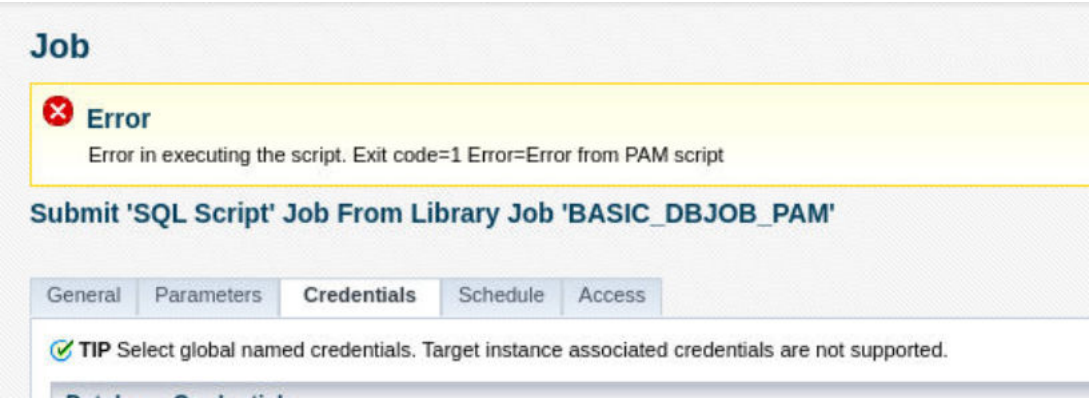
Enhance PAM integration script to catch all the errors/exceptions and write all error messages to STDERR for Enterprise Manager to process as shown below:

- Write to STDERR in the shell script using the syntax:

```
echo "error message" 1>&2
```

Enterprise Manager reads the error messages from the STDERR and shows it in the GUI, and in calling sub system process, susch as jobs and deployment procedures.

Example: Error message written to STDERR will be shown in **EM GUI** and **EM Jobs** as shown below.



How does the PAM integration script get stored within EM and how does EM handle tamperings of the script?

Step 1: Enterprise Manager supports script in Shell and Perl.

The contents of the script are stored in the repository database as CLOB data when the `emcli config_cred_provider` command is executed to register the script in EM.

Step 2: When the PAM based named credential is invoked after executing `emcli config_cred_provider`:

- It creates the executable integration script stored as CLOB in the EM repository in the internal EM directory.
- If the script file already exists, EM validates the checksum of the script in the internal directory with the checksum of the script in the form of CLOB data, and if the checksum value is the same for both, then it continues to use the integration script in the path. If not, it creates a new integration script file in the EM internal directory with the new CLOB data for the script execution. Any subsequent PAM credential invocation uses the same integration script file in the path which is already created if it is not tampered by any user, or updated by executing the `emcli config_cred_provider`.

Any tampering or security breach of the script is addressed within Enterprise Manager using checksum validation as explained above.

How to map the script output to an Enterprise Manager credential object?

Case 1

If the username is not passed while creating the PAM based named credential, then the script output should include username as shown below:

Example: If you don't pass DB username in the attributes while creating PAM based named credential, then it should be included in the script output and map it using store_cred_mapping command for Enterprise Manager to read it from script output and map it to EM credential object.

```
./emcli create_named_credential
-cred_name=OEM_SYSPAM
-auth_target_type=oracle_database
-cred_type=DBCreds
```

```
-alt_cred_storage
-cred_provider=PAM360
-cred_key="HRDB/sys"
-cred_mapping=PAM360toDBCreds
-attributes="DBRole:SYSDBA"


./emcli store_cred_mapping
-mapper_name="PAM360toDBCreds"
-mapper_desc="Map PAM 360 credential attributes to DBCreds type"
-auth_target_type=oracle_database
-cred_type="DBCreds"
-attributesmap="user:DBUserName;pass:DBPassword"
```

Case 2

If the username is passed while creating the PAM based named credential, then the script can be built just to return the password in the output as shown below:

Example: If you pass the DB username in the attributes while creating the PAM based named credential, then only the password can be returned in the script output, and map it using the `store_cred_mapping` command for Enterprise Manager to read it from the script output and map it to the EM credential object.

```
./emcli create_named_credential
-cred_name=OEM_SYSPAMD
-auth_target_type=oracle_database
-cred_type=DBCreds
-alt_cred_storage
-cred_provider=PAM360
-cred_key="HRDB/sys"
-cred_mapping=PAM360toDBCreds
-attributes="DBUserName:sys;DBRole:SYSDBA"


./emcli store_cred_mapping
-mapper_name="PAM360toDBCreds"
-mapper_desc="Map PAM 360 credential attributes to DBCreds type"
-auth_target_type=oracle_database
-cred_type="DBCreds"
-attributesmap="pass:DBPassword"
```

What are the parameters to be passed in the config_cred_provider emcli command?

```
emcli config_cred_provider
[-provider_name=\"provider name\"]
[-provider_type=\"provider type\"]
-params="params"
[-refparams="params"]
[-input_file="FILE:file_path"][-
separator="separator:attribute_name:character"]
[-subseparator="subseparator:attribute_name:character"]
```

Options:

`-provider_name`: Name of the provider to configure. **Name should contain only alphabets, numbers, hyphen(-) and underscore(_) and not exceed 64 characters.**

`-provider_type` : Optional. Credential provider type. This must be one of the supported provider types: `ScriptProvider`.

`-params` : Comma separated set of *name*=*value* pairs.

`-input_file`: to specify tags to file paths that contain longer content.

`-refparams`: Comma separated set of *name*=*value* pairs. Can be used to map PAM provider parameters to OMS properties such as: "oracle.sysman.core.security.auth.cred_provider_prop1".

> **Note:**
>
> `config_cred_provider`: if executed for the first time, it behaves like a creation, and later executions with the same `provider_name` behaves like a modification. To modify any of the provider details, execute the emcli `config_cred_provider` command with the same provider name.

What are the available global parameters to be used with the PAM integration feature in EM?

As part of this feature, Enterprise Manager has three global parameters configured to be used for storing PAM parameters, such as authentication token and authentication details.

Customer can use any of the below pre-configured parameters for the PAM integration.

oracle.sysman.core.security.auth.cred_provider_prop1

oracle.sysman.core.security.auth.cred_provider_prop2

oracle.sysman.core.security.auth.cred_provider_prop3

What are the file permissions to be set on the script to register a PAM provider in EM?

Only read permission are required to be set for the script while executing the `emcli config_cred_provider` command. EM reads the contents of the script and stores them as CLOB data in the EM Repository.

How to avoid long running times of the PAM integration script?

PAM Integration script should manage to time out the script execution and return an error to avoid dangling jobs and threads in Enterprise Manager.

3

Keeping Enterprise Manager Secure

This chapter provides guidelines for keeping Enterprise Manager secure.
This chapter provides instructional guidelines for keeping Enterprise Manager secure.

- Guidelines for Secure Infrastructure and Installations
- Guidelines for SSL Communication
- Guidelines for Authentication
- Guidelines for Authorization
- Guidelines for Auditing
- Guidelines for Managing Target Credentials
- Oracle Enterprise Manager FIPS140-2 Settings

Guidelines for Secure Infrastructure and Installations

Securing your Oracle Enterprise Manager deployment involves securing all layers of the stack starting with the underlying operating system (OS) on which the OMS and Repository reside all the way up to the Enterprise Manager components themselves. These recommendations will increase overall security as well as prevent certain DoS attacks.

Secure the Infrastructure and Operating System

Harden the machines themselves by removing all unsecure services such as rsh, rlogin, telnet, and rexec on Linux platform (for the list of unsecure services and how to remove them on different platforms, please refer to the CIS benchmarks). It is also recommended to stop non-essential services, this minimizes the ‘attack footprint' of the host and reduces resource consumption by services that are not required, freeing up system resources to deliver the best performance from the OMS.

Restrict OS access by supporting only indirect or impersonation-based access to all Oracle Homes by using utilities such as sudo or PowerBroker. Protect the WebLogic Server Home directory, especially the domain directory which contains configuration files, security files, log files and other Java EE resources for the WebLogic domain. Grant only one OS user who runs WebLogic Server the access privilege to the directory.

Ensure that all the Oracle Homes are patched with the latest CPU (Critical Patch Update). This is a recommended best practice for securing the Oracle Management Service, Repository, Agents and managed targets. Setup your My Oracle Support credentials to detect new Security Alerts and CPUs from the Patch Advisor. With the default Security Recommendations for Oracle Products compliance standard, when a target is missing the latest Security patches, a compliance standard violation will be triggered. In addition, the Secure Configuration for Host should be associated to the hosts of the OMS and Repository. There are additional compliance standards for Database and WLS that can be applied depending on your level of security. Review the Oracle Enterprise Manager Cloud Control Administrator's Guide section on Compliance for more information on available compliance standards and how to associate targets.

The OMS runs on top of the Oracle WebLogic Server. Most of the best practices for securing Oracle WebLogic Server are applicable for securing the OMS as well. Refer to the Oracle Fusion Middleware Securing a Production Environment for Oracle WebLogic Server section Securing Oracle WebLogic Server for additional information.

Ensure that the OMS, Repository and Agent are monitored for filesystem space. The OMS writes a lot of information to log and trace files, and proper space needs to be available for successful operation and troubleshooting. The Agent also relies on filesystem space for log and trace files as well as collecting target metrics.

Best Practices for Securing the Infrastructure and Operating System

- Remove unsecure services and stop non-essential services on all infrastructure components
- Restrict OS access and protect critical files and directories
- Apply latest OS security patches
- Adhere to security Compliance Standards and apply latest Oracle CPU patches to all components (OMS, Repository and Agent)
- Monitor filesystem space for OMS, Repository and Agent

Securing the Oracle Management Repository

In addition to the above recommendations, steps are necessary to secure the Oracle Management Repository. Since the Oracle Management Repository resides within an Oracle database, a number of the best practices for securing the Oracle database itself are applicable to securing the Repository as well. For best practices on Oracle database security, please refer to the Oracle Database Security Checklist.

The above document also covers certain Operating System level steps that need to be performed to secure the database. Following are additional recommendations to be implemented in the Enterprise Manager deployment.

Enable Advanced Security Option

Enable Advanced Security Option (ASO) between the OMS and Repository to ensure that the data between the OMS and Repository is secure both from confidentiality and integrity standpoints. In addition to the ASO configuration required on the Repository database, you will need to configure the OMS and Agent to connect to a secure Repository database. The detailed instructions for implementing ASO for Enterprise Manager can be found in the Enterprise Manager Security section of the Oracle Enterprise Manager Cloud Control Administrator's Guide.

Please refer to the Oracle Database Advanced Security Administrator's Guide to obtain detailed information about ASO.

Restrict Network Access

Restrict network access to the host on which the Repository resides by putting the repository database behind a firewall and checking network IP addresses. The Listener should be configured to accept requests only from OMS nodes by adding the following parameters into TNS_ADMIN/protocol.ora file:

- tcp.validnode_checking =YES
- tcp.excluded_nodes = (list of IP addresses)

- tcp.invited_nodes = (list of IP addresses), list all OMS nodes here)

The first parameter turns on the feature whereas the latter parameters respectively deny and allow specific client IP addresses from making connections to the Oracle listener. Please refer to the Secure the Network Connection section of the Oracle Database Security Guide for more information.

Audit SYS actions

Audit all SYS (schema) operations at the database level by setting AUDIT_SYS_OPERATIONS = TRUE.

Use the operating system syslog audit trail to minimize the risk that a privileged user, such as a database administrator, can modify or delete audit records stored in an operation system trail if the database version of Repository is 10gR2 or after.

- For 10gR2 DB, refer to the Auditing documentation to obtain more information about syslog audit trail.
- For 11g DB, set AUDIT_SYS_LEVEL initialization parameter appropriately to use syslog audit trail. Refer to the 11g documentation for details.

Securing User Accounts

Users should log in to the Console with their own individual accounts, and not use the SYSMAN user. SYSMAN is the schema owner and is more privileged than Enterprise Manager Super Administrators. Multiple users should be granted Super Administrator to reduce the need for SYSMAN access. One strong reason for creating multiple Super Administrator accounts is to ensure one user maintains account access in case another user becomes locked out by a dictionary/brute force attack. The Super Administrator privilege should be limited to users who truly need all the permissions that Super Administrator gives them.

In some cases, you may wish to prevent SYSMAN from logging into the console by executing the following SQL statement on the Repository database as the SYSMAN user:

```
UPDATE MGMT_CREATED_USERS
SET SYSTEM_USER='-1'
WHERE user_name='SYSMAN'
```

After disabling SYSMAN from logging into console, you can enable it by executing:

```
UPDATE MGMT_CREATED_USERS
SET SYSTEM_USER='1'
WHERE user_name='SYSMAN'
```

Use password profiles to enforce the password control of Enterprise Manager Administrators while Repository-based authentication is used. There is an out-of-box password profile MGMT_ADMIN_USER_PROFILE with the following parameter settings for Enterprise Manager Administrators:

- FAILED_LOGIN_ATTEMPTS=10
- PASSWORD_LIFE_TIME=180
- PASSWORD_REUSE_TIME=UNLIMITED
- PASSWORD_REUSE_MAX=UNLIMITED
- PASSWORD_LOCK_TIME=1
- PASSWORD_GRACE_TIME=7

- PASSWORD_VERIFY_FUNCTION=MGMT_PASS_VERIFY

The out-of-box password verification function MGMT_PASS_VERIFY will ensure that the password cannot be same as username, its minimum length is 8, and it must have at least one alphabet, digit and punctuation character. You can create customized password profiles with different values to meet your special requirements, for example, a new password verification function to meet a stricter password complexity requirement.

Change SYSMAN and MGMT_VIEW users' password on a regular basis using only the method documented in the Security section of the Oracle Enterprise Manager Cloud Control Administrator's Guide. The documented command (*update_db_password()*) helps you change the SYSMAN related passwords in the OMS and in the repository database. If you do not execute this command properly, the OMS may fail to start due to inconsistent passwords for one of the many accounts. You will be prompted for the old and new SYSMAN passwords.

When changing the MGMT_VIEW password, you can select “-auto_generate" to generate a random password that no one will know. The MGMT_VIEW password is used only by the Reporting system and should not be used for login, therefore the auto_generate flag can ensure the password is not known.

To avoid the service interruption due to the lockout of internal users, SYSMAN and MGMT_VIEW users are associated with MGMT_INTERNAL_USER_PROFILE upon install. The password parameters are all set to UNLIMITED. In addition, to avoid sessions hanging or taking a long time due to resource consumption limit, MGMT_INTERNAL_USER_PROFILE's kernel parameters are set to default, which is unlimited as well.

Secure and Backup the Encryption Key

The Encryption Key is the master key that is used to encrypt/decrypt sensitive data, such as passwords and preferred credentials, stored in the Repository. The key itself is originally stored in the Repository and removed automatically once the installation is done. It only needs to be in the Repository during an upgrade. By storing the key separately from the Enterprise Manager schema, we ensure that the sensitive data such as Preferred Credentials remain inaccessible to the schema owner and other SYSDBA users (privileged users who can perform maintenance tasks on the database). Keeping the key outside of the Enterprise Manager schema will ensure that sensitive data remain inaccessible while Repository backups are accessed. Further, the Enterprise Manager schema owner (SYSMAN) should not have access to the OMS Oracle Homes to prevent reading or overwriting the emkey. See the Oracle Enterprise Manager Cloud Control Administrator's Guide for more detailed information about Enterprise Manager's Cryptographic Support and the emkey. Follow the process outlined below to secure the encryption key.

Backup the encryption key to a file by running the following command and keep the encryption file on a separate machine securely, restrict access to only the OMS software owner. If the encryption key is lost or corrupted, the encrypted data in the repository is unusable.

```
$ emctl config emkey -copy_to_file_from_credstore -emkey_file emkey.ora
```

The encryption key is required to be in the Repository for some operations such as Enterprise Manager patches and upgrades.

Remove the key from the Repository once the operation is done.

```
$ emctl config emkey -remove_from_repos
```

Best Practices for Securing the Oracle Management Repository

- Enable Advanced Security Option on the Repository database and configure OMS and Agent
- Restrict network access to known targets
- Grant Super Administrator privilege to select administrators and do not log in with SYSMAN account
- Enable strong password profiles and change application related account passwords regularly
- Secure and backup the encryption key

Securing the Oracle Management Agent

For better security during agent installation, agents should be deployed using Enterprise Manager Enterprise Manager's Agent Deploy which uses the secure SSH protocol. When manually deploying Agents, to protect against the possibility of users installing unauthorized agents, use one-time registration passwords that have a reasonable expiry date instead of persistent registration passwords. Registration passwords can be created in the Console or by using the emctl secure setpwd command.

Install the agent as a separate user from OMS installation and support only impersonation based access to this account such as sudo or PowerBroker post installation to prevent unauthorized changes.

Secure Communication

There are several ways to secure the communication between OMS and agent, including firewalls, the OMS secure-lock feature, enabling TLSv1, enabling strong cipher suites and certificates. The following section looks at these in more detail.

Best Practices for Securing the Oracle Management Agent

- Utilize the Enterprise Manager Agent Deployment method for Agent installations.
- Use a one-time registration passwords with expiry dates
- Install the Agent as a separate user from OMS or Targets

> **Note:**
>
> Agents on remote servers need to be installed as a separate OS user of the targets on that server, however, this does not apply to chained Agents. A chained Agent cannot be installed as a separate user because it gets installed along with the OMS.

Enable ICMP

Enterprise Manager uses the industry-standard Internet Control Message Protocol (ICMP) echo request to check status of target host machines if the agent has not uploaded or responded in a timely fashion or at expected intervals. If ICMP is disabled, the target will appear to be down. Firewall should be configured to allow ICMP to prevent false down target alerts.

A Beacon is a target that allows the Management Agent to remotely monitor services. A Beacon can monitor one or more services at any point in time. ICMP and User Datagram Protocol (UDP) are also used to transfer data between Beacon targets that allow an Agent to monitor services and the network components you are monitoring. If there is a firewall or ACL between the Web application components and the Beacons you use to monitor those components, you must configure it to allow ICMP, UDP, and HTTP traffic.

Configure Oracle Management Agent for Firewalls

When the host where the agent resides is protected by a firewall, you need to configure the agent to use a proxy, or configure the firewall to allow incoming communication from the OMS. To configure the firewall you must determine the port assigned to the agent and whether communication is HTTP or HTPS. You can find this information by running emctl status agent.

To configure the proxy set the following properties using the Enterprise Manager Console to edit the Agent properties or emctl setproperty agent and restart the agent. The proxy realm, user and password may not be required in all environments.

```
$ emctl setproperty agent -name REPOSITORY_PROXYHOST –value test01.example.com
$ emctl setproperty agent -name REPOSITORY_PROXYPORT –value 80
$ emctl setproperty agent -name REPOSITORY_PROXYREALM –value <value if needed>
$ emctl setproperty agent -name REPOSITORY_PROXYUSER –value <value if needed>
$ emctl setproperty agent -name REPOSITORY_PROXYPWD –value <value if needed>
```

Configure Oracle Management Service for Firewalls

In cases where the Oracle Management Service is behind a firewall, configurations will be needed to allow proxy communications to the agents or incoming communication through the firewall.

If the agents that are behind the firewall are in different domains, you can configure the proxy to allow communication for those agents and use the dontProxyFor parameter to identify the agents within the firewall. To configure the proxy on the Management Service set the following properties using emctl set property. The proxy realm, user and password may not be required in all environments.

```
$ emctl set property -name REPOSITORY_PROXYHOST -value test01.example.com
$ emctl set property -name proxyPort -value 80
$ emctl set property -name dontProxyFor –value ".example.com"
```

To configure the firewall to allow inbound communication from the agents for metric uploads, the firewall must be configured to accept HTTP/HTTPS traffic on the upload ports. The default ports are 4889 (HTTP) and 1159 (HTTPS). If your ports were customized you'll need to use those ports.

If there is a firewall between your browser and the Enterprise Manager Console, you must configure firewall to allow the console to receive HTTP/HTTPS traffic over port 7788/7799 (defaults). You can validate your port by looking at the URL you access the Console with.

```
https://test01.example.com:7799/em
```

Additional component installations such as JVMD and APD have additional port requirements. Default ports are 9702/9703 (http/https). For more information please see the documentation specific to the component.

To manage the database targets that are configured behind firewalls, you must allow Oracle Net traffic on the listener ports (typically 1521 but often customized). For more information regarding configuring Oracle Databases for firewalls see the Oracle Database 2 Day + Security Guide.

Security Console

The Security Console is available to Super Administrators only and provides all security related configuration information in one location, allowing you to view, analyze, and optimize security for your managed environment. To access the Security Console, from the **Setup** menu, select **Security**, and then **Security Console**.

When the Security Console first displays, it is divided into two main windows, the menu window on the left hand side and the information window on the right hand side.

The Security Console contains both static (text) and dynamic information. The text is to provide quick, high level context to the data, it is not intended as a replacement to your documentation.

The Security Console is categorized into the following security areas:

- Overview
- Pluggable Authentication
- Fine-grained Access Control
- Secure Communication
- Credentials Management
- Comprehensive Auditing
- Active User Session Count
- Best Practices Analysis

Overview

The overview section gives a high level description of each of the Security Console categories.

Pluggable Authentication

The Pluggable Authentication section is further divided into two tabs. An "Overview" tab and a "Configuration" tab.

Pluggable Authentication Overview

The Overview section contains text from the documentation, however, it is not meant as a replacement for the documentation. Enterprise Manager Authentication is the process of determining the validity of the user attempting to access Enterprise Manager. The authentication feature is available across the different interfaces such as the Enterprise Manager console and the Enterprise Manager Command Line Interface (EM CLI). Oracle Enterprise Manager 13c relies on the WebLogic Server for external Authentication methods. For this reason, Enterprise Manager 13c can be authenticated using any authentication method supported by Oracle WebLogic Server.

This section also identifies the Authentication schemes supported by Enterprise Manager, for more information please see Security Features , Configuring Authentication .

Pluggable Authentication Configuration

This section displays the current configuration information in your enterprise relating to Authentication.

Authentication Configuration

Authentication Mode: This parameter provides information on the various pluggable authentication schemes configured in your Enterprise Manager environment.

External User Support Enabled: Displays if you have external user authentication enabled. If using any authentication other than "repository" authentication, this will display "yes".

Auto-provisioning supported: The status of auto-provisioning is also displayed. Auto-provisioning allows for an externally authenticated user to log into Enterprise Manager without being preconfigured within Enterprise Manager and the information is transferred from the authentication application. It requires that the OMS property *oracle.sysman.core.security.auth.autoprovisioning* be set. For more information please see Security Features , External Authorization using External Roles.

Password Profile

When creating an Administrator (Setup->Security->Administrators menu) you enter the type of password profile you want that user to use during login. This table gives a count of the number of users in Enterprise Manager which have been assigned the various password profiles. For more information on password profiles see Securing User Accounts.

Fine-grained Access Control

Enterprise Manager implements granular privileges to control access to targets, and other resources, allowing administrators to better segregate their duties. For example, consider the provisioning designer and provisioning operator job responsibilities. The former has greater responsibilities (creates components in the Software Library) than the latter (submits deployments). Fine-grained access control explains the privileges and roles and how they serve to provide various levels of access control to different applications, groups, services and targets within Enterprise Manager. Information about the Administrators last login to the system, their number of privileges and roles granted and recommendations on best practices relating to appropriate usage of roles and privileges can be found in this section.

The Fine-grained Access Control area is divided into five tabs, An Overview, Administrators tab, Privileges tab, Roles tab and Privilege Propagation Aggregates tab.

Overview

Giving the same level of access to all systems to all administrators is dangerous, but individually granting access to tens, hundreds, or even thousands of targets to every new member of the group is time consuming. With Enterprise Manager's administrator privileges and roles feature, this task can be performed within seconds, instead of hours. Authorization controls the access to the secure resources managed by Enterprise Manager via system, target, and object level privileges and roles.

This section describes Enterprise Manager's Authorization model including user classes, roles, and privileges assigned to each user class. The following topics are described:

- Classes of Users
- Privileges and Roles

Classes of Users

Oracle Enterprise Manager supports different classes of Oracle users, depending upon the environment you are managing and the context in which you are using Oracle Enterprise Manager. There are three administrator access categories:

- Super Administrator: Powerful Enterprise Manager administrator with full access privileges to all targets and administrator accounts within the Enterprise Manager environment. The

Super Administrator, SYSMAN is created by default when Enterprise Manager is installed.The super administrator account can manage all other administrator accounts and set up all administrator credentials. The super administrator can:

  - Create Enterprise Manager privileges and roles
  - Perform the initial setup of Enterprise Manager, for example, defining e-mail configurations and defining global notifications rules
  - Add targets to Enterprise Manager
  - Perform any action on any target in the system
- Administrator Regular Enterprise Manager administrator.
- Repository Owner Database administrator for the Management Repository. This account cannot be modified, duplicated, or deleted.

Privileges and Roles

User privileges provide a basic level of security in Enterprise Manager. Privileges can be divided into two categories: **Target Privileges** and **Resource Privileges**

A role is a collection of Enterprise Manager resource privileges, or target privileges, or both, which you can grant to administrators or to other roles. These roles can be based upon geographic location (for example, a role for Canadian administrators to manage Canadian systems), line of business (for example, a role for administrators of the human resource systems or the sales systems), or any other model.

- Out-of-Box Roles

  Enterprise Manager Cloud Control 13c comes with predefined roles to manage a wide variety of resource and target types.
- External Roles

  Enterprise Manager Cloud Control 13c can be integrated with external authorization source like Active Directory by defining External roles.
- Private Role
  - Secure privileges like FULL_CREDENTIAL,FULL_JOB etc which are not granted to Super Administrators by default, can be granted to a private role.
  - Private roles can not be converted into System Roles. Creator of a private role handles the life cycle of it.
  - Private roles can be granted to administrators 'WITH_ADMIN' option from Enterprise Manage command line interface (EMCLI) which will enable administrators to grantor revoke private roles to/from other administrators.

Fine-grained Access Control Administrators

This lists all the Administrators current created in Enterprise Manager, and also lists the date and time in which they last logged in.

Fine-grained Access Control Privileges

This lists the top five administrators with the number of privileges directly granted to them. Administrators with high numbers of privileges indicate an inefficient use of privileges and should be directed to use roles instead. It is recommended that an Administrator be granted the minimum number of privileges necessary to perform their task. For more information on privileges and roles, see section 2.2.3, "Managing Privileges with Privilege Propagating Groups ".

This section also displays all the Target and Resource Privileges available in Enterprise Manager, whether the privilege can be applied to a single target, a specific target, a target type and if that privilege contains another privilege.

Fine-grained Access Control Roles

This section allows us to view the top 5 Administrators with the Highest Number of Roles, if the number of role grants is high, it points to an inefficient role hierarchy, suggesting that roles could be combined for efficient manageability.

Roles with the Highest Number of Nested Roles can also be displayed here.

Fine-grained Access Control Privilege Propagation in Aggregates

An aggregate target is a target that consists of one or more member targets, such as groups and systems. Enterprise Manager support two type of aggregate targets based on privilege propagation mechanism:

- Normal aggregate target - If any privilege is granted on aggregate target, only view privilege will be propagated to its members
- Privilege Propagating aggregate target - If any privilege is granted on aggregate target then the same privilege will be propagated to its members

The following features are supported in case of target privileges on Aggregate Targets:

- Separation between the privilege grants on aggregate target and its members
- Along with the default existing behavior of propagating the same privilege on members, User can choose to have one privilege grant on aggregate target and another on its members.User can also choose to have no privilege on members.
- In case of non privilege propagating aggregate targets by default only view will be granted to the members where as in case of privilege propagating aggregate targets whatever privilege is specified by the administrator that will be granted appropriately.
- This feature is available from User and Role management pages as well as Target Access Page in the user interface.On these pages click on "Advanced Privilege Settings" button on top of Target Privileges table to see the advanced privileges in the table.
- EM CLI support is also available for this new feature.Please check EM CLI help for existing relevant verbs for more details on the usage.

Consider the following snapshot of the target privileges for a given administrator:

- Privileges listed under column “Manage Target Privilege Grants" are applicable to the Group as well as the members.
- Privileges listed under column “Manage Aggregate Only Privilege Grants" are applicable only on the Group.
- Privileges listed under column “Manage Member Only Privilege Grants" are applicable only on the members.
- In the following example PPG_DB_group1 is a privilege propagating group of database targets. PPG_HOST_group2 is a privilege propagating group of host targets. NORMAL_group1 is a non-privilege propagating group.

Table 3-1 Target Privileges and Privilege Propagation

Name	Type	Manage Target Privilege Grants	Manage Aggregate Only Privilege Grants	Manage Member Only Privilege Grants
PPG_DB_group1	Group	View	Configure Target	Blackout Target
PPG_HOST_group2	Group	None	Configure Target	None
NORMAL_group1	Group	None	Blackout Target	View
NORMAL_group1	Host	Host	Not Applicable	Not Applicable

- Consider the first row in the above table. This configuration means that the given user has View privilege on group PPG_group1 as well as the members. Along with that it has Configure Target privilege only on the group PPG_group1 and Blackout Target privilege only on members. This means that the current user in the picture can create Blackout on the members of group PPG_group1 but cannot do so on the group itself and it can configure PPG_group1 but cannot configure the members. The user has View on group as well as the members.
- Consider the second row.PPG_HOST_group2 is a privilege propagating group. This configuration means that the given user has Configure Target privilege only on the group PPG_group2 and it does not have even View on members.
- In the third row one can see a non privilege propagating group where the user is having Blackout Target privilege on the group and View privilege on the members.
- Note that the two new advanced privileges column values are not applicable in case of non aggregate target like host target.

Note that the above mentioned feature is applicable to all Aggregate Targets in general. The above example shows one of Aggregate Target type (Group).

