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Administrative Access to Cisco ISE Using an External Identity Store

In Cisco ISE, you can authenticate administrators via an external identity store such as Active Directory, LDAP, or RSA SecureID. There are two models you can use to provide authentication via an external identity store:

- External Authentication and Authorization: There are no credentials that are specified in the local Cisco ISE database for the administrator, and authorization is based on external identity store group membership only. This model is used for Active Directory and LDAP authentication.

- External Authentication and Internal Authorization: The administrator's authentication credentials come from the external identity source, and authorization and administrator role assignment take place using the local Cisco ISE database. This model is used for RSA SecurID authentication. This method requires you to configure the same username in both the external identity store and the local Cisco ISE database.

During the authentication process, Cisco ISE is designed to "fall back" and attempt to perform authentication from the internal identity database, if communication with the external identity store has not been established or if it fails. In addition, whenever an administrator for whom you have set up external authentication launches a browser and initiates a login session, the administrator still has the option to request authentication via the Cisco ISE local database by choosing **Internal** from the **Identity Store** drop-down list in the login dialog box.

Administrators who belong to a Super Admin group, and are configured to authenticate and authorize using an external identity store, can also authenticate with the external identity store for Command Line Interface (CLI) access.

Note You can configure this method of providing external administrator authentication only via the Admin portal. Cisco ISE CLI does not feature these functions.

If your network does not already have one or more existing external identity stores, ensure that you have installed the necessary external identity stores and configured Cisco ISE to access those identity stores.

External Authentication and Authorization

By default, Cisco ISE provides internal administrator authentication. To set up external authentication, you must create a password policy for the external administrator accounts that you define in the external identity stores. You can then apply this policy to the external administrator groups that eventually become a part of the external administrator RBAC policy.

To configure external authentication, you must:

- Configure password-based authentication using an external identity store.
- Create an external administrator group.
- Configure menu access and data access permissions for the external administrator group.
- Create an RBAC policy for external administrator authentication.

In addition to providing authentication via an external identity store, your network may also require you to use a Common Access Card (CAC) authentication device.

Configure a Password-Based Authentication Using an External Identity Store

You must first configure password-based authentication for administrators who authenticate using an external identity store such as Active Directory or LDAP.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Admin Access** > **Authentication**.

Step 2 On the **Authentication Method** tab, click **Password Based** and choose one of the external identity sources you have already configured. For example, the Active Directory instance that you have created.

Step 3 Configure any other specific password policy settings that you want for administrators who authenticate using an external identity store.

Step 4 Click **Save**.

Create an External Administrator Group

You will need to create an external Active Directory or LDAP administrator group. This ensures that Cisco ISE uses the username that is defined in the external Active Directory or LDAP identity store to validate the administrator username and password that you entered upon login.

Cisco ISE imports the Active Directory or LDAP group information from the external resource and stores it as a dictionary attribute. You can then specify that attribute as one of the policy elements while configuring the RBAC policy for this external administrator authentication method.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Admin Access** > **Administrators** > **Admin Groups**.

The **External Groups Mapped** column displays the number of external groups that are mapped to internal RBAC roles. You can click the number corresponding to a admin role to view the external groups (for example, if you click 2 displayed against Super Admin, the names of two external groups are displayed).

Step 2 Click **Add**.

Step 3 Enter a name and optional description.

Step 4 Click **External**.

If you have connected and joined to an Active Directory domain, your Active Directory instance name appears in the **Name** field.

Step 5 From the **External Groups** drop-down list box, choose the Active Directory group that you want to map for this external administrator group.

Click the "+" sign to map additional Active Directory groups to this external administrator group.

Step 6 Click **Save**.

Create an Internal Read-Only Admin

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Admin Access** > **Administrators** > **Admin Users** .

Step 2 Click **Add** and select **Create An Admin User**.

Step 3 Check the **Read Only** check box to create a Read-Only administrator.

Map External Groups to the Read-Only Admin Group

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** to configure the external authentication source.

Step 2 Click the required external identity source, such as Active Directory or LDAP, and then retrieve the groups from the selected identity source.

Step 3 Choose **Administration** > **System** > **Admin Access** > **Authentication** to map the authentication method for the admin access with the identity source.

Step 4 Choose **Administration** > **System** > **Admin Access** > **Administrators** > **Admin Groups** and select **Read Only Admin** group.

Step 5 Check the **External** check box and select the required external groups for whom you intend to provide read-only privileges.

Step 6 Click **Save**.

An external group that is mapped to a Read-Only Admin group cannot be assigned to any other admin group.

Configure Menu Access and Data Access Permissions for External Administrator Group

You must configure menu access and data access permissions that can be assigned to the external administrator group.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Admin Access** > **Permissions**.

Step 2 Click one of the following:

- **Menu Access**: All administrators who belong to the external administrator group can be granted permission at the menu or submenu level. The menu access permission determines the menus or submenus that they can access.
- **Data Access**: All administrators who belong to the external administrator group can be granted permission at the data level. The data access permission determines the data that they can access.

Step 3 Specify menu access or data access permissions for the external administrator group.

Step 4 Click **Save**.

Create an RBAC Policy for External Administrator Authentication

You must configure a new RBAC policy to authenticate an administrator using an external identity store and to specify custom menu and data access permissions. This policy must have the external administrator group for authentication and the Cisco ISE menu and data access permissions to manage the external authentication and authorization.

Note You cannot modify an existing (system-preset) RBAC policy to specify these new external attributes. If you have an existing policy that you would like to use as a template, you must duplicate that policy, rename it, and then assign the new attributes.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Admin Access** > **Authorization** > **RBAC Policy**.

Step 2 Specify the rule name, external administrator group, and permissions.

Remember that the appropriate external administrator group must be assigned to the correct administrator user IDs. Ensure that the administrator is associated with the correct external administrator group.

Step 3 Click **Save**.

If you log in as an administrator, and the Cisco ISE RBAC policy is not able to authenticate your administrator identity, Cisco ISE displays an "unauthenticated" message, and you cannot access the Admin portal.

Configure Admin Access Using an External Identity Store for Authentication with Internal Authorization

This method requires you to configure the same username in both the external identity store and the local Cisco ISE database. When you configure Cisco ISE to provide administrator authentication using an external RSA SecurID identity store, administrator credential authentication is performed by the RSA identity store. However, authorization (policy application) is still done according to the Cisco ISE internal database. In addition, there are two important factors to remember that are different from external authentication and authorization:

- You do not need to specify any particular external administrator groups for the administrator.
- You must configure the same username in both the external identity store and the local Cisco ISE database.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Admin Access** > **Administrators** > **Admin Users**.

Step 2 Ensure that the administrator username in the external RSA identity store is also present in Cisco ISE. Ensure that you click the **External** option under Password.

Note You do not need to specify a password for this external administrator user ID, nor are you required to apply any specially configured external administrator group to the associated RBAC policy.

Step 3 Click **Save**.

External Authentication Process Flow

When the administrator logs in, the login session passes through the following steps in the process:

1. The administrator sends an RSA SecurID challenge.
2. RSA SecurID returns a challenge response.
3. The administrator enters a user name and the RSA SecurID challenge response in the Cisco ISE login dialog, as if entering the user ID and password.

4. The administrator ensures that the specified Identity Store is the external RSA SecurID resource.
5. The administrator clicks **Login**.

Upon logging in, the administrator sees only the menu and data access items that are specified in the RBAC policy.

External Identity Sources

These windows enable you to configure and manage external identity sources that contain user data that Cisco ISE uses for authentication and authorization.

LDAP Identity Source Settings

The following table describes the fields on the LDAP Identity Sources window, which you can use to create an LDAP instance and connect to it. To view this window, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **LDAP**.

LDAP General Settings

The following table describes the fields in the **General** tab.

Table 1: LDAP General Settings

Field Name	Usage Guidelines
Name	Enter a name for the LDAP instance. This value is used in searches to obtain the subject DN and attributes. The value is of type string and the maximum length is 64 characters.
Description	Enter a description for the LDAP instance. This value is of type string, and has a maximum length of 1024 characters.
Schema	You can choose any one of the following built-in schema types or create a custom schema: • Active Directory • Sun Directory Server • Novell eDirectory You can click the arrow next to Schema to view the schema details. If you edit the attributes of the predefined schema, Cisco ISE automatically creates a Custom schema.
Note The following fields can be edited only when you choose the Custom schema.	
Subject Objectclass	Enter a value to be used in searches to obtain the subject DN and attributes. The value is of type string and the maximum length is 256 characters.

Field Name	Usage Guidelines
Subject Name Attribute	Enter the name of the attribute containing the username in the request. The value is of type string and the maximum length is 256 characters. **Note** The subject name attributes that are configured should be an indexed one in the external ID store.
Group Name Attribute	• CN: To retrieve the LDAP Identity Store Groups based on Common Name. • DN: To retrieve the LDAP Identity Store Groups based on Distinguished Name.
Certificate Attribute	Enter the attribute that contains the certificate definitions. For certificate-based authentication, these definitions are used to validate certificates that are presented by clients.
Group Objectclass	Enter a value to be used in searches to specify the objects that are recognized as groups. The value is of type string and the maximum length is 256 characters.
Group Map Attribute	Specifies the attribute that contains the mapping information. This attribute can be a user or group attribute based on the reference direction that is chosen.
Subject Objects Contain Reference To Groups	Click this option if the subject objects contain an attribute that specifies the group to which they belong.
Group Objects Contain Reference To Subjects	Click this option if the group objects contain an attribute that specifies the subject. This value is the default value.
Subjects in Groups Are Stored in Member Attribute As	(Only available when you enable the **Group Objects Contain Reference To Subjects** option) Specifies how members are sourced in the group member attribute and defaults to the DN.
User Info Attributes	By default, predefined attributes are used to collect user information (such as, first name, last name, email, telephone, locality, and so on) for the following built-in schema types: • Active Directory • Sun Directory Server • Novell eDirectory If you edit the attributes of the predefined schema, Cisco ISE automatically creates a Custom schema. You can also select the Custom option from the Schema drop-down list to edit the user information attributes based on your requirements.

Note The subject name attributes that are configured should be an indexed one in the external ID store.

LDAP Connection Settings

The following table describes the fields in the **Connection Settings** tab.

Table 2: LDAP Connection Settings

Field Name	Usage Guidelines
Enable Secondary Server	Check this option to enable the secondary LDAP server to be used as a backup if the primary LDAP server fails. If you check this check box, you must enter configuration parameters for the secondary LDAP server.
Primary and Secondary Servers	
Hostname/IP	Enter the IP address or DNS name of the machine that is running the LDAP software. The hostname can contain from 1 to 256 characters or a valid IP address expressed as a string. The only valid characters for hostnames are alphanumeric characters (a to z, A to Z, 0 to 9), the dot (.), and the hyphen (-).
Port	Enter the TCP/IP port number on which the LDAP server is listening. Valid values are from 1 to 65,535. The default is 389, as stated in the LDAP specification. If you do not know the port number, you can find this information from the LDAP server administrator.
Specify server for each ISE node	Check this check box to configure primary and secondary LDAP server hostnames/IP and their ports for each PSN. When this option is enabled, a table listing all the nodes in the deployment is displayed. You need to select the node and configure the primary and secondary LDAP server hostname/IP and their ports for the selected node.
Access	**Anonymous Access**: Click to ensure that searches on the LDAP directory occur anonymously. The server does not distinguish who the client is and will allow the client read access to any data that is configured as accessible to any unauthenticated client. In the absence of a specific policy permitting authentication information to be sent to a server, a client should use an anonymous connection. **Authenticated Access**: Click to ensure that searches on the LDAP directory occur with administrative credentials. If so, enter information for the Admin DN and Password fields.
Admin DN	Enter the DN of the administrator. The Admin DN is the LDAP account that has permission to search all required users under the User Directory Subtree and to search groups. If the administrator specified does not have permission to see the group name attribute in searches, group mapping fails for users who are authenticated by that LDAP server.
Password	Enter the LDAP administrator account password.
Secure Authentication	Click to use SSL to encrypt communication between Cisco ISE and the primary LDAP server. Verify that the Port field contains the port number used for SSL on the LDAP server. If you enable this option, you must choose a root CA.
LDAP Server Root CA	Choose a trusted root certificate authority from the drop-down list to enable secure authentication with a certificate.

Field Name	Usage Guidelines
Server Timeout	Enter the number of seconds that Cisco ISE waits for a response from the primary LDAP server before determining that the connection or authentication with that server has failed. Valid values are 1 to 99. The default is 10.
Max. Admin Connections	Enter the maximum number of concurrent connections (greater than 0) with LDAP administrator account permissions that can run for a specific LDAP configuration. These connections are used to search the directory for users and groups under the User Directory Subtree and the Group Directory Subtree. Valid values are 1 to 99. The default is 20.
Force reconnect every N seconds	Check this check box and enter the desired value in the **Seconds** field to force the server to renew LDAP connection at the specified time interval. The valid range is from 1 to 60 minutes.
Test Bind to Server	Click to test and ensure that the LDAP server details and credentials can successfully bind. If the test fails, edit your LDAP server details and retest.
Failover	
Always Access Primary Server First	Click this option if you want Cisco ISE to always access the primary LDAP server first for authentications and authorizations.
Failback to Primary Server After	If the primary LDAP server that Cisco ISE attempts to contact cannot be reached, Cisco ISE attempts to contact the secondary LDAP server. If you want Cisco ISE to use the primary LDAP server again, click this option and enter a value in the text box.

LDAP Directory Organization Settings

The following table describes the fields in the **Directory Organization** tab.

Table 3: LDAP Directory Organization Settings

Field Name	Usage Guidelines
Subject Search Base	Enter the DN for the subtree that contains all subjects. For example: o=corporation.com If the tree containing subjects is the base DN, enter: o=corporation.com or dc=corporation,dc=com as applicable to your LDAP configuration. For more information, refer to your LDAP database documentation.

Field Name	Usage Guidelines
Group Search Base	Enter the DN for the subtree that contains all groups. For example: ou=organizational unit, ou=next organizational unit, o=corporation.com If the tree containing groups is the base DN, type: o=corporation.com or dc=corporation,dc=com as applicable to your LDAP configuration. For more information, refer to your LDAP database documentation.
Search for MAC Address in Format	Enter a MAC Address format for Cisco ISE to use for search in the LDAP database. MAC addresses in internal identity sources are sourced in the format xx-xx-xx-xx-xx-xx. MAC addresses in LDAP databases can be sourced in different formats. However, when Cisco ISE receives a host lookup request, Cisco ISE converts the MAC address from the internal format to the format that is specified in this field. Use the drop-down list to enable searching for MAC addresses in a specific format, where <*format*> can be any one of the following: • xxxx.xxxx.xxxx • xxxxxxxxxxxx • xx-xx-xx-xx-xx-xx • xx:xx:xx:xx:xx:xx The format you choose must match the format of the MAC address sourced in the LDAP server.
Strip Start of Subject Name Up To the Last Occurrence of the Separator	Enter the appropriate text to remove domain prefixes from usernames. If Cisco ISE finds the delimiter character that is specified in this field in the username, it strips all characters from the beginning of the username through the delimiter character. If the username contains more than one of the characters that are specified in the <start_string> box, Cisco ISE strips characters through the last occurrence of the delimiter character. For example, if the delimiter character is the backslash (\) and the username is DOMAIN\user1, Cisco ISE submits user1 to an LDAP server. **Note** The <start_string> cannot contain the following special characters: the pound sign (#), the question mark (?), the quotation mark (“), the asterisk (*), the right angle bracket (>), and the left angle bracket (<). Cisco ISE does not allow these characters in usernames.

Field Name	Usage Guidelines
Strip End of Subject Name from the First Occurrence of the Separator	Enter the appropriate text to remove domain suffixes from usernames. If Cisco ISE finds the delimiter character that is specified in this field in the username, it strips all characters from the delimiter character through the end of the username. If the username contains more than one of the characters that are specified in this field, Cisco ISE strips characters starting with the first occurrence of the delimiter character. For example, if the delimiter character is @ and the username is *user1@domain*, then Cisco ISE submits *user1* to the LDAP server. **Note** The <*end_string*> box cannot contain the following special characters: the pound sign (#), the question mark (?), the quotation mark ("), the asterisk (*), the right angle bracket (>), and the left angle bracket (<). Cisco ISE does not allow these characters in usernames.

LDAP Group Settings

Table 4: LDAP Group Settings

Field Name	Usage Guidelines
Add	Choose **Add > Add Group** to add a new group or choose **Add > Select Groups From Directory** to select the groups from the LDAP directory. If you choose to add a group, enter a name for the new group. If you are selecting from the directory, enter the filter criteria, and click **Retrieve Groups**. Check the check boxes next to the groups that you want to select and click **OK**. The groups that you have selected will appear in the **Groups** window.

LDAP Attribute Settings

Table 5: LDAP Attribute Settings

Field Name	Usage Guidelines
Add	Choose **Add > Add Attribute** to add a new attribute or choose **Add > Select Attributes From Directory** to select attributes from the LDAP server. If you choose to add an attribute, enter a name for the new attribute. If you are selecting from the directory, enter the username and click **Retrieve Attributes** to retrieve the attributes. Check the check boxes next to the attributes that you want to select, and then click OK.

LDAP Advanced Settings

The following table describes the field in the Advanced Settings tab.

Table 6: LDAP Advanced Settings

Field Name	Usage Guidelines
Enable Password Change	Check this check box to enable the user to change the password in case of password expiry or password reset while using PAP protocol for device admin and RADIUS EAP-GTC protocol for network access. User authentication fails for the unsupported protocols. This option also enables the user to change the password on their next login.

Related Topics

LDAP Directory Service, on page 126
LDAP User Authentication, on page 128
LDAP User Lookup, on page 131
Add LDAP Identity Sources, on page 131

RADIUS Token Identity Sources Settings

The following table describes the fields on the RADIUS Token Identity Sources window, which you can use to configure and connect to an external RADIUS identity source. To view this window, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **RADIUS Token**.

Table 7: RADIUS Token Identity Source Settings

Field Name	Usage Guidelines
Name	Enter a name for the RADIUS token server. The maximum number of characters allowed is 64.
Description	Enter a description for the RADIUS token server. The maximum number of characters is 1024.
SafeWord Server	Check this check box if your RADIUS identity source is a SafeWord server.
Enable Secondary Server	Check this check box to enable the secondary RADIUS token server for Cisco ISE to use as a backup in case the primary fails. If you check this check box, you must configure a secondary RADIUS token server.
Always Access Primary Server First	Click this option if you want Cisco ISE to always access the primary server first.
Fallback to Primary Server after	Click this option to specify the amount of time in minutes that Cisco ISE can authenticate using the secondary RADIUS token server if the primary server cannot be reached. After this time elapses, Cisco ISE reattempts to authenticate against the primary server.
Primary Server	
Host IP	Enter the IP address of the primary RADIUS token server. This field can take as input a valid IP address that is expressed as a string. Valid characters that are allowed in this field are numbers and dot (.).

Field Name	Usage Guidelines
Shared Secret	Enter the shared secret that is configured on the primary RADIUS token server for this connection.
Authentication Port	Enter the port number on which the primary RADIUS token server is listening.
Server Timeout	Specify the time in seconds that Cisco ISE should wait for a response from the primary RADIUS token server before it determines that the primary server is down.
Connection Attempts	Specify the number of attempts that Cisco ISE should make to reconnect to the primary server before moving on to the secondary server (if defined) or dropping the request if a secondary server is not defined.
Secondary Server	
Host IP	Enter the IP address of the secondary RADIUS token server. This field can take as input a valid IP address that is expressed as a string. Valid characters that are allowed in this field are numbers and dot (.).
Shared Secret	Enter the shared secret configured on the secondary RADIUS token server for this connection.
Authentication Port	Enter the port number on which the secondary RADIUS token server is listening. Valid values are from 1 to 65,535. The default is 1812.
Server Timeout	Specify the time in seconds that Cisco ISE should wait for a response from the secondary RADIUS token server before it determines that the secondary server is down.
Connection Attempts	Specify the number of attempts that Cisco ISE should make to reconnect to the secondary server before dropping the request.

Related Topics

RADIUS Token Identity Sources, on page 148
Add a RADIUS Token Server, on page 152

RSA SecurID Identity Source Settings

The following table describes the fields on the RSA SecurID Identity Sources window, which you can use to create and connect to an RSA SecurID identity source. To view this window, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **RSA SecurID**.

RSA Prompt Settings

The following table describes the fields in the **RSA Prompts** tab.

Table 8: RSA Prompt Settings

Field Name	Usage Guidelines
Enter Passcode Prompt	Enter a text string to obtain the passcode.
Enter Next Token Code	Enter a text string to request the next token.
Choose PIN Type	Enter a text string to request the PIN type.
Accept System PIN	Enter a text string to accept the system-generated PIN.
Enter Alphanumeric PIN	Enter a text string to request an alphanumeric PIN.
Enter Numeric PIN	Enter a text string to request a numeric PIN.
Re-enter PIN	Enter a text string to request the user to re-enter the PIN.

RSA Message Settings

The following table describes the fields in the **RSA Messages** tab.

Table 9: RSA Messages Settings

Field Name	Usage Guidelines
Display System PIN Message	Enter a text string to label the system PIN message.
Display System PIN Reminder	Enter a text string to inform the user to remember the new PIN.
Must Enter Numeric Error	Enter a message that instructs users to enter only numbers for the PIN.
Must Enter Alpha Error	Enter a message that instructs users to enter only alphanumeric characters for PINs.
PIN Accepted Message	Enter a message that the users see when their PIN is accepted by the system.
PIN Rejected Message	Enter a message that the users see when the system rejects their PIN.
User Pins Differ Error	Enter a message that the users see when they enter an incorrect PIN.
System PIN Accepted Message	Enter a message that the users see when the system accepts their PIN.
Bad Password Length Error	Enter a message that the users see when the PIN that they specify does not fall within the range specified in the PIN length policy.

Related Topics

RSA Identity Sources, on page 154
Cisco ISE and RSA SecurID Server Integration, on page 155
Add RSA Identity Sources, on page 157

Cisco ISE Users

In this topic, the term *user* refers to employees and contractors who access a network regularly, as well as to sponsor users and guest users. A sponsor user is an employee or contractor of an organization who creates and manages guest user accounts through the sponsor portal. A guest user is an external visitor who needs access to an organization's network resources for a limited period of time.

You must create an account for all the users to gain access to resources and services on the Cisco ISE network. Employees, contractors, and sponsor users should be created from the Admin portal.

You can choose to add the **Date Enabled** column (**Settings** > **Columns** > **Date Enabled**) and the **Days Until Password Expires** column (**Settings** > **Columns** > **Days Until Password Expires**) to the **Network Access User** table in the **Network Access Users** window (**Administration** > **Identity Management** > **Identities** > **Users**) to help you sort network access users by using their password expiry information. The **Date Enabled** and **Days Until Password Expires** fields are not added by default. You can add them to the **Network Access User** table using the customization option in the window.

From Cisco ISE Release 3.3, you can add the **Date Created** column (**Settings** > **Columns** > **Date Created**) and **Date Modified** column (**Settings** > **Columns** > **Date Modified**) to the **Network Access User** table to help you sort network access users using this information in the **Network Access Users** window (**Administration** > **Identity Management** > **Identities** > **Users**). The **Date Created** column shows you when a user was created, and the **Date Modified** column shows you when the details of the user were last modified. These fields are not added by default. You can add them to the **Network Access User** table using the customization option in the **Network Access Users** window. These columns can also be sorted in ascending and descending order.

Note When you upgrade to Cisco ISE Release 3.3, the **Date Created** and **Date Modified** fields are marked as **Not Applicable (N/A)**. Hence, the exported CSV file will have blank cells in the **Date Created** and **Date Modified** columns for these users. When the details of these users are modified, the **Date Modified** field will be updated to display the date of modification.

We recommend that the passwords of internal users (Network Access users and Admin users) have at least eight characters.

User Identity

User identity is like a container that holds information about a user and forms their network access credentials. Each user's identity is defined by data and includes: a username, e-mail address, password, account description, associated administrative group, user group, and role.

User Groups

User groups are a collection of individual users who share a common set of privileges that allow them to access a specific set of Cisco ISE services and functions.

User Identity Groups

A user's group identity is composed of elements that identify and describe a specific group of users that belong to the same group. A group name is a description of the functional role that the members of this group have. A group is a listing of the users that belong to this group.

Default User Identity Groups

Cisco ISE comes with the following predefined user identity groups:

- All_Accounts
- Employee
- Group_Accounts
- GuestType_Contractor
- GuestType_Daily
- GuestType_SocialLogin
- GuestType_Weekly
- Own_Accounts

User Role

A user role is a set of permissions that determine what tasks a user can perform and what services they can access on the Cisco ISE network. A user role is associated with a user group. For example, a network access user.

User Account Custom Attributes

Cisco ISE allows you to restrict network access based on user attributes for both network access users and administrators. Cisco ISE comes with a set of predefined user attributes and also allows you to create custom attributes. Both types of attributes can be used in conditions that define the authentication policy. You can also define a password policy for user accounts so that passwords meet specified criteria.

Custom User Attributes

You can configure more user-account attributes on the **User Custom Attributes** window (**Administration > Identity Management > Settings > User Custom Attributes**). You can also view the list of predefined user attributes in this window. You cannot edit the predefined user attributes.

Enter the required details in the **User Custom Attributes** pane to add a new custom attribute. The custom attributes and the default values that you add on the **User Custom Attributes** window are displayed while adding or editing a Network Access user (**Administration > Identity Management > Identities > Users >**

Add/Edit) or Admin user (**Administration > System > Admin Access > Administrators > Admin Users > Add/Edit**). You can change the default values while adding or editing a Network Access or Admin user.

You can select the following data types for the custom attributes on the **User Custom Attributes** window:

- String: You can specify the maximum string length (maximum allowed length for a string attribute value).
- Integer: You can configure the minimum and maximum value (specifies the lowest and the highest acceptable integer value).
- Enum: You can specify the following values for each parameter:
  - Internal value
  - Display value

  You can also specify the default parameter. The values that you add in the Display field are displayed while adding or editing a Network Access or Admin user.
- Float
- Password: You can specify the maximum string length.
- Long: You can configure the minimum and maximum value.
- IP: You can specify a default IPv4 or IPv6 address.
- Boolean: You can set either True or False as the default value.
- Date: You can select a date from the calendar and set it as the default value. The date is displayed in yyyy-mm-dd format.

Check the **Mandatory** check box if you want to make an attribute mandatory while adding or editing a Network Access or Admin user. You can also set default values for the custom attributes.

The custom attributes can be used in the authentication policies. The data type and the allowable range that you set for the custom attributes are applied to the custom attribute values in the policy conditions.

Remember Some characters are considered invalid for Attribute Names and Attribute Values. Using the following characters for Attribute Names and Attribute Values is restricted.

- Attribute Value: @, =, +, or - (do not use these characters at the beginning of an attribute name or value)
- Attribute Name: ^, =, , \, ", `, |, : (do not use these characters anywhere in the string)

User Authentication Settings

Not all external identity stores allow network access users to change their passwords. See the section for each identity source for more information.

Network-use password rules should be configured in **Administration** > **Identity Management** > **Settings** > **User Authentication Settings**.

The following section has additional information about some of the fields in the **Password Policy** tab.

- **Required Characters**: If you configure a user-password policy that requires upper or lowercase characters, and the user's language does not support these characters, the user cannot set a password. To support UTF-8 characters, uncheck the following check boxes:
  - **Lowercase Alphabetic Characters**
  - **Uppercase Alphabetic Characters**
- **Password Change Delta**: Specifies the minimum number of characters that must change when changing the current password to a new password. From Cisco ISE 3.2, the passowrd range has changed to 1-20. Cisco ISE does not consider changing the position of a character as a change. For Example, if the password delta is 3, and the current password is "?Aa1234?", then "?Aa1567?" ("5","6" and "7" are the three new characters) is a valid new password. "?Aa1562?" fails, because "?","2", and "?" characters are in the current password. "Aa1234??" fails, because even though the character positions changed, the same characters are in the current password.

  Password change delta also considers the previous X passwords, where X is the value of **Password must be different from the previous versions**. If your password delta is 3, and your password history is 2, then you must change the four characters that are not a part of the past two passwords.
- **Dictionary words**: Check this check box to restrict the use of any dictionary word, its characters in reverse order, or its letters replaced with other characters.

  Substitution of "$" for "s", "@" for "a", "0" for "o", "1" for "l", "!" for "i", "3" for "e", is not permitted. For example, "Pa$$w0rd".
  - **Default Dictionary**: Choose this option to use the default Linux dictionary in Cisco ISE. The default dictionary contains approximately 480,000 English words.
  - **Custom Dictionary**: Choose this option to use your customized dictionary. Click **Choose File** to select a custom dictionary file. The text file must be of newline-delimited words, .dic extension, and size less than 20 MB.
- You can use the **Password Lifetime** section to update the password reset interval and reminder. To set the lifetime of a password, check the **Change password every __ days (valid range 1 to 3650)** check box, and enter the number of days in the input field. A user account can be disabled if a user does not change the password in the specified time by selecting the **Disable User Account** option. Choose the **Require password change on next login** to prompt the user to change their password the next time they login to Cisco ISE.

  To send a reminder email for password reset, check the **Display Reminder __ Days Prior to Password Expiration** check box and enter the number of days before which a reminder email should be sent to the email address configured for the network access user. While creating a network access user, you can add the email address in the **Administration > Identity Management > Identities > Users > Add Network Access User** window to send an email notification for password reset.

Note

- The reminder email is sent from the following email address: iseadminportal@<ISE-Primary-FQDN>. You must explicitly permit access for this sender.
- By default, the reminder email has the following content: Your network access password will expire on <*password expiry date and time*>. Please contact your system administrator for assistance.

  From Cisco ISE Release 3.2, you can customize the email content after the *Please contact your system administrator for assistance* portion of the email notification.
- From Cisco ISE Release 3.2, if the **Change Password** check box is not checked under the **Password Lifetime** field (**Administration** > **Identity Management** > **Settings** > **User Authentication Settings** > **Password Policy** > **Password Lifetime**), the **Password Lifetime** field is not displayed for this user in the **Network Access Users** window.

- **Lock/Suspend Account with Incorrect Login Attempts**: Use this option to suspend or lock an account if the login attempt failed for the specified number of times. The valid range is from 3 to 20.
- **Account Disable Policy**: Configure the rules about when to disable an existing user account. See Disable User Accounts Globally for more information.

Related Topics

User Account Custom Attributes, on page 17
To Add Users, on page 20

Generate Automatic Password for Users and Administrators

You can use the **Generate Password** option on the user and administrator creation window to generate instant password adhering to Cisco ISE password policies. This helps the users or administrators to use the password generated by Cisco ISE than spending time in thinking of a safe password to be configured.

The **Generate Password** option is available in the following windows:

- **Administration > Identity Management > Identities > Users**.
- **Administration > System > Admin Access > Administrators > Admin Users**.
- **Settings > Account Settings > Change Password**.

Internal User Operations

To Add Users

Cisco ISE allows you to view, create, modify, duplicate, delete, change the status, import, export, or search for attributes of Cisco ISE users.

If you are using a Cisco ISE internal database, you must create an account for any new user who needs access to the resources or services on a Cisco ISE network.

Step 1 Choose **Administration** > **Identity Management** > **Identities** > **Users**.

You can also create users by accessing the **Work Centers** > **Device Administration** > **Identities** > **Users** window.

Step 2 Click **Add (+)** to create a new user.

Step 3 Enter values in all the fields the fields**.**

Note Do not include !, %, :, ;, [, {, |, },], `, ?, =, <, >, \ and control characters in the username. Username with only spaces is also not allowed. If you use the Cisco ISE Internal Certificate Authority (CA) for BYOD, the username that you provide here is used as the Common Name for the endpoint certificate. Cisco ISE Internal CA does not support "+" or "*" characters in the Common Name field.

From Cisco ISE Release 3.2, as an internal user of Cisco ISE, you can:

a. Add an alias to your account name in the **Account Name Alias** field. Your account name alias will be used to email notifications about password expiration. If multiple internal users use the same email address, adding an alias helps you differentiate who the email recipient must be. The content of this notification email can be edited in the **User Authentication Settings** window (**Administration** > **Identity Management** > **Settings** > **User Authentication Settings**).

b. Enter the lifetime of the Login and Enable passwords of a user by using the **Password Lifetime** field.

- Click the **With Expiration** radio button to set a password with a defined lifetime. The number of days remaining till password expiry is displayed below this field.

  To prevent automatic disablement of the account after password expiration, change the **Password Lifetime** configuration in the **User Authentication Settings** window. This also applies to the *Enable* password unless it is explicitly set as **Never Expires** in the **User Authentication Settings** window (**Administration** > **Identity Management** > **Settings** > **User Authentication Settings**).

- Click the **Never Expires** radio button to prevent the Login and Enable passwords of a user from expiring. This overrides the global password settings, and the user account will not be disabled. This field does not apply to Cisco ISE admin users.

  Note
  - The **Password Lifetime** field is not available to Cisco ISE admin users who are also admins. A green check mark symbol can be seen against the Cisco ISE user who is also an admin in the **Network Access User** table.
  - The **Password Lifetime** field is only accessible when **Internal Users** is chosen as the **Password Type**.
  - If the **Change Password** check box is left unchecked under the **Password Lifetime** field (**Administration** > **Identity Management** > **Settings** > **User Authentication Settings** > **Password Policy** > **Password Lifetime**), the **Password Lifetime** option is not shown in the **Passwords** section of the **Network Access Users** window.

Step 4 Click **Submit** to create a new user in the Cisco ISE internal database.

Export Cisco ISE User Data

You can export user data from the Cisco ISE internal database. Cisco ISE allows you to export user data in the form of a password-protected CSV file.

Step 1 Choose **Administration** > **Identity Management** > **Identities** > **Users**.

Step 2 Check the check box that corresponds to the user(s) whose data you want to export.

Step 3 Click **Export Selected**.

Step 4 In the **Key** field, enter a key for encrypting the password.

Step 5 Click **Start Export** to create a users.csv file.

Step 6 Click **OK** to export the users.csv file.

When you upgrade to Cisco ISE Release 3.3, the **Date Created** and **Date Modified** fields are marked as **Not Applicable (N/A)**. Hence, the exported CSV file will have blank cells in the **Date Created** and **Date Modified** columns for these users.

Import Cisco ISE Internal Users

You can import new user data into Cisco ISE with a CSV file, to create new internal accounts. A template CSV file is available for download while you import user accounts. Sponsors can import users in the Sponsor portal. See Configure Account Content for Sponsor Account Creation for information about configuring the information types that the sponsor guest accounts use.

Note If the CSV file contains custom attributes, the data type and the allowable range that you set for the custom attributes will be applied to the custom attribute values during import.

Step 1 Choose **Administration** > **Identity Management** > **Identities** > **Users**.

Step 2 Click **Import** to import users from a comma-delimited text file.

If you do not have a comma-delimited text file, click **Generate a Template** to create a CSV file with the heading rows filled in.

Step 3 In the **File** field, enter the filename containing the usernames to import, or click **Browse** and navigate to the location where the file is present.

Step 4 Check the **Create new user(s) and update existing user(s) with new data** check box to create new users and update existing user details.

Step 5 Click **Save**.

We recommend that you do not delete all the network access users at a time, because this may lead to CPU spike and the services to crash, especially if you are using a very large database.

The import date will be considered as the creation date for imported Cisco ISE internal users.

Endpoint Settings

The following table describes the fields on the **Endpoints** window, which you can use to create endpoints and assign policies for endpoints. To view this window, click the **Menu** icon (☰) and choose **Work Centers** > **Network Access** > **Identities** > **Endpoints**.

Table 10: Endpoint Settings

Field Name	Usage Guidelines
MAC Address	Enter the MAC address in hexadecimal format to create an endpoint statically. The MAC address is the device identifier for the interface that is connected to the Cisco ISE enabled network.
Static Assignment	Check this check box when you want to create an endpoint statically in the Endpoints window and the status of static assignment is set to static. You can toggle the status of static assignment of an endpoint from static to dynamic or from dynamic to static.
Policy Assignment	(Disabled by default unless the **Static Assignment** is checked) Choose a matching endpoint policy from the **Policy Assignment** drop-down list. You can do one of the following: • If you do not choose a matching endpoint policy, but use the default endpoint policy Unknown, then the static assignment status is set to dynamic for the endpoint that allows dynamic profiling of an endpoint. • If you choose a matching endpoint policy other than Unknown, then the static assignment status is set to static for that endpoint and the **Static Assignment** check box is automatically checked.
Static Group Assignment	Check this check box when you want to assign an endpoint to an identity group statically. In you check this check box, the profiling service does not change the endpoint identity group the next time during evaluation of the endpoint policy for these endpoints, which were previously assigned dynamically to other endpoint identity groups. If you uncheck this check box, then the endpoint identity group is dynamic as assigned by the ISE profiler based on policy configuration. If you do not choose the Static Group Assignment option, then the endpoint is automatically assigned to the matching identity group the next time during evaluation of the endpoint policy.

Field Name	Usage Guidelines

Identity Group Assignment	Choose an endpoint identity group to which you want to assign the endpoint.
	You can assign an endpoint to an identity group when you create an endpoint statically, or when you do not want to use the **Create Matching Identity Group** option during evaluation of the endpoint policy for an endpoint.
	Cisco ISE includes the following system created endpoint identity groups:
	• Blocked List
	• GuestEndpoints
	• Profiled
	  • Cisco IP-Phone
	  • Workstation
	• RegisteredDevices
	• Unknown

Active Directory user endpoints that repeatedly fail RADIUS authentication for the same reason will be automatically rejected for a certain period, to avoid unnecessary processing by Cisco ISE and to protect against potential denial of service attacks.

To view a list of rejected endpoints, choose **Operations > Reports > Rejected Endpoints**. The data for this report will be available and displayed only when Advantage License is installed.

Note AD user endpoints that fail RADIUS authentication with the following two error messages are not rejected:

22063 - WRONG_PASSWORD

24408 - ACTIVE_DIRECTORY_USER_WRONG_PASSWORD

Related Topics

Identified Endpoints, on page 244
Create Endpoints with Static Assignments of Policies and Identity Groups, on page 239

Endpoint Import from LDAP Settings

The following table describes the fields on the Import from LDAP window, which you can use to import endpoints from an LDAP server. To view this window, click the **Menu** icon (☰) and choose **Work Centers** > **Network Access** > **Identities** > **Endpoints**.

Table 11: Endpoint Import from LDAP Settings

Field Name	Usage Guidelines
Connection Settings	
Host	Enter the hostname, or the IP address of the LDAP server.

Field Name	Usage Guidelines
Port	Enter the port number of the LDAP server. You can use the default port 389 to import from an LDAP server, and the default port 636 to import from an LDAP server over SSL. **Note** Cisco ISE supports any configured port number. The configured value should match the LDAP server connection details.
Enable Secure Connection	Check the **Enable Secure Connection** check box to import from an LDAP server over SSL.
Root CA Certificate Name	Click the drop-down arrow to view the trusted CA certificates. The Root CA Certificate Name refers to the trusted CA certificate that is required to connect to an LDAP server. You can add (import), edit, delete, and export trusted CA certificates in Cisco ISE.
Anonymous Bind	You must enable either the **Anonymous Bind** check box, or enter the LDAP administrator credentials from the slapd.conf configuration file.
Admin DN	Enter the distinguished name (DN) configured for the LDAP administrator in the slapd.conf configuration file. Admin DN format example: cn=Admin, dc=cisco.com, dc=com
Password	Enter the password configured for the LDAP administrator in the slapd.conf configuration file.
Base DN	Enter the distinguished name of the parent entry. Base DN format example: dc=cisco.com, dc=com.
Query Settings	
MAC Address objectClass	Enter the query filter, which is used for importing the MAC address, for example, ieee802Device.
MAC Address Attribute Name	Enter the returned attribute name for import, for example, macAddress.
Profile Attribute Name	Enter the name of the LDAP attribute. This attribute holds the policy name for each endpoint entry that is defined in the LDAP server. When you configure the **Profile Attribute Name** field, consider the following: • If you do not specify this LDAP attribute in the **Profile Attribute Name** field or configure this attribute incorrectly, then endpoints are marked "Unknown" during an import operation, and these endpoints are profiled separately to the matching endpoint profiling policies. • If you configure this LDAP attribute in the **Profile Attribute Name** field, the attribute values are validated to ensure that the endpoint policy matches with an existing policy in Cisco ISE, and endpoints are imported. If the endpoint policy does not match with an existing policy, then those endpoints will not be imported.

Field Name	Usage Guidelines
Time Out	Enter the time in seconds. The valid range is from 1 to 60 seconds.

Related Topics

Identified Endpoints, on page 244
Import Endpoints from LDAP Server, on page 242

Identity Group Operations

Create a User Identity Group

You must create a user identity group before you can assign a user to it.

Step 1 Choose **Administration** > **Identity Management** > **Groups** > **Identity Groups** > **User Identity Groups** > **Add**.

You can also create a user identity group by accessing the **Work Centers** > **Device Administration** > **User Identity Groups** > **Identity Groups** > **User Identity Groups** > **Add** page.

Step 2 Enter values in the Name and Description fields. Supported characters for the Name field are space # $ & ‘ ( ) * + - . / @ _ .

Step 3 Click **Submit**.

Related Topics

User Identity Groups, on page 17

Export User Identity Groups

Cisco ISE allows you to export locally configured user identity groups in the form of a csv file.

Step 1 Choose **Administration > Identity Management > Groups > Identity Groups > User Identity Groups**.

Step 2 Check the check box that corresponds to the user identity group that you want to export, and click **Export**.

Step 3 Click **OK**.

Import User Identity Groups

Cisco ISE allows you to import user identity groups in the form of a csv file.

Step 1 Choose **Administration** > **Identity Management** > **Groups** > **Identity Groups** > **User Identity Groups**.

Step 2 Click **Generate a Template** to get a template to use for the import file.

Step 3 Click Import to import network access users from a comma-delimited text file.

Step 4 Check the **Overwrite existing data with new data** check box if you want to both add a new user identity group and update existing user identity groups.

Step 5 Click **Import**.

Step 6 Click **Save** to save your changes to the Cisco ISE database.

Endpoint Identity Group Settings

The following table describes the fields on the Endpoint Identity Groups window, which you can use to create an endpoint group. To view this window, click the **Menu** icon (☰) and choose **Administration > Identity Management > Groups > Endpoint Identity Groups**.

Table 12: Endpoint Identity Group Settings

Field Name	Usage Guidelines
Name	Enter the name of the endpoint identity group that you want to create.
Description	Enter a description for the endpoint identity group that you want to create.
Parent Group	Choose an endpoint identity group from the **Parent Group** drop-down list to which you want to associate the newly created endpoint identity group.

Related Topics

Identified Endpoints Grouped in Endpoint Identity Groups, on page 246
Create Endpoint Identity Groups, on page 246

Configure Maximum Concurrent Sessions

For optimal performance, you can limit the number of concurrent user sessions. You can set the limits at the user level or at the group level. Depending upon the maximum user session configurations, the session count is applied to the user.

You can configure the maximum number of concurrent sessions for each user per ISE node. Sessions above this limit are rejected.

Step 1 Choose **Administration > System > Settings > Max Sessions > User**.

Step 2 Do one of the following:

- Enter the maximum number of concurrent sessions that are allowed for each user in the **Maximum Sessions per User** field.
- Check the **Unlimited Sessions** check box if you want the users to have unlimited sessions. This option is selected by default.

Step 3 Click **Save**.

If the maximum number of sessions is configured at both the user and group level, the smaller value will have precedence. For example, if the maximum session value for a user is set as 10 and the maximum session value of the group to which the user belongs is set as 5, the user can have a maximum of 5 sessions only.

Note The maximum concurrent session count is managed by the PSN in which it is configured. This count is not synchronized among the PSNs. If the authentication is done in Cisco ISE, where the maximum concurrent sessions per user or group is configured, and authorization is done in a different proxy server, then the maximum concurrent session limit is applicable only in the Cisco ISE and is not applied to the proxy server.

Maximum concurrent session count is implemented in the runtime process and the data is stored only in the memory. If the PSN is restarted, the maximum concurrent session counters are reset.

Maximum concurrent session count is case insensitive with respect to usernames irrespective of the Network Access Device used (when the same PSN node is used)

Maximum Concurrent Sessions for a Group

You can configure the maximum number of concurrent sessions for the identity groups.

Sometimes all the sessions can be used by a few users in the group. Requests from other users to create a new session are rejected because the number of sessions has already reached the maximum configured value. Cisco ISE allows you to configure a maximum session limit for each user in the group; each user belonging to a specific identity group cannot open sessions more than the session limit, irrespective of the number of sessions other users from the same group have opened. When calculating the session limit for a particular user, the lowest configuration value takes the precedence—whether the global session limit per user, the session limit per identity group that the user belongs to, or the session limit per user in the group.

To configure maximum number of concurrent sessions for an identity group:

Step 1 Choose **Administration > System > Settings > Max Sessions > Group**.

All the configured identity groups are listed.

Step 2 Click the Edit icon next to the group that you want to edit and enter the values for the following:

- Maximum number of concurrent sessions permitted for that group. If the maximum number of sessions for a group is set as 100, the total count of all sessions established by all members of that group cannot exceed 100.

  Note Group-level session limits are applied based on the group hierarchy.

- Maximum number of concurrent sessions permitted for each user in that group. This option overrides the maximum number of sessions for a group.

If you want to set the maximum number of concurrent sessions for a group or maximum concurrent sessions for the users in a group as Unlimited, leave the **Max Sessions for Group/Max Sessions for User in Group** field blank, click the Tick icon, and then click Save. By default, both these values are set as Unlimited.

Step 3 Click **Save**.

Configure Counter Time Limit

You can configure the timeout value for concurrent user sessions.

Step 1 Choose **Administration > System > Settings > Max Sessions > Counter Time Limit**.

Step 2 Select one of the following options:

- **Unlimited**: Check this check box if you do not want to set any timeout or time limit for the sessions.
- **Delete sessions after**: You can enter the timeout value for concurrent sessions in minutes, hours, or days. When a session exceeds the time limit, Cisco ISE deletes the session from the counter and updates the session count, thereby allowing new sessions. Users will not be logged out if their sessions exceed the time limit.

Step 3 Click **Save**.

You can reset the session count from the RADIUS Live Logs window. Click the Actions icon displayed on the Identity, Identity Group, or Server column to reset the session count. When you reset a session, the session is deleted from the counter (thereby allowing new sessions). Users will not be disconnected if their sessions are deleted from the counter.

Disable Account Policy

While authenticating or querying a user or administrator, Cisco ISE checks the global account disable policy settings at **Administration > Identity Management > Settings > User Authentication Settings** and authenticates or returns a result based on the configuration.

Cisco ISE verifies the following three policies:

- Disable user accounts that exceed a specified date (yyyy-mm-dd): Disables the user account on the specified date. However, the account disable policy settings for an individual network access user configured at **Administration > Identity Management > Identities > Users > Account Disable Policy** takes precedence over the global settings.
- Disable user account after *n* days of account creation or last enable: Disables user accounts after specific number of days of account creation or the last date when the account was active. You can check the user status at **Administration > Identity Management > Identities > Users > Status**.
- Disable accounts after *n* days of inactivity: Disables administrator and user accounts that have not been authenticated for the configured consecutive number of days. The disable accounts after *n* days of inactivity option is only applicable for Cisco ISE Internal Users using internal passwords.

When you migrate from Cisco Secure ACS to Cisco ISE, the account disable policy settings specified for a network access user in Cisco Secure ACS is migrated to Cisco ISE.

Note A collection filter configured for any **Filter Type** filters out the authentication syslog messages that are sent to the monitoring node. For more information, see the topic "Collection Filters" in the chapter "Maintain and Monitor" in the *Cisco ISE Administrator Guide*.

If you configure a collection filter (**Administration** > **System** > **Logging** > **Collection Filter**) for any **Attribute** and **Filter Type**; and you have also selected the **Disable account after n days of inactivity** check box (**Administration** > **Identity Management** > **User Authentication Settings** > **Disable Account Policy**), your account might be disabled as a result of the syslog messages of successful authentication not being relayed to the monitoring node.

Disable Individual User Accounts

Cisco ISE allows you to disable the user account for each individual user if the disable account date exceeds the date specified by the admin user.

Step 1 Choose **Administration > Identity Management > Identities > Users**.

Step 2 Click **Add** to create a new user or check the check box next to an existing user and click **Edit** to edit the existing user details.

Step 3 Check the **Disable account if the date exceeds** check box and select the date.

This option allows you to disable the user account when the configured date exceeds at user level. You can configure different expiry dates for different users as required. This option overrules the global configuration for each individual user. The configured date can either be the current system date or a future date.

Note You are not allowed to enter a date earlier than the current system date.

Step 4 Click **Submit** to configure the account disable policy for an individual user.

Disable User Accounts Globally

You can disable user accounts on a certain date, several days after account creation or last access date, and after several days of account inactivity.

Step 1 Choose **Administration > Identity Management > Settings > User Authentication Settings > Account Disable Policy**.

Step 2 Perform one of the following actions:

- Check the **Disable account if date exceeds** check box and select the appropriate date in yyyy-mm-dd format. This option allows you to disable the user account after the configured date. The **Disable account if date exceeds** setting at user level takes precedence over this global configuration.
- Check the **Disable account after n days of account creation or last enable** check box and enter the number of days. This option disables the user account when the account creation date or last access date exceeds the specified number of days. Administrators can manually enable the disabled user accounts, which reset the number of days count.
- Check the **Disable account after n days of inactivity** check box and enter the number of days. This option disables the user account when the account is inactive for the specified number of days.

Step 3 Click **Submit** to configure the global account disable policy.

Note When you are using the **Disable account after n days of inactivity** option to disable inactive users of Cisco ISE, the endpoints logged to My Devices portal will not have the number of active days reset. This is because My Devices portal doesn't send any profiling updates or accounting information.

Internal and External Identity Sources

Identity sources are databases that store user information. Cisco ISE uses user information from the identity source to validate user credentials during authentication. User information includes group information and other attributes that are associated with the user. You can add, edit, and delete user information from identity sources.

Cisco ISE supports internal and external identity sources. You can use both sources to authenticate sponsor and guest users.

Internal Identity Sources

Cisco ISE has an internal user database whree you can store user information. Users in the internal user database are called internal users. Cisco ISE also has an internal endpoint database that stores information about all the devices and endpoints that connect to it.

External Identity Sources

Cisco ISE allows you to configure the external identity source that contains user information. Cisco ISE connects to an external identity source to obtain user information for authentication. External identity sources also include certificate information for the Cisco ISE server and certificate authentication profiles. Cisco ISE uses authentication protocols to communicate with external identity sources.

Note the following points while configuring policies for internal users:

- Configure an authentication policy to authenticate internal users against an internal identity store.
- Configure an authorization policy for internal user groups by selecting the following option:

  `Identitygroup.Name EQUALS User Identity Groups:` **`Group_Name`**

The following table lists authentication protocols and the external identity sources that they support.

Table 13: Authentication Protocols and Supported External Identity Sources

Protocol (Authentication Type)	Internal Database	Active Directory	LDAP	RADIUS Token Server or RSA	REST	ODBC
EAP-GTC, PAP (plain text password)	Yes	Yes	Yes	Yes	Yes	Yes

Protocol (Authentication Type)	Internal Database	Active Directory	LDAP	RADIUS Token Server or RSA	REST	ODBC
MS-CHAP password hash: MSCHAPv1/v2 EAP-MSCHAPv2 (as inner method of PEAP, EAP-FAST, EAP-TTLS or TEAP) LEAP	Yes	Yes	No	No	No	Yes
EAP-MD5 CHAP	Yes	No	No	No	No	Yes
EAP-TLS PEAP-TLS (certificate retrieval) **Note** For TLS authentications (EAP-TLS and PEAP-TLS), identity sources are not required but can optionally be added for authorization policy conditions.	No	Yes	Yes	No	No	No

Credentials are stored differently, depending on the external data source connection type, and the features used.

- When joining an Active Directory Domain (but not for Passive ID), the credentials that are used to join are not saved. Cisco ISE creates an AD computer account, if it does not exist, and uses that account to authenticate users.
- For LDAP and Passive ID, the credentials that are used to connect to the external data source are also used to authenticate users.

Create an External Identity Source

Cisco ISE can connect with external identity sources such as Active Directory, LDAP, RADIUS Token, and RSA SecurID servers to obtain user information for authentication and authorization. External identity sources also include certificate authentication profiles that you need for certificate-based authentications.

Note To work with passive identity services, which enable you to receive and share authenticated user identities, see Additional Passive Identity Service Providers, on page 86.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources**.

Step 2 Choose one of these options:

- **Certificate Authentication Profile** for certificate-based authentications.
- **Active Directory** to connect to an Active Directory as an external identity source. See Active Directory as an External Identity Source, on page 35 for more details.
- **LDAP** to add an LDAP identity source. See LDAP, on page 126 for more details.
- **RADIUS Token** to add a RADIUS Token server. See RADIUS Token Identity Sources, on page 148 for more details.
- **RSA SecurID** to add an RSA SecurID server. See RSA Identity Sources, on page 154 for more details.
- **SAML Id Providers** to add an identity provider (IdP), such as Oracle Access Manager. See SAMLv2 Identity Provider as an External Identity Source, on page 160 for more details.
- **Social Login** to add a Social Login, such as Facebook, as an external identity source. See Social Login for Self-Registered Guests for more details.

Authenticate Internal Users Against External Identity Store Password

Cisco ISE allows you to authenticate internal users against external identity store passwords. Cisco ISE provides an option to select the password identity store for internal users from the **Administration > Identity Management > Identities > Users** window. Administrators can select the identity store from the list of Cisco ISE External Identity Sources while adding or editing users in the **Users** window. The default password identity store for an internal user is the internal identity store. Cisco Secure ACS users will retain the same password identity store during and after migration from Cisco Secure ACS to Cisco ISE.

Cisco ISE supports the following external identity stores for password types:

- Active Directory
- LDAP
- ODBC
- RADIUS Token server
- RSA SecurID server

Note As per the current design, if authentication is done against an external ID store, then the internal user identity group name cannot be configured in authorization policy. In order to use internal user identity group for authorization, authentication policy must be configured to authenticate against Internal Users ID store and password type, which can be either internal or external, must be selected in user configuration.

Certificate Authentication Profiles

For each profile, you must specify the certificate field that should be used as the principal username and whether you want a binary comparison of the certificates.

Add a Certificate Authentication Profile

You must create a certificate authentication profile if you want to use the Extensible Authentication Protocol-Transport Layer Security (EAP-TLS) certificate-based authentication method. Instead of authenticating via the traditional username and password method, Cisco ISE compares a certificate received from a client with one in the server to verify the authenticity of a user.

Before you begin

You must be a Super Admin or System Admin.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **Certificate Authentication Profile** > **Add**.

Step 2 Enter the name and an optional description for the certificate authentication profile.

Step 3 Select an identity store from the drop-down list.

Basic certificate checking does not require an identity source. If you want binary comparison checking for the certificates, you must select an identity source. If you select Active Directory as an identity source, subject and common name and subject alternative name (all values) can be used to look up a user.

Step 4 Select the use of identity from **Certificate Attribute** or **Any Subject or Alternative Name Attributes in the Certificate**. This will be used in logs and for lookups.

If you choose **Any Subject or Alternative Name Attributes in the Certificate**, Active Directory UPN will be used as the username for logs and all subject names and alternative names in a certificate will be tried to look up a user. This option is available only if you choose Active Directory as the identity source.

Step 5 Choose when you want to **Match Client Certificate Against Certificate In Identity Store**. For this you must select an identity source (LDAP or Active Directory.) If you select Active Directory, you can choose to match certificates only to resolve identity ambiguity.

- **Never**: This option never performs a binary comparison.
- **Only to resolve identity ambiguity**: This option performs the binary comparison of client certificate to certificate on account in Active Directory only if ambiguity is encountered. For example, several Active Directory accounts matching to identity names from certificate are found.
- **Always perform binary comparison**: This option always performs the binary comparison of client certificate to certificate on account in identity store (Active Directory or LDAP).

Step 6 Click **Submit** to add the certificate authentication profile or save the changes.

Active Directory as an External Identity Source

Cisco ISE uses Microsoft Active Directory as an external identity source to access resources such as users, machines, groups, and attributes. User and machine authentication in Active Directory allows network access only to users and devices that are listed in Active Directory.

After a Cisco ISE node joins Active Directory, in Active Directory, it is a member of the Authenticated Users group. The Authenticated Users group is a member of the Pre-Windows 2000 group by default. If you disable the Pre-Windows 2000 group or remove Authenticated Users from the Pre-Windows 2000 group, authentication failures occur.

We recommend that you do not disable the Pre-windows 2000 group. However, if you must disable this group for any reason, grant the Read Remote Access Information permission to Cisco ISE in AD for the relevant users or users' folders.

ISE Community Resource

ISE Administrative Portal Access with AD Credentials Configuration Example

Active Directory-Supported Authentication Protocols and Features

Active Directory supports features such as user and machine authentications, changing Active Directory user passwords with some protocols. The following table lists the authentication protocols and the respective features that are supported by Active Directory.

Table 14: Authentication Protocols Supported by Active Directory

Authentication Protocols	Features
EAP-FAST and password based Protected Extensible Authentication Protocol (PEAP)	User and machine authentication with the ability to change passwords using EAP-FAST and PEAP with an inner method of MS-CHAPv2 and EAP-GTC
Password Authentication Protocol (PAP)	User and machine authentication
Microsoft Challenge Handshake Authentication Protocol Version 1 (MS-CHAPv1)	User and machine authentication

Authentication Protocols	Features
Microsoft Challenge Handshake Authentication Protocol Version 2 (MS-CHAPv2)	User and machine authentication
Extensible Authentication Protocol-Generic Token Card (EAP-GTC)	User and machine authentication
Extensible Authentication Protocol-Transport Layer Security (EAP-TLS)	• User and machine authentication • Groups and attributes retrieval • Binary certificate comparison
Extensible Authentication Protocol- Flexible Authentication via Secure Tunneling-Transport Layer Security (EAP-FAST-TLS)	• User and machine authentication • Groups and attributes retrieval • Binary certificate comparison
Protected Extensible Authentication Protocol-Transport Layer Security (PEAP-TLS)	• User and machine authentication • Groups and attributes retrieval • Binary certificate comparison
Lightweight Extensible Authentication Protocol (LEAP)	User authentication

Active Directory Attribute and Group Retrieval for Use in Authorization Policies

Cisco ISE retrieves user or machine attributes and groups from Active Directory for use in authorization policy rules. These attributes can be used in Cisco ISE policies and determine the authorization level for a user or machine. Cisco ISE retrieves user and machine Active Directory attributes after successful authentication and can also retrieve attributes for an authorization that is independent of authentication.

Cisco ISE may use groups in external identity stores to assign permissions to users or computers; for example, to map users to sponsor groups. You should note the following restrictions on group memberships in Active Directory:

- Policy rule conditions may reference any of the following: a user's or computer's primary group, the groups of which a user or computer is a direct member, or indirect (nested) groups.
- Domain local groups outside a user's or computer's account domain are not supported.

Note You can use the value of the Active Directory attribute, msRadiusFramedIPAddress, as an IP address. This IP address can be sent to a network access server (NAS) in an authorization profile. The msRADIUSFramedIPAddress attribute supports only IPv4 addresses. Upon user authentication, the msRadiusFramedIPAddress attribute value fetched for the user will be converted to IP address format.

Attributes and groups are retrieved and managed per join point. They are used in authorization policy (by selecting first the join point and then the attribute). You cannot define attributes or groups per scope for authorization, but you can use scopes for authentication policy. When you use a scope in authentication policy, it is possible that a user is authenticated via one join point, but attributes and/or groups are retrieved via another join point that has a trust path to the user's account domain. You can use authentication domains to ensure that no two join points in one scope have any overlap in authentication domains.

During the authorization process in a multi join point configuration, Cisco ISE will search for join points in the order in which they listed in the authorization policy, only until a particular user has been found. Once a user has been found the attributes and groups assigned to the user in the join point, will be used to evaluate the authorization policy.

In a multi join point configuration, if authentication is successful for the same identity from each of the join points individually, then this authentication fails if it is done against the identity source sequence "All_AD_Join_Points".

In a multi join point configuration, if Active Directory group retrieval is successful for the same identity from each of the join points individually, then Active Directory group retrieval fails if:

- different join points are used for authentication and authorization.
- authentication uses EAP-TLS without Binary Comparison (**Match Client Certificate Against Certificate In Identity Store** is set to **Never** in the **Certificate Authentication Profile**) and there is an unmatched authorization rule with a different join point ahead of the matched authorization rule.
- authentication uses EAP-TLS without Binary Comparison (**Match Client Certificate Against Certificate In Identity Store** is set to **Never** in **Certificate Authentication Profile**) and Machine Access Restriction (MAR) is enabled with the endpoint using a different join point within the MAR period, from the join point in the current matched authorization rule.

Note In a multi join point configuration, Active Directory group retrieval is successful for each of the join points individually, but it fails if the authentication rule is configured with an identity source sequence that includes "All_AD_Join_Points". Active Directory group retrieval also fails if different join points are used for authorization and authentication.

See Microsoft-imposed limits on the maximum number of usable Active Directory groups: http://technet.microsoft.com/en-us/library/active-directory-maximum-limits-scalability(v=WS.10).aspx

An authorization policy fails if the rule contains an Active Directory group name with special characters such as /, !, @, \, #, $, %, ^, &, *, (,), _, +, or ~.

Admin user login through Active Directory might fail if the admin username contains $ character.

Use Explicit UPN

To reduce ambiguity when matching user information against Active Directory's User-Principal-Name (UPN) attributes, you must configure Active Directory to use Explicit UPN. Using Implicit UPN can produce ambiguous results if two users have the same value for *sAMAccountName*.

To set Explicit UPN in Active Directory, open the **Advanced Tuning** page, and set the attribute *REGISTRY.Services\lsass\Parameters\Providers\ActiveDirectory\UseExplicitUPN* to 1.

Support for Boolean Attributes

Cisco ISE supports retrieving Boolean attributes from Active Directory and LDAP identity stores.

You can configure the Boolean attributes while configuring the directory attributes for Active Directory or LDAP. These attributes are retrieved upon authentication with Active Directory or LDAP.

The Boolean attributes can be used for configuring policy rule conditions.

The Boolean attribute values are fetched from Active Directory or LDAP server as String type. Cisco ISE supports the following values for the Boolean attributes:

Boolean attribute	Supported values
True	t, T, true, TRUE, True, 1
False	f, F, false, FALSE, False, 0

Note Attribute substitution is not supported for the Boolean attributes.

If you configure a Boolean attribute (for example, msTSAllowLogon) as String type, the Boolean value of the attribute in the Active Directory or LDAP server will be set for the String attribute in Cisco ISE. You can change the attribute type to Boolean or add the attribute manually as Boolean type.

Active Directory Certificate Retrieval for Certificate-Based Authentication

Cisco ISE supports certificate retrieval for user and machine authentication that uses the EAP-TLS protocol. The user or machine record on Active Directory includes a certificate attribute of the binary data type. This certificate attribute can contain one or more certificates. Cisco ISE identifies this attribute as userCertificate and does not allow you to configure any other name for this attribute. Cisco ISE retrieves this certificate and uses it to perform binary comparison.

The certificate authentication profile determines the field where the username is taken from in order to lookup the user in Active Directory to be used for retrieving certificates, for example, Subject Alternative Name (SAN) or Common Name. After Cisco ISE retrieves the certificate, it performs a binary comparison of this certificate with the client certificate. When multiple certificates are received, Cisco ISE compares the certificates to check for one that matches. When a match is found, the user or machine authentication is passed.

Active Directory User Authentication Process Flow

When authenticating or querying a user, Cisco ISE checks the following:

- MS-CHAP and PAP authentications check if the user is disabled, locked out, expired or out of logon hours and the authentication fails if any of these conditions are true.
- EAP-TLS authentications checks if the user is disabled or locked out and the authentication fails if any of these conditions are met.

Connect Microsoft Entra ID with Cisco ISE

From Cisco ISE Release 3.1, Cisco ISE supports endpoint authentication and authorization with Microsoft Entra ID. Cisco ISE Release 3.1 supports only the Resource Owner Password Credentials (ROPC) method. Cisco ISE Release 3.2 supports EAP-TLS and TEAP methods in addition to the ROPC flow.

Configure Resource Owner Password Credentials Flow to Authenticate Users with Microsoft Entra ID

Caution The Resource Owner Password Credentials (ROPC) flow in Cisco ISE is a controlled introduction feature. We recommend that you thoroughly test this feature in a test environment before using it in a production environment.

Resource Owner Password Credentials (ROPC) is an OAuth 2.0 grant type that allows Cisco ISE to carry out authorization and authentication in a network with cloud-based identity providers.

Using the ROPC flow, Cisco ISE validates a user's credentials with a cloud-based identity source. The ROPC flow supports plaintext authentication protocols.

Cisco ISE currently supports Microsoft Entra ID through the ROPC flow.

Configure an Application for Resource Owner Password Credentials Flow in Microsoft Entra ID

Step 1 Log in to the Azure portal.

Step 2 Click the **Directory+Application** filter icon in the top navigation bar. Choose the Microsoft Entra ID tenant to which an ROPC-enabled application must be added.

Step 3 Use the search bar to find and choose **App Registrations**.

Step 4 Click **+ New Registration**.

Step 5 In the **Register an Application** window displayed, enter a meaningful name for this app in the **Name** field.

Step 6 In the **Supported account types** area, click **Accounts in this organizational directory only**.

Step 7 Click **Register**.

Step 8 In the new window displayed, click **Certificates & Secrets** from the left menu pane.

Step 9 In the **Client Secrets** area, click **+ New Client Secret**.

Step 10 In the **Add a Client Secret** dialog box displayed, enter a description in the **Description** field.

Step 11 In the **Expiry** area, click **Never**.

Step 12 Click **Add**.

Step 13 Click the copy to clipboard icon to copy the shared secret. You will need this value when configuring the ROPC flow in Cisco ISE.

Step 14 Click **Overview** in the left menu pane, and copy the following values to use in Cisco ISE when configuring the ROPC flow.

- Application (client) ID.
- Directory (tenant) ID.

Step 15 To enable the ROPC flow for this application, click **Authentication** in the left menu pane. In the **Advanced Settings** area, ensure that the toggle button is set to **Yes**.

Do not perform Step 15 if you want to use this application only for EAP-TLS or TEAP workflows.

Step 16 To add a groups claim to the app, click **Token Configuration** in the left menu pane.

Step 17 Click **+ Add Groups Claim**.

Step 18 In the **Edit Groups Claim** dialog box, check the **Security groups** check box.

Step 19 Click **Save**.

Step 20 To enable the use of APIs, click **API Permissions** in the left menu pane.

Step 21 Click **+ Add A Permission**.

Step 22 In the **Microsoft APIs** area, click **Microsoft Graph**.

Step 23 Click **Application Permissions**.

Step 24 In the **Group** drop-down area, check the **Group.Read.All** check box.

To use this application for EAP-TLS or TEAP workflows, check the **User.Read** and **User.Read.All** check boxes as well.

Step 25 Click **Add Permissions**.

Step 26 Click **Grant Admin Consent for <user>**, and then click **Yes**.

Configure Resource Owner Password Credentials Flow in Cisco ISE

Before you begin

In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **System** > **Certificates** > **Certificate Management** > **Trusted Certificates**. Check if **DigiCert Global Root G2** is displayed in the list trusted certificates.

If this certificate is not available in the Trusted Certificates store, import the public root certificate DigiCert Global Root G2 in PEM format into the Cisco ISE Trusted Certificates store.

See https://www.digicert.com/kb/digicert-root-certificates.htm.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **Settings** > **REST ID Store Settings**.

Step 2 Click **Enabled**, and then click **Submit**.

The message "**The service is starting. This may take a few minutes.**" is displayed on the window while the service is being enabled. The message "**The service is enabled**" is displayed on the window to indicate that the service is active.

Step 3 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **REST**.

Step 4 Click **Add**.

Step 5 In the new window displayed, in the **General** tab, enter a value in the **Name** field.

Step 6 From the **REST Identity Provider** drop-down list, choose the identity source to be configured.

Step 7 Enter the required values for the fields **Client ID**, **Client Secret**, and **Tenant ID**, from the information saved when configuring Microsoft Entra ID in the preceding task.

Step 8 Click **Test Connection** to check if Cisco ISE is able to connect to the chosen identity source.

Step 9 Click **Submit**.

Step 10 To add a REST identity store group, choose the **Groups** tab and click **Add**.

Click **Retrieve Groups** to import the user groups from the connected identity source. Check the check boxes next to the groups that you want to select and click **Save**. You can also select all the groups, if needed. The selected groups are listed in the **Groups** tab.

You can filter the results using the filter option.

To delete a user group, check the check box next to the group that you want to delete and click **Delete**.

Step 11 (Optional) Enter a value in the **Username Suffix** field to authenticate the users of a Microsoft Entra ID tenant by their user names.

For example, if the Azure Active Directory User Private Name (UPN) of a user is *example@myTest.onMicrosoft.com*, the suffix is the separator and the domain name is *@myTest.onMicrosoft.com*.

Step 12 Click **Submit**.

EAP-TLS and TEAP Authentication with Microsoft Entra ID

Cisco ISE supports certificate-based authentication and Microsoft Entra ID authorization. The certificate-based authentications can be either EAP-TLS or TEAP with EAP-TLS as the inner method. Then, you can select attributes from Microsoft Entra ID and add them to the Cisco ISE dictionary. These attributes can be used for authorization.

Note

- EAP Chaining the TEAP User session with an authenticated TEAP Computer session is not supported.
- Only user authentication is supported.

Step 1 Configure a Microsoft Entra ID application for Cisco ISE by following the steps in the task Configure an Application for Resource Owner Password Credentials Flow in Microsoft Entra ID, on page 39. Do not perform Step 15.

Step 2 Connect the Microsoft Entra ID application to Cisco ISE by following the steps in the task Configure Resource Owner Password Credentials Flow in Cisco ISE, on page 40.

Step 3 To choose the attributes that you want to add to the Cisco ISE dictionary for the Microsoft Entra ID integration, in the **User Attributes** tab (**Administration** > **Identity Management** > **External Identity Sources** > **REST**). From the list of REST identity source integrations, click the integration for which you want to choose attributes.

Step 4 In the **User attributes** tab, click **Add**. Check the check boxes next to the attributes that you want to add to the Cisco ISE dictionary. You can then use the attributes from the dictionary in policy set creations.

Support for Active Directory Multidomain Forests

Cisco ISE supports Active Directory with multidomain forests. Within each forest, Cisco ISE connects to a single domain, but can access resources from the other domains in the Active Directory forest if trust relationships are established between the domain to which Cisco ISE is connected and the other domains.

Refer to Release Notes for Cisco Identity Services Engine for a list of Windows Server Operating Systems that support Active Directory services.

Note Cisco ISE does not support Microsoft Active Directory servers that reside behind a network address translator and have a Network Address Translation (NAT) address.

Prerequisites for Integrating Active Directory and Cisco ISE

This section describes the manual steps required to configure Active Directory for integration with Cisco ISE. However, in most cases, you can enable Cisco ISE to automatically configure Active Directory. The following are the prerequisites to integrate Active Directory with Cisco ISE.

- Ensure you have Active Directory Domain Admin credentials, required to make changes to any of the AD domain configurations.
- Ensure you have the privileges of a Super Admin or System Admin in Cisco ISE.
- Use the Network Time Protocol (NTP) server settings to synchronize the time between the Cisco ISE server and Active Directory. You can configure NTP settings from Cisco ISE CLI.
- Cisco ISE can connect with multiple Active Directory domains that do not have a two-way trust or have zero trust between them. If you want to query other domains from a specific join point, ensure that trust relationships exist between the join point and the other domains that have user and machine information to which you need access. If trust relationships does not exist, you must create another join point to the untrusted domain. For more information on establishing trust relationships, refer to Microsoft Active Directory documentation.
- You must have at least one global catalog server operational and accessible by Cisco ISE, in the domain to which you are joining Cisco ISE.

Active Directory Account Permissions Required to Perform Various Operations

Join Operations	Leave Operations	Cisco ISE Machine Accounts
The join operation requires the following account permissions: • Search Active Directory (to see if a Cisco ISE machine account exists) • Create Cisco ISE machine account to domain (if the machine account does not already exist) • Set attributes on the new machine account (for example, Cisco ISE machine account password, SPN, dnsHostname)	The leave operation requires the following account permissions: • Search Active Directory (to see if a Cisco ISE machine account exists) • Remove the Cisco ISE machine account from the domain If you perform a force leave (leave without the password), it will not remove the machine account from the domain.	The ISE machine account that communicates to the Active Directory connection requires the following permissions: • Change password • Read the user and machine objects corresponding to users and machines that are authenticated • Query Active Directory to get information (for example, trusted domains, alternative UPN suffixes, and so on) • Read the tokenGroups attribute You can precreate the machine account in Active Directory. If the SAM name matches the Cisco ISE appliance hostname, it is located during the join operation and re-used. If there are multiple join operations, multiple machine accounts are maintained inside Cisco ISE, one for each join.

Note The credentials that are used for the join or leave operation are not stored in Cisco ISE. Only the newly created Cisco ISE machine account credentials are stored.

The **Network access: Restrict clients allowed to make remote calls to SAM** security policy in Microsoft Active Directory has been revised. Hence, Cisco ISE might not able to update its machine account password every 15 days. If the machine account password is not updated, Cisco ISE will no longer authenticate users through Microsoft Active Directory. You will receive the **AD: ISE password update failed** alarm on your Cisco ISE dashboard to notify you of this event.

Note This issue happens in Windows Server 2016 Active Directory or later and Windows 10 version 1607 due to the restriction in them. To overcome this restriction, when you are integrating Windows Server 2016 Active Directory or later or Windows 10 version 1607 with Cisco ISE, you much set the registry value in the following registry from non-zero to blank to give access to all: Registry:HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa\restrictremotesam This allows Cisco ISE to update its machine account password.

The security policy allows users to enumerate users and groups in the local Security Accounts Manager (SAM) database and in Microsoft Active Directory. To ensure Cisco ISE can update its machine account password,

check that your configurations in Microsoft Active Directory are accurate. For more information on the Windows operating systems and Windows Server versions affected, what this means for your network, and what changes may be needed, see:

https://docs.microsoft.com/en-us/windows/security/threat-protection/security-policy-settings/network-access-restrict-clients-allowed-to-make-remote-sam-calls

Network Ports that Must Be Open for Communication

Protocol	Port (remote-local)	Target	Authenticated	Notes
DNS (TCP/UDP)	Random number greater than or equal to 49152	DNS Servers/AD Domain Controllers	No	—
MSRPC	445	Domain Controllers	Yes	—
Kerberos (TCP/UDP)	88	Domain Controllers	Yes (Kerberos)	MS AD/KDC
LDAP (TCP/UDP)	389	Domain Controllers	Yes	—
LDAP (GC)	3268	Global Catalog Servers	Yes	—
NTP	123	NTP Servers/Domain Controllers	No	—
IPC	80	Other ISE Nodes in the Deployment	Yes (Using RBAC credentials)	—

DNS Server

While configuring your DNS server, make sure that you take care of the following:

- The DNS servers that you configure in Cisco ISE must be able to resolve all forward and reverse DNS queries for the domains that you want to use.
- The Authoritative DNS server is recommended to resolve Active Directory records, as DNS recursion can cause delays and have significant negative impact on performance.
- All DNS servers must be able to answer SRV queries for DCs, GCs, and KDCs with or without additional Site information.
- Cisco recommends that you add the server IP addresses to SRV responses to improve performance.
- Avoid using DNS servers that query the public Internet. They can leak information about your network when an unknown name has to be resolved.

Configure Active Directory as an External Identity Source

Configure Active Directory as an external identity source as part of the configuration for features such as Easy Connect and the PassiveID Work Center. For more information about these features, see Easy Connect, on page 74 and PassiveID Work Center , on page 78.

Before you configure Active Directory as an External Identity Source, make sure that:

- The Microsoft Active Directory server does not reside behind a network address translator and does not have a Network Address Translation (NAT) address.
- The Microsoft Active Directory account intended for the join operation is valid and is not configured with the Change Password on Next Login.
- You have the privileges of a Super Admin or System Admin in ISE.

Note If you see operational issues when Cisco ISE is connected to Active Directory, see the AD Connector Operations Report under **Operations** > **Reports**.

You must perform the following tasks to configure Active Directory as an external identity source.

1. Add an Active Directory Join Point and Join Cisco ISE Node to the Join Point, on page 45
2. Configure Authentication Domains, on page 50
3. Configure Active Directory User Groups, on page 51
4. Configure Active Directory User and Machine Attributes, on page 52
5. (Optional) Modify Password Changes, Machine Authentications, and Machine Access Restriction Settings, on page 52

Add an Active Directory Join Point and Join Cisco ISE Node to the Join Point

Before you begin

Ensure that the Cisco ISE node can communicate with the networks where the NTP servers, DNS servers, domain controllers, and global catalog servers are located. You can check these parameters by running the Domain Diagnostic tool.

Join points must be created in order to work with Active Directory as well as with the Agent, Syslog, SPAN and Endpoint probes of the Passive ID Work Center.

If you want to use IPv6 when integrating with Active Directory, then you must ensure that you have configured an IPv6 address for the relevant ISE nodes.

If you use the Google Chrome browser and have ad blocking software enabled, you must disable the ad blocker. This task contains Cisco ISE GUI elements that are affected by ad blockers. Alternatively, you can carry out this task in a Google Chrome Incognito browser.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Click **Add** and enter the domain name and identity store name from the **Active Directory Join Point Name** settings.

Step 3 Click **Submit**.

A pop-up appears asking if you want to join the newly created join point to the domain. Click **Yes** if you want to join immediately.

If you clicked **No**, then saving the configuration saves the Active Directory domain configuration globally (in the primary and secondary policy service nodes), but none of the Cisco ISE nodes are joined to the domain yet.

Step 4 Check the check box next to the new Active Directory join point that you created and click **Edit**, or click on the new Active Directory join point from the navigation pane on the left. The deployment join/leave table is displayed with all the Cisco ISE nodes, the node roles, and their status.

Step 5 In case the join point was not joined to the domain during Step 3, check the check box next to the relevant Cisco ISE nodes and click **Join** to join the Cisco ISE node to the Active Directory domain.

You must do this explicitly even though you saved the configuration. To join multiple Cisco ISE nodes to a domain in a single operation, the username and password of the account to be used must be the same for all join operations. If different username and passwords are required to join each Cisco ISE node, the join operation should be performed individually for each Cisco ISE node.

Step 6 Enter the Active Directory username and password in the **Join Domain** dialog box.

It is strongly recommended that you choose **Store credentials**, in which case your administrator's user name and password will be saved in order to be used for all Domain Controllers (DC) that are configured for monitoring.

The user used for the join operation should exist in the domain itself. If it exists in a different domain or subdomain, the username should be noted in a UPN notation, such as jdoe@acme.com.

Step 7 (Optional) Check the **Specify Organizational Unit** check box.

You should check this check box in case the Cisco ISE node machine account is to be located in a specific Organizational Unit other than CN=Computers,DC=someDomain,DC=someTLD. Cisco ISE creates the machine account under the specified organizational unit or moves it to this location if the machine account already exists. If the organizational unit is not specified, Cisco ISE uses the default location. The value should be specified in full distinguished name (DN) format. The syntax must conform to the Microsoft guidelines. Special reserved characters, such as /'+,;=<> line feed, space, and carriage return must be escaped by a backslash (\). For example, OU=Cisco ISE\,US,OU=IT Servers,OU=Servers\, and Workstations,DC=someDomain,DC=someTLD. If the machine account is already created, you need not check this check box. You can also change the location of the machine account after you join to the Active Directory domain.

Step 8 Click **OK**.

You can select more than one node to join to the Active Directory domain.

If the join operation is not successful, a failure message appears. Click the failure message for each node to view detailed logs for that node.

Note the following points while configuring the join points:

- When using multiple join points, if alternate UPN suffix is configured only for a single join point or domain, identity lookup is performed only in that join point or domain. Authentication might fail in such cases. As a workaround, you can configure the alternate UPN suffix for all the joint points or domains.
- You can only add up to 200 Domain Controllers on ISE. On exceeding the limit, you will receive the error "Error creating <*DC FQDN*> - Number of DCs Exceeds allowed maximum of 200". For more

information on the tested scale limit of domain controllers for deployment, see Performance and Scalability Guide for Cisco Identity Services Engine.

- When the join is complete, Cisco ISE updates its AD groups and corresponding security identifiers (SIDs). Cisco ISE automatically starts the SID update process. You must ensure that this process is allowed to complete.
- You might not be able to join Cisco ISE with an Active Directory domain if the DNS service (SRV) records are missing (the domain controllers do not advertise their SRV records for the domain that you are trying to join to).
- We recommended that you rejoin AD after a designated maintenance window. This ensures that the AD cache is refreshed with the most recent updates.
- The AD machine account name that is created will not match the Cisco ISE hostname if the hostname contains more than 15 characters. In this case, the machine account name will be created in the following format:

  first_8_characters_of(hostname) + "-" + 6 random characters + "$"

  For the machine account name and the hostname to match, the hostname must have 15 characters or less.

Add Domain Controllers

Step 1 Choose **Work Centers** > **PassiveID** > **Providers** and then from the left panel choose **Active Directory**.

Step 2 Check the check box next to the Active Directory join point that you created and click **Edit**. The deployment join/leave table is displayed with all the Cisco ISE nodes, the node roles, and their statuses.

Step 3 **Note** To add a new Domain Controller (DC) for Passive Identity services, you need the login credentials of that DC.

Go to the PassiveID tab and click **Add DCs**.

Step 4 Check the check box next to the domain controllers that you would like to add to the join point for monitoring and click **OK**.
The domain controllers appear in the Domain Controllers list of the PassiveID tab.

Step 5 Configure the domain controller:

a) Checkmark the domain controller and click **Edit**. The **Edit Item** screen appears.
b) Optionally, edit the different domain controller fields.

The DC failover mechanism is managed based on the DC priority list, which determines the order in which the DCs are selected in case of failover. If a DC is offline or not reachable due to some error, its priority is decreased in the priority list. When the DC comes back online, its priority is adjusted accordingly (increased) in the priority list.

MSRPC Protocol for Passive ID

From Cisco ISE Release 3.0 onwards, you can use MS-Eventing API or Microsoft Remote Procedure Call (MSRPC) protocol for Passive Identity. MSRPC protocol is used to establish node communication and monitor heartbeats between nodes in Cisco ISE.

MSRPC protocol promotes a reliable mechanism when Cisco ISE or Cisco ISE-PIC collects or monitors the events from several domain controllers. It also reduces latency on the domain controller user logon events.

For Cisco ISE 3.0 and later, MSRPC is the default protocol. We recommend that you enable the primary and secondary agent for high availability functionalities of the MSPRC, so that if there is a failure in the primary agent installed server, the secondary agent becomes active and monitors the domain controller.

You can also choose to use the standalone option for MSPRC while creating an agent. However, the standalone agent will not be backed up by a secondary agent, in case of agent failure and the domain controller events cannot be monitored.

While upgrading from Cisco ISE 2.x to 3.0 version, if the member server is updated with existing agents, the agent version is displayed as 2.0.0.1 in the **Version** column in the **Agents** window. To view this window, click the **Menu** icon (☰) and choose **Work Centers** > **Passive ID** > **Providers** > **Agents** .

When the agent is installed on the domain controller directly, ensure that the monitoring user is a member of the Event Log Readers group.

When the agent is installed on the AD domain member server, you must do the following:

- Ensure that the monitoring user is a member of the Event Log Readers group.
- If you have configured high availability, open UDP port 9095 in the firewall between the server pair.
- Ensure that the DNS servers configured in Cisco ISE are able to resolve the forward (A) and reverse (PTR) records of the Windows member servers. You must add the required details, if missing.

Irrespective of whether the agent is installed directly on the server or a member server, enable the following firewall rules for Remote Event Log Management group on the domain controller, to allow the server to access the event logs of the domain controller.

- Remote Event Log Management (NP-in)
- Remote Event Log Management (RPC)
- Remote Event Log Management (RPC-EPMAP)

If this is done after the agent is installed, you must restart the agent service on the server.

Deploy Agents for MSRPC

Before you begin

You must enable the Passive Identity Service. To do this:

In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Deployment** and check the check box adjacent to the deployment node. Click **Edit**. In the **Edit Node** window, check the **Enable Passive Identity Service** check box and click **Save**.

In the Cisco ISE-PIC GUI, choose **Administration** > **System** > **Deployment** and check the check box adjacent to the deployment node. Click **Edit**. In the **Edit Node** window, check the **Enable Passive Identity Service** check box and click **Save**.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **Passive ID** > **Providers** > **Agents**.

Step 2 Click **Add**.

Step 3 In the **Agents** window, click **Deploy New Agent**, if you want to deploy new agents or click **Register Existing Agents**, if you want to register an existing agent.

If you choose the **Register Existing Agent** option, a request from a supported registered client may be dropped due to the unsupported protocol. In such events, you need to configure the Cisco ISE client with a supported protocol.

Step 4 Enter the agent name in the **Name** field.

Step 5 Enter the Host FQDN URL in the **Host FQDN** field.

Step 6 Enter the **User Name** and **Password**.

The user account must have the permission to connect remotely to install the PIC agent.

Step 7 Choose **MSRPC** from the **Protocol** dropdown list.

Step 8 Click **Primary** in the **High Availability Settings** section.

After the primary agent is successfully deployed, the above steps should be repeated to deploy the secondary agents by selecting the **Secondary** option in the **High Availability Settings** section. While deploying the secondary agent, select the configured primary agent from the **Primary Agent** drop-down list.

Step 9 Click **Deploy**.

Map Domain Controller with Primary Agent

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **PassiveID** > **Providers** > **Active Directory**.

Step 2 In the **Active Directory** window, click **Add**.

Step 3 In the **Connection** section, enter the **Join Point Name** and **Active Directory Domain** for the domain controller.

Step 4 Click **Submit**.

The following message is displayed:

```
Would you like to Join all ISE Nodes to this Active Directory Domain?
```

Step 5 Click **Yes** to join all the ISE nodes.

Step 6 In the **Join Domain** pop-up window, enter the **AD User name** and **Password**.

Step 7 Click **Ok**.

Step 8 Click the **PassiveID** tab.

Step 9 In the **PassiveID Domain Controllers** window, click the check box adjacent to the ISE domain you want to map.

For multiple DC mapping, you can choose the existing agent from the **Use Existing Agent** option.

Step 10 Click **Edit**

Step 11 Enter the Host FQDN URL in the **Host FQDN** field.

Step 12 Enter the AD credentials in the **AD User Name** and **Password** fields. The user account must have the permission to read the security events on the domain controller.

Step 13 Choose **Agent** from the **Protocol** drop-down list.

Step 14 Select the corresponding agent (**Primary** for high availability or **Standalone**) from the **Agent** drop-down list.

Step 15 Click **Save**.

You can review the agent mapping status, the agent monitoring the domain controller and the agent role in the **Dashboard**. To view this window, click the **Menu** icon (☰) and choose **Work Centers** > **PassiveID** > **Overview**.

In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Operations** > **RADIUS** > **Live Sessions** to view the domain controller event logs.

Leave the Active Directory Domain

If you no longer need to authenticate users or machines from this Active Directory domain or from this join point, you can leave the Active Directory domain.

When you reset the Cisco ISE application configuration from the command-line interface or restore configuration after a backup or upgrade, it performs a leave operation, disconnecting the Cisco ISE node from the Active Directory domain, if it is already joined. However, the Cisco ISE node account is not removed from the Active Directory domain. We recommend that you perform a leave operation from the Admin portal with the Active Directory credentials because it also removes the node account from the Active Directory domain. This is also recommended when you change the Cisco ISE hostname.

Before you begin

If you leave the Active Directory domain, but still use Active Directory as an identity source for authentication (either directly or as part of an identity source sequence), authentications may fail.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Check the checkbox next to the Active Directory join point that you created and click **Edit**. The deployment join/leave table is displayed with all the Cisco ISE nodes, the node roles, and their statuses.

Step 3 Check the checkbox next to the Cisco ISE node and click **Leave**.

Step 4 Enter the Active Directory username and password, and click **OK** to leave the domain and remove the machine account from the Cisco ISE database.

If you enter the Active Directory credentials, the Cisco ISE node leaves the Active Directory domain and deletes the Cisco ISE machine account from the Active Directory database.

Note To delete the Cisco ISE machine account from the Active Directory database, the Active Directory credentials that you provide here must have the permission to remove machine account from domain.

Step 5 If you do not have the Active Directory credentials, check the **No Credentials Available** checkbox, and click **OK**.

If you check the **Leave domain without credentials** checkbox, the primary Cisco ISE node leaves the Active Directory domain. The Active Directory administrator must manually remove the machine account that was created in Active Directory during the time of the join.

Configure Authentication Domains

The domain to which Cisco ISE is joined to has visibility to other domains with which it has a trust relationship. By default, Cisco ISE is set to permit authentication against all those trusted domains. You can restrict interaction with the Active Directory deployment to a subset of authentication domains. Configuring authentication domains enables you to select specific domains for each join point so that the authentications are performed against the selected domains only. Authentication domains improves security because they instruct Cisco ISE to authenticate users only from selected domains and not from all domains trusted from join point. Authentication domains also improve performance and latency of authentication request processing

because authentication domains limit the search area (that is, where accounts matching to incoming username or identity will be searched). It is especially important when incoming username or identity does not contain domain markup (prefix or suffix). Due to these reasons, configuring authentication domains is a best practice, and we highly recommended it.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Click **Active Directory** join point.

Step 3 Click the **Authentication Domains** tab.

A table appears with a list of your trusted domains. By default, Cisco ISE permits authentication against all trusted domains.

Step 4 To allow only specified domains, uncheck **Use all Active Directory domains for authentication** check box.

Step 5 Check the check box next to the domains for which you want to allow authentication, and click **Enable Selected**. In the **Authenticate** column, the status of this domain changes to Yes.

You can also disable selected domains.

Step 6 Click **Show Unusable Domains** to view a list of domains that cannot be used. Unusable domains are domains that Cisco ISE cannot use for authentication due to reasons such as one-way trust, selective authentication and so on.

What to do next

Configure Active Directory user groups.

Configure Active Directory User Groups

You must configure Active Directory user groups for them to be available for use in authorization policies. Internally, Cisco ISE uses security identifiers (SIDs) to help resolve group name ambiguity issues and to enhance group mappings. SID provides accurate group assignment matching.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Click the **Groups** tab.

Step 3 Do one of the following:

a) Choose **Add** > **Select Groups From Directory** to choose an existing group.

b) Choose **Add** > **Add Group** to manually add a group. You can either provide both group name and SID or provide only the group name and press **Fetch SID**.

Do not use double quotes (”) in the group name for the user interface login.

Step 4 If you are manually selecting a group, you can search for them using a filter. For example, enter **admin*** as the filter criteria and click **Retrieve Groups** to view user groups that begin with admin. You can also enter the asterisk (*) wildcard character to filter the results. You can retrieve only 500 groups at a time.

Step 5 Check the check boxes next to the groups that you want to be available for use in authorization policies and click **OK**.

Step 6 If you choose to manually add a group, enter a name and SID for the new group.

Step 7 Click **OK**.

Step 8 Click **Save**.

Note If you delete a group and create a new group with the same name as original, you must click **Update SID Values** to assign new SID to the newly created group. After an upgrade, the SIDs are automatically updated after the first join.

What to do next

Configure Active Directory user attributes.

Configure Active Directory User and Machine Attributes

You must configure Active Directory user and machine attributes to be able to use them in conditions in authorization policies.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Click the **Attributes** tab.

Step 3 Choose **Add** > **Add Attribute** to manually add a attribute, or choose **Add** > **Select Attributes From Directory** to choose a list of attributes from the directory.

Cisco ISE allows you to configure the AD with IPv4 or IPv6 address for user authentication when you manually add the attribute type IP.

Step 4 If you choose to add attributes from the directory, enter the name of a user in the **Sample User or Machine Account** field, and click **Retrieve Attributes** to obtain a list of attributes for users. For example, enter **administrator** to obtain a list of administrator attributes. You can also enter the asterisk (*) wildcard character to filter the results.

Note When you enter an example username, ensure that you choose a user from the Active Directory domain to which the Cisco ISE is connected. When you choose an example machine to obtain machine attributes, be sure to prefix the machine name with “host/” or use the SAM$ format. For example, you might use host/myhost. The example value displayed when you retrieve attributes are provided for illustration only and are not stored.

Step 5 Check the check boxes next to the attributes from Active Directory that you want to select, and click **OK**.

Step 6 If you choose to manually add an attribute, enter a name for the new attribute.

Step 7 Click **Save**.

Modify Password Changes, Machine Authentications, and Machine Access Restriction Settings

Before you begin

You must join Cisco ISE to the Active Directory domain. For more information, see Add an Active Directory Join Point and Join Cisco ISE Node to the Join Point, on page 45.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Check the check box next to the relevant Cisco ISE node and click **Edit** .

Step 3 Click the **Advanced Settings** tab.

Step 4 Modify as required, the Password Change, Machine Authentication, and Machine Access Restrictions (MARs) settings.

Step 5 Check the **Enable dial-in check** check box to check the dial-in permissions of the user during authentication or query. The result of the check can cause a reject of the authentication in case the dial-in permission is denied.

Step 6 Check the **Enable callback check for dial-in clients** check box if you want the server to call back the user during authentication or query. The IP address or phone number used by the server can be set either by the caller or the network administrator. The result of the check is returned to the device on the RADIUS response.

Step 7 Check the **Use Kerberos for Plain Text Authentications** check box if you want to use Kerberos for plain-text authentications. The default and recommended option is MS-RPC.

Configure Maximum Password Attempts for Active Directory Account

A Cisco ISE admin needs a mechanism to prevent Active Directory account lockout because of too many bad password attempts. You can configure the Bad Password Count attribute to prevent a lockout. Before sending the authentication to Active Directory, Cisco ISE should check if there are enough attempts left.

Before authenticating a user, Cisco ISE compares the maximum bad password attempts configured in Cisco ISE with the current value of the badPwdCount attribute on the Active Directory. When the maximum bad password attempts configured in Cisco ISE is equal to the value of the badPwdCount attribute, the authentication is dropped and not sent to the Active Directory.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Check the check box next to the relevant Cisco ISE node and click **Edit** .

Step 3 Click the **Advanced Settings** tab.

Step 4 In the **Prevent Active Directory User Lockout** section, check the **Enable Failed Authentication Protection** check box.

Step 5 Enter the number of maximum bad password attempts.

Note The maximum password attempts here should be less than the maximum bad password attempts configured as the value of the badPwdCount attribute in the Active Directory.

Step 6 Check the **Wired** and **Wireless** check boxes as per the connection requests, for authentication.

Note The connection type (Wired or Wireless) is derived from the RADIUS NAS-port-type attribute. The NAD must include the correct value for this Radius attribute in the Access-request message for this feature to function.

Step 7 Click **Save**.

Step 8 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Policy Sets** > **Default** > **Authentication Policy**.

Step 9 For the required **Rule Name**, **Use** the Active Directory configured as the Identity Source.

Note Identity Sequence Scope or Active Directory Scope will not work. Make sure you use the specific Active Directory join point.

Step 10 Click **Save**.

Step 11 The same can be configured for Guest Portals as well.

Step 12 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **Guest Access** > **Identities** > **Identity Source Sequences** > **Add**.

Step 13 Enter the **Name** of the Identity Source Sequence.

Step 14 In the **Authentication Search List** section, use the **>** button to move the identity sources from the **Available** pane to the **Selected** pane.

Note Identity Sequence Scope or Active Directory Scope will not work. Make sure that you use the specific Active Directory join point. It uses only the first Active Directory join point that has this capability enabled. If this capability is enabled on more than one join point, only the first join point in the list is checked.

Step 15 Click **Submit**.

Troubleshooting

Issue 1: User is locked in Active Directory.

Solution: Ask the network administrator to reset the badPwdCount attribute for that user on the Active Directory.

Issue 2: User fails authentication in Active Directory while lockout prevention is enabled for that Active Directory.

Solution: Check or perform the following:

- Ensure that the User account exists in the Active Directory.
- The badPwdCount attribute value for the user account in the Active Directory must be less than the maximum bad password attempts configured in Cisco ISE.
- Authenticate using the unselected connection type. If lockout prevention is set to Wireless, try to authenticate using Wired connection and vice versa. Successful authentication resets the badPwdCount attribute in the Active Directory .
- Ask the network administrator to reset the badPwdCount attribute for the user in the Active Directory.

Issue 3: User gets locked out even when the lockout prevention for Active Directory is enabled.

Solution: Ensure that the maximum bad password attempts configured in Cisco ISE is less than the value of the badPwdCount attribute set in the Active Directory.

Issue 4: User fails authentication in Active Directory in a portal flow while lockout prevention is enabled for that Active Directory.

Solution: Check or perform the following:

- Make sure that the relevant Active Directory instance is part of the identity store (not sequence) used for that portal flow.
- Ensure that the user account exists in the Active Directory.
- The badPwdCount attribute value for the user account in the Active Directory must be less than the maximum bad password attempts configured in Cisco ISE.
- Try authenticating using the unselected connection type. If lockout prevention is set to Wireless, try to authenticate using Wired connection and vice versa. Successful authentication resets the badPwdCount attribute in the Active Directory.

- Ask the network administrator to reset the badPwdCount attribute for the user in the Active Directory.

Machine Access Restriction Cache

Cisco ISE stores the Machine Access Restriction (MAR) cache content, calling-station-ID list, and the corresponding time stamps to a file on its local disk when you manually stop the the application services. Cisco ISE does not store the MAR cache entries of an instance when there is an accidental restart of the application services. Cisco ISE reads the MAR cache entries from the file on its local disk based on the cache entry time to live when the application services restart. When the application services come up after a restart, Cisco ISE compares the current time of that instance with the MAR cache entry time. If the difference between the current time and the MAR entry time is greater than the MAR cache entry time to live, then Cisco ISE does not retrieve that entry from disk. Otherwise, Cisco ISE retrieves that MAR cache entry and updates its MAR cache entry time to live.

To Configure MAR Cache

On **Advanced Settings** tab of the Active Directory defined in External Identity Sources, verify that the following options are checked:

- **Enable Machine Authentication**: To enable machine authentication.
- **Enable Machine Access Restriction**: To combine user and machine authentication before authorization.

To Use MAR Cache in Authorization

Use `WasMachineAuthenticated is True` in an authorization policy. You can use this rule plus a credentials rule to do dual-authentication. Machine authentication must be done before AD credentials.

If you created a Node Group on the **System > Deployment** page, enable MAR Cache Distribution. MAR cache distribution replicates the MAR cache to all the PSNs in the same node group.

For more information, see the following Cisco ISE Community pages:

- https://community.cisco.com/t5/policy-and-access/mar-why-is-it-useful/td-p/3213527
- https://community.cisco.com/t5/policy-and-access/ise-2-1-mar-aging-time-eap-tls/td-p/3209628

Related Topics

Configure Active Directory as an External Identity Source, on page 45

Configure Custom Schema

Before you begin

You must join Cisco ISE to the Active Directory domain.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Select the Join point.

Step 3 Click the **Advanced Settings** tab.

Step 4 Under the **Schema** section, select the **Custom** option from the **Schema** drop-down list. You can update the user information attributes based on your requirements. These attributes are used to collect user information, such as, first name, last name, email, telephone, locality, and so on.

Predefined attributes are used for the Active Directory schema (built-in schema). If you edit the attributes of the predefined schema, Cisco ISE automatically creates a custom schema.

Support for Active Directory Multijoin Configuration

Cisco ISE supports multiple joins to Active Directory domains. Cisco ISE supports up to 50 Active Directory joins. Cisco ISE can connect with multiple Active Directory domains that do not have a two-way trust or have zero trust between them. Active Directory multi-domain join comprises a set of distinct Active Directory domains with their own groups, attributes, and authorization policies for each join.

You can join the same forest more than once, that is, you can join more than one domain in the same forest, if necessary.

Cisco ISE now allows to join domains with one-way trust. This option helps bypass the permission issues caused by a one-way trust. You can join either of the trusted domains and hence be able to see both domains.

- Join Point: In Cisco ISE, each independent join to an Active Directory domain is called a join point. The Active Directory join point is an Cisco ISE identity store and can be used in authentication policy. It has an associated dictionary for attributes and groups, which can be used in authorization conditions.
- Scope: A subset of Active Directory join points grouped together is called a scope. You can use scopes in authentication policy in place of a single join point and as authentication results. Scopes are used to authenticate users against multiple join points. Instead of having multiple rules for each join point, if you use a scope, you can create the same policy with a single rule and save the time that Cisco ISE takes to process a request and help improve performance. A join point can be present in multiple scopes. A scope can be included in an identity source sequence. You cannot use scopes in an authorization policy condition because scopes do not have any associated dictionaries.

  When you perform a fresh Cisco ISE install, by default no scopes exist. This is called the no scope mode. When you add a scope, Cisco ISE enters multi-scope mode. If you want, you can return to no scope mode. All the join points will be moved to the Active Directory folder.

  - Initial_Scope is an implicit scope that is used to store the Active Directory join points that were added in no scope mode. When multi-scope mode is enabled, all the Active Directory join points move into the automatically created Initial_Scope. You can rename the Initial_Scope.
  - All_AD_Instances is a built-in pseudo scope that is not shown in the Active Directory configuration. It is only visible as an authentication result in policy and identity sequences. You can select this scope if you want to select all Active Directory join points configured in Cisco ISE.

Create a New Scope to Add Active Directory Join Points

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Click **Scope Mode**.
A default scope called Initial_Scope is created, and all the current join points are placed under this scope.

Step 3 To create more scopes, click **Add**.

Step 4 Enter a name and a description for the new scope.

Step 5 Click **Submit**.

Identity Rewrite

Identity rewrite is an advanced feature that directs Cisco ISE to manipulate the identity before it is passed to the external Active Directory system. You can create rules to change the identity to a desired format that includes or excludes a domain prefix and/or suffix or other additional markup of your choice.

Identity rewrite rules are applied on the username or hostname received from the client, before being passed to Active Directory, for operations such as subject searches, authentication, and authorization queries. Cisco ISE will match the condition tokens and when the first one matches, Cisco ISE stops processing the policy and rewrites the identity string according to the result.

During the rewrite, everything enclosed in square bracket [ ] (such as [IDENTITY]) is a variable that is not evaluated on the evaluation side but instead added with the string that matches that location in the string. Everything without the brackets is evaluated as a fixed string on both the evaluation side and the rewrite side of the rule.

The following are some examples of identity rewrite, considering that the identity entered by the user is ACME\jdoe:

- If identity matches **ACME\[IDENTITY]**, rewrite as **[IDENTITY]**.

  The result would be jdoe. This rule instructs Cisco ISE to strip all usernames with the ACME prefix.

- If the identity matches **ACME\[IDENTITY]**, rewrite as **[IDENTITY]@ACME.com**.

  The result would be jdoe@ACME.com. This rule instructs Cisco ISE to change the format from prefix for suffix notation or from NetBIOS format to UPN formats.

- If the identity matches **ACME\[IDENTITY]**, rewrite as **ACME2\[IDENTITY]**.

  The result would be ACME2\jdoe. This rule instructs Cisco ISE to change all usernames with a certain prefix to an alternate prefix.

- If the identity matches **[ACME]\jdoe.USA**, rewrite as **[IDENTITY]@[ACME].com**.

  The result would be jdoe\ACME.com. This rule instructs Cisco ISE to strip the realm after the dot, in this case the country and replace it with the correct domain.

- If the identity matches **E=[IDENTITY]**, rewrite as **[IDENTITY]**.

  The result would be jdoe. This is an example rule that can be created when an identity is from a certificate, the field is an email address, and Active Directory is configured to search by Subject. This rule instructs Cisco ISE to remove ‘E=’.

- If the identity matches **E=[EMAIL],[DN]**, rewrite as **[DN]**.

  This rule will convert certificate subject from E=jdoe@acme.com, CN=jdoe, DC=acme, DC=com to pure DN, CN=jdoe, DC=acme, DC=com. This is an example rule that can be created when identity is taken from a certificate subject and Active Directory is configured to search user by DN . This rule instructs Cisco ISE to strip email prefix and generate DN.

The following are some common mistakes while writing the identity rewrite rules:

- If the identity matches **[DOMAIN]\[IDENTITY]**, rewrite as **[IDENTITY]@DOMAIN.com**.

  The result would be jdoe@DOMAIN.com. This rule does not have [DOMAIN] in square brackets [ ] on the rewrite side of the rule.

- If the identity matches **DOMAIN\[IDENTITY]**, rewrite as **[IDENTITY]@[DOMAIN].com**.

  Here again, the result would be jdoe@DOMAIN.com. This rule does not have [DOMAIN] in square brackets [ ] on the evaluation side of the rule.

Identity rewrite rules are always applied within the context of an Active Directory join point. Even if a scope is selected as the result of an authentication policy, the rewrite rules are applied for each Active Directory join point. These rewrite rules also applies for identities taken from certificates if EAP-TLS is being used.

Enable Identity Rewrite

Note This configuration task is optional. You can perform it to reduce authentication failures that can arise because of various reasons such as ambiguous identity errors.

Before you begin

You must join Cisco ISE to the Active Directory domain.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Click the **Advanced Settings** tab.

Step 3 Under the **Identity Rewrite** section, choose whether you want to apply the rewrite rules to modify usernames.

Step 4 Enter the match conditions and the rewrite results. You can remove the default rule that appears and enter the rule according to your requirement. Cisco ISE processes the policy in order, and the first condition that matches the request username is applied. You can use the matching tokens (text contained in square brackets) to transfer elements of the original username to the result. If none of the rules match, the identity name remains unchanged. You can click the **Launch Test** button to preview the rewrite processing.

Identity Resolution Settings

Some type of identities include a domain markup, such as a prefix or a suffix. For example, in a NetBIOS identity such as ACME\jdoe, “ACME” is the domain markup prefix, similarly in a UPN identity such as jdoe@acme.com, “acme.com” is the domain markup suffix. Domain prefix should match to the NetBIOS (NTLM) name of the Active Directory domain in your organization and domain suffix should match to the DNS name of Active Directory domain or to the alternative UPN suffix in your organization. For example jdoe@gmail.com is treated as without domain markup because gmail.com is not a DNS name of Active Directory domain.

The identity resolution settings allows you to configure important settings to tune the security and performance balance to match your Active Directory deployment. You can use these settings to tune authentications for usernames and hostnames without domain markup. In cases when Cisco ISE is not aware of the user's domain, it can be configured to search the user in all the authentication domains. Even if the user is found in one

domain, Cisco ISE will wait for all responses in order to ensure that there is no identity ambiguity. This might be a lengthy process, subject to the number of domains, latency in the network, load, and so on.

Avoid Identity Resolution Issues

It is highly recommended to use fully qualified names (that is, names with domain markup) for users and hosts during authentication. For example, UPNs and NetBIOS names for users and FQDN SPNs for hosts. This is especially important if you hit ambiguity errors frequently, such as, several Active Directory accounts match to the incoming username; for example, jdoe matches to jdoe@emea.acme.com and jdoe@amer.acme.com. In some cases, using fully qualified names is the only way to resolve issue. In others, it may be sufficient to guarantee that the users have unique passwords. So, it is more efficient and leads to less password lockout issues if unique identities are used initially.

Configure Identity Resolution Settings

Note This configuration task is optional. You can perform it to reduce authentication failures that can arise because of various reasons such as ambiguous identity errors.

Before you begin

You must join the Cisco ISE node to the Active Directory domain.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Click the **Advanced Settings** tab.

Step 3 Define the following settings for identity resolution for usernames or machine names under the **Identity Resolution** section. This setting provides you advanced control for user search and authentication.

The first setting is for the identities without a markup. In such cases, you can select any of the following options:

- **Reject the request**: This option will fail the authentication for users who do not have any domain markups, such as a SAM name. This is useful in case of multi join domains where Cisco ISE will have to look up for the identity in all the joined global catalogs, which might not be very secure. This option forces the users to use names with domain markups.
- **Only search in the "Authentication Domains" from the joined forest**: This option will search for the identity only in the domains in the forest of the join point which are specified in the authentication domains section. This is the default option.
- **Search in all the "Authentication Domains" sections**: This option will search for the identity in all authentication domains in all the trusted forests. This might increase latency and impact performance.

The selection is made based on how the authentication domains are configured in Cisco ISE. If only specific authentication domains are selected, only those domains will be searched (for both "joined forest" or "all forests" selections).

The second setting is used if Cisco ISE cannot communicate with all Global Catalogs (GCs) that it needs to in order to comply with the configuration specified in the "Authentication Domains" section. In such cases, you can select any of the following options:

- **Proceed with available domains**: This option will proceed with the authentication if it finds a match in any of the available domains.

- **Drop the request**: This option will drop the authentication request if the identity resolution encounters some unreachable or unavailable domain.

Test Users for Active Directory Authentication

The Test User tool can be used to verify user authentication from Active Directory. You can also fetch groups and attributes and examine them. You can run the test for a single join point or for scopes.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Choose one of the following options:

- To run the test on all join points, choose **Advanced Tools** > **Test User for All Join Points**.
- To run the test for a specific join point, select the joint point and click **Edit**. Select the Cisco ISE node and click **Test User**.

Step 3 Enter the username and password of the user (or host) in Active Directory.

Step 4 Choose the authentication type. Password entry in Step 3 is not required if you choose the Lookup option.

Step 5 Select the Cisco ISE node on which you want to run this test, if you are running this test for all join points.

Step 6 Check the Retrieve Groups and Attributes check boxes if you want to retrieve the groups and attributes from Active Directory.

Step 7 Click **Test**.
The result and steps of the test operation are displayed. The steps can help to identify the failure reason and troubleshoot.

You can also view the time taken (in milliseconds) for Active Directory to perform each processing step (for authentication, lookup, or fetching groups/attributes). Cisco ISE displays a warning message if the time taken for an operation exceeds the threshold.

Delete Active Directory Configurations

You should delete Active Directory configurations if you are not going to use Active Directory as an external identity source. Do not delete the configuration if you want to join another Active Directory domain. You can leave the domain to which you are currently joined and join a new domain.

Before you begin

Ensure that you have left the Active Directory domain.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Check the checkbox next to the configured Active Directory.

Step 3 Check and ensure that the Local Node status is listed as Not Joined.

Step 4 Click **Delete**.

You have removed the configuration from the Active Directory database. If you want to use Active Directory at a later point in time, you can resubmit a valid Active Directory configuration.

View Active Directory Joins for a Node

You can use the **Node View** button on the **Active Directory** page to view the status of all Active Directory join points for a given Cisco ISE node or a list of all join points on all Cisco ISE nodes.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Click **Node View**.

Step 3 Select a node from the **ISE Node** drop-down list.
The table lists the status of Active Directory by node. If there are multiple join points and multiple Cisco ISE nodes in a deployment, this table may take several minutes to update.

Step 4 Click the join point **Name** link to go to that Active Directory join point page and perform other specific actions.

Step 5 Click the link in the **Diagnostic Summary** column to go to the **Diagnostic Tools** page to troubleshoot specific issues. The diagnostic tool displays the latest diagnostics results for each join point per node.

Diagnose Active Directory Problems

The Diagnostic Tool is a service that runs on every Cisco ISE node. It allows you to automatically test and diagnose the Active Directory deployment and execute a set of tests to detect issues that may cause functionality or performance failures when Cisco ISE uses Active Directory.

There are multiple reasons for which Cisco ISE might be unable to join or authenticate against Active Directory. This tool helps ensure that the prerequisites for connecting Cisco ISE to Active Directory are configured correctly. It helps detect problems with networking, firewall configurations, clock sync, user authentication, and so on. This tool works as a step-by-step guide and helps you fix problems with every layer in the middle, if needed .

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**.

Step 2 Click the **Advanced Tools** drop-down and choose **Diagnostic Tools**.

Step 3 Select a Cisco ISE node to run the diagnosis on.

If you do not select a Cisco ISE node then the test is run on all the nodes.

Step 4 Select a specific Active Directory join point.

If you do not select an Active Directory join point then the test is run on all the join points.

Step 5 You can run the diagnostic tests either on demand or on a scheduled basis.

- To run tests immediately, choose **Run Tests Now**.
- To run the tests at an scheduled interval, check the **Run Scheduled Tests** check box and specify the start time and the interval (in hours, days, or weeks) at which the tests must be run. When this option is enabled, all the diagnostic tests are run on all the nodes and instances and the failures are reported in the **Alarms** dashlet in the **Home** dashboard.

Step 6 Click **View Test Details** to view the details for tests with Warning or Failed status.
This table allows you to rerun specific tests, stop running tests, and view a report of specific tests.

Enable Active Directory Debug Logs

Active Directory debug logs are not logged by default. You must enable this option on the Cisco ISE node that has assumed the Policy Service persona in your deployment. Enabling Active Directory debug logs may affect ISE performance.

Step 1 Choose **Administration** > **System** > **Logging** > **Debug Log Configuration**.
Step 2 Click the radio button next to the Cisco ISE Policy Service node from which you want to obtain Active Directory debug information, and click **Edit**.
Step 3 Click the **Active Directory** radio button, and click **Edit**.
Step 4 Choose **DEBUG** from the drop-down list next to Active Directory. This will include errors, warnings, and verbose logs. To get full logs, choose **TRACE**.
Step 5 Click **Save**.

Obtain the Active Directory Log File for Troubleshooting

Download and view the Active Directory debug logs to troubleshoot issues you may have.

Before you begin

Active Directory debug logging must be enabled.

Step 1 Choose **Operations** > **Troubleshoot** > **Download Logs**.
Step 2 Click the node from which you want to obtain the Active Directory debug log file.
Step 3 Click the **Debug Logs** tab.
Step 4 Scroll down this page to locate the ad_agent.log file. Click this file to download it.

Active Directory Alarms and Reports

Cisco ISE provides various alarms and reports to monitor and troubleshoot Active Directory related activities.

Alarms

The following alarms are triggered for Active Directory errors and issues:

- Configured nameserver not available
- Joined domain is unavailable
- Authentication domain is unavailable

- Active Directory forest is unavailable
- AD Connector had to be restarted
- AD: ISE account password update failed
- AD: Machine TGT refresh failed

Reports

You can monitor Active Directory related activities through the following two reports:

- RADIUS Authentications report: This report shows detailed steps of the Active Directory authentication and authorization. You can find this report here: **Operations** > **Reports** > **Endpoints and Users** > **RADIUS Authentications**.
- AD Connector Operations report: The AD Connector Operations report provides a log of background operations performed by AD connector, such as Cisco ISE server password refresh, Kerberos ticket management, DNS queries, DC discovery, LDAP, and RPC connections management. If you encounter any Active Directory failures, you can review the details in this report to identify the possible causes. You can find this report here: **Operations** > **Reports** > **Diagnostics** > **AD Connector Operations**.

Active Directory Advanced Tuning

The advanced tuning feature provides node-specific settings used for support action under the supervision of Cisco support personnel, to adjust the parameters deeper in the system. These settings are not intended for normal administration flow, and should be used only under guidance.

Configure Preferred Domain Controllers

You can specify the domain controllers that you want to use in case of a domain failover. If a domain fails, Cisco ISE compares the priority scores of the domain controllers that are added to the preferred list and selects the one with the highest priority score. If that domain controller is offline or not reachable because of an issue, the next one in the preferred list with the highest priority score is used. If all the domain controllers in the preferred list are down, a domain controller outside the list is selected based on the priority score. When the domain controller that was used before the failover is restored, Cisco ISE switches back to that domain controller.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration > Identity Management > External Identity Sources > Active Directory > Advanced Tools > Advanced Tuning**.

Step 2 From the **ISE Node** drop-down list, choose the Cisco ISE node that you want to configure.

Step 3 Enter the following registry key in the **Name** field:

REGISTRY.Services\lsass\Parameters\Providers\ActiveDirectory\PreferredDCs\<*Domain Name*>

Step 4 In the **Value** field, specify the domain controllers that you want to add to the preferred list, separated by a space. Here is an example: `dc01.domain.com dc03.domain.com dc05.domain.com`

Step 5 (Optional) In the **Comment** field, enter a description about the preferred list.

Step 6 Click **Update Value**.

Step 7 Click **Restart Active Directory Connector**.

If you do not want to use the preferred list, click **Reset Parameter to Factory Default**.

Active Directory Identity Search Attributes

Cisco ISE identifies users using the attributes SAM, CN, or both. Cisco ISE uses sAMAccountName attribute as the default attribute.

You can configure Cisco ISE to use SAM, CN, or both, if your environment requires it. When SAM and CN are used, and the value of the SAMAccountName attribute is not unique, Cisco ISE also compares the CN attribute value.

Note To modify this default behavior, change the value of the "IdentityLookupField" flag as mentioned in the "Configure Attributes for Active Directory Identity Search" section.

Configure Attributes for Active Directory Identity Search

1. Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory** .
2. In the **Active Directory** window, click **Advanced Tools**, and choose **Advanced Tuning**. Enter the following details:
   - **ISE Node**: Choose the ISE node that is connecting to Active Directory.
   - **Name**: Enter the registry key that you are changing. To change the Active Directory search attributes, enter: `REGISTRY.Services\lsass\Parameters\Providers\ActiveDirectory\IdentityLookupField`
   - **Value**: Enter the attributes that ISE uses to identify a user:
     - *SAM*: To use only SAM in the query (this option is the default).
     - *CN*: To use only CN in the query.
     - *SAMCN*: To use CN and SAM in the query.
   - **Comment**: Describe what you are changing, for example: Changing the default behavior to SAM and CN
3. Click **Update Value** to update the registry.

   A pop-up window appears. Read the message and accept the change. The AD connector service in ISE restarts.

Example Search Strings

For the following examples, assume that the username is *userd2only*:

- SAM search string—

```
filter=[(&(|(objectCategory=person)(objectCategory=computer))(|(cn=userd2only)(sAMAccountName=userd2only)))]
```

- SAM and CN search string—

```
filter=[(&(|(objectCategory=person)(objectCategory=computer))(sAMAccountName=userd2only))]
```

Supplemental Information for Setting Up Cisco ISE with Active Directory

For configuring Cisco ISE with Active Directory, you must configure group policies, and configure a supplicant for machine authentication.

Configure Group Policies in Active Directory

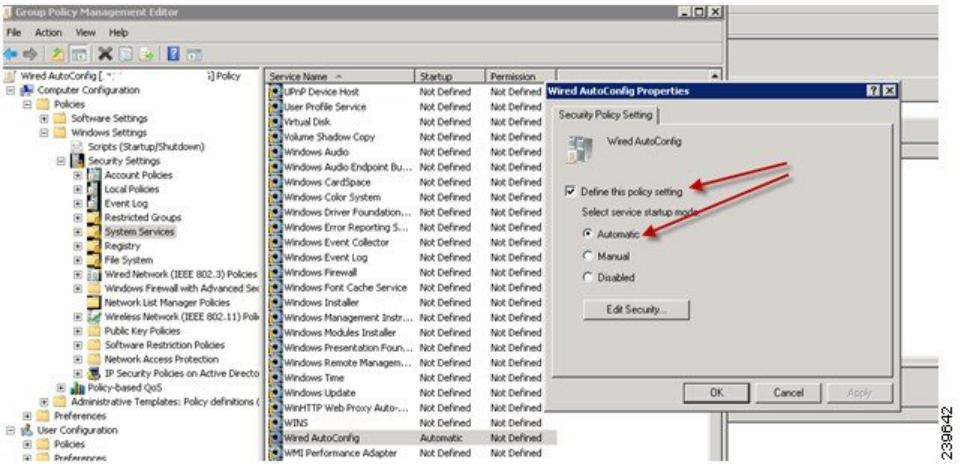
For more information about how to access the Group Policy management editor, refer to the Microsoft Active Directory documentation.

Step 1 Open the Group Policy management editor as shown in the following illustration.

Step 2 Create a new policy and enter a descriptive name for it or add to an existing domain policy.

In example below, we used Wired Autoconfiguration for the policy name.

Step 3 Check the **Define this policy setting** check box, and click the **Automatic** radio button for the service startup mode as shown in the following illustration.



Step 4 Apply the policy at the desired organizational unit or domain Active Directory level.

Configure Odyssey 5.X Supplicant for EAP-TLS Machine Authentications Against Active Directory

If you are using the Odyssey 5.x supplicant for EAP-TLS machine authentications against Active Directory, you must configure the following in the supplicant.

Step 1 Start Odyssey Access Client.

Step 2 Choose **Odyssey Access Client Administrator** from the Tools menu.

Step 3 Double-click the **Machine Account** icon.

Step 4 From the **Machine Account** window, you must configure a profile for EAP-TLS authentications:

a) Choose **Configuration** > **Profiles**.

b) Enter a name for the EAP-TLS profile.

c) On the Authentication tab, choose **EAP-TLS** as the authentication method.

d) On the Certificate tab, check the **Permit login using my certificate** check box, and choose a certificate for the supplicant machine.

e) On the **User Info** tab, check the **Use machine credentials** check box.

If this option is enabled, the Odyssey supplicant sends the machine name in the format host\<*machine_name*> and Active Directory identifies the request as coming from a machine and will look up computer objects to perform authentication. If this option is disabled, the Odyssey supplicant sends the machine name without the host\ prefix and Active Directory will look up user objects and the authentication fails.

Configure Agent for Machine Authentication

When you configure the Agent for machine authentication, you can do one of the following:

- Use the default machine hostname, which includes the prefix “host/.”
- Configure a new profile, in which case you must include the prefix “host/” and then the machine name.

Active Directory Requirements to Support Easy Connect and Passive Identity services

Easy Connect and Passive Identity services use Active Directory login audit events generated by the Active Directory domain controller to gather user login information. The Active Directory server must be configured properly so the ISE user can connect and fetch the user login information. The following sections show how to configure the Active Directory domain controller (configurations from the Active Directory side) to support Easy Connect and Passive Identity services.

To configure Active Directory domain controllers (configurations from the Active Directory side) to support Easy Connect and Passive Identity services, follow these steps:

Note You must configure all the domain controllers in all the domains.

1. Set up Active Directory join points and domain controllers from ISE (see Add an Active Directory Join Point and Join Cisco ISE Node to the Join Point, on page 45).
2. Perform the following steps from Active Directory:
   - Configure Active Directory for Passive Identity service, on page 67

- Set the Windows Audit Policy, on page 70

3. (Optional) Troubleshoot automatic configurations performed by ISE on Active Directory with these steps:
   - Set Permissions when Microsoft Active Directory Users are in Domain Admin Group, on page 70
   - Permissions for Microsoft Active Directory Users Not in Domain Admin Group, on page 71
   - Permissions to Use DCOM on the Domain Controller, on page 72

Configure Active Directory for Passive Identity service

ISE Easy Connect and Passive Identity services use Active Directory login audit events generated by the Active Directory domain controller to gather user login information. ISE connects to Active Directory and fetches the user login information.

The following steps should be performed from the Active Directory domain controller:

Step 1 Make sure relevant Microsoft patches are installed on the Active Directory domain controllers.

Step 2 Make sure the Active Directory logs the user login events in the Windows Security Log.

Verify that the Audit Policy settings (part of the Group Policy Management settings) allows successful logons to generate the necessary events in the Windows Security Log (this is the default Windows setting, but you must explicitly ensure that this setting is correct).

Step 3 You must have an Active Directory user with sufficient permissions for ISE to connect to the Active Directory. The following instructions show how to define permissions either for admin domain group user or none admin domain group user:

- Permissions Required when an Active Directory User is a Member of the Domain Admin Group
- Permissions Required when an Active Directory User is Not a Member of the Domain Admin Group

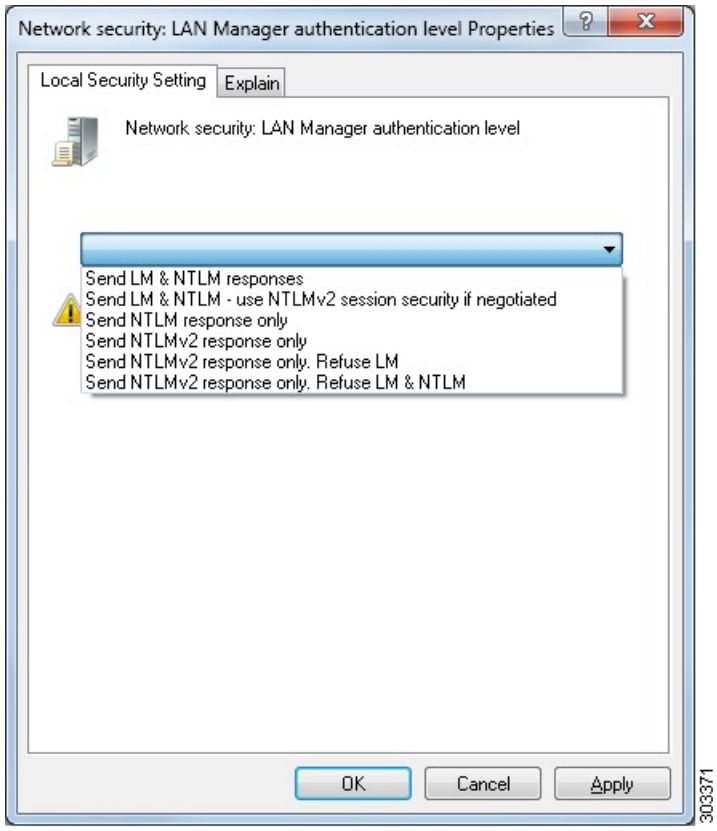
Step 4 The Active Directory user used by ISE can be authenticated either by NT Lan Manager (NTLM) v1 or v2. You need to verify that the Active Directory NTLM settings are aligned with ISE NTLM settings to ensure successful authenticated connection between ISE and the Active Directory Domain Controller. The following table shows all Microsoft NTLM options, and which ISE NTLM actions are supported. If ISE is set to NTLMv2, all six options described in are supported. If ISE is set to support NTLMv1, only the first five options are supported.

Table 15: Supported Authentication Types Based on ISE and AD NTLM Version Settings

ISE NTLM Setting Options / Active Directory (AD) NTLM Setting Options NTLMv1 NTLMv2	NTLMv1	NTLMv2
Send LM & NTLM responses connection is allowed connection is allowed	Connection is allowed	Connection is allowed

ISE NTLM Setting Options / Active Directory (AD) NTLM Setting Options NTLMv1 NTLMv2	NTLMv1	NTLMv2
Send LM & NTLM - use NTLMv2 session security if negotiated connection is allowed connection is allowed	Connection is allowed	Connection is allowed
Send NTLM response only connection is allowed connection is allowed	Connection is allowed	Connection is allowed
Send NTLMv2 response only connection is allowed connection is allowed	Connection is allowed	Connection is allowed
Send NTLMv2 response only. Refuse LM connection is allowed connection is allowed	Connection is allowed	Connection is allowed
Send NTLMv2 response only. Refuse LM & NTLM connection is refused connection is allowed	Connection is refused	Connection is allowed

Figure 1: MS NTLM Authentication Type Options



Step 5 Make sure that you have created a firewall rule to allow traffic to `dllhost.exe` on Active Directory domain controllers.

You can either turn the firewall off, or allow access on a specific IP (ISE IP address) to the following ports:

- TCP 135: General RPC Port. When doing asynchronous RPC calls, the service listening on this port tells the client which port the component servicing this request is using.
- UDP 137: Netbios Name Resolution
- UDP 138: Netbios Datagram Service
- TCP 139: Netbios Session Service
- TCP 445: SMB

Higher ports are assigned dynamically or you can configure them manually. We recommend that you add %SystemRoot%\System32\dllhost.exe as a target. This program manages ports dynamically.

All firewall rules can be assigned to specific IP (ISE IP).

Set the Windows Audit Policy

Ensure that the **Audit Policy** (part of the **Group Policy Management** settings) allows successful logons. This is required to generate the necessary events in the Windows Security Log of the AD domain controller machine. This is the default Windows setting, but you must verify that this setting is correct.

Step 1 Choose **Start** > **Programs** > **Administrative Tools** > **Group Policy Management**.

Step 2 Navigate under Domains to the relevant domain and expand the navigation tree.

Step 3 Choose **Default Domain Controller Policy**, right click and choose **Edit**.

The Group Policy Management Editor appears.

Step 4 Choose **Default Domain Controllers Policy** > **Computer Configuration** > **Policies** > **Windows Settings** > **Security Settings**.

- For Windows Server 2003 or Windows Server 2008 (non-R2), choose **Local Policies** > **Audit Policy**. For the two Policy items, **Audit Account Logon Events** and **Audit Logon Events**, ensure that the corresponding **Policy Setting** either directly or indirectly includes the **Success** condition. To include the Success condition indirectly, the **Policy Setting** must be set to **Not Defined**, indicating that the effective value will be inherited from a higher level domain, and the **Policy Setting** for that higher level domain must be configured to explicitly include the **Success** condition.
- For Windows Server 2008 R2 and Windows 2012, choose **Advanced Audit Policy Configuration** > **Audit Policies** > **Account Logon**. For the two Policy items, **Audit Kerberos Authentication Service** and **Audit Kerberos Service Ticket Operations**, ensure that the corresponding Policy Setting either directly or indirectly includes the Success condition, as described above.

Note Cisco ISE uses RC4 cipher in Kerberos protocol while communicating with Active Directory, unless this encryption type is disabled in Active Directory Domain Controller configuration. You can use the **Network Security: Configure Encryption Types Allowed for Kerberos** option in Active Directory to configure the allowed encrytion types for Kerberos protocol.

Step 5 If any Audit Policy item settings have been changed, you should then run `gpupdate /force` to force the new settings to take effect.

Set Permissions when Microsoft Active Directory Users are in Domain Admin Group

For Windows Server 2008 R2, Windows Server 2012, and Windows Server 2012 R2, the Domain Admin group does not have full control of certain registry keys in the Windows operating system by default. The Microsoft Active Directory administrator must give the Microsoft Active Directory user full control permissions on the following registry keys:

- **HKEY_CLASSES_ROOT\CLSID\{76A64158-CB41-11D1-8B02-00600806D9B6}**
- **HKLM\Software\Classes\Wow6432Node\CLSID\{76A64158-CB41-11D1-8B02-00600806D9B6}**

The following Microsoft Active Directory versions require no registry changes:

- Windows 2003

- Windows 2003R2
- Windows 2008

To grant full control, the Microsoft Active Directory admin must first take ownership of the key:

Step 1 Right-click the key icon and choose the **Owner** tab.

Step 2 Click **Permissions**.

Step 3 Click **Advanced**.

Permissions for Microsoft Active Directory Users Not in Domain Admin Group

For Windows Server 2012 R2, give the Microsoft AD user full control permissions on the following registry keys:

- `HKEY_CLASSES_ROOT\CLSID\{76A64158-CB41-11D1-8B02-00600806D9B6}`
- `HKLM\Software\Classes\Wow6432Node\CLSID\{76A64158-CB41-11D1-8B02-00600806D9B6}`

Use the following commands in Windows PowerShell to check if full permission is given to the registry keys:

- `get-acl -path "Microsoft.PowerShell.Core\Registry::HKEY_CLASSES_ROOT\CLSID\{76A64158-CB41-11D1-8B02-00600806D9B6}" | format-list`
- `get-acl -path "hklm:\Software\Classes\Wow6432Node\CLSID\{76A64158-CB41-11D1-8B02-00600806D9B6}" | format-list`

The following permissions are required when a Microsoft AD user is not in the Domain Admin group, but is in the Domain Users group:

- Add registry keys to allow Cisco ISE to connect to the domain controller.
- Permissions to Use DCOM on the Domain Controller, on page 72
- Set Permissions for Access to WMI Root and CIMv2 Namespace

These permissions are only required for the following Microsoft AD versions:

- Windows 2003
- Windows 2003R2
- Windows 2008
- Windows 2008 R2
- Windows 2012
- Windows 2012 R2
- Windows 2016

Add Registry Keys to Allow Cisco ISE to Connect to the Domain Controller

You must manually add some registry keys to the domain controller to allow Cisco ISE to connect as a domain user, and retrieve login authentication events. An agent is not required on the domain controllers or on any machines in the domain.