Secure Communication

This section provides a high-level overview of Secure Communication terms and protocols used within Enterprise Manager. You can also view the current status of secured Enterprise Manager components, their certificate issuers, and details.

Secure Communication Overview

Enterprise Manager Framework Security implements the following types of secure connections between the Enterprise Manager components:

- HTTPS and Public Key Infrastructure (PKI) components, including signed digital certificates, for communications between the Management Service and the Management Agents.
- Oracle Advanced Security for communications between the Management Service and the Management Repository.

Enabling Security for the Oracle Management Service

To enable Enterprise Manager Framework Security for the Management Service, you use the emctl secure oms utility, performs the following actions:

- Generates a Root Key within your Management Repository. The Root Key is used during distribution of Oracle Wallets containing unique digital certificates for your Management Agents.

- Modifies your WebTier to enable HTTPS channel between your Management Service and Management Agent.
- Enables your Management Service to accept requests from Management Agents using Enterprise Manager Framework Security.

Securing the Oracle Management Agent

When you install the Management Agent on a host, you must identify the Management Service that will be used by the Management Agent. To enable Enterprise Manager Framework Security for the Management Agent, use the emctl secure agent utility.

Restricting HTTP Access to the Management Service

It is important that only secure Management Agent installations that use the Management Service HTTPS channel are able to upload data to your Management Repository and Cloud Control console is accessible via HTTPS only.

Managing Agent Registration Passwords

Enterprise Manager uses the Agent Registration password to validate that installations of Oracle Management Agents are authorized to load their data into the Oracle Management Service.

The Agent Registration password is created during installation when security is enabled for the Oracle Management Service. You can add/edit/delete registration passwords directly from the Enterprise Manager console.

Enabling Security for the Management Repository Database
You enable security for the Management Repository by using Oracle Advanced Security.

Secure Communication Current Configuration

Agent Certificate Details: Displays secured agents along with their certificate details, including the algorithm, its strength, when it was created, when it expires and when the agent was secured.

Number of Unsecured Agents: Indicates the number of Agents in your enterprise that are currently operating unsecured.

Number of Expired Registration Passwords: Indicates the number of Agents which have stopped running due to an expired certificate.

Certificate Authority Details: Lists the certificates being used in your Enterprise Manager installation.

OMS Secure Configuration: Details the Enterprise Manager configuration and communication with the Management Services and indicates the secure configuration details of each, including the console and upload certificate details along with the SLB details.

Database Encryption Configuration

Following are the configuration details about encryption between the OMS and Management Repository/Target Database. The list of encryption algorithms and the checksum algorithms that the client supports are mentioned below. For more details refer to the section "Enabling Security for the Management Repository Database" above.

- *Encryption Algorithms Supported*: Lists all the encryption algorithm details supported.

- *Encryption Algorithm In Use*: Lists the current Algorithm being used.
- *Checksum Algorithm Supported*: Lists the check-up Algorithm currently supported (Only SHA(x) is supported).
- *Checksum Algorithm in use*: Lists the Algorithm currently in use.

Credentials Management

Credentials like user names and passwords are typically required to access targets such as databases, application servers, and hosts. Credentials are encrypted and stored in Enterprise Manager. Beginning with Enterprise Manager 13c, the credential subsystem supports, in addition to basic username-password, strong authentication schemes such as PKI, SSH keys and Kerberos. SSH key based host authentication, used by jobs, deployment procedures and other Enterprise Manger subsystems, is now supported.

By using appropriate credentials, you can:

- Collect metrics in the background as well as real-time
- Perform jobs such as backup, patching, and cloning
- Perform real-time target administration such as start, and stop
- Connect to My Oracle Support

Based on their usage, credentials can be classified into the following categories:

- Named Credentials
- Monitoring Credentials
- Preferred Credentials

Credentials Management Current Configuration

Encryption Key: The Encryption Key is the master key that is used to encrypt/decrypt sensitive data, such as passwords and preferred credentials that are stored in the Repository. The key is originally stored in the Repository and is removed from the Repository and copied to the Fusion Middleware managed Credential Store during installation of the first OMS.

Credentials Management Usage Statistics

The Usage Statistics tab provides credential usage information.

Comprehensive Auditing

Comprehensive Auditing shows the current *auditable operations* and whether they have been configured for external backup to disk. Statistics on the top five most used operations are also displayed, as well as the most active Administrators.

All operations performed by Enterprise Manager administrators, such as creating users, granting privileges, starting a remote job like patching or cloning, need to be audited to ensure compliance with the contracted internal controls of a service organization.

Non-repudiation is the central tenet of auditing. Enterprise Manager Comprehensive auditing provides a tamper-free audit trial of all critical operations.

From the Usage tab, you can view:

- Current Auditing Configuration
- Specific Audit Operations

- Audit Usage Statistics (Top 5 Operations in the last 7 days and Top 5 Administrators in the last 7 days)

Active User Session Count

Active User Session Count shows information related to the session management, such as session timeout, max and active sessions per user count.

All authenticated open user sessions can be viewed from this area.

From the Active User Session Count area, you can view:

- Session Settings (Session Timeout, Maximum Number of Sessions Allowed Per User, Permitted Number of Active Sessions)
- Active Sessions

Best Practices Analysis

Based on observations of information in the above categories, best practices advice is indicated in this section and covers areas such as management of the repository encryption key and auditing operations management. You can quickly view Enterprise Manager security configuration adherence to recommended Oracle security protocols. In addition, suggested best practices are provided based on the specifics of your Enterprise Manager environment.

From the Best Practices Analysis area, you can view:

- Pluggable Authentication: Best practice advice tailored to the pluggable authentication scheme of your environment.
- Fine-grained Access Control: Best practice advice pertaining to role and privilege management.
- Secure Communication: Best practices regarding secure communication between the Management Service, Agent, and Enterprise Manager console.

Guidelines for SSL Communication

This section covers the following SSL Guidelines:

- Ensure TLSv1.2 Protocol is Enabled
- Leave Communication in Secure-Lock Mode
- Modify Cipher Configuration if Required
- Best Practices for Securing Communication

Ensure TLSv1.2 Protocol is Enabled

Transport Layer Security (TLS) is a cryptographic protocol used to increase security over computer networks by providing communication privacy and data integrity between applications. Although it is technically the successor of SSL, TLS is generically referred to as SSL. Beginning with Enterprise Manager 13*c*, TLSv1.2 is enabled by default.

In the case of Enterprise Manager, these *secure* communication channels are between various components of the Enterprise Manager framework. For Enterprise Manager 13c, the TLSv1.2 protocol is supported on the infrastructure communication channels including:

- Oracle Management Services to 13*c* Agent

- 13*c* Agent to Agent
- EMCLI to Oracle Management Services
- Browser to Admin Server/Managed Server Console
- Oracle Management Services to Server Load Balancer
- 13c Agent to Always-On Monitoring Application
- Oracle Management Services to My Oracle Support
- 13c Agent to Fusion Middleware Target
- Oracle Management Services to Fusion Middleware Target

Enabling Oracle Management Service to Database Communication on TLS1.2

You can also configure TLSv1.2 communication channels between the OMS and target databases, which include the Enterprise Manager Management Repository.

- For specific instructions on enabling TLSv1.2 communication between the Oracle Management Service and the Management Repository, see Configure TLSv1.2 for Communication with the Enterprise Manager Repository.
- For information on configuring TLSv1.2 communication with target Oracle databases, see Secured Communication (TCPS) Access to Databases.

Enabling Always-On Monitoring Communication on TLS1.2

The Always-On Monitoring application provides the ability to monitor critical target status and metric alerts when the Oracle Management Service is unavailable. The service continuously monitors critical targets through the Enterprise Manager Agent and can be easily configured to send email notifications for these events to administrators. For information on configuring TLSv1.2 for communication between the Always-On Monitoring (AOM) application and AOM Repository, and between the AOM application and Enterprise Manager Repository, refer to Configuring the Always-On Monitoring Application for Secure Communication Using the TLSv1.2 Protocol in the *Enterprise Manager Administrator's Guide*.

Locking Down the Oracle Management Service to Use the TLSv1.2 Protocol Only

In order to restrict Oracle Management Services communication to use the TLSv1.2 protocol only:

1. Stop the Oracle Management Services. From the command line, run the following:

   ```
   <OMS_ORACLE_HOME>/bin/emctl stop oms
   ```

2. Set the OMS communication protocol: From the command line, run the following:

   ```
   <OMS_ORACLE_HOME>/bin/emctl secure oms -protocol TLSv1.2
   ```

3. Enter the following command to restart the OMS:

   ```
   $ emctl start oms
   ```

Enabling TLS in Mixed Version Environments

If you are installing a Enterprise Manager Cloud Control 13*c* for the very first time, all of the aforementioned communication channels will use TLSv1.2 by default. If you have an existing Enterprise Manager deployment and you want to enable TLS, you need to be aware that older Agents do not support TLSv1.2..

If there are 12*c* Agents in the environment which are not yet upgraded to 13*c*, the communication between the Agent and Oracle Management Service will default to SSL. To configure a 12*c* Agent to support only TLS v1.0 protocol while the Agent listens as a server,

edit the *Agent* properties in the Enterprise Manager console or run `emctl setproperty` at the command line. For example:

```
$ emctl setproperty agent -name allowTLSOnly -value true
```

To edit multiple Agents simultaneously, from the **Setup** menu, choose **Manage Cloud Control** and then **Agents**. From the list, select the Agents you want to modify and then click **Properties**. This will create a job definition where you specify the Agent property that needs to be changed. On the **Parameters** page, set the *minimumTLSVersion* property to *TLSv1.2*. The change will be applied to all selected Agents.

Once the changes have been made, you must bounce the Management Agent(s) in order for the changes to take effect.

Leave Communication in Secure-Lock Mode

Secure and Lock the OMS and Agents

The Oracle Management Service and Oracle Management Agents can run in non-secure (HTTP) or secure (HTTPS) modes. The recommendation is to always use secure mode, hence the default installation will automatically secure-lock the OMS. The secure-lock mode takes security one step further in requiring that agents communicate only through HTTPS port (HTTP port is locked). This ensures that the OMS-Agent communication is always encrypted and mutually authenticated. All requests from un-secure agents are rejected by the OMS. Similarly, any un-secure request from the OMS is rejected by the agent. This helps safeguard the management system from any malicious 'man-in-the-middle' attack happening from within the infrastructure.

If your installation was done before Oracle Enterprise Manager 10g Release 5, you may be required to secure-lock your OMS manually. In the case of upgrades, if the pre-upgrade environment is secured, the upgrade retains the secure mode but does not secure-lock the OMS. If the pre-upgrade environment is already secure-locked, the upgrade retains the secure-lock mode between OMS and Agent.

To check the secure status of the OMS and secure-lock the communication between OMS and agent run the command and restart the OMS:

```
$ emctl status oms -details
Oracle Enterprise Manager Cloud Control 13c Release 12.1.0.3.0
Copyright (c) 1996, 2013 Oracle Corporation. All rights reserved.
Enter Enterprise Manager Root (SYSMAN) Password :
Console Server Host : test01.example.com
HTTP Console Port : 7790
HTTPS Console Port : 7803
HTTP Upload Port : 4890
HTTPS Upload Port : 4904
OMS is not configured with SLB or virtual hostname
Agent Upload is locked.
OMS Console is locked.
Active CA ID: 1
Console URL: https://test01.example.com:7803/em
Upload URL: https://test01.example.com:4904/empbs/upload
…

$ emctl secure lock -upload
Oracle Enterprise Manager Cloud Control 13c Release 12.1.0.3.0
Copyright (c) 1996, 2013 Oracle Corporation. All rights reserved.
```

```
Enter Enterprise Manager Root (SYSMAN) Password :
Agent Upload is locked. Agents must be secure and upload over HTTPS port. Restart OMS.
```

Note that once OMSs are running in secure-lock mode, unsecure agents will not able to upload any data to the OMSs. To check the status and secure the agent issue the following, you will be prompted for the registration password:

```
$ emctl status agent -secure
Oracle Enterprise Manager 13c Cloud Control 12.1.0.1.0
Copyright (c) 1996, 2013 Oracle Corporation. All rights reserved.
Checking the security status of the Agent at location set in <AGENT_LOCATION>/em12/agent/
agent_inst/sysman/config/emd.properties... Done.
Agent is secure at HTTPS Port 3872.
Checking the security status of the OMS at https://test01.example.com:4904/empbs/
upload/... Done.
OMS is secure on HTTPS Port 4904

$ emctl secure agent
Oracle Enterprise Manager 13c Cloud Control 12.1.0.1.0
Copyright (c) 1996, 2013 Oracle Corporation. All rights reserved.
Agent successfully stopped... Done.
Securing agent... Started.
Enter Agent Registration Password :
Agent successfully restarted... Done.
EMD gensudoprops completed successfully
Securing agent... Successful.
```

To ensure the console access from the client browser is secure over SSL/TSL, the console must be locked as well. From Oracle Enterprise Manager 10g Release 5 installations are secure-locked by default. In the case of upgrades, if the pre-upgrade environment is not secure-locked, after the upgrade you need to run the following command to secure-lock the console access:

```
$ emctl secure lock -console
```

Modify Cipher Configuration if Required

A cipher suite is a combination of cryptographic parameters that define the security algorithms and key sizes used for authentication, key agreement, encryption, and integrity protection. Cipher suites protect the integrity of a communication. For example, the cipher suite called SSL_RSA_WITH_AES_128_CBC_SHA uses RSA for key exchange, AES with a 128-bit key, CBC, and SHA for bulk encryption. A cipher suite is a combination of cryptographic parameters that define the security algorithms and key sizes used for authentication, key agreement, encryption, and integrity protection. Cipher suites protect the integrity of a communication. For example, the cipher suite called SSL_RSA_WITH_AES_128_CBC_SHA uses RSA for key exchange, AES with a 128-bit key, CBC, and SHA for bulk encryption.

In Enterprise Manager, ciphers are configured for the following end points:

- Oracle Management Services (OMS) Console end point
- OMS Upload end point
- Agent end point
- WebLogic end point

Ciphers Supported for OMS Console and Upload End Points

Ciphers supported for OMS Console and Upload end points depends on the ciphers supported and exposed by Oracle HTTP Server (OHS), the web server front-ending the OMS server. The

ciphers supported by the OHS web server is listed in Table 1: Cipher Suites Supported in the OMS Console and Upload End Points,

A subset of the OHS-supported ciphers are set as default in the configuration files available within the EMGC_DOMAIN home and is used for OMS Console and Upload end points. The default set of OHS-supported ciphers used for the OMS Console and Upload end points are listed in the table below.

In order to modify the default cipher suites for OMS Console end points, edit the *SSLCipherSuite* property in the following ssl.conf file and add/modify from the list of OHS-supported ciphers list.

For a typical multi-OMS scenario:

1. Modify the following file on the primary OMS server:

   ```
   <WEBTIER_INSTANCE_HOME>/user_projects/domains/EMGC_DOMAIN/config/fmwconfig/
   components/OHS/ohs1/ssl.conf
   ```

2. Modify the following file on each of the additional OMS servers:

   ```
   <WEBTIER_INSTANCE_HOME>/user_projects/domains/EMGC_DOMAIN/config/fmwconfig/
   components/OHS/instance/ohs1/ssl.conf.emctl_secure
   ```

In order to modify the default cipher suites for the Upload end point, edit the *SSLCipherSuite* property in the following httpd_em.conf file and add/modify from the list of OHS supported ciphers.

For a typical multi-OMS scenario,

1. Modify the following file on primary OMS server:

   ```
   <WEBTIER_INSTANCE_HOME>/user_projects/domains/EMGC_DOMAIN/config/fmwconfig/
   components/OHS/ohs1/moduleconf/httpd_em.conf
   ```

2. Modify the following file on each additional OMS server:

   ```
   <WEBTIER_INSTANCE_HOME>/user_projects/domains/EMGC_DOMAIN/config/fmwconfig/
   components/OHS/instance/ohs1/moduleconf/httpd_em.conf.emctl_secure
   ```

Any modification of cipher suites for the OMS console and Upload end points requires a restart of the OMS, including the Admin server.

OHS Supported Cipher Suites	OMS Default: Console	OMS Default: Upload
SSL_RSA_WITH_AES_128_CBC_SHA	No	Yes
RSA_WITH_AES_128_CBC_SHA256	No	Yes
SSL_RSA_WITH_AES_256_CBC_SHA	No	Yes
RSA_WITH_AES_256_CBC_SHA256	No	Yes
ECDHE_RSA_WITH_AES_128_CBC_SHA	No	Yes
ECDHE_RSA_WITH_AES_256_CBC_SHA	No	Yes
RSA_WITH_AES_128_GCM_SHA256	No	Yes
RSA_WITH_AES_256_GCM_SHA384	No	Yes

Ciphers Supported for Agent End Points

Ciphers supported for Agent EMD_URL / end points (if it is enabled in Agent's JDK) are listed in Table 2. A subset of these supported ciphers are set as defaults on the agent end points. The table also shows which ciphers for the Agent EMD_URL /end point are enabled by default.

In order to override the default cipher suites used by the agent , edit the *SSLCipherSuites* property in emd.properties to include the ciphers from the list of supported ones. Optionally, you can use the `setproperty` command as follows:

```
$ emctl setproperty agent -name SSLCipherSuites -value <values>
```

Supported Cipher Suites	Agent Default
RSA_WITH_AES_128_CBC_SHA	Yes
RSA_WITH_AES_128_CBC_SHA256	Yes
RSA_WITH_AES_256_CBC_SHA	No
RSA_WITH_AES_256_CBC_SHA256	Yes
ECDHE_RSA_WITH_AES_128_CBC_SHA	No
ECDHE_RSA_WITH_AES_128_CBC_SHA256	Yes
ECDHE_RSA_WITH_AES_256_CBC_SHA	No
ECDHE_RSA_WITH_AES_256_CBC_SHA384	Yes
DHE_RSA_WITH_AES_128_CBC_SHA	No
DHE_RSA_WITH_AES_128_CBC_SHA256	Yes
DHE_RSA_WITH_AES_256_CBC_SHA	No
DHE_RSA_WITH_AES_256_CBC_SHA256	Yes

Notes:

- AES_256 ciphers will only work if the Agent JKS has unlimited strength policy file corresponding to the Agent Java version currently installed on the system. For instance, 13.2 agents using Java 7, download unlimited strength policy file from http://www.oracle.com/technetwork/java/javase/downloads/jce-7-download-432124.html. Unzip and copy local_policy.jar & US_export_policy.jar in to `<agent_base_directory>/agent_13.2.0.0.0/oracle_common/jdk/jre/lib/security`.
- All cipher suites using SHA256 & above will only work for TLS1.2. See Ensure TLSv1.2 Protocol is Enabled for information on making sure the end point is configured on TLS1.2.
- For SSL handshake to happen on a particular cipher suite, it should be enabled on both client and server. For example, if the communication from agent to OMS Server should happen on 'ECDHE_RSA_WITH_AES_128_CBC_SHA' cipher suite, then this cipher suite should be configured on both agent (client) and OMS Upload end point(server).

Ciphers Supported for WebLogic End Points

WebLogic end point uses the ciphers provided by the underlying JDK by default. In order to change the default ciphers, refer to the official guide on *Fusion Middleware Administering Security for Oracle WebLogic Server 12.1.3*.

Third Party Certificates

Use a certificate from well-known Certificate Authority (CA) to secure OMS-Agent communication and console access to take advantage of the well-known trusted certificates with different expiry and key size.

Oracle Wallets

Oracle has introduced the concept of a wallet, which is a password-protected container used to store authentication and signing credentials, including private keys, certificates, and trusted certificates needed by SSL.

To secure the console using a custom certificate authority, you need to create a wallet location and secure the console against that wallet location. For more information on creating a wallet, see the *Oracle Fusion Middleware Administrator's Guide*.

Creating an Oracle Wallet

The following example shows you how to create and add a certificate to an Oracle wallet.

1. Create the wallet container:

> **Note:**
>
> Currently, only single sign-on (SSO) wallets are supported.

```
S /u01/app/oracle/middleware/oracle_common/bin/orapki wallet create -wallet /home/
oracle/labs/mywallet -auto_login_only
```

2. Add a certificate to the wallet: When creating the wallet you must specify the Common Name (CN) as the hostname of the machine where the OMS is installed or the SLB name, if the OMS is behind an SLB. In this example, the OMS is behind an SLB, test.example.com.

```
S /u01/app/oracle/middleware/oracle_common/bin/orapki wallet add -wallet /home/
oracle/labs/mywallet -dn 'CN=test.example.com, OU=Oracle, O=Oracle University,
L=Boise, ST=ID, C=US' -keysize 2048 -self_signed -validity 3650 -auto_login_only
```

3. Set the required environment variables for the existing Weblogic domain. They must be set before using orapkiles:

```
$ . setDomainEnv.sh
```

4. View the certificates in the wallet:

```
S /u01/app/oracle/middleware/oracle_common/bin/orapki wallet display -wallet /home/
oracle/labs/mywallet
```

Best Practices for Securing Communication

Here is a summary of the best practices for securing communication:

- Enable ICMP for ping check validation
- Configure firewalls as appropriate in your environment
- Secure and lock the OMS and Agents
- Configure strong cipher suites for the OMS and Agent
- Secure upload and console virtual HTTPS hosts with third party certificates

Guidelines for Authentication

Enable External Authentication

Enterprise Manager Cloud Control 13c offers multiple methods of authentication. In addition to the predefined methods, a customized provider/module can be plugged in to Cloud Control authentication. The default system authentication method is the standard Repository based authentication. Additional predefined methods include:

- Oracle Single Sign-On (OSSO)
- Enterprise User Security (EUS)
- Integration with Oracle Access Manager Single Sign-On (OAM SSO)
- Direct LDAP integration (Oracle Internet Directory, Microsoft Active Directory)
- Security Assertion Markup Language (SAML)

Refer to "Configuring Authentication " for detailed information about how to configure Enterprise Manager to use the pre-defined providers.

Using one of the extended authentication modules enables you to take advantage of centralized identity management across the enterprise. Doing this allows you to rely on the external identity management system for password security compliance, password changes and resets. To create a user in Enterprise Manager with external authentication, you select the “external" flag upon creation. During creation of every new user in Enterprise Manager you are prompted for that users mode of Authentication, via an external Identity store such as Oracle Access Manager (OAM), LDAP or Oracle Internet Directory (OID), or internally via Enterprise Manager Repository.

When the account is deleted from the identity management system, it will no longer authenticate in Enterprise Manager but still needs to be manually removed. Ideally, a script or job could be run to remove the user from Enterprise Manager once removed from the identity management system.

When using external Authentication, Enterprise Manager allows the creation of external roles which map to the identity management systems groups by name (i.e. Enterprise Manager role “DBA" maps to LDAP group “DBA"). Thus allowing synchronized user access and privileges based on external group membership.

Target authentication provides access to the host, database or application targets managed through Enterprise Manager. Using strong target authentication methods, named credentials and configuring database password profiles are a few ways to ensure secure target authentication.

To ensure target authentication security, choose strong host and database authentication methods. Credentials for target access are encrypted and stored in Enterprise Manager. With Enterprise Manager Cloud Control 13c, strong authentication such as SSH-keys for host and Kerberos tickets for database are now supported. These credentials can be used by jobs, deployment procedures and other subsystems.

Best Practices for Authentication

- Integrate with corporate identity management system for enterprise wide authentication
- Use external roles to automatically assign privileges to users based on external group membership

- Automate user creation/deletion based on external group membership using EMCLI
- Utilize strong authentication methods (SSH for host, Kerberos for database)
- For local accounts set up password policies

Guidelines for Authorization

Authorization is the act of validating the privileges and permissions of an authenticated subject. To avoid exploiting authorization, you must implement a policy of segregation of duties. This means no one person should be given responsibility for more than one related function.

Enterprise Manager users may vary widely among a company, and they may have very different roles and purposes.

Enterprise Manager 13c comes with several out-of-the-box roles that provide role based authentication for various operational roles. Segregation of Operator, Designer and Administrator functions for Patching, Provisioning, Cloud, Compliance, and Plug-ins allow more granular authentication for users. Use the Create Like feature to further enhance or restrict as required for your operations.

> **Note:**
>
> Performing a Create Like operation on an existing role enables the newly created role to contain all of the privileges of the original role.

With using Role Based Access Control (RBAC), privilege management becomes easier; managing role grants is simpler than managing privilege grants. For a complete list of the out-of-the-box roles see the Privileges and Roles section of the Oracle Enterprise Manager Cloud Control Administrator's Guide.

With Enterprise Manager 13c we have the ability to specify target privileges and resource privileges. Target privileges allow an administrator to perform operations on a target. Some of the new target privileges include Connect to any Viewable Target, Execute Command Anywhere, Execute Command as any Agent and more. The target privileges can be assigned for all targets or for specific targets. Resource privileges grant access to a function, button or page within Enterprise Manager. Some of the new resource privileges include Backup Configurations, Cloud Policy, Compliance Framework, Enterprise Manager Plug-in, Job System, Patch Plan, Self Update and Template Collection. For a complete list, see "Configuring Privileges and Role Authorization ". With these new privileges, it's much easier to implement the Principal of Least Privilege by creating specific roles with very fine grained privileges assigned that match the job duties.

An extended auditing system makes it easy to monitor the privilege grants on a regular basis and also keep track of which users exercised what privileges. Some of the key privilege related auditable actions are listed here:

- Grant job privilege
- Grant privilege
- Grant role
- Grant target privilege
- Grant system privilege
- Revoke job privilege

- Revoke privilege
- Revoke role
- Revoke target privilege
- Revoke system privilege

Super Administrators have special privileges on targets, reports, templates and jobs. See the Classes of Users for more details. The Super Administrator privilege should be granted with caution. Use the following query to get the list of Super Administrators:

```
SELECT grantee FROM MGMT_PRIV_GRANTS WHERE PRIV_NAME = 'SUPER_USER'
```

Best Practices for Privilege and Role Management

- Create meaningful roles and grant roles to users instead of granting privileges to users.
- Grant only the minimum set of privileges a user needs for carrying out his/her responsibilities by granting the fine-grained privileges/roles only when needed.
- Audit privilege and role actions for complete monitoring and accountability.
- Limit the number of Super Administrators

Use Principle of Least Privileges for Defining Roles/Privileges

The fine granularity of privileges provided in Enterprise Manager allows for the Principle of Least Privileges to be implemented, this recommends that an Administrator must only be able to access the information or resources that are necessary for legitimate purposes.

Use Privilege Propagation Groups

Using groups and systems to organize your targets helps reduce security administration overhead. There are two types of groups available in Enterprise Manager 13c that help simplify privilege management and authorization. By granting roles to groups, instead of users and using privilege propagating groups, you can reduce the direct grants and ensure users have access to the targets as needed.

Privilege Propagating Groups simplify the privilege assignment, revocation, and administration along with group management by propagating the assigned privileges to all members of the group. For example, a user can be granted access to a privilege propagating group Sales, and they in turn receive access to all targets within that group.

Administration Groups are privilege propagating groups that automate the application of monitoring settings to targets upon joining the group. Targets cannot be assigned directly to the group, rather they are automatically added based on membership criteria.

Systems are also privilege propagating and allow you to group all related targets of a particular application or function into a system.

Best Practices for Groups and Systems

- Create meaningful roles and grant roles to users instead of granting privileges to users.
- Grant only the minimum set of privileges a user needs for carrying out his/her responsibilities by granting the fine-grained privileges/roles only when needed.
- Utilize privilege propagating groups and systems to reduce administration overhead

Guidelines for Auditing

Enterprise Manager has additional auditing that is available for purposes of tracking and validating infrastructure actions performed in Enterprise Manager, including jobs and credentials accessed. Basic and infrastructure auditing is enabled by default for Enterprise Manager 13c.

To enable audit for a subset of audited operations, please use the following EMCLI verb:

```
$ emcli update_audit_settings -audit_switch="ENABLE/DISABLE" -operations_to_enable="name
of the operations to enable,for all operations use ALL" -operations_to_disable="name of
the operations to disable, for all operations use ALL"
```

For example to audit only logon/logoff you would issue:

```
$ emcli update_audit_settings -audit_switch="ENABLE" -operations_to_enable="LOGIN;LOGOUT"
```

Refer to the section "Configuring and Managing Audit" for the list of operations that are audited by Enterprise Manager.

In Enterprise Manager 13c, there are over 150 options for auditing. The following command will show you the list of operations that can be audited by Enterprise Manager:

```
$ emcli show_operations_list
```

The following example shows the output of this command.

```
$ ./emcli show_operations_list
Operation ID                      Operation Name               Infrastructure
Operation
ADD_AGENT_REGISTRATION_PASSWORD   Add Registration Password         NO
ADD_CS_TARGET_ASSOC               Add Standard-Target Association   NO
AGENT_REGISTRATION_PASSWORD_USAGE Registration Password Usage       NO
AGENT_RESYNC                      Resync Agent                      NO
AG_AUD_CREATE                     Create Administration Groups      NO
AG_AUD_DELETE                     Delete Administration Groups      NO
AG_AUD_MODIFY                     Modify Administration Groups      NO
APPLY_TEMPLATE                    Apply Monitoring Template         NO
APPLY_UPDATE                      Apply Update                      YES
ATTACH_MEXT                       Attach Metric Extension           NO
```

Once audit is enabled, the audit records are kept in MGMT$AUDIT_LOG view in the Repository. Use Enterprise Manager Cloud Control Console to monitor the audit data as user with Super Administrator, click Setup -> Security -> Audit Data.

The externalization service via EMCLI verb update_audit_settings externalizes the audit data from the Repository to an external file system on a regular basis. Make sure there is enough space in the directory for the audit log files.

```
$ emcli update_audit_settings -file_prefix=<file_prefix> -
directory_name=<directory_name> -file_size = <file size> -data_retention_period=<period
in days>
```

The following example shows that the audit data will be retained in the Repository for 14 days and once exported the data will be stored in the OS directory that corresponds to database directory AUDIT with filenames prefixed with gc12_audit, and the file size will be 50M bytes each:

```
$ emcli update_audit_settings -externalization_switch=ENABLE -file_prefix=gc12_audit -
directory=AUDIT -file_size=50000000 -data_retention_period=14
```

Achieve separation of duties by restricting the access to the directory where the externalized audit data is stored. No Enterprise Manager users should have access to the externalized audit data.

Best Practices for Auditing

- Formalize the audit process by setting up an Audit Review schedule or integrating with an Audit tool such as Audit Vault for notifications and alerts.
- Externalize the audit service and secure the files created

Guidelines for Managing Target Credentials

Preferred Credentials simplify access to managed targets by storing target login credentials in the Management Repository. Users can access an Enterprise Manager target that recognizes those credentials without being prompted to log into the target. Preferred credentials are set on a per user basis, thus ensuring the security of the managed enterprise environment. Default credentials can be set for a particular target type as well as target credentials for a particular target. The target credentials override the default credentials.

Do not set preferred credentials for group/common accounts such as SYSMAN. If preferred credentials are set for common accounts, then the accountability of the use of these credentials is lost. The following SQL statements can be used to report the list of users who have the preferred credentials set:

```
SELECT t.target_name,tc.user_name,tc.credential_set_name FROM MGMT_TARGET_CREDENTIALS
tc, MGMT_TARGETS t WHERE tc.target_guid=t.target_guid

SELECT t.target_name,tc.user_name, tc.set_name FROM EM_TARGET_CREDS tc, MGMT_TARGETS t
WHERE tc.target_guid=t.target_guid and tc.user_name = 'SYSMAN'
```

Credentials can be stored as Named Credentials and then privileges granted to other users to use, update or own the credentials. These credentials can be used for jobs, patching or other administration tasks on specific targets or globally. Eligible credential types include username/password, SSH-key for host and Kerberos for database. This method allows administrators to configure Named Credentials for privileged access and grant to specific users. Auditing tracks Named Credential creation, modification and usage.

Named Credentials provide a secure mechanism in Enterprise Manager to allow for separation of privilege management from privilege delegation for targets. Using Named Credentials an organization can separate the management of the specific username/password/authentication details from the actual authority to use these credentials. This is an essential tool in modern, secure organizations where there needs to be certainty that a malicious user cannot conduct operations outside Enterprise Manager using a set of known credentials obtained from inside Enterprise Manager. Additionally, the management of a central set of Named Credentials removes a significant burden on the proliferation of credentials information across many Enterprise Manager administrators and also therefore reduces the likelihood of these being used outside the Enterprise Manager environment or helps prevent against the accidental publication of credentials.

Automate Monitoring and Non-monitoring User Credential Password Management

Password lifecycle management plays a crucial role in maintaining a secure database (DB) environment. This becomes a burden when dealing with hundreds or perhaps thousands of databases. This typically involves changing the password for a user and then updating all

Enterprise Manager configurations that use this password for monitoring or managing a database.

Enterprise Manager lets you use the job system to automate database password change/rotation tasks for both monitoring and non-monitoring database users with the respective jobs: *Change the Password for the Database Monitoring User* and *Change the Password for a Database User*. Both job types let you schedule jobs on Oracle Database and Cluster Database instances.

You can either explicitly specify a new password or optionally auto-generate a new password using either the current password or an explicitly specified *Reference Password* as the basis for auto-generation. Once Enterprise Manager changes the password to a generated one, this auto-generated password will not be known to anyone but Enterprise Manager and its components, e.g., the agent. Any target-scoped named credentials for the user will also be updated. The user-defined password option typically makes sense for a one-time scheduled job since manually having to run this job periodically will not effectively change the password across job runs. Having Enterprise Manager auto-generate random passwords is more effective from a security standpoint.

> **Note:**
>
> This job does **not** have the ability to understand password policy updates and new security standards and expects the specified password (when *Auto-Generate* is selected as *No*) or reference password to be compliant with current password policies in effect on the databases. When using *Yes (Based on Current Password)* the expectation is that the current password is compliant with the password policies in effect.

IMPORTANT: Both jobs, (*Change the Password for the Database Monitoring User* and *Change the Password for a Database User*), support users in Data Guard environments with SYSDBA and SYSDG privileges except the SYS user itself. To change the password on the standby database, it relies on the Oracle Database 12.2 and higher feature of auto-propagating passwords from the primary database to the standby database. It does not support changing monitoring passwords for Data Guard environments with either a *Far Sync* or *Snapshot Standby* database.

Warning Regarding Data Guard Environments

If there is a significant (> 1 minute) apply lag to any standby instance, the standby instance may be briefly shown as *down* in Enterprise Manager after the job completes until the new password is updated on the standby via *redo log apply*.

Automatic Password Management works for the following situations:

Beginning with Oracle Enterprise Manager 13c Release 5 Update 4 (13.5.0.4)

- Monitoring users for DB targets, DBSNMP and custom (Non-DBSNMP)
- Non-monitoring user with NORMAL on the Enterprise Manager repository target

Beginning with Oracle Enterprise Manager 13c Release 5 Update 6 (13.5.0.6)

- Monitoring and non-monitoring users with SYS* (SYSDBA, SYSDG, etc.) roles, including DB users with SYS roles for the Enterprise Manager repository target.

> **Note:**
>
> This feature is also available with *Oracle Enterprise Manager 13c Release 4 Update 18 (13.4.0.18)*.

Beginning with Oracle Enterprise Manager 13c Release 5 Update 12 (13.5.0.12)

- Support specifying a *Reference Password* which can be used (instead of the current password) as a basis for password auto-generation

This section discusses the following topics:

- Automate Monitoring User Password Management
- Automate Non-monitoring User Password Management

Automate Monitoring User Password Management

You can automate password management for users (monitoring only) that discovered database instances in Enterprise Manager console via the *Change the Password for the Database Monitoring User* job type.

When an Oracle database is installed, a DBSNMP user is provisioned out-of-the-box that is primarily used for monitoring that database from Enterprise Manager. The DBSNMP username and password are used both during discovery and for collecting metrics from the Enterprise Manager agent. DBSNMP is also used when collecting metrics that show up on the database home page in the Enterprise Manager console. Alternatively, you may choose to use a different user (Non-DBSNMP) as the database monitoring user.

Password rotation is a normal part of the security policy for all users, and this typically applies to the DBSNMP user or any other dedicated monitoring user as well. This task usually involves changing the password for this database user (DBSNMP or Non-DBSNMP) and then updating all Enterprise Manager configurations that use this password for monitoring/administrating that database. A new password can be user-specified or auto-generated by Enterprise Manager.

IMPORTANT: The password change job should be used for DBSNMP (or other monitoring users) configured with the Normal Role, SYSDBA, or SYSDG and where Enterprise Manager is the only product/user attempting to access the actual database as this user. See Automate Monitoring and Non-monitoring User Credential Password Management for more information.

Required Target Privileges

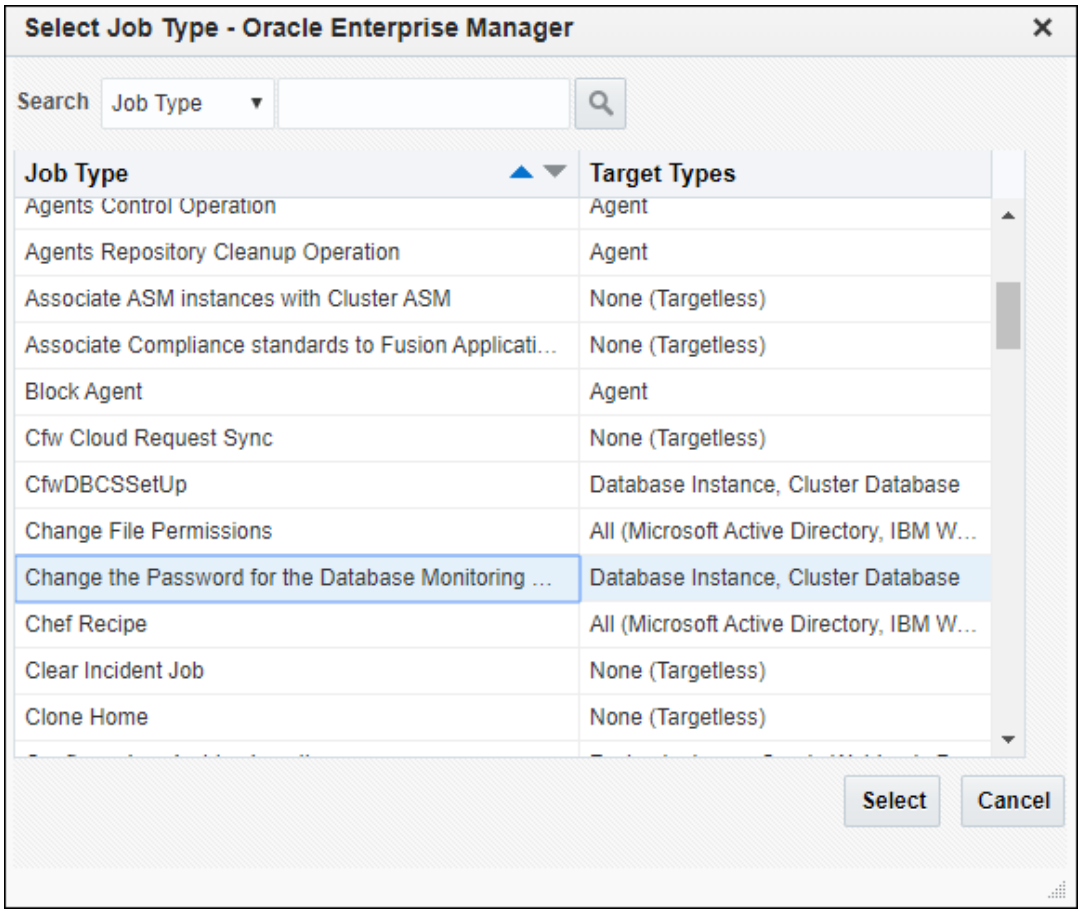
It is recommended that the Enterprise Manager user running this job be the user that initially discovered these database targets or else needs to have at least the following Enterprise Manager target privileges on the database/cluster.

- CONFIGURE_TARGET
- CONNECT_TARGET
- BLACKOUT_TARGET
- EDIT_CREDENTIAL (monitoring and any saved named credentials)

> **Note:**
>
> The EDIT_CREDENTIAL privilege is required because the job blacks out the targets and updates the credentials/monitoring configuration both on the target and in Enterprise Manager as well as updating any named credentials for this database user in Enterprise Manager.

Configuring and Scheduling the Job

1. From the Enterprise menu, choose **Job** and then **Activity**. On the Activity page, click **Create Job**. The *Select Job Type* dialog displays.

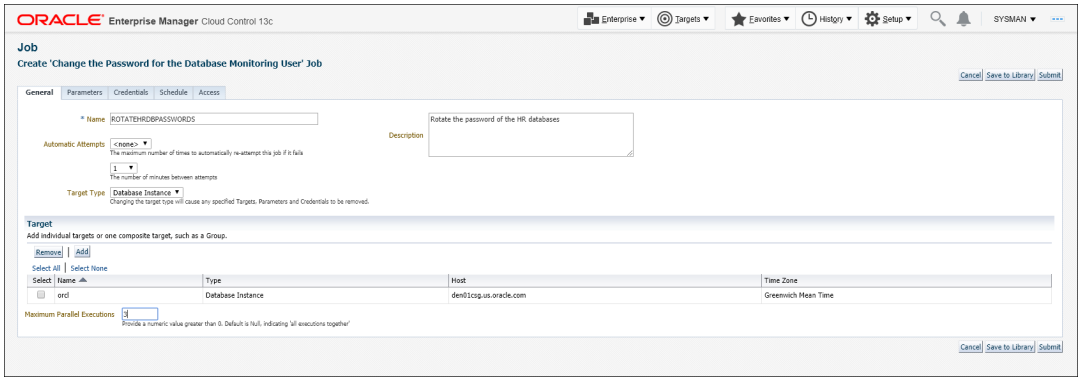


   Choose the *Change the Password for the Database Monitoring User* job type and click **Select**.

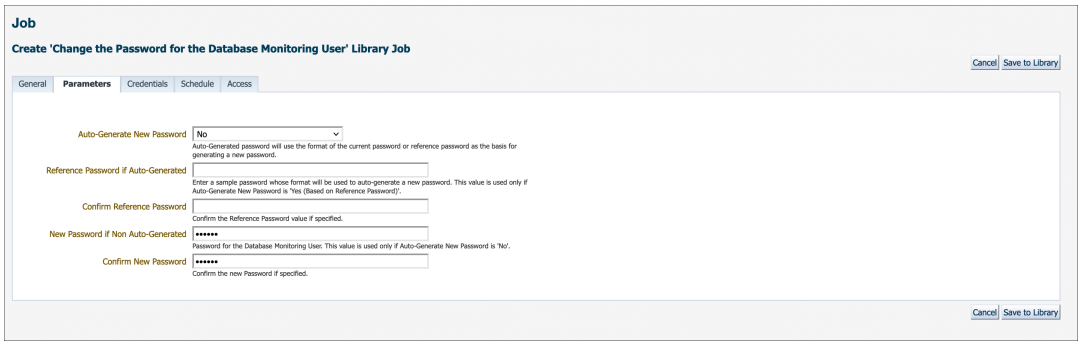
2. Define the job by specifying the required attributes (Job Name, Description, etc.) as well as selecting list of targets on which to schedule/run the job.

> **Note:**
>
> Instead of selecting a list of targets, you could also create a dynamic group and select the group. When selecting a dynamic group, all instances of type *Oracle Database* and *Cluster Database* present in the group will have the monitoring user passwords updated when the job is executed.

If there are a large number of targets being selected, it is recommended to specify a reasonable number of *Maximum Parallel Executions* for your environment (around 3) so that all of these jobs are not executed in parallel. Running large numbers of jobs in parallel will not only overload the job system, but also cause your targets to be in blackout concurrently.



3. Specify a *New Password* if you do not want Enterprise Manager to auto-generate a password as shown below.



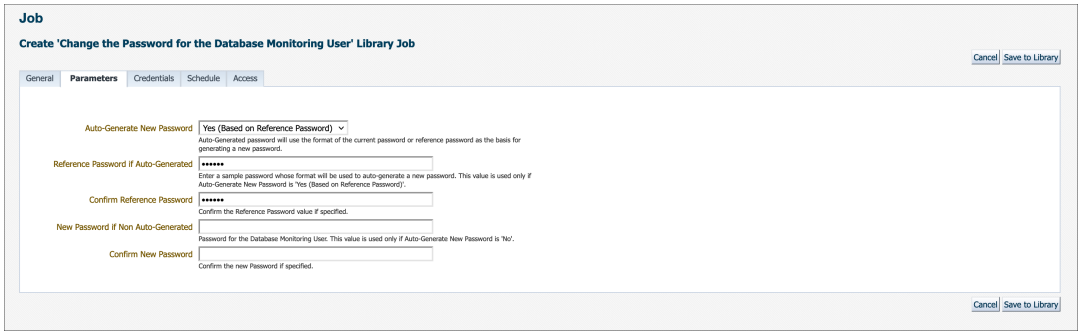
Auto-Generate New Password must be set to **No**. Enter the new password. If the new password and confirmation do not match, an inline error message will appear and you will not be able to submit the job.

If no parameters are specified in the Parameters tab, then a new password will be generated. Auto-generated passwords are only known to and managed by Enterprise Manager.

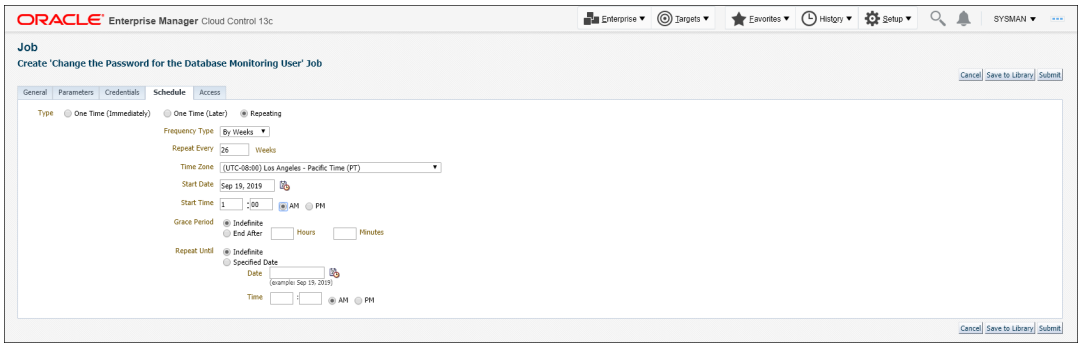
There are two explicit options for *Auto-Generate New Password*. Initially, auto-generating a new password used only the format of the current password as the basis for generating a new one. Beginning with Enterprise Manager 13c Release 5 Update 12 (13.5.0.12), there is now an additional option to auto-generate a new password based on the reference password. This means that you can enter a sample password in the provided field and

Enterprise Manager will use the format of the sample as the basis for auto-generating a new password.

> **Note:**
>
> When selecting *Auto-Generate New Password: Yes (Based on Reference Password)* you must ensure your sample/reference password is compliant with your current enterprise's password policies for Enterprise Manager to auto-generate a new compliant password. This option is useful for when your password policy changes (e.g., minimum password length increases) and the current password is no longer compliant and thus needs to be changed.



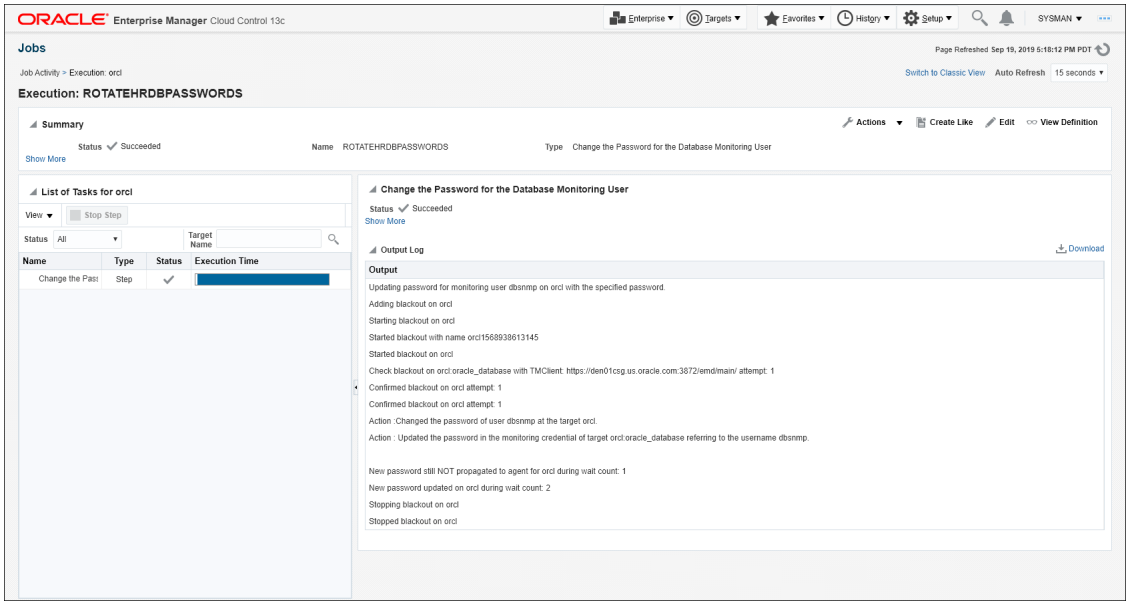
4. Define a schedule for this job. This would typically be the interval after which the monitoring user password needs to be changed as per the password profile defined for the database.



Click **Submit**.

Viewing the job run output (executions per target)

You can view the status/output of the password change job by clicking on the job name in the *Job Activity* table as shown below.



Automate Non-monitoring User Password Management

For custom non-monitoring database users, you can use the *Change the Password for a Database User* job type to automate password management. This task usually involves changing the password for this database user and then updating all Enterprise Manager configurations that use this password for monitoring/administrating that database. For more information, see Automate Monitoring and Non-monitoring User Credential Password Management.

> **Note:**
>
> Custom monitoring credentials (based on user-defined credential sets) will also be updated if these credentials are defined for the user specified in the job parameters.

In order to execute this job type, you must have the following Enterprise Manager privileges.

- CONNECT_TARGET
- CONFIGURE_TARGET
- EDIT_CREDENTIAL

> **Note:**
>
> This privilege is required for the *target-scoped* Named Credential on the target for the user specified in the job parameter.

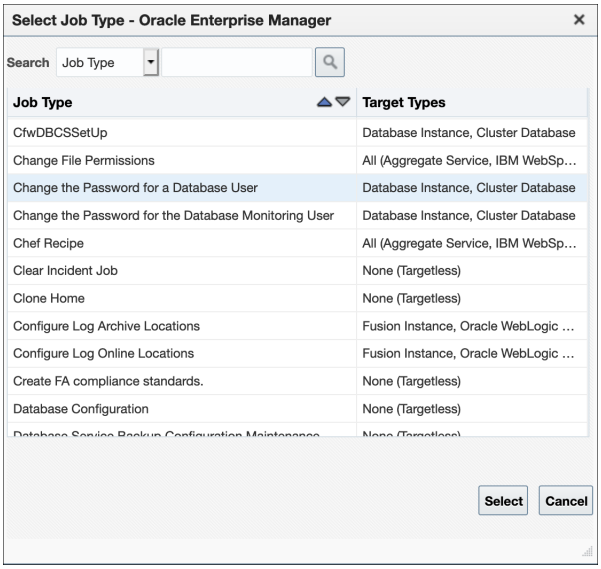
- CREATE_JOB

> **Note:**
>
> This privilege is needed to create and submit the job.

This job requires the username to be specified as an input argument to the job and expects a named credential with a valid current password to be defined on the database target(s) on which the job is invoked.

Configuring and Scheduling the Job

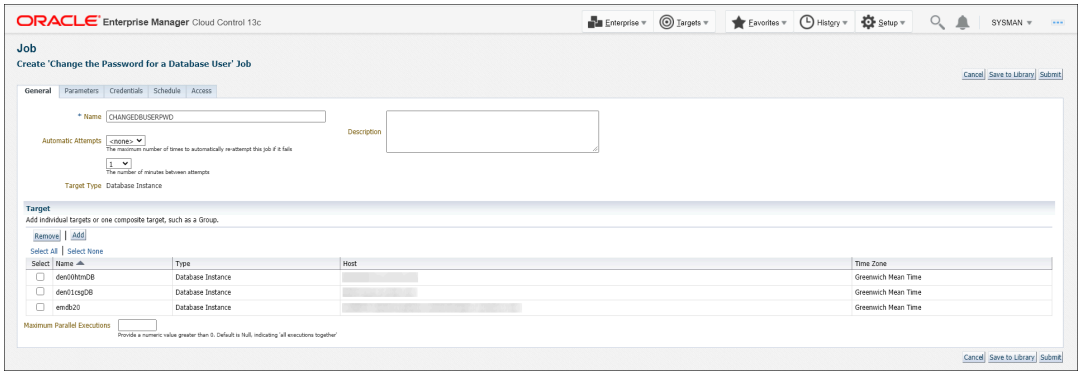
1. From the Enterprise menu, choose **Job** and then **Activity**. On the Activity page, click **Create Job**. The *Select Job Type* dialog displays.



2. Choose the *Change the password of the Database User* job type and click **Select**.
3. Define the job by specifying the required attributes (Job Name, Description, etc.) as well as selecting list of targets on which to schedule/run the job.

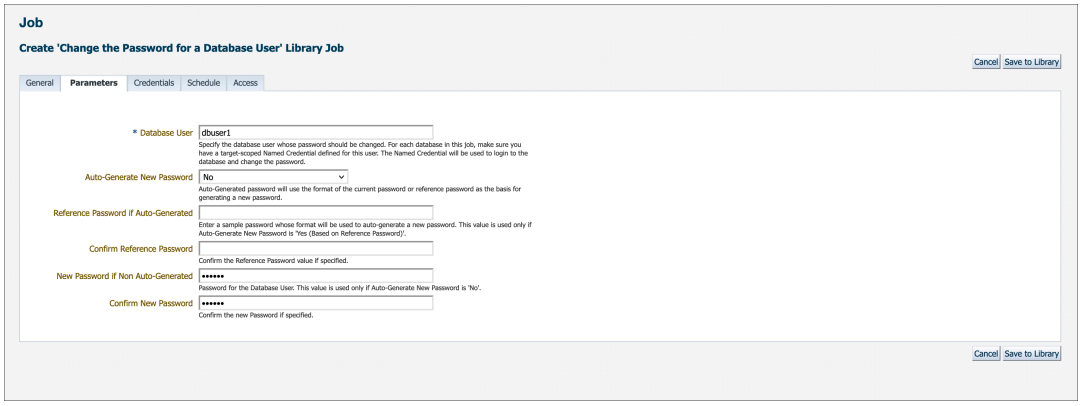
> **Note:**
>
> Instead of selecting a list of targets, you could also create a dynamic group and select the group. When selecting a dynamic group, all instances of type *Oracle Database* and *Cluster Database* present in the group will have the database user passwords updated when the job is executed.

If there are a large number of targets being selected, it is recommended to specify a number reasonable for your environment (around 3) so that all of these jobs are not executed in parallel. Running large numbers of jobs in parallel will not only overload the job system.



4. Define the job type Parameters. In this case the *Database User* is the user whose password needs to be changed/rotated. The job will check for the existence of ONE and only ONE Named Credential defined on **each** of the database instances defined for the job. The job will generate an error if there are no Named Credentials or more than one Named Credentials defined for this user on a DB target that is specified for the job. An error will also occur if this user is the *default* Monitoring user for the DB target.

5. Specify a *New Password* if you do not want Enterprise Manager to auto-generate a password as shown below.

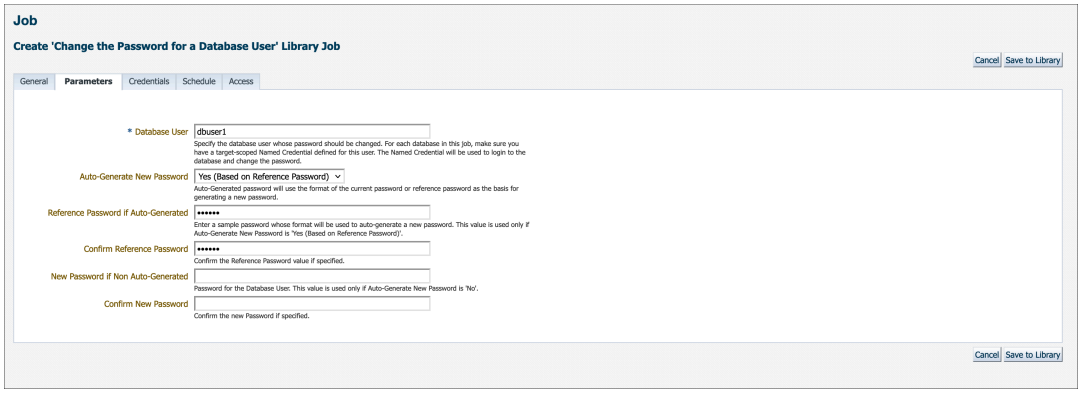


Auto-Generate New Password must be set to **No**. Enter the new password. If the new password and confirmation do not match, an inline error message will appear and you will not be able to submit the job.

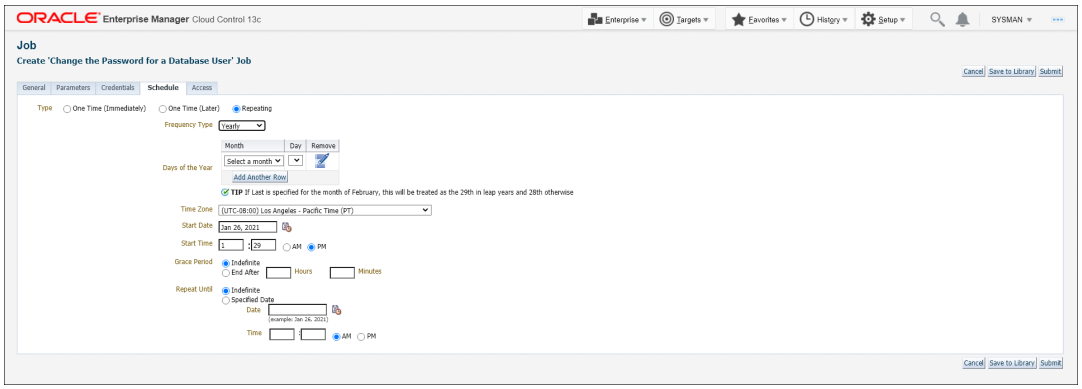
If no parameters are specified in the Parameters tab, then a new password will be generated. Auto-generated passwords are only known to and managed by Enterprise Manager.

There are two explicit options for *Auto-Generate New Password*. Initially, auto-generating a new password used only the format of the current password as the basis for generating a new one. Beginning in Enterprise Manager 13c Release 5 Update 12 (13.5.0.12), there is now an additional option to auto-generate a new password based on the reference password. This means that you can enter a sample password in the provided field and Enterprise Manager will use the format of the sample as the basis for auto-generating a new password.

> **Note:**
>
> When selecting *Auto-Generate New Password: Yes (Based on Reference Password)* you must ensure your sample/reference password is compliant with your current enterprise's password policies for Enterprise Manager to auto-generate a new compliant password. This option is useful for when your password policy changes (e.g., minimum password length increases) and the current password is no longer compliant and thus needs to be changed.



6. Define a schedule for this job. This would typically be the interval after which the monitoring user password needs to be changed as per the password profile defined for the database.



Click **Submit**.