The following registry script shows the keys to add. You can copy and paste this into a text file, save the file with a .reg extension, and double click the file to make the registry changes. To add registry keys, the user must be an owner of the root key.

```
Windows Registry Editor Version 5.00

[HKEY_CLASSES_ROOT\CLSID\{76A64158-CB41-11D1-8B02-00600806D9B6}]
"AppID"="{76A64158-CB41-11D1-8B02-00600806D9B6}"

[HKEY_CLASSES_ROOT\AppID\{76A64158-CB41-11D1-8B02-00600806D9B6}]
"DllSurrogate"="  "

[HKEY_CLASSES_ROOT\Wow6432Node\AppID\{76A64158-CB41-11D1-8B02-00600806D9B6}]
"DllSurrogate"="  "
```

Make sure that you include two spaces in the value of the DllSurrogate key. If the registry is manually updated, you must include only the two spaces and do not include the quotes. While updating the registry manually, ensure that quotes are not included for AppID, DllSurrogate, and its values.

Retain the empty lines as shown in the preceding script, including the empty line at the end of the file.

Use the following commands in the Windows command prompt to confirm if the registry keys are created and have the correct values:

- `reg query "HKEY_CLASSES_ROOT\CLSID\{76A64158-CB41-11D1-8B02-00600806D9B6}" /f "{76A64158-CB41-11D1-8B02-00600806D9B6}" /e`
- `reg query HKEY_CLASSES_ROOT\AppID\{76A64158-CB41-11D1-8B02-00600806D9B6} /f "  " /e`
- `reg query HKEY_CLASSES_ROOT\Wow6432Node\AppID\{76A64158-CB41-11D1-8B02-00600806D9B6} /f "  " /e`

Permissions to Use DCOM on the Domain Controller

The Microsoft Active Directory user who is used for Cisco ISE Passive Identity service must have the permissions to use DCOM on the domain controller server. Configure permissions with the **dcomcnfg** command line tool.

Step 1 Run the **dcomcnfg** tool from the command line.

Step 2 Expand **`Component Services`**.

Step 3 Expand **Computers** > **My Computer**.

Step 4 Choose **Action** from the menu bar, click **Properties**, and click **COM Security**.

Step 5 The account that Cisco ISE uses for both access and launch must have Allow permissions. Add the Microsoft Active Directory user to all the four options, **Edit Limits** and **Edit Default** for both **Access Permissions** and **Launch and Activation Permissions**.

Step 6 Allow all local and remote accesses for both **Access Permissions** and **Launch and Activation Permissions**.

Figure 2: Local and Remote Accesses for Access Permissions

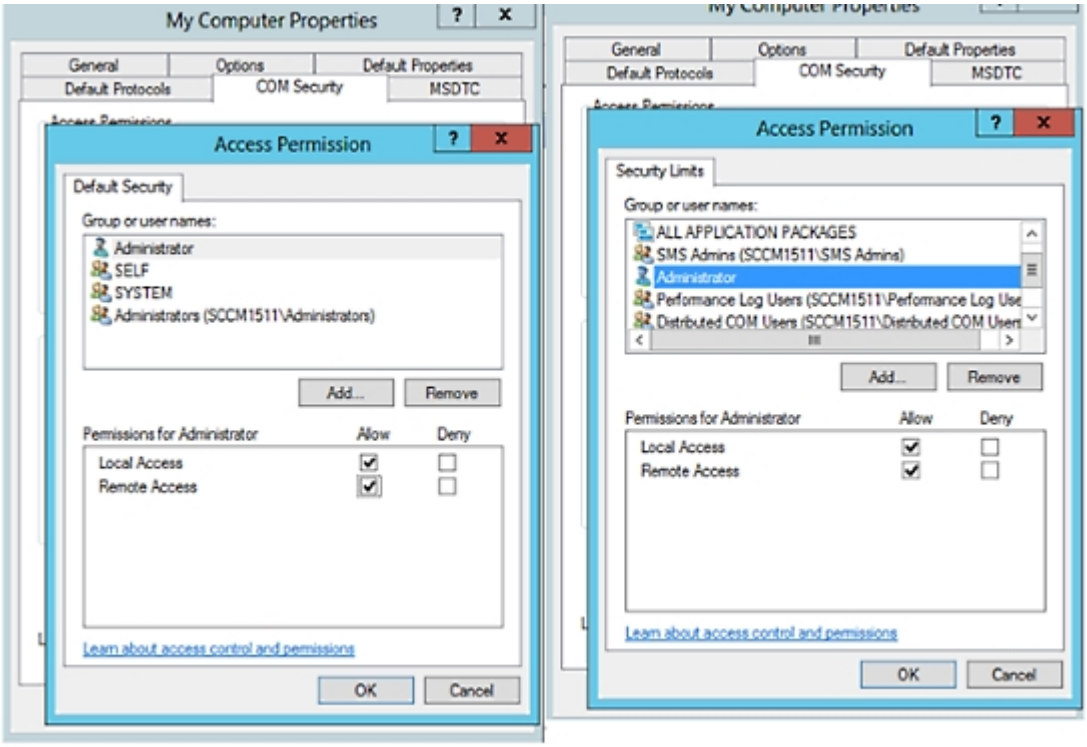
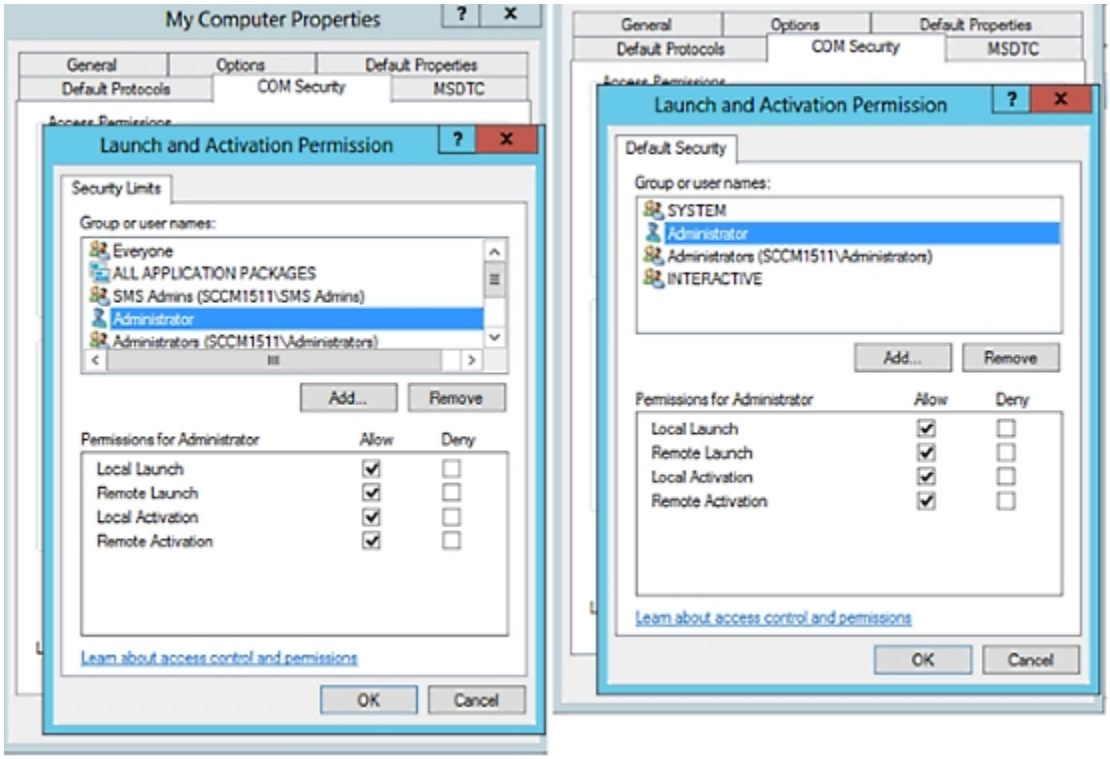


Figure 3: Local and Remote Accesses for Launch and Activation Permissions



Easy Connect

Easy Connect enables you to easily connect users from a wired endpoint to a network in a secure manner and monitor those users by authenticating them through an Active Directory Domain Controller and not by Cisco ISE. With Easy Connect, Cisco ISE collects user authentication information from the Active Directory Domain Controller. Easy Connect connects to a Windows system (Active Directory) using the MS WMI interface and queries logs from the Windows event messaging, hence it currently only supports Windows-installed endpoints. Easy Connect supports wired connections using MAB, which is much easier to configure than 802.1X. Unlike 802.1X, with Easy Connect and MAB:

- You don't need to configure supplicants
- You don't need to configure PKI
- ISE issues a CoA after the external server (AD) authenticates the user

Easy Connect supports these modes of operation:

- Enforcement-mode: ISE actively downloads the authorization policy to the network device for enforcement based on the user credentials.
- Visibility-mode: Cisco ISE publishes session merge and accounting information received from the NAD device sensor in order to send that information to pxGrid.

In both cases, users authenticated with Active Directory (AD) are shown in the Cisco ISE live sessions view, and can be queried from the session directory using Cisco pxGrid interface by third-party applications. The known information is the user name, IP address, the AD DC host name, and the AD DC NetBios name. For more information about pxGrid, see Cisco pxGrid Node.

Once you have set up Easy Connect, you can then filter certain users, based on their name or IP address. For example, if you have an administrator from IT services who logs in to an endpoint in order to assist the regular user with that endpoint, you can filter out the administrator activity so it does not appear in Live Sessions, but rather only the regular user of that endpoint will appear. To filter passive identity services, see Filter Passive Identity Services, on page 120.

Easy Connect Restrictions

- MAC Authentication Bypass (MAB) supports Easy Connect. Both MAB and 802.1X can be configured on the same port, but you must have a different ISE policy for each service.
- Only MAB connections are currently supported. You do not need a unique authentication policy for connections, because the connection is authorized and permissions are granted by an Easy Connect condition defined in the authorization policy.
- Easy Connect is supported in High Availability mode. Multiple nodes can be defined and enabled with a Passive ID. ISE then automatically activates one PSN, while the other nodes remain in standby.
- Only Cisco Network Access Devices (NADs) are supported.
- IPv6 is not supported.
- Wireless connections are not currently supported.
- Only Kerberos auth events are tracked and therefore Easy Connect enables only user authentication and does not support machine authentication.

Easy Connect requires configuration in ISE, while the Active Directory Domain server must also have the correct patches and configuration based on instructions and guidelines issued by Microsoft. For information about configuring the Active Directory domain controller for Cisco ISE, see Active Directory Requirements to Support Easy Connect and Passive Identity services, on page 66

Easy Connect Enforcement Mode

Easy Connect enables users to log on to a secure network from a wired endpoint (usually a PC) with a Windows operating system, by using MAC address bypass (MAB) protocol, and accessing Active Directory (AD) for authentication. Easy Connect listens for a Windows Management Instrumentation (WMI) event from the Active Directory server for information about authenticated users. When AD authenticates a user, the Domain Controller generates an event log that includes the user name and IP address allocated for the user. Cisco ISE receives notification of log in from AD, and then issues a RADIUS Change of Authorization (CoA).

Note MAC address lookup is not done for a MAB request when the Radius service-type is set to call-check. Therefore the return to the request is access-accept. This is the default configuration.

Easy Connect Enforcement Mode Process Flow

The Easy Connect Enforcement mode process is as follows:

1. The user connects to the NAD from a wired endpoint (such as a PC for example).
2. The NAD (which is configured for MAB) sends an access request to Cisco ISE. Cisco ISE responds with access, based on user configuration, allowing the user to access AD. Configuration must allow at least access to DNS, DHCP, and AD.
3. The user logs in to the domain and a security audit event is sent to Cisco ISE.
4. ISE collects the MAC address from RADIUS and the IP address and domain name, as well as accounting information (login information) about the user, from the security audit event.
5. After all data is collected and merged in the session directory, Cisco ISE issues a CoA to the NAD (based on the appropriate policy managed in the policy service node), and the user is provided access by the NAD to the network based on that policy.

Figure 4: Easy Connect Enforcement Mode Basic Flow

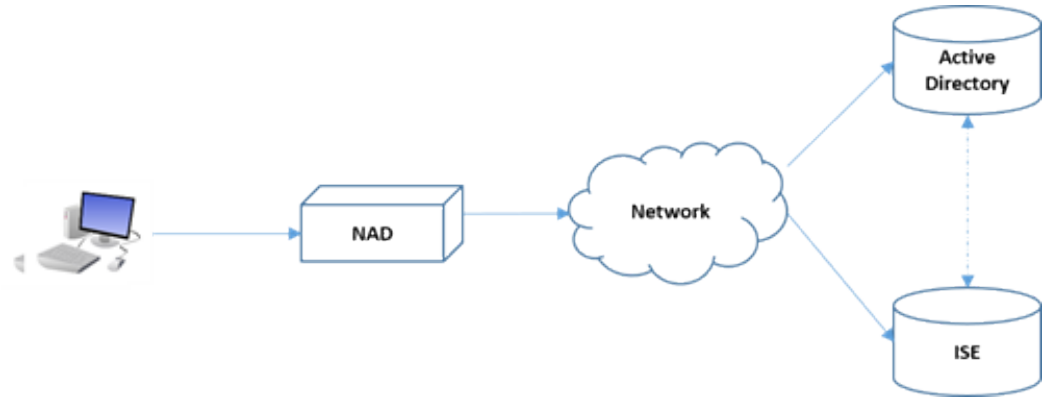
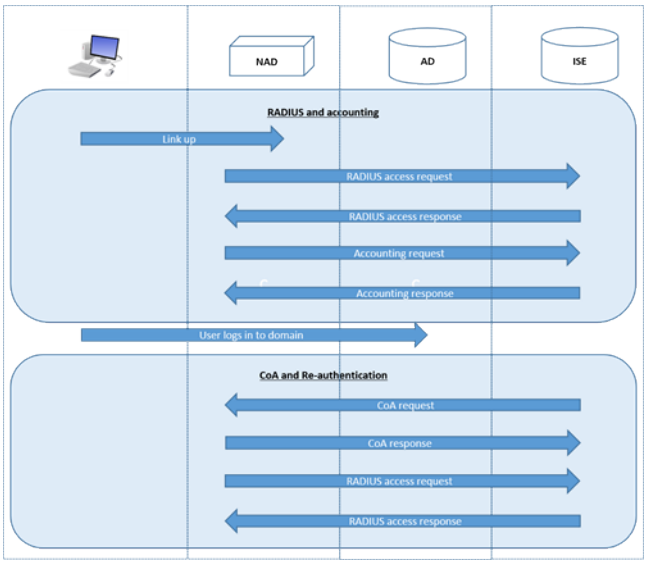


Figure 5: Easy Connect Enforcement Mode Detailed Flow

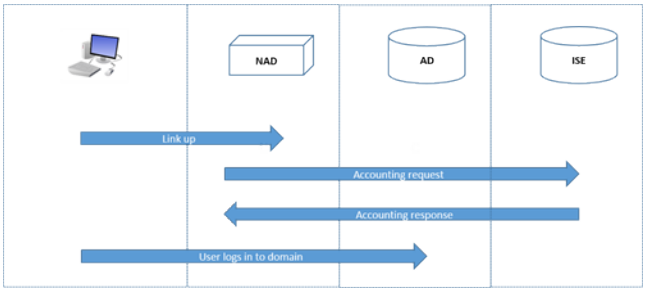


For more information about configuring Enforcement mode, see Configure Easy Connect Enforcement Mode, on page 77.

Easy Connect Visibility Mode

With the Visibility mode, Cisco ISE only monitors accounting information from RADIUS (part of the device sensor feature in the NAD) and does not perform authorization. Easy Connect listens for RADIUS Accounting and WMI events, and publishes that information to logs and reports, (and optionally, to pxGrid). Both RADIUS accounting start and session termination are published to pxGrid during user login using Active Directory when pxGrid is setup.

Figure 6: Easy Connect Visibility Mode Flow



For more information about configuring Easy Connect Visibility mode, see Configure Easy Connect Visibility Mode, on page 78 .

Configure Easy Connect Enforcement Mode

Before you begin

- For best performance, deploy a dedicated PSN to recieve WMI events.
- Create a list of Active Directory Domain Controllers for the WMI node, which receives AD login events.
- Determine the Microsoft Domain that Cisco ISE must join to fetch user groups from Active Directory.
- Determine the Active Directory groups that are used as a reference in the authorization policy.
- If you are using pxGrid to share session data from network devices with other pxGrid-enabled systems, then define a pxGrid persona in your deployment. For more information about pxGrid, see Cisco pxGrid Node
- After successful MAB, the NAD must provide a limited-access profile, which allows the user on that port access to the Active Directory server.

Note Passive Identity Service can be enabled on multiple nodes, but Easy Connect can only operate on one node at a time. If you enable the service for multiple nodes, ISE will automatically determine which node to use for the active Easy Connect session.

Step 1 Choose **Administration** > **System** > **Deployment**, open a node, and under **General Settings**, enable **Enable Passive Identity Service**.

Step 2 Configure an Active Directory join point and domain controller to be used by Easy Connect. For more information, see Active Directory Requirements to Support Easy Connect and Passive Identity services, on page 66.

Step 3 (Optional) Choose **Administration** > **Identity Management** > **External Identity Sources** > **Active Directory**. Click the **Groups** tab, and add the Active Directory groups you plan to use in your authorization policies.
The Active Directory groups that you map for the Domain Controller are dynamically updated in the PassiveID dictionary and can then be used when you set up your policy conditions rules.

Step 4 **Note** **Passive Identity Tracking** must be enabled for all profiles used for Easy Connect authorization in order for the Easy Connect process to run properly and enable ISE to issue a CoA.

Choose **Policy** > **Policy Elements** > **Results** > **Authorization** > **Authorization Profiles**. For any profiles to be used by Easy Connect, open the profile and enable **Passive Identify Tracking**.

Step 5 Choose **Policy** > **Policy Elements** > **Conditions** > **Authorization** > **Simple Conditions**, to create rules for Easy Connect. Click **Add** and define the condition:

a) Enter a name and description.
b) From **Attribute**, go to the PassiveID dictionary and select either PassiveID_Groups to create a condition for domain controller groups, or select PassiveID_user to create a condition for individual users.
c) Enter the correct operation.
d) Enter the user name or group name to be included in the policy.

Step 6 Click **Submit**.

Configure Easy Connect Visibility Mode

Before you begin

- For best performance, deploy a dedicated PSN to recieve WMI events.
- Create a list of Active Directory Domain Controllers for the WMI node, which receives AD login events.
- Determine the Microsoft Domain that Cisco ISE must join to fetch user groups from Active Directory.
- If you are using pxGrid to share session data from network devices with other pxGrid-enabled systems, then define a pxGrid persona in your deployment. For more information about pxGrid, see Cisco pxGrid Node

Step 1 Choose **Administration** > **System** > **Deployment**, open a node, and under **General Settings**, enable **Enable Passive Identity Service**.

Step 2 Configure an Active Directory join point and domain controller to be used by Easy Connect. For more information, see Active Directory Requirements to Support Easy Connect and Passive Identity services, on page 66.

PassiveID Work Center

Passive Identity Connector (the PassiveID work center) offers a centralized, one-stop installation and implementation enabling you to easily and simply configure your network in order to receive and share user identity information with a variety of different security product subscribers such as Cisco Firepower Management Center (FMC) and Stealthwatch. As the full broker for passive identification, the PassiveID work center collects user identities from different provider sources, such as Active Directory Domain Controllers

(AD DC), maps the user login information to the relevant IP addresses in use and then shares that mapping information with any of the subscriber security products that you have configured.

Note For information about the FMC and Stealthwatch releases that are validated with ISE, see *Cisco Identity Services Engine Network Component Compatibility*.

What is Passive Identity?

Standard flows offered by Cisco Identity Services Engine (ISE), which provide an authentication, authorization and accounting (AAA) server, and utilize technologies such as 802.1X or Web Authentication, communicate directly with the user or endpoint, requesting access to the network, and then using their login credentials in order to verify and actively authenticate their identity.

Passive identity services do not authenticate users directly, but rather gather user identities and IP addresses from external authentication servers such as Active Directory, known as providers, and then share that information with subscribers. the PassiveID work center first receives the user identity information from the provider, usually based on the user login and password, and then performs the necessary checks and services in order to match the user identity with the relevant IP address, thereby delivering the authenticated IP address to the subscriber.

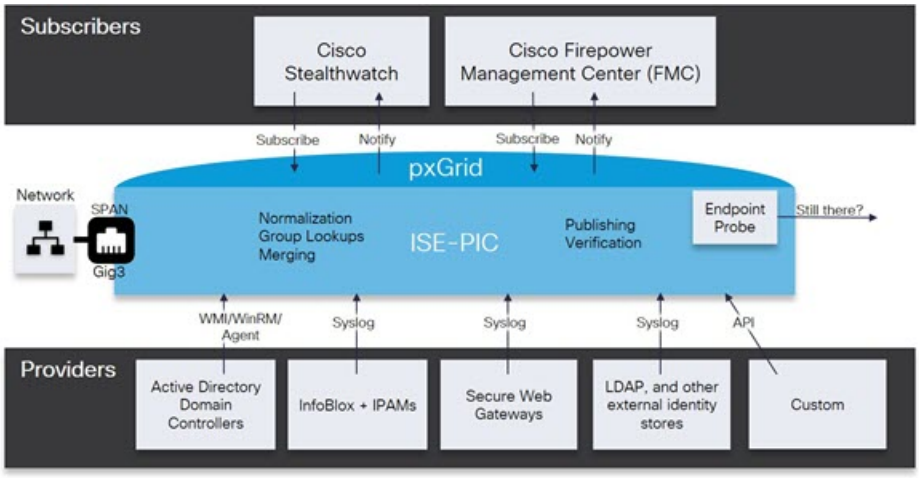
Passive Identity Connector (PassiveID work center) Flow

The flow for the PassiveID work center is as follows:

1. Provider performs the authentication of the user or endpoint.
2. Provider sends authenticated user information to Cisco ISE.
3. Cisco ISE normalizes, performs lookups, merges, parses and maps user information to IP addresses and publishes mapped details to pxGrid.
4. pxGrid subscribers receive the mapped user details.

The following diagram illustrates the high-level flow offered by Cisco ISE.

Figure 7: High Level Flow



Initial Setup and Configuration

To get started using Cisco PassiveID work center quickly, follow this flow:

1. Ensure you have properly configured the DNS server, including configuring reverse lookup for the client machine from Cisco ISE. For more information, see DNS Server, on page 44.
2. Enable the Passive Identity and pxGrid services on the dedicated Policy server (PSN) you intend to use for any of the Passive Identity services. Choose **Administration** > **System** > **Deployment**, open the relevant node, and under **General Settings**, enable **Enable Passive Identity Service** and **pxGrid**.
3. Synchronize clock settings for the NTP servers.
4. Configure an initial provider with the ISE Passive Identity Setup. For more information, see Getting Started with the PassiveID Setup, on page 81.
5. Configure a single or multiple subscribers.

After setting up an initial provider and subscriber, you can easily create additional providers (see Additional Passive Identity Service Providers, on page 86) and manage your passive identification from the different providers in the PassiveID work center.

PassiveID Work Center Dashboard

The Cisco PassiveID Work Center dashboard displays consolidated and correlated summary and statistical data that is essential for effective monitoring and troubleshooting, and is updated in real time. Dashlets show activity over the last 24 hours, unless otherwise noted. To access the dashboard, choose **Work Centers** > **PassiveID** and then from the left panel choose **Dashboard**. You can only view the Cisco PassiveID Work Center Dashboard in the Primary Administration Node (PAN).

- The **Main** view has a linear Metrics dashboard, chart dashlets, and list dashlets. In the PassiveID Work Center, the dashlets are not configurable. Available dashlets include:
  - **Passive Identity Metrics**: Displays the total number of unique live sessions currently being tracked, the total number of identity providers configured in the system, the total number of agents actively delivering identity data, and the total number of subscribers currently configured.
  - **Providers**: Providers provide user identity information to PassiveID Work Center. You configure the ISE probe (mechanisms that collect data from a given source) through which to receive information from the provider sources. For example, an Active Directory (AD) probe and an Agents probe both help ISE-PIC collect data from AD (each with different technology) while a Syslog probe collects data from a parser that reads syslog messages.
  - **Subscribers**: Subscribers connect to ISE to retrieve user identity information.
  - **OS Types**: The only OS type that can be displayed is Windows. Windows types display by Windows versions. Providers do not report the OS type, but ISE can query Active Directory to get that information. Up to 1000 entries are displayed in the dashlet.
  - **Alarms**: User identity-related alarms.

Active Directory as a Probe and a Provider

Active Directory (AD) is a highly secure and precise source from which to receive user identity information, including user name, IP address, and domain name.

By configuring the Active Directory probe you can also then quickly configure and enable these other probes (which also use Active Directory as their source):

- Active Directory Agents, on page 89

Note The Active Directory agents are only supported on Windows Server 2008 and higher.

- SPAN, on page 97
- Endpoint Probe, on page 120

In addition, configure the Active Directory probe in order to use AD user groups when collecting user information. You can use AD user groups for the AD, Agents, SPAN, and Syslog probes. For more information about AD groups, see Configure Active Directory User Groups, on page 51.

Getting Started with the PassiveID Setup

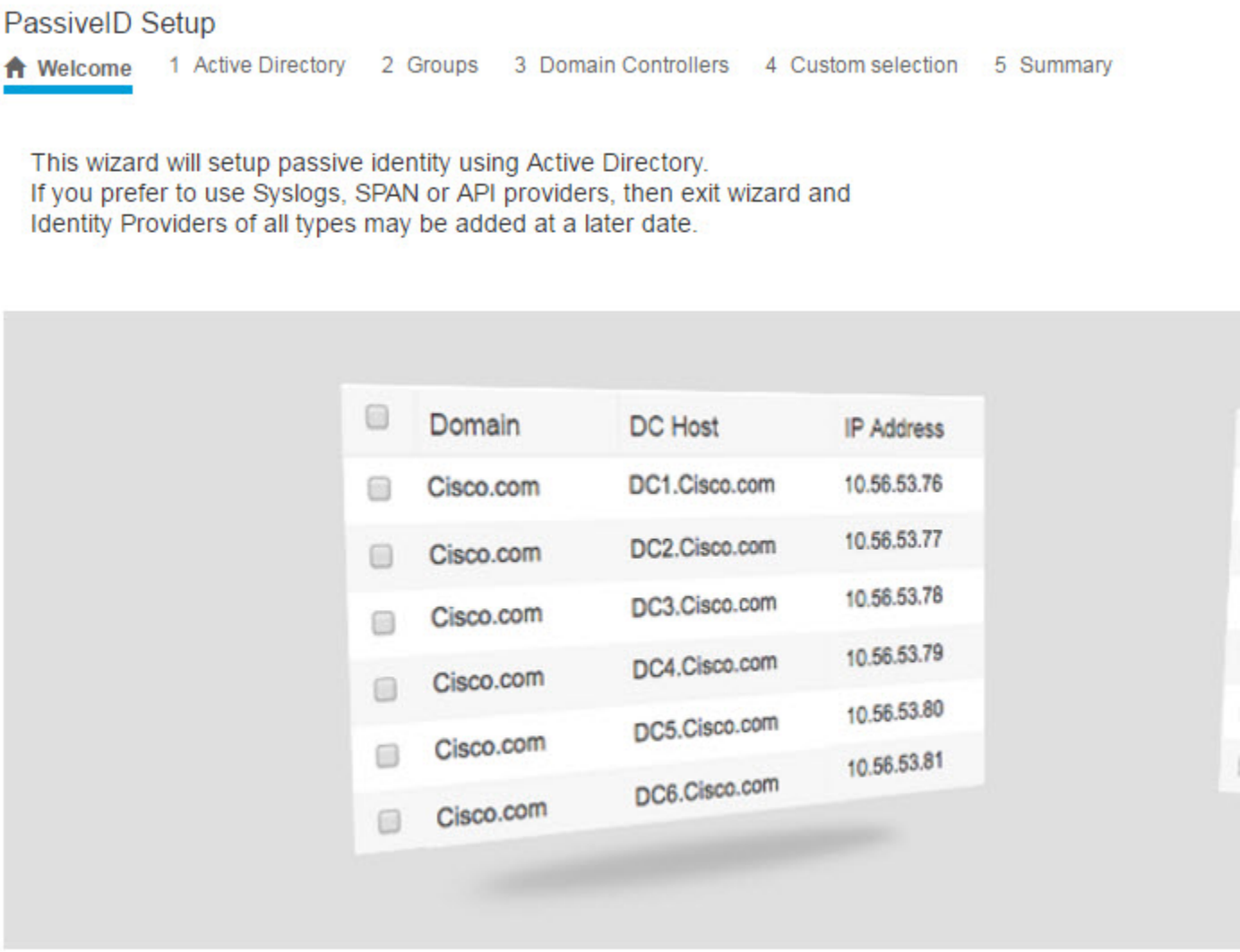
ISE-PIC offers a wizard from which you can easily and quickly configure Active Directory as your first user identity provider, in order to receive user identities from Active Directory. By configuring Active Directory for ISE-PIC, you also simplify the process for configuring other provider types later on. Once you have configured Active Directory, you must then configure a Subscriber (such as Cisco Firepower Management Center (FMC) or Stealthwatch), in order to define the client that is to receive the user data.

Before you begin

- Ensure the Microsoft Active Directory server does not reside behind a network address translator and does not have a Network Address Translation (NAT) address.
- Ensure the Microsoft Active Directory account intended for the join operation is valid and is not configured with the Change Password on Next Login.
- Ensure you have the privileges of a Super Admin or System Admin in ISE.
- Enable the Passive Identity and pxGrid services on the dedicated Policy server (PSN) you intend to use for any of the Passive Identity services. Choose **Administration** > **System** > **Deployment**, open the relevant node, and under **General Settings**, enable **Enable Passive Identity Service** and **pxGrid**.
- Ensure that ISE has an entry in the domain name server (DNS). Ensure you have properly configured reverse lookup for the client machine from ISE. For more information, see DNS Server, on page 44

Step 1 Choose **Work Centers** > **PassiveID**. From the Passive Identity Connector Overview screen, click **Passive Identity Wizard**.

Figure 8: The PassiveID Setup



Step 2 Click **Next** to begin the wizard.

Step 3 Enter a unique name for this Active Directory join point. Enter the domain name for the Active Directory Domain to which this node is connected, and enter your Active Directory administrator user name and password.

It is strongly recommended that you choose **Store credentials**, in which case your administrator's user name and password will be saved in order to be used for all Domain Controllers (DC) that are configured for monitoring.

Step 4 Click **Next** to define Active Directory groups and check any user groups to be included and monitored.
The Active Directory user groups automatically appear based on the Active Directory join point you configured in the previous step.

Step 5 Click **Next**. Select the DCs to be monitored. If you choose Custom, then from the next screen select the specific DCs for monitoring. When finished, click **Next**.

Step 6 Click **Exit** to complete the wizard.

What to do next

When you finish configuring Active Directory as your initial provider, you can easily configure additional provider types as well. For more information, see Additional Passive Identity Service Providers, on page 86. Furthermore, you can now also configure a subscriber, designated to receive the user identity information that is collected by any of the providers you have defined.

Manage the Active Directory Provider

Once you have created and configured your Active Directory join points, continue to manage the Active Directory probe with these tasks:

- Test Users for Active Directory Authentication, on page 60
- View Active Directory Joins for a Node, on page 61
- Diagnose Active Directory Problems, on page 61
- Leave the Active Directory Domain, on page 50
- Delete Active Directory Configurations, on page 60
- Enable Active Directory Debug Logs, on page 62

Active Directory Settings

Active Directory (AD) is a highly secure and precise source from which to receive user information, including user name and IP address.

To create and manage Active Directory probes by creating and editing join points, choose **Work Centers** > **PassiveID** > **Providers** > **Active Directory**.

For more information, see Add an Active Directory Join Point and Join Cisco ISE Node to the Join Point, on page 45.

Table 16: Active Directory Join Point Name Settings and Join Domain Window

Field Name	Description
Join Point Name	A unique name that distinguishes this configured join point quickly and easily.
Active Directory Domain	The domain name for the Active Directory Domain to which this node is connected.
Domain Administrator	This is the user principal name or the user account name for the Active Directory user with administrator priveleges.
Password	This is the domain administrator's password as configured in Active Directory.

Field Name	Description
Specifiy Organizational Unit	Enter the administrator's organizational unit information
Store Credentials	It is strongly recommended that you choose **Store credentials**, in which case your administrator's user name and password will be saved in order to be used for all Domain Controllers (DC) that are configured for monitoring. For the Endpoint probe, you must choose **Store credentials**.

Table 17: Active Directory Join/Leave Window

Field Name	Description
ISE Node	The URL for the specific node in the installation.
ISE Node Role	Indicates whether the node is the Primary or Secondary node in the installation.
Status	Indicates whether the node is actively joined to the Active Directory domain.
Domain Controller	For nodes that are joined to Active Directory, this column indicates the specific Domain Controller to which the node is connected in the Active Directory Domain.
Site	When an Active Directory forest is joined with ISE, this field indicates the specific Active Directory site within the forest as it appears in the Active Directory Sites and Services area.

Table 18: Passive ID Domain Controllers (DC) List

Field	Description
Domain	The fully qualified domain name of the server on which the domain controller is located.
DC Host	The host on which the domain controller is located.
Site	When an Active Directory forest is joined with ISE, this field indicates the specific Active Directory site within the forest as it appears in the Active Directory Sites and Services area.
IP Address	The IP address of the domain controller.
Monitor Using	Monitor Active Directory domain controllers for user identity information by one of these methods: • WMI: Monitor Active Directory directly with the WMI infrastructure. • Agent name: If you have defined agents to monitor Active Directory for user information, select the Agent protocol and choose the agent from the dropdown list that you would like to use. For more information about agents, see Active Directory Agents, on page 89.

Table 19: Passive ID Domain Controllers (DC) Edit Window

Field Name	Description
Host FQDN	Enter the fully qualified domain name of the server on which the domain controller is located.
Description	Enter a unique description for this domain controller in order to easily identiy it.
User Name	The administrator's user name for accessing Active Directory.
Password	The administrator's password for accessing Active Directory.
Protocol	Monitor Active Directory domain controllers for user identity information by one of these methods: • WMI: Monitor Active Directory directly with the WMI infrastructure. • Agent name: If you have defined agents to monitor Active Directory for user information, select the Agent protocol and choose the agent from the dropdown list that you would like to use. For more information about agents, see Active Directory Agents, on page 89.

Active Directory groups are defined and managed from Active Directory and the groups for the Active Directory that is joined to this node can be viewed from this tab. For more information about Active Directory, see https://msdn.microsoft.com/en-us/library/bb742437.aspx.

Table 20: Active Directory Advanced Settings

Field Name	Description
History interval	The time during which the Passive Identity service reads user login information that already occurred. This is required upon startup or restart of the Passive Identity service to catch up with events generated while it was unavailable. When the Endpoint probe is active, it maintains the frequency of this interval.
User session aging time	The amount of time the user can be logged in. The Passive Identity service identifies new user login events from the DC, however the DC does not report when the user logs off. The aging time enables Cisco ISE to determine the time interval for which the user is logged in.
NTLM Protocol settings	You can select either NTLMv1 or NTLMv2 as the communications protocol between Cisco ISE and the DC. NTLMv2 is the recommended default.

Field Name	Description
Authorization Flow	Check this check box to configure authorization policies for PassiveID login users. You can configure an authorization policy to assign an SGT to a user based on the Active Directory group membership. This allows you to create TrustSec policy rules even for PassiveID authorization. You can use the **PassiveID_Provider**, **PassiveID_Username**, or **PassiveID_Groups** attribute in the **PassiveID** dictionary to create the authorization rules for PassiveID login users. The following values can be set for the **PassiveID_Provider** attribute: • **API** • **Agent** • **SPAN** • **Syslog** • **WMI** • **Other** The IP-SGT mapping and Active Directory group details of PassiveID login users are included in the session topic. These details can be published through pxGrid, pxGrid Cloud, or SXP. You can view the authorization policy status and the SGT details in the **RADIUS Live Logs** window (**Operations > RADIUS > Live Logs**) and the **RADIUS Live Sessions** window (**Operations > RADIUS > Live Sessions**). **Note** • Ensure that the PassiveID, pxGrid, pxGrid Cloud, and SXP services are enabled on the node. To enable these services, choose **Administration > System > Deployment**. • You must enable the **Add RADIUS and PassiveID Mappings into SXP IP SGT Mapping Table** option in the **SXP Settings** window (**Work Centers > TrustSec > Settings > SXP Settings**) to include PassiveID mappings in the SXP mappings. • SGT details of the PassiveID login users that are authenticated using API provider cannot be published using SXP. However, the SGT details of these users can be published through pxGrid and pxGrid Cloud.

Additional Passive Identity Service Providers

In order to enable ISE to provide identity information (Passive Identity Service) to consumers that subscribe to the service (subscribers), you must first configure an ISE probe, which connects to the identity provider.

The table below provides details about all of the provider and probe types available from ISE. For more information about Active Directory, see Active Directory as a Probe and a Provider, on page 81.

You can define these provider types:

Table 21: Provider Types

Provider Type (Probe)	Description	Source System (Provider)	Technology	User Identity Information Collected	Document Link
Active Directory (AD)	A highly secure and precise source, as well as the most common, from which to receive user information. As a probe, AD works with WMI technology to deliver authenticated user identities. In addition, AD itself, rather than the probe, functions as a source system (a provider) from which other probes retrieve user data as well.	Active Directory Domain Controller	WMI	• User name • IP address • Domain	Active Directory as a Probe and a Provider, on page 81
Agents	A native 32-bit application installed on Active Directory domain controllers or on member servers. The Agent probe is a quick and efficient solution when using Active Directory for user identity information.		Agents installed on the domain controller or on a member server.	• User name • IP address • Domain	Active Directory Agents, on page 89
Endpoint			WMI	Whether the user is still connected	Endpoint Probe, on page 120

Provider Type (Probe)	Description	Source System (Provider)	Technology	User Identity Information Collected	Document Link
	Always runs in the background in addition to other configured probes, in order to verify whether the user is still connected.				
SPAN	Sits on the network switch in order to listen to network traffic, and extract user identity information based on Active Directory data.		SPAN, installed on the switch, and Kerberos messages	• User name • IP address • Domain	SPAN, on page 97
API providers	Gather user identity information from any system programmed to communicate with a RESTful API client, using the RESTful API service offered by ISE.	Any system programmed to communicate with a REST API client.	RESTful APIs. User identity sent to subscribers in JSON format.	• User name • IP address • Port range • Domain	API Providers, on page 93
Syslog	Parse syslog messages and retrieve user identities, including MAC addresses.	• Regular syslog message providers • DHCP servers	Syslog messages	• User name • IP address • MAC address • Domain	Syslog Providers, on page 99

Note pxGrid sends 200 events per second for session topics to avoid overloading the clients. If the publisher sends more than 200 events, the additional events are queued and sent in next batch.

If pxGrid consistently receives more than 200 events per second for a prolonged period of time, it might consume more memory than usual for storing the backlog events. This might affect the performance of pxGrid.

Active Directory Agents

From the Passive Identity service work center install the native 32-bit application, Domain Controller (DC) agents, anywhere on the Active Directory (AD) domain controller (DC) or on a member server (based on your configurations) to retrieve user identity information from AD and then send those identities to the subscribers you have configured. The Agent probe is a quick and efficient solution when using Active Directory for user identity information. Agents can be installed on a separate domain, or on the AD domain, and once installed, they provide status updates to ISE once every minute.

The agents can be either automatically installed and configured by ISE, or you can manually install them. Upon installation, the following occurs:

- The agent and its associated files are installed at the following path: **`Program Files/Cisco/Cisco ISE PassiveID Agent`**
- A config file called **`PICAgent.exe.config`** is installed indicating the logging level for the agent. You can manually change the logging level from within the config file.
- The CiscoISEPICAgent.log file is stored with all logging messages.
- The nodes.txt file contains the list of all nodes in the deployment with which the agent can communicate. The agent contacts the first node in the list. If that node cannot be contacted, the agent continues to attempt communication according to the order of the nodes in the list. For manual installations, you must open the file and enter the node IP addresses. Once installed (manually or automatically), you can only change this file by manually updating it. Open the file and add, change or delete node IP addresses as necessary.
- The Cisco ISE PassiveID Agent service runs on the machine, which you can manage from the Windows Services dialog box.
- The Active Directory agents are only supported on Windows Server 2008 and higher. If you cannot install agents, then use the Active Directory probe for passive identity services. For more information, see Active Directory as a Probe and a Provider, on page 81.

Note Even if you are running the AD agent on a member server, it still queries the Active Directory for the login requests.

Automatically Install and Deploy Active Directory Agents

When configuring the Agent provider to monitor domain controllers for user identities, the agent must be installed on either a member server or on a domain controller. The agents can be either automatically installed by ISE, or you can manually install them. After installation, automatic or manual, you must then configure the installed agent to monitor specified domain controllers rather than the default WMI. This process describes how to enable automatic installation and configure the agent to monitor a domain controller.

Before you begin

Before you begin:

- Configure reverse lookup for the relevant DNS servers from the server side. For more information about the DNS server configuration requirements for ISE, see DNS Server, on page 44

- Ensure Microsoft .NET Framework is updated for the machine designated for the agents, to a minimum of version 4.0. For more information about the .NET framework, see https://www.microsoft.com/net/framework.
- Active Passive ID and pxGrid services. For more information, see Initial Setup and Configuration, on page 80.
- Create an AD join point and add at least one domain controller. For more information about creating join points, see Active Directory as a Probe and a Provider, on page 81.

  Use AD user groups for the AD, Agents, SPAN and Syslog probes. For more information about AD groups, see Configure Active Directory User Groups, on page 51.

Step 1 Choose **Work Centers** > **PassiveID** > **Providers** and then choose **Agents** from the left panel.

Step 2 To add a new agent, click **Add** from the top of the table.

Step 3 To create the new agent and automatically install it on the host that you indicate in this configuration, select **Deploy New Agent**.

Step 4 Complete all mandatory fields in order to configure the client correctly. For more information, see Active Directory Agent Settings, on page 92.

Step 5 Click **Deploy**.
The agent is automatically installed on the host according to the domain that you indicated in the configuration, and the settings are saved. The agent now also appears in the Agents table and can be applied to monitor specified domain controllers, as described in the following steps.

Step 6 Choose **Work Centers** > **PassiveID** > **Providers** and then choose **Active Directory** from the left panel to view all currently configured join points.

Step 7 Click the link for the join point from which you would like to enable the agent you created.

Step 8 Choose the **Passive ID** tab to configure the domain controllers that you added as part of the prerequisites.

Step 9 Select the domain controller that you would like to monitor with the agent you created and click **Edit**.

Step 10 From the **Protocol** drop-down list, select **Agent**

Step 11 Select the agent you created from the **Agent** drop-down list. Enter the user name and password credentials of the agent that you created, and click **Save**.

The user name and password credentials are used to install the agent on the domain controller. Finally, when you click on **Deploy**, the *picagent.exe* is copied from */opt/pbis/bin* to the specified Windows machine.

Manually Install and Deploy Active Directory Agents

When configuring the Agent provider to monitor domain controllers for user identities, the agent must be installed on either a member server or on a domain controller. The agents can be either automatically installed by ISE, or you can manually install them. After installation, automatic or manual, you must then configure the installed agent to monitor specified domain controllers rather than the default WMI. This process describes how to manually install and configure the agent to monitor a domain controller.

Before you begin

Before you begin:

- Configure reverse lookup for the relevant DNS servers from the server side. For more information about the DNS server configuration requirements for ISE, see DNS Server, on page 44
- Ensure Microsoft .NET Framework is updated for the machine designated for the agents, to a minimum of version 4.0. For more information about the .NET framework, see https://www.microsoft.com/net/framework.
- Active Passive ID and pxGrid services. For more information, see Initial Setup and Configuration, on page 80.
- Create an AD join point and add at least one domain controller. For more information about creating join points, see Active Directory as a Probe and a Provider, on page 81.

  Use AD user groups for the AD, Agents, SPAN and Syslog probes. For more information about AD groups, see Configure Active Directory User Groups, on page 51.

Step 1 Choose **Work Centers** > **PassiveID** > **Providers** and then choose **Agents** from the left panel.

Step 2 Click **Download Agent** to download the **`picagent-installer.zip`** file for manual installation.
The file is downloaded to your standard Windows Download folder.

Step 3 Place the zip file on the designated host machine and run the installation.

Step 4 From the ISE GUI, again choose **Work Centers** > **PassiveID** > **Providers** and then choose **Agents** from the left panel.

Step 5 To configure a new agent, click **Add** from the top of the table.

Step 6 To configure the agent that you have already installed on the host machine, select **Register Existing Agent**.

Step 7 Complete all mandatory fields in order to configure the client correctly. For more information, see Active Directory Agent Settings, on page 92.

Step 8 Click **Save**.
The agent settings are saved. The agent now also appears in the Agents table and can be applied to monitor specified domain controllers, as described in the following steps.

Step 9 Choose **Work Centers** > **PassiveID** > **Providers** and then choose **Active Directory** from the left panel to view all currently configured join points.

Step 10 Click the link for the join point from which you would like to enable the agent you created.

Step 11 Choose the **Passive ID** tab to configure the domain controllers that you added as part of the prerequisites.

Step 12 Select the domain controller that you would like to monitor with the agent you created and click **Edit**.

Step 13 From the **Protocol** drop-down list, select **Agent**.

Step 14 Select the agent you created from the **Agent** drop-down list. Enter the user name and password to connect to the agent, and click **Save**

The user account must have the necessary permissions to read security events. A user account for a WMI-based agent must have WMI/DCOM permissions.

Uninstall the Agent

Agents, installed automatically or manually, can be easily (manually) uninstalled directly from Windows.

Step 1 From the Windows dialog, go to **Programs and Features**.

Step 2 Find and select the Cisco ISE PassiveID Agent in the list of installed programs.

Step 3 Click **Uninstall**.

Active Directory Agent Settings

Allow ISE to automatically install agents on a specified host in the network in order to retrieve user identity information from different Domain Controllers (DC) and deliver that information to Passive Identity service subscribers.

To create and manage agents, choose **Providers** > **Agents**. See Automatically Install and Deploy Active Directory Agents, on page 89.

Table 22: Agents Window

Field Name	Description
Name	The agent name as you configured it.
Host	The fully qualified domain name of the host on which the agent is installed.
Monitoring	This is a comma separated list of domain controllers that the specified agent is monitoring.

Table 23: Agents New

Field	Description
Deploy New Agent or Register Existing Agent	• Deploy New Agent: Install a new agent on the specified host. **Note** The user must have Domain User and Domain Admin privileges to deploy an agent on the specified host. • Register Existing Agent: Manually install the agent on the host and then configure that agent from this screen for Passive Identity service to enable the service.
Name	Enter a name by which you can easily recognize the agent.
Description	Enter a description by which you can easily recognize the agent.
Host FQDN	This is the fully qualified domain name for the host on which the agent is installed (register existing agent), or is to be installed (automatic deployment).
User Name	Enter your user name in order to access the host on which to install the agent. Passive Identity service uses these credentials in order to install the agent for you. The user account must have permissions to connect remotely and install the PIC agent.
Password	Enter your user password in order to access the host on which to install the agent. Passive Identity service uses these credentials in order to install the agent for you.

API Providers

The API Providers feature in Cisco ISE enables you to push user identity information from your customized program or from the terminal server (TS)-Agent to the built-in ISE passive identity services REST API service. In this way, you can customize a programmable client from your network to send user identities that were collected from any network access control (NAC) system to the service. Furthermore, the Cisco ISE API provider enables you to interface with network applications such as the TS-Agent on a Citrix server, where all users have the same IP address but are assigned unique ports.

For example, an agent running on a Citrix server that provides identity mappings for users authenticated against an Active Directory (AD) server can send REST requests to ISE to add or delete a user session whenever a new user logs in or off. ISE then takes the user identity information, including the IP address and assigned ports, delivered from the client and sends it to pre-configured subscribers, such as the Cisco Firepower Management Center (FMC).

The ISE REST API framework implements the REST service over the HTTPS protocol (no client certificate validation necessary) and the user identity information is delivered in JSON (JavaScript Object Notation) format. For more information about JSON, see http://www.json.org/ .

The ISE REST API service parses user identities and in addition, maps that information to port ranges, in order to distinguish between the different users logged in simultaneously to one system. Everytime a port is allocated to a user, the API sends a message to ISE.

The REST API Provider Flow

After you have configured a bridge to your customized client from ISE by declaring that client as a Provider for ISE and enabling that specific customized program (the client) to send RESTful requests, the ISE REST service works in the following way:

1. For client authentication, Cisco ISE requires an authentication token. A customized program on the client machine sends a request for an authentication token when initiating contact and then every time ISE notifies that the previous token has expired. The token is returned in response to the request, enabling ongoing communication between the client, and the ISE service.
2. After a user has logged into the network, the client retrieves user identity information and posts that information to the ISE REST service using the API Add command.
3. Cisco ISE receives and maps the user identity information.
4. Cisco ISE sends the mapped user identity information to the subscriber.
5. Whenever necessary, the customized machine can send a request to remove user information by sending a Remove API call and including the user ID received as the response when the Add call was sent.

Work with REST API Providers in ISE

Follow these steps to activate the REST service in ISE:

1. Configure the client side. For more information, see the client user documentation.
2. Activate Passive ID and pxGrid services. For more information, see Initial Setup and Configuration, on page 80.
3. Ensure you have properly configured the DNS server, including configuring reverse lookup for the client machine from ISE. For more information about the DNS server configuration requirements for , see DNS Server, on page 44

4. See Configure a Bridge to the ISE REST Service for Passive Identity Services, on page 94.

Note To configure the API Provider to work with a TS-Agent add the TS-Agent information when creating a bridge from ISE to that agent, and then consult with the TS-Agent documentation for information about sending API calls.

5. Generate an authentication token and send add and remove requests to the API service.

Configure a Bridge to the ISE REST Service for Passive Identity Services

In order to enable the ISE REST API service to receive information from a specific client, you must first define the specific client from Cisco ISE. You can define multiple REST API clients with different IP addresses.

Before you begin

Before you begin:

- Ensure you have activated Passive ID and pxGrid services. For more information, see Initial Setup and Configuration, on page 80.
- Ensure you have properly configured the DNS server, including configuring reverse lookup for the client machine from Cisco ISE. For more information about the DNS server configuration requirements for Cisco ISE, see DNS Server, on page 44

Step 1 Choose **Work Centers** > **PassiveID** > **Providers** and then choose **API Providers** from the left panel
The API Providers table is displayed, including status information for each existing client.

Step 2 To add a new client, click **Add** from the top of the table.

Step 3 Complete all mandatory fields in order to configure the client correctly. For more information, see API Provider Settings, on page 95.

Step 4 Click **Submit**.
The client configuration is saved and the screen displays the updated API Providers table. The client can now send posts to the ISE REST service.

What to do next

Set up your customized client to post authentication tokens and user identities to the ISE REST service. See Send API Calls to the Passive ID REST Service, on page 94.

Send API Calls to the Passive ID REST Service

Before you begin

Configure a Bridge to the ISE REST Service for Passive Identity Services, on page 94

Step 1 Enter the Cisco ISE URL in the address bar of your browser (for example, *https://<ise hostname or ip address>/admin/*)

Step 2 Enter the username and password that you specified and configured from the **API Providers** window. For more information, see Configure a Bridge to the ISE REST Service for Passive Identity Services, on page 94.

Step 3 Press **Enter**.

Step 4 Enter the API call in the URL Address field of the target node.

Step 5 Click **Send** to issue the API call.

What to do next

See API Calls, on page 95 for more information and details about the different API calls, their schemas and their results.

API Provider Settings

Note The full API definition and object schemas can be retrieved with a request call as follows:

- For the full API specifications (wadl)—https://YOUR_ISE:9094/application.wadl
- For the API model and object schemas—https://YOUR_ISE:9094/application.wadl/xsd0.xsd

Table 24: API Providers Settings

Field	Description
Name	Enter a unique name for this client that distinguishes it quickly and easily from other clients.
Description	Enter a clear description of this client.
Status	Select **Enabled** to enable the client to interact with the REST services immediately upon completing configuration.
Host/ IP	Enter the IP address for the client host machine. Ensure you have properly configured the DNS server, including configuring reverse lookup for the client machine from ISE.
User name	Create a unique user name to be used when posting to the REST service.
Password	Create a unique password to be used when posting to the REST service.

API Calls

Use these API calls to manage user identity events for Passive Identity services with Cisco ISE.

Purpose: Generate Authentication Token

- **Request**

  POST

  https://<PIC IP address>:9094/api/fmi_platform/v1/identityauth/generatetoken

The request should contain the BasicAuth authorization header. Provide the API provider's credentials as previously created from the ISE-PIC GUI. For more information see API Provider Settings, on page 95.

- **Response Header**

  The header includes the X-auth-access-token. This is the token to be used when posting additional REST requests.

- **Response Body**

  HTTP 204 No Content

Purpose: Add User

- **Request**

  POST

  https://<PIC IP address>:9094/api/identity/v1/identity/useridentity

  Add X-auth-access-token in the header of the POST request, for example, Header: X-auth-access-token, Value: f3f25d81-3ac5-43ee-bbfb-20955643f6a7

- **Response Header**

  201 Created

- **Response Body**

  {

  "user": "<username>",

  "srcPatRange": {

  "userPatStart": <user PAT start value>,

  "userPatEnd": <user PAT end value>,

  "patRangeStart": <PAT range start value>

  },

  "srcIpAddress": "<src IP address>",

  "agentInfo": "<Agent name>",

  "timestamp": "<ISO_8601 format i.e. “YYYY-MM-DDTHH:MM:SSZ" >",

  "domain": "<domain>"

  }

- **Notes**

  - srcPatRange can be removed in above json to create a single IP user binding.
  - Response body contains the "ID" which is the unique identifier for the user session binding created. Use this ID when sending a DELETE request to indicate which user should be removed.
  - This reponse also contains the self link which is the URL for this newly created user session binding.

Purpose: Remove User

- **Request**

  DELETE

  https://<PIC IP address>:9094/api/identity/v1/identity/useridentity/<id>

  In <id> enter the ID as was received from the Add response.

  Add the X-auth-access-token in the header of the DELETE request, for example, Header: X-auth-access-token, Value: f3f25d81-3ac5-43ee-bbfb-20955643f6a7

- **Response Header**

  200 OK

- **Response Body**

  Response body contains the details about the user session binding which got deleted.

SPAN

SPAN is a Passive Identity service that allows you to quickly and easily enable Cisco ISE to listen to the network and retrieve user information without having to configure Active Directory to work directly with Cisco ISE. SPAN sniffs network traffic, specifically examining Kerberos messages, extracts user identity information also stored by Active Directory and sends that information to ISE. ISE then parses the information, ultimately delivering user name, IP address and domain name to the subscribers that you have also already configured from ISE.

In order for SPAN to listen to the network and extract Active Directory user information, ISE and Active Directory must both be connected to the same switch on the network. In this way, SPAN can copy and mirror all user identity data from Active Directory.

With SPAN, user information is retrieved in the following way:

1. The user endpoint logs in to the network.
2. Log in and user data are stored in Kerberos messages.
3. When the user logs in and the user data passes through the switch, SPAN mirrors the network data.
4. Cisco ISE listens to the network for user information and retrieves the mirrored data from the switch.
5. Cisco ISE parses the user information and updates passive ID mappings.
6. Cisco ISE delivers the parsed user information to the subscribers.

Working with SPAN

Before you begin

In order to enable ISE to receive SPAN traffic from a network switch, you must first define which nodes and node interfaces are to listen to the switch. You can configure SPAN in order to listen to the different installed ISE nodes. For each node, only one interface can be configured to listen to the network and the interface used to listen must be dedicated to SPAN only.

Before you begin, ensure you have activated Passive ID and pxGrid services. Only nodes for which Passive ID has been turned on will appear in the list of available interfaces for configuring SPAN. For more information, see Initial Setup and Configuration, on page 80.

In addition, you must:

- Ensure Active Directory is configured on your network.
- Run a CLI on the switch in the network that is also connected to Active Directory in order to ensure the switch can communicate with ISE.
- Configure the switch to mirror the network from AD.
- Configure a dedicated ISE network interface card (NIC) for SPAN. This NIC is used only for SPAN traffic.
- Ensure the NIC that you have dedicated to SPAN is activated via the command line interface.
- Create a VACL that sends only Kerberos traffic into the SPAN port.

Step 1 Choose **Work Centers** > **PassiveID** > **Providers** and then choose **SPAN** from the left panel to configure SPAN.

Step 2 **Note** We recommend that the GigabitEthernet0 network interface card (NIC) remain available and that you select any other available NIC for configuring SPAN. GigabitEthernet0 is used for system management purposes.

Enter a meaningful description (optional), select status **Enabled**, and choose the nodes and the relevant NICs that will be used to listen to the network switch. For more information, see SPAN Settings, on page 98.

Step 3 Click **Save**.
The SPAN configuration is saved and ISE-PIC ISE is now actively listening to network traffic.

SPAN Settings

From each node that you have deployed, quickly and easily configure ISE to receive user identities by installing SPAN on a client network.

Table 25: SPAN Settings

Field	Description
Description	Enter a unique description to remind you of which nodes and interfaces are currently enabled.
Status	Select **Enabled** to enable the client immediately upon completing configuration.
Interface NIC	Select one or more of the nodes installed for ISE, and then for each selected node, choose the node interface that is to listen to the network for information. **Note** We recommend that the GigabitEthernet0 NIC remain available and that you select any other available NIC for configuring SPAN. GigabitEthernet0 is used for system management purposes.

Syslog Providers

Passive Identity service parses syslog messages from any client (identity data provider) that delivers syslog messages, including regular syslog messages (from providers such as InfoBlox, Blue Coat, BlueCat, and Lucent) as well as DHCP syslog messages, and sends back user identity information, including MAC addresses. This mapped user identity data is then delivered to subscribers.

You can specify the syslog clients from which to receive the user identity data (see Configure Syslog Clients, on page 99). While configuring the provider, you must specify the connection method (TCP or UDP) and the syslog template to be used for parsing.

Note When TCP is the configured connection type, if there is a problem with the message header and the host name cannot be parsed, ISE attempts to match the IP address received in the packet to the IP address of any of the providers in the list of providers that have already been configured for Syslog messages in ISE. To view this list, choose **Work Centers** > **PassiveID** > **Providers** > **Syslog Providers**. We recommend that you check the message headers and customize if necessary to guarantee parsing succeeds. For more information about customizing headers, see Customize Syslog Headers, on page 104.

The syslog probe sends syslog messages that are received to the ISE parser, which maps the user identity information, and publishes that information to ISE. ISE then delivers the parsed and mapped user identity information to the Passive Identity service subscribers.

To parse syslog messages for user identity from ISE-PIC ISE:

- Configure syslog clients from which to receive user identity data. See Configure Syslog Clients, on page 99.
- Customize a single message header. See Customize Syslog Headers, on page 104.
- Customize message bodies by creating templates. See Customize the Syslog Message Body, on page 104.
- Use the message templates pre-defined in ISE when configuring your syslog client as the message template used for parsing, or base your customized header or body templates on these pre-defined templates. See Work with Syslog Predefined Message Templates, on page 108.

Configure Syslog Clients

In order to enable Cisco ISE to listen to syslog messages from a specific client, you must first define the specific client from Cisco ISE. You can define multiple providers with different IP addresses.

Before you begin

Before you begin, ensure you have activated Passive ID and pxGrid services. For more information, see Initial Setup and Configuration, on page 80.

Step 1 Choose **Work Centers** > **PassiveID** > **Providers** and then choose **Syslog Providers** from the left panel. The Syslog Providers table is displayed, including status information for each existing client.

Step 2 To configure a new syslog client, click **Add** from the top of the table.

Step 3 Complete all mandatory fields (see Syslog Settings, on page 100 for more details) and create a message template if necessary (see Customize the Syslog Message Body, on page 104 for more details) to configure the client correctly.

Step 4 Click **Submit**.

Syslog Settings

Configure Cisco ISE to receive user identities, including MAC addresses, by way of syslog messages from a specific client. You can define multiple providers with different IP addresses.

Table 26: Syslog Providers

Field Name	Description
Name	Enter a unique name that distinguishes this configured client quickly and easily.
Description	A meaningful description of this Syslog provider.
Status	Select **Enabled** to enable the client immediately upon completing configuration.
Host	Enter the FQDN of the host machine.
Connection Type	Enter UDP or TCP to indicate the channel by which ISE listens for syslog messages. **Note** When TCP is the configured connection type, if there is a problem with the message header and the host name cannot be parsed, then Cisco ISE attempts to match the IP address received in the packet to the IP address of any of the providers in the list of providers that have already been configured for Syslog messages in Cisco ISE. To view this list, choose **Work Centers** > **PassiveID** > **Providers** > **Syslog Providers**. We recommend that you check the message headers and customize if necessary to ensure that parsing succeeds. For more information about customizing headers, see Customize Syslog Headers, on page 104.

Field Name	Description
Template	

Field Name	Description
	A template indicates precise body message structure so that the parser can identify the pieces of information within the syslog message that should be parsed, mapped and delivered. For example, a template can indicate the exact position of the user name so that the parser can find the user name in every message received. From this field, indicate the template (for the body of the syslog message) to be used in order to recognize and correctly parse the syslog message. Choose either from the pre-defined dropdown list, or click **New** to create your own customized template. For more information about creating new templates, see Customize the Syslog Message Body, on page 104. Most of the pre-defined templates use regular expressions, and customized templates should also use regular expressions. **Note** Only customized templates can be edited or removed, while pre-defined system templates in the dropdown cannot be altered. ISE currently offers these pre-defined DHCP provider templates: • InfoBlox • BlueCat • Lucent_QIP • DHCPD • MSAD DHCP **Note** DHCP syslog messages do not contain user names. Therefore, these messages are delivered from the parser with a delay so that Cisco ISE can first check users registered in the local session directory (displayed from Live Sessionss) and attempt to match those users by their IP addresses to the IP addresses listed in the DHCP syslog messages received, in order to correctly parse and deliver user identity information. If the data received from a DHCP syslog message cannot be matched to any of the currently logged in users, then the message is not parsed and user identity is not delivered. Cisco ISE offers these pre-defined regular syslog provider templates: • ISE • ACS • F5_VPN • ASA_VPN • Blue Coat • Aerohive • Safe connect_NAC

Field Name	Description
	• Nortel_VPN For information about templates, see Work with Syslog Predefined Message Templates, on page 108.
Default Domain	If the domain is not identified in the syslog message for the specific user, this default domain is automatically assigned to the user in order to ensure that all users are assigned a domain. With the default domain or with the domain that was parsed from the message, the user name is appended to username@domain, thereby including that domain, in order to get more information about the user and user groups.

Customize Syslog Message Structures (Templates)

A template indicates precise message structure so that the parser can identify the pieces of information within the syslog message that should be parsed, mapped and delivered. For example, a template can indicate the exact position of the user name so that the parser can find the user name in every message received. Templates determine the supported structures for both new and remove mapping messages.

Cisco ISE enables you to customize a single message header and multiple body structures, to be used by the Passive ID parser.

The templates should include regular expressions to define the structure for user name, IP address, MAC address and domain in order to enable the Passive ID parser to correctly identify whether the message is to add or remove user identity mapping and to correctly parse the user details.

When customizing your message templates, you can choose to base your customization on the message templates pre-defined in ISE-PIC ISE by consulting with the regular expressions and message structures used within those pre-defined options. For more information about the pre-defined template regular expressions, message structures, examples and more, see Work with Syslog Predefined Message Templates, on page 108.

You can customize:

- A single message header—Customize Syslog Headers, on page 104
- Multiple message bodies—Customize the Syslog Message Body, on page 104.

Note DHCP syslog messages do not contain user names. Therefore, these messages are delivered from the parser with a delay so that Cisco ISE can first check users registered in the local session directory (displayed from Live Sessionss) and attempt to match those users by their IP addresses to the IP addresses listed in the DHCP syslog messages received, in order to correctly parse and deliver user identity information. If the data received from a DHCP syslog message cannot be matched to any of the currently logged in users, then the message is not parsed and user identity is not delivered.

The delay necessary to properly match, parse and map details from DHCP messages cannot be applied to customized templates, and therefore it is not recommended that DHCP message templates be customized. Instead, use any of the pre-defined DHCP templates.

Customize the Syslog Message Body

Cisco ISE enables you to customize your own syslog message templates (by customizing the message body) to be parsed by the Passive ID parser. The templates should include regular expressions to define the structure for user name, IP address, MAC address and domain.

Note DHCP syslog messages do not contain user names. Therefore, these messages are delivered from the parser with a delay so that Cisco ISE can first check users registered in the local session directory (displayed from Live Sessionss) and attempt to match those users by their IP addresses to the IP addresses listed in the DHCP syslog messages received, to correctly parse and deliver user identity information. If the data received from a DHCP syslog message cannot be matched to any of the currently logged in users, then the message is not parsed and user identity is not delivered.

The delay necessary to properly match, parse and map details from DHCP messages cannot be applied to customized templates, and therefore it is not recommended that DHCP message templates be customized. Instead, use any of the pre-defined DHCP templates.

Create and edit syslog message body templates from within the syslog client configuration screen.

Note You can only edit your own customized templates. Pre-defined templates offered by the system cannot be changed.

Step 1 Choose **Work Centers** > **PassiveID** > **Providers** and then choose **Syslog Providers** from the left panel.
The Syslog Providers table is displayed, including status information for each existing client.

Step 2 Click **Add** to add a new syslog client or **Edit** to update an already configured client. For more information about configuring and updating syslog clients, see Configure Syslog Clients, on page 99.

Step 3 In the **Syslog Providers** window, click **New** to create a new message template. To edit an existing template, select the template from the dropdown list and click **Edit**.