Best Practices for Credentials

- Use EMCLI to automate routine password changes on privileged named credentials, this allows one administrator to know and update the password for granted users.
- Utilize named credentials when setting preferred credentials to simplify credential management.
- Do not set preferred credentials for group/common accounts such as SYSMAN.

Oracle Enterprise Manager FIPS140-2 Settings

Starting with Release Update 21, Oracle Enterprise Manager, 13c Release 5 can run compliant with the Federal Information Processing Standard Publication 140-2, (FIPS 140-2). Follow the steps in the sections below to make sure all EM components run in FIPS mode:

Prerequisites:

As a prerequisite, please ensure you have installed the latest OMS patch. For detailed instructions, please see MOS Doc ID 2776765.1.

- Oracle HTTP Server in FIPS Mode
- EM Repository Database in FIPS Mode
- Oracle WebLogic Server
- Oracle EM Agent in FIPS Mode
- Steps to Add a New Additional OMS in FIPS Mode

Oracle HTTP Server in FIPS Mode

1. **Secure OMS with AES encrypted wallet**

   All wallets have to be AES encrypted (orapki from 12.1 encrypts `ewallet.p12` using AES, MOS Doc ID 2198551.1) with a key size of 2048.

   WebLogic in FIPS mode allows only generating an agent certificate with a 2048 bit key. Agent certificates are created with the same key size as OMS CA certificate. Follow the bellow steps to create a new OMS CA certificate with a 2048 bit key, and re-secure all agents:

   a. **Check if OMS CA certificate is longer than 2048 bits:**

   ```
   <OMS_HOME>/bin/emcli login -username=sysman
   <OMS_HOME>/bin/emcli sync
   emcli get_ca_info
   ```

   Sample output:

   ```
   Info about CA with ID: 1
   CA is not configured
   Signature algorithm : sha512
   Key strength : 1024
   DN: CN=example.com,C=US,ST=CA,L=EnterpriseManager on
   example.com,OU=EnterpriseManager on example.com,O=EnterpriseManager on
   example.com
   Serial# : -4357905706800919315
   Valid From: Tue Apr 14 07:43:33 PDT 2020
   Valid Till: Sat Apr 13 07:43:33 PDT 2030
   Number of Agents registered with CA ID CA ID 1 is 1
   ```

   If the OMS CA certificate has a key that is shorter than 2048 bits, create a new OMS CA following the instructions in step 4 below.

   b. **Create OMS wallets:**

If OMS is already secure with 3rd party certificate (with 2048 bits keysize) then the new AES wallet can be converted or created with the same private key and certificate.

- To convert a wallet to AES:

```
orapki wallet convert -wallet <wallet_path> -compat_v12 -pwd
<wallet_password>
```

If Certificate key size is 1024, create new wallet for the OMS console:

- From the OMS console, go to OMS upload , and with WebLogic use the `orapki` tool with `-compat_v12` option

> **Note:**
>
> For more information regarding how to configure the OMS with SSL certificates, please see Doc ID 2202569.1.

c. **If the wallet is newly created, add Root CA certificate to trust store:**

```
<OMS_HOME>/bin/emctl secure oms -trust_certs_loc $WALLET_BASE/rootCA/
cert.pem
```

If you have SLB configured, run this command instead:

```
<OMS_HOME>/bin/emctl secure oms -host <SLB hostname> -secure_port
<port> -slb_port <port> -slb_console_port <port> -
trust_certs_loc $WALLET_BASE/rootCA/cert.pem
```

> **Note:**
>
> Don't bounce the OMS, until completing the steps below.

d. **If key strength of OMS CA certificate is less than 2048 bits (in step 1), then create new CA:**

```
<OMS_HOME>/bin/emctl secure createca -key_strength 2048
```

Sample output:

```
Oracle Enterprise Manager

Copyright (c) 1996, 2024 Oracle Corporation.  All rights reserved.

Creating CA... Started.

Enter Enterprise Manager Root (SYSMAN) Password :

Successfully created CA with ID 2
```

e. **Secure all agents**

Secure all agents irrespective of the OMS wallet being newly created or not, as the OMS CA has been regenerated with a 2048 bits size.

Using the emcli command, you can also secure multiple agents together.

```
<AGENT_HOME>/bin/emctl secure_agents
        [-agt_names="agt1;agt2;..."] [-agt_names_file="<file>"]
```

f. **Secure OMS with AES encryption**

```
<OMS_HOME>/bin/emctl secure oms -wallet $WALLET_BASE/em_cert -
trust_certs_loc $WALLET_BASE/rootCA/cert.pem
```

If you have SLB configured, run this command instead:

```
<OMS_HOME>/bin/emctl secure oms -host <SLB hostname> -
wallet $WALLET_BASE/slb_cert -secure_port <port> -slb_port <port> -
slb_console_port <port> -trust_certs_loc $WALLET_BASE/rootCA/cert.pem
```

g. **Secure OMS Console with AES encryption**

```
<OMS_HOME>/bin/emctl secure console -wallet $WALLET_BASE/em_cert
```

If you have SLB configured, run this command instead:

```
<OMS_HOME>/bin/emctl secure console -wallet $WALLET_BASE/slb_cert -host
<SLB HostName>
```

h. **Secure Weblogic with AES encrypted wallet**

```
<OMS_HOME>/bin>emctl secure wls -wallet $WALLET_BASE/em_cert
```

i. **Repeat the step g-h on all OMS**

j. **Restart the OMS**

Primary first and then the secondary ones, one at a time:

```
emctl stop oms -all


emctl start oms
```

2. **Enable FIPS mode flag**

Add `SSLFIPS ON` inside `<IfModule ossl_module>` in the following files:

> **Note:**
>
> Do not add `SSLFIPS ON` inside the file in <VirtualHost>

In primary OMS:

```
$DOMAIN_HOME/config/fmwconfig/components/OHS/ohs1/ssl.conf
$DOMAIN_HOME/config/fmwconfig/components/OHS/instances/ohs1/ssl.conf
```

In additional OMS (replace ohs2 to appropriate ohs instance):

```
$DOMAIN_HOME/config/fmwconfig/components/OHS/instances/ohs2/ssl.conf
$DOMAIN_HOME/config/fmwconfig/components/OHS/instances/ohs2/
ssl.conf.emctl_secure (if exists)
```

Example:

Go to:

```
 $INSTANCE_HOME/user_projects/domains/GCDomain/config/fmwconfig/
components/OHS/ohs1/ssl.conf
```

Update the `ssl.conf` file as below:

```
# Some MIME-types for downloading Certificates and CRLs SSLFIPS ON
```

EM Repository Database in FIPS Mode

1. Transparent Data Encryption (TDE) and `DBMS_CRYPTO` PL/SQL package program

   a. **Configure:**

   To configure Transparent Data Encryption and the DBMS_CRYPTO PL/SQL package program units to run in FIPS mode, set the DBFIPS_140 initialization parameter to TRUE.

```
sqlplus / as sysdba

SQL>SELECT name,value FROM SYS.V$PARAMETER WHERE NAME = 'DBFIPS_140';

DBFIPS_140

FALSE

SQL>ALTER SYSTEM SET DBFIPS_140 = TRUE SCOPE=SPFILE ;

SQL> shutdown immediate

SQL> startup

SQL> SELECT name,value FROM SYS.V$PARAMETER WHERE NAME = 'DBFIPS_140';

DBFIPS_140

TRUE

SQL> exit
```

b. **Test**

```
select DBMS_CRYPTO.hash(UTL_RAW.CAST_TO_RAW ('TestString'), 2) from
dual;

second param is Hash algorithm

HASH_MD4 (128 bit hash)     1

HASH_MD5 (128 bit hash)     2

HASH_SH1 (160 bit hash)     3

HASH_SH256                      4

HASH_SH384                     5

HASH_SH512                     6

Above query (MD4, MD5 hash) works in  non FIPS mode (DBFIPS_140=FALSE)
and fails in FIPS mode (DBFIPS_140=TRUE)
```

2. **SSL Transport Security**

   a. **Create DB Wallet**

   To create a new wallet, from the OMS console, go to OMS upload , and with Weblogic use the `orapki` tool.

   b. **Configure SSL Communication**

   Add `SSLFIPS_140=TRUE` flag in

   ```
   $DB_HOME/ldap/admin/fips.ora
   ```

   For more information on configuring SSL communication, see Configure TLSv1.2 for the Enterprise Manager Repository.

   c. **Restart Listener**

   ```
   $DB_HOME/bin/lsnrctl stop


   $DB_HOME/bin/lsnrctl start
   ```

3. **Configure EM to use TCPS listener**

   For more information on configuring EM to use TCPS listener, see Configuring the Oracle Management Service to connect to the TLSv1.2-enabled Enterprise Manager Repository.

Oracle WebLogic Server

1. **Add RSA JSSE and RSA JCE provider**

Add RSA providers at the top and move other existing providers down accordingly in the `<OMS_HOME>/oracle_common/jdk/jre/lib/security/java.security` file:

```
security.provider.1=com.rsa.jsafe.provider.JsafeJCE
security.provider.2=com.rsa.jsse.JsseProvider
security.provider.3=sun.security.provider.Sun
security.provider.4=sun.security.rsa.SunRsaSign
security.provider.5=sun.security.ec.SunEC
security.provider.6=com.sun.net.ssl.internal.ssl.Provider
security.provider.7=com.sun.crypto.provider.SunJCE
security.provider.8=sun.security.jgss.SunProvider
security.provider.9=com.sun.security.sasl.Provider
security.provider.10=org.jcp.xml.dsig.internal.dom.XMLDSigRI
security.provider.11=sun.security.smartcardio.SunPCSC
```

2. **Add FIPS compliant TrustStore and provider Jars in class path**

   Follow these steps to add the two `.jar` files in Web-Logic and Node Manager, from `$ORACLE_HOME/wlserver/server/lib`:

   ```
   <OMS_HOME>/wlserver/server/lib/jcmFIPS.jar


   <OMS_HOME>/wlserver/server/lib/sslj.jar
   ```

   a. Add the FIPS configuration in `<EM_INSTANCE_BASE/user_projects/domains/GCDomain/bin/startEMServer.sh` after the `EXT_POST_CLASSPATH="<omshome>/sysman/jlib/emagentPermissions.jar"` export `EXT_POST_CLASSPATH` line:

   ```
   JAVA_OPTIONS="-Doracle.net.isFipsMode=true -
   Dcom.sun.net.ssl.enableECC=false ${JAVA_OPTIONS} "
   export JAVA_OPTIONS


   PRE_CLASSPATH="<OMS_HOME>/wlserver/server/lib/jcmFIPS.jar:<OMS_HOME>/
   wlserver/server/lib/sslj.jar:${PRE_CLASSPATH}"
   ```

   Example domain home:

   ```
   /u01/app/Oracle/gc_inst/user_projects/domains/GCDomain/bin/
   startEMServer.sh
   ```

   b. Add FIPS configuration in `$DOMAIN_HOME/bin/startNodeManager.sh` above the `# start node manager ...` line:

   ```
   JAVA_OPTIONS=" -Dcom.sun.net.ssl.enableECC=false ${JAVA_OPTIONS} "
   PRE_CLASSPATH="<OMS_HOME>/wlserver/server/lib/jcmFIPS.jar:<OMS_HOME>/
   wlserver/server/lib/sslj.jar"


   export JAVA_OPTIONS
   export PRE_CLASSPATH
   ```

c. Start Node Manager:

```
$DOMAIN_HOME/bin/startNodeManager.sh
```

d. Re-create Trust store and Key store with Password based encryption with a FIPS compliant algorithm, such as `aes-256-cbc`, using openssl.

e. Update the PKCS12 wallet under `<EM_INSTANCE_BASE/em/omrWallets/<trustStore>` and `<EM_INSTANCE_BASE/em/omrWallets/<keyStore>` with the trust and key of the newly updated PKCS12 wallet.

```
openssl pkcs12 -in ewallet.p12 -out cert.pem <genrate pem file from
already generated wallet under trsuststore and keystore >


openssl pkcs12 -keypbe aes-256-cbc -certpbe aes-256-cbc -export -in
<path to .pem file and file name> -out <path to .pfx file and file name>
```

Example domain home:

```
/u01/app/Oracle/gc_inst/em/omrWallets
```

f. Bounce all components:

```
emctl stop oms -all
emctl start oms
```

Oracle EM Agent in FIPS Mode

Agent Communication

The table lists the default ciphers supported by the Oracle EM Agent. As some of the ciphers are not FIPS compliant, add the ciphers explicitly in the agent `emd.properties` file, and bounce the agent to be FIPS compliant:

```
SSLCipherSuites=ECDHE_ECDSA_WITH_AES_128_GCM_SHA256:ECDHE_ECDSA_WITH_AES_256_G
CM_SHA384:ECDHE_RSA_WITH_AES_128_GCM_SHA256:AES_128_CCM_8_SHA256:AES_128_CCM_S
HA256:AES_128_GCM_SHA256:AES_256_GCM_SHA384:DHE_DSS_WITH_AES_:28_GCM_SHA256:DH
E_DSS_WITH_AES_256_GCM_SHA384:DHE_RSA_WITH_AES_128_GCM_SHA256:DHE_RSA_WITH_AES
_256_GCM_S:A384:ECDHE_RSA_WITH_AES_256_GCM_SHA384:DH_DSS_WITH_AES_128_GCM_SHA2
56:DH_DSS_WITH_AES_256_GCM_SHA384:TLS:DH_RSA_WITH_AES_128_GCM_SHA256:DH_RSA_WI
TH_AES_256_GCM_SHA384:ECDH_ECDSA_WITH_AES_128_GCM_SHA256:ECDH_EC:SA_WITH_AES_2
56_GCM_SHA384:ECDH_RSA_WITH_AES_128_GCM_SHA256:ECDH_RSA_WITH_AES_256_GCM_SHA38
4:DHE_DSS_WITH_AES_128_CB:_SHA:DHE_DSS_WITH_AES_128_CBC_SHA256:DHE_DSS_WITH_AE
S_256_CBC_SHA:DHE_DSS_WITH_AES_256_CBC_SHA256:DHE_:SA_WITH_AES_128_CBC_SHA:DHE
_RSA_WITH_AES_128_CBC_SHA256:DHE_RSA_WITH_AES_256_CBC_SHA:DHE_RSA_WITH_AES_256
_:BC_SHA256:ECDH_ECDSA_WITH_AES_128_CBC_SHA:ECDH_ECDSA_WITH_AES_128_CBC_SHA256
:ECDH_ECDSA_WITH_AES_256_CBC_S:A:ECDH_ECDSA_WITH_AES_256_CBC_SHA384:ECDH_RSA_W
ITH_AES_128_CBC_SHA:ECDH_RSA_WITH_AES_128_CBC_SHA256:EC:H_RSA_WITH_AES_256_CBC
_SHA:ECDH_RSA_WITH_AES_256_CBC_SHA384:ECDHE_ECDSA_WITH_AES_128_CBC_SHA:ECDHE_E
CDSA_W:TH_AES_128_CBC_SHA256:ECDHE_ECDSA_WITH_AES_256_CBC_SHA:ECDHE_ECDSA_WITH
_AES_256_CBC_SHA384:ECDHE_RSA_WITH_:ES_128_CBC_SHA:ECDHE_RSA_WITH_AES_128_CBC_
SHA256:ECDHE_RSA_WITH_AES_256_CBC_SHA:ECDHE_RSA_WITH_AES_256_CBC:SHA384:RSA_WI
```

```
TH_AES_128_CBC_SHA:RSA_WITH_AES_128_CBC_SHA256:RSA_WITH_AES_128_GCM_SHA256:RSA
_WITH_AES_2:6_CBC_SHA:RSA_WITH_AES_256_CBC_SHA256:RSA_WITH_AES_256_GCM_SHA384
```

Cipher	FIPS
TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256	YES
TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384	YES
TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	YES
TLS_AES_128_CCM_8_SHA256	YES
TLS_AES_128_CCM_SHA256	YES
TLS_AES_128_GCM_SHA256	YES
TLS_AES_256_GCM_SHA384	YES
TLS_CHACHA20_POLY1305_SHA256	NO
TLS_DHE_DSS_WITH_AES_128_GCM_SHA256	YES
TLS_DHE_DSS_WITH_AES_256_GCM_SHA384	YES
TLS_DHE_RSA_WITH_AES_128_GCM_SHA256	YES
TLS_DHE_RSA_WITH_AES_256_GCM_SHA384	YES
TLS_ECDHE_ECDSA_WITH_CHACHA20_POLY1305_SHA256	NO
TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384	YES
TLS_ECDHE_RSA_WITH_CHACHA20_POLY1305_SHA256	NO
TLS_DH_DSS_WITH_AES_128_GCM_SHA256	YES
TLS_DH_DSS_WITH_AES_256_GCM_SHA384	YES
TLS_DH_RSA_WITH_AES_128_GCM_SHA256	YES
TLS_DH_RSA_WITH_AES_256_GCM_SHA384	YES
TLS_ECDH_ECDSA_WITH_AES_128_GCM_SHA256	YES
TLS_ECDH_ECDSA_WITH_AES_256_GCM_SHA384	YES
TLS_ECDH_RSA_WITH_AES_128_GCM_SHA256	YES
TLS_ECDH_RSA_WITH_AES_256_GCM_SHA384	YES
TLS_DH_DSS_WITH_AES_128_CBC_SHA	NO
TLS_DH_DSS_WITH_AES_128_CBC_SHA256	NO
TLS_DH_DSS_WITH_AES_256_CBC_SHA	NO
TLS_DH_DSS_WITH_AES_256_CBC_SHA256	NO
TLS_DH_RSA_WITH_AES_128_CBC_SHA	NO
TLS_DH_RSA_WITH_AES_128_CBC_SHA256	NO
TLS_DH_RSA_WITH_AES_256_CBC_SHA	NO
TLS_DH_RSA_WITH_AES_256_CBC_SHA256	NO
TLS_DHE_DSS_WITH_AES_128_CBC_SHA	YES
TLS_DHE_DSS_WITH_AES_128_CBC_SHA256	YES
TLS_DHE_DSS_WITH_AES_256_CBC_SHA	YES
TLS_DHE_DSS_WITH_AES_256_CBC_SHA256	YES

Cipher	FIPS
TLS_DHE_RSA_WITH_AES_128_CBC_SHA	YES
TLS_DHE_RSA_WITH_AES_128_CBC_SHA256	YES
TLS_DHE_RSA_WITH_AES_256_CBC_SHA	YES
TLS_DHE_RSA_WITH_AES_256_CBC_SHA256	YES
TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA	YES
TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA256	YES
TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA	YES
TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA384	YES
TLS_ECDH_RSA_WITH_AES_128_CBC_SHA	YES
TLS_ECDH_RSA_WITH_AES_128_CBC_SHA256	YES
TLS_ECDH_RSA_WITH_AES_256_CBC_SHA	YES
TLS_ECDH_RSA_WITH_AES_256_CBC_SHA384	YES
TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA	YES
TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256	YES
TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA	YES
TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384	YES
TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA	YES
TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256	YES
TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA	YES
TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384	YES
TLS_RSA_WITH_AES_128_CBC_SHA	YES
TLS_RSA_WITH_AES_128_CBC_SHA256	YES
TLS_RSA_WITH_AES_128_GCM_SHA256	YES
TLS_RSA_WITH_AES_256_CBC_SHA	YES
TLS_RSA_WITH_AES_256_CBC_SHA256	YES
TLS_RSA_WITH_AES_256_GCM_SHA384	YES
TLS_RSA_WITH_CAMELLIA_128_CBC_SHA	NO
TLS_RSA_WITH_CAMELLIA_256_CBC_SHA	NO

AgentCrypto's symmetric key algorithm is `AES-128`, which is FIPS compliant

Steps to Add a New Additional OMS in FIPS Mode

1. **Revert to wls certificate only in primary OMS:**
   - `emctl secure wls -use_demo_cert`
   - Bounce primary OMS
2. **Install OMS software in the new machine**

- Follow the steps described in Installing Additional Oracle Management Services in Silent Mode. As a software-only install, deploy the plug-ins,and apply all the patches you applied on the first OMS.

3. **Copy wallet to the new OMS machine**
4. **Add RootCA into java truststore**

```
export ORACLE_HOME=<OMS_HOME>
```

```
keytool -importcert -file <WalletPath ROOTCA>/cert.pem -alias emreprootca -
keystore
$ORACLE_HOME/oracle_common/jdk/jre/lib/security/cacerts -storepass
"<password>"
```

5. **Export the configuration details from the first OMS and copy the bka file to new OMS machine**

```
$<ORACLE_HOME>/bin/emctl exportconfig oms -dir <absolute_path_to_directory>
```

6. **Run OMSCA command**

```
$<ORACLE_HOME>/bin/omsca recover -ms -backup_file
<absolute_path_to_bka_file> [-AS_HTTPS_PORT <port> -MSPORT <port> -
MS_HTTPS_PORT <port> -EM_NODEMGR_PORT <port> -EM_UPLOAD_PORT <port> -
EM_UPLOAD_HTTPS_PORT <port> -EM_CONSOLE_PORT <port> -EM_CONSOLE_HTTPS_PORT
<port> -config_home <absolute_path_to_instance_dir> -EM_INSTANCE_HOST
<second_oms_host_name>] -nostart
```

This command is the same as the one in **step 8** from Installing Additional Oracle Management Services in Silent Mode with additional `-nostart` flag.

7. **Repeat all the steps in the above *Oracle HTTP Server* section in the new OMS except startup.**
8. **Repeat all the steps in the above *Oracle Web-Logic server* section in the new OMS except startup.**
9. **Start new OMS using the following steps:**

```
emctl stop oms -all
emctl start oms
```

10. **Resecure primary OMS to use custom certificate**.

4

Security Best Practices for Database Management in Enterprise Manager

This chapter provides information about the security best practices that can be implemented for database management using Enterprise Manager 13. It contains the following sections:

- Database Monitoring User Access
- Flexible Database Access Control
- Secured Communication (TCPS) Access to Databases
- Account Management
- Oracle Enterprise Manager Support for TDE-Enabled Oracle Databases

Database Monitoring User Access

To monitor the status and performance of your database targets, Enterprise Manager connects to your database using a database user name and password. The user is referred to as the database monitoring user; the user name and password combination is referred to as the database monitoring credentials.

When you first add, provision or clone an Oracle database target, by default Enterprise Manager uses the DBSNMP database user account and the password for the DBSNMP account as the monitoring credentials.

Alternatively, you may choose to use a different user as the database monitoring user. This new user must have the same roles and privileges as DBSNMP. To create this database monitoring user, refer to MOS note *EM 13c: Creating the Oracle Database Monitoring Credentials for Oracle Enterprise Manager 13.5 RU4 (and later)* DocID 2847191.1

***non-DBSNMP Monitoring User* Availability:**

- *Adding a an Oracle database*: Enterprise Manager 13*c* Release 5 Update 4

  (13.5.0.4)
- *Database-as-a-Service*: Enterprise Manager 13*c* Release 5 Update 8

  (13.5.0.8)
- *Oracle database provisioning (outside Exadata) and cloning:* Enterprise Manager 13*c* Release 5 Update 8

  (13.5.0.8)
- *Oracle database provisioning for Exadata:* Enterprise Manager 13*c* Release 5 Update 9

  (13.5.0.9)

Notes:

While discovery and monitoring of Oracle database targets works with non-DBSNMP users, there are management features that still assume DBSNMP as the database monitoring user.

These features include the following:

- Oracle Database Benchmarks such as CIS Oracle Database 19*c* Benchmark include assessments for the DBSNMP user. These assessments will continue to support only the DBSNMP user, and not other database users used as monitoring credentials
- For monitoring AVDF (Oracle Audit Vault and Database Firewall) targets, the use of non-DBSNMP users as monitoring credentials is not supported.

Monitoring with SYSDG Privileges

For security reasons, you may not want to have an administrator monitor Enterprise Manager database targets with SYSDBA privileges. Because Oracle Data Guard is commonly used by Oracle database customers, users with the SYSDG administrative privilege can also monitor Enterprise Manager database targets. Any SYSDG database monitoring user can discover/monitor both *Primary* and *Standby* databases.

> **Note:**
>
> Users with SYSDG privilege can connect to the database even when it is not open.

You can log in with the SYSDG administrative privileges to perform Data Guard operations. You can use this privilege with either Data Guard Broker or the DGMGRL command-line interface. See Oracle Data Guard Command-Line Interface Reference for more information. In order to connect to the database as SYSDG using a password, you must create a password file for it.

Beginning with Enterprise Manager 13c Release 5 Update 8, the SYSDG role can be assigned by the database administrator or Enterprise Manager Super Administrator when creating Named/Preferred Credentials directly from the Enterprise Manager console. The SYSDG role appears as one of the selectable role options (in addition to *Normal* and *SYSDBA*).

See **Named Credentials** or Preferred Credentials for information on these credential types.

SYSDG Limitations

Note that there are differences between SYSDG and DBSNMP users during discovery. When target database discovery is initiated by an Enterprise Administrator with SYSDG privileges, the following happens:

- Target database allows database connection for the database monitoring user, but switches the user context to the official (built-in) Data Guard SYSDG user.
- However, the Enterprise Manager database monitoring user remains unchanged--SYSDG-enabled, DBSNMP or non-DBSNMP - but not SYSDG.

These differences have privilege implications in that the SYSDG-enabled user may not have the sufficient privileges to perform a specific task. For example, when an Enterprise Manager user connects to a target database as the database monitoring user in SYSDG role and attempts to execute SQL scripts to create any database objects, these objects are created using the *built-in* SYSDG user context.

For more information about Oracle Data Guard, see Oracle Data Guard: Concepts and Administration.

Flexible Database Access Control

Enterprise Manager 13.1 introduces flexible database access control for Enterprise Manager Database Plug-in. The new out of box roles align with database personas and provide tighter access control on managed target databases. Before the introduction of this feature an Enterprise Manager user granted access on the database had access to all of the database management features, such as performance management, high availability management, storage management, security management and so forth. Enterprises have different classes of users such as DBA, Application Developer, Application DBA, and Infrastructure DBA that need to access database management functions. There is a need for a flexible privilege model to accommodate these roles. For example, enterprises may want their application developers to access only performance management functions in a View Only mode.

Providing enterprise users access to unnecessary features and pages opens up the database to security vulnerabilities. Oracle recommends that you grant Enterprise Manager users the minimum number of privileges required to perform their job. Introducing these out of box database management roles grants users access to only the Enterprise Manager pages required to perform their job.

Fine grained privilege control for Enterprise Manager Database plug-in provides a privilege control model for database pages. This enables Enterprise Manager super administrators to grant the minimum access to Enterprise Manager administrators and users required to complete their more specific responsibilities.

High levels of security can be implemented using the new flexible DB access control features for database management. This section includes the following:

- Database Management Roles and Responsibilities
- Application DBA Access
- Application Developer Access
- Database Monitoring User Access
- Database Administrator Access
- Privilege Groups

Database Management Roles and Responsibilities

Oracle Enterprise Manager supports granting different levels of access to DBAs based on their roles and responsibilities in the organization. The following roles are recommended to implement security best practices for an organization.

- Application DBA

  An application DBA is a restricted database administrator who manages application schemas, application objects, and application performance in the database. An application DBA should be able to identify and fix application performance issues in the database. An application DBA is responsible for keeping the application up and running and in good performance.

- Application Developer

  An application developer is a person who develops an application. Application developers capture requirements from customers and develop the application according to customer requirements. Application developers use Oracle Enterprise Manager to tune SQL in their application modules for optimal performance in production environments. Application

developers are responsible for the modules of the application in development, test, and production environments.

- Monitoring User

  The database monitoring user monitors the database for smooth functioning of the application in production environments. Monitoring users respond to alerts raised in the Enterprise Manager environment. Monitoring users can update the schedule of metrics and setup blackouts on the databases. Monitoring users are not allowed to make any changes to the production database. Monitoring users ensure that the application is up and running by responding to any issues reported and ensuring that the issues are assigned to the DBAs responsible for resolution.

- Database Administrator

  Database administrators performs full database lifecycle management including installation configuration, monitoring, backup, recovery, and performance tuning.

Application DBA Access

Application DBAs should have access to the Performance and Schema Management pages in Enterprise manager.

Creating an Application DBA Account

To create an application DBA account in Enterprise Manager:

1. Follow the instructions in "Creating a New Administrator" to create an Enterprise Manager administrator.
2. Grant the privilege Database Application DBA on the database target.
3. Grant the Full privilege on the database host target.
4. Using the Resource Privileges Page, grant the Create New Named Credentials privilege on the Named Credential Resource Type privilege page and Create Privilege on Job System Resource Type privilege.

Creating Named Credentials

To create named credentials, the database administrator can create their own named credential or it can be created by the super administrator (or a privileged Administrator with the system resource privilege) and then granted to the application DBA. The named Credential is granted the view privilege on the named credential so that the application DBA does not even know or see the contents of the named credential.

Application Developer Access

Application developers generally work on their development environments and have full access to their development databases. Application developers are not usually granted access to the production databases. However they might need access to a production database to see performance of application queries in a production environment. The access of the application developer to a production database must be READ ONLY access. Application developers should not be allowed to make any changes to the database. The application developer's access to a production database should be liberal enough to allow the developer to access performance management reports for a production database.

An Enterprise Manager administrator with the user management or grants management resource type privilege can grant application developer access on a database to an Enterprise administrator in Oracle Enterprise Manager 13c.

Granting Application Developer Access on the Database

To grant application developer access on the database, follow the instructions in "Creating a New Administrator" to create an Enterprise Manager administrator then grant the privilege Database Application Developer on the database.

Granting Application Developer Access to the Database Named Credentials

To access database management performance management pages the user must log in to the database using database named credentials. An application DBA should grant view credential access on a database named credential to the application developer in Enterprise Manager. The database named credential should have at least the SELECT_CATALOG_ROLE role on the database.

The application developer must not be given the user's password. The application developer should not be granted view access on the host, or any database host named credential.

The application developer account created in this way in Enterprise Manager will be able to view only the Performance Management and Schema Management pages in Enterprise Manager. The user will not be able to make any changes to the database.

Database Administrator Access

The database administrator has full access on the database and can perform any operation on the database.

Creating a Database Administrator Account

To create a database administrator account:

1. Follow the instructions in "Creating a New Administrator" to create an Enterprise Manager administrator
2. On the Create Administrator <*Name*>: Roles page add the EM_PATCH_ADMINISTRATOR and EM_PROVISIONING_OPERATOR roles.
3. On the Target Privileges page grant the Add Any Target privilege from the Privileges Applicable to all Targets section.

Creating Named Credentials

To create named credentials the database administrator logs in to Enterprise Manager and creates a database named credential and a host named credential.

The database administrator provisions the database and adds the database to Enterprise Manager for management. Doing this makes the database administrator the owner of the database and listener targets in Enterprise Manager. The owner has FULL access on the targets in Enterprise Manager.

Granting Privileges Through Roles and Privilege Propagating Groups

A similar level of access on the database to multiple users can be granted by creating Enterprise Manager roles. Privileges can be granted to roles and the roles can be granted to

the Enterprise Manager administrators. Access changes made to the roles are reflected to the Enterprise Manager administrators granted that role.

To manage a similar level of access across multiple databases to a user, privilege propagating groups should be created. Individual databases should be added to a privilege propagating group. Privileges can be granted on the privilege propagating group. Privileges granted at the group level are automatically propagated to the group members. The user automatically receives the privileges to any database that is later added to the privilege propagating group.

Enterprise Manager roles are explained in Section 2.2.1 of the Oracle Enterprise Manager Cloud Control Security Guide.

> **Note:**
>
> For more information about Enterprise Manager roles, see "Understanding Users, Privileges, and Roles"

Pluggable Database Administrator Access

The pluggable database administrator has access limited to the pluggable database. These steps are a best practice recommendation on how to create a Pluggable Database Administrator.

Creating a Pluggable Database Administrator Account

To create a pluggable database administrator account:

1. From the **Setup** menu, select **Security**, then select **Administrators**. The Administrators page is displayed.
2. Click **Create**, type the Administrator name and password. Click **Next**.
3. On the Create Administrator <*Name*>: Roles page add the `EM_USER` and `PUBLIC` roles.
4. On the Privileges page grant the following privileges:
   - Privileges applicable to all targets: `Connect to any viewable target`
   - Target Privilege: For the PDB to be managed, click Manage Target Privilege Grants to `Full`
   - Resource Privileges:
     - `Job System with Create`
     - `Manage View Access`
     - `Named Credential for the PDB administrator`
   - Database Privileges Required:
     - SELECT ANY DICTIONARY
     - SELECT CATALOG ROLE
     - EXECUTE ON DBMS_WORKLOAD_REPOSITORY

Granting Pluggable Database Administrator Database Privileges

Database privileges must be granted by the CDB administrator for the required PDB user. These privileges will be reflected as a Named Credential.

1. Login as the CDB administrator.
2. Grant the following privileges to the new PDB user:

```
SQL> GRANT SELECT ANY DICTIONARY TO <PDB_USER>
SQL> GRANT SELECT CATALOG ROLE TO <PDB_USER>
SQL> GRANT EXECUTE ON DBMS_WORKLOAD_REPOSITORY TO <PDB_USER>
```

Creating Named Credentials

A PDB administrator can not create their own named credentials. To create one, a super administrator (or a privileged Administrator with the system resource privilege) needs to create and then grant the named credential to the PDBA. The named credential is granted the **View** privilege on the named credential so that the PDBA does not know or see the contents of the named credential.

To create a named credential:

1. From the main menu, select **Setup**, then select **Security**, finally click **Named Credential**.
2. Click **Create**.
3. In Target Type, select **Pluggable Database** and in Target Name select the PDB name.
4. In Access Control, select the PDB administrator that was created for this named credential. Grant **View** privileges.
5. Click **Save**.

> **Note:**
>
> The PDB administrator has to be created in the target PDB by the CDB administrator and have the required database privileges granted as applicable.

Privilege Groups

Flexible DB Access Control privileges are broadly categorized into 12 privilege groups for easy manageability. The following sections describe the 12 privilege groups available in Enterprise Manager:

> **Note:**
>
> The privilege groups listed in this section apply to the following target types:
>
> - Database Instance
> - Cluster Database
> - Pluggable Database

> **Note:**
>
> Privilege Groups are not supported for PDB Administrators. This can be handled using DB roles and privileges.

- Database Application DBA
- Database Application Developer
- Manage Database High Availability Privilege Group
- View Database High Availability Privilege Group
- Manage Database Performance Privilege Group
- View Database Performance Privilege Group
- Manage Database Schema Privilege Group
- View Database Schema Privilege Group
- Manage Database Security Privilege Group
- View Database Security Privilege Group
- Manage Database Storage Privilege Group
- View Database Storage Privilege Group

Database Application DBA

The Database Application DBA can manage the application schema, application objects, and application performance in the database. In addition, the Database Application DBA can view and update the database to fix performance and other issues on the database.

Target Privileges	Menu Items
Manage the Database Performance Privilege group	Manage Database Performance Privilege Group
Manage the Database Schema Privilege group	Manage Database Schema Privilege Group

Database Application Developer

The Database Application Developer can view the database performance in Enterprise Manager but cannot make any changes to the database.

Target Privileges	Menu Items
View the Database Performance Privilege group	View Database Performance Privilege Group
View the Database Schema Privilege group	View Database Schema Privilege Group

Manage Database High Availability Privilege Group

The Manage Database High Availability Privilege group has the ability to manage database high availability pages in Enterprise Manager.

Target Privileges	Menu Items
View the database backup View database advanced queues View database redo logs View recovery settings View the high availability console View database resources	Availability>MAA AdvisorAdministration>Resource ManagerAvailability>Backup & Recovery>Backup ReportsAvailability>Backup & Recovery>Backup SettingsAvailability>Backup & Recovery>Recovery SettingsAvailability>Backup & Recovery>Recovery Catalog SettingsAvailability>Backup & Recovery>Transactions

View Database High Availability Privilege Group

The Manage Database High Availability Privilege group has the ability to view database high availability pages in Enterprise Manager.

Target Privileges	Menu Items
View the database backup View database advanced queues View database redo logs View recovery settings View the high availability console View database resources	Availability>MAA AdvisorAdministration>Resource ManagerAvailability>Backup & Recovery>Backup ReportsAvailability>Backup & Recovery>Backup SettingsAvailability>Backup & Recovery>Recovery SettingsAvailability>Backup & Recovery>Recovery Catalog SettingsAvailability>Backup & Recovery>Transactions

Manage Database Performance Privilege Group

Members of this group have the ability to manage all database performance and advisory features including SQL Monitor, SQL Performance Analyzer, memory advisors, segment advisors, and so on.

Target Privileges	Menu Items
Use the database SQL Access Advisor	Performance>Performance Home
Manage the database SQL plan	Performance>SQL>SQL Performance Analyzer Home
control	Performance>SQL>Optimizer statistics
Use the database SQL Tuning Advisor	Performance>Top Activity
Manage the database SQL Tuning sets	Performance>ASH Analytics
Database SPA administration	Performance>SQL Monitor
Manage database sessions	Performance>SQL>SQL Tuning Sets
Database segment administration	Performance>SQL>SQL Plan Control
View database memory usage	Performance>SQL>Cloud Control SQL History
View the Database Performance Privilege Group	Performance>SQL>Search SQL
Database optimizer statistics administration	Performance>Search Sessions
Connect target	Performance>Blocking Sessions
Database ADDM administration	Performance>Advisors Home
Database advisor tasks administration	Performance>Real-Time ADDM
Automated maintenance tasks administration	Administration>Storage>Automatic Undo Management
Manage database ASH reports	Performance>AWR>AWR Report
Manage database automatic undo management	Performance>AWR>AWR Administration
Manage database AWR settings	Performance>AWR>Compare Period ADDM
Manage database health checkers	Performance>AWR>Compare Period Reports
Manage database memory usage	Performance>SQL>SQL Performance Analyzer Setup
	Performance>SQL>SQL Tuning Advisor
	Performance>SQL>SQL Access Advisor
	Administration>Initialization Parameters

View Database Performance Privilege Group

Members of this group have the ability to view all database performance and advisory features including SQL Monitor, SQL Performance Analyzer, memory advisors, segment advisors, and so on.

Target Privileges	Menu Items
Connect to a target (read-only)	Performance>Performance Home
View database actions	Performance>SQL>SQL Performance Analyzer Home
View database ADDM	Performance>SQL>Optimizer statistics
View Database Advisor Home	Performance>Top Activity
View automated maintenance tasks	Performance>ASH Analytics
View database ASH reports and analytics	Performance>SQL Monitor
View database automatic undo management	Performance>SQL>SQL Tuning Sets
View database AWR reports	Performance>SQL>SQL Plan Control
View database health checkers	Performance>SQL>Cloud Control SQL History
View database clients	Performance>SQL>Search SQL
View the database Data Recovery Advisor	Performance>Search Sessions
View the database in-memory setting	Performance>Blocking Sessions
Install database management packages	Performance>Advisors Home
View database modules	Performance>Real-Time ADDM
View the Database Performance Home Page	Administration>Storage>Automatic Undo Management
View Database Optimizer statistics	Performance>AWR>AWR Report
View database segments	Performance>AWR>AWR Administration
View database services	Performance>AWR>Compare Period ADDM
View database sessions	Performance>AWR>Compare Period Reports
View the database SQL Performance Analyzer	
View the Database SQL monitor	
View the database SQL plan control	
View the database SQL tuning sets	
View database SQL scripts	
View database top activity	

Manage Database Schema Privilege Group

Members of this group have the ability to manage database schema elements such as tables, views, indexes, packages, functions, and so on.

Target Privileges	Menu Items
Manage database directory objects	Schema>Database Objects>Synonyms
Manage database export	Schema>Database Objects>Sequences
Manage database import	Schema>Database Objects>Database Links
Manage database indexes	Schema>Database Objects>Directory Objects
Manage database Java content	Schema>Text Manager>Text Indexes
Manage database materialized	Schema>Workspaces
views	Schema>XML Database>Resources
Manage database tables	Schema>XML Database>XML Schemas
Manage database procedures and functions	Schema>XML Database>XMLType Views
Reorganize database objects	Schema>XML Database>XML Indexes
Manage database sequences	Schema>XML Database>XML Repository Events
Manage database synonyms	Schema>XML Database>XMLType Tables
Manage database workspaces	Schema>Programs>Packages
Manage the XML database	Schema>Programs>Package Bodies
Manage database types	Schema>Programs>Java Sources
Manage database triggers	Schema>Programs>Java Classes
Manage database text Indexes	Schema>Materialized Views>Materialized Views
View database table data	Schema>Materialized Views>Materialized View Logs
Manage database dimensions	Schema>Materialized Views>Refresh Groups>Dimensions
Manage database links	Schema>User Defined Types>Array Types
Manage database packages and package bodies	Schema>User Defined Types>Object Types
	Schema>User Defined Types>Table Types
	Schema>Database Objects>Reorganize Objects
	Schema>Database Export/Import>Export to Export Files...
	Schema>Database Export/Import>Import from Export Files...
	Schema>Database Export/Import>Import from Database...
	Schema>Database Export/Import>Load Data from User Files...
	Schema>Text Manager>Query Statistics
	Schema>XML Database>Configuration
	Schema>Change Management>Data Comparisons Schema Change Plans
	Schema>Change Management>Schema Baselines
	Schema>Change Management>Schema Comparisons
	Schema>Change Management>Schema Change Plans
	Schema>Change Management>Schema Synchronizations

View Database Schema Privilege Group

Members of this group have the ability to view database schema elements such as tables, views, indexes, packages, functions, and so on.

Target Privileges	Menu Items
View the XML database	Schema>Database Objects>Tables
View database workspaces	Schema>Database Objects>Views
View database types	Schema>Database Objects>Indexes
View database triggers	Schema>Database Objects>Synonyms
View database text indexes	Schema>Database Objects>Sequences
View database tables	Schema>Database Objects>Database Links
View database synonyms	Schema>Database Objects>Directory Objects
View database sequences	Schema>Text Manager>Text Indexes
View database procedures and functions	Schema>Workspaces
View database packages and package bodies	Schema>XML Database>Resources
View database materialized views	Schema>XML Database>XML Schemas
View database Java content	Schema>XML Database>XMLType Views
View database indexes	Schema>XML Database>XML Indexes
View database directory objects	Schema>XML Database>XML Repository Events
View database dimensions	Schema>XML Database>XMLType Tables
View database links	Schema>Programs>Packages
	Schema>Programs>Package Bodies
	Schema>Programs>Java Sources
	Schema>Programs>Java Classes
	Schema>Materialized Views>Materialized Views
	Schema>Materialized Views>Materialized View Logs
	Schema>Materialized Views>Refresh Groups>Dimensions
	Schema>User Defined Types>Array Types
	Schema>User Defined Types>Object Types
	Schema>User Defined Types>Table Types

Manage Database Security Privilege Group

Members of this group have the ability to manage all database security features including users, roles, profiles, transparent data encryption, database vault, and so on.

Target Privileges	Menu Items
Manage database roles	Security>Home
Manage database audit settings	Security>Reports
Manage database audit trails	Security>Database Vault
Manage the database vault	Administration>Oracle Scheduler>Jobs
Manage database virtual private database policies	Administration>Oracle Scheduler>Job Classes
Manage database users	Administration>Oracle Scheduler>Chains
Manage database transparent data encryption settings	Administration>Oracle Scheduler>Schedules
View the Database Security Privilege group	Administration>Oracle Scheduler>Programs
Manage the database scheduler	Administration>Oracle Scheduler>Windows
Database redaction administration	Administration>Oracle Scheduler>Window Groups
Manage database profiles	Security>Roles
Manage privilege analysis	Security>Users
Manage database Oracle label security	Security>Profiles
	Security>Audit Settings
	Security>Transparent Data Encryption
	Security>Data Redaction
	Security>Label Security
	Security>Application Contexts
	Security>Enterprise User Security
	Security>Virtual Private Database
	Security>Application Contexts
	Security>Enterprise User Security
	Security>Privilege Analysis

View Database Security Privilege Group

Members of this group have the ability to view all database security features including users, roles, profiles, data encryption, data vault, audit vault, and so on.

Target Privileges	Menu Items
View database audit settingsView the database audit trailMonitor the database vaultView database feature usageView database Oracle label securityView privilege analysisView database profilesView database redactionView database rolesView the database schedulerView the Database Security HomeView database security reportsView database transparent data encryption settingsView database usersView database virtual private database policies	Security>Home Security>Reports Security>Database Vault Administration>Oracle Scheduler>Jobs Administration>Oracle Scheduler>Job Classes Administration>Oracle Scheduler>Chains Administration>Oracle Scheduler>Schedules Administration>Oracle Scheduler>Programs Administration>Oracle Scheduler>Windows Administration>Oracle Scheduler>Window Groups Security>Roles Security>Users Security>Profiles Security>Audit Settings Security>Transparent Data Encryption Security>Data Redaction Security>Label Security Security>Application Contexts Security>Enterprise User Security Security>Virtual Private Database Security>Application Contexts Security>Enterprise User Security Security>Privilege Analysis

Manage Database Storage Privilege Group

The members of this group have the ability to manage database storage.

Target Privileges	Menu Items
Manage database control files	Administration>Storage>Archive Logs
Manage database data files	Administration>Storage>Datafiles
Manage database redo logs	Administration>Storage>Control Files
Manage database tablespaces	Administration>Storage>Redo Log Groups
Manage database transport tablespace	Administration>Storage>Tablespaces
	Administration>Storage>Temporary Tablespace Groups
	Administration>Storage>Database File Systems
	Administration>Storage>Information Lifecycle Management

View Database Storage Privilege Group

Members of this group have the ability to view database storage.

Target Privileges	Menu Items
View Database Tablespaces View Database Redo Logs View Database Archive Logs View Database Datafiles	Administration>Storage>Archive Logs Administration>Storage>DatafilesAdministration>Storage>Control Files Administration>Storage>Redo Log Groups Administration>Storage>TablespacesAdministration>Storage>Temporary Tablespace Groups Administration>Storage>Database File Systems Administration>Storage>Information Lifecycle Management

Secured Communication (TCPS) Access to Databases

Out of the box support is provided for discovering, monitoring, and administration of TCPS enabled listeners. All databases created through the Admin provisioning flow or Cloud Self Service portal support SSL enabled connection strings by default. Target databases can be monitored securely by configuring the TCPS connection protocol. By configuring secured access, data transport encryption is enabled between OMS and the database server target and between the Agent and the database server target.

As businesses look towards cloud solutions, secure user authentication is a key requirement of the product offering. Oracle's default authentication protocols O3LOGON and O5LOGON (introduced in Enterprise Manager 11*g*) have been revamped to enable user authentication using the TCPS protocol for Oracle Database Server instead of the not-so-secure TCP protocol.

> **Note:**
>
> Using secure authentication has no impact on normal database performance.

Configuring TCPS

To configure TCPS:

1. Enable the Oracle Advanced Security TLS setting on the target database.

   For TLSv1.2 configuration,

   1) Ensure SSL_VERSION is set to **1.2** for configuring TLSv1.2 in the *sqlnet.ora* or the *listener.ora* file,

   2) Ensure the SSL_CLIENT_AUTHENTICATION parameter in the *sqlnet.ora* file is set to **TRUE**.
2. Configure secure wallets with third party CA certificates.
3. Configure third party CA certificate wallets for OMS and Agent communication.
4. Set the connection protocol to TCPS in the monitoring configuration properties of target database.

Configuring Third Party CA Certificates for Communication With Target Databases

You must set the following set of properties at the OMS server and Agent for secure target monitoring. Bounce the OMS and the agent to bring the changes into effect.

> **Note:**
>
> For more information about emctl, see "Using emctl partool Utility" in the Oracle Enterprise Manager Lifecycle Management Administrator's Guide. .

Properties to be Set at the OMS Server:

- #Client authority
  - emctl set property -name em.targetauth.db.pki.KeyStore -value <…wallet..>
  - emctl set property -name em.targetauth.db.pki.KeyStorePassword -value <…>
  - emctl set property -name em.targetauth.db.pki.KeyStoreType -value <..>
- #Server authority
  - emctl set property -name em.targetauth.db.pki.TrustStorePassword -value <…>
  - emctl set property -name em.targetauth.db.pki.TrustStoreType -value <..>
  - emctl set property -name em.targetauth.db.pki.TrustStore -value <…wallet..>

Properties to be set at the Agent residing on the target database host:

- #Client authority
  - emctl setproperty agent -name connectionKeyStoreLocation -value <…wallet..>
  - emctl setproperty agent -name connectionKeyStoreType -value <..>
  - emctl setproperty agent -name connectionKeyStorePassword -value <..>
- #Server authority
  - emctl setproperty agent -name connectionTrustStoreLocation -value <…wallet..>
  - emctl setproperty agent -name connectionTrustStoreType -value <..>
  - emctl setproperty agent -name connectionTrustStorePassword -value <..>

Kerberos and RADIUS Authentication

In addition to logging in to a target database using a conventional username and password, you can also use named credentials to administer Oracle Databases in your Enterprise Manager environment. Enterprise Manager named credentials support both Kerberos (Username/Password and Keytab) and RADIUS credential types.

Kerberos and RADIUS credentials are currently supported for the following database management functionality:

- Basic management operations accessed through a direct database connection from the Enterprise Manager Management Server (e.g. Users page)

- Database performance pages, including Performance Hub
- Execute SQL and SQL script jobs

This section covers the following:

- Kerberos Keytab
- One-time Database Target Login Using Any Supported Credential Type
- RADIUS

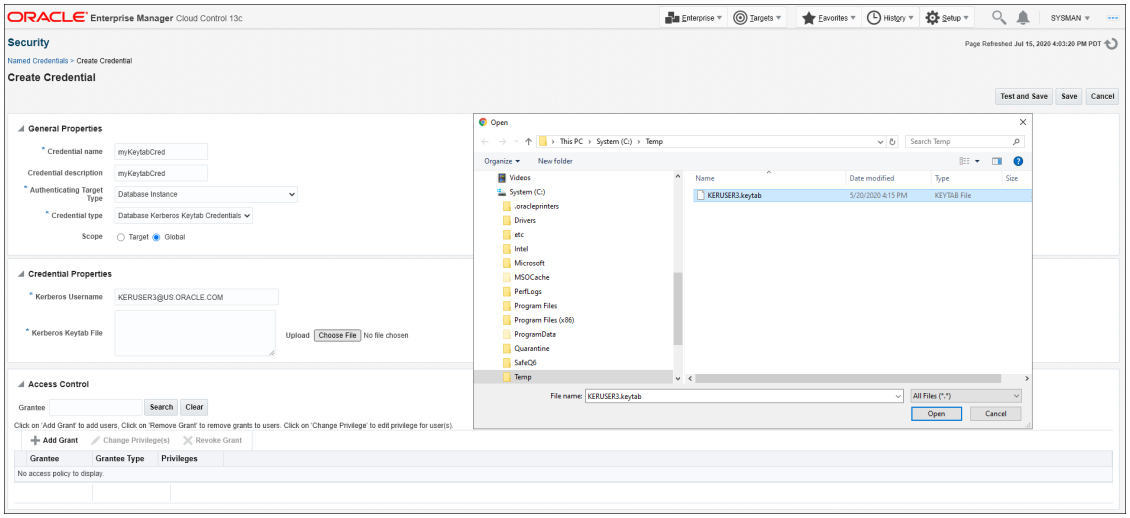
Kerberos Keytab

To use Kerberos Keytab for database target authentications, you create a named credential in Enterprise Manager of type *DBKerberosKeytabCreds* where you define a username and ketyab file. There are two ways in which a keytab file can be implemented:

Upload the Content of the Ketyab File to the OMS/Repository

You can physically upload the content of the keytab file to the OMS and repository in much the same way SSH-based credentials are defined. When defining the named credential with the *DBKerberosKeytabCreds* credential type, Enterprise Manager will use this keytab to log in and connect to the database target. You will need to update the keytab contents in Enterprise Manager whenever the keytab is changed due to password being rotated by updating the named credential.

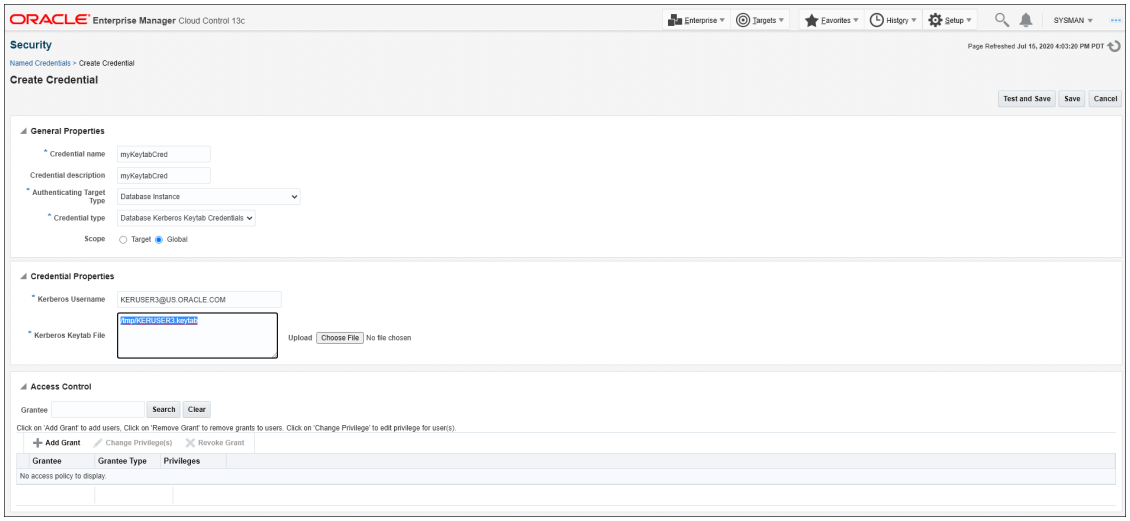
The following graphic illustrates how to specify the keytab file when creating a named credential.



Provide the Full Path to the Keytab File

You can also provide the full path to the keytab file that is accessible from the OMS (or each of the OMSes for multi-OMS environments). The keytab file must be present at the same location on the filesystem (this could be a single copy of the keytab file that is NFS mounted) and secured with the appropriate file permissions that would allow the OMS user to have at least read access to it. You will need to keep the file in this location updated with any changes to the keytab. This can be done completely independently and outside of Enterprise Manager.

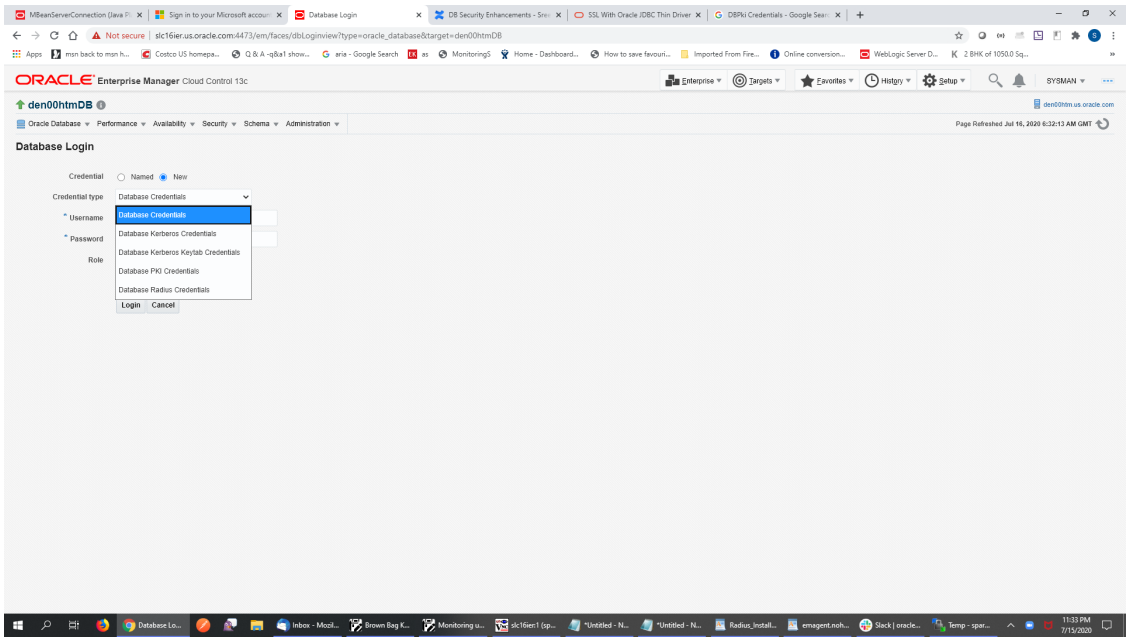
The following graphic illustrates how to define instances of the *DBKerberosKeytabCreds* credential type.



One-time Database Target Login Using Any Supported Credential Type

You can perform one-time database target login using any of the supported credential types, instead of being forced to pre-define a named credential and then use that to log in to the database target. This is useful in situations where you do not want to save any credentials or keytab files in Enterprise Manager and want to use a local file (say on your laptop) to log in each time. This file can then be updated independent of Enterprise Manager.

When you select the *New* radio button for Credential on the database login page, a drop down menu displays allowing you to select from a list of credential types enabled for the database target, as shown in the following graphic.



Enabling One-time Login

You enable one-time login using multiple credential types as well as enabling support for the two new credential types (RADIUS and Kerberos Keytab) via the OMS property `oracle.sysman.db.multiCredTypeLogin`.

```
emctl set property -name oracle.sysman.db.multiCredTypeLogin -value true
```

A value of *false* (or property not set) will disable this functionality and revert to the authentication functionality from Oracle Enterprise Manager 13c Release 5 Update 5 (13.5.0.5) and earlier. The default value is *false* if the property is absent.

Customizing the Credential Type Selection Menu for One

You can customize the list of credential types that appear in the Credential Type selection menu for one-time login shown above via the following OMS properties :

- **`emctl set property -name oracle.sysman.db.enable_radius_auth -value true`**
  Enable RADIUS. Default is false if property is absent.
- **`emctl set property -name oracle.sysman.db.enable_kerberos_auth -value true`**
  Enable both Kerberos-based credential types for one-time login on the database login page. The default is false if the property is absent.

> **Note:**
>
> None of the above property setting/changes require a restart of the OMS.

Example:

Say you want to enable one-time login to database targets using Kerberos username-password or Kerberos username-keytab. You would set the following OMS properties to enable the credential type drop-down on the database login page:

```
emctl set property -name oracle.sysman.db.multiCredTypeLogin -value true
```

AND

```
emctl set property -name oracle.sysman.db.enable_kerberos_auth -value true
```

If the above OMS properties are not set, you will still be able to define named credentials for Kerberos or RADIUS and use those to log into the database targets.

RADIUS

You can log into a target database as a database user that is externally authenticated using RADIUS. Although the entire process is transparent from an Enterprise Manager client perspective, specific connection parameters need to be specified via JDBC during the database login. The database itself acts as a RADIUS client and passes information from the database client (Enterprise Manager) to the RADIUS server to authenticate the user. RADIUS-based login only supports synchronous authentication mode.

> **Note:**
>
> Choosing the RADIUS authentication option requires users who log into the target database be aware that RADIUS authentication is necessary.