Step 4 Complete all mandatory fields.

For information about how to enter the values correctly, see Syslog Customized Template Settings and Examples, on page 106.

Step 5 Click **Test** to ensure the message is correctly parsed based on the strings you have entered.

Step 6 Click **Save**.

Customize Syslog Headers

Syslog headers also contain the host name from which the message originated. If your syslog messages are not recognized by the Cisco ISE message parser, you may need to customize the message header by configuring the delimiter that proceeds the host name, thereby enabling Cisco ISE to recognize the host name and parse the message correctly. For more details about the fields in this screen, see Syslog Customized Template Settings and Examples, on page 106. The customized header configuration is saved and added to the header types that are used by the parser whenever messages are received.

Note You can only customize a single header. After you customize a header, when you click **Custom Header** and create a template, only the newest configuration is saved.

Step 1 Choose **Work Centers** > **PassiveID** > **Providers** and then choose **Syslog Providers** from the left panel.
The Syslog Providers table is displayed, including status information for each existing client.

Step 2 Click **Custom Header** to open the Syslog Custom Header screen.

Step 3 In the **Paste sample syslog** field, enter an example of the header format in your syslog messages. For example, copy and paste this header from one of your messages: `<181>Oct 10 15:14:08 Cisco.com`.

Step 4 In the **Separator** field, indicate whether words are separated by spaces or tabs.

Step 5 In the **Position of hostname in header** field, indicate which place in the header is the host name. For example, in the header offered above, the host name is the fourth word in the header. Enter 4 to indicate this.

The **Hostname** field displays the host name based on the details indicated in the first three fields. For example, if the header example in **Paste sample syslog** is as follows:

<181>Oct 10 15:14:08 Cisco.com

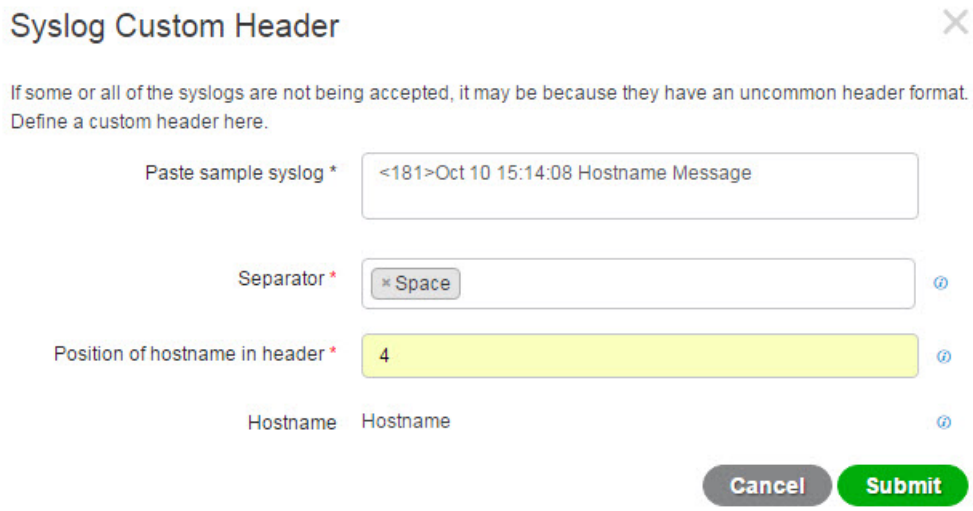
The separator is indicated as **Space** and the **Position of hostname in header** is entered as 4.

The **Hostname** will automatically appear as Cisco.com, which is the fourth word in the header phrase pasted in the **Paste sample syslog** field.

If the host name is incorrectly displayed, check the data you have entered in the **Separator** and **Position of hostname in header** fields.

This example is as in the following screen capture:

Figure 9: Customize Syslog Headers



Step 6 Click **Submit**.

The customized header configuration is saved and added to the header types that are used by the parser whenever messages are received.

Syslog Customized Template Settings and Examples

Cisco ISE enables you to customize your own syslog message templates to be parsed by the Passive ID parser. Customized templates determine the supported structures for both new and remove mapping messages. The templates should include regular expressions to define the structure for user name, IP address, MAC address and domain in order to enable the Passive ID parser to correctly identify whether the message is to add or remove user identity mapping and to correctly parse the user details.

Note Most of the pre-defined templates use regular expressions. Customized templates should also use regular expressions.

Syslog Header Parts

You can customize a single header that is recognized by the Syslog probe by configuring the delimiter that proceeds the host name.

The following table describes the different parts and fields that can be included in your customized syslog header. For more information about regular expressions, see Table 29: Regular Expressions for Customized Templates, on page 108.

Table 27: Syslog Custom Header

Field	Description
Paste sample syslog	Enter an example of the header format in your syslog messages. For example, copy and paste this header: `<181>Oct 10 15:14:08 Hostname Message`
Separator	Indicate whether words are separated by spaces or tabs.
Position of hostname in header	Indicate which place in the header is the host name. For example, in the header offered above, the host name is the fourth word in the header. Enter 4 to indicate this.
Hostname	Displays the hostname based on the details indicated in the first three fields. For example, if the header example in **Paste sample syslog** is as follows: <181>Oct 10 15:14:08 Hostname Message The separator is indicated as **Space** and the **Position of hostname in header** is entered as 4. The **Hostname** will automatically appear as Hostname. If the host name is incorrectly displayed, check the data you have entered in the **Separator** and **Position of hostname in header** fields.

Syslog Template Parts and Descriptions for the Message Body

The following table describes the different parts and fields that can be included in your customized syslog message templates. For more information about regular expressions, see Table 29: Regular Expressions for Customized Templates, on page 108.

Table 28: Syslog Template

Part	Field	Description
	Name	A unique name by which to recognize the purpose of this template.
Mapping Operations	New Mapping	A regular expression that describes the kind of mapping used with this template to add a new user. For example, enter "logged on from" in this field to indicate a new user that has logged on to the F5 VPN.
	Removed Mapping	A regular expression that describes the kind of mapping used with this template to remove a user. For example, enter "session disconnect" in this field to indicate a user that should be removed for ASA VPN.
User Data	IP Address	A regular expression that indicates the IP addresses to be captured. For example, for Bluecat messages, to capture identities for users within this IP address range, enter: (\d{3}(25[0-4]|2[0-4][0-9]|[01][0-9][0-9])\.){3}(25[0-4]|2[0-4][0-9]|[01][0-9][0-9])
	User Name	A regular expression that indicates the user name format to be captured.
	Domain	A regular expression that indicates the domain to be captured.
	Mac Address	A regular expression that indicates the MAC address format to be captured.

Regular Expression Examples

In order to parse messages use regular expressions. This sections offers regular expression examples in order to parse IP address, user name and add mapping messages.

For example, use regular expressions to parse the following messages:

<174>192.168.0.1 %ASA-4-722051: Group <DfltGrpPolicy> User <user1> IP <192.168.0.10> IPv4 Address <192.168.0.6> IPv6 address <::> assigned to session

<174>192.168.0.1 %ASA-6-713228: Group = xyz, Username = user1, IP = 192.168.0.12, Assigned private IP address 192.168.0.8 to remote user

The regular expressions are as defined in the following table.

Table 29: Regular Expressions for Customized Templates

Part	Regular Expression
IP address	Address <([^\s]+)>|address ([^\s]+)
User name	User <([^\s]+)>| Username = ([^\s]+)
Add mapping message	(%ASA-4-722051|%ASA-6-713228)

Work with Syslog Predefined Message Templates

Syslog messages have a standard structure which include a header and the message body.

The predefined templates offered by Cisco ISE are described in this section, including content details for the headers that are supported, as well as the supported body structure, based on the origin of the messages.

In addition, you can create your own templates with customized body content for sources that are not predefined in the system. The supported structure for customized templates is also described in this section. You can configure a single customized header to be used in addition to the headers predefined in the system, when parsing messages, and you can configure multiple customized templates for the message body. For more information about customizing the header, see Customize Syslog Headers, on page 104. For more information about customizing the body, see Customize the Syslog Message Body, on page 104.

Note Most of the predefined templates use regular expressions, and customized templates should also use regular expressions.

Message Headers

There are two header types recognized by the parser, for all message types (new and remove), for all client machines. These headers are as follows:

- <171>Host message
- <171>Oct 10 15:14:08 Host message

Once received, the header is parsed for host name, which can be IP address, hostname, or full FQDN.

Headers can also be customized. To customize your headers, see Customize Syslog Headers, on page 104.

Syslog ASA VPN Pre-Defined Template

The supported syslog message format and types for ASA VPN are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Body Messages

There are different ASA VPN body messages that are recognized by the parser as described in the following table.

Body Message	Parsing Example
%ASA-6-109005 Authentication succeeded for user UserA from 10.0.0.11/100 to 10.10.11.11/20 on interface eth1/1	[UserA,10.0.0.11]
%ASA-6-602303 IPSEC: An direction tunnel_type SA (SPI=spi) between local_IP and 10.0.0.11 (UserA) has been created.	
%ASA-6-721016 (device) WebVPN session for client user UserA, IP 10.0.0.11 has been created.	
%ASA-6-603104 PPTP Tunnel created, tunnel_id is number, remote_peer_ip is remote_address, ppp_virtual_interface_id is number,\ client_dynamic_ip is 10.0.0.11,ffg123 #% UserA is UserA, MPPE_key_strength is string	
%ASA-6-603106 L2TP Tunnel created, tunnel_id is number, remote_peer_ip is remote_address, ppp_virtual_interface_id is number,\ client_dynamic_ip is 10.0.0.11, UserA is user	

Body Message	Parsing Example
%ASA-6-113039 Group group User UserA IP 10.0.0.11 agent parent session started.	
%ASA-6-802001 User UserA IP 10.100.1.1 OS os_name UDID number MDM action session started.	
%ASA-6-713228: Group = xyz, UserA = xxxx227, IP = 192.168.0.11, Assigned private IP address 172.16.0.11 to remote user	[UserA,172.16.0.11] **Note** The parsed IP address from this message type is the private IP address, as indicated in the message.
%ASA-4-722051: Group <DfltGrpPolicy> User <UserA> IP <172.16.0.12> IPv4 Address <172.16.0.21> IPv6 address <::> assigned to session	[UserA,172.16.0.12] **Note** The parsed IP address from this message type is the IPv4 address.

Remove Mapping Body Messages

The Remove Mapping messages supported for ASA VPN by the parser are as described in this section.

Once received, the body is parsed for user details as follows:

[UserA,10.1.1.1]

Body Message
%ASA-4-113019 Group = group, UserA = UserA, IP = 10.1.1.1, Session disconnected. Session Type: type, Duration:\ duration, Bytes xmt: count,Bytes rcv: count, Reason: reason
%ASA-4-717052 Group group name User UserA IP 10.1.1.1 Session disconnected due to periodic certificate authentication failure. Subject Name id subject name Issuer Name id issuer name\ Serial Number id serial number
%ASA-6-602304 IPSEC: An direction tunnel_type SA (SPI=spi) between local_IP and 10.1.1.1 (UserA) has been deleted.

Body Message
%ASA-6-721018 WebVPN session for client user UserA, IP 10.1.1.1 has been deleted.
%ASA-4-722049 Group group User UserA IP 10.1.1.1 Session terminated: SVC not enabled or invalid image on the ASA
%ASA-4-722050 Group group User UserA IP 10.1.1.1 Session terminated: SVC not enabled for the user.
%ASA-6-802002 User UserA IP 10.1.1.1 OS os_name UDID number MDM action session terminated.
%ASA-3-716057 Group group User UserA IP 10.1.1.1 Session terminated, no type license available.
%ASA-3-722046 Group group User UserA IP 10.1.1.1 Session terminated: unable to establish tunnel.
%ASA-4-113035 Group group User UserA IP 10.1.1.1 Session terminated: Agent not enabled or invalid agent image on the ASA.
%ASA-4-716052 Group group-name User UserA IP 10.1.1.1 Pending session terminated.
%ASA-6-721018 WebVPN session for client user UserA, IP 10.1.1.1 has been deleted.

Syslog Bluecat Pre-Defined Template

The supported syslog message format and types for Bluecat are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Body Messages

The messages supported for New Mapping for Bluecat syslog are as described in this section.

Once received, the body is parsed for user details as follows:

[macAddress=nn:xx:nn:ca:xx:nn,ip=172.16.0.12]

Body
Nov 7 23:37:32 xx-campus1 dhcpd: DHCPACK on 172.16.0.13 to nn:xx:nn:ca:xx:nn via 172.16.0.17

Remove Mapping Messages

There are no remove mapping messages known for Bluecat.

Syslog F5 VPN Pre-Defined Template

The supported syslog message format and types for F5 VPN are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Body Messages

There are different F5 VPN body messages that are recognized by the parser as described in the following table.

Once received, the body is parsed for user details as follows:

[user=UserA,ip=172.16.0.12]

Body
Apr 10 09:33:58 Oct 2 08:28:32 abc.xyz.org security[nnnnn]: [UserA@vendor-abcr] User UserA logged on from 172.16.0.21 to \ 172.16.0.12 Sid = xyz\

Remove Mapping Messages

Currently there are no remove messages for F5 VPN that are supported.

Syslog Infoblox Pre-Defined Template

The supported syslog message format and types for Infoblox are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Body Messages

There are different ASA VPN body messages that are recognized by the parser as described in the following table.

Once received, the body is parsed for user details as follows:

[macAddress= nn:xx:xx:xx:nn:nn,ip=10.0.10.100]

Body Message
Nov 15 11:37:26 user1-lnx dhcpd[3179]: DHCPACK on 10.0.0.14 to nn:xx:xx:nx:nn:nn (android-df67ddcbb1271593) via eth2 relay 10.0.0.24 lease-duration 3600
Nov 15 11:38:11 user1-lnx dhcpd[3179]: DHCPACK on 172.16.0.18 to nn:xx:xx:xn:nn:nn (DESKTOP-HUDGAAQ) via eth2 relay 172.16.0.13 lease-duration 691200 (RENEW)
Nov 15 11:38:11 192.168.0.12 dhcpd[25595]: DHCPACK to 10.0.0.11 (nn:xx:xx:xn:nn:nx) via eth1

Remove Mapping Messages

Once received, the body is parsed for user details as follows:

- If MAC address is included:

  [00:0c:29:a2:18:34,10.0.10.100]

- If MAC address is not included:

  [10.0.10.100]

Body Message
07-11-2016 23:37:32 Daemon.Info 10.0.10.2 Jul 12 10:42:26 10.0.10.2 dhcpd[26083]: DHCPEXPIRE 10.0.10.100 has expired
07-11-2016 23:37:32 Daemon.Info 10.0.10.2 Jul 12 10:42:26 10.0.10.2 dhcpd[26083]: DHCPRELEASE of 10.0.10.100 from 00:0c:29:a2:18:34 \ (win10) via eth1 uid 01:00:0c:29:a2:18:34
07-11-2016 23:37:32 Daemon.Info 10.0.10.2 Jul 12 10:42:26 10.0.10.2 dhcpd[25595]: RELEASE on 10.20.31.172 to c0:ce:cd:44:4f:bd

Syslog Linux DHCPd3 Pre-Defined Template

The supported syslog message format and types for Linux DHCPd3 are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Messages

There are different Linux DHCPd3 body messages that are recognized by the parser as described in the following table.

Once received, the body is parsed for user details as follows:

[macAddress=24:ab:81:ca:f2:72,ip=172.16.0.21]

Body Message
Nov 11 23:37:32 dhcpsrv dhcpd: DHCPACK on 10.0.10.100 to 00:0c:29:a2:18:34 (win10) via eth1
Nov 11 23:37:32 dhcpsrv dhcpd: DHCPACK on 10.0.10.100 (00:0c:29:a2:18:34) via eth1

Remove Mapping Body Messages

The Remove Mapping messages supported for Linux DHCPd3 by the parser are as described in this section.

Once received, the body is parsed for user details as follows:

[00:0c:29:a2:18:34 ,10.0.10.100]

Body Message
Nov 11 23:37:32 dhcpsrv dhcpd: DHCPEXPIRE 10.0.10.100 has expired
Nov 11 23:37:32 dhcpsrv dhcpd: DHCPRELEASE of 10.0.10.100 from 00:0c:29:a2:18:34 (win10) via eth1

Syslog MS DHCP Pre-Defined Template

The supported syslog message format and types for MS DHCP are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Body Messages

There are different MS DHCP body messages that are recognized by the parser as described in the following table.

Once received, the parser divides data by searching for the comma (,) and then messages of these formats are parsed as in the following example:

[macAddress=000C29912E5D,ip=10.0.10.123]

Body Message
Nov 11 23:37:32 10,07/21/16,16:55:22,Assign,10.0.10.123,win10.IDCSPAN.Local,000C29912E5D,,724476048,0,,,,,0x4D53465420352E30,MSFT,5.0

Remove Mapping Body Messages

The Remove Mapping messages supported for MS DHCP by the parser are as described in this section.

Once received, the parser divides data by searching for the comma (,) and then messages of these formats are parsed as in the following example:

[macAddress=000C29912E5D,ip=10.0.10.123]

Body Message
Nov 11 23:37:32 12,07/21/16,16:55:18,Release,10.0.10.123,win10.IDCSPAN.Local,000C29912E5D,,3128563632,\ 0,,,,,,,,,0

Syslog SafeConnect NAC Pre-Defined Template

The supported syslog message format and types for SafeConnect NAC are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Body Messages

There are different SafeConnect NAC body messages that are recognized by the parser as described in the following table.

Once received, the body is parsed for user details as follows:

[user=galindk1i,p=xxxx.xx.xxx.xxd,domain=Resnet-Macs]

Body Message
Apr 10 09:33:58 nac Safe*Connect: authenticationResult|xxx.xx.xxx.xxx|xxx.xx.xxx.xxx|UserA|true|Resnet-Macs|TCNJ-Chain|001b63b79018|MAC

Remove Mapping Messages

Currently there are no remove messages for Safe Connect that are supported.

Syslog Aerohive Pre-Defined Templates

The supported syslog message format and types for Aerohive are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Body Messages

There are different Aerohive body messages that are recognized by the parser as described in the following table.

Details parsed from the body include user name and IP address. The regular expression used for parsing is as in the following examples:

- `New mapping—auth\:`
- `IP—ip ([A-F0-9a-f:.]+)`
- `User name—UserA ([a-zA-Z0-9\_]+)`

Once received, the body is parsed for user details as follows:

[UserA,10.5.50.52]

Body Message
2013-04-01 14:06:05 info ah auth: Station 1cab:a7e6:cf7f ip 10.5.50.52 UserA UserA

Remove Mapping Messages

Currently the system does not support remove mapping messages from Aerohive.

Syslog Blue Coat Pre-Defined Templates—Main Proxy, Proxy SG, Squid Web Proxy

The system supports the following message types for Blue Coat:

- BlueCoat Main Proxy
- BlueCoat Proxy SG
- BlueCoat Squid Web Proxy

The supported syslog message format and types for Bluecoat messages are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Body Messages

There are different Blue Coat body messages that are recognized by the parser as described in the following table.

Once received, the body is parsed for user details as follows:

[UserA,192.168.10.24]

Body Message (this example is taken from a BlueCoat Proxy SG message)
2016-09-21 23:05:33 58 10.0.0.1 UserA - - PROXIED "none" http://www.example.com/ 200 TCP_MISS GET application/json;charset=UTF-8 http site.api.example.com 80 /apis/v2/scoreboard/header ?rand=1474499133503 - "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/46.0.2486.0 Safari/537.36 Edge/13.10586" 192.168.10.24 7186 708 - "unavailable

The following table describes the different regular expression structures used per client for new mapping messages.

Client	Regular expressions
BlueCoat Main Proxy	New mapping **(TCP_HIT|TCP_MEM){1}** IP **\s((?:(?:[0-9]{1,3}\.){3}[0-9]{1,3})|(?:(?:[a-zA-Z0-9]{1,4}\:{1,2}){1,7}[a-zA-Z0-9]{1,4}))\s** User name **\s\-\s([a-zA-Z0-9_]+)\s\-\s**
BlueCoat Proxy SG	New mapping **(\-\sPROXIED){1}** IP **\s((?:(?:[0-9]{1,3}\.){3}[0-9]{1,3})|(?:(?:[a-zA-Z0-9]{1,4}\:{1,2}){1,7}[a-zA-Z0-9]{1,4}))\s[a-zA-Z0-9_]+\s\-** User name **\s[0-9]{1,3}\.[0-9]{1,3}\.[0-9]{1,3}\.[0-9]{1,3}\s([a-zA-Z0-9_]+)\s\-**
BlueCoat Squid Web Proxy	New mapping **(TCP_HIT|TCP_MEM){1}** IP **\s((?:(?:[0-9]{1,3}\.){3}[0-9]{1,3})|(?:(?:[a-zA-Z0-9]{1,4}\:{1,2}){1,7}[a-zA-Z0-9]{1,4}))\sTCP** User name **\s([a-zA-Z0-9\._]+)\s\-\/**

Remove Mapping Messages

Remove mapping messages are supported for Blue Coat clients, though no examples are currently available.

The following table describes the different known regular expression structure examples used per client for remove mapping messages.

Client	Regular expressions
BlueCoat Main Proxy	**(TCP_MISS|TCP_NC_MISS){1}**
BlueCoat Proxy SG	No example currently available.
BlueCoat Squid Web Proxy	**(TCP_MISS|TCP_NC_MISS){1}**

Syslog ISE and ACS Pre-Defined Templates

When listening to ISE or ACS clients, the parser receives the following message types:

- Pass authentication: When the user is authenticated by ISE or ACS, the pass authentication message is issued notifying that authentication succeeded, and including user details. The message is parsed and the user details and session ID are saved from this message.
- Accounting start and accounting update messages (new mapping): The accounting start or accounting update message is parsed with the user details and session ID that were saved from the Pass Authentication message and then the user is mapped.
- Accounting stop (remove mapping): The user mapping is deleted from the system.

The supported syslog message format and types for ISE and ACS are as described below.

Pass Authentication Messages

The following messages are supported for Pass Authentication.

- **Header**

  ```
  <181>Sep 13 10:51:41 Server logTag messageId totalFragments currentFragments message
  ```

  For example: <181>Sep 13 10:51:41 Positron CISE_PassiveID 0000005255 1 0 message

- **Body**

  Passed-Authentication 000011 1 0 2016-05-09 12:48:11.011 +03:00 0000012435 5200 NOTICE Passed-Authentication: Authentication succeeded, ConfigVersionId=104, Device IP Address=10.0.0.12, DestinationIPAddress=10.0.0.18, DestinationPort=1812, UserA=UserA, Protocol=Radius, RequestLatency=45, NetworkDeviceName=DefaultNetworkDevice, User-Name=UserA, NAS-IP-Address=10.0.0.1, Session-Timeout=90, Calling-Station-ID=, cisco-av-pair=audit-session-id=5

- **Parsing Example**

  User name and session ID only are parsed.

  [UserA,5]

Accounting Start/Update (New Mapping) Messages

The following messages are supported for New Mapping.

- **Header**

```
<181>Sep 13 10:51:41 Server logTag messageId totalFragments currentFragments message
```

For example: <181>Sep 13 10:51:41 Positron CISE_PassiveID 0000005255 1 0 message

- **Body**

  CISE_RADIUS_Accounting 000011 1 0 2016-05-09 12:53:52.823 +03:00 0000012451 3000 NOTICE Radius-Accounting: RADIUS Accounting start request, ConfigVersionId=104, Device IP Address=10.0.0.12, RequestLatency=12, NetworkDeviceName=DefaultNetworkDevice, User-Name=UserA, NAS-IP-Address=10.0.0.1, Framed-IP-Address=10.0.0.16, Session-Timeout=90, Calling-Station-ID=, Acct-Status-Type=Start, Acct-Session-Id=6, cisco-av-pair=audit-session-id=5

- **Parsing Example**

  Parsed details include user name, and framed IP address, as well as the MAC address if it is included in the message.

  [UserA,10.0.0.16]

Remove Mapping Messages

The following messages are supported for Remove Mapping.

- **Header**

  ```
  <181>Sep 13 10:51:41 Server logTag messageId totalFragments currentFragments message
  ```

  For example: <181>Sep 13 10:51:41 Positron CISE_PassiveID 0000005255 1 0 message

- **Body**

  2016-05-09 12:56:27.274 +03:00 0000012482 3001 NOTICE Radius-Accounting: RADIUS Accounting stop request, ConfigVersionId=104, Device IP Address=10.0.0.17, RequestLatency=13, NetworkDeviceName=DefaultNetworkDevice, User-Name=UserA, NAS-IP-Address=10.0.0.1, Framed-IP-Address=10.0.0.16, Session-Timeout=90, Calling-Station-ID=, Acct-Status-Type=Stop, Acct-Session-Id=104, cisco-av-pair=audit-session-id=5

- **Parsing Example**

  Parsed details include user name, and framed IP address, as well as the MAC address if it is included in the message.

  [UserA,10.0.0.16]

Syslog Lucent QIP Pre-Defined Template

The supported syslog message format and types for Lucent QIP are as described below.

Headers

Headers supported by the parser are identical for all clients, as described in Work with Syslog Predefined Message Templates, on page 108.

New Mapping Body Messages

There are different Lucent QIP body messages that are recognized by the parser as described in the following table.

The regular expression structure for these messages is as follows:

DHCP_GrantLease|:DHCP_RenewLease

Once received, the body is parsed for user details as follows:

[00:0C:29:91:2E:5D,10.0.0.11]

Body Message
DHCP:subtype=0:Single:$IGNORE_N$ DHCP_GrantLease: Host=$HOSTNAME$ P=10.0.0.11 MAC=00:0C:29:91:2E:5D
DHCP:subtype=0:Single:$IGNORE_N$ DHCP_RenewLease: Host=$HOSTNAME$ P=10.0.0.11 MAC=00:0C:29:91:2E:5D

Remove Mapping Body Messages

The regular expression structure for these messages is as follows:

Delete Lease:|DHCP Auto Release:

Once received, the body is parsed for user details as follows:

[10.0.0.11]

Body Message
DHCP:subtype=0:Single:$IGNORE_N$ Delete Lease: IP=10.0.0.11 $IGNORE_N$
DHCP:subtype=0:Single:$IGNORE_N$ DHCP Auto Release: IP=10.0.0.11 $IGNORE_N$

Filter Passive Identity Services

You can filter certain users, based on their name or IP address. For example, if you have an administrator from IT services who logs in to an endpoint in order to assist the regular user with that endpoint, you can filter out the administrator activity so it does not appear in Live Sessions, but rather only the regular user of that endpoint will appear. The Live Session shows Passive Identity service components that are not filtered out by the Mapping Filters. You can add as many filters as needed. The "OR" logic operator applies between filters. If both the fields are specified in a single filter, the "AND" logic operator applies between these fields.

Step 1 Choose **Work Centers** > **PassiveID** > **Providers** and then from the left panel choose **Mapping Filters**.

Step 2 Choose **Providers** > **Mapping Filters**.

Step 3 Click **Add**, enter the Username and or IP address of the user you want to filter and click **Submit**.

Step 4 To view the non-filtered users that are currently logged into the Monitoring session directory, choose **Operations** > **RADIUS Livelog**.

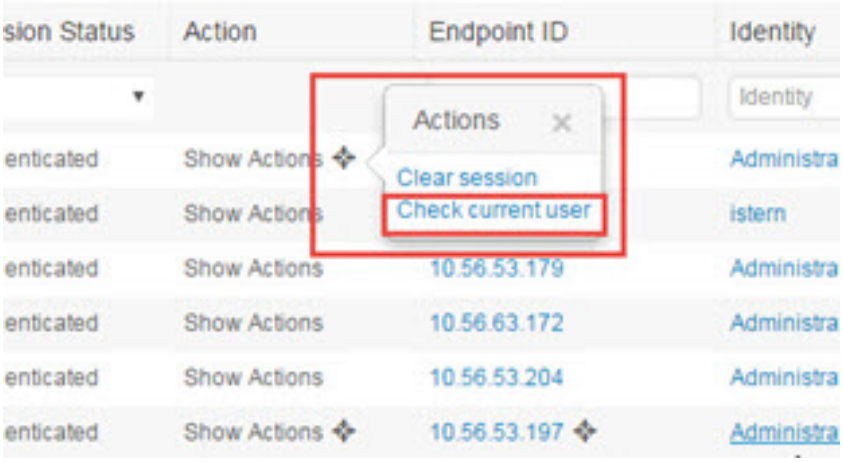
Endpoint Probe

In addition to the customized providers that you can configure the Endpoint probe is enabled in ISE when the Passive Identity service is activated and always runs in the background. The Endpoint probe periodically checks whether each specific user is still logged in to the system.

Note In order to ensure Endpoint runs in the background, you must first configure an initial Active Directory join point and ensure you choose to **Store Credentials**. For more information about configuring the Endpoint probe, see Work with the Endpoint Probe, on page 122.

To manually check for endpoint status go to **Live Sessions** , from the **Actions** column, click **Show Actions** and choose **Check current user**, as in the following figure.

Figure 10: Check Current User



For more information about endpoint user status, and manually running the check, see RADIUS Live Sessions.

When the Endpoint probe recognizes that a user has connected, if 4 hours have passed since the last time the session was updated for the specific endpoint, it checks whether that user is still logged in and collects the following data:

- MAC address
- Operating system version

Based on the this check, the probe does the following:

- When the user is still logged in, the probe updates Cisco ISE with the status Active User.
- When the user has logged out, the session state is updated as Terminated and fifteen minutes later, the user is removed from the Session Directory.
- When the user cannot be contacted, for example, when a firewall prevents contact or the endpoint has shut down, the status is updated as Unreachable and the Subscriber policy will determine how to handle the user session. The endpoint will remain in the Session Directory.

Work with the Endpoint Probe

Before you begin

Create and enable Endpoint probes based on subnet ranges. One Endpoint probe can be created per PSN. To work with Endpoint probes, first ensure you have configured the following:

- Endpoints must have network connectivity to port 445.
- From ISE, configure an initial Active Directory join point and ensure you select **Select Credentials** when prompted. For more information about join points, see Active Directory as a Probe and a Provider, on page 81.

Note In order to ensure Endpoint runs in the background, you must first configure an initial Active Directory join point, which enables the Endpoint probe to run even when the Active Directory probe is not fully configured.

Step 1 Choose **Work Centers** > **Passive ID** > **Providers** and then choose **Endpoint Probes**.

Step 2 Click **Add** to create a new Endpoint probe.

Step 3 Complete the mandatory fields, ensuring you select **Enable** from the **Status** field, and click **Submit**. See Endpoint Probe Settings, on page 122 for more information.

Endpoint Probe Settings

Create a single Endpoint probe per PSN, based on subnet ranges. If you have multiple PSNs in your deployment, then you can allot each PSN for a separate set of subnets.

Table 30: Endpoint Probes Settings

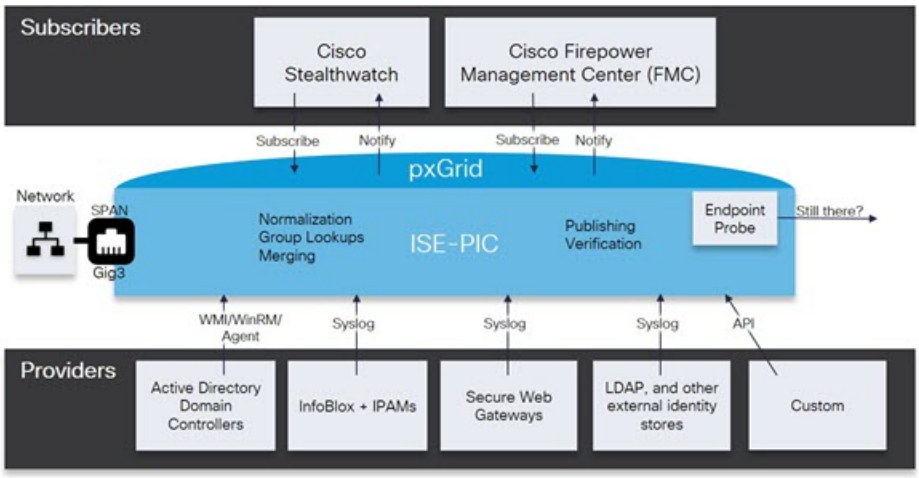
Field Name	Description
Name	Enter a unique name by which to identify the use of this probe.
Description	Enter a unique description that explains the use for this probe.
Status	Choose **Enable** to activate this probe.
Host Name	Choose a PSN for this probe from the list of available PSNs in your deployment.
Subnets	Enter the subnet range for the group of endpoints that should be checked by this probe. Use standard subnet mask ranges and separate subnet addresses with commas. For example: 10.56.14.111/32,2.55.2.0/16,2.2.3.0/16,1.2.3.4/32 Each range must be unique and separate from all other ranges. For example, you cannot enter the following ranges for the same probe because they overlap with each other: 2.2.2.0/16,2.2.3.0/16

Subscribers

The Passive Identity services use Cisco pxGrid services to deliver authenticated user identities that are collected from various providers and stored by the Cisco ISE session directory, to other network systems such as Cisco Stealthwatch or Cisco Firepower Management Center (FMC).

In the following figure, the pxGrid node collects user identities from external providers. Those identities are parsed, mapped and formatted. pxGrid takes those formatted user identities and sends them to Passive Identity service subscribers.

Figure 11: Passive Identity Service Flow



Subscribers connected to Cisco ISE must register to use the pxGrid services. Subscribers should adopt the pxGrid Client Library available from Cisco through the pxGrid SDK to become the clients. A subscriber can log in to pxGrid using a unique name and certificate-based mutual authentication. Once they have sent a valid certificate, Cisco pxGrid subscribers are automatically approved by ISE.

Subscribers can connect to either a configured pxGrid server hostname or an IP Address. We recommend that you use hostname to avoid unnecessary errors, particularly to ensure the DNS queries work properly. Capabilities are information topics or channels that are created on pxGrid for subscribers to publish and subscribe. In Cisco ISE, only SessionDirectory and IdentityGroup are supported. You can view capability information that is available from the publisher through publish, directed query, or bulk download query, by navigating to **Subscribers** in the **Capabilities** tab.

To enable subscribers to receive information from ISE, you must:

1. Optionally, generate a certificate from the subscriber's side.
2. Generate pxGrid Certificates for Subscribers, on page 124 from the PassiveID work center.
3. Enable Subscribers, on page 125. Either perform this step, or automatically enable approvals, in order to allow subscribers to receive user identities from ISE. See Configure Subscriber Settings, on page 125.

Generate pxGrid Certificates for Subscribers

Before you begin

You can generate certificates for pxGrid subscribers in order to guarantee mutual trust between pxGrid and the subscribers, thereby enabling user identities to be passed from ISE to the subscribers. To perform the following task, you must be a Super Admin or System Admin.

Step 1 Choose**Work Centers** > **PassiveID** > **Subscribers** and go to the **Certificates** tab.

Step 2 Select one of the following options from the **I want to** drop-down list:

- **Generate a single certificate without a certificate signing request**: You must enter the Common Name (CN) if you select this option. In the Common Name field, enter the pxGrid FQDN which includes pxGrid as the prefix. For example, www.pxgrid-ise.ise.net. Or, alternatively, use wildcards. For example, *.ise.net
- **Generate a single certificate with a certificate signing request**: You must enter the Certificate Signing Request details if you select this option.
- **Generate bulk certificates**: You can upload a CSV file that contains the required details.
- **Download Root Certificate Chain**: Download the ISE public root certificates in order to add them to the pxGrid client's trusted certificate store. The ISE pxGrid node only trusts the newly signed pxGrid client certificate and vice-versa, eliminating the need for outside certificate authorities.

Step 3 (optional) You can enter a description for this certificate.

Step 4 View or edit the pxGrid Certificate template on which this certificate is based. Certificate templates contain properties that are common to all certificates issued by the Certificate Authority (CA) based on that template. The certificate template defines the Subject, Subject Alternative Name (SAN), key type, key size, SCEP RA profile that must be used, validity period of the certificate, and the extended key usage (EKU) that specifies whether the certificate has to be used for client or server authentication or both. The internal Cisco ISE CA (ISE CA) uses a certificate template to issue certificates based on that template. To edit this template, choose **Administration** > **Certificates** > **Certificate Authority** > **Certificate Templates**.

Step 5 Specify the Subject Alternative Name (SAN). You can add multiple SANs. The following options are available:

- **FQDN**: Enter the fully qualified domain name of the ISE node. For example www.isepic.ise.net. Or, alternatively, use wildcards for the FQDN. For example, *.ise.net

  An additional line can be added for FQDN in which the pxGrid FQDN can also be entered. This should be identical to the FQDN you used in the Common Name field.

- **IP address**: Enter the IP address of the ISE node to be associated with the certificate. This information must be entered if the subscriber uses IP addresses instead of an FQDN.

Note This field is not displayed if you have selected the Generate Bulk Certificate option.

Step 6 Select one of the following options from the **Certificate Download Format** drop-down list:

- **Certificate in Private Enhanced Electronic Mail (PEM) format, key in PKCS8 PEM format (including certificate chain)**: The root certificate, the intermediate CA certificates, and the end entity certificate are represented in the PEM format. PEM formatted certificate are BASE64-encoded ASCII files. Each certificate starts with the "--------BEGIN CERTIFICATE-----" tag and ends with the "-------END CERTIFICATE----" tag. The end entity's

private key is stored using PKCS* PEM. It starts with the "-----BEGIN ENCRYPTED PRIVATE KEY----" tag and ends with the "-----END ENCRYPTED PRIVATE KEY----" tag.

- **PKCS12 format (including certificate chain; one file for both the certificate chain and key)**: A binary format to store the root CA certificate, the intermediate CA certificate, and the end entity 's certificate and private key in one encrypted file.

Step 7 Enter a certificate password.

Step 8 Click **Create**.

Enable Subscribers

You must perform this task, or alternatively automatically enable approvals, in order to allow subscribers to receive user identities from Cisco ISE. See Configure Subscriber Settings, on page 125.

Before you begin

- Enable the pxGrid persona on at least one node to view the requests from the Cisco pxGrid clients.
- Enable Passive Identity Service. For more information, see Easy Connect, on page 74.

Step 1 Choose **Work Centers** > **PassiveID** > **Subscribers** and ensure you are viewing the **Clients** tab.

Step 2 Check the checkbox next to the subscriber and click **Approve**.

Step 3 Click **Refresh** to view the latest status.

View Subscriber Events from Live Logs

The Live Logs page displays all the Subscriber events. Event information includes the subscriber and capability names along with the event type and timestamp.

Navigate to **Subscribers** and select the **Live Log** tab to view the list of events. You can also clear the logs and resynchronize or refresh the list.

Configure Subscriber Settings

Before you begin

To perform the following task, you must be a Super Admin or System Admin.

Step 1 Choose **Administration** > **pxGrid Services** > **Settings**.

Step 2 Select the following options based on your requirements:

- **Automatically Approve New Accounts**: Check this checkbox to automatically approve the connection requests from new pxGrid clients.

- **Allow Password Based Account Creation**: Check this checkbox to enable username/password based authentication for pxGrid clients. If this option is enabled, the pxGrid clients cannot be automatically approved.

  A pxGrid client can register itself with the pxGrid controller by sending the username via REST API. The pxGrid controller generates a password for the pxGrid client during client registration. The administrator can approve or deny the connection request.

Step 3 Click **Save**.

Monitoring and Troubleshooting Service in PassiveID Work Center

Learn about how you can manage PassiveID Work Center with monitoring, troubleshooting and reporting tools.

- RADIUS Live Sessions
- See the Reports section in Cisco ISE Reports
- TCP Dump Utility to Validate Incoming Traffic

LDAP

Lightweight Directory Access Protocol (LDAP) is a networking protocol defined by RFC 2251 for querying and modifying directory services that run on TCP/IP. LDAP is a lightweight mechanism for accessing an X.500-based directory server.

Cisco ISE integrates with an LDAP external database, which is also called an identity source, by using the LDAP protocol.

LDAP Directory Service

LDAP directory service is based on a client-server model. A client starts an LDAP session by connecting to an LDAP server and sending operation requests to the server. The server then sends its responses. One or more LDAP servers contain data from the LDAP directory tree or the LDAP backend database.

The directory service manages a directory, which is a database that holds information. Directory services use a distributed model for storing information, and that information is usually replicated between directory servers.

An LDAP directory is organized in a simple tree hierarchy and can be distributed among many servers. Each server can have a replicated version of the total directory, which is synchronized periodically.

An entry in the tree contains a set of attributes, where each attribute has a name (an attribute type or attribute description) and one or more values. The attributes are defined in a schema.

Each entry has a unique identifier: its distinguished name (DN). This name contains the relative distinguished name (RDN), which is constructed from attributes in the entry, followed by the DN of the parent entry. You can think of the DN as a full filename, and the RDN as a relative filename in a folder.

Multiple LDAP Instances

By creating more than one LDAP instance with different IP addresses or port settings, you can configure Cisco ISE to authenticate using different LDAP servers or different databases on the same LDAP server. Each primary server IP address and port configuration, along with the secondary server IP address and port configuration, forms an LDAP instance that corresponds to one Cisco ISE LDAP identity source instance.

Cisco ISE does not require that each LDAP instance correspond to a unique LDAP database. You can have more than one LDAP instance set to access the same database. This method is useful when your LDAP database contains more than one subtree for users or groups. Because each LDAP instance supports only one subtree directory for users and one subtree directory for groups, you must configure separate LDAP instances for each user directory and group directory subtree combination for which Cisco ISE submits authentication requests.

LDAP Failover

Cisco ISE supports failover between a primary LDAP server and a secondary LDAP server. A failover occurs when an authentication request fails because Cisco ISE could not connect to an LDAP server because it is down or is otherwise unreachable.

If you establish failover settings and the first LDAP server that Cisco ISE attempts to contact cannot be reached, Cisco ISE always attempts to contact a second LDAP server. If you want Cisco ISE to use the first LDAP server again, you must enter a value in the Failback Retry Delay text box.

Note Cisco ISE always uses the primary LDAP server to obtain groups and attributes for use in authorization policies from the Admin portal, so the primary LDAP server must be accessible when you configure these items. Cisco ISE uses the secondary LDAP server only for authentications and authorizations at run time, according to the failover configuration.

LDAP Connection Management

Cisco ISE supports multiple concurrent LDAP connections. Connections are opened on demand at the time of the first LDAP authentication. The maximum number of connections is configured for each LDAP server. Opening connections in advance shortens the authentication time. You can set the maximum number of connections to use for concurrent binding connections. The number of open connections can be different for each LDAP server (primary or secondary) and is determined based on the maximum number of administration connections configured for each server.

Cisco ISE retains a list of open LDAP connections (including the binding information) for each LDAP server that is configured in Cisco ISE. During the authentication process, the connection manager attempts to find an open connection from the pool. If an open connection does not exist, a new one is opened.

If the LDAP server closed the connection, the connection manager reports an error during the first call to search the directory, and tries to renew the connection. After the authentication process is complete, the connection manager releases the connection.

LDAP User Authentication

You can configure LDAP as an external identity store. Cisco ISE uses plain password authentication. User authentication includes:

- Searching the LDAP server for an entry that matches the username in the request.
- Checking the user password with the one that is found in the LDAP server.
- Retrieving a group's membership information for use in policies.
- Retrieving values for specified attributes for use in policies and authorization profiles.

To authenticate a user, Cisco ISE sends a bind request to the LDAP server. The bind request contains the DN and password of the user in clear text. If the DN and password of the user match the username and password in the LDAP directory, then the user is authenticated.

When Active Directory is used as LDAP, UPN names are used for user authentication. When Sun ONE Directory Server is used as LDAP, SAM names are used for user authentication

Note

- Cisco ISE sends two searchRequest messages for every user authentication. This does not impact Cisco ISE authorization or network performance. The second LDAP request is to make sure the Ciso ISE is talking to the right identity.
- Cisco ISE as a DNS client, uses only the first IP returned in the DNS response to perform the LDAP bind.

We recommend that you protect the connection to the LDAP server using Secure Sockets Layer (SSL).

Note Password change is supported for LDAP only if there are remaining grace logins for the account after the password has expired. If password change is successful, the LDAP server's bindResponse is LDAP_SUCCESS, and includes the remaining grace logins control field in the bindResponse message. If the bindResponse message contains any additional control fields (other than remaining grace logins), Cisco ISE might not be able to decode the message.

LDAP Group and Attribute Retrieval for Use in Authorization Policies

Cisco ISE can authenticate a subject (user or host) against an LDAP identity source by performing a bind operation on the directory server to find and authenticate the subject. After a successful authentication, Cisco ISE can retrieve groups and attributes that belong to the subject whenever they are required. You can configure the attributes to retrieve in the Cisco ISE Admin portal by choosing **Administration** > **Identity Management** > **External Identity Sources** > **LDAP**. These groups and attributes can be used by Cisco ISE to authorize the subject.

To authenticate a user or query the LDAP identity source, Cisco ISE connects to the LDAP server and maintains a connection pool.

You should note the following restrictions on group memberships when Active Directory is configured as an LDAP store:

- Users or computers must be direct members of the group defined in the policy conditions to match the policy rule.
- The defined group may not be a user's or computer's primary group. This restriction is applicable only when Active Directory is configured as an LDAP store.

LDAP Group Membership Information Retrieval

For user authentication, user lookup, and MAC address lookup, Cisco ISE must retrieve group membership information from LDAP databases. LDAP servers represent the association between a subject (a user or a host) and a group in one of the following ways:

- Groups Refer to Subjects: The group objects contain an attribute that specifies the subject. Identifiers for subjects can be sourced in the group as the following:
  - Distinguished names
  - Plain usernames
- Subjects Refer to Groups: The subject objects contain an attribute that specifies the group to which they belong.

LDAP identity sources contain the following parameters for group membership information retrieval:

- Reference direction: This parameter specifies the method to use when determining group membership (either groups to subjects or subjects to groups).
- Group map attribute: This parameter indicates the attribute that contains group membership information.
- Group object class: This parameter determines that certain objects are recognized as groups.
- Group search subtree: This parameter indicates the search base for group searches.
- Member type option: This parameter specifies how members are stored in the group member attribute (either as DNs or plain usernames).

LDAP Attributes Retrieval

For user authentication, user lookup, and MAC address lookup, Cisco ISE must retrieve the subject attributes from LDAP databases. For each instance of an LDAP identity source, an identity source dictionary is created. These dictionaries support attributes of the following data types:

- String
- Unsigned integer 32
- IPv4 address

For unsigned integers and IPv4 attributes, Cisco ISE converts the strings that it has retrieved to the corresponding data types. If conversion fails or if no values are retrieved for the attributes, Cisco ISE logs a debug message, but the authentication or lookup process does not fail.

You can optionally configure default values for the attributes that Cisco ISE can use when the conversion fails or when Cisco ISE does not retrieve any values for the attributes.

LDAP Certificate Retrieval

If you have configured certificate retrieval as part of user lookup, then Cisco ISE must retrieve the value of the certificate attribute from LDAP. To retrieve the value of the certificate attribute from LDAP, you must have previously configured the certificate attribute in the list of attributes to be accessed while configuring an LDAP identity source.

Errors Returned by the LDAP Server

The following errors can occur during the authentication process:

- Authentication Errors—Cisco ISE logs authentication errors in the Cisco ISE log files.

  Possible reasons for an LDAP server to return binding (authentication) errors include the following:

  - Parameter errors—Invalid parameters were entered
  - User account is restricted (disabled, locked out, expired, password expired, and so on)
  - Initialization Errors—Use the LDAP server timeout settings to configure the number of seconds that Cisco ISE should wait for a response from an LDAP server before determining that the connection or authentication on that server has failed.

    Possible reasons for an LDAP server to return an initialization error are:

    - LDAP is not supported.
    - The server is down.
    - The server is out of memory.
    - The user has no privileges.
    - Administrator credentials are configured incorrectly.

The following errors are logged as external resource errors, indicating a possible problem with the LDAP server:

- A connection error occurred
- The timeout expired
- The server is down
- The server is out of memory

The following error is logged as an Unknown User error:

- A user does not exist in the database

The following error is logged as an Invalid Password error, where the user exists, but the password sent is invalid:

- An invalid password was entered

LDAP User Lookup

Cisco ISE supports the user lookup feature with an LDAP server. This feature allows you to search for a user in the LDAP database and retrieve information without authentication. The user lookup process includes the following actions:

- Searching the LDAP server for an entry that matches the username in the request
- Retrieving a user's group membership information for use in policies
- Retrieving values for specified attributes for use in policies and authorization profiles

LDAP MAC Address Lookup

Cisco ISE supports the MAC address lookup feature. This feature allows you to search for a MAC address in the LDAP database and retrieve information without authentication. The MAC address lookup process includes the following actions:

- Searching the LDAP server for an entry that matches the MAC address of the device
- Retrieving a MAC Address group information for the device for use in policies
- Retrieving values for specified attributes for use in policies

Add LDAP Identity Sources

Before you begin

- To perform the following task, you must be a Super Admin or System Admin.
- Cisco ISE always uses the primary LDAP server to obtain groups and attributes for use in authorization policies. Therefore, your primary LDAP server must be reachable when you configure these items.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **LDAP** > **Add**.

Step 2 Enter the values.

Step 3 Click **Submit** to create an LDAP instance.

LDAP Identity Source Settings

The following table describes the fields on the LDAP Identity Sources window, which you can use to create an LDAP instance and connect to it. To view this window, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **LDAP**.

LDAP General Settings

The following table describes the fields in the **General** tab.

Table 31: LDAP General Settings

Field Name	Usage Guidelines
Name	Enter a name for the LDAP instance. This value is used in searches to obtain the subject DN and attributes. The value is of type string and the maximum length is 64 characters.
Description	Enter a description for the LDAP instance. This value is of type string, and has a maximum length of 1024 characters.
Schema	You can choose any one of the following built-in schema types or create a custom schema: • Active Directory • Sun Directory Server • Novell eDirectory You can click the arrow next to Schema to view the schema details. If you edit the attributes of the predefined schema, Cisco ISE automatically creates a Custom schema.
Note The following fields can be edited only when you choose the Custom schema.	
Subject Objectclass	Enter a value to be used in searches to obtain the subject DN and attributes. The value is of type string and the maximum length is 256 characters.
Subject Name Attribute	Enter the name of the attribute containing the username in the request. The value is of type string and the maximum length is 256 characters. **Note** The subject name attributes that are configured should be an indexed one in the external ID store.
Group Name Attribute	• CN: To retrieve the LDAP Identity Store Groups based on Common Name. • DN: To retrieve the LDAP Identity Store Groups based on Distinguished Name.
Certificate Attribute	Enter the attribute that contains the certificate definitions. For certificate-based authentication, these definitions are used to validate certificates that are presented by clients.
Group Objectclass	Enter a value to be used in searches to specify the objects that are recognized as groups. The value is of type string and the maximum length is 256 characters.
Group Map Attribute	Specifies the attribute that contains the mapping information. This attribute can be a user or group attribute based on the reference direction that is chosen.
Subject Objects Contain Reference To Groups	Click this option if the subject objects contain an attribute that specifies the group to which they belong.

Field Name	Usage Guidelines
Group Objects Contain Reference To Subjects	Click this option if the group objects contain an attribute that specifies the subject. This value is the default value.
Subjects in Groups Are Stored in Member Attribute As	(Only available when you enable the **Group Objects Contain Reference To Subjects** option) Specifies how members are sourced in the group member attribute and defaults to the DN.
User Info Attributes	By default, predefined attributes are used to collect user information (such as, first name, last name, email, telephone, locality, and so on) for the following built-in schema types: • Active Directory • Sun Directory Server • Novell eDirectory If you edit the attributes of the predefined schema, Cisco ISE automatically creates a Custom schema. You can also select the Custom option from the Schema drop-down list to edit the user information attributes based on your requirements.

Note The subject name attributes that are configured should be an indexed one in the external ID store.

LDAP Connection Settings

The following table describes the fields in the **Connection Settings** tab.

Table 32: LDAP Connection Settings

Field Name	Usage Guidelines
Enable Secondary Server	Check this option to enable the secondary LDAP server to be used as a backup if the primary LDAP server fails. If you check this check box, you must enter configuration parameters for the secondary LDAP server.
Primary and Secondary Servers	
Hostname/IP	Enter the IP address or DNS name of the machine that is running the LDAP software. The hostname can contain from 1 to 256 characters or a valid IP address expressed as a string. The only valid characters for hostnames are alphanumeric characters (a to z, A to Z, 0 to 9), the dot (.), and the hyphen (-).
Port	Enter the TCP/IP port number on which the LDAP server is listening. Valid values are from 1 to 65,535. The default is 389, as stated in the LDAP specification. If you do not know the port number, you can find this information from the LDAP server administrator.

Field Name	Usage Guidelines
Specify server for each ISE node	Check this check box to configure primary and secondary LDAP server hostnames/IP and their ports for each PSN. When this option is enabled, a table listing all the nodes in the deployment is displayed. You need to select the node and configure the primary and secondary LDAP server hostname/IP and their ports for the selected node.
Access	**Anonymous Access**: Click to ensure that searches on the LDAP directory occur anonymously. The server does not distinguish who the client is and will allow the client read access to any data that is configured as accessible to any unauthenticated client. In the absence of a specific policy permitting authentication information to be sent to a server, a client should use an anonymous connection. **Authenticated Access**: Click to ensure that searches on the LDAP directory occur with administrative credentials. If so, enter information for the Admin DN and Password fields.
Admin DN	Enter the DN of the administrator. The Admin DN is the LDAP account that has permission to search all required users under the User Directory Subtree and to search groups. If the administrator specified does not have permission to see the group name attribute in searches, group mapping fails for users who are authenticated by that LDAP server.
Password	Enter the LDAP administrator account password.
Secure Authentication	Click to use SSL to encrypt communication between Cisco ISE and the primary LDAP server. Verify that the Port field contains the port number used for SSL on the LDAP server. If you enable this option, you must choose a root CA.
LDAP Server Root CA	Choose a trusted root certificate authority from the drop-down list to enable secure authentication with a certificate.
Server Timeout	Enter the number of seconds that Cisco ISE waits for a response from the primary LDAP server before determining that the connection or authentication with that server has failed. Valid values are 1 to 99. The default is 10.
Max. Admin Connections	Enter the maximum number of concurrent connections (greater than 0) with LDAP administrator account permissions that can run for a specific LDAP configuration. These connections are used to search the directory for users and groups under the User Directory Subtree and the Group Directory Subtree. Valid values are 1 to 99. The default is 20.
Force reconnect every N seconds	Check this check box and enter the desired value in the **Seconds** field to force the server to renew LDAP connection at the specified time interval. The valid range is from 1 to 60 minutes.
Test Bind to Server	Click to test and ensure that the LDAP server details and credentials can successfully bind. If the test fails, edit your LDAP server details and retest.
Failover	

Field Name	Usage Guidelines
Always Access Primary Server First	Click this option if you want Cisco ISE to always access the primary LDAP server first for authentications and authorizations.
Failback to Primary Server After	If the primary LDAP server that Cisco ISE attempts to contact cannot be reached, Cisco ISE attempts to contact the secondary LDAP server. If you want Cisco ISE to use the primary LDAP server again, click this option and enter a value in the text box.

LDAP Directory Organization Settings

The following table describes the fields in the **Directory Organization** tab.

Table 33: LDAP Directory Organization Settings

Field Name	Usage Guidelines
Subject Search Base	Enter the DN for the subtree that contains all subjects. For example: o=corporation.com If the tree containing subjects is the base DN, enter: o=corporation.com or dc=corporation,dc=com as applicable to your LDAP configuration. For more information, refer to your LDAP database documentation.
Group Search Base	Enter the DN for the subtree that contains all groups. For example: ou=organizational unit, ou=next organizational unit, o=corporation.com If the tree containing groups is the base DN, type: o=corporation.com or dc=corporation,dc=com as applicable to your LDAP configuration. For more information, refer to your LDAP database documentation.

Field Name	Usage Guidelines
Search for MAC Address in Format	Enter a MAC Address format for Cisco ISE to use for search in the LDAP database. MAC addresses in internal identity sources are sourced in the format xx-xx-xx-xx-xx-xx. MAC addresses in LDAP databases can be sourced in different formats. However, when Cisco ISE receives a host lookup request, Cisco ISE converts the MAC address from the internal format to the format that is specified in this field. Use the drop-down list to enable searching for MAC addresses in a specific format, where <*format*> can be any one of the following: • xxxx.xxxx.xxxx • xxxxxxxxxxxx • xx-xx-xx-xx-xx-xx • xx:xx:xx:xx:xx:xx The format you choose must match the format of the MAC address sourced in the LDAP server.
Strip Start of Subject Name Up To the Last Occurrence of the Separator	Enter the appropriate text to remove domain prefixes from usernames. If Cisco ISE finds the delimiter character that is specified in this field in the username, it strips all characters from the beginning of the username through the delimiter character. If the username contains more than one of the characters that are specified in the <start_string> box, Cisco ISE strips characters through the last occurrence of the delimiter character. For example, if the delimiter character is the backslash (\) and the username is DOMAIN\user1, Cisco ISE submits user1 to an LDAP server. **Note** The <start_string> cannot contain the following special characters: the pound sign (#), the question mark (?), the quotation mark (“), the asterisk (*), the right angle bracket (>), and the left angle bracket (<). Cisco ISE does not allow these characters in usernames.
Strip End of Subject Name from the First Occurrence of the Separator	Enter the appropriate text to remove domain suffixes from usernames. If Cisco ISE finds the delimiter character that is specified in this field in the username, it strips all characters from the delimiter character through the end of the username. If the username contains more than one of the characters that are specified in this field, Cisco ISE strips characters starting with the first occurrence of the delimiter character. For example, if the delimiter character is @ and the username is *user1@domain*, then Cisco ISE submits *user1* to the LDAP server. **Note** The <*end_string*> box cannot contain the following special characters: the pound sign (#), the question mark (?), the quotation mark ("), the asterisk (*), the right angle bracket (>), and the left angle bracket (<). Cisco ISE does not allow these characters in usernames.

LDAP Group Settings

Table 34: LDAP Group Settings

Field Name	Usage Guidelines
Add	Choose **Add** > **Add Group** to add a new group or choose **Add** > **Select Groups From Directory** to select the groups from the LDAP directory. If you choose to add a group, enter a name for the new group. If you are selecting from the directory, enter the filter criteria, and click **Retrieve Groups**. Check the check boxes next to the groups that you want to select and click **OK**. The groups that you have selected will appear in the **Groups** window.

LDAP Attribute Settings

Table 35: LDAP Attribute Settings

Field Name	Usage Guidelines
Add	Choose **Add** > **Add Attribute** to add a new attribute or choose **Add** > **Select Attributes From Directory** to select attributes from the LDAP server. If you choose to add an attribute, enter a name for the new attribute. If you are selecting from the directory, enter the username and click **Retrieve Attributes** to retrieve the attributes. Check the check boxes next to the attributes that you want to select, and then click OK.

LDAP Advanced Settings

The following table describes the field in the Advanced Settings tab.

Table 36: LDAP Advanced Settings

Field Name	Usage Guidelines
Enable Password Change	Check this check box to enable the user to change the password in case of password expiry or password reset while using PAP protocol for device admin and RADIUS EAP-GTC protocol for network access. User authentication fails for the unsupported protocols. This option also enables the user to change the password on their next login.

Related Topics

LDAP Directory Service, on page 126
LDAP User Authentication, on page 128
LDAP User Lookup, on page 131
Add LDAP Identity Sources, on page 131

Configure LDAP Schema

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **LDAP**.

Step 2 Select the LDAP instance.

Step 3 Click the **General** tab.

Step 4 Click the drop-down arrow near the **Schema** option.

Step 5 Select the required schema from the **Schema** drop-down list. You can select the **Custom** option to update the attributes based on your requirements.

Predefined attributes are used for the built-in schema, such as Active Directory, Sun directory Server, Novell eDirectory. If you edit the attributes of the predefined schema, Cisco ISE automatically creates a custom schema.

Configure Primary and Secondary LDAP Servers

After you create an LDAP instance, you must configure the connection settings for the primary LDAP server. Configuring a secondary LDAP server is optional.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **LDAP**.

Step 2 Check the check box next to the LDAP instance that you want to edit and click **Edit**.

Step 3 Click the **Connection** tab to configure the primary and secondary servers.

Step 4 Enter the values as described in LDAP Identity Source Settings.

Step 5 Click **Submit** to save the connection parameters.

Enable Cisco ISE to Obtain Attributes from the LDAP Server

For Cisco ISE to obtain user and group data from an LDAP server, you must configure LDAP directory details in Cisco ISE. For LDAP identity source, the following three searches are applicable:

- Search for all groups in group subtree for administration
- Search for user in subject subtree to locate user
- Search for groups in which the user is a member

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **LDAP**.

Step 2 Check the check box next to the LDAP instance that you want to edit and click **Edit**.

Step 3 Click the **Directory Organization** tab.

Step 4 Enter the values as described in LDAP Identity Source Settings.

Step 5 Click **Submit** to save the configuration.

Retrieve Group Membership Details from the LDAP Server

You can add new groups or select groups from the LDAP directory.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **LDAP**.

Step 2 Check the check box next to the LDAP instance that you want to edit and click **Edit**.

Step 3 Click the **Groups** tab.

Step 4 Choose **Add** > **Add Group** to add a new group or choose **Add** > **Select Groups From Directory** to select the groups from the LDAP directory.

a) If you choose to add a group, enter a name for the new group.

b) If you are selecting from the directory, enter the filter criteria, and click **Retrieve Groups**. Your search criteria can contain the asterisk (*) wildcard character.

Step 5 Check the check boxes next to the groups that you want to select and click **OK**.

The groups that you have selected will appear in the Groups page.

Step 6 Click **Submit** to save the group selection.

Note Active Directory built-in groups are not supported when Active Directory is configured as LDAP Identity Store in Cisco ISE.

Retrieve User Attributes from the LDAP Server

You can obtain user attributes from the LDAP server for use in authorization policies.

Step 1 Choose **Administration** > **Identity Management** > **External Identity Sources** > **LDAP**.

Step 2 Check the check box next to the LDAP instance that you want to edit and click **Edit**.

Step 3 Click the **Attributes** tab.

Step 4 Choose **Add** > **Add Attribute** to add a new attribute or choose **Add** > **Select Attributes From Directory** to select attributes from the LDAP server.

a) If you choose to add an attribute, enter a name for the new attribute.

b) If you are selecting from the directory, enter an example user and click **Retrieve Attributes** to retrieve the user's attributes. You can use the asterisk (*) wildcard character.

Cisco ISE allows you to configure the LDAP server with IPv4 or IPv6 address for user authentication when you manually add the attribute type IP.

Step 5 Check the check boxes next to the attributes that you want to select, then click **OK**.

Step 6 Click **Submit** to save the attribute selections.

Enable Secure Authentication with LDAP Identity Source

When you choose the Secure Authentication option in the LDAP configuration page, Cisco ISE uses SSL to secure communication with the LDAP identity source. Secure connection to LDAP identity source is established using:

- SSL tunnel: Using SSL v3 or TLS v1 (the strongest version supported by the LDAP server)
- Server authentication (authentication of LDAP server): Certificate based
- Client authentication (authentication of Cisco ISE): None (Administrator bind is used inside the SSL tunnel)
- Cipher suites: All cipher suites supported by Cisco ISE

We recommend that you use TLS v1 with the strongest encryption and ciphers that Cisco ISE supports.

To enable Cisco ISE to communicate securely with the LDAP identity source:

Before you begin

- Cisco ISE must be connected to an LDAP server
- TCP port 636 should be open

Step 1 Import the full Certificate Authority (CA) chain of the CA that issued the server certificate to the LDAP server in to Cisco ISE (**Administration** > **System** > **Certificates** > **Trusted Certificates**).

The full CA chain refers to the root CA and intermediate CA certificates; not the LDAP server certificate.

Step 2 Configure Cisco ISE to use secure authentication when communicating with the LDAP identity source (**Administration** > **Identity Management** > **External Identity Sources** > **LDAP**; be sure to check the Secure Authentication check box in the Connection Settings tab).

Step 3 Select the root CA certificate in the LDAP identity store.

When the LDAP Identity Source is used as the Identity Source Sequence to access a Sponsor Portal, users within the LDAP group will have access to the Sponsor Portal based on Sponsor Group permissions. To restrict access to the Sponsor Portal, do not use the LDAP Identity Source as the Identity Source Sequence.

ODBC Identity Source

You can use an Open Database Connectivity (ODBC)-compliant database as an external identity source to authenticate users and endpoints. ODBC identity source can be used in an identity store sequence and for Guest and Sponsor authentications. It can also be used for BYOD flow.

The following database engines are supported:

- MySQL
- Oracle
- PostgreSQL

- Microsoft SQL Server
- Sybase

Configuring Cisco ISE to authenticate against an ODBC-compliant database does not affect the configuration of the database. To manage your database, refer to your database documentation.

Note Cisco ISE does not support encryption with ODBC. Hence, ODBC connections are not secured.

Credential Check for ODBC Database

Cisco ISE supports three different types of credential check for an ODBC database. You must configure appropriate SQL stored procedure for each credential check type. Cisco ISE uses the stored procedure to query the appropriate tables in the ODBC database and receive the output parameters or recordset from the ODBC database. The database can return a recordset or a set of named parameters in response to an ODBC query.

The password can be stored in an ODBC database in clear text or encrypted format. The stored procedure can decrypt it back to clear text when it is called by Cisco ISE.

Credential Check Type	ODBC Input Parameters	ODBC Output Parameters	Credential Check	Authentication Protocols
Plain text password authentication in ODBC database	Username Password	Result Group Account Info Error string	If the username and password are matched, relevant user information is returned.	PAP EAP-GTC (as inner method of PEAP or EAP-FAST) TACACS
Plain text password fetching from ODBC database	Username	Result Group Account Info Error string Password	If the username is found, its password and relevant user information is returned by the stored procedure. Cisco ISE calculates the password hash based on the authentication method and compares it with the one that is received from the client.	CHAP MSCHAPv1/v2 EAP-MD5 LEAP EAP-MSCHAPv2 (as inner method of PEAP or EAP-FAST) TACACS
Lookup	Username	Result Group Account Info Error string	If the username is found, relevant user information is returned.	MAB Fast reconnect of PEAP, EAP-FAST, and EAP-TTLS

Note If ODBC is used as the lookup source for authorization, ensure that the ODBC database and incoming request MAB format are same.