Synchronous Login

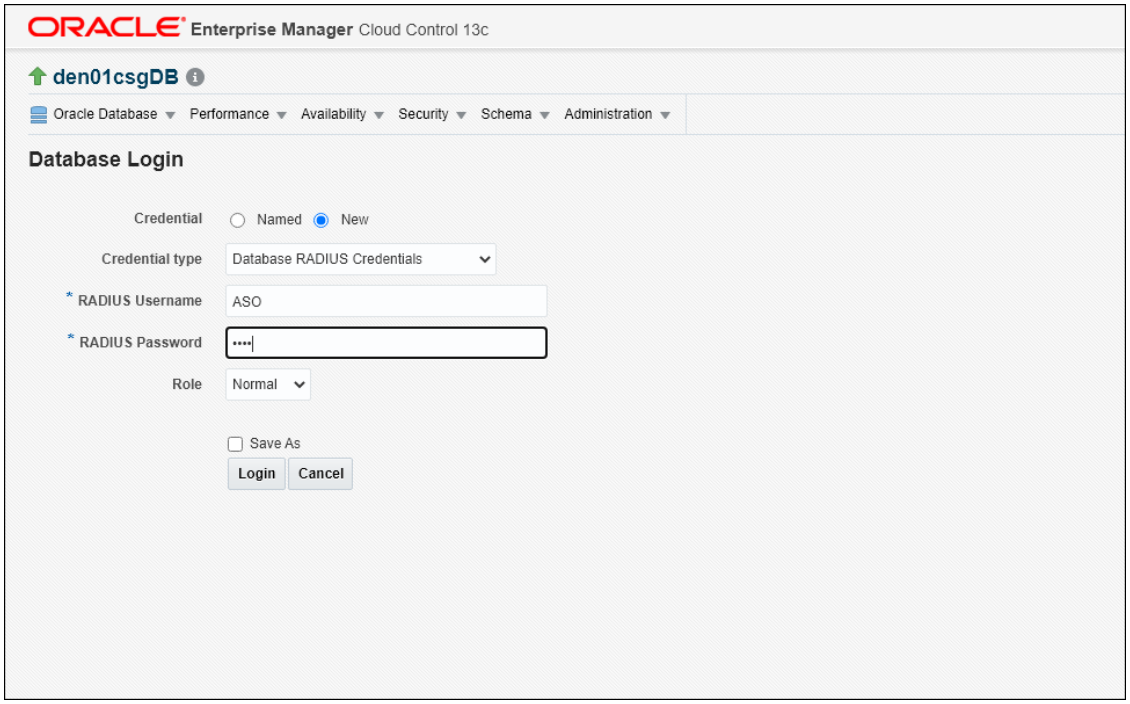
Enterprise manager supports one-time database login using RADIUS by setting following OMS properties:

```
emctl set property -name oracle.sysman.db.enable_radius_auth -value true
```

AND

```
emctl set property -name oracle.sysman.db.multiCredTypeLogin -value true
```

Enabling the RADIUS authentication type provides a full-fledged RADIUS credential type that will prompt for the username and password, as shown in the following graphic.



Co-existance with an Earlier Version of Radius Authentication

If you are using the existing option of specifying the OMS RADIUS property and used the **Enable Radius** checkbox in the database login UI, set the following OMS properties as shown below to revert back to the original behavior for RADIUS credentials.

`emctl set property -name oracle.sysman.db.multiCredTypeLogin -value false` (or unset this property if previously set via `emctl delete property -name oracle.sysman.db.multiCredTypeLogin`)

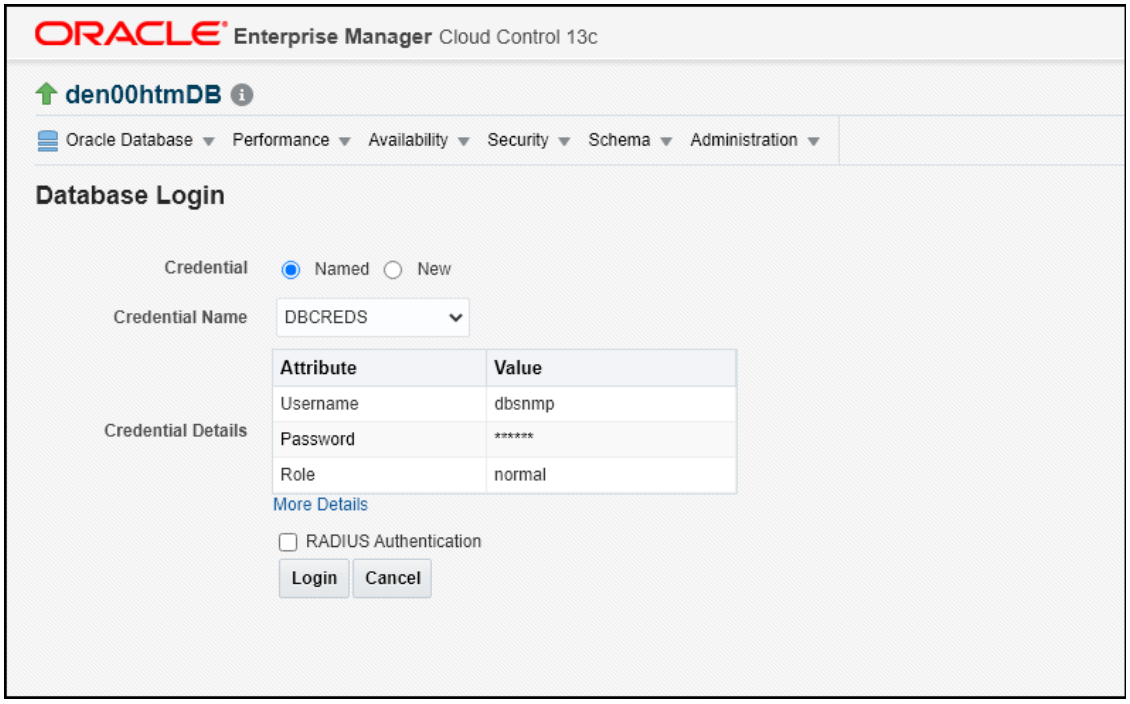
`emctl add property -name oracle.sysman.db.enable_radius_auth -value true`

Upgrade Implications

If you are currently using this feature via the OMS RADIUS property being set, an upgrade to the latest version will NOT result in any visible changes, by default. You can explicitly enable the new RADIUS credential type and enable multi-login support with both the *DBCredsType* and *DBRadiusCredsType* options being displayed in the drop-down selection for one-time login by explicitly setting **`emctl set property -name oracle.sysman.db.multiCredTypeLogin -value true`**

You will need to unset the OMS property for *multiCredTypeLogin* mentioned above to false (or delete the property) to revert to original behavior if desired or will now need to define new named credentials of type *DBRadiusCreds* to log in to target database using RADIUS

Setting the following parameters will return RADIUS authentication to the original Enterprise Manager 13c Release 4 behavior on the one-time login screen.



emctl set property -name oracle.sysman.db.multiCredTypeLogin -value false

OR

emctl delete property -name oracle.sysman.db.multiCredTypeLogin

You must also ensure the follwing property continues to be set:

emctl add property -name oracle.sysman.db.enable_radius_auth -value false (or remove the property)

Setting Kerberos/RADIUS-based Named Credentials as Preferred Credentials

Beginning with Enterprise Manager Cloud Control 13*c* Release 5 Update 9 (13.5.0.9), two credential sets have been created specifically for Oracle database, RAC database, and PDB target types.

The credential sets are:

- Normal Database Credentials (Advanced)
- SYSDBA Database Credentials (Advanced)

You can associate predefined Named Credentials of type Kerberos/Kerberos Keytab or RADIUS to these credential sets.

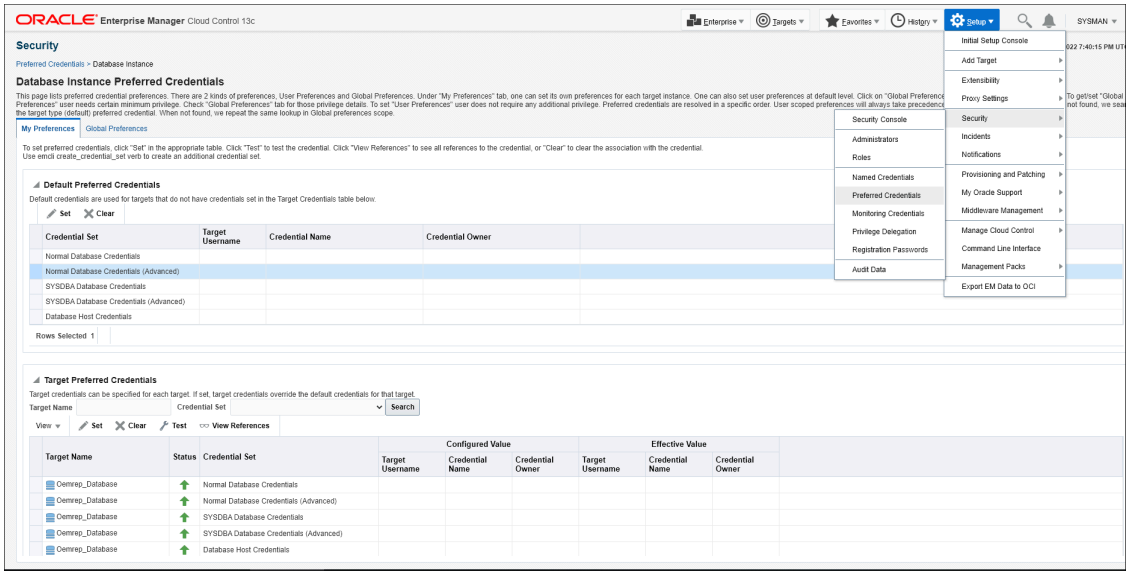
> **Note:**
>
> If you define a Named Credential with Role SYSDG, then these Named Credentials can be associated with the *SYSDBA Database Credentials (Advanced)* credential set as it is assumed that you are using SYSDG-based user credentials in lieu of accessing the database targets as a user with SYSDBA role.

There are three ways to set Kerberos/RADIUS credential types as Preferred Credentials on database targets.

- Set Named Credentials from the Enterprise Manager Console
- Define and Set a Kerberos/RADIUS Credential as a Preferred Credential via the One-Time Database Login Option
- Set Kerberos/RADIUS credentials as Preferred Credentials using emcli

Set Named Credentials from the Enterprise Manager Console

You can set RADIUS/Kerberos credential types as *Preferred Credentials* on databases and related targets directly from the Enterprise Manager console. To access the Preferred Credentials page, from the Setup menu, select **Security** and then **Preferred Credentials**.

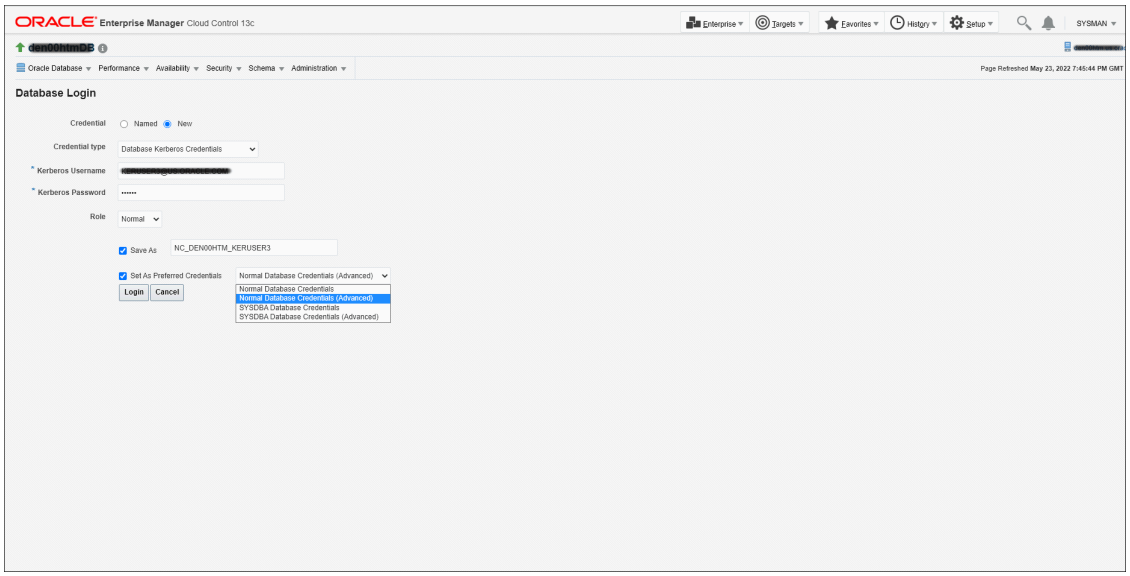


> **Note:**
>
> Named Credentials of type RADIUS or KERBEROS must have already been created and saved before they can be selected and set as Preferred Credentials in the Preferred Credentials page above. You cannot create a new credential of type RADIUS or Kerberos and then save this as a preferred credential via this page in the same step.

Define and Set a Kerberos/RADIUS Credential as a Preferred Credential via the One-Time Database Login Option

You can set the following OMS properties to enable a one-time database login using a new RADIUS/Kerberos credential type.

```
emctl set property -name oracle.sysman.db.enable_radius_auth -value true
emctl set property -name oracle.sysman.db.enable_kerberos_auth   -value true
emctl set property -name oracle.sysman.db.multiCredTypeLogin -value true
```



Once the above Preferred Credentials are set on the database and/or related target, they can be used for underlying jobs (like ExecuteSQL or SQLScript) that support these advanced credentials types.

Logging in from the Enterprise Manager console to the target is similar to using regular database (username/password) Preferred Credential sets. For example if *Normal Database Credentials (Advanced)* is set as a Preferred Credential for a given database target (and *Normal Database Credentials* is NOT set), navigating to any Enterprise Manager console page for this database target (requiring a database login as a user with Normal role) will result in an auto-login to the database target as this Kerberos/RADIUS user that is represented by the Preferred Credential being set.

Set Kerberos/RADIUS Credentials as Preferred Credentials Using `emcli`

You can use `emcli` to associate Kerberos/RADIUS-based Named Credentials as Preferred Credentials on a database or related target using `emcli` commands shown in the following examples.

To set a SYSDBA Kerberos-based Named Credential as a Preferred Credential on the database target *emdb020DB*:

```
emcli set_preferred_credential -set_name="DBCredsSYSDBAASO" -
target_name="emdb020DB" -target_type="oracle_database" -
credential_name="NC_EMDB020D_KEYTAB_SYSDBA"
```

To set a Normal RADIUS based Named Credential as a Preferred Credential of type *Normal Database Credentials (Advanced)* on the database target *den01csgDB*:

```
emcli set_preferred_credential -set_name="DBCredsNormalASO" -
target_name="den01csgDB" -target_type="oracle_database" -
credential_name="NC_DEN01CSG_ASO"
```

Propagation of Kerberos/RADIUS Subject and Role Across Database Logins

When you log into a database target as a Kerberos/RADIUS user and then navigate to a UI page in the Enterprise Manager console to access another database target that requires a database login with a specific role, Enterprise Manager will log in automatically using the original Kerberos user and role if that user is a valid user on the second database.

However, if there is a Preferred Credential defined for the second database with the appropriate role, then that Preferred Credential will be used for the DB login instead of the cached Kerberos credentials.

Example:

The DataGuard Administration page requires a database login with as a SYSDBA user. If there is a Kerberos/RADIUS Preferred Credential set defined for the database target under *SYSDBA Database Credentials (Advanced)* and no SYSDBA database credentials are defined, then accessing the DataGuard Administration page for the first time on a database target will result in an auto-login using the Kerberos/RADIUS credentials defined as a Preferred Credential on defined as a Preferred Credential for the *SYSDBA Database Credentials (Advanced)* credential set.

If **both** SYSDBA Database Credentials **AND** *SYSDBA Database Credentials (Advanced)* are defined on the same target, then the regular SYSDBA database credential set will take precedence.

Account Management

The following new EM CLI verbs have either been added or modified for target database account management:

> **Note:**
>
> For more information about these verbs, including examples, see the Verb Reference chapter in the *Oracle Enterprise Manager Command Line Interface*.

- get_db_profile

  Displays the database profile details such as profile, resource name, resource type, and limits for a specific search criteria. The following example displays details about the profile with the name DEFAULT:

  ```
  emcli get_db_profile
        -target_name=myDB
        -profile= DEFAULT
        -connect_as="DBNamedCreds:SYS_myDB"
  ```

- get_db_account

Displays database account details such as username, profile, account status, and authentication type for a specific search criteria. The following example displays the details of the user Admin1:

```
emcli get_db_account
      -target_name=myDB
      -user_name=Admin1
      -connect_as"DBNamedCreds:SYS_myDB"
```

- update_db_account_status

  Updates the database account status to LOCKED, OPEN, EXPIRED,or LOCKED & EXPIRED. The following example locks the account:

  ```
  emcli update_db_account_status
        -target_name=myDB
        -user_name=Admin1
        -action=LOCK
        -connect_as="DBNamedCreds:SYS_myDB"
  ```

- update_db_password

  Updates the target database password change in the Enterprise Manager Credential sub-system and can change the password on the target database as well. This verb also propagates the collection or monitoring credentials to Enterprise Manager Management Agents.

  The EM CLI verb update_db_password can now change passwords for all users, including SYS/SYSDBA users. The verb can change passwords for the database target and all Enterprise Manager credentials. It syncs the password file across RAC and Dataguard instances. It accepts database named credentials to logon to database targets if it is used for changing other users' passwords. The following example updates the database password:

  ```
  emcli update_db_password
        -target_name=myDB
        -user_name=Admin1
  ```

Oracle Enterprise Manager Support for TDE-Enabled Oracle Databases

Transparent Data Encryption (TDE) enables you to encrypt sensitive data that you store in tables and tablespaces.

To configure TDE, you must perform a one-time setup before you create keystores and encrypt data. The Oracle Database retrieves the keystore by searching in a few locations. Most Oracle Enterprise Manager capabilities support TDE and currently only support the wallet location specified by the `ENCRYPTION_WALLET_LOCATION` parameter in the default `$ORACLE_HOME/network/admin/sqlnet.ora` file.

The following Oracle Enterprise Manager capabilities do not support TDE-enabled Oracle Databases:

- `emcli migrate_db` verb
- `emcli migrate_noncdb_to_pdb` verb
- The UI migration method "Plug as a PDB"
- Provisioning of CDB or TDE-enabled databases
  Note that provisioning of TDE-enabled PDBs *is* supported.

- AWR warehouse
- Configuration and compliance for Oracle Databases

5
Troubleshooting

This chapter contains information about troubleshooting security issue in Oracle Enterprise Manager.

Troubleshooting Authentication Issues in Enterprise Manager

Authentication can fail for a number of reasons. This section discusses ways to troubleshoot authentication failures. When Enterprise Manager is configured with external authentication, the LDAP/SSO WebLogic authentication providers authenticate the user. If authentication succeeds, the Enterprise Manager authentication layer checks if that user exists in Enterprise Manager repository. If authentication fails, the Enterprise Manager administrator should check ldap_trace.logATN located in the `../gc_inst/user_projects/domains/GCDomain`' directory. This file contains authentication entries from the LDAP authenticator. If that file does not exist, you need to enable the WebLogic debug flag (DebugSecurityAtn).

Enabling the WebLogic Debug Flag

From the WebLogic Server Console, enable logging, set the WebLogic debug log level and then the enable the debug flag.

1. Navigate to **Environment->Servers->EMGC_OMS1** and choose the **Logging** tab.
2. Under **Rotation**, set the **file rotation size** to 64000.
3. Expand **Advanced**.
4. Under **Message destinations(s)** (**Log file:** region) set the **Severity level** to **Trace**.
5. Navigate to the **Environment->Servers->EMGC_OMS1** and choose the **Debug** tab.
6. Check **WebLogic->security->atn->DebugSecurityAtn**.
7. Click **Save**.

Debugging errors in ldap_trace.logATN file

1. In the **Advanced** section, set **Minimum severity to log** to **Debug**.
2. In **Message** destinations, set the **Log file Severity** level to **Debug**
3. Click Save/Activate changes.
4. Navigate to the Debug tab and enable debug for

   weblogic->security->atn->DebugSecurityAtn
5. Click Save/Activate changes.

Invalid Credentials

Now, let's say user johndoe tries to log in with bad credentials. You should see something like the following in the ldap_trace.logATN. The non-zero resultCode of 49 indicates a bad password.

```
12:39:36.529 ldc=3 Connected to ldaps://<ldaphost>:3060
12:39:36.529 ldc=3 op=215 BindRequest {version=3, name=cn=orcladmin,
authentication=********}
12:39:36.566 ldc=3 op=215 BindResponse {resultCode=0}
12:39:36.568 ldc=3 op=216 BindRequest {version=3,
name=cn=johndoe,cn=Users,dc=us,dc=company,dc=com, authentication=********}
12:39:36.608 ldc=3 op=216 BindResponse {resultCode=49}
```

If user johndoe authenticates successfully by the LDAP provider but does not exist in the Enterprise Manager repository, then there should be no errors in the ldap_trace.logATN (you will see resultCode of 0) but in the Enterprise Manager log file emoms.log (under ../gc_inst/em/sysman/log) you should see something like the following:

```
2013-05-28 12:47:43,295 [[ACTIVE] ExecuteThread: '3' for queue: 'weblogic.kernel.Default
(self-tuning)'] WARN  auth.EMRepLoginFilter doFilter.457 - InvalidEMUserException caught
in EMRepLoginFilter: Failed to login using external authentication for user: johndoe
oracle.sysman.emSDK.sec.auth.InvalidEMUserException: Failed to login using external
authentication for user: johndoe
        at
oracle.sysman.emSDK.sec.auth.EMLoginService._performLogin(EMLoginService.java:1269)
        at
oracle.sysman.emSDK.sec.auth.EMLoginService._doSSOLogin(EMLoginService.java:754)
        at
oracle.sysman.emSDK.sec.auth.EMLoginService.doSSOLogin(EMLoginService.java:727)
        at oracle.sysman.emSDK.sec.auth.EMLoginService.doLogin(EMLoginService.java:228)
        at oracle.sysman.emSDK.sec.auth.EMLoginService.doLogin(EMLoginService.java:256)
```

To obtain more detailed debug data in `emoms.trc`, you can enable the Enterprise Manager authentication logger via the following command:

```
emctl set property -name "log4j.category.oracle.sysman.core.security.auth" -value
"DEBUG, emtrcAppender
```

emctl list properties will display something similar to the following output.

```
log4j.category.oracle.sysman.core.security.auth=DEBUG, emtrcAppender
```

> **Note:**
>
> Do not leave this debug logger enabled for performance reasons. Once the authentication issue has been diagnosed, turn this logger off using 'emctl delete property -name ".category.oracle.sysman.core.security.auth"

Timeout in LDAP Server'

There could be other non-zero resultCodes in ldap_trace.logATN that would indicate some other type of failure in the LDAP authentication layer. If the provider times out while trying to fetch results from the LDAP server, you should see something similar to the following in the file.

```
09:36:44.168 ldc=2 op=214 AbandonRequest {msgid=213}
```

To fix this issue, you can increase the *Results time limit* configuration parameter in the LDAP provider.

Errors Outside ldap_trace.logATN'

Sometimes, ldap_trace.logATN may not give the complete picture. In that case, check the diagnostic log EMGC_OMS1-diagnostic.log for errors/warnings from the configured external authentication provider.

Occasionally, There might be intermittent network issues between the LDAP server and the OMS host or the search base given as input might be too broad. You can use the 'ldapsearch' command that comes with the OS on your OMS host to validate connection/result retrieval timing issues. This command may not be available on all operating systems. You may use other LDAP tools. For example,

```
ldapsearch -h hostname -p 3060 -D cn=orcladmin -x -w xxxxxxx -b
"cn=users,dc=us,dc=oracle,dc=com" -s one -l 5 -z 15
```

Where:

- lh - hostname of the ldap server
- p - port of the ldap server
- D - bind dn
- x - use simple authentication rather than SASL
- w - password for the bind dn used above
- l - gives a time limit in seconds for a search to complete
- b - search base
- s - specify scope search
- z - specifies the limit of search result entries to be returned

You can give the user as well as the group base dn (that you specify in the emctl command) for the -b option and check if the appropriate results are returned and within the expected timeframe.

If you start seeing delays or timeouts, you should run this command from the same machine where Enterprise Manager is installed to ensure it is not LDAP server/network related.

6
References

The following Oracle documentation provides in-depth information on the topics discussed in the book.

- Oracle Database Advanced Security Administrator's Guide
- Oracle Database Security Guide
- Oracle Database Security Checklist
- Oracle Database 2 Day + Security Guide
- Oracle Enterprise Manager Cloud Control Administrator's Guide
- Oracle Fusion Middleware Administrator's Guide
- Oracle Fusion Middleware Securing Oracle WebLogic Server
- Oracle Fusion Middleware Securing a Production Environment for Oracle WebLogic Server

A
Out-of-Box Roles

The following table lists predefined roles that are available out-of-box with Enterprise Manager.

Table A-1 Out-of-Box Roles

Roles	Description
EM_ALL_ADMINISTRATOR	Role has privileges to perform Enterprise Manager administrative operations. It provides Full privileges on all secure resources (including targets)
EM_ALL_DESIGNER	Role has privileges to design Enterprise Manager operational entities such as Monitoring Templates.
EM_ALL_OPERATOR	Role has privileges to manage Enterprise Manager operations.
EM_ALL_VIEWER	Role has privileges to view Enterprise Manager operations.
EM_CBA_ADMIN	Role has privileges to manage Chargeback Objects. It provides the ability to create and view chargeback plans, chargeback consumers, assign chargeback usage, and view any CaT targets.
EM_CLOUD_ADMINISTRATOR	Enterprise Manager user for setting up and managing the infrastructure cloud. This role could be responsible for deploying the cloud infrastructure (servers, pools, zones) and infrastructure cloud operations for performance and configuration management.
EM_COMPLIANCE_DESIGNER	Role has privileges for create, modify and delete compliance entities.
EM_COMPLIANCE_OFFICER	Role has privileges to view compliance framework definition and results.
EM_CPA_ADMIN	Role to manage Consolidation Objects. It gives the capability to create and view consolidation plans, consolidation projects and view any CaT targets.
EM_HOST_DISCOVERY_OPERATOR	Role has privileges to execute host discovery
EM_INFRASTRUCTURE_ADMIN	Role has privileges to manage the Enterprise Manager infrastructure such as managing plug-in lifecycle or managing self update.
EM_PATCH_ADMINISTRATOR	Role for creating, editing, deploying, deleting and granting privileges for any patch plan.
EM_PATCH_DESIGNER	Role for creating and viewing for any patch plan
EM_PATCH_OPERATOR	Role for deploying patch plans
EM_PLUGIN_AGENT_ADMIN	Role to support plug-in lifecycle on Management Agent
EM_PLUGIN_OMS_ADMIN	Role to support plug-in lifecycle on Management Server
EM_PLUGIN_USER	Role to support view plug-in console
EM_PROVISIONING_DESIGNER	Role has privileges for provisioning designer
EM_PROVISIONING_OPERATOR	Role has privileges for provisioning operator

Table A-1 (Cont.) Out-of-Box Roles

Roles	Description
EM_SSA_ADMINISTRATOR	Enterprise Manager user with privilege to set up the Self Service Portal. This role can define quotas and constraints for self service users and grant them access privileges.
EM_SSA_USER	This role grants Enterprise Manager user the privilege to access the Self Service Portal.
EM_TARGET_DISCOVERY_OPERATOR	Role has privileges to execute target discovery.
EM_TC_DESIGNER	Role has privileges for creating Template Collections
EM_USER	Role has privilege to access Enterprise Manager Application.
PUBLIC	PUBLIC role is granted to all administrators. This role can be customized at site level to group privileges that need to be granted to all administrators.

EM_ALL_ADMINISTRATOR

Role has privileges to perform Enterprise Manager administrative operations. It provides Full privileges on all secure resources (including targets)

Table A-2 Privileges applicable to all targets

Name	Description
Create any user defined aggregate	Ability to create any user defined aggregate targets.
Create Privilege Propagating Group	Propagating Group Ability to create privilege propagating groups. Privileges granted on a privilege propagating group will be automatically granted on the members of the group.
Full any Target	Ability to perform all administrative operations on all the targets, that includes target deletion.

Table A-3 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Configuration Extensions	Configuration Extensions allow extending target configuration collections	Manage Configuration Extensions owned by any user
Deployment Procedure	Deployment procedures are customizable orchestration routines for various Provisioning and Patching tasks	Import
Enable Target Model	The Enable Target Model feature replaced deprecated Request Monitoring feature	Request Monitoring Administrator
JVM Diagnostics	JVM Diagnostics allows users to monitor any java target	JVM Diagnostics Administrator

Table A-3 (Cont.) Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Middleware Diagnostics Advisor	Middleware Diagnostics Advisor, allows administrators to run diagnostics on middleware targets	MDA Administrator Privilege
Report	Reports of Enterprise Manager management and monitoring data	Publish Report
Software Library Administration	Defines the access privileges required for the administration of Software Library	Software Library Storage Administration

EM_ALL_DESIGNER

Role has privileges to design Enterprise Manager operational entities such as Monitoring Templates, etc

Table A-4 Privileges applicable to all targets

Name	Description
Create any user defined aggregate	Ability to create any user defined aggregate targets.
Create Privilege Propagating Group	Propagating Group Ability to create privilege propagating groups. Privileges granted on a privilege propagating group will be automatically granted on the members of the group.
Full any Target	Ability to perform all administrative operations on all the targets, that includes target deletion.

Table A-5 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Compliance Framework	Compliance Framework provides capability to define/customize/ manage compliance frameworks, and compliance standards/rules and evaluate compliance of targets/systems with regards to business best practices for configuration/security/storage etc.	Create Compliance Entity, Full any Compliance Entity
Enterprise Rule Set	Collection of rules that apply to Enterprise Manager elements, for example, targets and job. Individual rules can be used to send notifications, create incidents, update incidents, and other incident-management related actions.	Create Enterprise Rule Set

Table A-5 (Cont.) Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Metric Extensions	Metric Extensions allows extending monitoring for a target type by adding new metrics	Create Metric Extension, Create Repository Metric Extension
Named Credential	Credentials to perform Enterprise Manager Administrative Operations	Create new Named Credential
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	Create Any Software Library Entity, Export Any Software Library Entity, Import Any Software Library Entity
Template Collection	Template Collections are sets of Monitoring Template, Compliance Standard and/or Cloud Policies that are applied to targets.	Create Template Collection

EM_ALL_OPERATOR

Role has privileges to manage Enterprise Manager operations

Table A-6 Privileges applicable to all targets

Name	Description
Connect to any viewable target	Ability to connect and manage any of the viewable target
Add any Target	Add any target in Enterprise Manager
Operator any Target	Ability to perform administrative operations on all managed targets
Execute Command Anywhere	Execute any OS Command at any Agent

Table A-7 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Application Replay Entities	Application Replay Entities include captures, replay tasks, and replays.	Application Replay Operator
Configuration Extensions	Configuration Extensions allow extending target configuration collections	Manage Configuration Extensions owned by the user
Named Credential	Credentials to perform Enterprise Manager Administrative Operations	Create new Named Credential
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	Create Any Software Library Entity, Edit Any Software Library Entity, Export Any Software Library Entity, Import Any Software Library Entity

EM_ALL_VIEWER

Role has privileges to view Enterprise Manager operations

Table A-8 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Application Replay Entities	Application Replay Entities include captures, replay tasks, and replays.	Application Replay Viewer
Enable Target Model	The Enable Target Model feature replaced deprecated Request Monitoring feature	Request Monitoring User
JVM Diagnostics	JVM Diagnostics allows users to monitor any java target	JVM Diagnostics User, JVM Diagnostics View Locals Privilege
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	View Middleware Diagnostics Advisor jobs
Middleware Diagnostics Advisor	Middleware Diagnostics Advisor, allows administrators to run diagnostics on middleware targets	MDA User Access Privilege
Patch Plan	A patch plan is a collection of patches which you might want to consider applying as a group to one or more targets	View any Patching Plan
Self Update	Self Update enables administrators to receive notifications and view, download, and apply new functionality and updates for existing features in Enterprise Manager.	View any Enterprise Manager Update
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	View Any Software Library Entity
Template Collection	Template Collections are sets of Monitoring Template, Compliance Standard and/or Cloud Policies that are applied to targets.	View any Template Collection

EM_ALL_VIEWER

Role has privileges to view Enterprise Manager operations

Table A-9 Privileges applicable to all targets

Name	Description
Manage events on any Oracle Management Service targets	Ability to manage events for all Oracle Management Service targets

Table A-10 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Chargeback and Consolidation	Extends Enterprise Manager feature to allow Chargeback and Consolidation of Targets based on configuration and resource usage	Add Chargeback Targets, Assign Chargeback Plan, Assign Chargeback Usage, Manage Any Chargeback and Consolidation Target, Manage Chargeback Consumers, Manage Chargeback Plans, Setup Chargeback and Consolidation Planner/ Workbench
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Submit On-demand chargeback data collection job

EM_CLOUD_ADMINISTRATOR

EM user for setting up and managing the cloud. This role could be responsible for deploying the cloud infrastructure (servers, pools, zones etc) and cloud operations for performance and configuration management.

Table A-11 Privileges applicable to all targets

Name	Description
Add any Target	Add any target in Enterprise Manager
Execute Command Anywhere	Execute any OS Command at any Agent
View any Infrastructure Cloud	View any Infrastructure Cloud
View any Oracle VM Manager	View any Oracle VM Manager
View any Resource Provider	View any Resource Provider
View Cloud Home	View Cloud Home

Table A-12 Target Privileges

Name	Type
Infrastructure Cloud	Infrastructure Cloud
Middleware and Database Cloud	Middleware and Database Cloud
Oracle Linux Virtualization Infrastructure Cloud	Oracle Linux Virtualization Cloud

Table A-13 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Cloud Policy	Defines access privileges for Cloud Policies	Create any Policy

Table A-13 (Cont.) Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Cloud Policy Group	Defines access privileges for Cloud Policy Groups	Create Policy Group
Cloud Self Service Portal	Defines the access privileges and roles for Cloud Self Service Portal.	Setup Cloud Infrastructure Resources
Cloud Service Actions	Defines access privileges for Cloud Service Actions.	Register Cloud Service Actions
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create
Network Profile	A set of Network Profile settings.	Setup Network Profile
Requests	Defines access privileges for Cloud Requests.	View Any Request
Self Update	Self Update enables administrators to receive notifications and view, download, and apply new functionality and updates for existing features in Enterprise Manager.	Self Update Administrator
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	Create Any Software Library Entity, Manage Any Software Library Entity
Target Discovery Framework	Target Discovery Framework provides capability to discover host target via network scan, view discovered hosts and targets on host etc	Scan Network
Template Collection	Template Collections are sets of Monitoring Template, Compliance Standard and/or Cloud Policies that are applied to targets.	Create Template Collection

EM_COMPLIANCE_DESIGNER

Role has privileges for create, modify and delete compliance entities

Table A-14 Privileges applicable to all targets

Name	Description
Manage Any Target Compliance	Ability to manage compliance of any target
Manage Any Target Metric	Ability to manage metric for any target
View any Target	Ability to view all managed targets in Enterprise Manager

Table A-15 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Compliance Framework	Compliance Framework provides capability to define/customize/ manage compliance frameworks, and compliance standards/rules and evaluate compliance of targets/systems with regards to business best practices for configuration/security/storage etc.	Create Compliance Entity, Full any Compliance Entity
Configuration Extensions	Configuration Extensions allow extending target configuration collections	Manage Configuration Extensions owned by any user
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create

EM_COMPLIANCE_OFFICER

Role has privileges to view compliance framework definition and results

Table A-16 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Compliance Framework	Compliance Framework provides capability to define/customize/ manage compliance frameworks, and compliance standards/rules and evaluate compliance of targets/systems with regards to business best practices for configuration/security/storage etc.	View any Compliance Framework

EM_CPA_ADMIN

Role to manage Consolidation Objects. It gives the capability to create and view consolidation plans, consolidation projects and view any CaT targets.

Table A-17 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Chargeback and Consolidation	Extends Enterprise Manager feature to allow Chargeback and Consolidation of Targets based on configuration and resource usage	Manage Any Chargeback and Consolidation Target, Manage Consolidation Plan, Manage Consolidation Project, Setup Chargeback and Consolidation Planner/Workbench

EM_HOST_DISCOVERY_OPERATOR

Role has privileges to execute host discovery

Table A-18 Privileges applicable to all targets

Name	Description
Add any Target	Add any target in Enterprise Manager
Execute Command Anywhere	Execute any OS Command at any Agent
Execute Command as any Agent	Execute any OS Command as the Agent User at any Agent
Put File as any Agent	Put any File to any Agent's Filesystem as the Agent User

Table A-19 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create
Target Discovery Framework	Target Discovery Framework provides capability to discover host target via network scan, view discovered hosts and targets on host etc	Scan Network

EM_INFRASTRUCTURE_ADMIN

Role has privileges to manage the Enterprise Manager infrastructure such as managing plug-in lifecycle, managing self update, etc

Table A-20 Privileges applicable to all targets

Name	Description
Connect to any viewable target	Ability to connect and manage any of the viewable target
Add any Target	Add any target in Enterprise Manager
Monitor Enterprise Manager	Monitor Enterprise Manager performance
Execute Command Anywhere	Execute any OS Command at any Agent
View any Target	Ability to view all managed targets in Enterprise Manager

Table A-21 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create, View status of "Refresh Updates From Oracle" Job
Named Credential	Credentials to perform Enterprise Manager Administrative Operations	Create new Named Credential
OMS Configuration Property	Secure class for OMS Configuration Property	View / Edit any OMS configuration property
Patching Setup	A set of Patching functionality specific settings.	Setup Offline Patching
Proxy Settings	The settings of the proxy servers through which the OMS connects to My Oracle Support or communicates with the Management Agents.	Set Up Proxy for Connecting to Management Agents, Set Up Proxy for Connecting to My Oracle Support
Self Update	Self Update enables administrators to receive notifications and view, download, and apply new functionality and updates for existing features in Enterprise Manager.	Self Update Administrator, View any Enterprise Manager Update
Software Library Administration	Defines the access privileges required for the administration of Software Library	Software Library Storage Administration
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	Create Any Software Library Entity, Edit Any Software Library Entity, Export Any Software Library Entity, Import Any Software Library Entity, Manage Any Software Library Entity
Enterprise Manager High Availability	Enterprise Manager High Availability Administration allows you to add an additional Management Service using a deployment procedure.	Enterprise Manager High Availability Administration

EM_PATCH_ADMINISTRATOR

Role for creating, editing, deploying, deleting and granting privileges for any patch plan

Table A-22 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Patch Plan	A patch plan is a collection of patches which you might want to consider applying as a group to one or more targets	Full privileges on any Patching Plan, Manage privileges on any Patching Plan, Patch Setup

Table A-22 (Cont.) Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Patching Setup	A set of Patching functionality specific settings.	Setup Offline Patching
Proxy Settings	The settings of the proxy servers through which the OMS connects to My Oracle Support or communicates with the Management Agents.	Set Up Proxy for Connecting to Management Agents, Set Up Proxy for Connecting to My Oracle Support

EM_PATCH_DESIGNER

Role for creating and viewing for any patch plan

Table A-23 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Deployment Procedure	Deployment procedures are customizable orchestration routines for various Provisioning and Patching tasks	Create
Patch Plan	A patch plan is a collection of patches which you might want to consider applying as a group to one or more targets	Create Patch Plan Template, View any Patching Plan

EM_PATCH_OPERATOR

Role for deploying patch plans

Table A-24 Privileges applicable to all targets

Name	Description
Execute Command Anywhere	Execute any OS Command at any Agent

Table A-25 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Named Credential	Credentials to perform Enterprise Manager Administrative Operations	Create new Named Credential
Patch Plan	A patch plan is a collection of patches which you might want to consider applying as a group to one or more targets	Create Patching Plan, View any Patching Plan Template

Table A-25 (Cont.) Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	Create Any Software Library Entity, View Any Software Library Entity
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create

EM_PLUGIN_AGENT_ADMIN

Enables you to manage the lifecycle of plug-ins on Management Agents

Table A-26 Privileges applicable to all targets

Name	Description
Execute Command Anywhere	Execute any OS Command at any Agent
Execute Command as any Agent	Execute any OS Command as the Agent User at any Agent
Put File as any Agent	Put any File to any Agent's Filesystem as the Agent User

Table A-27 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
EM Plug-in	Manage the access control for Enterprise Manager plug-ins	Plug-in Agent Administrator
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	View Any Software Library Entity

EM_PLUGIN_OMS_ADMIN

Enables you to manage the lifecycle of plug-ins on Management Server instances

Table A-28 Privileges applicable to all targets

Name	Description
Execute Command Anywhere	Execute any OS Command at any Agent

Table A-28 (Cont.) Privileges applicable to all targets

Name	Description
Execute Command as any Agent	Execute any OS Command as the Agent User at any Agent
Put File as any Agent	Put any File to any Agent's Filesystem as the Agent User

Table A-29 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
EM Plug-in	Manage the access control for Enterprise Manager plug-ins	Plug-in OMS Administrator
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create
Self Update	Self Update enables administrators to receive notifications and view, download, and apply new functionality and updates for existing features in Enterprise Manager.	Self Update Administrator
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	View Any Software Library Entity

EM_PLUGIN_OMS_ADMIN

Enables you to view the plug-in lifecycle console

Table A-30 Privileges applicable to all targets

Name	Description
View any Target	Ability to view all managed targets in Enterprise Manager

Table A-31 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
EM Plug-in	Manage the access control for Enterprise Manager plug-ins	Plug-in OMS Administrator
Self Update	Self Update enables administrators to receive notifications and view, download, and apply new functionality and updates for existing features in Enterprise Manager.	Self Update Administrator

EM_PROVISIONING_DESIGNER

Role has privileges for provisioning designer

Table A-32 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Deployment Procedure	Deployment procedures are customizable orchestration routines for various Provisioning and Patching tasks	Create, Manage launch access
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	Create Any Software Library Entity

EM_PROVISIONING_OPERATOR

Role has privileges for provisioning operator

Table A-33 Privileges applicable to all targets

Name	Description
Create Privilege Propagating Group	Ability to create privilege propagating groups.Privileges granted on a privilege propagating group will be automatically granted on the members of the group
Execute Command Anywhere	Execute any OS Command at any Agent

Table A-34 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create
Named Credential	Credentials to perform Enterprise Manager Administrative Operations	Create new Named Credential
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	View Any Software Library Entity

EM_SSA_ADMINISTRATOR

EM user with privileges to set up the Self Service Portal. This user can define quotas and constraints for self service users and grant them access privileges.

Table A-35 Privileges applicable to all targets

Name	Description
Administer any Oracle VM Zone	Ability to administer any Oracle VM Zone
View Cloud Home	View Cloud Home

Table A-36 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Cloud JVM Diagnostics SSA Administrator Access	Users with this privilege have access to JVM Diagnostics Cloud Administrator, Portal and JVMD Setup pages.	Cloud JVM Diagnostics SSA Administrator Access
Cloud Self Service Portal for Test	Defines the access privileges and roles related to the Cloud Self Service Portal for Test.	Access the Cloud Self Service Portal for Test
Cloud Service Families	Defines access privileges for Cloud Service Families.	Grant View Service Family, Manage Any Service Family
Cloud Service Templates	Defines access privileges for Cloud Service Templates.	-
Cloud Service Types	Defines access privileges for Cloud Service Types.	Grant View Service Type, Manage Any Service Type
Infrastructure Self Service Portal	Defines the access privileges and roles for Infrastructure Self Service Portal.	Access Infrastructure Self Service Portal

EM_SSA_USER

Users with this role can access the Self Service Portal and all service families and types available.

Table A-37 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Cloud Self Service Portal for JVM Diagnostics	Defines the access privileges and roles related to the Cloud Self Service Portal for JVM Diagnostics.	Cloud Self Service Portal for JVM Diagnostics
Cloud Self Service Portal for Oracle Public Cloud Machine	Defines the access privileges and roles related to the Oracle Public Cloud Machine Self Service Portal.	Access the Oracle Public Cloud Machine Self Service Portal
Cloud Self Service Portal for Test	Defines the access privileges and roles related to the Cloud Self Service Portal for Test.	Access the Cloud Self Service Portal for Test
Cloud Service Actions	Defines access privileges for Cloud Service Actions.	View Any Cloud Service Action
Cloud Service Families	Defines access privileges for Cloud Service Families.	View Any Service Family

Table A-37 (Cont.) Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Cloud Service Templates	Defines access privileges for Cloud Service Templates.	-
Cloud Service Types	Defines access privileges for Cloud Service Types.	View Any Service Type
Infrastructure Self Service Portal	Defines the access privileges and roles for Infrastructure Self Service Portal.	Access Infrastructure Self Service Portal
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	-
Requests	Defines access privileges for Cloud Requests.	Create Any Request
Software Library Entity	Defines the access privileges required for managing the lifecycle of Software Library entities	View any Oracle Load Testing Scenario Entity, View any User Defined Test Entity
TaaS Test	Defines access privileges for TaaS Tests.	Create any TaaS Test

EM_TARGET_DISCOVERY_OPERATOR

Role has privileges to execute target discovery

Table A-38 Privileges applicable to all targets

Name	Description
Add any Target	Add any target in Enterprise Manager
Execute Command Anywhere	Execute any OS Command at any Agent
Execute Command as any Agent	Execute any OS Command as the Agent User at any Agent
Put File as any Agent	Put any File to any Agent's Filesystem as the Agent User

Table A-39 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create

EM_TC_DESIGNER

Role has privileges for creating Template Collections

Table A-40 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Cloud Policy	Defines access privileges for Cloud Policies	View any Policy
Job System	Job is a unit of work that may be scheduled that an administrator defines to automate the commonly run tasks	Create
Monitoring Template	Monitoring Templates are a collection of metrics settings (thresholds, collection schedules, corrective actions) for a target type that can be applied to multiple targets of that type.	View any Monitoring Template
Template Collection	Template Collections are sets of Monitoring Template, Compliance Standard and/or Cloud Policies that are applied to targets.	Create Template Collection

EM_USER

Role has privilege to access Enterprise Manager Application

Table A-41 Resource Privileges

Resource Type	Description	Privilege Grants Applicable to all Resources
Access	Defines the access to different application in Enterprise Manager Cloud Control	Access Enterprise Manager

PUBLIC

PUBLIC role is granted to all administrators. This role can be customized at site level to group privileges that need to be granted to all administrators

B

User Access to Database Targets without SYSDBA Privileges

A user may need to perform operation on a database target such as:

- Monitor Performance Page
- Review and administer AWR
- Use SQL Access Advisor
- Use SQL Tuning

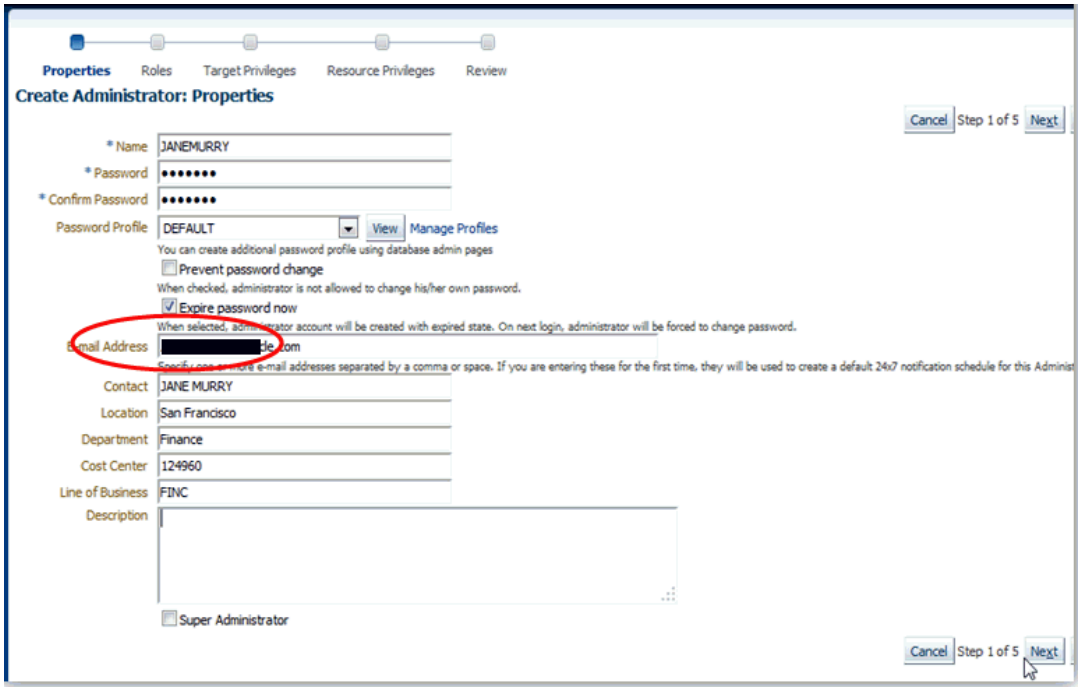
In circumstances where a user is required to access database monitoring/management functions in Enterprise Manager but has not been given full SYSDBA access to database targets, you can create an Enterprise Manager administrator and give him the EM_USER and PUBLIC roles as well as, "Connect to any viewable target" privileges to the database targets that you want the administrator to access.

In the following steps we will grant "Connect to any viewable target" to all targets (instead of listing specific target instances). Depending on the type of authentication model being used, the administrator details will be stored in either the Cloud Control Repository or an external store, such as LDAP.

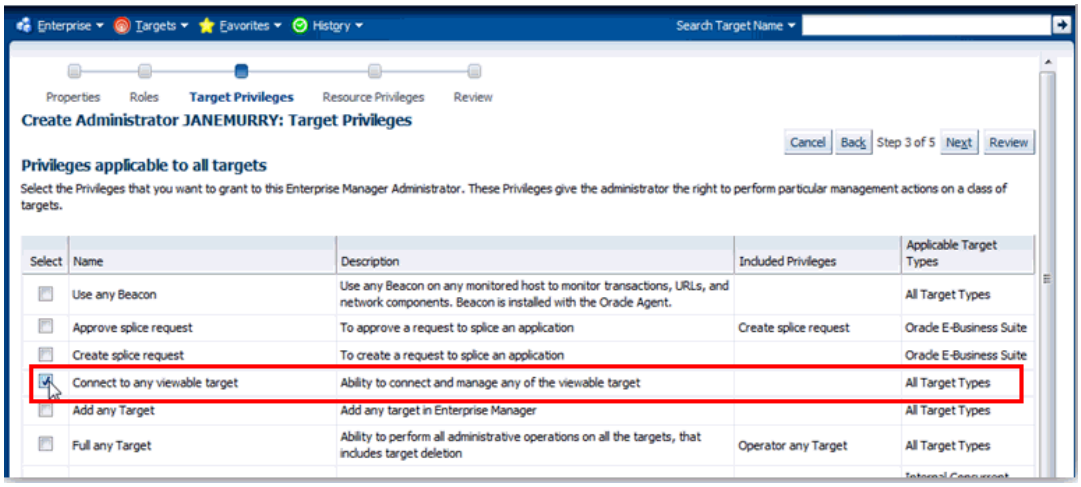
Creating an Administrator

1. From the Setup menu, select Security and then Administrators.
2. Click Create.
3. From the Create Administrator: Properties page, enter all necessary information, including the password profile as enforced by your security team. In the graphic shown below,"Expire password now", has been selected so that when this user logs in with the temporary password, they will be forced to reset their password.

   Once you have entered the requisite information, click **Next**.



4. From the Create Administrator: Roles Page, choose the default roles and click **Next**.
5. From the Create Administrator: Target Privilege page, Select the **Connect to any viewable** target privilege. This enables the administrator to connect to all targets viewable in his console.



Click **Next**.

6. From the Resource page, click **Next**. This accepts the default settings.
7. Review your settings on the Review page. Click **Finish**.

Valid users must reside on the target instances.

Users Requiring Access to the Database Performance Page

1. On the DB Target host, log in as sysdba and create a <dbmonitor_admin> user and grant appropriate privileges:

```
SQL> create user <dbmonitor_admin> identified by <password>;
SQL> grant select any dictionary to <dbmonitor_admin>;
SQL> grant create session to <dbmonitor_admin>;
```

2. Log in to the Cloud Control console as <gc_user> user, which is JANEMURRY in the example:

   TARGETS > DATABASE > ORADB > PERFORMANCE

   Enter login and password for <dbmonitor_admin> user.

   The Performance page should now appear. The following user will now be able to access all pages under the section of Additional Monitoring Links.

User Requiring Accessing AWR/ADDM

1. On a DB Target host log in as sysdba and create an <awr_admin> user and grant appropriate privileges:

   ```
   SQL> create user <awr_admin> identified by <password>;
   SQL> grant select any dictionary to <awr_admin>;
   SQL> grant create session to <awr_admin>;
   SQL> grant execute on dbms_workload_repository to <awr_admin>;
   ```

2. Log in to the Cloud Control console as <gc_user> user, which is JANEMURRY in our example:

   TARGETS > DATABASE > ORADB > Related Links: Advisor Central

   Enter login and password for the <awr_admin> user.

3. Then to generate the AWR/ADDM report:

   ADDM > OK

User Requiring Access to SQL Access Advisor

1. On the DB Target host log in as sysdba and create a <sqlaccess_admin> user and grant the appropriate privileges:

   ```
   SQL> create user <sqlaccess_admin> identified by <password>;
   SQL> grant select any dictionary to <sqlaccess_admin>;
   SQL> grant create session to <sqlaccess_admin>;
   SQL> grant oem_advisor to <sqlaccess_admin>;
   ```

2. Log in to the Cloud Control console as <gc_user> user, which is JANEMURRY in our example:

   TARGETS > DATABASE > ORADB > Related Links: Advisor Central >SQL Access Advisor Enter login and password for <sqlaccess_admin> user.

3. To perform SQL Access tasks, complete steps in the wizard

User Requiring Access to SQL Tuning Advisor

1. On the DB Target host, log in as sysdba and create a <sqltune_admin> user and grant appropriate privileges:

   ```
   SQL> create user <sqltune_admin> identified by <password>; SQL> grant select any
   dictionary to <sqltune_admin>; SQL> grant create session to <sqltune_admin>; SQL>
   grant oem_advisor to <sqltune_admin>;
   ```

2. Log in to the Cloud Control console as <gc_user> user, which is JANEMURRY in our example:

   TARGETS > DATABASE > ORADB > Related Links: Advisor Central > SQL Tuning AdvisorEnter login and password for <sqltune_admin> user.

3. You may now perform SQL Tuning tasks. For example, click on TOP ACTIVITY > Run ASH reports.

C
Privileges

The following tables list available target privileges.

Table C-1 Target Privileges Applicable to All Targets

Display Name	Description	Included Privilges	Applicable Target types	Internal Name
Full any Target	Ability to do all operations on all the targets, including delete the target	Operator any Target		FULL_ANY_TARGET
Execute Command as any Agent	Execute any OS Command as the Agent User at any Agent		Agent	PERFORM_OPERATION_AS_ANY_AGENT
Put File as any Agent	Put any File to any Agent's Filesystem as the Agent User		Agent	PUT_FILE_AS_ANY_AGENT
Execute Command Anywhere	Execute any OS Command at any Agent		Host	PERFORM_OPERATION_ANYWHERE
Operator any Target	Ability to perform administrative operations on all managed targets	View any Target		OPERATOR_ANY_TARGET
Connect to any viewable target	Ability to connect and manage any of the viewable target			CONNECT_ANY_VIEW_TARGET
Use any beacon	Use any Beacon on any monitored host to monitor transactions, URLs, and network components. Beacon is installed with the Oracle Agent.			USE_ANY_BEACON
Monitor Enterprise Manager	Monitor Enterprise Manager performance			EM_MONITOR
View any Target	Ability to view any target	Monitor Enterprise Manager		VIEW_ANY_TARGET

Table C-1 (Cont.) Target Privileges Applicable to All Targets

Display Name	Description	Included Privilges	Applicable Target types	Internal Name
Create Privilege Propagating Group	Ability to create privilege propagating groups.Privileges granted on a privilege propagating group will be automatically granted on the members of the group	Add any Target		CREATE_PROPAGATING_GROUP
Add any Target	Add any target in Enterprise Manager			CREATE_TARGET

Table C-2 Target Privileges Applicable to Specific Targets

Display Name	Description	Internal Name	Included Privilges	Applicable Target types
Group Administration	Ability to administor groups	GROUP_ADMINISTRATION	Full Target on group members	Group
Full Target	Ability to do all operations on the target, including delete the target	FULL_TARGET	Connect Target, Operator Target	
Connect Target	Ability to connect to the target.	CONNECT_TARGET	Connect Target Read-only	
Connect Target Readonly	Ability to connect to the target in readonly mode	CONNECT_READONLY_TARGET		
Operator Target	Ability to do normal administrative operations on the target, such as configure a blackout and edit the target properties	OPERATOR_TARGET	Manage Template Collection Operations, Manage Target Patch, Manage Target Metrics, Manage Target Compliance, Manage Target Events, Configure Target, Blackout Target, Execute Command	
Manage Target Compliance	Ability to manage compliance of the target	MANAGE_TARGET_COMPLIANCE		
Execute Command as Agent	Execute any OS Command as the Agent User	PERFORM_OPERATION_AS_AGENT	Agent	

Table C-2 (Cont.) Target Privileges Applicable to Specific Targets

Display Name	Description	Internal Name	Included Privilges	Applicable Target types
Put File as Agent	Put any File to the Agent's Filesystem as the Agent User	PUT_FILE_AS_AGENT	Agent	
Execute Command	Execute any OS Command	PERFORM_OPERATION	Host	
Manage Target Events	Ability to clear events, re-evaluate metric alert events, create incidents, add events to incidents, and define what actions the administrator can perform on individual incidents, such as acknowledgment or escalation.	MANAGE_TARGET_ALERTS		
Configure target	Ability to edit target properties and modify monitoring configuration	CONFIGURE_TARGET		
Manage Target Patch	Privilege to Analyze, Apply and Rollback patches on the target	MANAGE_TARGET_PATCH	Blackout Target	
Manage Target Metrics	Ability to edit threshold for metric and policy setting, apply monitoring templates, and manage User Defined Metrics	MANAGE_TARGET_METRICS		
Manage Template Collection Operations	Ability to associate a template collection to a adminiministration group and Sync targets with the associated template collections.	MANAGE_TC_OPERATION		
Blackout Target	Ability to create, edit, schedule and stop a blackout on the target	BLACKOUT_TARGET		
View Target	Ability to view properties, inventory and monitor information about a target	VIEW_TARGET		

Table C-2 (Cont.) Target Privileges Applicable to Specific Targets

Display Name	Description	Internal Name	Included Privilges	Applicable Target types
View FA Target	Ability to view all Fusion Application Service targets	FA_VIEW_FASVC_TARGET		
Manage Events for Any Fusion Application Service Target	Ability to manage events for all Fusion Applications service targets	MANAGE_EVENT_ANY_FASVC_TGT		
View Logs for All Fusion Applications Service Targets	Ability to view logs for all Fusion Applications service targets	VIEW_ANY_FASVC_TARGET_LOG		

Resource Privileges: These privileges allow a user to perform operations against specific types of resources. The following table lists all available resource privileges.