The groups that are returned in the output parameters are not used in Cisco ISE. Only the groups that are retrieved by the Fetch Groups stored procedure are used in Cisco ISE. The account information is included only in the authentication audit log.

The following table lists the mapping between the result codes returned by the ODBC database stored procedure and Cisco ISE authentication result codes:

Result code (returned by the stored procedure)	Description	Cisco ISE authentication result code
0	CODE_SUCCESS	NA (authentication passed)
1	CODE_UNKNOWN_USER	UnknownUser
2	CODE_INVALID_PASSWORD	Failed
3	CODE_UNKNOWN_USER_OR_INVALID_PASSWORD	UnknownUser
4	CODE_INTERNAL_ERROR	Error
10001	CODE_ACCOUNT_DISABLED	DisabledUser
10002	CODE_PASSWORD_EXPIRED	NotPerformedPasswordExpired

Note Cisco ISE performs the actual authentication or lookup operation based on this mapped authentication result code.

You can use the stored procedures to fetch groups and attributes from the ODBC database.

Here is a sample procedure that returns recordset for plain text password authentication (for Microsoft SQL Server):

```
CREATE PROCEDURE [dbo].[ISEAuthUserPlainReturnsRecordset]
        @username varchar(64), @password varchar(255)
AS
BEGIN
        IF EXISTS( SELECT  username
        FROM  NetworkUsers
        WHERE  username  = @username
        AND  password  = @password )
        SELECT 0,11,'give full access','No Error'
        FROM  NetworkUsers
        WHERE  username  = @username
        ELSE
        SELECT 3,0,'odbc','ODBC Authen Error'
END
```

Here is a sample procedure that returns recordset for plain text password fetching (for Microsoft SQL Server):

```
CREATE PROCEDURE [dbo].[ISEFetchPasswordReturnsRecordset]
        @username varchar(64)
```

```
AS
BEGIN
        IF EXISTS( SELECT  username
        FROM  NetworkUsers
        WHERE  username  = @username)
        SELECT 0,11,'give full access','No Error',password
        FROM  NetworkUsers
        WHERE  username  = @username
        ELSE
        SELECT 3,0,'odbc','ODBC Authen Error'
END
```

Here is a sample procedure that returns recordset for Lookup (for Microsoft SQL Server):

```
CREATE PROCEDURE [dbo].[ISEUserLookupReturnsRecordset]
        @username varchar(64)
AS
BEGIN
        IF EXISTS( SELECT  username
        FROM  NetworkUsers
        WHERE  username  = @username)
        SELECT 0,11,'give full access','No Error'
        FROM  NetworkUsers
        WHERE  username  = @username
        ELSE
        SELECT 3,0,'odbc','ODBC Authen Error'
END
```

Here is a sample procedure that returns parameters for plain text password authentication (for Microsoft SQL Server):

```
CREATE PROCEDURE [dbo].[ISEAuthUserPlainReturnsParameters]
       @username varchar(64), @password varchar(255), @result INT OUTPUT, @group varchar(255)
 OUTPUT, @acctInfo varchar(255) OUTPUT, @errorString varchar(255) OUTPUT
AS
BEGIN
        IF EXISTS( SELECT  username
        FROM  NetworkUsers
        WHERE  username  = @username
        AND  password  = @password )
        SELECT @result=0, @group=11, @acctInfo='give full access', @errorString='No Error'
        FROM  NetworkUsers
        WHERE  username  = @username
        ELSE
        SELECT @result=3, @group=0, @acctInfo='odbc',  @errorString='ODBC Authen Error'
END
```

Here is a sample procedure that returns parameters for plain text password fetching (for Microsoft SQL Server):

```
CREATE PROCEDURE [dbo].[ISEFetchPasswordReturnsParameters]
        @username varchar(64), @result INT OUTPUT, @group varchar(255) OUTPUT, @acctInfo
varchar(255) OUTPUT, @errorString varchar(255) OUTPUT, @password varchar(255) OUTPUT
AS
BEGIN
        IF EXISTS( SELECT  username
        FROM  NetworkUsers
        WHERE  username  = @username)
       SELECT @result=0, @group=11, @acctInfo='give full access', @errorString='No Error',
 @password=password
        FROM  NetworkUsers
        WHERE  username  = @username
        ELSE
        SELECT @result=3, @group=0, @acctInfo='odbc', @errorString='ODBC Authen Error'
END
```

Here is a sample procedure that returns parameters for Lookup (for Microsoft SQL Server):

```
CREATE PROCEDURE [dbo].[ISEUserLookupReturnsParameters]
        @username varchar(64), @result INT OUTPUT, @group varchar(255) OUTPUT, @acctInfo
varchar(255) OUTPUT, @errorString varchar(255) OUTPUT
AS
BEGIN
        IF EXISTS( SELECT  username
        FROM  NetworkUsers
        WHERE  username  = @username)
        SELECT @result=0, @group=11, @acctInfo='give full access', @errorString='No Error'
        FROM  NetworkUsers
        WHERE  username  = @username
        ELSE
        SELECT @result=3, @group=0, @acctInfo='odbc', @errorString='ODBC Authen Error'
END
```

Here is a sample procedure that fetches groups from Microsoft SQL Server:

```
CREATE PROCEDURE [dbo].[ISEGroupsH]
        @username varchar(64), @result int output
AS
BEGIN
        if exists (select * from NetworkUsers where username = @username)
        begin
                set @result = 0
                select 'accountants', 'engineers', 'sales','test_group2'
        end
        else
                set @result = 1
END
```

Here is a sample procedure that fetches all the groups of all the users if the username is "*" (for Microsoft SQL Server):

```
ALTER PROCEDURE [dbo].[ISEGroupsH]
                @username varchar(64), @result int output
AS
BEGIN
                if @username = '*'
                begin
                                -- if username is equal to '*' then return all existing
groups
                                set @result = 0
                                select 'accountants', 'engineers',
'sales','test_group1','test_group2','test_group3','test_group4'
                end
                else
                if exists (select * from NetworkUsers where username = @username)
                begin
                                set @result = 0
                                select 'accountants'
                end
                else
                                set @result = 1
END
```

Here is a sample procedure that fetches attributes from Microsoft SQL Server:

```
CREATE PROCEDURE [dbo].[ISEAttrsH]
        @username varchar(64), @result int output
AS
BEGIN
        if exists (select * from NetworkUsers where username = @username)
        begin
                set @result = 0
                                select phone as phone, username as username, department as
 department, floor as floor, memberOf as memberOf, isManager as isManager from NetworkUsers
```

```
 where username = @username
        end
        else
                set @result = 1
END
```

Additional Examples of ODBC Configuration

https://www.cisco.com/c/en/us/support/docs/security/identity-services-engine/211581-Configure-ODBC-on-ISE-2-3-with-Oracle-Da.html

https://www.cisco.com/c/en/us/support/docs/security/identity-services-engine-21/200544-Configure-ISE-2-1-with-MS-SQL-using-ODBC.html

https://www.cisco.com/c/en/us/support/docs/security/identity-services-engine-21/200644-Configure-ODBC-on-ISE-2-1-with-PostgreSQ.html

Add ODBC Identity Source

Before you begin

To perform the following task, you must be a Super Admin or System Admin.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources**.

Step 2 Click **ODBC**.

Step 3 Click **Add**.

Step 4 In the **General** tab, enter a name and description for the ODBC identity source.

Step 5 In the **Connection** tab, enter the following details:

- Hostname or IP address of the ODBC database. If you are using a nonstandard TCP port for the database, you can specify the port number in the following format: hostname or IP address:port
- Name of the ODBC database
- Admin username and password (Cisco ISE connects to the database using these credentials)
- Server timeout in seconds (default is 5 seconds)
- Connection attempts (default is 1)
- Database type. Choose one of the following:
  - **MySQL**
  - **Oracle**
  - **PostgreSQL**
  - **Microsoft SQL Server**
  - **Sybase**

Step 6 If you choose **MySQL** as the database type in Step 5, the **Secure Connection** area is displayed. Check the **Enable Secure Connection** check box to secure the ODBC connection and ensure that your credentials are protected.

After you choose the **Enable Secure Connection** option, you can check the **Require Server Identity Check** check box. This option requires Cisco ISE to check the CN and SAN fields of the ODBC server certificate to verify if the information matches the configured FQDN or IP address. A connection is established only if the information matches.

Step 7 Click **Test Connection** to check the connectivity with the ODBC database and to verify the existence of the stored procedures for the configured use cases.

Step 8 In the **Stored Procedures** tab, enter the following details:

- **Stored Procedure Type**: Specify the type of output that your database provides:
  - **Returns Recordset**: The database returns a recordset in response to an ODBC query.
  - **Returns Parameters**: The database returns a set of named parameters in response to an ODBC query.
- **Plain Text Password Authentication**: Enter the name of the stored procedure that runs on the ODBC server for plain text password authentication. Used for PAP, EAP-GTC inner method, and TACACS.
- **Plain Text Password Fetching**: Enter the name of the stored procedure that runs on the ODBC server to fetch plain text passwords. Used for CHAP, MS-CHAPv1/v2, LEAP, EAP-MD5, EAP-MSCHAPv2 inner method, and TACACS.
- **Check Username or Machine Exists**: Enter the name of the stored procedure that runs on the ODBC server for User/MAC address lookup. Used for MAB and fast reconnect of PEAP, EAP-FAST, and EAP-TTLS.
- **Fetch Groups**: Enter the name of the stored procedure that retrieves the groups from the ODBC database.
- **Fetch Attributes**: Enter the name of the stored procedure that retrieves the attributes and their values from the ODBC database.
- **Advanced Settings**: Click this option to use the attributes under the following dictionaries as input parameters in the **Fetch Attributes** stored procedure (in addition to the username and password):
  - **RADIUS**
  - **Device**
  - **Network Access**

  Note You can use only the following attributes in the **Network Access** dictionary: **AuthenticationMethod**, **Device IP Address**, **EapAuthentication**, **EapTunnel**, **ISE Host Name**, **Protocol**, **UserName**, **VN**, and **WasMachineAuthenticated**.

  In the **Attribute Name in Stored Procedure** field, specify the attribute name that is used in the stored procedure.

  You can configure the stored procedures to retrieve the following output parameters from the ODBC database:
  - ACL
  - Security Group
  - VLAN (name or number)
  - Web-redirect ACL
  - Web-redirect portal name

You can use these attributes to configure the authorization profiles. These attributes are listed in the **Common Tasks** section in the **Authorization Profiles** window (under **Policy > Policy Elements > Results**). The following are a few sample use case scenarios where you can use these attributes:

- To configure an authorization profile to use the VLAN that is returned from the ODBC database, based on the specified input attributes (MAC address, username, called-station-ID, or device location), instead of manually specifying the VLAN for each authorization profile.
- To configure an authorization profile to block access for the calling station IDs that are blocked in the ODBC identity store.
- To configure an authorization profile to retrieve the web-redirect ACL or web-redirect portal name from the ODBC database, based on the MAC address, username, called-station-ID, or device location.

While configuring an authorization policy, you can select the security groups that are retrieved from the ODBC database in the **Policy Sets** window.

Note While using the **Advanced Settings** option, a new table named user_attributes_detail is created in the ODBC database to store the additional details. You must set the data type as VARCHAR2 for all the output parameters. Otherwise, the stored procedure might fail during the Union and Compilation process. For example, if SGTNAME is set as VARCHAR2 and VLANNUMBER is set as NUMBER, compilation of the following stored procedure might fail:

```
select  ATTR_NAME, value from ATTRIBUTES where user_id=userid
          union
         select 'SGTNAME', SGTNAME from user_attributes_detail where USER_ID = userid
 and user_attributes_detail.DEVICELOCATIONS=ise_DEVICETYPE
          union
          select 'VLANNUMBER', VLANNUMBER from user_attributes_detail where USER_ID
 = userid and user_attributes_detail.DEVICELOCATIONS=ise_DEVICETYPE;
```

- **Search for MAC Address in Format**: The incoming MAC address is normalized based on the selected MAC format.

Step 9 Add the required attributes in the **Attributes** tab. While adding an attribute, you can specify how the attribute name should appear in the authorization policy rules.

You can also fetch the attributes from the ODBC database. These attributes can be used in the authorization policies.

Step 10 Add the user groups in the **Groups** tab. You can also fetch the groups from the ODBC database by specifying the username or MAC address. These groups can be used in authorization policies.

You can rename the groups and attributes. By default, the name that is displayed in the **Name in ISE** field is same as that in ODBC database, however, you can modify this name. This name is used in the authorization policies.

Step 11 Click **Submit**.

For more information on how to configure the ODBC identity source, see the following links:

- Configure ODBC on Cisco ISE with Oracle Database
- Configure Cisco ISE with MS SQL using ODBC
- Configure ODBC on Cisco ISE with PostgreSQL
- Configure Cisco ISE for integration with MySQL server

Note If you have configured input attributes, you must do the following while duplicating an ODBC identity store. Otherwise, input parameters might be lost in the duplicated ODBC identity store.

1. Click **Advance Settings**.
2. Verify whether the input parameters are set properly.
3. Click **OK** to save these input parameters in the duplicated ODBC identity store.

RADIUS Token Identity Sources

A server that supports the RADIUS protocol and provides authentication, authorization, and accounting (AAA) services to users and devices is called a RADIUS server. A RADIUS identity source is simply an external identity source that contains a collection of subjects and their credentials and uses the RADIUS protocol for communication. For example, the Safeword token server is an identity source that can contain several users and their credentials as one-time passwords that provides an interface that you can query using the RADIUS protocol.

Cisco ISE supports any RADIUS RFC 2865-compliant server as an external identity source. Cisco ISE supports multiple RADIUS token server identities, for example the RSA SecurID server and the SafeWord server. RADIUS identity sources can work with any RADIUS token server that is used to authenticate a user.

Note The Process Host Lookup option must be enabled for MAB authentication. We recommend that you don't configure the RADIUS token server that is used as the external identity source, for MAB authentication, because the devices that are using MAB authentication cannot generate an OTP or a RADIUS token (which is required for RADIUS token server authentication). Hence, the authentication will fail. You can use the external RADIUS server option to process the MAB requests.

RADIUS Token Server-Supported Authentication Protocols

Cisco ISE supports the following authentication protocols for RADIUS identity sources:

- RADIUS PAP
- Protected Extensible Authentication Protocol (PEAP) with inner Extensible Authentication Protocol-Generic Token Card (EAP-GTC)
- EAP-FAST with inner EAP-GTC

Ports Used by the RADIUS Token Servers for Communication

RADIUS token servers use the UDP port for authentication sessions. This port is used for all RADIUS communication. For Cisco ISE to send RADIUS one-time password (OTP) messages to a RADIUS-enabled token server, you must ensure that the gateway devices between Cisco ISE and the RADIUS-enabled token server allow communication over the UDP port. You can configure the UDP port through the Admin portal.

RADIUS Shared Secret

You must provide a shared secret while configuring RADIUS identity sources in Cisco ISE. This shared secret should be the same as the shared secret that is configured on the RADIUS token server.

Failover in RADIUS Token Servers

Cisco ISE allows you to configure multiple RADIUS identity sources. Each RADIUS identity source can have primary and secondary RADIUS servers. When Cisco ISE is unable to connect to the primary server, it uses the secondary server.

Configurable Password Prompt in RADIUS Token Servers

RADIUS identity sources allow you to configure the password prompt. You can configure the password prompt through the Admin portal.

RADIUS Token Server User Authentication

Cisco ISE obtains the user credentials (username and passcode) and passes them to the RADIUS token server. Cisco ISE also relays the results of the RADIUS token server authentication processing to the user.

User Attribute Cache in RADIUS Token Servers

RADIUS token servers, by default, do not support user lookups. However, the user lookup functionality is essential for the following Cisco ISE features:

- PEAP session resume: This feature allows the PEAP session to resume after successful authentication during EAP session establishment.
- EAP/FAST fast reconnect: This feature allows fast reconnection after successful authentication during EAP session establishment.
- TACACS+ Authorization: Happens after a successful TACACS+ authentication.

Cisco ISE caches the results of successful authentications to process user lookup requests for these features. For every successful authentication, the name of the authenticated user and the retrieved attributes are cached. Failed authentications are not written to the cache.

The cache is available in the memory at runtime and is not replicated between Cisco ISE nodes in a distributed deployment. You can configure the Time to Live (TTL) limit for the cache through the Admin portal. Starting with ISE 2.6, you may choose to enable the identity caching option and set the aging time in minutes. The option is disabled by default and when enabled, the cache will be available in the memory for the specified amount of time.

RADIUS Identity Source in Identity Sequence

You can add the RADIUS identity source for authentication sequence in an identity source sequence. However, you cannot add the RADIUS identity source for attribute retrieval sequence because you cannot query the RADIUS identity source without authentication. Cisco ISE cannot distinguish among different errors while authenticating with a RADIUS server. RADIUS servers return an Access-Reject message for all errors. For

example, when a user is not found in the RADIUS server, instead of returning a User Unknown status, the RADIUS server returns an Access-Reject message.

RADIUS Server Returns the Same Message for All Errors

When a user is not found in the RADIUS server, the RADIUS server returns an Access-Reject message. Cisco ISE provides an option to configure this message through the Admin portal as either an Authentication Failed or a User Not Found message. However, this option returns a User Not Found message not only for cases where the user is not known, but for all failure cases.

The following table lists the different failure cases that are possible with RADIUS identity servers.

Table 37: Error Handling

Failure Cases	Reasons for Failure
Authentication Failed	• User is unknown. • User attempts to log in with an incorrect passcode. • User login hours expired.
Process Failed	• RADIUS server is configured incorrectly in Cisco ISE. • RADIUS server is unavailable. • RADIUS packet is detected as malformed. • Problem during sending or receiving a packet from the RADIUS server. • Timeout.
Unknown User	Authentication failed and the Fail on Reject option is set to false.

Safeword Server Supports Special Username Format

The Safeword token server supports authentication with the following username format:

Username—Username, OTP

As soon as Cisco ISE receives the authentication request, it parses the username and converts it to the following username:

Username—Username

The SafeWord token servers support both of these formats. Cisco ISE works with various token servers. While configuring a SafeWord server, you must check the SafeWord Server check box in the Admin portal for Cisco ISE to parse the username and convert it to the specified format. This conversion is done in the RADIUS token server identity source before the request is sent to the RADIUS token server.

Authentication Request and Response in RADIUS Token Servers

When Cisco ISE forwards an authentication request to a RADIUS-enabled token server, the RADIUS authentication request contains the following attributes:

- User-Name (RADIUS attribute 1)
- User-Password (RADIUS attribute 2)
- NAS-IP-Address (RADIUS attribute 4)

Cisco ISE expects to receive any one of the following responses:

- Access-Accept: No attributes are required, however, the response can contain a variety of attributes based on the RADIUS token server configuration.
- Access-Reject: No attributes are required.
- Access-Challenge: The attributes that are required per RADIUS RFC are the following:
  - State (RADIUS attribute 24)
  - Reply-Message (RADIUS attribute 18)
  - One or more of the following attributes: Vendor-Specific, Idle-Timeout (RADIUS attribute 28), Session-Timeout (RADIUS attribute 27), Proxy-State (RADIUS attribute 33)

    No other attributes are allowed in Access-Challenge.

RADIUS Token Identity Sources Settings

The following table describes the fields on the RADIUS Token Identity Sources window, which you can use to configure and connect to an external RADIUS identity source. To view this window, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **RADIUS Token**.

Table 38: RADIUS Token Identity Source Settings

Field Name	Usage Guidelines
Name	Enter a name for the RADIUS token server. The maximum number of characters allowed is 64.
Description	Enter a description for the RADIUS token server. The maximum number of characters is 1024.
SafeWord Server	Check this check box if your RADIUS identity source is a SafeWord server.
Enable Secondary Server	Check this check box to enable the secondary RADIUS token server for Cisco ISE to use as a backup in case the primary fails. If you check this check box, you must configure a secondary RADIUS token server.
Always Access Primary Server First	Click this option if you want Cisco ISE to always access the primary server first.
Fallback to Primary Server after	Click this option to specify the amount of time in minutes that Cisco ISE can authenticate using the secondary RADIUS token server if the primary server cannot be reached. After this time elapses, Cisco ISE reattempts to authenticate against the primary server.

Field Name	Usage Guidelines
Primary Server	
Host IP	Enter the IP address of the primary RADIUS token server. This field can take as input a valid IP address that is expressed as a string. Valid characters that are allowed in this field are numbers and dot (.).
Shared Secret	Enter the shared secret that is configured on the primary RADIUS token server for this connection.
Authentication Port	Enter the port number on which the primary RADIUS token server is listening.
Server Timeout	Specify the time in seconds that Cisco ISE should wait for a response from the primary RADIUS token server before it determines that the primary server is down.
Connection Attempts	Specify the number of attempts that Cisco ISE should make to reconnect to the primary server before moving on to the secondary server (if defined) or dropping the request if a secondary server is not defined.
Secondary Server	
Host IP	Enter the IP address of the secondary RADIUS token server. This field can take as input a valid IP address that is expressed as a string. Valid characters that are allowed in this field are numbers and dot (.).
Shared Secret	Enter the shared secret configured on the secondary RADIUS token server for this connection.
Authentication Port	Enter the port number on which the secondary RADIUS token server is listening. Valid values are from 1 to 65,535. The default is 1812.
Server Timeout	Specify the time in seconds that Cisco ISE should wait for a response from the secondary RADIUS token server before it determines that the secondary server is down.
Connection Attempts	Specify the number of attempts that Cisco ISE should make to reconnect to the secondary server before dropping the request.

Related Topics

RADIUS Token Identity Sources, on page 148
Add a RADIUS Token Server, on page 152

Add a RADIUS Token Server

Before you begin

To perform the following task, you must be a Super Admin or System Admin.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** **External Identity Sources** > **RADIUS Token** > **Add**.

Step 2 Enter the values in the **General** and **Connection** tabs.

Step 3 Click the **Authentication** tab.

This tab allows you to control the responses to an Access-Reject message from the RADIUS token server. This response could either mean that the credentials are invalid or that the user is not known. Cisco ISE accepts one of the following responses: Failed authentication or User not found. This tab also allows you to enable identity caching and to set the aging time for the cache. You can also configure a prompt to request the password.

a) Click the **Treat Rejects as 'authentication failed'** radio button if you want the Access-Reject response from the RADIUS token server to be treated as a failed authentication.

b) Click the **Treat Rejects as 'user not found'** radio button if you want the Access-Reject response from the RADIUS token server to be treated as an unknown user failure.

Step 4 Check the **Enable Passcode Caching** check box if you want Cisco ISE to store the passcode in the cache after the first successful authentication with an RADIUS token server and use the cached user credentials for the subsequent authentications if they happen within the configured time period.

Enter the number of seconds for which the passcode must be stored in the cache in the **Aging Time** field. Within this period of time, the user can perform more than one authentication with the same passcode. The default value is 30 seconds. The valid range is from 1 to 900 seconds.

Note Cisco ISE clears the cache after the first failed authentication. The user must enter a new, valid passcode.

The cache is available in the memory at runtime and it is not replicated between Cisco ISE nodes in a distributed deployment.

Note We strongly recommend that you enable this option only when you use a protocol that supports encryption of the passcode, for example, EAP-FAST-GTC. For information on supported authentication protocols for RADIUS Token server, see RADIUS Token Server-Supported Authentication Protocols, on page 148

Step 5 Check the **Enable Identity Caching** check box if you want to allow processing of requests that do not perform authentication against the server.

You can enable the identity caching option and set the aging time in minutes. The default value is 120 minutes. The valid range is from 1 to 1440 minutes. The results and attributes obtained from the last successful authentication are retained in the cache for the specified time period.

This option is disabled by default.

Step 6 Click the **Authorization** tab.

This tab allows you to configure a name that will appear for the attribute that is returned by the RADIUS token server while sending an Access-Accept response to Cisco ISE. This attribute can be used in authorization policy conditions. The default value is CiscoSecure-Group-Id.

Note If you want to send any attribute in Access-Accept from External ID source, Ext ID source needs to send <ciscoavpair> as attribute name and value in the format: ACS:<attrname>=<attrvalue> where <attrname> is configured in the **Authorization** tab.

Step 7 Click **Submit**.

Delete a RADIUS Token Server

Before you begin

- To perform the following task, you must be a Super Admin or System Admin.
- Ensure that you do not select the RADIUS token servers that are part of an identity source sequence. If you select a RADIUS token server that is part of an identity source sequence for deletion, the delete operation fails.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **RADIUS Token**.

Step 2 Check the check box next to the RADIUS token server or servers that you want to delete, then click **Delete**.

Step 3 Click **OK** to delete the RADIUS token server or servers that you have selected.

If you select multiple RADIUS token servers for deleting, and one of them is used in an identity source sequence, the delete operation fails and none of the RADIUS token servers are deleted.

RSA Identity Sources

Cisco ISE supports the RSA SecurID server as an external database. RSA SecurID two-factor authentication consists of the PIN of the user and an individually registered RSA SecurID token that generates single-use token codes based on a time code algorithm. A different token code is generated at fixed intervals (usually each at 30 or 60 seconds). The RSA SecurID server validates this dynamic authentication code. Each RSA SecurID token is unique, and it is not possible to predict the value of a future token based on past tokens. Thus, when a correct token code is supplied together with a PIN, there is a high degree of certainty that the person is a valid user. Therefore, RSA SecurID servers provide a more reliable authentication mechanism than conventional reusable passwords.

Cisco ISE supports the following RSA identity sources:

- RSA ACE/Server 6.x series
- RSA Authentication Manager 7.x and 8.0 series

You can integrate with RSA SecurID authentication technology in any one of the following ways:

- Using the RSA SecurID agent: Users are authenticated with their username and passcode through the RSA native protocol.
- Using the RADIUS protocol: Users are authenticated with their username and passcode through the RADIUS protocol.

The RSA SecurID token server in Cisco ISE connects with the RSA SecurID authentication technology by using the RSA SecurID Agent.

Cisco ISE supports only one RSA realm.

Cisco ISE and RSA SecurID Server Integration

These are the two administrative roles involved in connecting Cisco ISE with an RSA SecurID server:

- RSA Server Administrator: Configures and maintains RSA systems and integration
- Cisco ISE Administrator: Configures Cisco ISE to connect to the RSA SecurID server and maintains the configuration

This section describes the processes that are involved in connecting Cisco ISE with the RSA SecurID server as an external identity source. For more information on RSA servers, please refer to the RSA documentation.

RSA Configuration in Cisco ISE

The RSA administrative system generates an sdconf.rec file, which the RSA system administrator will provide to you. This file allows you to add Cisco ISE servers as RSA SecurID agents in the realm. You have to browse and add this file to Cisco ISE. By the process of replication, the primary Cisco ISE server distributes this file to all the secondary servers.

RSA Agent Authentication Against the RSA SecurID Server

After the sdconf.rec file is installed on all Cisco ISE servers, the RSA agent module initializes, and authentication with RSA-generated credentials proceeds on each of the Cisco ISE servers. After the agent on each of the Cisco ISE servers in a deployment has successfully authenticated, the RSA server and the agent module together download the securid file. This file resides in the Cisco ISE file system and is in a well-known place defined by the RSA agent.

RSA Identity Sources in a Distributed Cisco ISE Environment

Managing RSA identity sources in a distributed Cisco ISE environment involves the following:

- Distributing the sdconf.rec and sdopts.rec files from the primary server to the secondary servers.
- Deleting the securid and sdstatus.12 files.

RSA Server Updates in a Cisco ISE Deployment

After you have added the sdconf.rec file in Cisco ISE, the RSA SecurID administrator might update the sdconf.rec file in case of decommissioning an RSA server or adding a new RSA secondary server. The RSA SecurID administrator will provide you with an updated file. You can then reconfigure Cisco ISE with the updated file. The replication process in Cisco ISE distributes the updated file to the secondary Cisco ISE servers in the deployment. Cisco ISE first updates the file in the file system and coordinates with the RSA agent module to phase the restart process appropriately. When the sdconf.rec file is updated, the sdstatus.12 and securid files are reset (deleted).

Override Automatic RSA Routing

You can have more than one RSA server in a realm. The sdopts.rec file performs the role of a load balancer. Cisco ISE servers and RSA SecurID servers operate through the agent module. The agent module that resides on Cisco ISE maintains a cost-based routing table to make the best use of the RSA servers in the realm. You can, however, choose to override this routing with a manual configuration for each Cisco ISE server for the realm using a text file called sdopts.rec through the Admin portal. Refer to the RSA documentation for information on how to create this file.

RSA Node Secret Reset

The securid file is a secret node key file. When RSA is initially set up, it uses a secret to validate the agents. When the RSA agent that resides in Cisco ISE successfully authenticates against the RSA server for the first time, it creates a file on the client machine called securid and uses it to ensure that the data exchanged between the machines is valid. At times, you may have to delete the securid file from a specific Cisco ISE server or a group of servers in your deployment (for example, after a key reset on the RSA server). You can use the Cisco ISE Admin portal to delete this file from a Cisco ISE server for the realm. When the RSA agent in Cisco ISE authenticates successfully the next time, it creates a new securid file.

Note If authentications fail after upgrading to a latest release of Cisco ISE, reset the RSA secret.

RSA Automatic Availability Reset

The sdstatus.12 file provides information about the availability of RSA servers in the realm. For example, it provides information on which servers are active and which are down. The agent module works with the RSA servers in the realm to maintain this availability status. This information is serially listed in the sdstatus.12 file, which is sourced in a well-known location in the Cisco ISE file system. Sometimes this file becomes old and the current status is not reflected in this file. You must remove this file so that the current status can be recreated. You can use the Admin portal to delete the file from a specific Cisco ISE server for a specific realm. Cisco ISE coordinates with the RSA agent and ensures correct restart phasing.

The sdstatus.12 file is deleted whenever the securid file is reset, or the sdconf.rec or sdopts.rec files are updated.

RSA SecurID Identity Source Settings

The following table describes the fields on the RSA SecurID Identity Sources window, which you can use to create and connect to an RSA SecurID identity source. To view this window, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **RSA SecurID**.

RSA Prompt Settings

The following table describes the fields in the **RSA Prompts** tab.

Table 39: RSA Prompt Settings

Field Name	Usage Guidelines
Enter Passcode Prompt	Enter a text string to obtain the passcode.
Enter Next Token Code	Enter a text string to request the next token.
Choose PIN Type	Enter a text string to request the PIN type.
Accept System PIN	Enter a text string to accept the system-generated PIN.
Enter Alphanumeric PIN	Enter a text string to request an alphanumeric PIN.

Field Name	Usage Guidelines
Enter Numeric PIN	Enter a text string to request a numeric PIN.
Re-enter PIN	Enter a text string to request the user to re-enter the PIN.

RSA Message Settings

The following table describes the fields in the **RSA Messages** tab.

Table 40: RSA Messages Settings

Field Name	Usage Guidelines
Display System PIN Message	Enter a text string to label the system PIN message.
Display System PIN Reminder	Enter a text string to inform the user to remember the new PIN.
Must Enter Numeric Error	Enter a message that instructs users to enter only numbers for the PIN.
Must Enter Alpha Error	Enter a message that instructs users to enter only alphanumeric characters for PINs.
PIN Accepted Message	Enter a message that the users see when their PIN is accepted by the system.
PIN Rejected Message	Enter a message that the users see when the system rejects their PIN.
User Pins Differ Error	Enter a message that the users see when they enter an incorrect PIN.
System PIN Accepted Message	Enter a message that the users see when the system accepts their PIN.
Bad Password Length Error	Enter a message that the users see when the PIN that they specify does not fall within the range specified in the PIN length policy.

Related Topics

RSA Identity Sources, on page 154
Cisco ISE and RSA SecurID Server Integration, on page 155
Add RSA Identity Sources, on page 157

Add RSA Identity Sources

To create an RSA identity source, you must import the RSA configuration file (sdconf.rec). You must obtain the sdconf.rec file from your RSA administrator. To perform this task, you must be a Super Admin or System Admin.

Adding an RSA identity source involves the following tasks:

Import the RSA Configuration File

You must import the RSA configuration file to add an RSA identity source in Cisco ISE.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **RSA SecurID** > **Add**.

Step 2 Click **Browse** to choose the new or updated sdconf.rec file from the system that is running your client browser.

When you create the RSA identity source for the first time, the Import new sdconf.rec file field will be a mandatory field. From then on, you can replace the existing sdconf.rec file with an updated one, but replacing the existing file is optional.

Step 3 Enter the server timeout value in seconds. Cisco ISE will wait for a response from the RSA server for the amount of time specified before it times out. This value can be any integer from 1 to 199. The default value is 30 seconds.

Step 4 Check the **Reauthenticate on Change PIN** check box to force a reauthentication when the PIN is changed.

Step 5 Click **Save**.

Cisco ISE also supports the following scenarios:

- Configuring the Options File for a Cisco ISE Server and Resetting SecurID and sdstatus.12 Files.
- Configuring Authentication Control Options for RSA Identity Source.

Configure the Options File for a Cisco ISE Server and Resetting SecurID and sdstatus.12 Files

Step 1 Log into the Cisco ISE server.

Step 2 Choose **Administration** > **Identity Management** > **External Identity Sources** > **RSA SecurID** > **Add**.

Step 3 Click the **RSA Instance Files** tab.

This page lists the sdopts.rec files for all the Cisco ISE servers in your deployment.

The Node Secret Status is displayed as *Created* when the user is authenticated against RSA SecurID token server. The Node Secret Status can be one of the following—Created or Not Created. The Node Secret Status is displayed as *Not Created* when it is cleared.

Step 4 Click the radio button next to the sdopts.rec file for a particular Cisco ISE server, and click **Update Options File**.

The existing file is displayed in the Current File region.

Step 5 Choose one of the following:

- Use the Automatic Load Balancing status maintained by the RSA agent—Choose this option if you want the RSA agent to automatically manage load balancing.
- Override the Automatic Load Balancing status with the sdopts.rec file selected below—Choose this option if you want to manually configure load balancing based on your specific needs. If you choose this option, you must click **Browse** and choose the new sdopts.rec file from the system that is running your client browser.

Step 6 Click **OK**.

Step 7 Click the row that corresponds to the Cisco ISE server to reset the securid and sdstatus.12 files for that server:

a) Click the drop-down arrow and choose **Remove on Submit** in the Reset securid File and Reset sdstatus.12 File columns.

Note The Reset sdstatus.12 File field is hidden from your view. Using the vertical and horizontal scroll bars in the innermost frame, scroll down and then to your right to view this field.

b) Click **Save** in this row to save the changes.

Step 8 Click **Save**.

Configure Authentication Control Options for RSA Identity Source

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **RSA SecurID** > **Add**.

Step 2 Click the **Authentication Control** tab.

Step 3 Choose one of the following:

- Treat Rejects as "authentication failed"—Choose this option if you want the rejected requests to be treated as failed authentications.
- Treat Rejects as "user not found"—Choose this option if you want the rejected requests to be treated as user not found errors.

Step 4 Check the **Enable Passcode Caching** check box if you want Cisco ISE to store the passcode in the cache after the first successful authentication and use the cached user credentials for the subsequent authentications if they happen within the configured time period.

Enter the number of seconds for which the passcode must be stored in the cache in the **Aging Time** field. Within this period of time, the user can perform more than one authentication with the same passcode. The default value is 30 seconds. The valid range is from 1 to 300 seconds.

Note Cisco ISE clears the cache after the first failed authentication. The user must enter a new, valid passcode.

Note We strongly recommend that you enable this option only when you use a protocol that supports encryption of the passcode, for example, EAP-FAST-GTC.

Step 5 Check the **Enable Identity Caching** check box if you want to allow processing of requests that do not perform authentication against the server.

You can enable the identity caching option and set the aging time in minutes. The default value is 120 minutes. The valid range is from 1 to 1440 minutes. The results and attributes obtained from the last successful authentication are retained in the cache for the specified time period.

This option is disabled by default.

Step 6 Click **Save** to save the configuration.

Configure RSA Prompts

Cisco ISE allows you to configure RSA prompts that are presented to the user while processing requests sent to the RSA SecurID server.

Before you begin

To perform the following task, you must be a Super Admin or System Admin.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **RSA SecurID**.

Step 2 Click **Prompts**.

Step 3 Enter the values as described in RSA SecurID Identity Source Settings.

Step 4 Click **Submit**.

Configure RSA Messages

Cisco ISE allows you to configure messages that are presented to the user while processing requests sent to the RSA SecurID server.

Before you begin

To perform the following task, you must be a Super Admin or System Admin.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **RSA SecurID**.

Step 2 Click **Prompts**.

Step 3 Click the **Messages** tab.

Step 4 Enter the values as described in RSA SecurID Identity Source Settings.

Step 5 Click **Submit**.

SAMLv2 Identity Provider as an External Identity Source

Security Assertion Markup Language (SAML) is an XML-based open standard data format that enables administrators to access a defined set of applications seamlessly after signing into one of those applications. SAML describes the exchange of security related information between trusted business partners. SAML enables exchange of security authentication information between an Identity Provider (IdP) and a service provider (in this case, ISE).

SAML Single Sign On (SSO) establishes a Circle of Trust (CoT) by exchanging metadata and certificates as part of the provisioning process between the IdP and the Service Provider. The Service Provider trusts the IdP's user information to provide access to the various services or applications.

Enabling SAML SSO results in several advantages:

- It reduces password fatigue by removing the need for entering different user name and password combinations.
- It improves productivity because you spend less time re-entering credentials for the same identity.
- It transfers the authentication from your system that hosts the applications to a third party system.
- It reduces costs as fewer help desk calls are made for password reset, thereby leading to more savings.

The IdP is an authentication module that creates, maintains, and manages identity information for users, systems, or services. The IdP stores and validates the user credentials and generates a SAML response that allows the user to access the service provider protected resources.

Note You must be familiar with your IdP service, and ensure that it is currently installed and operational.

SAML SSO is supported for the following portals:

- Guest portal (sponsored and self-registered)
- Sponsor portal
- My Devices portal
- Certificate Provisioning portal

You cannot select IdP as external identity source for BYOD portal, but you can select an IdP for a guest portal and enable BYOD flow.

Cisco ISE is SAMLv2 compliant and supports all SAMLv2 compliant IdPs that use Base64-encoded certificates. The IdPs listed below have been tested with Cisco ISE:

- Oracle Access Manager (OAM)
- Oracle Identity Federation (OIF)
- SecureAuth
- PingOne
- PingFederate
- Microsoft Entra ID

The IdP cannot be added to an identity source sequence.

The SSO session will be terminated and Session Timeout error message will be displayed if there is no activity for the specified time (default is 5 minutes).

If you want to add the Sign On Again button in the Error page of the portal, add the following JavaScript in the Optional Content field in the Portal Error page:

```
<button class="cisco-ise" data-inline="true" data-mini="true" data-theme="b"
id="ui_aup_accept_button" onclick="location.href='PortalSetup.action?portal=<Portal ID>'"
type="button">SignOn Again</button>
```

Enabling Session Services

Before you begin

The session services must be enabled on the node on which you want to enable SAML SSO. To enable this option:

Step 1 Choose **Administration** > **System** > **Deployment**.

Step 2 Select the node and click **Edit**.

Step 3 In the **General Settings** tab, enable the **Policy Service** toggle button.

Step 4 Check the **Enable Session Services** check box and click **Save**.

Configure SAML Identity Providers in Cisco ISE

To configure SAML Identity Providers in Cisco ISE:

- You must be a Super Admin or System Admin in Cisco ISE.
- If the certificate to be used is not self-signed by the Identity Provider (IdP), import the Certificate Authority (CA) certificate in to the Trusted Certificate Store.
- You must have admin access to the IdP portal being configured. The following task involves some steps to be performed in the IdP portal.

To configure SAML Identity Providers in Cisco ISE:

1. Add a SAML Identity Provider to Cisco ISE.
2. Add SAML Identity Provider as the authentication method of a portal.
3. Configure SAML ID Provider.

Add a SAML Identity Provider to Cisco ISE

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **External Identity Sources** > **SAML Id Providers**.

Step 2 Click **Add**.

Step 3 In the **SAML Identity Provider** window displayed, enter the **Id Provider Name** and **Description** in the **General** tab.

Step 4 Click **Submit**.

Step 5 In the **Identity Provider Config** tab, import the relevant metadata.xml file, and click **Submit**.

In Cisco ISE Release 3.3, if the imported metadata file contains a self-signed certificate, the certificate is automatically added to the Cisco ISE Trusted Certificates store. You can then access this certificate in the Trusted Certificate store.

Note The **Want Authentication Requests Signed** check box is read-only. The selection or non-selection of the option is automatically done based on the information in the metadata XML file that you upload.

To choose whether authentication requests must be signed, use the Sign Authentication Request check box in the Advanced Settings tab. The Sign Authentication Request takes precedence in execution.

Add an SAML Identity Provider as Authentication Method of a Portal

You can add the SAML Identity Provider you just created to the following portals:

1. Self-registered Guest Portals and Sponsored Guest Portals (**Work Centers** > **Guest Access** > **Portals and Components**)
2. Certificate Provisioning Portals (**Administration** > **Device Portal Management** > **Certificate Provisoning** > **Certificate Provisioning Portal)**

Step 1 In the portal customization window of the portal you are configuring, click **Portal Settings**.

Step 2 In the drop-down section that is displayed, go to **Authentication Method** section and use the menu to select the SAML IP Provider you added.

Step 3 Click **Save**.

Configure SAML ID Provider

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **External Identity Sources** > **SAML Id Providers**. Select the IdP that you have just linked to a portal, and click **Edit**.

Step 2 (Optional) If you are using a load balancer to optimize the load on Cisco ISE nodes, you can add its details in the **Service Provider Info** tab to simplify the configuration of IdPs. Software or hardware load balancers can be added.

The load balancer should be able to forward requests to the Cisco ISE nodes in the deployment using the port specified in the **Portal Settings** window.

When a load balancer is added, its URL alone is provided in the service provider metadata file. If a load balancer is not present, multiple **AssertionConsumerService** URLs are included in the service provider metadata file.

Note We recommend that you avoid using the same IP address of the load balancer at the portal FQDN setting.

Step 3 In the **Service Provider Info** tab, click **Export** to export the service provider metadata file. The exported metadata includes the signing certificate of Cisco ISE, which is identical to the chosen portal's certificate.

The exported metadata zip folder includes a Readme file that contains basic instructions for configuring each IdP (including, Microsoft Entra ID, PingOne, PingFederate, SecureAuth, and OAM)

You must re-export the service provider metadata if there are any changes in the following:

- Registration of a new Cisco ISE node.
- Hostname or IP Address of a node.
- Fully qualified domain name (FQDN) of My Devices, Sponsor, or Certificate Provisioning portal.

- Port or interface settings.
- Associated load balancer.

If the updated metadata is not re-exported, the IdP may reject a user authentication request.

Step 4 Go to your IdP portal and log in as Admin user, and import the service provider metadata file that you just exported from Cisco ISE. You need to first unzip the exported folder and a metadata file with the name of the portal. The metadata file includes the Provider ID and Binding URI.

Step 5 Return to the Cisco ISE portal.

Step 6 (Optional) In the **Groups** tab of the **SAML Identity Provider** window, add the required user groups.

Enter the assertion attribute that specifies the group membership of users in the **Group Membership Attribute** field.

Step 7 (Optional) Add the user attributes in the **Attributes** tab to specify how the attribute appears in the assertions returned from the IdP.

The name you specify in the **Name in ISE** field will appear in policy rules.

The following data types are supported for the attributes:

- String
- Integer
- IPv4
- Boolean

Step 8 Configure the following options in the **Advanced Settings** tab:

Option	Description
Identity Attribute	Select the attribute that specifies the identity of the user that is being authenticated by clicking the radio button against the options displayed. **Note** Cisco ISE does not support SAML IdP responses that contain subject name (NameID) in transient or persistent formats. Cisco ISE cannot retrieve the Username attribute assertion from the SAML IdP response if these methods are used and the authentication will fail.
Email attribute	From the drop-down list, select the assertion attribute which returns the email address of the user. The email attribute must be configured if you plan to filter (limit) the list of sponsored guests to be approved by a sponsor.
Multi-Value Attributes	Select one of the following: • **Each value in a separate XML**: Click this option if your IdP returns multiple values of the same attribute in separate XML elements. • **Multiple values in a single XML**: Click this option if your IdP returns multiple values in a single XML element. Specify the delimiter in the text box.
Authentication Settings	Cisco ISE signs authentication requests with defined certificates. For an SAML-signing request, an SAML-signing certificate must be properly defined. **a. Request**

Option	Description
	• **Sign Authentication Request**: Check this check box if your external identity provider requires signed requests. Some identity providers like PingFederate need signed authentication requests. • **Include Certificate Info**: Check this check box to include information about a particular certificate in the authentication request. **b. Response Signature** **Note** By default, Cisco ISE requires at least one signed SAML response or signed SAML assertion. Cisco ISE will enforce this even if the **Require SAML Signed Response** and **Require Assertions Signed** check boxes are not checked. You can check the apppropraite check box to choose a specific signature from the following options: • **Require SAML Signed Response**: Choosing this option ensures that Cisco ISE only accepts signed SAML responses. • **Require Assertions Signed**: Choosing this option ensures that Cisco ISE only accepts SAML responses with signed SAML assertions. **c. Assertion Encryption** • **Require Assertions Encrypted**: Choosing this option ensures that Cisco ISE only accepts encrypted SAML assertions.
Logout Settings	Check the **Sign Logout Requests** check box if you want logout requests to be signed. This option is not displayed if the IdP being configured is Oracle Access Manager or Oracle Identity Federation. **Note** SecureAuth does not support SAML logout. The following options are displayed only when configuring Oracle Access Manager or Oracle Identity Federation IdPs, and a load balancer is not configured: • **Logout URL**: Enter the URL for the page to which a user is redirected to terminate an SSO session, when they log out of either the Sponsor or the My Devices portal. • **Redirect Parameter Name**: When the SSO session is terminated, the user is brought back to the IdP's login page.The redirect parameter name may differ based on the IdP, for example, **end_url** or **returnURL**. This field is case sensitive. If the logout does not work as expected, check the IdP's documentation for details on using logout URLs and redirect parameter names.
Authentication Context	Use this section to edit SAML IdP authentication context class reference. Cisco ISE SAML requests have typically used **PasswordProtectedTransport** authentication method in SAML request headings. This resulted in authentication failure in the case of multi-factor authentications being used. To avoid this, you can use **AuthnContextClassRef SAML Element** section to specify an authentication method. If you are unsure of the authentication method used, we recommend that you leave this section empty to avoid authentication failures.

Step 9 Click **Submit**.

Delete an Identity Provider

Before you begin

To perform the following task, you must be a Super Admin or System Admin.

Ensure that the IdP that you want to delete is not linked to any portal. If the IdP is linked to any portal, the delete operation fails.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers > Network Access > Ext Id Sources > SAML Id Providers**.

Step 2 Check the check box next to the IdP that you want to delete, and then click **Delete**.

Step 3 Click **OK** to delete the IdP that you have selected.

SAML-Based Admin Login

SAML-based login adds a single sign-on (SSO) capability to Cisco ISE using the SAML 2.0 standard. You can use an external identity provider (IdP) such as Okta, or any other IdP that implements the SAML 2.0 standard.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **SAML Id Providers** > **Add** > **General**.

Step 2 Enter a value in the **Id Provider Name** field.

Step 3 Click **Submit**.

Step 4 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Admin Access** > **Authentication** > **Authentication Method**.

Step 5 Click **Password Based** radio button.

Step 6 From the **Identity Source** drop-down list, choose the IdP name that was created earlier in the procedure.

Step 7 Click **Save**.

Step 8 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **External Identity Sources** > **SAML Id Providers**.

Step 9 Check the check box next to the IdP you created earlier in the procedure, and click **Edit**.

Step 10 In the **Service Provider Info** tab, click **Export** to download the service provider metadata. Cisco ISE metadata is exported as a .xml file.

Step 11 Open the metadata file.

Step 12 Log out and click **Log in With SAML**.

Step 13 The URL redirects you to the PSN IP address. Use this IP Address in the external Identity Provider. Alternatively, you can also configure multiple Single Sign On (SSO) URLs for all the PSNs in the network in the external Identity Provider.

Note The active PSN must be reachable from PAN. Port 8443 of the active PSN should be reachable from the device where the admin is trying to do the SAML Login.

Step 14 In the external Identity Provider, use the **AssertionConsumerService** URL and **entityID** from the exported metadata.

Step 15 Configure the Group Attributes in the Identity Provider.

Step 16 Export the Identity Provider metadata.

Step 17 In the **Identity Provider Config** tab, click **Choose File** to upload the Identity Provider metadata.

Note Admin Cisco ISE Portal should use a dedicated IdP. Do not re-use any IdP created for other portals such as Guest Portal.

Step 18 Under the **Groups** tab, enter the required value in the **Group Membership Attribute** field. Use the group attribute name that was used in the Identity Provider.

Step 19 Click **Add**.

Step 20 Enter the group name that is configured in Identity Provider, in **Name in Assertion**.

Step 21 Choose the admin group from **Name in ISE** drop-down list.

Step 22 Click **Add**.

Step 23 Click **Save**.

Step 24 The modified Cisco ISE login page is displayed. Click **Log in With SAML** to redirect to the Identity Provider for authentication.

Note In case of a multi-node deployment, use the FQDN instead of the IP Address to login.

Important When Microsoft Entra ID is used as the IdP, login access is denied if the user is a member of 150 or more groups. To avoid this, you can do one of the following:

- Restrict the number of groups the admin is a member of, to less than 150.
- Configure a filter on the group claim on the Enterprise Application SSO configuration to filter and include only the groups necessary for admin access.

This is a Microsoft Entra ID limitation and more information on this can be found on the Microsoft page as part of Microsoft Entra ID documentation.

Authentication Failure Log

When authentication against SAML ID Store fails and the IdP redirects the user back to ISE portal (through SAML response), ISE will report a failure reason in the authentication log. For Guest portal (with or without BYOD flow enabled), you can check the RADIUS Livelog (Operations > RADIUS > Live Log) to know the authentication failure reason. For My Devices portal and Sponsor portal, you can check the My Devices Login/Audit report and Sponsor Login/Audit report (under Operations > Reports > Guest) to know the authentication failure reason.

In case of logout failure, you can check the reports and logs to know the failure reason for My Devices, Sponsor, and Guest portal.

Authentication can fail due to the following reasons:

- SAML Response parse errors

- SAML Response validation errors (for example, Wrong Issuer)
- SAML Assertion validation errors (for example, Wrong Audience)
- SAML Response signature validation errors (for example, Wrong Signature)
- IdP signing certificate errors (for example, Certificate Revoked)

Note Cisco ISE does not support SAML responses with encrypted assertions. If this is configured in the IdP, you will see the following error message in ISE: `FailureReason=24803 Unable to find 'username' attribute assertion.`

If the authentication fails, we recommend that you check the "DetailedInfo" attribute in the authentication log. This attribute provides additional information regarding the cause of failure.

Cisco pxGrid Direct

Note In Cisco ISE Releases 3.2 Patch 2 and later, pxGrid Direct is no longer a controlled introduction (beta) feature. This document describes pxGrid Direct as it is presented in Cisco ISE Releases 3.2 Patch 2 and later.

Before you upgrade to Cisco ISE Release 3.3, we recommend that you delete all configured pxGrid Direct connectors and any authorization profiles and policies that use data from pxGrid Direct connectors. After you upgrade to Cisco ISE Release 3.3, reconfigure pxGrid Direct connectors. If you do not delete the configured pxGrid Direct connectors, the connectors are automatically deleted during the upgrade. This deletion results in uneditable and unusable authorization profiles and policies that you must delete and replace with new ones.

You require the Advantage license to create, edit, enable, and disable a pxGrid Direct connector.

Cisco pxGrid Direct helps to evaluate and authorize the endpoints faster by enabling you to connect to external REST APIs that provide JSON data for endpoint attributes and fetch this data into the Cisco ISE database. This feature eliminates the need to query for endpoint attribute data each time an endpoint must be authorized. You can then use the fetched data in authorization policies.

For information on Cisco pxGrid, see the chapter "Cisco pxGrid" in the *Cisco ISE Administrator Guide*.

pxGrid Direct helps collect data based on the attributes you specify in your pxGrid Direct configurations. Two mandatory fields called Unique Identifier and Correlation Identifier are used to fetch relevant data. If a connector does not contain values for either of these fields, the fetching and saving of data from a connector may be erroneous.

The following are the characteristics of pxGrid Direct:

- The number of pxGrid Direct attributes you configure in a policy set proportionately increases the run-time (transactions per second) of a policy execution.
- Adding more than 10 connectors might cause performance degradation.

pxGrid Direct runs on the PAN and the data fetched is available on all the PSNs to be used in the authorization policies.

You can view details of the configured connectors and the fetched endpoint data in the **Context Visibility** > **Endpoints** > **pxGrid Direct Connectors** and **Context Visibility** > **Endpoints** > **pxGrid Direct Endpoints** windows.

In the **pxGrid Direct Endpoints** window, click an endpoint to view its details in a slide-in pane.

In the **Operations** > **Reports** > **Audit** > **Change Configuration Audit** window, you can view the related logs with the Object Type name **pxGrid Direct Connector Operation**.

Configure pxGrid Direct debug logs in the **Operations** > **Troubleshoot** > **Debug Wizard** > **Debug Log Configuration** window.

You can create a pxGrid Direct connector using the pxGrid Direct Open API or GUI. See Create a Connector Using Open API, on page 172 or Create a Connector Using GUI, on page 173 for steps on how to create a connector.

The pxGrid Direct connector fetches the data from the external REST APIs based on the attributes that are mapped in a connector, and stores the data in the endpoint table in the Cisco ISE database. The attributes that are mapped in a connector are available as dictionary attributes in the authorization profile.

You can create conditions based on the dictionary attribute values to define the course of action that Cisco ISE must perform when an endpoint accesses the Cisco ISE environment.

The following log files provide information related to pxGrid Direct connectors:

- pxgriddirect.log—Contains logs related to whether fetched endpoint data has been received and saved to the Cisco ISE database.
- pxgriddirect-connector.log—Contains logs that indicate whether a pxGrid Directed connector is successfully added to Cisco ISE.

The following is an example of a pxGrid Direct connector configuration response that you receive when you use the Open API GET /api/v1/pxgrid-direct/connector-config/<connector-name>. The pxGrid Direct Open APIs are listed in the Cisco ISE API - pxGrid Direct document.


```
{
    "connector": {
      "connectorName": "SNOW_CMDBconnectorfetch",
      "description": "description",
      "connectorType": "urlfetcher",
      "skipCertificateValidations": true,
      "enabled": true,
      "url": {
        "bulkUrl": "https://cmdbhostname.domain/cmdb-random/1",
        "authenticationType": "basic",
        "userName": "BASIC_USER_NAME",
        "password": "BASIC_PASSWORD"
      },
      "fullsyncSchedule": {
        "intervalUnit": "days",
        "interval": 1,
        "startDate": "2022-05-30T09:00:00"
      },
      "attributes": {
        "topLevelObject": "result",
        "uniqueIdentifier": "mac_address",
        "bulkUniqueIdentifier": "mac_address",
        "attributeMapping": [
          {
            "includeInDictionary": true,
            "jsonAttribute": "group_tag",
            "dictionaryAttribute": "securityTag"
```

```
          }
        ]
      }
    }
  }
```

The following example shows the JSON response from a pxGrid Direct connector that has top-level object as `result`. When the URL mentioned in the key **bulkUrl** in the GET API above is used, you receive the following example result.

```
{
  "result": [
    {
      "mac_manufacturer": "Example, Incorporated",
      "operational_status": "Operational",
      "sys_updated_on": "2022-03-31 17:27:41",
      "sys_updated_by": "admin",
      "sys_created_on": "2022-01-20 12:23:40",
      "sys_created_by": "admin",
      "cmdb_ci": "Computer1",
      "install_status": "Installed",
      "name": "NetworkAdapter",
      "sys_id": "00abc11xyz",
      "mac_address": "00:00:xx:00:xx:xx",
      "group_tag": "0123"
    }
  ]
}
```

The attributes `group_tag` and `mac_address` are selected from this JSON response. These attributes are used by pxGrid Direct connector to identify this JSON response when pxGrid Direct connects to the external REST API.

The bulk unique identifier and unique identifier are defined as `mac_address`.

The top-level object is defined as `result`.

The connector's name is `SNOW_CMDBconnectorfetch`.

The connector type is defined as `urlfetcher`. It fetches the data from the URL that is defined in `bulkurl` and `incrementalurl`. Currently, the `authenticationType` is limited only to `basic`.

The data synchronization schedules are defined in `deltasyncSchedule` and `fullsyncSchedule` along with the data synchronization intervals. The URL mentioned in the `bulkUrl` is used for full synchronization of the data. The URL mentioned in the `incrementalUrl` is used for incremental synchronization of the data.

Interval for Data Synchronization

The configuration steps to add a pxGrid Direct connector include the option to schedule full and partial synchronizations.

The full synchronization is used for bulk data collection, for example, when you initially connect to the external REST APIs to collect the data.

Schedule full synchronization after business hours to avoid any performance issues due to huge volume of data transfer from the external REST APIs to the Cisco ISE database.

Full synchronization also allows periodic bulk data collection, as required.

The incremental synchronization is used when you must update the data from the external REST API from which you have already collected the data using the full synchronization.

Instance	Interval
Schedule full synchronization	Default: 1 week Minimum: 12 hours Maximum: 1 month
Schedule incremental synchronization	Default: 1 day Minimum: 1 hour Maximum: 1 week

On-demand pxGrid Direct Data Synchronization using Sync Now

From Cisco ISE Release 3.3 Patch 2, you can use the **Sync Now** feature to perform on-demand synchronization of data for pxGrid Direct connectors.

You require the Advantage license to create, edit, enable, and disable a pxGrid Direct connector. However, after a pxGrid Direct connector is created, the synchronization of data will continue irrespective of the license status until the connector is edited. You can use the sync now feature using the Essentials license if the pxGrid Direct connector is already created.

On-demand synchronization is supported for both Full and Incremental syncs. You can synchronize individual pxGrid Direct connectors or synchronize pxGrid Direct connectors in bulk. On-demand data synchronization using **Sync Now** can be performed through the Cisco ISE GUI or using OpenAPI. Currently, synchronization of connectors in bulk is only supported through the Cisco ISE GUI. If a scheduled synchronization of data is in progress for a connector, you cannot use the **Sync Now** option for that connector. If you disable a connector while a synchronization (scheduled sync or sync now) is in progress, the connector will still complete the ongoing data fetch from the server and upload the data to the Cisco ISE database. The data fetches that follow the ongoing data fetch will be disabled.

You can use the **Sync Now** column in the **pxGrid Direct Connectors** window of the Cisco ISE GUI to perform full or incremental data synchronization on-demand for one or more pxGrid Direct connectors. When synchronizing data for a newly added connector using the **Sync Now** option (prior to the first scheduled **Full Sync**), we recommend that you choose **Full Sync**.

- **Sync Now for One pxGrid Connector**: To sync a pxGrid Direct connector, click **Full** or **Incremental** in the **Sync Now** column depending on your data synchronization requirement.
- **Sync Now for Many pxGrid Connectors**: Check the check boxes next to the pxGrid Direct connectors that want to select for the sync now operation. From the **Sync Now** drop-down list, select **Incremental Sync** or **Full Sync** depending on your data synchronization requirement.

Note

- Only five pxGrid Direct connectors can be synchronized at any given time.
- If more than five pxGrid Direct connectors are selected, all of them are queued, but only five of them will be synced at a time. As one connector moves to **Completed** status, the next connector in the queue will begin syncing.

Click **Refresh** at the top of the table in the **pxGrid Direct Connectors** window to view the updated synchronization statuses of the selected pxGrid Direct connector. The **Sync Status** column displays the synchronization status of the pxGrid Direct connectors. The synchronization statuses are as follows:

Sync Status	Description
Queued	The pxGrid Direct connector is in queue for data synchronization.
Submitted	The data synchronization of the pxGrid Direct connector is initiated. Here, the data is fetched from an external server.
InProgress	The data synchronization of the pxGrid Direct connector is in progress. Here, the data is being fetched from an external server and is stored in Cisco ISE. **Note** If a scheduled sync cycle is triggered when a sync now operation is in progress, the scheduled sync cycle is skipped, and will be noted in the audit log.
Completed	The data synchronization of the pxGrid Direct connector is completed. The data is stored in primary PAN and replication of data to the PSNs is still in progress.
Errored	There was an error during the data synchronization. For information on the error, refer to the audit log.
Cancelled	During a failover or an upgrade or a restore operation, a sync in progress can be cancelled. You can manually trigger the data synchronization for that pxGrid Direct connector using a sync now operation or wait for the next regular sync schedule.

Note Click **Cancel Sync** in the **Sync Now** column to cancel a sync that is queued. You can only cancel a sync when it's in the **Queued** state. You can't cancel a sync if it has progressed to the **InProgress** or **Submitted** states.

The **Last Sync** column displays the time of the latest data synchronization of the pxGrid Direct connector.

The **Total Objects** column displays the total number of objects saved in the Cisco ISE database for each pxGrid Direct connector after the most recent sync. The count in the column changes when you click **Refresh** to view the status of the sync.

Note When synchronization is in progress for a connector and a PAN failover occurs, the ongoing data synchronization will be terminated automatically and the status will be displayed as **Cancelled**. You have to manually trigger the synchronization again.

Create a Connector Using Open API

Before you begin

- If your external server cannot be reached without a proxy, configure the proxy connection.

- If the URLs you configure require certificate validations, upload the required certificate in the Trusted Certificate store.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Settings** > **API Settings**.

Step 2 In the **API Settings** window, click the **Swagger API** link.

Step 3 In the **Cisco ISE API** window, from the **Select a Definition** drop-down list, choose **pxGrid Direct**.

Step 4 Click **pxGrid Direct**.

Step 5 Click **POST /api/v1/pxgrid-direct/connector-config Configure connnectorconfig information**.

Step 6 Click **Try it Out**.

Step 7 In the **Request Body** field, enter the following details. Note that your inputs are not validated upon entry. The entry of incorrect field names and values results in a failure to fetch endpoint data from the configured connector, even if the connector may be displayed in the list of configured connectors in the Cisco ISE administration portal.

- dictionary attribute
- include in dictionary
- JSON attribute
- bulk unique identifier
- top level object
- unique identifier
- correlation identifier
- version identifier
- connector name (The connector name must be limited to 50 characters.)
- connector type
- delta sync schedule
- full sync schedule
- protocol
- authentication type
- bulk URL
- incremental URL

Step 8 Click **Execute**.

Create a Connector Using GUI

Before you begin

- If your external server cannot be reached without a proxy, configure the proxy connection.

- If the URLs you configure require certificate validations, upload the required certificate in the Trusted Certificate store.

Step 1 In your Cisco ISE administration portal, choose **Administration** > **Network Resources** > **pxGrid Direct Connectors**.

Step 2 In the **pxGrid Direct Connectors** window, click **Add**.

Step 3 In the **Add pxGrid Direct Connector** wizard, click **Let's Do It**.

Step 4 In the **Connector Definition** window, enter the connector name and description.

Note The connector type is predefined as **URL Fetcher** because it is the only connector type currently supported.

Step 5 (Optional) Check the **Skip Certificate Validations** check box.

Step 6 Click **Next**.

Step 7 In the **Add URL** window, in the **URL** field, enter the URL from which you need to fetch the data for full synchronization.

Step 8 (Optional) In the **Add URL** window, in the **Incremental URL** field, enter the URL from which you want to fetch the data for incremental synchronization. In Cisco ISE Releases 3.2 Patch 2 and later, you can include the latest version component in the incremental URL.

An example of an incremental sync URL:https://<hostname>/api/now/table/test_adapter?sysparm_limit=5&sysparm_query=sys_updated_on>=javascript:gs.dateGenerate('{{LATEST_VERSION}}').

If you use sys_updated_on as the latest version identifier, the incremental sync fetches endpoint data starting from the most recent sys_updated_on value mentioned in the previous data fetch from the connector.

Note The option to configure the incremental synchronization schedule in the **Set Up Synchronization Schedule** window is enabled only if you enter the URL in the **Incremental URL** field.

The latest version component is not supported in Cisco ISE Releases 3.2 Patch 1 and earlier.

Step 9 In the **Authentication** field, enter your login credentials.

Step 10 Click **Test Connection** to check if you have access to the added URLs.

If you did not check the **Skip Certificate Validations** check box at Step 5, and the required URL validation certificate is not uploaded in the Cisco ISE Trusted Certificates store, an error message is displayed. You must import the required certificate to the Trusted Certificate store, and check the **Trust for Authentication of Cisco Services** check box for the certificate.

Step 11 Click **Next**.

Step 12 In the **Set Up Synchronization Schedule** window, choose one of the following options:

- **Full**: Choose this option if you want to extract the entire data from the external REST API.
- **Full and Incremental**: Choose this option if you want to extract the entire data from the external REST API, as well as update the data in the Cisco ISE database at regular intervals.

  Note The schedule is always based on the system time on the PAN.

Step 13 In the **Schedule Full Sync** field, enter the duration, start date, and start time for full synchronization.

Step 14 In the **Schedule Incremental Sync** field, enter the duration, start date, and start time for incremental synchronization.

Note This field appears only if you have selected the **Full and Incremental** option in step 12.

Step 15 Click **Next**.

Step 16 In the **Parent Object** window, enter the **Parent Object** name that is required to identify the JSON file present in the external REST API from which the rest of the attributes are queried.

Step 17 Click **Next**.

Step 18 In the **Select Attributes Configure Dictionary Items** window, click **Add**.

Step 19 In the **External Name** field, enter the name of the attribute present in the external REST API.

Step 20 Click **Include in Dictionary** to add this external REST API attribute to the pxGrid Direct connector dictionary.

Step 21 In the **Name in Dictionary** field, enter a name for this attribute.

Step 22 Click **Next**.

Step 23 In the **Identifiers** window, from the **Unique Identifier** drop-down list, choose the attributes that are unique to an endpoint.

Step 24 From the **Correlation ID** drop-down list, choose the attributes using which Cisco ISE matches an endpoint to an authorization policy.

Step 25 (Optional) From the **Version Identifier** drop-down list, choose the attributes that help to record the version of the endpoint data.

Step 26 Click **Next**.

Step 27 In the **Configuration Summary** window, review the configuration settings. To proceed, click **Done**.
The new connector is displayed in the **pxGrid Direct Connectors** window.

In the **pxGrid Direct Connectors** window, you can edit, refresh, or delete the pxGrid Direct connectors. You can also enable or disable the **Scheduling** option for the pxGrid Direct connectors.

- To edit a pxGrid Direct connector, check the check box next to the connector that you want to edit and click **Edit**. Update the required details and click **Save**.
- You can enable the connector if you want to fetch the data from the external REST API as defined in the connector.
- You can disable the connector if you do not want to fetch the data from the external REST API. When you disable a connector, the endpoint data that is already fetched persists in Cisco ISE in the**pxGrid Direct Connectors** window. The connector does not attempt any fetches after it is disabled.

Step 28 To verify if the connector is created:

a. In your Cisco ISE administration portal, choose**Policy** > **Policy Elements** > **Dictionaries**.

b. In the **System Dictionaries** window, click the connector name that you provided while creating the connector.

c. In the **View Dictionary** window, click **Dictionary Attributes** to view the dictionary attributes that you added while creating the connector.

Configure an Authorization Profile Using the Connector Attributes

Step 1 In your Cisco ISE administration portal, choose **Policy** > **Policy Elements** > **Results**.

Step 2 Choose **Authorization** > **Authorization Profiles**.

Step 3 In the **Standard Authorization Profiles** window, click **Add**.

Step 4 In the **Authorization Profile** window, enter a name for the authorization profile.

Step 5 In the **Advanced Attributes Settings** section, from the **Dictionaries** drop-down list, choose **cisco-av-pair**.

Step 6 From the **Attribute Values** drop-down list, choose the required dictionary attributes.

Step 7 Click **Submit**.

Identity Source Sequences

Identity source sequences define the order in which Cisco ISE looks for user credentials in the different databases.

If you have user information in more than one of the databases that are connected to Cisco ISE, you can define the order in which you want Cisco ISE to look for information in these identity sources. Once a match is found, Cisco ISE does not look any further, but evaluates the credentials, and returns the result to the user. This policy is the first match policy.

Create Identity Source Sequences

Before you begin

Ensure that you have configured your external identity sources in Cisco ISE.

To perform the following task, you must be a Super Admin or System Admin.

For allowing guest users to authenticate through Local WebAuth, you must configure both the Guest portal authentication source and the identity source sequence to contain the same identity stores.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **Identity Source Sequences** > **Add**.

Step 2 Enter a name for the identity source sequence. You can also enter an optional description.

Step 3 Check the **Select Certificate Authentication Profile** check box and choose a certificate authentication profile for certificate-based authentication.

Step 4 Choose the database or databases that you want to include in the identity source sequence in the **Selected List** field.

Step 5 Rearrange the databases in the **Selected list** field in the order in which you want Cisco ISE to search the databases.

Step 6 If a selected identity store cannot be accessed for authentication, choose one of the following options in the **Advanced Search List** area:

- **Do not access other stores in the sequence and set the AuthenticationStatus attribute to ProcessError**
- **Treat as if the user was not found and proceed to the next store in the sequence**

  While processing a request, Cisco ISE searches these identity sources in sequence. Ensure that you have the identity sources in the Selected list field listed in the order in which you want Cisco ISE to search them.

Step 7 Click **Submit** to create the identity source sequence that you can then use in policies.

Delete Identity Source Sequences

You can delete identity source sequences that you no longer use in policies.

Before you begin

- Ensure that the identity source sequence that you are about to delete is not used in any authentication policy.
- To perform the following task, you must be a Super Admin or System Admin.

Step 1 Choose **Administration** > **Identity Management** > **Identity Source Sequences**.

Step 2 Check the check box next to the identity source sequence or sequences that you want to delete, then click **Delete**.

Step 3 Click **OK** to delete the identity source sequence or sequences.

Identity Source Details in Reports

Cisco ISE provides information about the identity sources through the Authentications dashlet and Identity Source reports.

Authentications Dashlet

From the Authentications dashlet, you can drill down to find more information including failure reasons.

Choose Operations > RADIUS Livelog to view real-time authentication summary. For more information about RADIUS Live Logs, see RADIUS Live Logs.

Identity Source Reports

Cisco ISE provides various reports that include information about identity sources. See the Available Reports section for a description of these reports.

Profiled Endpoints on the Network

The Profiler service assists in identifying, locating, and determining the capabilities of all endpoints on your network (known as identities in Cisco ISE), regardless of their device types, to ensure and maintain appropriate access to your enterprise network. The Cisco ISE Profiler function uses a number of probes to collect attributes for all endpoints on your network, and pass them to the Profiler analyzer, where the known endpoints are classified according to their associated policies and identity groups.

The Profiler Feed service allows administrators to retrieve new and updated endpoint profiling policies and the updated OUI database as a feed from a designated Cisco feed server through a subscription in to Cisco ISE.

Profiler Condition Settings

The following table describes the fields in the Profiler Condition window. The navigation path for this window is **Policy** > **Policy Elements** > **Conditions** > **Profiling**.

Table 41: Profiler Condition Settings

Field Name	Usage Guidelines
Name	Name of the profiler condition.
Description	Description of the profiler condition.
Type	Choose any one of the predefined types.
Attribute Name	Choose an attribute on which to base the profiler condition.
Operator	Choose an operator.
Attribute Value	Enter the value for the attribute that you have chosen. For Attribute Names that contain pre-defined Attribute Values, this option displays a drop-down list with the pre-defined values, and you can choose a value.
System Type	Profiling conditions can be any one of the following types: • **Cisco Provided**: Profiling conditions that are provided by Cisco ISE when deployed are identified as Cisco Provided. You cannot edit or delete them from the system. • **Administrator Created**: Profiling conditions that you create as an administrator of Cisco ISE are identified as Administrator Created.

Related Topics

Cisco ISE Profiling Service, on page 178
Profiler Conditions, on page 211
Profiler Feed Service, on page 249
Create a Profiler Condition, on page 225

Cisco ISE Profiling Service

The profiling service in Cisco Identity Services Engine (ISE) identifies the devices that connect to your network and their location. The endpoints are profiled based on the endpoint profiling policies configured in Cisco ISE. Cisco ISE then grants permission to the endpoints to access the resources in your network based on the result of the policy evaluation.

The profiling service:

- Facilitates an efficient and effective deployment and ongoing management of authentication by using IEEE standard 802.1X port-based authentication access control, MAC Authentication Bypass (MAB) authentication, and Network Admission Control (NAC) for any enterprise network of varying scale and complexity.

- Identifies, locates, and determines the capabilities of all of the attached network endpoints regardless of endpoint types.
- Protects against inadvertently denying access to some endpoints.

ISE Community Resource

ISE Endpoint Profiles

How To: ISE Profiling Design Guide

Profiler Work Center

The Profiler Work Center menu (Work Centers > Profiler) contains all the profiler pages, which acts as a single start point for ISE administrators. The Profiler Work Center menu contains the following options: Overview, Ext ID Stores, Network Devices, Endpoint Classification, Node Config, Feeds, Manual Scans, Policy Elements, Profiling Policies, Authorization Policy, Troubleshoot, Reports, Settings, and Dictionaries.

Profiler Dashboard

The Profiler dashboard (Work Centers > Profiler > Endpoint Classification) is a centralized monitoring tool for the profiles, endpoints, and assets in your network. The dashboard represents data in both graphical and table formats. The Profiles dashlet displays the logical and endpoint profiles that are currently active in the network. The Endpoints dashlet displays the identity group, PSNs, OS types of the endpoints that connect to your network. The Assets dashlet displays flows such as Guest, BYOD, and Corporate. The table displays the various endpoints that are connected and you can also add new endpoints.

Endpoint Inventory Using Profiling Service

You can use the profiling service to discover, locate, and determine the capabilities of all the endpoints connected to your network. You can ensure and maintain appropriate access of endpoints to the enterprise network, regardless of their device types.

The profiling service collects attributes of endpoints from the network devices and the network, classifies endpoints into a specific group according to their profiles, and stores endpoints with their matched profiles in the Cisco ISE database. All the attributes that are handled by the profiling service need to be defined in the profiler dictionaries.

The profiling service identifies each endpoint on your network, and groups those endpoints according to their profiles to an existing endpoint identity group in the system, or to a new group that you can create in the system. By grouping endpoints, and applying endpoint profiling policies to the endpoint identity group, you can determine the mapping of endpoints to the corresponding endpoint profiling policies.

Cisco ISE Profiler Queue Limit Configuration

Cisco ISE profiler collects a significant amount of endpoint data from the network in a short period of time. It causes Java Virtual Machine (JVM) memory utilization to go up due to accumulated backlog when some of the slower Cisco ISE components process the data generated by the profiler, which results in performance degradation and stability issues.

To ensure that the profiler does not increase the JVM memory utilization and prevent JVM to go out of memory and restart, limits are applied to the following internal components of the profiler:

- Endpoint Cache: Internal cache is limited in size that has to be purged periodically (based on least recently used strategy) when the size exceeds the limit.
- Forwarder: The main ingress queue of endpoint information collected by the profiler.
- Event Handler: An internal queue that disconnects a fast component, which feeds data to a slower processing component (typically related to a database query).

Endpoint Cache

- maxEndPointsInLocalDb = 100000 (endpoint objects in cache)
- endPointsPurgeIntervalSec = 300 (endpoint cache purge thread interval in seconds)
- numberOfProfilingThreads = 8 (number of threads)

The limit is applicable to all profiler internal event handlers. A monitoring alarm is triggered when queue size limit is reached.

Cisco ISE Profiler Queue Size Limits

- forwarderQueueSize = 5000 (endpoint collection events)
- eventHandlerQueueSize = 10000 (events)

Event Handlers

- NetworkDeviceEventHandler: For network device events, in addition to filtering duplicate Network Access Device (NAD) IP addresses, which are already cached.
- ARPCacheEventHandler: For ARP Cache events.

Martian IP Addresses

Martian IP addresses are not displayed in **Context Visibility** > **Endpoints** and **Work Centers** > **Profiler** > **Endpoint Classification** windows as the RADIUS parser removes such addresses before they reach the profiling service. Martian IP addresses are a security concern as they are vulnerable to attacks. However, martian IP addresses are displayed in MnT logs for auditing purposes. This behaviour stands true in the case of multicast IP addresses as well. For more information on Martian IP addresses, see https://www.cisco.com/assets/sol/sb/Switches_Emulators_v2_3_5_xx/help/250/index.html#page/tesla_250_olh/martian_addresses.html

Profiler Forwarder Persistence Queue

The Profiler Forwarder Persistence queue stores events before they are sent to the profiler module for further processing. In addition, the queuing capacity has also been increased to support increased event handling. This reduces the number events that are lost because of a sudden increase in the number of events. This in turn reduces the alarms raised, when the queue reaches its maximum limit.

This feature is enabled by default. If required, you can disable this feature to fall back to the original mechanism, where events are sent directly to the profiler module. To enable or disable this feature, choose **Administration** > **System** > **Settings** > **Profiling** and check or uncheck the **Enable Profiler Forwarder Persistence Queue** check box.

Configure Profiling Service in Cisco ISE Nodes

You can configure the profiling service that provides you a contextual inventory of all the endpoints that are using your network resources in any Cisco ISE-enabled network.

You can configure the profiling service to run on a single Cisco ISE node that assumes all Administration, Monitoring, and Policy Service personas by default.

In a distributed deployment, the profiling service runs only on Cisco ISE nodes that assume the Policy Service persona and does not run on other Cisco ISE nodes that assume the Administration and Monitoring personas.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Deployment**.

Step 2 Choose a Cisco ISE node that assumes the Policy Service persona.

Step 3 Click **Edit** in the Deployment Nodes page.

Step 4 On the **General Settings** tab, check the **Policy Service** check box. If the Policy Service check box is unchecked, both the session services and the profiling service check boxes are disabled.

Step 5 Perform the following tasks:

a) Check the **Enable Session Services** check box to run the Network Access, Posture, Guest, and Client Provisioning session services.

b) Check the **Enable Profiling Services** check box to run the profiling service.

c) Check the **Enable Device Admin Service** check box to run the device administration service to control and audit an enterprise's network devices.

Step 6 Click **Save** to save the node configuration.

Network Probes Used by Profiling Service

Network probe is a method used to collect an attribute or a set of attributes from an endpoint on your network. The probe allows you to create or update endpoints with their matched profile in the Cisco ISE database.

Cisco ISE can profile devices using a number of network probes that analyze the behavior of devices on the network and determine the type of the device. Network probes help you to gain more network visibility.

IP Address and MAC Address Binding

You can create or update endpoints only by using their MAC addresses in an enterprise network. If you do not find an entry in the ARP cache, then you can create or update endpoints by using the L2 MAC address of an HTTP packet and the IN_SRC_MAC of a NetFlow packet in Cisco ISE. The profiling service is dependent on L2 adjacency when endpoints are only a hop away. When endpoints are L2 adjacent, the IP addresses and MAC addresses of endpoints are already mapped, and there is no need for IP-MAC cache mapping.

If endpoints are not L2 adjacent and are multiple hops away, mapping may not be reliable. Some of the known attributes of NetFlow packets that you collect include PROTOCOL, L4_SRC_PORT, IPV4_SRC_ADDR, L4_DST_PORT, IPV4_DST_ADDR, IN_SRC_MAC, OUT_DST_MAC, IN_SRC_MAC, and OUT_SRC_MAC. When endpoints are not L2 adjacent and are multiple L3 hops away, the IN_SRC_MAC attributes carry only the MAC addresses of L3 network devices. When the HTTP probe is enabled in Cisco ISE, you can create endpoints only by using the MAC addresses of HTTP packets, because the HTTP request messages do not carry IP addresses and MAC addresses of endpoints in the payload data.

Cisco ISE implements an ARP cache in the profiling service, so that you can reliably map the IP addresses and the MAC addresses of endpoints. For the ARP cache to function, you must enable either the DHCP probe or the RADIUS probe. The DHCP and RADIUS probes carry the IP addresses and the MAC addresses of endpoints in the payload data. The dhcp-requested address attribute in the DHCP probe and the Framed-IP-address attribute in the RADIUS probe carry the IP addresses of endpoints, along with their MAC addresses, which can be mapped and stored in the ARP cache.

NetFlow Probe

Cisco ISE profiler implements Cisco IOS NetFlow Version 9. We recommend using NetFlow Version 9, which has additional functionality needed to enhance the profiler to support the Cisco ISE profiling service.

You can collect NetFlow Version 9 attributes from the NetFlow-enabled network access devices to create an endpoint, or update an existing endpoint in the Cisco ISE database. You can configure NetFlow Version 9 to attach the source and destination MAC addresses of endpoints and update them. You can also create a dictionary of NetFlow attributes to support NetFlow-based profiling.

For more information on the NetFlow Version 9 Record Format, see Table 6, “NetFlow Version 9 Field Type Definitions” of the NetFlow Version 9 Flow-Record Format document.

In addition, Cisco ISE supports NetFlow versions earlier than Version 5. If you use NetFlow Version 5 in your network, then you can use Version 5 only on the primary network access device (NAD) at the access layer because it will not work anywhere else.

Cisco IOS NetFlow Version 5 packets do not contain MAC addresses of endpoints. The attributes that are collected from NetFlow Version 5 cannot be directly added to the Cisco ISE database. You can discover endpoints by using their IP addresses, and append the NetFlow Version 5 attributes to endpoints, which can be done by combining IP addresses of the network access devices and IP addresses obtained from the NetFlow Version 5 attributes. However, these endpoints must have been previously discovered with the RADIUS or SNMP probe.

The MAC address is not a part of IP flows in earlier versions of NetFlow Version 5, which requires you to profile endpoints with their IP addresses by correlating the attributes information collected from the network access devices in the endpoints cache.

For more information on the NetFlow Version 5 Record Format, see Table 2, “Cisco IOS NetFlow Flow Record and Export Format Content Information” of the NetFlow Services Solutions Guide.

DHCP Probe

The Dynamic Host Configuration Protocol probe in your Cisco ISE deployment allows the Cisco ISE profiling service to reprofile endpoints based only on new requests of INIT-REBOOT and SELECTING message types. Though other DHCP message types such as RENEWING and REBINDING are processed, they are not used for profiling endpoints. Any attribute parsed out of DHCP packets is mapped to endpoint attributes.

From Cisco ISE Release 3.3 onwards, IPv6 is supported in DHCP Probe.

DHCPREQUEST Message Generated During INIT-REBOOT State

If the DHCP client checks to verify a previously allocated and cached configuration, then the client must not fill in the Server identifier (server-ip) option. Instead it should fill in the Requested IP address (requested-ip) option with the previously assigned IP address, and fill in the Client IP Address (ciaddr) field with zero in its DHCPREQUEST message. The DHCP server will then send a DHCPNAK message to the client if the Requested IP address is incorrect or the client is located in the wrong network.

DHCPREQUEST Message Generated During SELECTING State

The DHCP client inserts the IP address of the selected DHCP server in the Server identifier (server-ip) option, fills in the Requested IP address (requested-ip) option with the value of the Your IP Address (yiaddr) field from the chosen DHCPOFFER by the client, and fills in the "ciaddr" field with zero.

Table 42: DHCP Client Messages from Different States

—	INIT-REBOOT	SELECTING	RENEWING	REBINDING
broadcast/unicast	broadcast	broadcast	unicast	broadcast
server-ip	MUST NOT	MUST	MUST NOT	MUST NOT
requested-ip	MUST	MUST	MUST NOT	MUST NOT
ciaddr	zero	zero	IP address	IP address

Wireless LAN Controller Configuration in DHCP Bridging Mode

We recommend that you configure wireless LAN controllers (WLCs) in Dynamic Host Configuration Protocol (DHCP) bridging mode, where you can forward all the DHCP packets from the wireless clients to Cisco ISE. You must uncheck the Enable DHCP Proxy check box available in the WLC web interface: **Controller** > **Advanced** > **DHCP Master Controller Mode** > **DHCP Parameters**. You must also ensure that the DHCP IP helper command points to the Cisco ISE Policy Service node.

DHCP SPAN Probe

The DHCP Switched Port Analyzer (SPAN) probe, when initialized in a Cisco ISE node, listens to network traffic, which are coming from network access devices on a specific interface. You need to configure network access devices to forward DHCP SPAN packets to the Cisco ISE profiler from the DHCP servers. The profiler receives these DHCP SPAN packets and parses them to capture the attributes of an endpoint, which can be used for profiling endpoints.

For example,

```
switch(config)# monitor session 1 source interface Gi1/0/4
switch(config)# monitor session 1 destination interface Gi1/0/2
```

HTTP Probe

In HTTP probe, the identification string is transmitted in an HTTP request-header field User-Agent, which is an attribute that can be used to create a profiling condition of IP type, and to check the web browser

information. The profiler captures the web browser information from the User-Agent attribute along with other HTTP attributes from the request messages, and adds them to the list of endpoint attributes.

Cisco ISE listens to communication from the web browsers on both port 80 and port 8080. Cisco ISE provides many default profiles, which are built in to the system to identify endpoints based on the User-Agent attribute.

HTTP probe is enabled by default. Multiple ISE services such as CWA, Hotspot, BYOD, MDM, and Posture rely on URL-redirection of the client's web browser. The redirected traffic includes the RADIUS session ID of the connected endpoint. When a PSN terminates these URL-redirected flows, it has visibility into the decrypted HTTPS data. Even when the HTTP probe is disabled on the PSN, the node will parse the browser user agent string from the web traffic and correlate the data to the endpoint based on its associated session ID. When browser strings are collected through this method, the source of the data is listed as Guest Portal or CP (Client Provisioning) rather than HTTP Probe.

From Cisco ISE Release 3.3 onwards, IPv6 is supported in HTTP Probe.

HTTP SPAN Probe

The HTTP probe in your Cisco ISE deployment, when enabled with the Switched Port Analyzer (SPAN) probe, allows the profiler to capture HTTP packets from the specified interfaces. You can use the SPAN capability on port 80, where the Cisco ISE server listens to communication from the web browsers.

HTTP SPAN collects HTTP attributes of an HTTP request-header message along with the IP addresses in the IP header (L3 header), which can be associated to an endpoint based on the MAC address of an endpoint in the L2 header. This information is useful for identifying different mobile and portable IP-enabled devices such as Apple devices, and computers with different operating systems. Identifying different mobile and portable IP-enabled devices is made more reliable because the Cisco ISE server redirects captures during a guest login or client provisioning download. This allows the profiler to collect the User-Agent attribute and other HTTP attributes, from the request messages and then identify devices such as Apple devices.

Unable to Collect HTTP Attributes in Cisco ISE Running on VMware

If you deploy Cisco ISE on an ESX server (VMware), the Cisco ISE profiler collects the Dynamic Host Configuration Protocol traffic but does not collect the HTTP traffic due to configuration issues on the vSphere client. To collect HTTP traffic on a VMware setup, configure the security settings by changing the Promiscuous Mode to Accept from Reject (by default) of the virtual switch that you create for the Cisco ISE profiler. When the Switched Port Analyzer (SPAN) probe for DHCP and HTTP is enabled, Cisco ISE profiler collects both the DHCP and HTTP traffic.

pxGrid Probe

The pxGrid probe leverages Cisco pxGrid for receiving endpoint context from external sources. Prior to Cisco ISE 2.4, Cisco ISE served only as a publisher and shared various context information such as session identity and group information as well as configuration elements to external subscribers. With the introduction of the pxGrid probe in Cisco ISE 2.4, other solutions serve as the publishers and Cisco ISE Policy Service nodes become the subscribers.

The pxGrid probe is based on pxGrid v2 specification using the Endpoint Asset topic */topic/com.cisco.endpoint.asset* with Service Name *com.cisco.endpoint.asset*. The following table displays the topic attributes all of which are preceded by the prefix *asset*.

Table 43: Endpoint Asset Topic

Attribute Name	Type	Description
assetId	Long	Asset ID
assetName	String	Asset name
assetIpAddress	String	IP address
assetMacAddress	String	MAC address
assetVendor	String	Manufacturer
assetProductId	String	Product Code
assetSerialNumber	String	Serial Number
assetDeviceType	String	Device Type
assetSwRevision	String	S/W Revision number
assetHwRevision	String	H/W Revision number
assetProtocol	String	Protocol
assetConnectedLinks	Array	Array of Network Link objects
assetCustomAttributes	Array	Array of Custom name-value pairs

In addition to the attributes commonly used to track networked assets such as device MAC address (assetMacAddress) and IP address (assetIpAddress), the topic allows vendors to publish unique endpoint information as Custom Attributes (assetCustomAttributes). The use of Endpoint Custom Attributes in Cisco ISE makes the topic extensible to a variety of use cases without requiring schema updates for each new set of unique vendor attributes shared over pxGrid.

RADIUS Probe

You can configure Cisco ISE for authentication with RADIUS, where you can define a shared secret that you can use in client-server transactions. With the RADIUS request and response messages that are received from the RADIUS servers, the profiler can collect RADIUS attributes, which can be used for profiling endpoints.

Cisco ISE can function as a RADIUS server, and a RADIUS proxy client to other RADIUS servers. When it acts as a proxy client, it uses external RADIUS servers to process RADIUS requests and response messages.

The RADIUS probe also collects attributes sent in RADIUS accounting packets by device sensors. For more information, see Attributes Collection from Cisco IOS Sensor-Embedded Switches, on page 198 and Configuration Checklist for Cisco IOS Sensor-Enabled Network Access Devices, on page 199.

The RADIUS probe is running by default, even for systems not configured for Profiling Service to ensure ISE can track endpoint authentication and authorization details for use in Context Visibility Services.

The RADIUS probe and Profiling Services are also used to track the creation and update times for registered endpoints for purposes of purge operations.

From Cisco ISE Release 3.3 onwards, IPv6 is supported in RADIUS Probe.

Table 44: Common Attributes Collected Using the RADIUS Probe

User Name	Calling Station ID	Called Station ID	Framed IP Address
NAS-IP-Address	NAS-Port-Type	NAS-Port-Id	NAS-Identifier
Device Type (NAD)	Location (NAD)	Authentication Policy	Authorization Policy

Note When an accounting stop is received, it triggers the Cisco ISE to reprofile the corresponding endpoint if it was originally profiled with an IP address. Therefore if you have custom profiles for endpoints profiled with IP addresses, the only way to meet the total certainty factor for these profiles is to match on the corresponding IP address.

Network Scan (NMAP) Probe

Cisco ISE enables you to detect devices in a subnet by using the NMAP security scanner. You enable the NMAP probe on the Policy Service node that is enabled to run the profiling service. You use the results from that probe in an endpoint profiling policy.

The NMAP scan is performed automatically for any endpoint device that matches the Unknown profile and has an IP address assigned, or matches the NMAP condition in the profiling policy. This automatic NMAP scan is peformed only thrice, for both Unknown endpoints and matches of the Network Scan action. If further scanning is required, you can perform a manual scan or remove the endpoint device from Context Visibility.

Each NMAP manual subnet scan has a unique numeric ID that is used to update an endpoint source information with that scan ID. Upon detection of endpoints, the endpoint source information can also be updated to indicate that it is discovered by the Network Scan probe.

The NMAP manual subnet scan is useful for detecting devices such as printers with a static IP address assigned to them that are connected constantly to the Cisco ISE network, and therefore these devices cannot be discovered by other probes.

NMAP Scan Limitations

Scanning a subnet is highly resource intensive. Scanning a subnet is lengthy process that depends on the size and density of the subnet. Number of active scans is always restricted to one scan, which means that you can scan only a single subnet at a time. You can cancel a subnet scan at any time while the subnet scan is in progress. You can use the **Click** to see latest scan results link to view the most recent network scan results that are stored in **Work Centers** > **Profiler** > **Manual Scans** > **Manual NMAP Scan Results**.

Manual NMAP Scan

The following NMAP command scans a subnet and sends the output to nmapSubnet.log:

```
nmap -O -sU -p U:161,162 -oN /opt/CSCOcpm/logs/nmapSubnet.log
    --append-output -oX - <subnet>
```

Table 45: NMAP Commands for a Manual Subnet Scan

-O	Enables OS detection
-sU	UDP scan

-p <port ranges>	Scans only specified ports. For example, U:161, 162
oN	Normal output
oX	XML output

SNMP Read Only Community Strings for NMAP Manual Subnet Scan

The NMAP manual subnet scan is augmented with an SNMP Query whenever the scan discovers that UDP port 161 is open on an endpoint that results in more attributes being collected. During the NMAP manual subnet scan, the Network Scan probe detects whether SNMP port 161 is open on the device. If the port is open, an SNMP Query is triggered with a default community string (public) with SNMP version 2c.

If the device supports SNMP and the default Read Only community string is set to public, you can obtain the MAC address of the device from the MIB value “ifPhysAddress”.

In addition, you can configure additional SNMP Read Only community strings separated by a comma for the NMAP manual network scan in the **Profiler Configuration** window. You can also specify new Read Only community strings for an SNMP MIB walk with SNMP versions 1 and 2c. For information on configuring SNMP Read Only community strings, see Setup CoA, SNMP RO Community, and Endpoint Attribute Filter, on page 192.

Manual NMAP Scan Results

The most recent network scan results are stored in Work Centers > Profiler > Manual Scans > Manual NMAP Scan Results. The Manaul NMAP Scan Results page displays only the most recent endpoints that are detected, along with their associated endpoint profiles, their MAC addresses, and their static assignment status as the result of a manual network scan you perform on any subnet. This page allows you to edit points that are detected from the endpoint subnet for better classification, if required.

Cisco ISE allows you to perform the manual network scan from the Policy Service nodes that are enabled to run the profiling service. You must choose the Policy Service node from the primary Administration ISE node user interface in your deployment to run the manual network scan from the Policy Service node. During the manual network scan on any subnet, the Network Scan probe detects endpoints on the specified subnet, their operating systems, and check UDP ports 161 and 162 for an SNMP service.

Given below is additional information related to the manual NMAP scan results:

- To detect unknown endpoints, NMAP should be able to learn the IP/MAC binding via NMAP or a supporting SNMP scan.
- ISE learns IP/MAC binding of known endpoints via Radius authentication or DHCP profiling.
- The IP/MAC bindings are not replicated across PSN nodes in a deployment. Therefore, you must trigger the manual scan from the PSN, which has the IP/MAC binding in its local database (for example, the PSN against which a mac address was last authenticated with).
- The NMAP scan results do not display any information related to an endpoint that NMAP had previously scanned, manually or automatically.

DNS Probe

The Domain Name Service (DNS) probe in your Cisco ISE deployment allows the profiler to lookup an endpoint and get the fully qualified domain name (FQDN). After an endpoint is detected in your Cisco ISE-enabled network, a list of endpoint attributes is collected from the NetFlow, DHCP, DHCP SPAN, HTTP, RADIUS, or SNMP probes.

When you deploy Cisco ISE in a standalone or in a distributed environment for the first time, you are prompted to run the setup utility to configure the Cisco ISE appliance. When you run the setup utility, you will configure the Domain Name System (DNS) domain and the primary nameserver (primary DNS server), where you can configure one or more nameservers during setup. You can also change or add DNS nameservers later after deploying Cisco ISE using the CLI commands.

DNS FQDN Lookup

Before a DNS lookup can be performed, one of the following probes must be started along with the DNS probe: DHCP, DHCP SPAN, HTTP, RADIUS, or SNMP. This allows the DNS probe in the profiler to do a reverse DNS lookup (FQDN lookup) against specified name servers that you define in your Cisco ISE deployment. A new attribute is added to the attribute list for an endpoint, which can be used for an endpoint profiling policy evaluation. The FQDN is the new attribute that exists in the system IP dictionary. You can create an endpoint profiling condition to validate the FQDN attribute and its value for profiling. The following are the specific endpoint attributes that are required for a DNS lookup and the probe that collects these attributes:

- The dhcp-requested-address attribute—An attribute collected by the DHCP and DHCP SPAN probes.
- The SourceIP attribute—An attribute collected by the HTTP probe
- The Framed-IP-Address attribute—An attribute collected by the RADIUS probe
- The cdpCacheAddress attribute—An attribute collected by the SNMP probe

Configure Call Station ID Type in the WLC Web Interface

You can use the WLC web interface to configure Call Station ID Type information. You can go to the Security tab of the WLC web interface to configure the calling station ID in the RADIUS Authentication Servers page. The MAC Delimiter field is set to Colon by default in the WLC user interface.

For more information on how to configure in the WLC web interface, see Chapter 6, “Configuring Security Solutions” in the Cisco Wireless LAN Controller Configuration Guide, Release 7.2.

For more information on how to configure in the WLC CLI using the config radius callStationIdType command, see Chapter 2, “Controller Commands” in the Cisco Wireless LAN Controller Command Reference Guide, Release 7.2.

Step 1 Log in to your Wireless LAN Controller user interface.

Step 2 Click **Security**.

Step 3 Expand **AAA**, and then choose **RADIUS** > **Authentication**.

Step 4 Choose **System MAC Address** from the Call Station ID Type drop-down list.

Step 5 Check the **AES Key Wrap** check box when you run Cisco ISE in FIPS mode.

Step 6 Choose **Colon** from the MAC Delimeter drop-down list.

SNMP Query Probe

In addition to configuring the SNMP Query probe in the Edit Node page, you must configure other Simple Management Protocol settings in the following location: **Administration** > **Network Resources** > **Network Devices**.

You can configure SNMP settings in the new network access devices (NADs) in the Network Devices list page. The polling interval that you specify in the SNMP query probe or in the SNMP settings in the network access devices query NADs at regular intervals.

You can turn on and turn off SNMP querying for specific NADs based on the following configurations:

- SNMP query on Link up and New MAC notification turned on or turned off
- SNMP query on Link up and New MAC notification turned on or turned off for Cisco Discovery Protocol information
- SNMP query timer for once an hour for each switch by default

For an iDevice, and other mobile devices that do not support SNMP, the MAC address can be discovered by the ARP table, which can be queried from the network access device by an SNMP Query probe.

Cisco Discovery Protocol Support with SNMP Query

When you configure SNMP settings on the network devices, you must ensure that the Cisco Discovery Protocol is enabled (by default) on all the ports of the network devices. If you disable the Cisco Discovery Protocol on any of the ports on the network devices, then you may not be able to profile properly because you will miss the Cisco Discovery Protocol information of all the connected endpoints. You can enable the Cisco Discovery Protocol globally by using the cdp run command on a network device, and enable the Cisco Discovery Protocol by using the cdp enable command on any interface of the network access device. To disable the Cisco Discovery Protocol on the network device and on the interface, use the no keyword at the beginning of the commands.

Link Layer Discovery Protocol Support with SNMP Query

The Cisco ISE profiler uses an SNMP Query to collect LLDP attributes. You can also collect LLDP attributes from a Cisco IOS sensor, which is embedded in the network device, by using the RADIUS probe. The following are the default LLDP configuration settings that you can use to configure LLDP global configuration and LLDP interface configuration commands on the network access devices.

Table 46: Default LLDP Configuration

Attribute	Setting
LLDP global state	Disabled
LLDP holdtime (before discarding)	120 seconds
LLDP timer (packet update frequency)	30 seconds

Attribute	Setting
LLDP reinitialization delay	2 seconds
LLDP tlv-select	Enabled to send and receive all TLVs.
LLDP interface state	Enabled
LLDP receive	Enabled
LLDP transmit	Enabled
LLDP med-tlv-select	Enabled to send all LLDP-MED TLVs

CDP and LLDP Capability Codes Displayed in a Single Character

The Attribute List of an endpoint displays a single character value for the lldpCacheCapabilities and lldpCapabilitiesMapSupported attributes. The values are the Capability Codes that are displayed for the network access device that runs CDP and LLDP.

Example 1

```
lldpCacheCapabilities S
lldpCapabilitiesMapSupported S
```

Example 2

```
lldpCacheCapabilities B;T
lldpCapabilitiesMapSupported B;T
```

Example 3

```
Switch#show cdp neighbors
Capability Codes:
R - Router, T - Trans Bridge, B - Source Route Bridge, S - Switch, H - Host, I - IGMP,
r - Repeater, P - Phone, D - Remote, C - CVTA, M - Two-port Mac Relay
...
Switch#

Switch#show lldp neighbors
Capability codes:
(R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
(W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other
...
Switch#
```

SNMP Trap Probe

The SNMP Trap receives information from the specific network access devices that support MAC notification, linkup, linkdown, and informs. The SNMP Trap probe receives information from the specific network access devices when ports come up or go down and endpoints disconnect from or connect to your network.

For SNMP Trap to be fully functional and create endpoints, you must enable SNMP Query so that the SNMP Query probe triggers a poll event on the particular port of the network access device when a trap is received. To make this feature fully functional, you should configure the network access device and SNMP Trap.

Note Cisco ISE does not support SNMP Traps that are received from the Wireless LAN Controllers (WLCs) and Access Points (APs).

Active Directory Probe

The Active Directory (AD) probe:

- Improves the fidelity of OS information for Windows endpoints. Microsoft AD tracks detailed OS information for AD-joined computers including version and service pack levels. The AD probe retrieves this information directly using the AD Runtime connector to provide a highly reliable source of client OS information.
- Helps distinguish between corporate and non-corporate assets. A basic but important attribute available to the AD probe is whether an endpoint exists in AD. This information can be used to classify an endpoint contained in the AD as a managed device or corporate asset.

You can enable the AD probe under **Administration** > **System** > **Deployment** > **Profiling Configuration**. When this probe is enabled, Cisco ISE fetches the AD attributes for a new endpoint as soon as it receives a hostname. The hostname is typically learned from the DHCP or DNS probes. Once successfully retrieved, ISE does not attempt to query AD again for the same endpoint until a the rescan timer expires. This is to limit the load on AD for attribute queries. The rescan timer is configurable in the **Days Before Rescan** field (**Administration** > **System** > **Deployment** > **Profiling Configuration** > **Active Directory**). If there is additional profiling activity on the endpoint, the AD is queried again.

The following AD probe attributes can be matched in the **Policy** > **Policy Elements** > **Profiling** using the ACTIVEDIRECTORY condition. AD attributes collected using the AD Probe appear with the prefix “AD” in the endpoint details on the **Context Visibility** > **Endpoints** window.

- AD-Host-Exists
- AD-Join-Point
- AD-Operating-System
- AD-OS-Version
- AD-Service-Pack

Configure Probes for Each Cisco ISE Node

You can configure one or more probes on the Profiling Configuration tab per Cisco ISE node in your deployment that assumes the Policy Service persona, which could be:

- A standalone node: If you have deployed Cisco ISE on a single node that assumes all Administration, Monitoring, and Policy Service personas by default.
- Multiple nodes: If you have registered more than one node in your deployment that assume Policy Service persona.

Note Not all probes are enabled by default. Some probes are partially enabled even when they are not explicitly enabled by a check mark. The profiling configuration is currently unique to each PSN. We recommend that each PSN in the deployment should be configured with identical profiler configuration settings.

Before you begin

You can configure the probes per Cisco ISE node only from the Administration node, which is unavailable on the secondary Administration node in a distributed deployment.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Deployment**.

Step 2 Choose a Cisco ISE node that assumes the Policy Service persona.

Step 3 Click **Edit** in the Deployment Nodes page.

Step 4 On the **General Settings** tab, check the **Policy Service** check box. If the Policy Service check box is unchecked, both the session services and the profiling service check boxes are disabled.

Step 5 Check the **Enable Profiling Services** check box.

Step 6 Click the **Profiling Configuration** tab.

Step 7 Configure the values for each probe.

Step 8 Click **Save** to save the probe configuration.

Setup CoA, SNMP RO Community, and Endpoint Attribute Filter

Cisco ISE allows a global configuration to issue a Change of Authorization (CoA) in the Profiler Configuration page that enables the profiling service with more control over endpoints that are already authenticated.

In addition, you can configure additional SNMP Read Only community strings separated by a comma for the NMAP manual network scan in the Profiler Configuration page. The SNMP RO community strings are used in the same order as they appear in the Current custom SNMP community strings field.

You can also configure endpoint attribute filtering in the Profiler Configuration page.

Step 1 Choose **Administration** > **System** > **Settings** > **Profiling**.

Step 2 Choose one of the following settings to configure the CoA type:

- **No CoA** (default)—You can use this option to disable the global configuration of CoA. This setting overrides any configured CoA per endpoint profiling policy. If the goal is only visibilibility, retain the default value as **No CoA**.
- **Port Bounce**—You can use this option, if the switch port exists with only one session. If the port exists with multiple sessions, then use the Reauth option. If the goal is to immediately update the access policy based on profile changes, select the **Port Bounce** option, this will ensure that any clientless endpoints is reauthorized, and IP address is refreshed, if required.
- **Reauth**—You can use this option to enforce reauthentication of an already authenticated endpoint when it is profiled. Select the **Reauth** option, if no VLAN or address change is expected following the reauthorization of the current session.

  Note If you have multiple active sessions on a single port, the profiling service issues a CoA with the **Reauth** option even though you have configured CoA with the **Port Bounce** option. This function avoids disconnecting other sessions, a situation that might occur with the **Port Bounce** option.

Step 3 Enter new SNMP community strings separated by a comma for the NMAP manual network scan in the **Change Custom SNMP Community Strings** field, and re-enter the strings in the **Confirm Custom SNMP Community Strings** field for confirmation.

The default SNMP community string used is *public*. Click **Show** in the **Current Custom SNMP Community Strings** section to verify this.

Step 4 Check the **Endpoint Attribute Filter** check box to enable endpoint attribute filtering.

On enabling the **EndPoint Attribute Filter**, the Cisco ISE profiler only keeps allowed attributes and discards all other attributes. For more information, see Global Setting to Filter Endpoint Attributes, on page 196 and Attribute Filters for ISE Database Persistence and Performance, on page 196 sections. As a best practice, we recommend you to enable **Endpoint Attribute Filter** in production deployments.

Step 5 Check the **Enable Probe Data Publisher** check box if you want Cisco ISE to publish endpoint probe data to pxGrid subscribers that need this data to classify endpoints onboarding on ISE. The pxGrid subscriber can pull the endpoint records from Cisco ISE using bulk download during initial deployment phase. Cisco ISE sends the endpoint records to the pxGrid subscriber whenever they are updated in PAN. This option is disabled by default.

When you enable this option, ensure that the pxGrid persona is enabled in your deployment.

Step 6 Click **Save**.

Global Configuration of Change of Authorization for Authenticated Endpoints

You can use the global configuration feature to disable change of authorization (CoA) by using the default No CoA option or enable CoA by using port bounce and reauthentication options. If you have configured Port Bounce for CoA in Cisco ISE, the profiling service may still issue other CoAs as described in the “CoA Exemptions” section.

The global configuration chosen dictates the default CoA behavior only in the absense of more specific settings. See Change of Authorization Configuration for Each Endpoint Profiling Policy, on page 231.

You can use the RADIUS probe or the Monitoring persona REST API to authenticate the endpoints. You can enable the RADIUS probe, which allows faster performance. If you have enabled CoA, then we recommend

that you enable the RADIUS probe in conjunction with your CoA configuration in the Cisco ISE application for faster performance. The profiling service can then issue an appropriate CoA for endpoints by using the RADIUS attributes that are collected.

If you have disabled the RADIUS probe in the Cisco ISE application, then you can rely on the Monitoring persona REST API to issue CoAs. This allows the profiling service to support a wider range of endpoints. In a distributed deployment, your network must have at least one Cisco ISE node that assumes the Monitoring persona to rely on the Monitoring persona REST API to issue a CoA.

Cisco ISE arbitrarily will designate either the primary or secondary Monitoring node as the default destination for REST queries in your distributed deployment, because both the primary and secondary Monitoring nodes have identical session directory information.

Use Cases for Issuing Change of Authorization

The profiling service issues the change of authorization in the following cases:

- Endpoint deleted: When an endpoint is deleted from the Endpoints page and the endpoint is disconnected or removed from the network.
- An exception action is configured: If you have an exception action configured per profile that leads to an unusual or an unacceptable event from that endpoint. The profiling service moves the endpoint to the corresponding static profile by issuing a CoA.
- An endpoint is profiled for the first time: When an endpoint is not statically assigned and profiled for the first time; for example, the profile changes from an unknown to a known profile.
    - An endpoint identity group has changed: When an endpoint is added or removed from an endpoint identity group that is used by an authorization policy.

      The profiling service issues a CoA when there is any change in an endpoint identity group, and the endpoint identity group is used in the authorization policy for the following:

        - The endpoint identity group changes for endpoints when they are dynamically profiled
        - The endpoint identity group changes when the static assignment flag is set to true for a dynamic endpoint

- An endpoint profiling policy has changed and the policy is used in an authorization policy: When an endpoint profiling policy changes, and the policy is included in a logical profile that is used in an authorization policy. The endpoint profiling policy may change due to the profiling policy match or when an endpoint is statically assigned to an endpoint profiling policy, which is associated to a logical profile. In both the cases, the profiling service issues a CoA, only when the endpoint profiling policy is used in an authorization policy.

Exemptions for Issuing a Change of Authorization

The profiling service does not issue a CoA when there is a change in an endpoint identity group and the static assignment is already true.

Cisco ISE does not issue a CoA for the following reasons:

- An Endpoint disconnected from the network—When an endpoint disconnected from your network is discovered.

- Authenticated wired (Extensible Authentication Protocol) EAP-capable endpoint—When an authenticated wired EAP-capable endpoint is discovered.
- Multiple active sessions per port—When you have multiple active sessions on a single port, the profiling service issues a CoA with the Reauth option even though you have configured CoA with the Port Bounce option.
- Packet-of-Disconnect CoA (Terminate Session) when a wireless endpoint is detected—If an endpoint is discovered as wireless, then a Packet-of-Disconnect CoA (Terminate-Session) is issued instead of the Port Bounce CoA. The benefit of this change is to support the Wireless LAN Controller (WLC) CoA.
- Profiler CoA is suppressed when the **Suppress Profiler CoA for endpoints in Logical Profile** option is used for the configured logical profile in the Authorization Profile. Profiler CoA will be triggered for all other endpoints by default.
- Global No CoA Setting overrides Policy CoA—Global No CoA overrides all configuration settings in endpoint profiling policies as there is no CoA issued in Cisco ISE irrespective of CoA configured per endpoint profiling policy.

Note No CoA and Reauth CoA configurations are not affected, and the profiler service applies the same CoA configuration for wired and wireless endpoints.

Change of Authorization Issued for Each Type of CoA Configuration

Table 47: Change of Authorization Issued for Each Type of CoA Configuration

Scenarios	No CoA Configuration	Port Bounce Configuration	Reauth Configuration	Additional Information
Global CoA configuration in Cisco ISE (typical configuration)	No CoA	Port Bounce	Reauthentication	—
An endpoint is disconnected on your network	No CoA	No CoA	No CoA	Change of authorization is determined by the RADIUS attribute Acct-Status -Type value Stop.
Wired with multiple active sessions on the same switch port	No CoA	Reauthentication	Reauthentication	Reauthentication avoids disconnecting other sessions.
Wireless endpoint	No CoA	Packet-of-Disconnect CoA (Terminate Session)	Reauthentication	Support to Wireless LAN Controller.

Scenarios	No CoA Configuration	Port Bounce Configuration	Reauth Configuration	Additional Information
Incomplete CoA data	No CoA	No CoA	No CoA	Due to missing RADIUS attributes.

Attribute Filters for ISE Database Persistence and Performance

Cisco ISE implements filters for Dynamic Host Configuration Protocol (both DHCP Helper and DHCP SPAN), HTTP, RADIUS, and Simple Network Management Protocol probes except for the NetFlow probe to address performance degradation. Each probe filter contains the list of attributes that are temporal and irrelevant for endpoint profiling and removes those attributes from the attributes collected by the probes.

The isebootstrap log (isebootstrap-yyyymmdd-xxxxxx.log) contains messages that handles the creation of dictionaries and with filtering of attributes from the dictionaries. You can also configure to log a debug message when endpoints go through the filtering phase to indicate that filtering has occurred.

The Cisco ISE profiler invokes the following endpoint attribute filters:

- A DHCP filter for both the DHCP Helper and DHCP SPAN contains all the attributes that are not necessary and they are removed after parsing DHCP packets. The attributes after filtering are merged with existing attributes in the endpoint cache for an endpoint.
- An HTTP filter is used for filtering attributes from HTTP packets, where there is no significant change in the set of attributes after filtering.
- A RADIUS filter is used once the syslog parsing is complete and endpoint attributes are merged into the endpoint cache for profiling.
- SNMP filter for SNMP Query includes separate CDP and LLDP filters, which are all used for SNMP-Query probe.

Global Setting to Filter Endpoint Attributes

You can reduce the number of persistence events and replication events by reducing the number of endpoint attributes that do not change frequently at the collection point. Enabling the **EndPoint Attribute Filter** will have the Cisco ISE profiler only to keep allowed attributes and discard all other attributes.

To enable the **Endpoint Attribute Filter**), see the Setup CoA, SNMP RO Community, and Endpoint Attribute Filter, on page 192 section.

An allowed list is a set of attributes that are used in custom endpoint profiling policies for profiling endpoints, and that are essential for Change of Authorization (CoA), Bring Your Own Device (BYOD), Device Registration WebAuth (DRW), and so on to function in Cisco ISE as expected. The allowed list is always used as a criteria when ownership changes for the endpoint (when attributes are collected by multiple Policy Service nodes) even when disabled.

By default, the allowed list is disabled and the attributes are dropped only when the attribute filter is enabled. The allowed list is dynamically updated when endpoint profiling policies change including from the feed to include new attributes in the profiling policies. Any attribute that is not present in the allowed list is dropped immediately at the time of collection, and the attribute is not used for profiling endpoints. When combined with the buffering, the number of persistence events can be reduced.

You must ensure that the allowed list contains a set of attributes determined from the following two sources:

- A set of attributes that are used in the default profiles so that you can match endpoints to the profiles.
- A set of attributes that are essential for Change of Authorization (CoA), Bring Your Own Device (BYOD), Device Registration WebAuth (DRW), and so on to function as expected.

Note To add an new attribute to the allowed list, the administrator needs to create a new profiler condiion and policy that uses the attribute. This new attribute will be automatically added to the allowed list of stored and replicated attributes.

Table 48: Allowed Attributes

AAA-Server	BYODRegistration
Calling-Station-ID	Certificate Expiration Date
Certificate Issue Date	Certificate Issuer Name
Certificate Serial Number	Description
DestinationIPAddress	Device Identifier
Device Name	DeviceRegistrationStatus
EndPointPolicy	EndPointPolicyID
EndPointProfilerServer	EndPointSource
FQDN	FirstCollection
Framed-IP-Address	IdentityGroup
IdentityGroupID	IdentityStoreGUID
IdentityStoreName	L4_DST_PORT
LastNmapScanTime	MACAddress
MatchedPolicy	MatchedPolicyID
NADAddress	NAS-IP-Address
NAS-Port-Id	NAS-Port-Type
NmapScanCount	NmapSubnetScanID
OS Version	OUI
PolicyVersion	PortalUser

PostureApplicable	Product
RegistrationTimeStamp	—
StaticAssignment	StaticGroupAssignment
TimeToProfile	Total Certainty Factor
User-Agent	cdpCacheAddress
cdpCacheCapabilities	cdpCacheDeviceId
cdpCachePlatform	cdpCacheVersion
ciaddr	dhcp-class-identifier
dhcp-requested-address	host-name
hrDeviceDescr	ifIndex
ip	lldpCacheCapabilities
lldpCapabilitiesMapSupported	lldpSystemDescription
operating-system	sysDescr
161-udp	—

Attributes Collection from Cisco IOS Sensor-Embedded Switches

An Cisco IOS sensor integration allows Cisco ISE run time and the Cisco ISE profiler to collect any or all of the attributes that are sent from the switch. You can collect DHCP, CDP, and LLDP attributes directly from the switch by using the RADIUS protocol. The attributes that are collected for DHCP, CDP, and LLDP are then parsed and mapped to attributes in the profiler dictionaries in the following location: **Policy** > **Policy Elements** > **Dictionaries**.

For information about the supported Catalyst platforms for Device sensors, see https://communities.cisco.com/docs/DOC-72932.

Cisco IOS Sensor-Embedded Network Access Devices

Integrating Cisco IOS sensor embedded network access devices with Cisco ISE involves the following components:

- A Cisco IOS sensor
- Data collector that is embedded in the network access device (switch) for gathering DHCP, CDP, and LLDP data
- Analyzers for processing the data and determining the device-type of endpoints

  There are two ways of deploying an analyzer, but they are not expected to be used in conjunction with each other:

- An analyzer can be deployed in Cisco ISE
- Analyzers can be embedded in the switch as the sensor

Configuration Checklist for Cisco IOS Sensor-Enabled Network Access Devices

This section summarizes a list of tasks that you must configure in the Cisco IOS sensor-enabled switches and Cisco ISE to collect DHCP, CDP, and LLDP attributes directly from the switch:

- Ensure that the RADIUS probe is enabled in Cisco ISE.
- Ensure that network access devices support an IOS sensor for collecting DHCP, CDP, and LLDP information.
- Ensure that network access devices run the following CDP and LLDP commands to capture CDP and LLDP information from endpoints:

```
cdp enable
lldp run
```

- Ensure that session accounting is enabled separately by using the standard AAA and RADIUS commands.

  For example, use the following commands:

```
aaa new-model
aaa accounting dot1x default start-stop group radius

radius-server host <ip> auth-port <port> acct-port <port> key <shared-secret>
radius-server vsa send accounting
```

- Ensure that you run IOS sensor-specific commands.
  - Enabling Accounting Augmentation

    You must enable the network access devices to add Cisco IOS sensor protocol data to the RADIUS accounting messages and to generate additional accounting events when it detects new sensor protocol data. This means that any RADIUS accounting message should include all CDP, LLDP, and DHCP attributes.

    Enter the following global command:

    device-sensor accounting

  - Disabling Accounting Augmentation

    To disable (accounting) network access devices and add Cisco IOS sensor protocol data to the RADIUS accounting messages for sessions that are hosted on a given port (if the accounting feature is globally enabled), enter the following command at the appropriate port:

    no device-sensor accounting

  - TLV Change Tracking

    By default, for each supported peer protocol, client notifications and accounting events are generated only when an incoming packet includes a type, length, and value (TLV) that has not been received previously in the context of a given session.

You must enable client notifications and accounting events for all TLV changes where there are either new TLVs, or where previously received TLVs have different values. Enter the following command:

device-sensor notify all-changes

- Be sure that you disable the Cisco IOS Device Classifier (local analyzer) in the network access devices.

  Enter the following command:

```
no macro auto monitor
```

Note This command prevents network access devices from sending two identical RADIUS accounting messages per change.

Support for Cisco IND Controllers by ISE Profiler

Cisco ISE can profile and display the status of devices attached to a Cisco Industrial Network Device (IND). PxGrid connects Cisco ISE and the Cisco Industrial Network Director to communicate endpoint (IoT) data. pxGrid on Cisco ISE consumes Cisco IND events, and queries Cisco IND to update endpoint type.

Cisco ISE profiler has dictionary attributes for IoT devices. Choose **Policy** > **Policy Elements** > **Dictionaries**, and select *IOTASSET* from the list of System Dictionaries to see the dictionary attributes.

Guidelines and Recommendations

If you have several ISE nodes configured for profiling, we recommend that you enable pxGrid for Cisco IND on only one node.

Multiple Cisco IND devices can connect to a single ISE.

If the same endpoint is received from two or more publishers (Cisco IND), Cisco ISE only keeps the last publisher's data for that endpoint.

Cisco ISE gets Cisco IND data from the service names *com.cisco.endpoint.asset* and */topic/com.cisco.endpoint.asset*in pxGrid.

Cisco IND Profiling Process Flow

Cisco IND Asset discovery finds an IoT device and publishes the endpoint data for that device to pxGrid. Cisco ISE sees the event on pxGrid, and gets the endpoint data. Profiler policies in Cisco ISE assign the device data to attributes in the ISE profiler dictionary, and applies those attributes to the endpoint in Cisco ISE.

IoT endpoint data which does not meet the existing attributes in Cisco ISE are not saved. But you can create more attributes in Cisco ISE, and register them with Cisco IND.

Cisco ISE does a bulk download of endpoints when the connection to Cisco IND through pxGrid is first established. If there is a network failure, Cisco ISE does another bulk download of accumulated endpoint changes.

Configure Cisco ISE and Cisco IND for IND Profiling

Note You must install the Cisco ISE certificate in Cisco IND, and install the Cisco IND certificate in ISE, before you activate pxGrid in Cisco IND.

1. Choose **Administration** > **Deployment**. Edit the PSN that you plan to use as pxGrid consumer, and enable pxGrid. This PSN is the one that creates endpoints from pxGrid data published by Cisco IND and profiling.
2. Choose **Administration** > **pxGrid Services** to verify that pxGrid is running. Then click the **Certificates** tab, and fill in the certificate fields. Click **Create** to issue the certificate and download the certificate.
   - For **I want to**, select "**Generate a single certificate (without a certificate signing request), Common Name**, and enter a name for the Cisco IND you are connecting with.
   - For **Certificate Download Format**, choose **`PKS12 format`**.
   - For **Certificate Password**, create a password.

Note The ISE internal CA must be enabled. If your browser blocks popups, you won't be able to download the certificate. Unzip the certificate to make the PEM file available for the next step.

3. In Cisco IND, choose **Settings** > **pxGrid**, and click **`Download .pem IND certificate`**. Keep this window open.
4. In Cisco ISE, choose **Administration** > **pxGrid Services** > **All Clients**. When you see the Cisco IND pxGrid client, approve it.
5. In Cisco IND, move the slider to enable pxGrid. Another screen opens, where you define the location of the ISE node, the name of the certificate that you entered for this pxGrid server in ISE, and the password you provided. Click **Upload Certificate**, and locate the ISE pxGrid PEM file.
6. In ISE, choose **Administration** > **Certificates** > **Trusted Certificates**. Click **Import** and enter the path to the certificate you got from Cisco IND.
7. In Cisco IND, click **Activate**.
8. In Cisco ISE, choose **Adminstration > Deployment**. Select the PSN you are using for the Cisco IND connection, select the Profiling window, and enable the pxGrid probe.
9. The pxGrid connection between ISE and Cisco IND is now active. Verify that by displaying the IoT endpoints that Cisco IND has found.

Add an Attribute for IND Profiling

Cisco IND may return attributes that are not in the ISE dictionary. You can add more attributes to Cisco ISE, so you can more accurately profile that IoT device. To add a new attribute, you create a custom attribute in Cisco ISE, and send that attribute to Cisco IND over pxGrid.

1. Choose **Administration** > **Identity Management** > **Settings**, and select **Endpoint Custom Attributes**. Create an attribute endpoint attribute.

2. You can now use this attribute in a profiler policy to identify assets with the new attribute. Choose **Policy** > **Profiling**, and create a new profiler policy. In the **Rules** section, create a new rule. When you add an **attribute/value**, select the **CUSTOMATTRIBUTE** folder, and the custom attribute you created.

Cisco ISE Support for MUD

Manufacturer Usage Descriptor (MUD) is an IETF standard, which defines a way to on-board IoT devices. It provides seamless visibility and segmentation automation of IoT devices. MUD has been approved in IETF process, and released as RFC8520. For more information, see https://datatracker.ietf.org/doc/draft-ietf-opsawg-mud/.

Cisco ISE, Release 2.6 and later supports identification of IoT devices. Cisco ISE automatically creates profiling policies and Endpoint Identity Groups. MUD supports profiling IoT devices, creating profiling policies dynamically, and automating the entire process of creating policies and Endpoint Identity Groups. Administrators can use these profiling policies to create manually Authorization Policies and Profiles. IoT devices sending MUD URL in DHCP and LLDP packets are on board, using those profiles and policies.

Cisco ISE performs unsigned classification of IoT devices. Cisco ISE does not store the MUD attributes; the attributes are only used in the current session. In the **Context and Visibility > Endpoints** window, you can filter IoT devices by the **Endpoint Profile** field.

The following devices support sending MUD data to Cisco ISE:

- Cisco Catalyst 3850 Series Switches running Cisco IOS XE Version 16.9.1 & 16.9.2
- Cisco Catalyst Digital Building Series Switches running Cisco IOS Version 15.2(6)E2
- Cisco Industrial Ethernet 4000 Series Switches running Cisco IOS Version 15.2(6)E2
- Internet of Things (IoT) devices with embedded MUD functionality

Cisco ISE supports the following profiling protocols and profiling probes:

- LLDP and Radius - TLV 127
- DHCP - Option 161

Both fields can be sent to Cisco ISE by IOS Device Sensor.

Configuring ISE for MUD

1. Choose **Work Centers** > **Profiler** > **Profiler Settings** , and check the **Enable profiling for MUD** check box.
2. Add the Network Access Device that can send MUD URIs to ISE. To add network devices, choose **Administration** > **Network Resources** > **Network Devices**.
3. Verify that the MUD-URL connection is working.
   a. Choose **Context Visibility** > **Endpoints**, and find IoT endpoints that ISE successfully classified. You can filter IoT devices by the Endpoint profile name, which starts with `IOT-MUD`.
   b. Click the endpoint MAC address of one of the IoT devices, and select the attribute tag. Verify that there is a mud-url in the list of attributes.
   c. Choose **Policy** > **Profiling** and filter the list by selecting `IOT Created` for **System Type**.

4. Optionally configure debug logging for the new IoT devices.
   a. Choose **System** > **Logging** > **Debug Log Configuration**, and select the ISE node that has the MUD configuration.
   b. Select **Debug Log Configuration** in the left menu, and then select **profiler**.

As more IoT devices are classified, all devices of the same category or group with same MUD-URL are assigned to the same endpoint group. For example, if a Molex light connects, and is classified, a profiler group is created for that Molex light. As more Molex lights of the same type (with the same MUD-URL) are classified, they inherit the same classification or endpoint identity group.

Verify MUD Traffic Flow in ISE and the Switch

1. Before turning on the IoT device, either **connect port** or **unshut** the interface:
   a. Start packet capture at ISE.
   b. Start packet capture at switch ports.
2. View the following output on the switch:
   a. **show device-sensor cache all**
   b. **show access-session**
   c. **show radius statistics**
3. Turn on the IoT devices.
4. Repeat the following every minute:
   a. **show device-sensor cache all**
   b. **show access-session**
   c. **show radius statistics**
5. Wait for 3 to 5 minutes for all the devices show up on ISE.
6. Stop both the ISE and switch packet captures.
7. Repeat the following every minute:
   a. **show device-sensor cache all**
   b. **show access-session**
   c. **show radius statistics**

Multi-Factor Classification for Enhanced Endpoint Visibility

You can create nuanced authorization policies using four specific attributes from the endpoints connecting to your network. The Multi-Factor Classification (MFC) profiler uses various profiling probes to fetch four new endpoint attributes to the Cisco ISE authorization policy creation workflows:

- MFC Endpoint Type, for example, Workstation, Printer, Network Device
- MFC Hardware Manufacture, for example, Xerox Corporation, Google, Inc., TP-LINK TECHNOLOGIES CO.,LTD
- MFC Hardware Mode, for example, Xerox-Printer-Phaser3250, TP-LINK-Device
- MFC Operating System, for example, Windows, Lexmark-OS

To receive multifactor classification endpoint attributes, we recommend that you enable the following probes:

- Active Directory
- DHCP
- DHCP SPAN
- DNS
- HTTP
- NetFlow
- Network Scan (NMAP)
- RADIUS
- SNMP Trap
- SNMP Query

Multifactor classification adds four new labels as endpoint attributes, enabling you to create effective authorization policies that enhance endpoint visibility. The multifactor classification labels and the collected data can be exported as reports.

To view and use multifactor classification attributes, you must have Advantage licenses in your Cisco ISE deployment.

The multifactor classification profiler is enabled by default in Cisco ISE Release 3.3 and runs on Policy Service Nodes (PSN) and the primary Policy Administration Node (PAN).

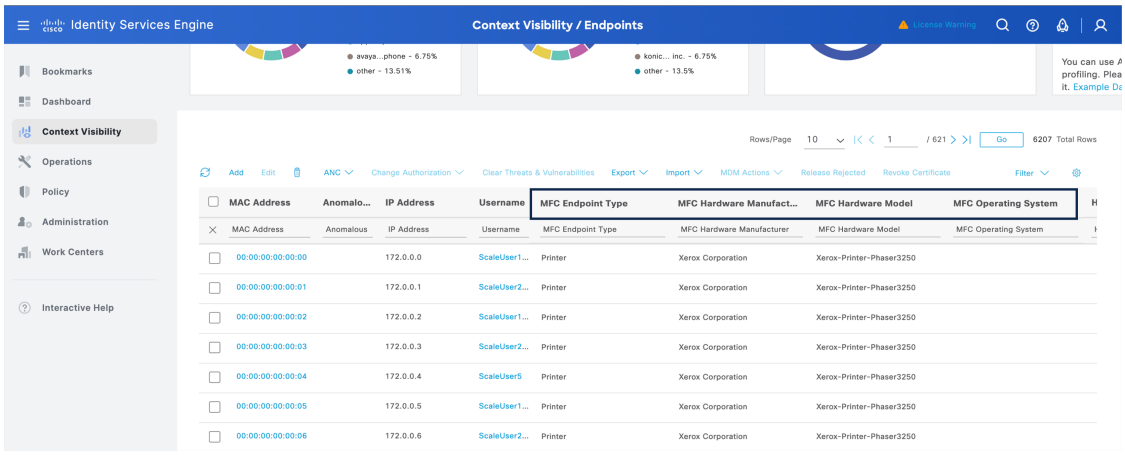
To disable multifactor classification, in the Cisco ISE administration portal, choose **Work Centers > Profiler > Settings > Profiler Settings**. In the **MFC Profiling** area, uncheck the **MFC Profiling and AI Rules** check box.

Disabling **MFC Profiling** stops the Multi-Factor Classification feature on all the Cisco ISE PSNs. Data collection until the time of disablement is retained in Cisco ISE. You might continue to view the old data in the **Context Visibility** > **Endpoints** > **Authentication** window.

Cisco AI-ML Rule Proposals for Endpoint Profiling does not work when you uncheck the **MFC Profiling and AI Rules** check box.

The attribute data fetched by the Multi-Factor Classification feature is displayed in the **Context Visibility** > **Endpoints** > **Authentication** window. Four new columns display the endpoint attribute data—**MFC Endpoint Type**, **MFC Hardware Manufacturer**, **MFC Hardware Model**, **MFC Operating System**.

Figure 12: Multi-Factor Classification Endpoint Attributes in the Context Visibility > Endpoints Window



Rule Prioritization

Profiling rules have the following inalterable order of priority in multifactor classification, with the first rule having the highest priority:

1. System Rules
   a. Cisco-managed direct mapping attribute values. The dictionary lookup order is MDM, Wi-Fi Device Analytics, IOT-Assets, Posture, and ACIDEX.
   b. Cisco-managed MFC rules—Existing profiling policies in Cisco ISE that generate multifactor classification labels.
2. AI-ML rules—These are user-accepted AI-ML profiling policies that generate multifactor classification labels.
3. System library rules—Cisco-managed user agent and OUI rules.

If an MFC label is provided by a higher priority rule, the label is not overwritten by a lower priority rule. Consider a scenario where a system rule provides an endpoint's Hardware Manufacturer label. If an AI-ML rule exists for the endpoint containing all four labels, the Hardware Manufacturer value from the system rule is retained. Only the other three labels are taken from the AI-ML rule.