Table C-3 Resource Privileges

Resource Type	Privilege Name	Description	Internal Name
Access	Access Enterprise Manager	Ability to access Enterprise Manager interfaces	ACCESS_EM
Application Performance Management	Real User Session Diagnostics	Gives ability to access real user session diagnostic capabilities in Business Applications	ACCESS_APM_SESSION_DIAG
Application Performance Management	Associate APM Entities to Business Application	Gives ability to associate Application Performance Management managed entities to a Business Application service target	ASSOCIATE_APM_ENTITIES
Application Performance Management	View Payload Content	Gives ability to view page/object or transaction/message payload content in Business Applications	VIEW_APM_PAYLOAD
Application Performance Management	Business Applications Menu Item	Shows Business Applications menu item in the Targets menu	VIEW_BA_MENU_ITEM
Application Replay Entities	Application Replay Viewer	View any Application Replay entity.	ASREPLAY_VIEWER
Application Replay Entities	Application Replay Operator	View, create, and edit any Application Replay entity.	ASREPLAY_OPERATOR
Backup Configurations	Create Backup Configuration	Ability to create a backup configuration.	CREATE_BACKUP_CONFIG
Backup Configurations	Edit Backup Configuration	Ability to edit a backup configuration.	EDIT_BACKUP_CONFIG

Table C-3 (Cont.) Resource Privileges

Resource Type	Privilege Name	Description	Internal Name
Backup Configurations	Full Access	Full access to a backup configuration.	FULL_BACKUP_CONFIG
Backup Configurations	Use Backup Configuration	Ability to use a backup configuration.	USE_BACKUP_CONFIG
Backup Status Report	Create Backup Status Report	Ability to create a backup status report.	CREATE_BACKUP_REPORT
Backup Status Report	Full Access	Full access to a backup report.	FULL_BACKUP_REPORT
Backup Status Report	View Backup Status Report	Ability to view a backup report.	VIEW_BACKUP_REPORT
Change Activity Plan	Basic Change Activity Plan Access	Basic Access privilege provides the ability to view and manage Change Activity Plans.	BASIC_CAP_ACCESS
Change Activity Plan	Create Change Activity Plan	Create privilege provides the ability to create, edit, delete and activate Change Activity Plans	CREATE_CAP_PLAN
Change Plan	View change plan	View a Change Manager Change Plan	VIEW_CHANGE_PLAN
Change Plan	Edit change plan	Edit a Change Manager Change Plan	EDIT_CHANGE_PLAN
Change Plan	Manage change plans	Create and delete Change Manager Change Plans	MANAGE_ANY_CHANGE_PLAN
Cloud Policy	Create any Policy	Ability to Create any Policy	CREATE_ANY_POLICY
Cloud Policy	View any Policy	Ability to View any Policy	VIEW_ANY_POLICY
Cloud Policy	View Policy	Ability to View a Policy	VIEW_POLICY
Cloud Policy	Modify Policy	Ability to Modify a Policy	MODIFY_POLICY
Cloud Policy	Full Policy	Privilege required to View, Modify, Delete a Policy	FULL_POLICY
Cloud Policy Group	Create Policy Group	Ability to Create Policy Group	CREATE_POLICY_GROUP
Cloud Policy Group	View any Policy Group	Ability to View any Policy Group	VIEW_ANY_POLICY_GROUP
Cloud Policy Group	View Policy Group	Ability to View a Policy Group	VIEW_POLICY_GROUP
Cloud Policy Group	Modify Policy Group	Ability to Modify a Policy Group	MODIFY_POLICY_GROUP
Cloud Policy Group	Full Policy Group	Privilege required to View, Modify, Delete a Policy Group	FULL_POLICY_GROUP
Compliance Framework	Create Compliance Entity	Ability to create compliance framework, standard, rules	CREATE_COMPLIANCE_ENTITY

Table C-3 (Cont.) Resource Privileges

Resource Type	Privilege Name	Description	Internal Name
Compliance Framework	Full any Compliance Entity	Ability to edit/delete compliance framework, standard, rules	FULL_ANY_COMPLIANCE_ENTITY
Compliance Framework	View any Compliance Framework	Ability to view compliance framework definition and results	VIEW_ANY_COMPLIANCE_FWK
Custom Configurations	Manage custom configurations owned by any user	Ability to create new and edit/delete Custom Configuration specification owned by any user	FULL_ANY_CCS
Custom Configurations	Manage custom configurations owned by the user	Ability to create new and edit/delete Custom Configuration specification owned by the user	FULL_OWNED_CCS
Dashboards	Create Services Dashboard		SVCD_CREATE_DASH
Dashboards	Edit Services Dashboard		SVCD_EDIT_DASH
Database Replay Entities	Database Replay Viewer	Ability to view any Database Replay entity.	VIEW_DBREPLAY_ENTITY
Database Replay Entities	Database Replay Operator	Ability to view, create, and edit any Database Replay entity.	OPERATE_DBREPLAY_ENTITY
Deployment Procedure	Create	Ability to create deployment procedures.	CREATE_DP
Deployment Procedure	Launch	Ability to perform launch and create like operations on a Deployment Procedure.	LAUNCH_DP
Deployment Procedure	Full	Ability to perform launch, create like, edit structure and delete operations on a Deployment Procedure.	FULL_DP
Deployment Procedure	Import	Ability to create deployment procedures and ability to import/ export customized deployment procedures.	IMPORT_DP
Deployment Procedure	Grant launch privilege	Ability to grant launch privilege on deployment procedures.	GRANT_LAUNCH_DP
Deployment Procedure	Grant full privilege	Ability to grant upto full privilege on deployment procedures.	GRANT_FULL_DP
Enterprise Manager High Availability	Enterprise Manager High Availability Administration	Gives access to manage Enterprise Manager High Availability	EMHA_ADMINISTRATION

Table C-3 (Cont.) Resource Privileges

Resource Type	Privilege Name	Description	Internal Name
Enterprise Manager Plug-in	Plug-in Agent Administrator	Gives access to manage Enterprise Manager plug-in on Agent	PLUGIN_AGENT_ADMINISTRATOR
Enterprise Manager Plug-in	Plug-in OMS Administrator	Gives access to manage Enterprise Manager plug-in on Management Server	PLUGIN_OMS_ADMINISTRATOR
Enterprise Manager Plug-in	Plug-in view privilege	Gives access to manage Enterprise Manager plug-in life cycle console	PLUGIN_VIEW
Fusion MiddleWare Offline Diagnostics	View object	Ability to view the offline diagnostics objects	VIEW_OBJECT
Fusion MiddleWare Offline Diagnostics	Create Object	Ability to manage the offline diagnostic object lifecycle	CREATE_OBJECT
JVM Diagnostics	JVM Diagnostics Administrator	Gives capability to manage all JVM Diagnostic Administrative operations	AD4J_ADMINISTRATOR
JVM Diagnostics	JVM Diagnostics User	Gives capability to view the JVM Diagnostic data	AD4J_USER
JVM Diagnostics	JVM Diagnostics View Locals Privilege	Gives capability to view the JVM Diagnostics frame locals data	JVMD_VIEW_LOCALS_PRIV
Job System	Create	Ability to submit jobs, create library jobs, create deployment procedure instance and create deployment procedure configuration.	CREATE_JOB
Job System	View	Ability to view, do create like on a job, launch deployment procedure configuration and view deployment procedure instance.	VIEW_JOB
Job System	Grant view privilege	Ability to grant view privilege on jobs.	GRANT_VIEW_JOB
Job System	Manage	Ability to perform various operations except edit and delete on job, library job, deployment procedure configuration and on deployment procedure instance.	MANAGE_JOB

Table C-3 (Cont.) Resource Privileges

Resource Type	Privilege Name	Description	Internal Name
Job System	Full	Ability to perform all the valid operations on job, library job, deployment procedure configuration and on deployment procedure instance.	FULL_JOB
Linux Patching	Setup Linux Patching	Ability to perform Linux Patching setup.	LINUX_PATCHING_SETUP
Metric Extensions	Create New Metric Extension	Create or import new metric extensions	CREATE_MEXT
Metric Extensions	Edit MEXT	Can edit or create the next version of a metric extension object, but cannot delete it	EDIT_MEXT
Metric Extensions	Full MEXT	Gives complete access to edit, and delete metric extension object	FULL_MEXT
Named Credentials	Edit Credential	User can update credential but cannot delete it.	EDIT_CREDENTIAL
Named Credentials	Full Credential	Full Credential	FULL_CREDENTIAL
Named Credentials	View Credential	View Credential	GET_CREDENTIAL
Named Credentials	Create new Named Credential	Ability to create new named credentials	CREATE_CREDENTIAL
OMS Configuration Property	View any OMS configuration property	Gives access to view any OMS configuration property	VIEW_ANY_OMS_PROPERTY
OMS Configuration Property	View / Edit any OMS configuration property	Gives access to view / edit any OMS configuration property	MANAGE_ANY_OMS_PROPERTY
Patch Plan	Create Patch Plan	Privilege for creating a Patching Plan object	CREATE_PATCH_PLAN
Patch Plan	Create Patch Plan Template	Privilege for creating a Patching Plan Template object	CREATE_PLAN_TEMPLATE
Patch Plan	View Patching Plan	Privilege to View a Patching Plan Object	VIEW_PATCH_PLAN
Patch Plan	Full Patch Plan	Privilege to view, modify, execute and delete a Patching plan object	FULL_PATCH_PLAN
Patch Plan	View any Patching Plan	Privilege to view any Patching plan object	VIEW_ANY_PATCH_PLAN
Patch Plan	View any Patching Plan Template	Privilege to view any Patching Plan Template object	VIEW_ANY_PLAN_TEMPLATE
Patch Plan	Manage privileges on a Patching Plan	Privilege to grant or revoke privileges on a Patching plan object	MANAGE_PRIV_PATCH_PLAN

Table C-3 (Cont.) Resource Privileges

Resource Type	Privilege Name	Description	Internal Name
Patch Plan	Full privileges on any Patching Plan	Privilege to view, modify, execute and delete any Patching plan object	FULL_ANY_PATCH_PLAN
Patch Plan	Manage privileges on any Patching Plan	Privilege to grant or revoke privileges on any Patching plan object	MANAGE_PRIV_ANY_PATCH_PLAN
Patch Plan	Privileges for Patch Setup	Privilege to grant privileges any Patching plan object	PATCH_SETUP
Patching Setup	Setup Offline Patching	Ability to perform Offline Patching setup.	SETUP_OFFLINE_PATCHING
Proxy Settings	Setup Proxy for connecting to Agents	Ability to set up a proxy server which can be used by your Oracle Management Server (OMS) to connect to Agents.	SETUP_PROXY_FOR_AGENTS
Proxy Settings	Setup Proxy for connecting to My Oracle Support	Ability to set up a proxy server which can be used by your Oracle Management Service (OMS) to connect to My Oracle Support.	SETUP_PROXY_FOR_MOS
Reports	Publish Report	Ability to publish reports for public viewing	PUBLISH_REPORT
Reports	View Report	Ability to view report definition and stored reports, generate on demand reports and do a create like	VIEW_REPORT
Request monitoring	Request Monitoring Administrator	Gives capability to manage all Request Monitoring Administrative Operations	BTM_ADMINISTRATOR
Request monitoring	Request Monitoring User	Gives capability to view the Request Monitoring Data	BTM_USER
Ruleset	Create Business Ruleset	Create Business Ruleset	CREATE_BUSINESS_RULESET
Ruleset	Edit Business Ruleset	Edit Business Ruleset	EDIT_BUSINESS_RULESET
Self Update	View any Enterprise Manager Update	Gives access to view any Enterprise Manager Update	VIEW_ANY_SELFUPDATE
Self Update	Self Update Administrator	Gives access to manage Enterprise Manager Update	SELFUPDATE_ADMINISTRATOR

Table C-3 (Cont.) Resource Privileges

Resource Type	Privilege Name	Description	Internal Name
Software Library Administration	Software Library Storage Administration	Ability to manage upload and reference file storage locations, import and export entities, and purge deleted entities	SWLIB_STORAGE_ADMIN
Software Library Entity	Create Any Software Library Entity	Ability to create any Software Library entity	SWLIB_CREATE_ANY_ENTITY
Software Library Entity	Edit Any Software Library Entity	Ability to edit any Software Library entity	SWLIB_EDIT_ANY_ENTITY
Software Library Entity	Edit an Software Library Entity	Ability to edit a Software Library entity	SWLIB_EDIT_ENTITY
Software Library Entity	Export Any Software Library Entity	Ability to view and export any Software Library entity to a Provisioning Archive (PAR) file	SWLIB_EXPORT
Software Library Entity	Grant Any Entity Privilege	Ability to grant view, edit and delete privilege on any Software Library entity. This privilege is required if the user granting the privilege on an entity is not a super administrator or owner of the entity.	SWLIB_GRANT_ANY_ENTITY_PRIV
Software Library Entity	Import Any Software Library Entity	Ability to import any Software Library entity from a Provisioning Archive (PAR) file	SWLIB_IMPORT
Software Library Entity	Manage Any Software Library Entity	Ability to create, view, edit and delete any Software Library entity	SWLIB_MANAGE_ANY_ENTITY
Software Library Entity	Manage Entity	Ability to view, edit and delete a Software Library entity	SWLIB_MANAGE_ENTITY
Software Library Entity	View Any Software Library Entity	Ability to view any Software Library entity	SWLIB_VIEW_ANY_ENTITY
Software Library Entity	View Software Library Entity	Ability to view a Software Library entity	SWLIB_VIEW_ENTITY
Software Library Entity	View any Oracle Load Testing Scenario Entity	Ability to view any Oracle Load Testing Scenario Entity	VIEW_ANY_SWLIB_OLT_SCE_ENTITY
Software Library Entity	View any User Defined Test Entity	Ability to view any User Defined Test Entity	VIEW_ANY_SWLIB_USERTEST_ENTITY
Software Library Entity	View any Template Entity	Ability to view any Template Entity	VIEW_ANY_SWLIB_TEMPLATE_ENTITY
Software Library Entity	View any Virtual Disk Entity	Ability to view any Virtual Disk Entity	VIEW_ANY_SWLIB_V_DISK_ENTITY
Software Library Entity	View any Assembly Entity	Ability to view any Assembly Entity	VIEW_ANY_SWLIB_ASSEMBLY_ENTITY

Table C-3 (Cont.) Resource Privileges

Resource Type	Privilege Name	Description	Internal Name
Software Library Entity	View any ISO Entity	Ability to view any ISO Entity	VIEW_ANY_SWLIB_ISO_ENTITY
System	Create Role and Manage System	Provides all the privileges to any target in the system	CREATE_ROLE MANAGE_SYSTEM_ROLES
Target Discovery Framework	Scan Network	Ability to create, edit and delete host discovery configuration	CAN_SCAN_NETWORK_PRIVILEGE
Target Discovery Framework	View Any Discovered Hosts	Ability to view any discovered hosts	VIEW_ANY_DISCOVERED_HOSTS
Target Discovery Framework	View Any Discovered Targets On Host	Ability to view any discovered targets on host	VIEW_ANY_DISC_TARGETS_ON_HOST
Template	View Template	Ability to view a template and apply it to any target on which you have Manage Target Metrics	VIEW_TEMPLATE

D
Audit Operations

To view a list of current audit operations, do one of the following:

- From the Enterprise Manager Security Console:
  1. In Enterprise Manager, select **Security**>**Security Console** from the **Setup** menu.
  2. Under Enterprise Manager Security, click **Comprehensive Auditing**.
  3. Select the Audit Operations tab.

     The list of audit operations appears.
- From the Enterprise Manager Command Line Interface (EM CLI), enter the following command:

  ```
  $ emcli show_operations_list
  ```

  The list of audit operations appears.

E

Configure TLSv1.2 for Communication with the Enterprise Manager Repository

By enabling the TLSv1.2 protocol for communication with the Enterprise Manager Repository, the Oracle Management Service communicates with the repository in a secured mode using TLS to encrypt communication traffic and allow the Enterprise Manager Repository to authenticate itself to the Oracle Management Service. Starting from Release Update 08, Enterprise Manager supports One-way or Two-way SSL configured database:

- One-way SSL: In one-way SSL, the client only validates the server certificate to ensure that it receives data from the intended server. i.e., no man in the middle attack.
- Two-way SSL: In two-way SSL, both client and server authenticate each other to ensure that both parties involved in the communication are trusted. Both parties share their public certificates to each other and then validation is performed.

To enable TLSv1.2 protocol for communication with the Enterprise Manager Repository, follow these steps:

> **Note:**
>
> PKCS12 is the only wallet format supported.

Step 1: Configure TLSv1.2 for the Enterprise Manager Repository

Because the Enterprise Manager Repository resides within an Oracle database, the best practices for configuring SSL on an Oracle database also apply to the Enterprise Manager Repository. Refer to the *Oracle Database Security Guide* to obtain detailed information on configuring SSL.

- For a sample configuration on an Advanced Networking Option - Version 11.2.0.1 and later and Oracle Net Services - Version 12.2.1.2.0 and later, refer to MOS Note **ID 1448841.1.** For more information see Configuring Transport Layer Security Authentication
- In the *sqlnet.ora* and the *listener.ora* file, ensure that the SSL_VERSION parameter is set to 1.2 for configuring TLSv1.2.
- In the *sqlnet.ora* file, ensure that the SSL_CLIENT_AUTHENTICATION parameter is set to FALSE.

> **Note:**
>
> The SSL_CLIENT_AUTHENTICATION parameter is set to FALSE for 1-way SSL configuration. For 2-way SSL configuration, the SSL_CLIENT_AUTHENTICATION parameter is set to TRUE.

- Update the `WALLET_LOCATION` in the *sqlnet.ora* and the *listener.ora* file:

```
WALLET_LOCATION = (SOURCE = (METHOD = FILE)(METHOD_DATA = (DIRECTORY =
C:\new135wallet\client\wallet)))
```

- Verify the configuration by making an SSL connection using the SQLPLUS and the TCPS connect descriptors before proceeding to the next step.

  To ensure that the connect descriptors are correct, you can test the connection by running the following command:

```
./sqlplus sysman/
<sysman_pwd>@"(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)
(HOST=<REPOS_HOST/SCAN_HOST>)(PORT=<TCPS_PORT>)))(CONNECT_DATA= (SID=<SID/
SERVICE>)))"
```

> **Note:**
>
> It is important to keep both TCP and TCPS listeners up until the Oracle Management Service connect descriptor is changed to use TCPS, as show in Step 2.

Step 2: Configure blackouts for Enterprise Manager Repository-related targets

In order to suppress alerts until the target configurations are complete, place all targets related to the Enterprise Manager Repository (oracle_database , oracle_emrep, oracle_oms ,and metadata_repository target types) under blackout.

Step 3: Configuring the Oracle Management Service to connect to the TLSv1.2-enabled Enterprise Manager Repository

Perform the following sequence of steps in a rolling manner—start with the *Primary Oracle Management Service* first and then proceed with the remaining Oracle Management Services.

1. Change the connect descriptor to use only TCPS.

   Obtain the existing connect descriptor using the command: `emctl config oms -list_repos_details`

   Execute the following using the changed TCPS protocol and port.

```
emctl config oms -store_repos_details -repos_conndesc <connect descriptor>
-repos_user <username>
      [-repos_pwd <pwd>] -repos_truststore <truststore file> [-
repos_truststore_pwd <pwd>]
      [-repos_truststore_type <type>] [-repos_keystore <keystore file>] [-
repos_keystore_pwd <pwd>]
      [-repos_keystore_type <type>]
```

   Depending on how the database is configured, with one-way SSL or two-way SSL, different commands need to be executed:

> **Note:**
>
> In the case of multi-OMS execute the above step on all other additional OMSs.

a. If the Database is configured with one-way SSL (`SSL_CLIENT_AUTHENTICATION=FALSE`), from the OMS host, run:

```
$MW_HOME/bin/emctl config oms -store_repos_details -repos_user sysman -
repos_pwd <sysman password> -repos_conndesc " <DB CONNECT STRING with
TCPS port> " -repos_truststore <truststore file path> -
repos_truststore_pwd <password> -repos_truststore_type PKCS12
```

Example:

```
$MW_HOME/bin/emctl config oms -store_repos_details -repos_user sysman -
repos_pwd password -repos_conndesc
"(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)
(HOST=myhost.us.example.com)(PORT=7777)))(CONNECT_DATA=(SID=orcln1)))" -
repos_truststore
/scratch/new135wallet/truststore/wallet/ewallet.p12 -
repos_truststore_pwd password -repos_truststore_type PKCS12
```

b. If the Database is configured with Two-way SSL (`SSL_CLIENT_AUTHENTICATION=TRUE`), from the OMS box, run:

```
$MW_HOME/bin/emctl config oms -store_repos_details -repos_user sysman -
repos_pwd <sysman password> -repos_conndesc " <DB CONNECT STRING with
TCPS port> " -repos_truststore <truststore file path> -
repos_truststore_pwd password -repos_truststore_type <truststore_type> -
repos_keystore <keystore file path> -repos_keystore_pwd password -
repos_keystore_type PKCS12
```

Example:

```
$MW_HOME/bin/emctl config oms -store_repos_details -repos_user sysman -
repos_pwd password repos_conndesc
"(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)
(HOST=myhost.us.example.com)(PORT=7777)))(CONNECT_DATA=(SID=orcln1)))" -
repos_truststore /scratch/new135wallet/truststore/wallet/ewallet.p12 -
repos_truststore_pwd password -repos_truststore_type PKCS12 -
repos_keystore /scratch/new135wallet/client/wallet/ewallet.p12 -
repos_keystore_pwd password -repos_keystore_type PKCS12
```

2. Change the Connect Descriptor of Services to use only TCPS, which only needs to be done once.

> **Note:**
>
> If the repository database is used as RAC and if the services are created for subsystems, then modify the connect descriptor to use the TCPS configuration. For more information regarding EM sizing guidelines, see Sizing Your EM Deployment.

If there are other services created for subsystems such as Ping, Events, Jobs and Loader, modify its connect descriptor to use the new TCPS configuration details.

Execute the following on the Primary Oracle Management Service first.

- For the Ping subsystem connect descriptor, execute the following command to see any value is set:

  ```
  emctl get property -name
  "oracle.sysman.core.omsAgentComm.ping.connectionService.connectDescripto
  r"
  ```

  If any value is already set, run the following command to set new a Connect Descriptor:

  ```
  emctl set property -name
  "oracle.sysman.core.omsAgentComm.ping.connectionService.connectDescripto
  r " -value "(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)
  (HOST=<REPOS_HOST/SCAN_HOST>)(PORT=<TCPS_PORT>)))
  (CONNECT_DATA=(SERVICE_NAME=ping)))"
  ```

- For the Event subsystem connect descriptor, execute the following command to see any value is set:

  ```
  emctl get property -name "oracle.sysman.core.events.connectDescriptor"
  ```

  If any value is already set, run the following command to set new a Connect Descriptor:

  ```
  emctl set property -name "oracle.sysman.core.events.connectDescriptor" -
  value "(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)
  (HOST=<REPOS_HOST/SCAN_HOST>)(PORT=<TCPS_PORT>)))
  (CONNECT_DATA=(SERVICE_NAME=event)))"
  ```

- For the Jobs subsystem connect descriptor, execute the following command to see any value is set:

  ```
  emctl get property -name "oracle.sysman.core.jobs.conn.service"
  ```

  If any value is already set, run the following command to set new a Connect Descriptor:

  ```
  emctl set property -name "oracle.sysman.core.jobs.conn.service" -value
  "(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)(HOST=<REPOS_HOST/
  SCAN_HOST>)(PORT=<TCPS_PORT>)))(CONNECT_DATA=(SERVICE_NAME=emjob)))"
  ```

- For the Loader subsystem connect descriptor, execute the following command to see any value is set:

  ```
  emctl get property -name
  "oracle.sysman.core.pbs.gcloader.connectDescriptor"
  ```

  If any value is already set, run the following command to set new a Connect Descriptor:

  ```
  emctl set property -name
  "oracle.sysman.core.pbs.gcloader.connectDescriptor" -value
  "(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)(HOST=<REPOS_HOST/
  SCAN_HOST>)(PORT=<TCPS_PORT>)))(CONNECT_DATA=(SERVICE_NAME=loader)))"
  ```

Once you executed the commands in Step 3 on the Primary Oracle Management Service, repeat them for all remaining Oracle Management Services .

Step 4: Bounce all Oracle Management Services

Execute the following on all Oracle Management Services, starting with the Primary Oracle Management Service:

```
emctl stop oms –all
```

Disable the TCP listener in the *listener.ora* file of Enterprise Manager Repository and bounce the listener again to enable only the TCPS connection.

Start the primary Oracle Management Service.

```
emctl start oms
```

> **Note:**
>
> If the Oracle Management Services do not start, you will need to do one of the following:
>
> Add “SQLNET.RECV_TIMEOUT=100000“ to the database `sqlnet.ora` file.
>
> **OR**
>
> Apply database patch 20544797 (preferred method).

It is required to set the SSL credentials in "Management Services and Repository" target. Next, set the SSL credentials for the "Management Services and Repository" target. Make sure that the Central Agent running on the Oracle Management Service host is version 13c Release 5 Update 8 (13.5.0.8) or later and then execute:

```
$MW_HOME/bin/emctl config emrep -set_ssl_creds
```

Once the Primary Oracle Management Service is up, start the remaining Oracle Management Services one at a time.

To confirm Oracle Management Service's Connect Descriptor has been changed to TCPS successfully, execute the below command:

```
emctl config oms -list_repos_details
```

Step 5: Reconfigure the Agents monitoring the Enterprise Manager Repository

Reconfigure the Agent that is monitoring the Repository Database target. If RAC is configured for the repository, you will need to reconfigure the Agents that monitor the Database instances of the RAC.

Execute the following commands to reconfigure the Agent(s) running on the repository database host:

- If the Repository Database is configured for 1-way SSL, execute:

```
AGENT_HOME/bin/emctl setproperty agent -name connectionTrustStoreLocation -
value <wallet_base>/truststore/wallet/ewallet.p12
AGENT_HOME/bin/emctl setproperty agent -name connectionTrustStorePassword -
value password
AGENT_HOME/bin/emctl setproperty agent -name connectionTrustStoreType -
value PKCS12
```

- If the Repository Database is configured for 2-way SSL, execute:

```
AGENT_HOME/bin/emctl setproperty agent -name connectionTrustStoreLocation -
value <wallet_base>/truststore/wallet/ewallet.p12
AGENT_HOME/bin/emctl setproperty agent -name connectionTrustStorePassword -
value password
AGENT_HOME/bin/emctl setproperty agent -name connectionTrustStoreType -
value PKCS12
AGENT_HOME/bin/emctl setproperty agent -name connectionKeyStoreLocation -
value <wallet_base>/client/wallet/ewallet.p12.
AGENT_HOME/bin/emctl setproperty agent -name connectionKeyStorePassword -
value password
AGENT_HOME/bin/emctl setproperty agent -name connectionKeyStoreType -value
PKCS12
```

Step 6: Reconfigure the targets referencing the Enterprise Manager Repository connection

Identify the targets referencing the repository connection in the target XML of the Primary Oracle Management Service central Agent monitoring the Enterprise Manager Repository. Also, identify the targets in target XML of the local physical host Agent if it is deployed on the Enterprise Manager Repository host.

Execute the following EMCLI command for each of the targets identified:

```
emcli modify_target -name="<Target Name>" -type="<target_type>" -
properties="<Property>:<Property Value>;<Property>:<Property Value>" -on_agent
```

> **Note:**
>
> Make sure you use the `target_name`, `target_type`, `property` and `property value` format gathered from the Agent's targets.xml file.

Examples:

```
emcli modify_target -name="database1.mycompany.com" -type="oracle_database" -
properties="Port:<TCPS_PORT>;Protocol:TCPS" -on_agent
```

```
emcli modify_target -name="/EMGC_GCDomain/GCDomain/EMGC_ADMINSERVER/mds-owsm"
-type="metadata_repository" -properties="JdbcUrl|
jdbc:oracle:thin:@(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)
(HOST=<REPOS_HOST/SCAN_HOST>)(PORT=<TCPS_PORT>)))
(CONNECT_DATA=(SID=<SID>)));DatabaseName|
@(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)(HOST=<REPOS_HOST/
SCAN_HOST>)(PORT=<TCPS_PORT>)))(CONNECT_DATA=(SID=<SID>)))" -on_agent -
subseparator=properties="|"
```

```
emcli modify_target -name="/EMGC_GCDomain/GCDomain/EMGC_ADMINSERVER/mds-
sysman_mds" -type="metadata_repository" -properties="JdbcUrl|
jdbc:oracle:thin:@(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)
(HOST=<REPOS_HOST/SCAN_HOST>)(PORT=<TCPS_PORT>)))
(CONNECT_DATA=(SID=<SID>)));DatabaseName|
@(DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCPS)(HOST=<REPOS_HOST/
SCAN_HOST>)(PORT=<TCPS_PORT>)))(CONNECT_DATA=(SID=<SID>)))" -on_agent -
subseparator=properties="|"
```

Step 7: End blackouts for Management Repository-related targets

Bring the Enterprise Manager Repository-related targets out of blackout and verify that the targets have *Target Up* status in Enterprise Manager Console.

F

Add a New Security Certificate

Enterprise Manager OMS Console, OMS Upload, and Agent can be secured with wildcard SSL and SAN certificates.

To learn how to add and configure security certificates, see:

EM 13c, 12c: How to Configure the Enterprise Manager Management Service (OMS) with Secure Socket Layer (SSL) Certificates (Doc ID 2202569.1)

EM 13c, 12c: How to Configure the Enterprise Manager Management Agent for Secure Socket Layer (SSL) Certificates (Doc ID 2213661.1)

The steps for using wildcard certificates, wallet creation, and securing OMS and Agents are all the same.

> **Note:**
>
> While securing OMS with wildcard certificates, ensure that all the Agents are using the latest version.
>
> When raising CSR, specify the wildcard character: `(*.<DOMAIN_NAME>)`.
>
> Agents below version 13.4 will not be able to communicate to 13.4 OMS secured with wildcard certificates.
>
> SAN certificates can be created using `orapki` command starting from Enterprise Manager 13.4.
>
> A wallet with SAN certificate can be created using *openssl* or other utilities, that can be used to secure OMS or Agent.
>
> Weblogic in EM setup cannot be secured with wildcard and SAN certificate.

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