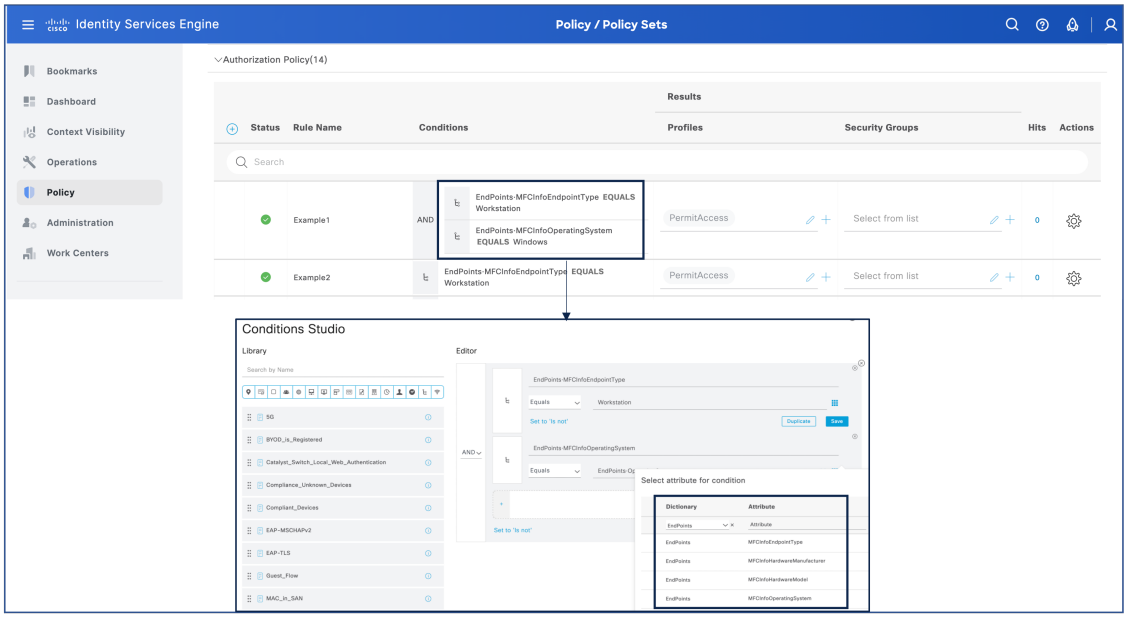
Create Authorization Policy Sets Using Multifactor Classification Attributes

You can create authorization policy sets using multifactor classification attributes in the **Policy > Policy Sets > Default > Authorization Policy** window.

Multifactor classification attributes are automatically added to the **Endpoints Dictionary**. When you create a new policy or update an existing one, you can choose from the four **MFC**-prefixed attributes to leverage these details and define a focused authorization policy.

The following image displays the four multifactor classification attributes available for use in the conditions studio, along with an example of a complete policy set that uses multifactor classification endpoint attributes:

Figure 13: Authorization Policies with Conditions that Use Multifactor Classification Attributes



The ordering of the policy sets in the **Authorization Policy** area is important. An endpoint is profiled according to the first policy set it matches. We recommend that you place your policy set with multifactor classification attribute conditions ahead of other policy sets to effectively use this nuanced endpoint information.

To view the endpoints that have matched these policy sets, go to the **Operations > RADIUS > Live Logs** window. If there are any changes to an endpoint's profiling because of the newly defined policies, a CoA is automatically triggered.

Troubleshooting Multifactor Classification

To view logs for troubleshooting the Multi-Factor Classification feature, download a support bundle:

1. Choose **Operations** > **Troubleshoot** > **Download Logs**.
2. On the left pane, click the node for which you want to generate a support bundle.
3. In the **Debug Logs** tab, select the required logs from the **pi-profiler** and **profiler** sections.
4. In the **Support Bundle** tab, check the **Include debug logs** check box.
5. Click **Create Support Bundle**.

You can configure the severity level for logs related to the Multi-Factor Classification feature in the **Operations > Troubleshoot > Debug Wizard > Debug Profile Configuration** window:

1. Click **Profiling**.
2. For the component **MFC Profiler** choose the desired severity level from the **Log Level** drop-down list.
3. Click **Save**.

Services Enabled by AI Analytics

Enable Cisco AI Analytics

The Cisco AI Analytics agent queries the endpoints data from Cisco ISE and sends it to the machine learning (ML) cloud at regular intervals. The agent accesses the endpoints information from Cisco ISE using the pxGrid REST APIs.

In Cisco ISE releases subsequent to Cisco ISE 3.2, using AI and ML, the number of unknown endpoints in the network can be reduced by providing AI-based endpoint groupings, automated custom profiling rules, and crowd-sourced endpoint labels.

Before you begin

- Enable pxGrid persona in at least one of the nodes of the Cisco ISE deployment. The system certificate used for pxGrid services must contain a DNS name in its Subject Alternative Name (SAN) field.
- This feature requires Smart licensing to be enabled and needs the Advantage License. For information on Smart Licensing, see here.
- The SSM On-Prem Server and Specific License Reservation (SLR) licensing methods are not supported.
- You must have network connectivity to api.prd.kairos.ciscolabs.com over HTTPS (TCP Port 443). If required, configure proxy settings in Cisco ISE.
- Cisco AI Analytics is not supported with the built-in evaluation license.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **Profiler** > **Settings** > **Cisco AI Analytics**.

Step 2 Click **Configure**.

Step 3 Do one of the following in the **Choose Configuration Method** section:

- For a new configuration, click **New Configuration**.
- To restore an existing customer configuration from a previously saved configuration file, click **Recover from a config file**.

Note Recovering from a saved configuration file imports previous AI Analytics Settings using a backup JSON configuration file. The AI Analytics backup file includes private encryption keys, cloud location, and customer identity information. After the import, AI Analytics restores the previous configuration settings.

Step 4 Check the check box to accept and confirm that you have read and acknowledged the General Terms and Cisco Privacy Statement.

Note Do not check the check box, if you do not have the authority to bind your company and its affiliates, or if you do not agree with the terms of the Universal Cloud Agreement.

Step 5 From the **Choose Region** drop-down list, choose the required region.

Step 6 Click **Enable**.

After the agent is enabled, a **Success** dialog box is displayed stating that you have successfully onboarded AI Analytics. You are also asked to download the configuration file. You can use this configuration to restore your connectivity to the same AI Analytics cloud instance to access your historical data.

Step 7 Click **OK**.

Step 8 Click **Download configuration file** to download the configuration file.

Note The configuration file contains confidential information and must be stored in a secure location. Access to the configuration file must be controlled. When you enable or disable the Cisco AI Analytics configuration, an audit is generated. To view the audit details, click the **Menu** icon (☰) and choose **Operations** > **Reports** > **Reports** > **Audit** > **Change Configuration Audit**.

You can view the **ai-analytics** logs in the **Debug Log Configuration** window of the Cisco ISE GUI to check whether the endpoints data is transferred from Cisco ISE to the cloud. To view this window, click the **Menu** icon (☰) and choose **Operations** > **Troubleshoot** > **Debug Wizard** > **Debug Log Configuration**.

To troubleshoot issues relating to AI Analytics, set the **Log Level** for the **ai-analytics** component to **DEBUG** in the **Debug Log Configuration** window.

The logs can be downloaded from the **Download Logs** window. To view this window, click the **Menu** icon (☰) and choose **Operations** > **Troubleshoot** > **Download Logs**.

Cisco AI-ML Rule Proposals for Endpoint Profiling

Cisco ISE now provides profiling suggestions based on continuous learning across networks, helping you to enhance endpoint profiling and management. You can use these suggestions to reduce the number of unknown or unprofiled endpoints in your network.

To receive machine learning-powered profiling proposals you must enable Cisco AI Analytics to allow information sharing between Cisco ISE and the Cisco AI Analytics system.

The following prerequisites apply for Cisco AI Analytics:

- You must have Smart Licensing enabled with registered Advantage licenses.
- The licensing methods SSM On-Prem Server and Specific License Reservation (SLR) are not in use.
- You must have pxGrid services enabled on at least one Cisco ISE node.

To receive AI Proposals, the Multi-Factor Classification for Enhanced Endpoint Visibility feature must be enabled in the **Work Centers > Profiler > Settings > Profiler Settings** window. This feature is enabled in Cisco ISE by default.

If both Cisco AI Analytics and MFC Profiling features are enabled, you can expect AI proposals for the endpoints that have at least two endpoint attribute values. We recommend that you enable the following sources for the AI proposals engine:

- Active Directory
- DHCP
- DHCP SPAN
- DNS

- HTTP
- Netflow
- Network Scan (NMAP)
- RADIUS
- SNMP Trap
- SNMP Query

The AI proposals engine does not process unique endpoint identifiers like IP and MAC addresses.

You can view, review, and apply AI Proposals in the **Context Visibility** > **Endpoints** > **Endpoint Classification** window.

Cisco ISE shares any new or modified endpoint information with the AI proposals engine every 12 hours. Endpoint data collected over the last 7 days are analyzed every 24 hours for ML modeling and rule proposal creation.

Use AI Proposals to Reduce Unknowns in Your Network

In the **Context Visibility** > **Endpoints** > **Endpoint Classification** window, in the **AI Proposals** dashlet, click **Review** to view the AI proposals generated for your Cisco ISE.

Based on continuous learning across networks, the AI Proposals present classification rules and labels for the unknown endpoints in your network. Each endpoint is part of only one proposal group.

Each proposal group contains endpoints that:

- May or may not have been profiled by system rules
- May or may not have a label suggestion for Multi-Factor Classification fields

When you apply an AI-proposed rule, only the unknown and unprofiled endpoints that are part of the proposal group are impacted. Endpoints that are already profiled by existing system rules are not reprofiled or impacted in any way.

The AI Proposals window displays endpoint attributes from the Multi-Factor Classification (MFC) profiler. Each column displays the suggested label and the percentage of endpoints in the group that are already profiled.

Click **View Proposals** for the endpoint group that you want to review.

Figure 14: AI Proposals for an Endpoint Group

A slide-in pane displays the rule suggestion and allows you to name the profiling policies and update label values as required. The **Profile Rule and Attributes tab** displays the number of unknown endpoints in the group, and the attribute information that informed the AI proposal. The tab also displays the last known network access devices for the endpoints.

The Endpoints tab displays the list of endpoints in the selected proposal group.

After you edit the labels as required and review the details of the AI proposal, you can choose to accept or reject the proposal by clicking the relevant button at the end of the pane. You cannot modify the rule condition for a proposal. Accepting the profiling rule applies the proposal to the unknown endpoints in the selected endpoint group.

If you reject the grouping, the proposal is removed from your Cisco ISE and will not be presented again.

Profiler Conditions

Profiling conditions are policy elements and are similar to other conditions. However unlike authentication, authorization, and guest conditions, the profiling conditions can be based on a limited number of attributes. The Profiler Conditions page lists the attributes that are available in Cisco ISE and their description.

Profiler conditions can be one of the following:

- Cisco Provided: Cisco ISE includes predefined profiling conditions when deployed and they are identified as Cisco Provided in the Profiler Conditions window. You cannot delete Cisco Provided profiling conditions.

  You can also find Cisco Provided conditions in the System profiler dictionaries in the following location: **Policy > Policy Elements > Dictionaries > System**.

  For example, MAC dictionary. For some products, the OUI (Organizationally Unique Identifier) is an unique attribute that you can use it first for identifying the manufacturing organization of devices. It is a component of the device MAC address. The MAC dictionary contains the MACAddress and OUI attributes.

- Administrator Created: Profiler conditions that you create as an administrator of Cisco ISE or predefined profiling conditions that are duplicated are identified as Administrator Created. You can create a profiler condition of DHCP, MAC, SNMP, IP, RADIUS, NetFlow, CDP, LLDP, and NMAP types using the profiler dictionaries in the **Profiler Conditions** window.

Although, the recommended upper limit for the number of profiling policies is 1000, you can stretch up to 2000 profiling policies.

Profiling Network Scan Actions

An endpoint scan action is a configurable action that can be referred to in an endpoint profiling policy, and that is triggered when the conditions that are associated with the network scan action are met.

An endpoint scan is used to scan endpoints in order to limit resources usage in the Cisco ISE system. A network scan action scans a single endpoint, unlike resource-intensive network scans. It improves the overall classification of endpoints, and redefines an endpoint profile for an endpoint. Endpoint scans can be processed only one at a time.

You can associate a single network scan action to an endpoint profiling policy. Cisco ISE predefines three scanning types for a network scan action, which can include one or all three scanning types: for instance, an OS-scan, an SNMPPortsAndOS-scan, and a CommonPortsAndOS-scan. You cannot edit or delete OS-scan, SNMPPortsAndOS-scan, and CommonPortsAndOS-scans, which are predefined network scan actions in Cisco ISE. You can also create a new network scan action of your own.

Once an endpoint is appropriately profiled, the configured network scan action cannot be used against that endpoint. For example, scanning an Apple-Device allows you to classify the scanned endpoint to an Apple device. Once an OS-scan determines the operating system that an endpoint is running, it is no longer matched to an Apple-Device profile, but it is matched to an appropriate profile for an Apple device.

Create a New Network Scan Action

A network scan action that is associated with an endpoint profiling policy scans an endpoint for an operating system, Simple Network Management Protocol (SNMP) ports, and common ports. Cisco provides network scan actions for the most common NMAP scans, but you can also create one of your own.

When you create a new network scan, you define the type of information that the NMAP probe will scan for.

Before you begin

The Network Scan (NMAP) probe must be enabled before you can define a rule to trigger a network scan action. The procedure for that is described in Configure Probes for Each Cisco ISE Node.

Step 1 Choose **Policy** > **Policy Elements** > **Results** > **Profiling** > **Network Scan (NMAP) Actions**. Alternatively, you can choose **Work Centers** > **Profiler** > **Policy Elements** > **NMAP Scan Actions**.

Step 2 Click **Add**.

Step 3 Enter a name and description for the network scan action that you want to create.

Step 4 Check one or more check boxes when you want to scan an endpoint for the following:

- Scan OS: To scan for an operating system
- Scan SNMP Port: To scan SNMP ports (161, 162)
- Scan Common Port: To scan common ports.
- Scan Custom Ports: To scan custom ports.
- Scan Include Service Version Information: To scan the version information, which may contain detailed description of the device.
- Run SMB Discovery Script: To scan SMB ports (445 and 139) to retrieve information such as the OS and computer name.
- Skip NMAP Host Discovery: To skip the initial host discovery stage of the NMAP scan.

Note The Skip NMAP Host Discovery option is selected by default for automatic NMAP scan, however, you must select it to run manual NMAP scan.

Step 5 Click **Submit**.

NMAP Operating System Scan

The operating system scan (OS-scan) type scans for an operating system (and OS version) that an endpoint is running. This is a resource intensive scan.

The NMAP tool has limitations on OS-scan which may cause unreliable results. For example, when scanning an operating system of network devices such as switches and routers, the NMAP OS-scan may provide an incorrect operating-system attribute for those devices. Cisco ISE displays the operating-system attribute, even if the accuracy is not 100%.

You should configure endpoint profiling policies that use the NMAP operating-system attribute in their rules to have low certainty value conditions (Certainty Factor values). We recommend that whenever you create an endpoint profiling policy based on the NMAP:operating-system attribute, include an AND condition to help filter out false results from NMAP.

The following NMAP command scans the operating system when you associate Scan OS with an endpoint profiling policy:

```
nmap -sS -O -F -oN /opt/CSCOcpm/logs/nmap.log -append-output -oX - <IP-address>
```

The following NMAP command scans a subnet and sends the output to nmapSubnet.log:

```
nmap -O -sU -p U:161,162 -oN /opt/CSCOcpm/logs/nmapSubnet.log
    --append-output -oX - <subnet>
```

Table 49: NMAP Commands for a Manual Subnet Scan

-O	Enables OS detection
-sU	UDP scan
-p <port ranges>	Scans only specified ports. For example, U:161, 162
oN	Normal output
oX	XML output

Operating System Ports

The following table lists the TCP ports that NMAP uses for OS scanning. In addition, NMAP uses ICMP and UDP port 51824.

1	3	4	6	7	9	13	17	19
20	21	22	23	24	25	26	30	32
33	37	42	43	49	53	70	79	80
81	82	83	84	85	88	89	90	99
100	106	109	110	111	113	119	125	135
139	143	144	146	161	163	179	199	211
212	222	254	255	256	259	264	280	301
306	311	340	366	389	406	407	416	417

425	427	443	444	445	458	464	465	481
497	500	512	513	514	515	524	541	543
544	545	548	554	555	563	587	593	616
617	625	631	636	646	648	666	667	668
683	687	691	700	705	711	714	720	722
726	749	765	777	783	787	800	801	808
843	873	880	888	898	900	901	902	903
911	912	981	987	990	992	993	995	999
1000	1001	1002	1007	1009	1010	1011	1021	1022
1023	1024	1025	1026	1027	1028	1029	1030	1031
1032	1033	1034	1035	1036	1037	1038	1039	1040-1100
1102	1104	1105	1106	1107	1108	1110	1111	1112
1113	1114	1117	1119	1121	1122	1123	1124	1126
1130	1131	1132	1137	1138	1141	1145	1147	1148
1149	1151	1152	1154	1163	1164	1165	1166	1169
1174	1175	1183	1185	1186	1187	1192	1198	1199
1201	1213	1216	1217	1218	1233	1234	1236	1244
1247	1248	1259	1271	1272	1277	1287	1296	1300
1301	1309	1310	1311	1322	1328	1334	1352	1417
1433	1434	1443	1455	1461	1494	1500	1501	1503
1521	1524	1533	1556	1580	1583	1594	1600	1641
1658	1666	1687	1688	1700	1717	1718	1719	1720
1721	1723	1755	1761	1782	1783	1801	1805	1812
1839	1840	1862	1863	1864	1875	1900	1914	1935
1947	1971	1972	1974	1984	1998-2010	2013	2020	2021
2022	2030	2033	2034	2035	2038	2040-2043	2045-2049	2065
2068	2099	2100	2103	2105-2107	2111	2119	2121	2126
2135	2144	2160	2161	2170	2179	2190	2191	2196
2200	2222	2251	2260	2288	2301	2323	2366	2381-2383

2393	2394	2399	2401	2492	2500	2522	2525	2557
2601	2602	2604	2605	2607	2608	2638	2701	2702
2710	2717	2718	2725	2800	2809	2811	2869	2875
2909	2910	2920	2967	2968	2998	3000	3001	3003
3005	3006	3007	3011	3013	3017	3030	3031	3052
3071	3077	3128	3168	3211	3221	3260	3261	3268
3269	3283	3300	3301	3306	3322	3323	3324	3325
3333	3351	3367	3369	3370	3371	3372	3389	3390
3404	3476	3493	3517	3527	3546	3551	3580	3659
3689	3690	3703	3737	3766	3784	3800	3801	3809
3814	3826	3827	3828	3851	3869	3871	3878	3880
3889	3905	3914	3918	3920	3945	3971	3986	3995
3998	4000-4006	4045	4111	4125	4126	4129	4224	4242
4279	4321	4343	4443	4444	4445	4446	4449	4550
4567	4662	4848	4899	4900	4998	5000-5004	5009	5030
5033	5050	5051	5054	5060	5061	5080	5087	5100
5101	5102	5120	5190	5200	5214	5221	5222	5225
5226	5269	5280	5298	5357	5405	5414	5431	5432
5440	5500	5510	5544	5550	5555	5560	5566	5631
5633	5666	5678	5679	5718	5730	5800	5801	5802
5810	5811	5815	5822	5825	5850	5859	5862	5877
5900-5907	5910	5911	5915	5922	5925	5950	5952	5959
5960-5963	5987-5989	5998-6007	6009	6025	6059	6100	6101	6106
6112	6123	6129	6156	6346	6389	6502	6510	6543
6547	6565-6567	6580	6646	6666	6667	6668	6669	6689
6692	6699	6779	6788	6789	6792	6839	6881	6901
6969	7000	7001	7002	7004	7007	7019	7025	7070
7100	7103	7106	7200	7201	7402	7435	7443	7496
7512	7625	7627	7676	7741	7777	7778	7800	7911

7920	7921	7937	7938	7999	8000	8001	8002	8007
8008	8009	8010	8011	8021	8022	8031	8042	8045
8080-8090	8093	8099	8100	8180	8181	8192	8193	8194
8200	8222	8254	8290	8291	8292	8300	8333	8383
8400	8402	8443	8500	8600	8649	8651	8652	8654
8701	8800	8873	8888	8899	8994	9000	9001	9002
9003	9009	9010	9011	9040	9050	9071	9080	9081
9090	9091	9099	9100	9101	9102	9103	9110	9111
9200	9207	9220	9290	9415	9418	9485	9500	9502
9503	9535	9575	9593	9594	9595	9618	9666	9876
9877	9878	9898	9900	9917	9929	9943	9944	9968
9998	9999	10000	10001	10002	10003	10004	10009	10010
10012	10024	10025	10082	10180	10215	10243	10566	10616
10617	10621	10626	10628	10629	10778	11110	11111	11967
12000	12174	12265	12345	13456	13722	13782	13783	14000
14238	14441	14442	15000	15002	15003	15004	15660	15742
16000	16001	16012	16016	16018	16080	16113	16992	16993
17877	17988	18040	18101	18988	19101	19283	19315	19350
19780	19801	19842	20000	20005	20031	20221	20222	20828
21571	22939	23502	24444	24800	25734	25735	26214	27000
27352	27353	27355	27356	27715	28201	30000	30718	30951
31038	31337	32768	32769	32770	32771	32772	32773	32774
32775	32776	32777	32778	32779	32780	32781	32782	32783
32784	32785	33354	33899	34571	34572	34573	34601	35500
36869	38292	40193	40911	41511	42510	44176	44442	44443
44501	45100	48080	49152	49153	49154	49155	49156	49157
49158	49159	49160	49161	49163	49165	49167	49175	49176
49400	49999	50000	50001	50002	50003	50006	50300	50389
50500	50636	50800	51103	51493	52673	52822	52848	52869

54045	54328	55055	55056	55555	55600	56737	56738	57294
57797	58080	60020	60443	61532	61900	62078	63331	64623
64680	65000	65129	65389					

NMAP SNMP Port Scan

The SNMPPortsAndOS-scan type scans an operating system (and OS version) that an endpoint is running and triggers an SNMP Query when SNMP ports (161 and 162) are open. It can be used for endpoints that are identified and matched initially with an Unknown profile for better classification.

The following NMAP command scans SNMP ports (UDP 161 and 162) when you associate the Scan SNMP Port with an endpoint profiling policy:

nmap -sU -p U:161,162 -oN /opt/CSCOcpm/logs/nmap.log --append-output -oX - <IP-address>

Table 50: NMAP Commands for an Endpoint SNMP Port Scan

-sU	UDP scan.
-p <port-ranges>	Scans only specified ports. For example, scans UDP ports 161 and 16.2
oN	Normal output.
oX	XML output.
IP-address	IP-address of an endpoint that is scanned.

NMAP Common Ports Scan

The CommonPortsAndOS-scan type scans an operating system (and OS version) that an endpoint is running and common ports (TCP and UDP), but not SNMP ports. The following NMAP command scans common ports when you associate Scan Common Port with an endpoint profiling policy:nmap -sTU -p T:21,22,23,25,53,80,110,135,139,143,443,445,3306,3389,8080,U:53,67,68,123,135,137,138,139,161,445,500,520,631,1434,1900 -oN /opt/CSCOcpm/logs/nmap.log --append-output -oX - <IP address>

Table 51: NMAP Commands for an Endpoint Common Ports Scan

-sTU	Both TCP connect scan and UDP scan.
-p <port ranges>	Scans TCP ports: 21,22,23,25,53,80,110,135,139,143, 443,445,3306,3389,8080 and UDP ports: 53,67,68,123,135,137, 138,139,161,445,500,520,631,1434,1900
oN	Normal output.
oX	XML output.
IP address	IP address of an endpoint that is scanned.

Common Ports

The following table lists the common ports that NMAP uses for scanning.

Table 52: Common Ports

TCP Ports		UDP Ports	
Ports	**Service**	**Ports**	**Service**
21/tcp	ftp	53/udp	domain
22/tcp	ssh	67/udp	dhcps
23/tcp	telnet	68/udp	dhcpc
25/tcp	smtp	123/udp	ntp
53/tcp	domain	135/udp	msrpc
80/tcp	http	137/udp	netbios-ns
110/tcp	pop3	138/udp	netbios-dgm
135/tcp	msrpc	139/udp	netbios-ssn
139/tcp	netbios-ssn	161/udp	snmp
143/tcp	imap	445/udp	microsoft-ds
443/tcp	https	500/udp	isakmp
445/tcp	microsoft-ds	520/udp	route
3389/tcp	ms-term-serv	1434/udp	ms-sql-m
8080/tcp	http-proxy	1900/udp	upnp

NMAP Custom Ports Scan

In addition to the common ports, you can use custom ports (**Work Centers** > **Profiler** > **Policy Elements** > **NMAP Scan Actions** or **Policy** > **Policy Elements** > **Results** > **Profiling** > **Network Scan (NMAP) Actions**) to specify automatic and manual NMAP scan actions. NMAP probes collect the attributes from endpoints via the specified custom ports that are open. These attributes are updated in the endpoint's attribute list in the ISE Identities page (**Work Centers** > **Network Access** > **Identities** > **Endpoints**). You can specify up to 10 UDP and 10 TCP ports for each scan action. You cannot use the same port numbers that you have specified as common ports. See Configure Profiler Policies Using the McAfee ePolicy Orchestrator for more information.

NMAP Include Service Version Information Scan

The Include Service Version Information NMAP probe automatically scans the endpoints to better classify them, by collecting information about services running on the device. The service version option can be combined with common ports or custom ports.

Example:

CLI Command: nmap -sV -p T:8083 172.21.75.217

Output:

Port	State	Service	Version
8083/tcp	open	http	McAfee ePolicy Orchestrator Agent 4.8.0.1500 (ePOServerName: WIN2008EPO, AgentGuid: {[illegible]})

NMAP SMB Discovery Scan

NMAP SMB Discovery scan helps differentiate the Windows versions, and results in a better endpoint profiling. You can configure the NMAP scan action to run the SMB discovery script that is provided by NMAP.

The NMAP scan action is incorporated within the windows default policies and when the endpoint matches the policy and the scanning rule, the endpoint is scanned and the result helps to determine the exact windows version. The policy will be then configured on the feed service and new pre-defined NMAP scan is created with the SMB discovery option.

The NMAP scan action is invoked by the Microsoft-Workstation policies and the result of the scan is saved on the endpoint under the operating system attribute and leveraged to the Windows policies. You can also find the SMB Discovery script option in the manual scan on the subnet.

Note For SMB discovery, be sure to enable the Windows file sharing option in the endpoint.

SMB Discovery Attributes

When the SMB discovery script is executed on the endpoint, new SMB discovery attributes, such as SMB.Operating-system, are added to the endpoint. These attributes are considered for updating the Windows endpoint profiling policies on the feed service. When a SMB discovery script is run, the SMB discovery attribute is prefixed with SMB, such as SMB.operating-system, SMB.lanmanager, SMB.server, SMB.fqdn, SMB.domain, SMB.workgroup, and SMB.cpe.

Skip NMAP Host Discovery

Scanning every port of every single IP address is a time-consuming process. Depending on the purpose of the scan, you can skip the NMAP host discovery of active endpoints.

If a NMAP scan is triggered after the classification of an endpoint, the profiler always skips the host discovery of the endpoint. However, if a manual scan action is triggered after enabling the Skip NMAP Host Discovery Scan, then host discovery is skipped.

NMAP Scan Workflow

Steps to be followed to perform a NMAP scan:

Before you begin

In order to run NMAP SMB discovery script, you must enable the file sharing in your system. Refer to the Enable File Sharing to Run NMAP SMB Discovery Script topic for an example.

Step 1 Create an SMB Scan Action.
Step 2 Configure the Profiler Policy Using the SMB Scan Action.
Step 3 Add a New Condition Using the SMB Attribute.

Create an SMB Scan Action

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Policy Elements** > **Results** > **Profiling** > **Network Scan (NMAP) Actions**.
Step 2 Enter the **Action Name** and **Description**.
Step 3 Check the **Run SMB Discovery Script** checkbox.
Step 4 Click **Add** to create the network access users.

What to do next

You should configure the profiler policy using the SMB scan action.

Configure the Profiler Policy Using the SMB Scan Action

Before you begin

You must create a new profiler policy to scan an endpoint with the SMB scan action. For example, you can scan a Microsoft Workstation by specifying a rule that if the DHCP class identifier contains the MSFT attribute, then a network action should be taken.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Profiling** > **Add**.
Step 2 Enter the **Name** and **Description**.
Step 3 In the drop-down, select the scan action (for example, SMBScanAction) that you had created.

What to do next

You should add a new condition using the SMB attribute.

Add a New Condition Using the SMB Attribute

Before you begin

You should create a new profiler policy to scan the version of an endpoint. For example, you can scan for Windows 7 under the Microsoft Workstation parent policy.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Profiling** > **Add**.
Step 2 Enter the **Name** (for example, Windows-7Workstation) and **Description**.

Step 3 In the **Network Scan (NMAP) Action** drop-down, select **None**.

Step 4 In the **Parent Policy** drop-down choose the Microsoft-Workstation policy.

Enable File Sharing to Run NMAP SMB Discovery Script

Given below is an example to enable file sharing in Windows OS version 7, to run the NMAP SMB discovery script.

Step 1 Choose **Control Panel** > **Network and Internet**.

Step 2 Click **Network and Sharing Center**.

Step 3 Click **Change Advanced Sharing Settings**.

Step 4 Click **Turn on File and Printer Sharing**.

Step 5 Enable the following options: **Enable File Sharing for Devices That Use 40- or 56-bit Encryption** and **Turn on Password Protected Sharing**.

Step 6 Click **Save Changes**.

Step 7 Configure the Firewall settings.

a) In the Control Panel, navigate to **System and Security** > **Windows Firewall** > **Allow a Program Through Windows Firewall**.
b) Check the **File and Printer Sharing** check box.
c) Click **OK**.

Step 8 Configure the shared folder.

a) Right-click the destination folder, and select **Properties**.
b) Click the **Sharing** tab, and click **Share**.
c) In the **File Sharing** dialog box, add the required names and click **Share**.
d) Click **Done** after the selected folder is shared.
e) Click **Advanced Sharing** and select the **Share This Folder** check box.
f) Click **Permissions**.
g) In the **Permissions for Scans** dialog box, choose **Everyone** and check the **Full Control** check box.
h) Click **OK**.

Exclude Subnets from NMAP Scan

You can perform an NMAP scan to identify an endpoint's OS or SNMP port.

When performing the NMAP scan, you can exclude a whole subnet or IP range that should not be scanned by NMAP. You can configure the subnet or IP range in the **NMAP Scan Subnet Exclusions** window (**Work Centers > Profiler > Settings > NMAP Scan Subnet Exclusions**). This helps limit the load on your network and saves a considerable amount of time.

For Manual NMAP scan, you can use the **Run Manual NMAP Scan** window (**Work Centers > Profiler > Manual Scans > Manual NMAP Scan > Configure NMAP Scan Subnet Exclusions At**) to specify the subnet or IP range.

Manual NMAP Scan Settings

You can perform a manual NMAP scan (**Work Centers** > **Profiler** > **Manual Scans** > **Manual NMAP Scan**) using the scan options that are available for automatic NMAP scan. You can choose either the scan options or the predefined ones.

Table 53: Manual NMAP Scan Settings

Field Name	Usage Guidelines
Node	Choose the ISE node from which the NMAP scan is run.
Manual Scan Subnet	Enter the range of subnet IP addresses of endpoints for which you want to run the NMAP scan.
Configure NMAP Scan Subnet Exclusions At	You will be directed to the **Work Centers** > **Profiler** > **Settings** > **NMAP Scan Subnet Exclusions** window. Specify the IP address and subnet mask that should be excluded. If there is a match, the NMAP scan is not run.
NMAP Scan Subnet	You can do one of the following: • Specify Scan Options • Select an Existing NMAP Scan
Specify Scan Options	Select the required scan options: OS, SNMP Port, Common Ports, Custom Ports, Include Service Version Information, Run SMB Discovery Script, Skip NMAP Host Discovery. See Create a New Network Scan Action for more information.
Select an Existing NMAP Scan	Displays the **Existing NMAP Scan Actions** drop-down list that displays the default profiler NMAP scan actions.
Reset to Default Scan Options	Click this option to restore default settings (all scan options are checked).
Save as NMAP Scan Action	Enter an action name and a description.

Run a Manual NMAP Scan

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **Profiler** > **Manual Scans** > **Manual NMAP Scan**.

Step 2 In the **Node** drop-down list, select the ISE node from which you intend to run the NMAP scan.

Step 3 In the **Manual Scan Subnet** text box, enter the subnet address whose endpoints you intend to check for open ports.

Step 4 Select one of the following:

a) Choose **Specify Scan Options**, and on the right side of the page, choose the required scan options. Refer to the Create a New Network Scan Action page for more information.

b) Choose **Select An Existing NMAP Scan Action** to select the default NMAP scan action, such as MCAFeeEPOOrchestratorClientScan.

Step 5 Click **Run Scan**.

Configure Profiler Policies Using the McAfee ePolicy Orchestrator

Cisco ISE profiling services can detect if the McAfee ePolicy Orchestrator (McAfee ePO) client is present on the endpoint. This helps in determining if a given endpoint belongs to your organization.

The entities involved in the process are:

- ISE Server
- McAfee ePO Server
- McAfee ePO Agent

Cisco ISE provides an in-built NMAP scan action (MCAFeeEPOOrchestratorClientscan) to check if the McAfee agent is running on an endpoint using NMAP McAfee script on the configured port. You can also create new NMAP scan options using the custom ports (for example, 8082). You can configure a new NMAP scan action using the McAfee ePO software by following the steps below:

Step 1 Configure the McAfee ePo NMAP Scan Action.

Step 2 Configure the McAfee ePO Agent.

Step 3 Configure Profiler Policies Using the McAfee ePO NMAP Scan Action.

Configure the McAfee ePo NMAP Scan Action

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **Profiler** > **Policy Elements** > **Network Scan (NMAP) Actions**.

Step 2 Click **Add**.

Step 3 Enter the **Action Name** and **Description**.

Step 4 In the **Scan Options**, select **Custom Ports**.

Step 5 In the **Custom Ports** dialog box, add the required TCP port. The 8080 TCP port is enabled by default for McAfee ePO.

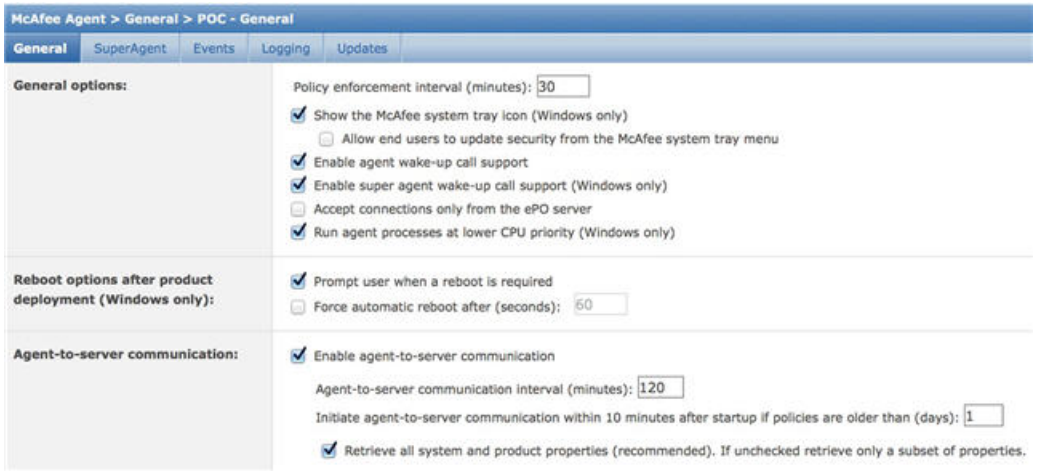
Step 6 Check the **Include Service Version Information** checkbox.

Step 7 Click **Submit**.

Configure the McAfee ePO Agent

Step 1 In your McAfee ePO server, check the recommended settings to facilitate the communication between the McAfee ePO agent and the ISE server.

Figure 15: McAfee ePO Agent Recommended Options



Step 2 Verify that the **Accept Connections Only From The ePO Server** is unchecked.

Configure Profiler Policies Using the McAfee ePO NMAP Scan Action

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Profiling** > **Add**.

Step 2 Enter the **Name** and **Description**.

Step 3 In the **Network Scan (NMAP) Action** drop-down list, select the required action (for example, MCAFeeEPOOrchestratorClientscan).

Step 4 Create the parent profiler policy (for example, Microsoft-Workstation containing a rule to check if the DHCP class identifier contains the MSFT attribute).

Step 5 Create a new policy (for example CorporateDevice) within the parent NMAP McAfee ePO policy (for example, Microsoft-Workstation) to check if the McAfee ePO agent is installed on the endpoint.

Endpoints that meet the condition are profiled as corporate devices. You can use the policy to move endpoints profiled with McAfee ePO agent to a new VLAN.

Profiler Endpoint Custom Attributes

Choose **Administration** > **Identity Management** > **Settings** > **Endpoint Custom Attributes** to assign attributes to endpoints, besides the attributes that the endpoint gathers from the probe. The endpoint custom attributes can be used in authorization policies to profile endpoints.

You can create a maximum of 100 endpoint custom attributes. The types of endpoint custom attributes supported are: Int, String, Long, Boolean, and Float.

You can add values for the endpoint custom attributes in the **Context Directory** > **Endpoints** > **Endpoint Classification** window.

Use cases for endpoint custom attributes include, to allow or block devices based on certain attributes or to assign certain privileges based on the authorization.

Using Endpoint Custom Attributes in Authorization Policy

The endpoint custom attributes section allows you to configure extra attributes. Each definition consists of the attribute and type (String, Int, Boolean, Float, Long). You can profile devices using endpoint custom attributes.

Note You must have a Cisco ISE Advantage license to add custom attributes to the endpoints.

The following steps show how to create an authorization policy using endpoint custom attributes.

Step 1 Create the endpoint custom attributes and assign values.

a) Choose **Administration** > **Identity Management** > **Settings** > **Endpoint Custom Attributes** page.
b) In the **Endpoint Custom Attributes** area, enter the **Attribute Name** (for example, deviceType), Data Type (for example, String) and Parameters.
c) Click **Save**.
d) Choose **Context Visibility** > **Endpoints** > **Summary**.
e) Assign the custom attribute values.

- Check the required MAC address check box, and click **Edit**.
- Or, click the required MAC address, and on the Endpoints page, click **Edit**.

f) In the **Edit Endpoint** dialog box, in the **Custom Attribute** area enter the required attribute values (for example, deviceType = Apple-iPhone).
g) Click **Save**.

Step 2 Create an authorization policy using the custom attributes and values.

a) Choose **Policy** > **Policy Sets**.
b) Create the authorization policy by selecting the custom attributes from the Endpoints dictionary (for example, Rule Name: Corporate Devices, Conditions:EndPoints:deviceType Contains Apple-iPhone, Permissions: then PermitAccess).
c) Click **Save**.

Related Topics

Profiler Endpoint Custom Attributes, on page 224

Create a Profiler Condition

Endpoint profiling policies in Cisco ISE allow you to categorize discovered endpoints on your network, and assign them to specific endpoint identity groups. These endpoint profiling policies are made up of profiling conditions that Cisco ISE evaluates to categorize and group endpoints.

Before you begin

To perform the following task, you must be a Super Admin or Policy Admin.

Step 1 Choose **Policy** > **Policy Elements** > **Conditions** > **Profiling** > **Add**.

Step 2 Enter values for the fields as described in the Endpoint Profiling Policies Settings, on page 227.

Step 3 Click **Submit** to save the profiler condition.

Step 4 Repeat this procedure to create more conditions.

Endpoint Profiling Policy Rules

You can define a rule that allows you to choose one or more profiling conditions from the library that are previously created and saved in the policy elements library, and to associate an integer value for the certainty factor for each condition, or associate either an exception action or a network scan action for that condition. The exception action or the network scan action is used to trigger the configurable action while Cisco ISE is evaluating the profiling policies with respect to the overall classification of endpoints.

When the rules in a given policy are evaluated separately with an OR operator, the certainty metric for each rule contributes to the overall matching of the endpoint profiles into a specific category of endpoints. If the rules of an endpoint profiling policy match, then the profiling policy and the matched policy are the same for that endpoint when they are dynamically discovered on your network.

Profiling Policy Classification Priority

Cisco ISE classifies the devices in your network based on profiling policies that are either Cisco-provided or created by administrators. From Cisco ISE Release 3.3, you can set a priority for which category of profiling policies is used to classify the devices.

The **Work Centers** > **Profiler** > **Profiling Policies** page lists both Cisco-provided and administrator-created profiling policies.

To prioritize a profiling policy type, go to **Work Centers** > **Profiler** > **Settings** > **Profiler Settings**. From the **Overlapping Classification Priority** drop-down menu, choose **Admin First** or **Cisco First**. The default value for this setting is admin-created policies first.

If there are both Cisco-provided and admin-created profiling policies that match for an endpoint, this priority setting determines which profile is enforced through profiling workflows. The value of the priority setting alone determines the policy that is matched with an endpoint, regardless of the certainty factors of the overlapping policies.

For example, if Cisco Policy A with certainty factor 10 and Admin Policy B with certainty factor 5 are available for an endpoint, if **Admin First** is the chosen priority, Admin Policy B is assigned to the endpoint.

The configured priority also influences endpoint authorization based on the AuthZ conditions used such as Endpoints:EndpointPolicy or Endpoints:LogicalProfile.

Logically Grouped Conditions in Rules

An endpoint profiling policy (profile) contains a single condition or a combination of multiple single conditions that are logically combined using an AND or OR operator, against which you can check, categorize, and group endpoints for a given rule in a policy.

A condition is used to check the collected endpoint attribute value against the value specified in the condition for an endpoint. If you map more than one attribute, you can logically group the conditions, which helps you to categorize endpoints on your network. You can check endpoints against one or more such conditions with a corresponding certainty metric (an integer value that you define) associated with it in a rule or trigger an exception action that is associated to the condition or a network scan action that is associated to the condition.

Certainty Factor

The minimum certainty metric in the profiling policy evaluates the matching profile for an endpoint. Each rule in an endpoint profiling policy has a minimum certainty metric (an integer value) associated to the profiling conditions. The certainty metric is a measure that is added for all the valid rules in an endpoint profiling policy, which measures how each condition in an endpoint profiling policy contributes to improve the overall classification of endpoints.

The certainty metric for each rule contributes to the overall matching of the endpoint profiles into a specific category of endpoints. The certainty metric for all the valid rules are added together to form the matching certainty. It must exceed the minimum certainty factor that is defined in an endpoint profiling policy. By default, the minimum certainty factor for all new profiling policy rules and predefined profiling policies is 10.

Endpoint Profiling Policies Settings

The following table describes the fields in the **Endpoint Policies** window. To view this window, click the **Menu** icon (☰) and choose **Policy** > **Profiling** > **Profiling Policies**.

Table 54: Endpoint Profiling Policies Settings

Field Name	Usage Guidelines
Name	Enter the name of the endpoint profiling policy that you want to create.
Description	Enter the description of the endpoint profiling policy that you want to create.
Policy Enabled	By default, the **Policy Enabled** check box is checked to associate a matching profiling policy when you profile an endpoint. When unchecked, the endpoint profiling policy is excluded when you profile an endpoint.
Minimum Certainty Factor	Enter the minimum value that you want to associate with the profiling policy. The default value is 10.
Exception Action	Choose an exception action, which you want to associate with the conditions when defining a rule in the profiling policy. The default is NONE. The exception actions are defined in the following location: **Policy > Policy Elements > Results > Profiling > Exception Actions**.
Network Scan (NMAP) Action	Choose a network scan action from the list, which you want to associate with the conditions when defining a rule in the profiling policy, if required. The default is NONE. The exception actions are defined in the following location: **Policy > Policy Elements > Results > Profiling > Network Scan (NMAP) Actions**.
Create an Identity Group for the policy	Check one of the following options to create an endpoint identity group: • **Yes, create matching Identity Group** • **No, use existing Identity Group hierarchy**

Field Name	Usage Guidelines
Yes, create matching Identity Group	Choose this option to use an existing profiling policy. This option creates a matching identity group for those endpoints and the identity group will be the child of the Profiled endpoint identity group when an endpoint profile matches an existing profiling policy. For example, the Xerox-Device endpoint identity group is created in the Endpoints Identity Groups page when endpoints discovered on your network match the Xerox-Device profile.
No, use existing Identity Group hierarchy	Check this check box to assign endpoints to the matching parent endpoint identity group using hierarchical construction of profiling policies and identity groups. This option allows you to make use of the endpoint profiling policies hierarchy to assign endpoints to one of the matching parent endpoint identity groups, as well as to the associated endpoint identity groups to the parent identity group. For example, endpoints that match an existing profile are grouped under the appropriate parent endpoint identity group. Here, endpoints that match the Unknown profile are grouped under Unknown, and endpoints that match an existing profile are grouped under the Profiled endpoint identity group. For example, • If endpoints match the Cisco-IP-Phone profile, then they are grouped under the Cisco-IP-Phone endpoint identity group. • If endpoints match the Workstation profile, then they are grouped under the Workstation endpoint identity group. The Cisco-IP-Phone and Workstation endpoint identity groups are associated to the Profiled endpoint identity group in the system.
Parent Policy	Choose a parent profiling policy that are defined in the system to which you want to associate the new endpoint profiling policy. You can choose a parent profiling policy from which you can inherit rules and conditions to its child.
Associated CoA Type	Choose one of the following CoA types that you want to associate with the endpoint profiling policy: • No CoA • Port Bounce • Reauth • Global Settings that is applied from the profiler configuration set in Administration > System > Settings > Profiling
Rules	One or more rules that are defined in endpoint profiling policies determine the matching profiling policy for endpoints, which allows you to group endpoints according to their profiles. One or more profiling conditions from the policy elements library are used in rules for validating endpoint attributes and their values for the overall classification.

Field Name	Usage Guidelines
Conditions	Click the plus [+] sign to expand the Conditions anchored overlay, and click the minus [-] sign, or click outside the anchored overlay to close it. Click **Select Existing Condition from Library** or **Create New Condition (Advanced Option)** . **Select Existing Condition from Library**: You can define an expression by selecting Cisco predefined conditions from the policy elements library. **Create New Condition (Advanced Option)**: You can define an expression by selecting attributes from various system or user-defined dictionaries. You can associate one of the following with the profiling conditions: • An integer value for the certainty factor for each condition • Either an exception action or a network scan action for that condition Choose one of the following predefined settings to associate with the profiling condition: • Certainty Factor Increases: Enter the certainty value for each rule, which can be added for all the matching rules with respect to the overall classification. • Take Exception Action: Triggers an exception action that is configured in the Exception Action field for this endpoint profiling policy. • Take Network Scan Action: Triggers a network scan action that is configured in the Network Scan (NMAP) Action field for this endpoint profiling policy.
Select Existing Condition from Library	You can do the following: • You can choose Cisco predefined conditions that are available in the policy elements library, and then use an AND or OR operator to add multiple conditions. • Click the Action icon to do the following in the subsequent steps: • **Add Attribute or Value**: You can add ad-hoc attribute or value pairs • **Add Condition from Library**: You can add Cisco predefined conditions • **Duplicate**: Create a copy of the selected condition • **Add Condition to Library**: You can save ad-hoc attribute/value pairs that you create to the policy elements library • **Delete**: Delete the selected condition.

Field Name	Usage Guidelines
Create New Condition (Advance Option)	You can do the following: • You can add ad-hoc attribute/value pairs to your expression, and then use an AND or OR operator to add multiple conditions. • Click the Action icon to do the following in the subsequent steps: • **Add Attribute or Value**: You can add ad-hoc attribute or value pairs • **Add Condition from Library**: You can add Cisco predefined conditions • **Duplicate**: Create a copy of the selected condition • **Add Condition to Library**: You can save ad-hoc attribute/value pairs that you create to the policy elements library • **Delete**: Delete the selected condition. You can use the AND or OR operator

Related Topics

Cisco ISE Profiling Service, on page 178
Create Endpoint Profiling Policies, on page 230
Endpoint Context Visibility Using UDID Attribute, on page 261

Create Endpoint Profiling Policies

You can create new profiling policies to profile endpoints by using the following options in the New Profiler Policy page:

- Policy Enabled
- Create an Identity Group for the policy to create a matching endpoint identity group or use the endpoint identity group hierarchy
- Parent Policy
- Associated CoA Type

Note When you choose to create an endpoint policy in the **Profiling Policies** window, do not use the Stop button on your web browsers. This action leads to the following: stops loading the **New Profiler Policy** window, loads other list pages and the menus within the list pages when you access them, and prevents you from performing operations on all the menus within the list pages except the Filter menus. You might need to log out of Cisco ISE, and then log in again to perform operations on all the menus within the list pages.

You can create a similar characteristic profiling policy by duplicating an endpoint profiling policy through which you can modify an existing profiling policy instead of creating a new profiling policy by redefining all conditions.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Profiling** > **Profiling Policies**.

Step 2 Click **Add**.

Step 3 Enter a name and description for the new endpoint policy that you want to create. The **Policy Enabled** check box is checked by default to include the endpoint profiling policy for validation when you profile an endpoint.

Step 4 Enter a value for the minimum certainty factor within the valid range 1 to 65535.

Note The following considerations must be taken into account when you create custom profiling policies:

- If the same attributes configured in the custom policy are already configured to be evaluated by a default profiling policy, and if the default profiling policy has a greater certainty factor (CF) than the custom policy, then the custom profiling policy will never be asigned to any endpoint. This is because a profiling policy that has higher increases of CF will take precedence over any other with lower increases of the CF.
- Many default profiling policies are configured for incremental CF increases by 10, 20 and 30.

Step 5 Click the arrow next to the **Exception Action** drop-down list to associate an exception action or click the arrow next to the **Network Scan (NMAP) Action** drop-down list to associate a network scan action.

Step 6 Choose one of the following options for **Create an Identity Group for the policy**:

- **Yes, create matching Identity Group**
- **No, use existing Identity Group hierarchy**

Step 7 Click the arrow next to the **Parent Policy** drop-down list to associate a parent policy to the new endpoint policy.

Step 8 Choose a CoA type to be associated in the **Associated CoA Type** drop-down list.

Step 9 Click in the rule to add conditions and associate an integer value for the certainty factor for each condition or associate either an exception action or a network scan action for that condition for the overall classification of an endpoint.

Step 10 Click **Submit** to add an endpoint policy or click the **Profiler Policy List** link from the New Profiler Policy page to return to the Profiling Policies page.

Change of Authorization Configuration for Each Endpoint Profiling Policy

In addition to the global configuration of change of authorization (CoA) types in Cisco ISE, you can also configure to issue a specific type of CoA associated for each endpoint profiling policy.

The global No CoA type configuration overrides each CoA type configured in an endpoint profiling policy. If the global CoA type is set other than the No CoA type, then each endpoint profiling policy is allowed to override the global CoA configuration.

When a CoA is triggered, each endpoint profiling policy can determine the actual CoA type, as follows:

- General Setting—This is the default setting for all the endpoint profiling policies that issues a CoA per global configuration.
- No CoA—This setting overrides any global configuration and disables CoA for the profile.
- Port Bounce—This setting overrides the global Port Bounce and Reauth configuration types, and issues port bounce CoA.

- Reauth—This setting overrides the global Port Bounce and Reauth configuration types, and issues reauthentication CoA.

Note If the profiler global CoA configuration is set to Port Bounce (or Reauth), ensure that you configure corresponding endpoint profiling policies with No CoA, the per-policy CoA option so that the BYOD flow does not break for your mobile devices.

See the summary of configuration below combined for all the CoA types and the actual CoA type issued in each case based on the global and endpoint profiling policy settings.

Table 55: CoA Type Issued for Various Combination of Configuration

Global CoA Type	Default CoA Type set per Policy	No coA Type per Policy	Port Bounce Type per Policy	Reauth Type per Policy
No CoA	No CoA	No CoA	No CoA	No CoA
Port Bounce	Port Bounce	No CoA	Port Bounce	Re-Auth
Reauth	Reauth	No CoA	Port Bounce	Re-Auth

Import Endpoint Profiling Policies

You can import endpoint profiling policies from a file in XML by using the same format that you can create in the export function. If you import newly created profiling policies that have parent policies associated, then you must have defined parent policies before you define child policies.

The imported file contains the hierarchy of endpoint profiling policies that contain the parent policy first, then the profile that you imported next along with the rules and checks that are defined in the policy.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Profiling** > **Profiling** > **Profiling Policies**.

Step 2 Click **Import**.

Step 3 Click **Browse** to locate the file that you previously exported and want to import.

Step 4 Click **Submit**.

Step 5 Click the **Profiler Policy List** link to return to the **Profiling Policies** window.

Export Endpoint Profiling Policies

You can export endpoint profiling policies to other Cisco ISE deployments. Or, you can use the XML file as a template for creating your own policies to import. You can also download the file to your system in the default location, which can be used for importing later.

A dialog appears when you want to export endpoint profiling policies, which prompts you to open the profiler_policies.xml with an appropriate application or save it. This is a file in XML format that you can open in a web browser, or in other appropriate applications.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Profiling** > **Profiling** > **Profiling Policies**.

Step 2 Choose **Export**, and choose one of the following:

- **Export Selected**: You can export only the selected endpoint profiling policies in the **Profiling Policies** window.
- **Export Selected with Endpoints**: You can export the selected endpoint profiling policies, and the endpoints that are profiled with the selected endpoint profiling policies.
- **Export All**: By default, you can export all the profiling policies in the **Profiling Policies** window.

Step 3 Click **OK** to export the endpoint profiling policies in the profiler_policies.xml file.

Predefined Endpoint Profiling Policies

Cisco ISE includes predefined default profiling policies when Cisco ISE is deployed, and their hierarchical construction allows you to categorize identified endpoints on your network, and assign them to a matching endpoint identity groups. Because endpoint profiling policies are hierarchical, you can find that the **Profiling Policies** window displays the list of generic (parent) policies for devices and child policies to which their parent policies are associated in the Profiling Policies listing window.

The **Profiling Policies** window displays endpoint profiling policies with their names, type, description and the status, if enabled or not for validation.

The endpoint profiling policy types are classified as follows:

- Cisco Provided: Endpoint profiling policies that are predefined in Cisco ISE are identified as the Cisco Provided type.
    - Administrator Modified: Endpoint profiling policies are identified as the Administrator Modified type when you modify predefined endpoint profiling policies. Cisco ISE overwrites changes that you have made in the predefined endpoint profiling policies during upgrade.
- Administrator Created: Endpoint profiling policies that you create or when you duplicate Cisco-provided endpoint profiling policies are identified as the Administrator Created type.

We recommend that you create a generic policy (a parent) for a set of endpoints from which its children can inherit the rules and conditions. If an endpoint has to be classified, then the endpoint profile has to first match the parent, and then its descendant (child) policies when you are profiling an endpoint.

For example, Cisco-Device is a generic endpoint profiling policy for all Cisco devices, and other policies for Cisco devices are children of Cisco-Device. If an endpoint has to be classified as a Cisco-IP-Phone 7960, then the endpoint profile for this endpoint has to first match the parent Cisco-Device policy, its child Cisco-IP-Phone policy, and then the Cisco-IP-Phone 7960 profiling policy for better classification.

Note Cisco ISE will not overwrite the Administrator Modified policies nor their children policies even if they are still labeled as Cisco Provided. If an Administrator Modified policy is deleted, it reverts back to the previous Cisco Provided policy. Next time when Feed Update happens, all children policies are updated.

Predefined Endpoint Profiling Policies Overwritten During Upgrade

You can edit existing endpoint profiling policies in the Profiling Policies page. You must also save all your configurations in a copy of the predefined endpoint profiles when you want to modify the predefined endpoint profiling policies.

During an upgrade, Cisco ISE overwrites any configuration that you have saved in the predefined endpoint profiles.

Unable to Delete Endpoint Profiling Policies

You can delete selected or all the endpoint profiling policies in the **Profiling Policies** window. By default, you can delete all the endpoint profiling policies from the **Profiling Policies** window. When you select all the endpoint profiling policies and try to delete them in the **Profiling Policies** window, some of them may not be deleted, if the endpoint profiling policies are mapped to other endpoint profiling policies or mapped to an authorization policy.

- You cannot delete Cisco Provided endpoint profiling policies.
- You cannot delete a parent profile in the **Profiling Policies** window when an endpoint profile is defined as a parent to other endpoint profiles. For example, Cisco-Device is a parent to other endpoint profiling policies for Cisco devices.
- You cannot delete an endpoint profile when it is mapped to an authorization policy. For example, Cisco-IP-Phone is mapped to the Profiled Cisco IP Phones authorization policy, and it is a parent to other endpoint profiling policies for Cisco IP Phones.

Predefined Profiling Policies for Draeger Medical Devices

Cisco ISE contains default endpoint profiling policies that include a generic policy for Draeger medical devices, a policy for Draeger-Delta medical device, and a policy for Draeger-M300 medical device. Both the medical devices share ports 2050 and 2150, and therefore you cannot classify the Draeger-Delta and Draeger-M300 medical devices when you are using the default Draeger endpoint profiling policies.

If these Draeger devices share ports 2050 and 2150 in your environment, you must add a rule in addition to checking for the device destination IP address in the default Draeger-Delta and Draeger-M300 endpoint profiling policies so that you can distinquish these medical devices.

Cisco ISE includes the following profiling conditions that are used in the endpoint profiling policies for the Draeger medical devices:

- Draeger-Delta-PortCheck1 that contains port 2000
- Draeger-Delta-PortCheck2 that contains port 2050
- Draeger-Delta-PortCheck3 that contains port 2100

- Draeger-Delta-PortCheck4 that contains port 2150
- Draeger-M300PortCheck1 that contains port 1950
- Draeger-M300PortCheck2 that contains port 2050
- Draeger-M300PortCheck3 that contains port 2150

Endpoint Profiling Policy for Unknown Endpoints

An endpoint that does not match existing profiles and cannot be profiled in Cisco ISE is an unknown endpoint. An unknown profile is the default system profiling policy that is assigned to an endpoint, where an attribute or a set of attributes collected for that endpoint do not match with existing profiles in Cisco ISE.

An Unknown profile is assigned in the following scenarios:

- When an endpoint is dynamically discovered in Cisco ISE, and there is no matching endpoint profiling policy for that endpoint, it is assigned to the unknown profile.
- When an endpoint is statically added in Cisco ISE, and there is no matching endpoint profiling policy for a statically added endpoint, it is assigned to the unknown profile.

  If you have statically added an endpoint to your network, the statically added endpoint is not profiled by the profiling service in Cisco ISE. You can change the unknown profile later to an appropriate profile and Cisco ISE will not reassign the profiling policy that you have assigned.

Endpoint Profiling Policy for Statically Added Endpoints

For the endpoint that is statically added to be profiled, the profiling service computes a profile for the endpoint by adding a new MATCHEDPROFILE attribute to the endpoint. The computed profile is the actual profile of an endpoint if that endpoint is dynamically profiled. This allows you to find the mismatch between the computed profile for statically added endpoints and the matching profile for dynamically profiled endpoints.

Endpoint Profiling Policy for Static IP Devices

If you have an endpoint with a statically assigned IP address, you can create a profile for such static IP devices.

You must enable the RADIUS probe or SNMP Query and SNMP Trap probes to profile an endpoint that has a static IP address.

Endpoint Profiling Policy Matching

Cisco ISE always considers a chosen policy for an endpoint that is the matched policy rather than an evaluated policy when the profiling conditions that are defined in one or more rules are met in a profiling policy. Here, the status of static assignment for that endpoint is set to false in the system. But, this can be set to true after it is statically reassigned to an existing profiling policy in the system, by using the static assignment feature during an endpoint editing.

The following apply to the matched policies of endpoints:

- For statically assigned endpoint, the profiling service computes the MATCHEDPROFILE.

- For dynamically assigned endpoints, the MATCHEDPROFILEs are identical to the matching endpoint profiles.

You can determine a matching profiling policy for dynamic endpoints using one or more rules that are defined in a profiling policy and assign appropriately an endpoint identity group for categorization.

When an endpoint is mapped to an existing policy, the profiling service searches the hierarchy of profiling policies for the closest parent profile that has a matching group of policies and assigns the endpoint to the appropriate endpoint policy.

Endpoint Profiling Policies Used for Authorization

You can use an endpoint profiling policy in authorization rules, where you can create a new condition to include a check for an endpoint profiling policy as an attribute, and the attribute value assumes the name of the endpoint profiling policy. You can select an endpoint profiling policy from the endpoints dictionary, which includes the following attributes: PostureApplicable, EndPointPolicy, LogicalProfile, and BYODRegistration.

The attribute value for PostureApplicable is auto set based on the operating system. It is set to *No* for IOS and Android devices because Agent support is not available on those platforms to perform Posture. The value is set as *Yes* for Mac OSX and Windows devices.

You can define an authorization rule that includes a combination of EndPointPolicy, BYODRegistration, and identity groups.

Wi-Fi Device Analytics Data from Cisco Catalyst 9800 Wireless LAN Controller

You can create profiling policies, authorization conditions, and authentication conditions and policies for Apple, Intel, and Samsung endpoints, using device analytics data from the Cisco Wireless LAN Controllers integrated with your Cisco ISE. The controller learns about endpoint attributes such as model number, operating system version, and other information from a set of endpoints using device analytics. The collected data is then shared with Cisco ISE.

In Cisco ISE, the received data is added to a new dictionary named Wi-Fi Device Analytics.

You must ensure that the following conditions are met to allow device attribute data exchange between the two systems.

For Cisco Wireless LAN Controllers:

- The network device is a Cisco Catalyst 9800 Series Wireless Controller running Cisco IOS XE 17.10.1 or later versions, with 802.11ac Wave2 and 802.11ax (Wi-Fi 6/6E) access points.
- In the Cisco Catalyst 9800 Wireless Controller:
  1. Configure a policy profile to enable:
     - RADIUS Profiling
     - HTTP TLV Caching
     - DHCP TLV Caching
     - Dot11-tlv-accounting (configured only through the CLI).

2. Apple iOS analytics requires a secure WLAN with either PSK or 802.1X.
3. Samsung analytics requires a secure WLAN with WPA, WPA2, or WPA3 policy.
4. Intel analytics requires a secure WLAN with Protected Management Frame (PMF) set to either optional or required.

- RADIUS accounting must be enabled in the controller.

For information on how to configure the Cisco Catalyst 9800 Series Wireless Controllers devices, see the configuration guide for your device.

To receive device analytics data from the Cisco Wireless LAN Controllers, carry out the following steps in the Cisco ISE administration portal:

1. Choose **Administration** > **System** > **Deployment** > **Node** .
2. Click the hostname of a node.
3. In the **Edit Node** window, in the **Profiling Configuration** tab, ensure that the **RADIUS** option is enabled.
4. Choose **Work Centers** > **Device Administration** > **Network Resources** > **Network Devices**. Ensure that the required Cisco Catalyst 9800 Series Wireless Controller devices are integrated with your Cisco ISE. For information on how to add these devices to Cisco ISE, see Add a Network Device in Cisco ISE.

After the Cisco Catalyst 9800 Series Wireless Controller devices and Cisco ISE are configured to allow the sharing of device attributes between the two systems, you can view the device attributes in the **Context Visibility** > **Endpoints** window. When you click the endpoint's MAC address, the details include new attributes whose names are in the format DEVICE_INFO_<*ATTRIBUTE NAME*>.

Seven device Information attributes are available from Cisco Wireless LAN Controllers:

- Model Number
- Firmware Version
- OS version
- Manufacturer Name
- Model Name
- Hardware Model
- Vendor Type

Endpoint Profiling Policies Grouped into Logical Profiles

A logical profile is a container for a category of profiles or associated profiles, irrespective of Cisco-provided or administrator-created endpoint profiling policies. An endpoint profiling policy can be associated with multiple logical profiles.

You can use the logical profile in an authorization policy condition to help create an overall network access policy for a category of profiles. You can create a simple condition for authorization, which can be included in the authorization rule. The attribute-value pair that you can use in the authorization condition is the logical

profile (attribute) and the name of the logical profile (value), which can be found in the EndPoints systems dictionary.

For example, you can create a logical profile for all mobile devices like Android, Apple iPhone, or Blackberry by assigning matching endpoint profiling policies for that category to the logical profile. Cisco ISE contains IP-Phone, a default logical profile for all the IP phones, which includes IP-Phone, Cisco-IP-Phone, Nortel-IP-Phone-2000-Series, and Avaya-IP-Phone profiles.

Create Logical Profiles

You can create a logical profile that you can use to group a category of endpoint profiling policies, which allows you to create an overall category of profiles or associated profiles. You can also remove the endpoint profiling policies from the assigned set moving them back to the available set.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Profiling** > **Profiling** > **Logical Profiles**.

Step 2 Click **Add**.

Step 3 Enter a name and description for the new logical profile in the text boxes for **Name** and **Description**.

Step 4 Choose endpoint profiling policies from the **Available Policies** to assign them in a logical profile.

Step 5 Click the right arrow to move the selected endpoint profiling policies to the **Assigned Policies**.

Step 6 Click **Submit**.

Profiling Exception Actions

An exception action is a single configurable action that can be referred to in an endpoint profiling policy, and that is triggered when the exception conditions that are associated with the action are met.

Exception Actions can be any one of the following types:

- Cisco-provided—You can not delete Cisco-provided exception actions. Cisco ISE triggers the following noneditable profiling exception actions from the system when you want to profile endpoints in Cisco ISE:
  - Authorization Change—The profiling service issues a change of authorization when an endpoint is added or removed from an endpoint identity group that is used by an authorization policy.
  - Endpoint Delete—An exception action is triggered in Cisco ISE and a CoA is issued when an endpoint is deleted from the system in the Endpoints page, or reassigned to the unknown profile from the edit page on a Cisco ISE network.
  - FirstTimeProfiled—An exception action is triggered in Cisco ISE and a CoA is issued when an endpoint is profiled in Cisco ISE for the first time, where the profile of that endpoint changes from an unknown profile to an existing profile but that endpoint is not successfully authenticated on a Cisco ISE network.
- Administrator-created—Cisco ISE triggers profiling exception actions that you create.

Create Exception Actions

You can define and associate one or more exception rules to a single profiling policy. This association triggers an exception action (a single configurable action) when the profiling policy matches and at least one of the exception rules matches in the profiling endpoints in Cisco ISE.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Policy** > **Policy Elements** > **Results** > **Profiling** > **Exception Actions**.

Step 2 Click **Add**.

Step 3 Enter a name and description for the exception action in the text boxes for **Name** and **Description**.

Step 4 Check the **CoA Action** check box.

Step 5 Click the **Policy Assignment** drop-down list to choose an endpoint policy.

Step 6 Click **Submit**.

Create Endpoints with Static Assignments of Policies and Identity Groups

You can create a new endpoint statically by using the MAC address of an endpoint in the Endpoints page. You can also choose an endpoint profiling policy and an identity group in the Endpoints page for static assignment.

The regular and mobile device (MDM) endpoints are displayed in the Endpoints Identities list. In the listing page, columns for attributes like Hostname, Device Type, Device Identifier for MDM endpoints are displayed. Other columns like Static Assignment and Static Group Assignment are not displayed by default.

Note You cannot add, edit, delete, import, or export MDM Endpoints using this page.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **Network Access** > **Identities** > **Endpoints**.

Step 2 Click **Add**.

Step 3 Enter the MAC address of an endpoint in hexadecimal format and separated by a colon.

Step 4 Choose a matching endpoint policy from the **Policy Assignment** drop-down list to change the static assignment status from dynamic to static.

Step 5 Check the **Static Assignment** check box to change the status of static assignment that is assigned to the endpoint from dynamic to static.

Step 6 Choose an endpoint identity group to which you want to assign the newly created endpoint from the **Identity Group Assignment** drop-down list.

Step 7 Check the **Static Group Assignment** check box to change the dynamic assignment of an endpoint identity group to static.

Step 8 Click **Submit**.

Import Endpoints Using a CSV File

You can import endpoints from a CSV file that you have created from a Cisco ISE template and update it with endpoint details. Endpoints exported from Cisco ISE contains around 90 attributes and therefore cannot be imported directly into another ISE deployment. If columns that are not allowed for import are present in the CSV file, a message with the list of attributes that cannot be imported is displayed. You must delete the specified columns before trying to import the file again.

In the **Export Endpoints** dialog box, check the **Importable Only** check box if you want to export only the attributes that can be imported to Cisco ISE without any modification to the CSV file. Using this option removes the need to modify the column or metadata in the exported CSV file before importing it to Cisco ISE.

There are about 31 attributes that can be imported. The list includes MACAddress, EndPointPolicy, and IdentityGroup. Optional attributes are:

Description	PortalUser	LastName
PortalUser.GuestType	PortalUser.FirstName	EmailAddress
PortalUser.Location	Device Type	host-name
PortalUser.GuestStatus	StaticAssignment	Location
PortalUser.CreationType	StaticGroupAssignment	MDMEnrolled
PortalUser.EmailAddress	User-Name	MDMOSVersion
PortalUser.PhoneNumber	DeviceRegistrationStatus	MDMServerName
PortalUser.LastName	AUPAccepted	MDMServerID
PortalUser.GuestSponsor	FirstName	BYODRegistration
CUSTOM.<custom attribute name>	—	—

The file header has to be in the format as specified in the default import template so that the list of endpoints appear in this order: MACAddress, EndpointPolicy, IdentityGroup <List of attributes listed above as optional attributes>. You can create the following file templates:

- MACAddress
- MACAddress, EndPointPolicy
- MACAddress, EndPointPolicy, IdentityGroup
- MACAddress, EndPointPolicy, IdentityGroup, <List of attributes listed above as optional attributes>

All attribute values, except MAC address, are optional for importing endpoints from a CSV file. If you want to import endpoints without certain values, the values are still separated by a comma. For example,

- MAC1, Endpoint Policy1, Endpoint Identity Group1
- MAC2
- MAC3, Endpoint Policy3

- MAC4, , Endpoint Identity Group4
- MAC5, , Endpoint Identity Group5, MyDescription, MyPortalUser, and so on

To import the endpoints using a CSV file:

Step 1 Choose **Context Visibility** > **Endpoints** > **Import** .

Step 2 Click **Import From File**.

Step 3 Click **Browse** to locate the CSV file that you have already created.

Step 4 Click **Submit**.

To import endpoint custom attributes, you have to create the same custom attributes as in the CSV file in the **Administration** > **Identity Management** > **Settings** > **Endpoint Custom Attributes** window using the correct data types. These attributes have to be prefixed with CUSTOM to differentiate them from endpoint attributes.

Default Import Template Available for Endpoints

You can generate a template in which you can update endpoints that can be used to import endpoints. By default, you can use the Generate a Template link to create a CSV file in the Microsoft Office Excel application and save the file locally on your system. The file can be found in **Context Visibility** > **Endpoints** > **Import** > **Import From File**. You can use the Generate a Template link to create a template, and the Cisco ISE server will display the Opening template.csv dialog. This dialog allows you to open the default template.csv file, or save the template.csv file locally on your system. If you choose to open the template.csv file from the dialog, the file opens in the Microsoft Office Excel application. The default template.csv file contains a header row that displays the MAC address, Endpoint Policy, and Endpoint Identity Group, and other optional attributes.

You must update the MAC addresses of endpoints, endpoint profiling policies, endpoint identity groups along with any of the optional attribute values you wish to import, and save the file with a new file name. This file can be used to import endpoints. See the header row in the template.csv file that is created when you use the Generate a Template link.

Table 56: CSV Template File

MAC	EndpointPolicy	IdentityGroup	Other Optional Attributes
11:11:11:11:11:11	Android	Profiled	<Empty>/<Value>

Unknown Endpoints Reprofiled During Import

If the file used for import contains endpoints that have their MAC addresses, and their assigned endpoint profiling policies is the Unknown profile, then those endpoints are immediately reprofiled in Cisco ISE to the matching endpoint profiling policies during import. However, they are not statically assigned to the Unknown profile. If endpoints do not have endpoint profiling policies assigned to them in the CSV file, then they are assigned to the Unknown profile, and then reprofiled to the matching endpoint profiling policies. See below how Cisco ISE reprofiles Unknown profiles that match the Xerox_Device profile during import and also how Cisco ISE reprofiles an endpoint that is unassigned.

Table 57: Unknown Profiles: Import from a File

MAC Address	Endpoint Profiling Policy Assigned Before Import in Cisco ISE	Endpoint Profiling Policy Assigned After Import in Cisco ISE
00:00:00:00:01:02	Unknown	Xerox-Device
00:00:00:00:01:03	Unknown	Xerox-Device
00:00:00:00:01:04	Unknown	Xerox-Device
00:00:00:00:01:05	If no profile is assigned to an endpoint, then it is assigned to the Unknown profile, and also reprofiled to the matching profile.	Xerox-Device

Endpoints with Invalid Attributes Not Imported

If any of the endpoints present in the CSV file have invalid attributes, then the endpoints are not imported and an error message is displayed.

For example, if endpoints are assigned to invalid profiles in the file used for import, then they are not imported because there are no matching profiles in Cisco ISE. See below how endpoints are not imported when they are assigned to invalid profiles in the CSV file.

Table 58: Invalid Profiles: Import from a File

MAC Address	Endpoint Profiling Policy Assigned Before Import in Cisco ISE	Endpoint Profiling Policy Assigned After Import in Cisco ISE
00:00:00:00:01:02	Unknown	Xerox-Device
00:00:00:00:01:05	If an endpoint such as 00:00:00:00:01:05 is assigned to an invalid profile other than the profiles that are available in Cisco ISE, then Cisco ISE displays a warning message that the policy name is invalid and the endpoint will not be imported.	The endpoint is not imported because there is no matching profile in Cisco ISE.

Import Endpoints from LDAP Server

You can import the MAC addresses, the associated profiles, and the endpoint identity groups of endpoints securely from an LDAP server.

Before you begin

Before you begin to import endpoints, ensure that you have installed the LDAP server.

You have to configure the connection settings and query settings before you can import from an LDAP server. If the connection settings or query settings are configured incorrectly in Cisco ISE, then the "LDAP import failed:" error message appears.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Context Visibility** > **Endpoints** > **Import** > **Import from LDAP**.

Step 2 Enter the values for the connection settings.

Step 3 Enter the values for the query settings.

Step 4 Click **Submit**.

Export Endpoints Using CSV File

You can export all the endpoints or only the selected endpoints using a CSV file. The endpoints are listed with around 90 attributes along with their MAC addresses, endpoint profiling policies, and endpoint identity groups. The custom attributes are also exported to the CSV file and are prefixed with CUSTOM to differentiate them from other endpoint attributes.

Note To import endpoint custom attributes that are exported from one deployment to another, you must create the same custom attributes in the **Administration** > **Identity Management** > **Settings** > **Endpoint Custom Attributes** window and use the same data type as specified in the original deployment.

To export the endpoints using a CSV file:

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Context Visibility** > **Endpoints**.

Step 2 From the **Export** drop-down list, choose one of the following options:

- **Export All**: Choose this option to export all the endpoints listed in the **Endpoints** window.
- **Export Selected**: Choose this option to export only the selected endpoints.
- **Export Filtered**: Choose this option while using the **Quick Filter** or the **Advanced Filter** option to export only the filtered endpoints.

Step 3 In the **Export Endpoints** dialog box, check the **Importable Only** check box if you want to export only the attributes that can be imported to Cisco ISE without any modification to the CSV file. Using this option prevents the need to modify the columns or metadata in the exported CSV file before importing it to Cisco ISE.

Step 4 Click **OK** to save the CSV file.

Most of the attributes in the exported spreadsheet are simple. The following attributes require an explanation:

- *UpdateTime*: The last time that the profiler updated the endpoint, due to a change to an endpoint attribute. The value is 0 if there have been no updates since the endpoint session started. It will be blank briefly, during an update
- *InactivityTime*: Time since the endpoint was active.

Identified Endpoints

Cisco ISE displays identified endpoints that connect to your network and use resources on your network in the **Endpoints** window. An endpoint is typically a network-capable device that connect to your network through wired and wireless network access devices and VPN. Endpoints can be personal computers, laptops, IP phones, smart phones, gaming consoles, printers, fax machines, and so on.

The MAC address of an endpoint, expressed in hexadecimal form, is always the unique representation of an endpoint, but you can also identify an endpoint with a varying set of attributes and the values associated to them, called an attribute-value pair. You can collect a varying set of attributes for endpoints based on the endpoint capability, the capability and configuration of the network access devices and the methods (probes) that you use to collect these attributes.

Dynamically Profiled Endpoints

When endpoints are discovered on your network, they can be profiled dynamically based on the configured profiling endpoint profiling policies, and assigned to the matching endpoint identity groups depending on their profiles.

Statically Profiled Endpoints

An endpoint can be profiled statically when you create an endpoint with its MAC address and associate a profile to it along with an endpoint identity group in Cisco ISE. Cisco ISE does not reassign the profiling policy and the identity group for statically assigned endpoints.

Unknown Endpoints

If you do not have a matching profiling policy for an endpoint, you can assign an unknown profiling policy (Unknown) and the endpoint therefore will be profiled as Unknown. The endpoint profiled to the Unknown endpoint policy requires that you create a profile with an attribute or a set of attributes collected for that endpoint. The endpoint that does not match any profile is grouped within the Unknown endpoint identity group.

Identified Endpoints Locally Stored in Policy Service Nodes Database

Cisco ISE writes identified endpoints locally in the Policy Service node database. After storing endpoints locally in the database, these endpoints are then made available (remote write) in the Administration node database only when significant attributes change in the endpoints, and replicated to the other Policy Service nodes database. Significant attributes are those used by the Cisco ISE system or those used specifically in an endpoint profiling policy or rule.

The following are the significant attributes:

- ip
- EndPointPolicy
- MatchedValue
- StaticAssignment
- StaticGroupAssignment

- MatchedPolicyID
- NmapSubnetScanID
- PortalUser
- DeviceRegistrationStatus
- BYODRegistration

When you change endpoint profile definitions in Cisco ISE, all endpoints have to be reprofiled. A Policy Service node that collects the attributes of endpoints is responsible for reprofiling of those endpoints.

When a Policy Service node starts collecting attributes about an endpoint for which attributes were initially collected by a different Policy Service node, then the endpoint ownership changes to the current Policy Service node. The new Policy Service node will retrieve the latest attributes from the previous Policy Service node and reconcile the collected attributes with those attributes that were already collected.

When a significant attribute changes in the endpoint, attributes of the endpoint are automatically saved in the Administration node database so that you have the latest significant change in the endpoint. If the Policy Service node that owns an endpoint is not available for some reasons, then the Administrator ISE node will reprofile an endpoint that lost the owner and you have to configure a new Policy Service node for such endpoints.

Policy Service Nodes in Cluster

Cisco ISE uses Policy Service node group as a cluster that allows to exchange endpoint attributes when two or more nodes in the cluster collect attributes for the same endpoint. We recommend to create clusters for all Policy Service nodes that reside behind a load balancer.

If a different node other than the current owner receives attributes for the same endpoint, it sends a message across the cluster requesting the latest attributes from the current owner to merge attributes and determine if a change of ownership is needed. If you have not defined a node group in Cisco ISE, it is assumed that all nodes are within one cluster.

There are no changes made to endpoint creation and replication in Cisco ISE. Only the change of ownership for endpoints is decided based on an allowed list of attributes used for profiling that are built from static attributes and dynamic attributes.

Upon subsequent attributes collection, the endpoint is updated on the Administration node, if anyone of the following attributes changes:

- ip
- EndPointPolicy
- MatchedValue
- StaticAssignment
- StaticGroupAssignment
- MatchedPolicyID
- NmapSubnetScanID
- PortalUser

- DeviceRegistrationStatus
- BYODRegistration

When an endpoint is edited and saved in the Administration node, the attributes are retrieved from the current owner of the endpoint.

Create Endpoint Identity Groups

Cisco ISE groups endpoints that it discovers in to the corresponding endpoint identity groups. Cisco ISE comes with several system-defined endpoint identity groups. You can also create additional endpoint identity groups from the **Endpoint Identity Groups** window. You can edit or delete the endpoint identity groups that you have created. You can only edit the description of the system-defined endpoint identity groups. You cannot edit the name of these groups or delete them.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **Groups** > **Endpoint Identity Groups**.

Step 2 Click **Add**.

Step 3 Enter the **Name** for the endpoint identity group that you want to create (do not include spaces in the name of the endpoint identity group).

Step 4 Enter the **Description** for the endpoint identity group that you want to create.

Step 5 Click the **Parent Group** drop-down list to choose an endpoint identity group to which you want to associate the newly created endpoint identity group.

Step 6 Click **Submit**.

Identified Endpoints Grouped in Endpoint Identity Groups

Cisco ISE groups discovered endpoints into their corresponding endpoint identity groups based on the endpoint profiling policies. Profiling policies are hierarchical, and they are applied at the endpoint identify groups level in Cisco ISE. By grouping endpoints to endpoint identity groups, and applying profiling policies to endpoint identity groups, Cisco ISE enables you to determine the mapping of endpoints to the endpoint profiles by checking corresponding endpoint profiling policies.

Cisco ISE creates a set of endpoint identity groups by default, and allows you to create your own identity groups to which endpoints can be assigned dynamically or statically. You can create an endpoint identity group and associate the identity group to one of the system-created identity groups. You can also assign an endpoint that you create statically to any one of the identity groups that exists in the system, and the profiling service cannot reassign the identity group.

Default Endpoint Identity Groups Created for Endpoints

Cisco ISE creates the following endpoint identity groups:

- Blocked List: This endpoint identity group includes endpoints that are statically assigned to this group in Cisco ISE and endpoints that are blocked in the device registration portal. An authorization profile can be defined in Cisco ISE to permit, or deny network access to endpoints in this group.

- GuestEndpoints: This endpoint identity group includes endpoints that are used by guest users.
- Profiled: This endpoint identity group includes endpoints that match endpoint profiling policies except Cisco IP phones and workstations in Cisco ISE.
- RegisteredDevices: This endpoint identity group includes endpoints, which are registered devices that are added by an employee through the devices registration portal. The profiling service continues to profile these devices normally when they are assigned to this group. Endpoints are statically assigned to this group in Cisco ISE, and the profiling service cannot reassign them to any other identity group. These devices will appear like any other endpoint in the endpoints list. You can edit, delete, and block these devices that you added through the device registration portal from the endpoints list in the Endpoints window in Cisco ISE. Devices that you have blocked in the device registration portal are assigned to the Blocked List endpoint identity group, and an authorization profile that exists in Cisco ISE redirects blocked devices to a URL, which displays "Unauthorised Network Access", a default portal page to the blocked devices.
- Unknown: This endpoint identity group includes endpoints that do not match any profile in Cisco ISE.

In addition to the above system created endpoint identity groups, Cisco ISE creates the following endpoint identity groups, which are associated to the Profiled (parent) identity group. A parent group is the default identity group that exists in the system:

- Cisco-IP-Phone: An identity group that contains all the profiled Cisco IP phones on your network.
- Workstation: An identity group that contains all the profiled workstations on your network.

Endpoint Identity Groups Created for Matched Endpoint Profiling Policies

If you have an endpoint policy that matches an existing policy, then the profiling service can create a matching endpoint identity group. This identity group becomes the child of the Profiled endpoint identity group. When you create an endpoint policy, you can check the Create Matching Identity Group check box in the Profiling Policies page to create a matching endpoint identity group. You cannot delete the matching identity group unless the mapping of the profile is removed.

Add Static Endpoints in Endpoint Identity Groups

You can add or remove statically added endpoints in any endpoint identity group.

You can add endpoints from the Endpoints widget only to a specific identity group. If you add an endpoint to the specific endpoint identity group, then the endpoint is moved from the endpoint identity group where it was dynamically grouped earlier.

Upon removal from the endpoint identity group where you recently added an endpoint, the endpoint is reprofiled back to the appropriate identity group. You do not delete endpoints from the system but only remove them from the endpoint identity group.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **Identity Management** > **Groups** > **Endpoint Identity Groups**.

Step 2 Choose an endpoint identity group, and click **Edit**.

Step 3 Click **Add**.

Step 4 Choose an endpoint in the Endpoints widget to add the selected endpoint in the endpoint identity group.

Step 5 Click the **Endpoint Group List** link to return to the Endpoint Identity Groups page.

Dynamic Endpoints Reprofiled After Adding or Removing in Identity Groups

If an endpoint identity group assignment is not static, then endpoints are reprofiled after you add or remove them from an endpoint identity group. Endpoints that are identified dynamically by the ISE profiler appear in appropriate endpoint identity groups. If you remove dynamically added endpoints from an endpoint identity group, Cisco ISE displays a message that you have successfully removed endpoints from the identity group but reprofiles them back in the endpoint identity group.

Endpoint Identity Groups Used in Authorization Rules

You can effectively use endpoint identity groups in the authorization policies to provide appropriate network access privileges to the discovered endpoints. For example, an authorization rule for all types of Cisco IP Phones is available by default in Cisco ISE in the following location: **Policy** > **Policy Sets** > **Default** > **Authorization Policy** .

You must ensure that the endpoint profiling policies are either standalone policies (not a parent to other endpoint profiling policies), or their parent policies of the endpoint profiling policies are not disabled.

Anycast and Profiler Services

Anycast is a networking technique where the same IP address is assigned to two or more hosts and routing is allowed to determine the most appropriate target to receive the data. Similar to the load balancer use cases to provide a single target for profiling data (RADIUS, DHCP relay, SNMP traps, and NetFlow), Anycast allows the sources to be configured with a single IP target to avoid sending the same data to multiple destinations.

The Anycast IP address can be assigned to a real PSN interface IP address or a load balancer virtual IP address to support redundancy across data centers. You must not assign the Anycast IP address to ISE Gigabit Ethernet 0 management interface.

The interface used for Anycast must be a dedicated interface used by the Profiler probe. The same requirement does not apply when the Anycast IP address is assigned to a load balancer virtual IP address.

When using Anycast, it is critical that any node failure be automatically detected and the corresponding route to the failed node be removed from the routing table. If an Anycast target is the only host on the link or VLAN, then failure may result in route being automatically removed.

When IP Anycast is deployed, it is very important to ensure that the route metrics to each target have significant weighting or bias. If the routes to Anycast targets flap or result in an Equal-Cost Multi-Path Routing (ECMP) scenario, then traffic for a given service (RADIUS AAA, DHCP or SNMP Trap Profiling, HTTPS portals) may be distributed to each target resulting in excessive traffic and service failures (RADIUS AAA and HTTPS portals) or suboptimal profiling and database replication (profiling services).

The key advantage of IP Anycast is that it greatly simplifies the configuration on access devices, profile data sources, and DNS. It can also optimize ISE profiling by ensuring that the data for a given endpoint is sent only to a single PSN. Additional route configuration must be carefully planned and managed with appropriate monitors. However, troubleshooting might be difficult because distinct subnetworks and IP addresses are not used.

Profiler Feed Service

Profiler conditions, exception actions, and NMAP scan actions are classified as Cisco-provided or administrator-created, as shown in the System Type attribute. Endpoint profiling policies are classified as Cisco-provided, administrator-created, or administrator- modified. These classifications are shown in the System Type attribute.

You can perform different operations on the profiler conditions, exception actions, NMAP scan actions, and endpoint profiling policies depending on the System Type attribute. You cannot edit or delete Cisco-provided conditions, exception actions, and nmap scan actions. You can not delete Endpoint policies that are provided by Cisco. When you edit policies, they are called administrator-modified. When the feed service updates policies, the administrator-modified policies are replaced by the up-to-date version of the Cisco-provided policy that it was based on.

You can retrieve new and updated endpoint profiling policies and the updated OUI database from the Cisco feed server. You must have a subscription to Cisco ISE. You can also receive e-mail notifications about applied, success, and failure messages. You can send the anonymous information back to Cisco about feed service actions, which helps Cisco improve the feed service.

The OUI database contains the MAC OUIs assigned to vendors. The OUI list is available here: http://standards.ieee.org/develop/regauth/oui/oui.txt

Cisco ISE downloads policies and OUI database updates every day at 1:00 A.M of the local Cisco ISE server time zone. Cisco ISE automatically applies these downloaded feed server policies, and stores the the changes so that you can revert to the previous state. When you revert to a previous state, the new endpoint profiling policies are removed and updated endpoint profiling policies are reverted to the previous state. In addition, the profiler feed service is automatically disabled.

You can also update the feed services manually in offline mode. You can download the updates manually by using this option if you cannot connect your ISE deployments to Cisco feed service.

Note Updates from the Feed Service are not allowed after the license goes Out of Compliance (OOC) for 45 days within a 60-day window period. The license is out of compliance when it has expired, or when the usage exceeds the allowed number of sessions.

Configure Profiler Feed Service

The Profiler Feed Service retrieves new and updated endpoint profiling policies and MAC OUI database updates from the Cisco Feed server. If the Feed Service is unavailable or other errors have occurred, it is reported in the Operations Audit report.

You can configure Cisco ISE to send anonymous feed service usage report back to Cisco, which sends the following information to Cisco:

- Hostname: Cisco ISE hostname
- MaxCount: Total number of endpoints
- ProfiledCount: Profiled endpoints count
- UnknownCount: Unknown endpoints count

- MatchSystemProfilesCount: Cisco Provided profiles count
- UserCreatedProfiles: User created profiles count

You can change the CoA type in a Cisco-provided profiling policy. When the feed service updates that policy, the CoA type will not be changed, but the rest of that policy's attributes will be still be updated.

Cisco ISE, Release 2.7 and later allow you to manually download OUI updates without downloading policy updates. If you customized some of your profiler conditions to change more than just the CoA type, you may not want the profiler feed to replace those conditions. You may still want the OUI updates, so the profiler can identify new devices as manufacturers add them. The option to download only OUI is available on the Feed Service portal.

Before you begin

The Profiler feed service can only be configured from the Cisco ISE Admin portal in a distributed deployment or in a standalone ISE node.

Set up a Simple Mail Transfer Protocol (SMTP) server if you plan to send e-mail notifications from the Admin portal about feed updates (**Administration** > **System** > **Settings**).

To update the Feed Services online:

Step 1 Choose **Administration** > **System** > **Certificates** > **Trusted Certificates**, and check if **QuoVadis Root CA 2** is enabled.

Step 2 Choose **Work Centers** > **Profiler** > **Feeds**.
You can also access the option in the **Administration** > **FeedService** > **Profiler** page.

Step 3 Click the **Online Subscription Update** tab.

Step 4 Click the **Test Feed Service Connection** button to verify that there is a connection to the Cisco Feed Service, and that the certificate is valid.

Step 5 Check the **Enable Online Subscription Update** check box.

Step 6 Enter time in HH:MM format (local time zone of the Cisco ISE server). By default, Cisco ISE feed service is scheduled at 1.00 AM every day.

Step 7 Check the **Notify administrator when download occurs** check box and enter your e-mail address in the **Administrator email address** text box. Check the **Provide Cisco anonymous information to help improve profiling accuracy** check box, if you want to allow Cisco ISE to collect non-sensitive information (that will be used to provide better services and additional features in forthcoming releases).

Step 8 Click **Save**.

Step 9 Click **Update Now**.

Instructs Cisco ISE to contact Cisco feed server for new and updated profiles created since the last feed service update. This re-profiles all endpoints in the system, which may cause an increase the load on the system. Due to updated endpoint profiling policies, there may be changes in the authorization policy for some endpoints that are currently connected to Cisco ISE.

The **Update Now** button is disabled when you update new and updated profiles created since the last feed service and enabled only after the download is completed. You must navigate away from the profiler feed service configuration window and return to this window.

Related Topics

Configure Profiler Feed Services Offline, on page 251

Configure Profiler Feed Services Offline

You can update the feed services offline when Cisco ISE is not directly connected to the Cisco feed server. You can download the offline update package from the Cisco feed server and upload it to Cisco ISE using the offline feed update. You can also set email notifications about new policies that are added to the feed server.

Configuring the profiler feed services offline involves the following tasks:

1. Download Offline Update Package
2. Apply Offline Feed Updates

Download Offline Update Package

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **Profiler** > **Feeds**.
You can also access the option in the **Administration** > **FeedService** > **Profiler** page.

Step 2 Click the **Offline Manual Update** tab.

Step 3 Click **Download Updated Profile Policies** link. You will be redirected to Feed Service Partner Portal.
You can also go to https://ise.cisco.com/partner/ from your browser, to go to the feed service partner portal directly.

Step 4 If you are a first time user, accept the terms and agreements.
An email will be triggered to Feed Services administrator to approve your request. Upon approval, you will receive a confirmation email.

Step 5 Login to the partner portal using your Cisco.com credentials.

Step 6 Choose **Offline Feed** > **Download Package** .

Step 7 Click **Generate Package** .

Step 8 Click the **Click to View the Offline Update Package contents** link to view all the profiles and OUIs that are included in the generated package.

- The policies under Feed Profiler 1 and Feed OUI will be downloaded to all versions of Cisco ISE.
- The policies under Feed Profiler 2 will be downloaded only to Cisco ISE Release 1.3 and later.
- The policies under Feed Profiler 3 will be downloaded only to Cisco ISE Release 2.1 and later.

Step 9 Click **Download Package** and save the file to your local system.
You can upload the saved file to Cisco ISE server to apply the feed updates in the downloaded package.

Apply Offline Feed Updates

Before you begin

You must have downloaded the offline update package before applying the feed updates.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **Profiler** > **Feeds** .
You can also access the option in the **Administration** > **FeedService** > **Profiler** window.

Step 2 Click the **Offline Manual Update** tab.

Step 3 Click **Browse** and choose the downloaded profiler feed package.

Step 4 Click **Apply Update** .

Configure Email Notifications for Profile and OUI Updates

You can configure your email address to receive notifications on profile and OUI updates.

Step 1 Perform **Step 1** through **Step 5** in the Download Offline Update Package section to go to the Feed Service Partner Portal.

Step 2 Choose **Offline Feed** > **Email Preferences**.

Step 3 Check the **Enable Notifications** checkbox to receive notifications.

Step 4 Choose the number of days from the **days** drop-down list to set the frequency in which you want to receive the notifications on new updates.

Step 5 Enter the e-mail address/addresses and click **Save** .

Undo Feed Updates

You can revert endpoint profiling policies that were updated in the previous update and remove endpoint profiling policies and OUIs that are newly added through the previous update of the profiler feed service .

An endpoint profiling policy, if modified after an update from the feed server is not changed in the system.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Work Centers** > **Profiler** > **Feeds**.

Step 2 Click **Go to Update Report Page** if you want to view the configuration changes made in the Change Configuration Audit report.

Step 3 Click **Undo Latest**.

Profiler Reports

Cisco ISE provides you with various reports on endpoint profiling, and troubleshooting tools that you can use to manage your network. You can generate reports for historical as well as current data. You may be able to drill down on a part of the report to view more details. For large reports, you can also schedule reports and download them in various formats.

You can run the following reports for endpoints from **Operations > Reports > Endpoints and Users**:

- Endpoint Session History
- Profiled Endpoint Summary
- Endpoint Profile Changes
- Top Authorizations by Endpoint
- Registered Endpoints

Detect Anomalous Behavior of Endpoints

Cisco ISE protects your network from the illegitimate use of a MAC address. Cisco ISE detects the endpoints involved in MAC address spoofing and allows you to restrict the permission of the suspicious endpoints.

The following are the two options in the profiler configuration page for Anomalous Behavior:

- Enable Anomalous Behavior Detection
- Enable Anomalous Behavior Enforcement

If you enable Anomalous Behavior detection, Cisco ISE probes for data, and checks for any contradiction to the existing data with respect to changes in attributes related to NAS-Port-Type, DHCP Class Identifier, and Endpoint Policy. If so, an attribute called **AnomalousBehavior** set to true is added to the endpoint which helps you to filter and view the endpoints in the Visibility Context page. Audit logs are also generated for the respective MAC address.

When anomalous behavior detection is enabled, Cisco ISE checks if the following attributes of existing endpoints have changed:

1. Port-Type—Determines if the access method of an endpoint has changed. This only applies when the same MAC address that is connected via Wired Dot1x has been used for Wireless Dot1x and visa-versa.
2. DHCP Class Identifier—Determines whether the type of client or vendor of an endpoint has changed. This only applies when DHCP Class identifier attribute is populated with a certain value and is then changed to another value. If an endpoint is configured with a static IP, the DHCP Class Identifier attribute is empty in Cisco ISE. Later on, if another device spoofs the MAC address of this endpoint and uses DHCP, the Class Identifier changes from an empty value to a specific string. This will not trigger anomalous behavior detection.
3. Endpoint Policy—Determines if there are significant profile changes. This only applies when the profile of an endpoint changes from a “Phone” or “Printer” to a “Workstation”.

If you enable Anomalous Behavior Enforcement, a CoA is issued upon detection of the anomalous Behavior, which can be used to re-authorize the suspicious endpoints, based on the authorization rules configured in the **Profiler Configuration** window.

Set Authorization Policy Rules for Endpoints with Anomalous Behavior

You can choose the action to be taken against any endpoint with anomalous Behavior by setting the corresponding rules on the Authorization Policy page.

Step 1 Choose **Policy** > **Policy Sets**.

Step 2 Click the arrow icon from the **View** column corresponding to the Default Policy to open the Set view screen and view and manage the default authorization policy.

Step 3 From the **Actions** column on any row, click the cog icon and then from the drop-down list, insert a new authorization rule by selecting any of the insert or duplicate options, as necessary.
A new row appears in the Policy Sets table.

Step 4 Enter the Rule Name.

Step 5 From the **Conditions** column, click the (+) symbol.

Step 6 Create the required conditions in the **Conditions Studio Page**. In the **Editor** section, click the **Click To Add an Attribute** text box, and select the required Dictionary and Attribute (for example, Endpoints.AnomalousBehaviorEqualsTrue).

You can also drag and drop a Library condition to the **Click To Add An Attribute** text box.

Step 7 Click **Use** to set the authorization policy rules for endpoints with anomalous behavior.

Step 8 Click **Done**.

View Endpoints with Anomalous Behavior

You can view the endpoints with anomalous behavior by using any of the following options:

- Click Anomalous Behavior from **Home** > **Summary** > **Metrics**. This action opens a new tab with Anomalous Behaviour column in the lower pane of the window.
- Choose **Context Visibility** > **Endpoints** > **Endpoint Classification**. You can view the Anomalous Behaviour column in the lower pane of the window.
- You can create a new Anomalous Behavior column in Authentication view or Compromised Endpoints view in the Context Visibility window as explained in the following steps:

Step 1 Choose **Context Visibility** > **Endpoints** > **Authentication** or **Context Visibility** > **Endpoints** > **Compromised Endpoints**.

Step 2 Click the Settings icon in the lower pane of the window and check **Anomalous Behavior** check box..

Step 3 Click **Go**.
You can view the Anomalous Behavior column in the Authentication or Compromised Endpoints View.

Agent Download Issues on Client Machine

Problem

The client machine browser displays a “no policy matched” error message after user authentication and authorization. This issue applies to user sessions during the client provisioning phase of authentication.

Possible Causes

The client provisioning policy is missing required settings.

Posture Agent Download Issues

Remember that downloading the posture agent installer requires the following:

- The user must allow the ActiveX installer in the browser session the first time an agent is installed on the client machine. The client provisioning download page prompts for this.
- The client machine must have Internet access.

Resolution

- Ensure that a client provisioning policy exists in Cisco ISE. If yes, verify the policy identity group, conditions, and type of agent defined in the policy. Also ensure whether or not there is any agent profile configured under **Policy** > **Policy Elements** > **Results** > **Client Provisioning** > **Resources** > **Add** > **Agent Posture Profile**, even a profile with all default values.
- Try re-authenticating the client machine by bouncing the port on the access switch.

Endpoints

These windows enable you to configure and manage endpoints that connect to your network.

Endpoint Settings

The following table describes the fields on the **Endpoints** window, which you can use to create endpoints and assign policies for endpoints. To view this window, click the **Menu** icon (☰) and choose **Work Centers** > **Network Access** > **Identities** > **Endpoints**.

Table 59: Endpoint Settings

Field Name	Usage Guidelines
MAC Address	Enter the MAC address in hexadecimal format to create an endpoint statically. The MAC address is the device identifier for the interface that is connected to the Cisco ISE enabled network.
Static Assignment	Check this check box when you want to create an endpoint statically in the Endpoints window and the status of static assignment is set to static. You can toggle the status of static assignment of an endpoint from static to dynamic or from dynamic to static.
Policy Assignment	(Disabled by default unless the **Static Assignment** is checked) Choose a matching endpoint policy from the **Policy Assignment** drop-down list. You can do one of the following: • If you do not choose a matching endpoint policy, but use the default endpoint policy Unknown, then the static assignment status is set to dynamic for the endpoint that allows dynamic profiling of an endpoint. • If you choose a matching endpoint policy other than Unknown, then the static assignment status is set to static for that endpoint and the **Static Assignment** check box is automatically checked.

Field Name	Usage Guidelines
Static Group Assignment	Check this check box when you want to assign an endpoint to an identity group statically. In you check this check box, the profiling service does not change the endpoint identity group the next time during evaluation of the endpoint policy for these endpoints, which were previously assigned dynamically to other endpoint identity groups. If you uncheck this check box, then the endpoint identity group is dynamic as assigned by the ISE profiler based on policy configuration. If you do not choose the Static Group Assignment option, then the endpoint is automatically assigned to the matching identity group the next time during evaluation of the endpoint policy.

Identity Group Assignment	Choose an endpoint identity group to which you want to assign the endpoint.
	You can assign an endpoint to an identity group when you create an endpoint statically, or when you do not want to use the **Create Matching Identity Group** option during evaluation of the endpoint policy for an endpoint.
	Cisco ISE includes the following system created endpoint identity groups:
	• Blocked List
	• GuestEndpoints
	• Profiled
	  • Cisco IP-Phone
	  • Workstation
	• RegisteredDevices
	• Unknown

Active Directory user endpoints that repeatedly fail RADIUS authentication for the same reason will be automatically rejected for a certain period, to avoid unnecessary processing by Cisco ISE and to protect against potential denial of service attacks.

To view a list of rejected endpoints, choose **Operations > Reports > Rejected Endpoints**. The data for this report will be available and displayed only when Advantage License is installed.

Note AD user endpoints that fail RADIUS authentication with the following two error messages are not rejected:

22063 - WRONG_PASSWORD

24408 - ACTIVE_DIRECTORY_USER_WRONG_PASSWORD

Related Topics

Identified Endpoints, on page 244
Create Endpoints with Static Assignments of Policies and Identity Groups, on page 239

Endpoint Import from LDAP Settings

The following table describes the fields on the Import from LDAP window, which you can use to import endpoints from an LDAP server. To view this window, click the **Menu** icon (☰) and choose **Work Centers** > **Network Access** > **Identities** > **Endpoints**.

Table 60: Endpoint Import from LDAP Settings

Field Name	Usage Guidelines
Connection Settings	
Host	Enter the hostname, or the IP address of the LDAP server.
Port	Enter the port number of the LDAP server. You can use the default port 389 to import from an LDAP server, and the default port 636 to import from an LDAP server over SSL. **Note** Cisco ISE supports any configured port number. The configured value should match the LDAP server connection details.
Enable Secure Connection	Check the **Enable Secure Connection** check box to import from an LDAP server over SSL.
Root CA Certificate Name	Click the drop-down arrow to view the trusted CA certificates. The Root CA Certificate Name refers to the trusted CA certificate that is required to connect to an LDAP server. You can add (import), edit, delete, and export trusted CA certificates in Cisco ISE.
Anonymous Bind	You must enable either the **Anonymous Bind** check box, or enter the LDAP administrator credentials from the slapd.conf configuration file.
Admin DN	Enter the distinguished name (DN) configured for the LDAP administrator in the slapd.conf configuration file. Admin DN format example: cn=Admin, dc=cisco.com, dc=com
Password	Enter the password configured for the LDAP administrator in the slapd.conf configuration file.
Base DN	Enter the distinguished name of the parent entry. Base DN format example: dc=cisco.com, dc=com.
Query Settings	
MAC Address objectClass	Enter the query filter, which is used for importing the MAC address, for example, ieee802Device.
MAC Address Attribute Name	Enter the returned attribute name for import, for example, macAddress.

Field Name	Usage Guidelines
Profile Attribute Name	Enter the name of the LDAP attribute. This attribute holds the policy name for each endpoint entry that is defined in the LDAP server. When you configure the **Profile Attribute Name** field, consider the following: • If you do not specify this LDAP attribute in the **Profile Attribute Name** field or configure this attribute incorrectly, then endpoints are marked "Unknown" during an import operation, and these endpoints are profiled separately to the matching endpoint profiling policies. • If you configure this LDAP attribute in the **Profile Attribute Name** field, the attribute values are validated to ensure that the endpoint policy matches with an existing policy in Cisco ISE, and endpoints are imported. If the endpoint policy does not match with an existing policy, then those endpoints will not be imported.
Time Out	Enter the time in seconds. The valid range is from 1 to 60 seconds.

Related Topics

Identified Endpoints, on page 244
Import Endpoints from LDAP Server, on page 242

Endpoint Profiling Policies Settings

The following table describes the fields in the **Endpoint Policies** window. To view this window, click the **Menu** icon (☰) and choose **Policy** > **Profiling** > **Profiling Policies**.

Table 61: Endpoint Profiling Policies Settings

Field Name	Usage Guidelines
Name	Enter the name of the endpoint profiling policy that you want to create.
Description	Enter the description of the endpoint profiling policy that you want to create.
Policy Enabled	By default, the **Policy Enabled** check box is checked to associate a matching profiling policy when you profile an endpoint. When unchecked, the endpoint profiling policy is excluded when you profile an endpoint.
Minimum Certainty Factor	Enter the minimum value that you want to associate with the profiling policy. The default value is 10.
Exception Action	Choose an exception action, which you want to associate with the conditions when defining a rule in the profiling policy. The default is NONE. The exception actions are defined in the following location: **Policy** > **Policy Elements** > **Results** > **Profiling** > **Exception Actions**.

Field Name	Usage Guidelines
Network Scan (NMAP) Action	Choose a network scan action from the list, which you want to associate with the conditions when defining a rule in the profiling policy, if required. The default is NONE. The exception actions are defined in the following location: **Policy > Policy Elements > Results > Profiling > Network Scan (NMAP) Actions**.
Create an Identity Group for the policy	Check one of the following options to create an endpoint identity group: • **Yes, create matching Identity Group** • **No, use existing Identity Group hierarchy**
Yes, create matching Identity Group	Choose this option to use an existing profiling policy. This option creates a matching identity group for those endpoints and the identity group will be the child of the Profiled endpoint identity group when an endpoint profile matches an existing profiling policy. For example, the Xerox-Device endpoint identity group is created in the Endpoints Identity Groups page when endpoints discovered on your network match the Xerox-Device profile.
No, use existing Identity Group hierarchy	Check this check box to assign endpoints to the matching parent endpoint identity group using hierarchical construction of profiling policies and identity groups. This option allows you to make use of the endpoint profiling policies hierarchy to assign endpoints to one of the matching parent endpoint identity groups, as well as to the associated endpoint identity groups to the parent identity group. For example, endpoints that match an existing profile are grouped under the appropriate parent endpoint identity group. Here, endpoints that match the Unknown profile are grouped under Unknown, and endpoints that match an existing profile are grouped under the Profiled endpoint identity group. For example, • If endpoints match the Cisco-IP-Phone profile, then they are grouped under the Cisco-IP-Phone endpoint identity group. • If endpoints match the Workstation profile, then they are grouped under the Workstation endpoint identity group. The Cisco-IP-Phone and Workstation endpoint identity groups are associated to the Profiled endpoint identity group in the system.
Parent Policy	Choose a parent profiling policy that are defined in the system to which you want to associate the new endpoint profiling policy. You can choose a parent profiling policy from which you can inherit rules and conditions to its child.

Field Name	Usage Guidelines
Associated CoA Type	Choose one of the following CoA types that you want to associate with the endpoint profiling policy: • No CoA • Port Bounce • Reauth • Global Settings that is applied from the profiler configuration set in Administration > System > Settings > Profiling
Rules	One or more rules that are defined in endpoint profiling policies determine the matching profiling policy for endpoints, which allows you to group endpoints according to their profiles. One or more profiling conditions from the policy elements library are used in rules for validating endpoint attributes and their values for the overall classification.
Conditions	Click the plus [+] sign to expand the Conditions anchored overlay, and click the minus [-] sign, or click outside the anchored overlay to close it. Click **Select Existing Condition from Library** or **Create New Condition (Advanced Option)** . **Select Existing Condition from Library**: You can define an expression by selecting Cisco predefined conditions from the policy elements library. **Create New Condition (Advanced Option)**: You can define an expression by selecting attributes from various system or user-defined dictionaries. You can associate one of the following with the profiling conditions: • An integer value for the certainty factor for each condition • Either an exception action or a network scan action for that condition Choose one of the following predefined settings to associate with the profiling condition: • Certainty Factor Increases: Enter the certainty value for each rule, which can be added for all the matching rules with respect to the overall classification. • Take Exception Action: Triggers an exception action that is configured in the Exception Action field for this endpoint profiling policy. • Take Network Scan Action: Triggers a network scan action that is configured in the Network Scan (NMAP) Action field for this endpoint profiling policy.

Field Name	Usage Guidelines
Select Existing Condition from Library	You can do the following: • You can choose Cisco predefined conditions that are available in the policy elements library, and then use an AND or OR operator to add multiple conditions. • Click the Action icon to do the following in the subsequent steps: • **Add Attribute or Value**: You can add ad-hoc attribute or value pairs • **Add Condition from Library**: You can add Cisco predefined conditions • **Duplicate**: Create a copy of the selected condition • **Add Condition to Library**: You can save ad-hoc attribute/value pairs that you create to the policy elements library • **Delete**: Delete the selected condition.
Create New Condition (Advance Option)	You can do the following: • You can add ad-hoc attribute/value pairs to your expression, and then use an AND or OR operator to add multiple conditions. • Click the Action icon to do the following in the subsequent steps: • **Add Attribute or Value**: You can add ad-hoc attribute or value pairs • **Add Condition from Library**: You can add Cisco predefined conditions • **Duplicate**: Create a copy of the selected condition • **Add Condition to Library**: You can save ad-hoc attribute/value pairs that you create to the policy elements library • **Delete**: Delete the selected condition. You can use the AND or OR operator

Related Topics

Cisco ISE Profiling Service, on page 178
Create Endpoint Profiling Policies, on page 230
Endpoint Context Visibility Using UDID Attribute, on page 261

Endpoint Context Visibility Using UDID Attribute

The Unique Identifier (UDID) is an endpoint attribute that identifies MAC addresses of a particular endpoint. An endpoint can have multiple MAC addresses. For example, one MAC address for the wired interface and another for the wireless interface. The agent generates a UDID for that endpoint, and saves it as an endpoint attribute. You can use the UDID in authorization query. The UDID remains constant for an endpoint; the UDID does not change with the Agent installation or uninstallation. When using UDID, **Context Visibility** window (**Context Visibility > Endpoints > Compliance**) displays one entry instead of multiple entries for endpoints with multiple NICs. You can ensure posture control on a specific endpoint rather than on a Mac address.

Note The endpoint must have AnyConnect 4.7 or higher to create the UDID.

Single Entry for Endpoints with GUID in Endpoint Context Visibility Window

If an endpoint that uses random MAC addresses connects to Cisco ISE and meets the following conditions, the **Endpoint Context Visibility** window displays only the latest MAC address for the endpoint:

- The endpoint connects to Cisco ISE through a certificate-based authentication method (such as EAP-TLS).
- The endpoint connects to Cisco ISE through an MDM server.

An endpoint that meets the above conditions is identified through a unique attribute that is called a GUID, instead of its MAC address. In the Cisco ISE GUI, in the **Context Visibility** > **Endpoints** window, an endpoint with a GUID is listed only once with its latest random MAC address.

The **MDM-GUID** column displays the consistent GUID that is assigned to the endpoint.

All the endpoint data that was available with the previous MAC address entry is carried forward to the new entry.

Endpoint Scripts Wizard for Windows and MacOS Endpoints

The Endpoint Scripts Wizard allows you to run scripts on connected endpoints to carry out administrative tasks that comply with your organization's requirements. This includes tasks like uninstalling obsolete software, starting or terminating processes or applications, and enabling or disabling specific services.

Endpoint scripts can be run on Windows and MacOS endpoints through the Endpoint Scripts Wizard.

Before you begin

- You must have the user role of Super Admin.
- Configure login credentials for Cisco ISE to access MacOS and Windows endpoints with administrative privileges.

  In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Administration** > **System** > **Settings** > **Protocols** > **Endpoint Login Configuration**, and configure the following:

  - Domain credentials with which Cisco ISE can log into endpoints.
  - Local user credentials for Windows and MacOS with which Cisco ISE can log into the endpoints as a local user.

    Domain user has precedence over local user. If you have configured both, and need to run a script with local user credentials, you must remove domain credentials.

- Windows endpoints must have Windows PowerShell version 5.1 or later installed. PowerShell remoting must be enabled.
- MacOS endpoints must have Bash installed.
- Both Windows and MacOS endpoints must have cURL version 7.34 or later installed.

- The Windows and MacOS endpoints must be connected to a network and have active sessions in Cisco ISE.

Step 1 In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Context Visibility** > **Endpoints**

Step 2 Click the link icon in the top-right corner of the window, and choose **Run Endpoint Scripts** from the drop-down list.

The **Welcome** tab contains a link to the **Endpoint Login Configuration** window to configure login credentials, if this is not already done. You can click the **Start** button at the bottom-right corner of this tab only when login credentials are configured.

Step 3 In the **Select Category** tab, you can select endpoints based either on their operating systems, or the applications available on them. Click the radio button for **By OS** or **By Application** to make your choice. Click **Next** to continue.

Step 4 In the **Select Endpoints** window, a dashlet displays the filters available for OS type, or application, as applicable. In the dashlet, click the filter you wish to apply, and all the endpoints for that filter are listed in a table.

- To select all the endpoints for the chosen filter, check the checkbox in the title row of the table.
- To select specific endpoints, check the check box for that entry in the table. To find a specific endpoint from the table, click the **Filter** button above the table and choose **Quick Filter**. You can filter by any of the parameters displayed to find the required endpoints.

Note If you chose **By Application** in the **Select Categories** step, remember to select endpoints belonging to the same OS type in this step. In the case of application-based scripts, create a script for each OS type and set up a separate job for each OS type on the Endpoints Scripts Wizard.

Step 5 Click **Next** after choosing the endpoints on which to run a script.

Step 6 In the **Select Scripts** tab, click **Add**.

Step 7 Click **Add Script** to choose the script from your system. Click **Start Upload** to add the script to the **Select Scripts** tab.

Step 8 Check the check box for the script you wish to run and click **Next**.

Step 9 The **Summary** tab displays the endpoints selected and the script chosen. Review the selection here and click **Back** to change any details. Click **Finish** to initiate running the scripts.

A pop-up window named **Endpoints Script Report** is displayed, with the **Job ID** of this task. Click **Endpoint Scripts provisioning report** to be redirected to the window with the details of this task.

To view the reports of jobs run through the Endpoints Scripts Wizard, choose **Operations** > **Reports** > **Reports** > **Endpoints and Users** > **Endpoint Scripts Provisioning Summary**.

Endpoint Scripts Provisioning Summary Report

In the Cisco ISE GUI, click the **Menu** icon (☰) and choose **Operations** > **Reports** > **Reports** > **Endpoints and Users** > **Endpoint Scripts Provisioning Summary**

The Endpoint Scripts Provisioning Summary window displays details of jobs run through the Endpoint Scripts Wizard, over the last 30 days. Click **Schedule** in the top-right corner of the window to schedule exporting reports and keep track of older reports.

Click **Export To** and choose an option from the drop-down list to save a CSV or PDF version of the report to a repository or a local destination.

The **Endpoint Scripts Provisioning Summary** window displays a table with the following columns by default:

Name of Column	Information Displayed
Logged At	Time stamp of submission of job.
Job ID	Click the Job ID entry to view details of this entry. A new tab open with **Endpoint Scripts Provisioning Details**, with timestamp, MAC addresses of the endpoints selected, script status and provisioning status of the script for each of the endpoints, name of PSN provisioning the job, and the Job ID. **Note** **Note**: Click the MAC address for granular step-by-step details of the script run.
Admin Name	Name of administrator who submitted the job.
Operating System	Operating system for which the selected script was run.
Total/ Success /Failed/In-Progress Endpoints	• Total number of endpoints selected. • Number of endpoints on which the script ran successfully. • Number of endpoints on which the script failed to run. • Number of endpoints on which the script is still running.
Script Name	Name of the script included in the job.

IF-MIB

Object	OID
ifIndex	1.3.6.1.2.1.2.2.1.1
ifDescr	1.3.6.1.2.1.2.2.1.2
ifType	1.3.6.1.2.1.2.2.1.3
ifSpeed	1.3.6.1.2.1.2.2.1.5
ifPhysAddress	1.3.6.1.2.1.2.2.1.6
ifAdminStatus	1.3.6.1.2.1.2.2.1.7

Object	OID
ifOperStatus	1.3.6.1.2.1.2.2.1.8

SNMPv2-MIB

Object	OID
system	1.3.6.1.2.1.1
sysDescr	1.3.6.1.2.1.1.1.0
sysObjectID	1.3.6.1.2.1.1.2.0
sysUpTime	1.3.6.1.2.1.1.3.0
sysContact	1.3.6.1.2.1.1.4.0
sysName	1.3.6.1.2.1.1.5.0
sysLocation	1.3.6.1.2.1.1.6.0
sysServices	1.3.6.1.2.1.1.7.0
sysORLastChange	1.3.6.1.2.1.1.8.0
sysORTable	1.3.6.1.2.1.1.9.0

IP-MIB

Object	OID
ipAdEntIfIndex	1.3.6.1.2.1.4.20.1.2
ipAdEntNetMask	1.3.6.1.2.1.4.20.1.3
ipNetToMediaPhysAddress	1.3.6.1.2.1.4.22.1.2
ipNetToPhysicalPhysAddress	1.3.6.1.2.1.4.35.1.4

CISCO-CDP-MIB

Object	OID
cdpCacheEntry	1.3.6.1.4.1.9.9.23.1.2.1.1
cdpCacheIfIndex	1.3.6.1.4.1.9.9.23.1.2.1.1.1

Object	OID
cdpCacheDeviceIndex	1.3.6.1.4.1.9.9.23.1.2.1.1.2
cdpCacheAddressType	1.3.6.1.4.1.9.9.23.1.2.1.1.3
cdpCacheAddress	1.3.6.1.4.1.9.9.23.1.2.1.1.4
cdpCacheVersion	1.3.6.1.4.1.9.9.23.1.2.1.1.5
cdpCacheDeviceId	1.3.6.1.4.1.9.9.23.1.2.1.1.6
cdpCacheDevicePort	1.3.6.1.4.1.9.9.23.1.2.1.1.7
cdpCachePlatform	1.3.6.1.4.1.9.9.23.1.2.1.1.8
cdpCacheCapabilities	1.3.6.1.4.1.9.9.23.1.2.1.1.9
cdpCacheVTPMgmtDomain	1.3.6.1.4.1.9.9.23.1.2.1.1.10
cdpCacheNativeVLAN	1.3.6.1.4.1.9.9.23.1.2.1.1.11
cdpCacheDuplex	1.3.6.1.4.1.9.9.23.1.2.1.1.12
cdpCacheApplianceID	1.3.6.1.4.1.9.9.23.1.2.1.1.13
cdpCacheVlanID	1.3.6.1.4.1.9.9.23.1.2.1.1.14
cdpCachePowerConsumption	1.3.6.1.4.1.9.9.23.1.2.1.1.15
cdpCacheMTU	1.3.6.1.4.1.9.9.23.1.2.1.1.16
cdpCacheSysName	1.3.6.1.4.1.9.9.23.1.2.1.1.17
cdpCacheSysObjectID	1.3.6.1.4.1.9.9.23.1.2.1.1.18
cdpCachePrimaryMgmtAddrType	1.3.6.1.4.1.9.9.23.1.2.1.1.19
cdpCachePrimaryMgmtAddr	1.3.6.1.4.1.9.9.23.1.2.1.1.20
cdpCacheSecondaryMgmtAddrType	1.3.6.1.4.1.9.9.23.1.2.1.1.21
cdpCacheSecondaryMgmtAddr	1.3.6.1.4.1.9.9.23.1.2.1.1.22
cdpCachePhysLocation	1.3.6.1.4.1.9.9.23.1.2.1.1.23
cdpCacheLastChange	1.3.6.1.4.1.9.9.23.1.2.1.1.24

CISCO-VTP-MIB

Object	OID
vtpVlanIfIndex	1.3.6.1.4.1.9.9.46.1.3.1.1.18.1

Object	OID
vtpVlanName	1.3.6.1.4.1.9.9.46.1.3.1.1.4.1
vtpVlanState	1.3.6.1.4.1.9.9.46.1.3.1.1.2.1

CISCO-STACK-MIB

Object	OID
portIfIndex	1.3.6.1.4.1.9.5.1.4.1.1.11
vlanPortVlan	1.3.6.1.4.1.9.5.1.9.3.1.3.1

BRIDGE-MIB

Object	OID
dot1dTpFdbPort	1.3.6.1.2.1.17.4.3.1.2
dot1dBasePortIfIndex	1.3.6.1.2.1.17.1.4.1.2

OLD-CISCO-INTERFACE-MIB

Object	OID
locIfReason	1.3.6.1.4.1.9.2.2.1.1.20

CISCO-LWAPP-AP-MIB

Object	OID
cLApEntry	1.3.6.1.4.1.9.9.513.1.1.1
cLApSysMacAddress	1.3.6.1.4.1.9.9.513.1.1.1.1.1
cLApIfMacAddress	1.3.6.1.4.1.9.9.513.1.1.1.1.2
cLApMaxNumberOfDot11Slots	1.3.6.1.4.1.9.9.513.1.1.1.1.3
cLApEntPhysicalIndex	1.3.6.1.4.1.9.9.513.1.1.1.1.4
cLApName	1.3.6.1.4.1.9.9.513.1.1.1.1.5
cLApUpTime	1.3.6.1.4.1.9.9.513.1.1.1.1.6

Object	OID
cLLwappUpTime	1.3.6.1.4.1.9.9.513.1.1.1.1.7
cLLwappJoinTakenTime	1.3.6.1.4.1.9.9.513.1.1.1.1.8
cLApMaxNumberOfEthernetSlots	1.3.6.1.4.1.9.9.513.1.1.1.1.9
cLApPrimaryControllerAddressType	1.3.6.1.4.1.9.9.513.1.1.1.1.10
cLApPrimaryControllerAddress	1.3.6.1.4.1.9.9.513.1.1.1.1.11
cLApSecondaryControllerAddressType	1.3.6.1.4.1.9.9.513.1.1.1.1.12
cLApSecondaryControllerAddress	1.3.6.1.4.1.9.9.513.1.1.1.1.13
cLApTertiaryControllerAddressType	1.3.6.1.4.1.9.9.513.1.1.1.1.14
cLApTertiaryControllerAddress	1.3.6.1.4.1.9.9.513.1.1.1.1.15
cLApLastRebootReason	1.3.6.1.4.1.9.9.513.1.1.1.1.16
cLApEncryptionEnable	1.3.6.1.4.1.9.9.513.1.1.1.1.17
cLApFailoverPriority	1.3.6.1.4.1.9.9.513.1.1.1.1.18
cLApPowerStatus	1.3.6.1.4.1.9.9.513.1.1.1.1.19
cLApTelnetEnable	1.3.6.1.4.1.9.9.513.1.1.1.1.20
cLApSshEnable	1.3.6.1.4.1.9.9.513.1.1.1.1.21
cLApPreStdStateEnabled	1.3.6.1.4.1.9.9.513.1.1.1.1.22
cLApPwrInjectorStateEnabled	1.3.6.1.4.1.9.9.513.1.1.1.1.23
cLApPwrInjectorSelection	1.3.6.1.4.1.9.9.513.1.1.1.1.24
cLApPwrInjectorSwMacAddr	1.3.6.1.4.1.9.9.513.1.1.1.1.25
cLApWipsEnable	1.3.6.1.4.1.9.9.513.1.1.1.1.26
cLApMonitorModeOptimization	1.3.6.1.4.1.9.9.513.1.1.1.1.27
cLApDomainName	1.3.6.1.4.1.9.9.513.1.1.1.1.28
cLApNameServerAddressType	1.3.6.1.4.1.9.9.513.1.1.1.1.29
cLApNameServerAddress	1.3.6.1.4.1.9.9.513.1.1.1.1.30
cLApAMSDUEnable	1.3.6.1.4.1.9.9.513.1.1.1.1.31
cLApEncryptionSupported	1.3.6.1.4.1.9.9.513.1.1.1.1.32
cLApRogueDetectionEnabled	1.3.6.1.4.1.9.9.513.1.1.1.1.33

CISCO-LWAPP-DOT11-CLIENT-MIB

Object	OID
cldcClientEntry	1.3.6.1.4.1.9.9.599.1.3.1.1
cldcClientMacAddress	1.3.6.1.4.1.9.9.599.1.3.1.1.1
cldcClientStatus	1.3.6.1.4.1.9.9.599.1.3.1.1.2
cldcClientWlanProfileName	1.3.6.1.4.1.9.9.599.1.3.1.1.3
cldcClientWgbStatus	1.3.6.1.4.1.9.9.599.1.3.1.1.4
cldcClientWgbMacAddress	1.3.6.1.4.1.9.9.599.1.3.1.1.5
cldcClientProtocol	1.3.6.1.4.1.9.9.599.1.3.1.1.6
cldcAssociationMode	1.3.6.1.4.1.9.9.599.1.3.1.1.7
cldcApMacAddress	1.3.6.1.4.1.9.9.599.1.3.1.1.8
cldcIfType	1.3.6.1.4.1.9.9.599.1.3.1.1.9
cldcClientIPAddress	1.3.6.1.4.1.9.9.599.1.3.1.1.10
cldcClientNacState	1.3.6.1.4.1.9.9.599.1.3.1.1.11
cldcClientQuarantineVLAN	1.3.6.1.4.1.9.9.599.1.3.1.1.12
cldcClientAccessVLAN	1.3.6.1.4.1.9.9.599.1.3.1.1.13
cldcClientLoginTime	1.3.6.1.4.1.9.9.599.1.3.1.1.14
cldcClientUpTime	1.3.6.1.4.1.9.9.599.1.3.1.1.15
cldcClientPowerSaveMode	1.3.6.1.4.1.9.9.599.1.3.1.1.16
cldcClientCurrentTxRateSet	1.3.6.1.4.1.9.9.599.1.3.1.1.17
cldcClientDataRateSet	1.3.6.1.4.1.9.9.599.1.3.1.1.18

CISCO-AUTH-FRAMEWORK-MIB

Object	OID
cafPortConfigEntry	1.3.6.1.4.1.9.9.656.1.2.1.1
cafSessionClientMacAddress	1.3.6.1.4.1.9.9.656.1.4.1.1.2
cafSessionStatus	1.3.6.1.4.1.9.9.656.1.4.1.1.5

Object	OID
cafSessionDomain	1.3.6.1.4.1.9.9.656.1.4.1.1.6
cafSessionAuthUserName	1.3.6.1.4.1.9.9.656.1.4.1.1.10
cafSessionAuthorizedBy	1.3.6.1.4.1.9.9.656.1.4.1.1.12
cafSessionAuthVlan	1.3.6.1.4.1.9.9.656.1.4.1.1.14

EEE8021-PAE-MIB: RFC IEEE 802.1X

Object	OID
dot1xAuthAuthControlledPortStatus	1.0.8802.1.1.1.1.2.1.1.5
dot1xAuthAuthControlledPortCntrl	1.0.8802.1.1.1.1.2.1.1.6
dot1xAuthSessionUserName	1.0.8802.1.1.1.1.2.4.1.9

HOST-RESOURCES-MIB

Object	OID
hrDeviceDescr	1.3.6.1.2.1.25.3.2.1.3
hrDeviceStatus	1.3.6.1.2.1.25.3.2.1.5

LLDP-MIB

Object	OID
lldpEntry	1.0.8802.1.1.2.1.4.1.1
lldpTimeMark	1.0.8802.1.1.2.1.4.1.1.1
lldpLocalPortNum	1.0.8802.1.1.2.1.4.1.1.2
lldpIndex	1.0.8802.1.1.2.1.4.1.1.3
lldpChassisIdSubtype	1.0.8802.1.1.2.1.4.1.1.4
lldpChassisId	1.0.8802.1.1.2.1.4.1.1.5
lldpPortIdSubtype	1.0.8802.1.1.2.1.4.1.1.6
lldpPortId	1.0.8802.1.1.2.1.4.1.1.7

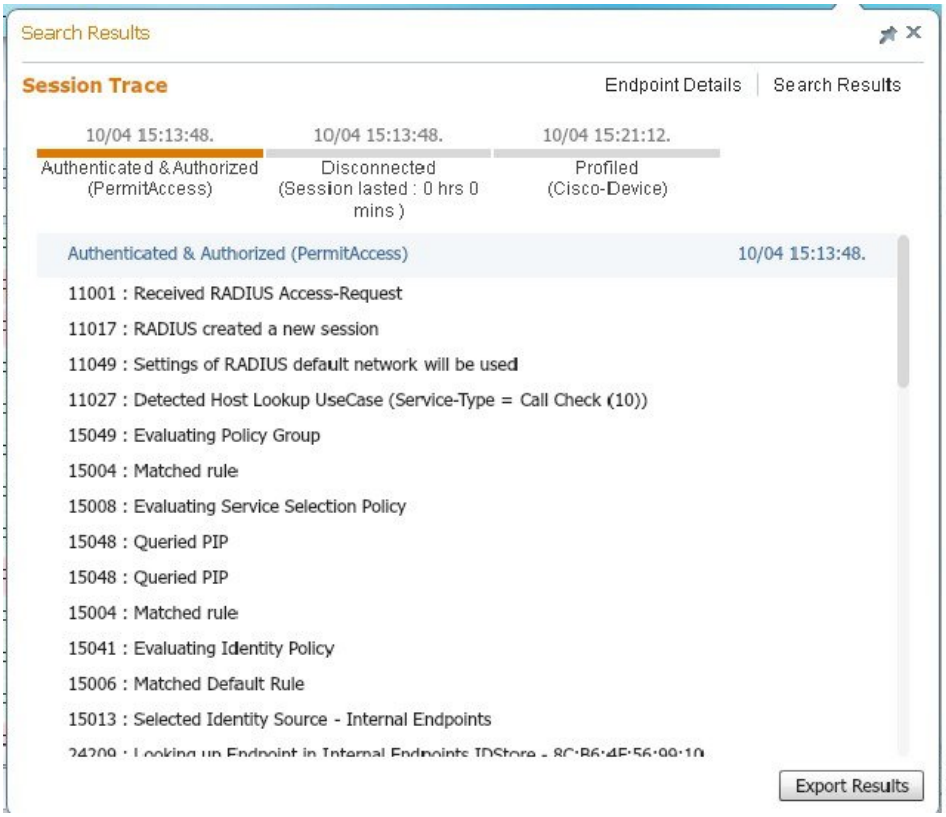
Object	OID
lldpPortDescription	1.0.8802.1.1.2.1.4.1.1.8
lldpSystemName	1.0.8802.1.1.2.1.4.1.1.9
lldpSystemDescription	1.0.8802.1.1.2.1.4.1.1.10
lldpCapabilitiesMapSupported	1.0.8802.1.1.2.1.4.1.1.11
lldpCacheCapabilities	1.0.8802.1.1.2.1.4.1.1.12

Session Trace for an Endpoint

You can use the global search box available at the top of the Cisco ISE home page to get session information for a particular endpoint. When you search with a criteria, you get a list of endpoints. Click on any of these endpoints to see the session trace information for that endpoint. The following figure shows an example of the session trace information displayed for an endpoint.

Note The dataset used for search is based on Endpoint ID as indexes. Therefore, when authentication occurs, it is mandatory to have Endpoint IDs for the endpoints for those authentications to include them in the search result set.

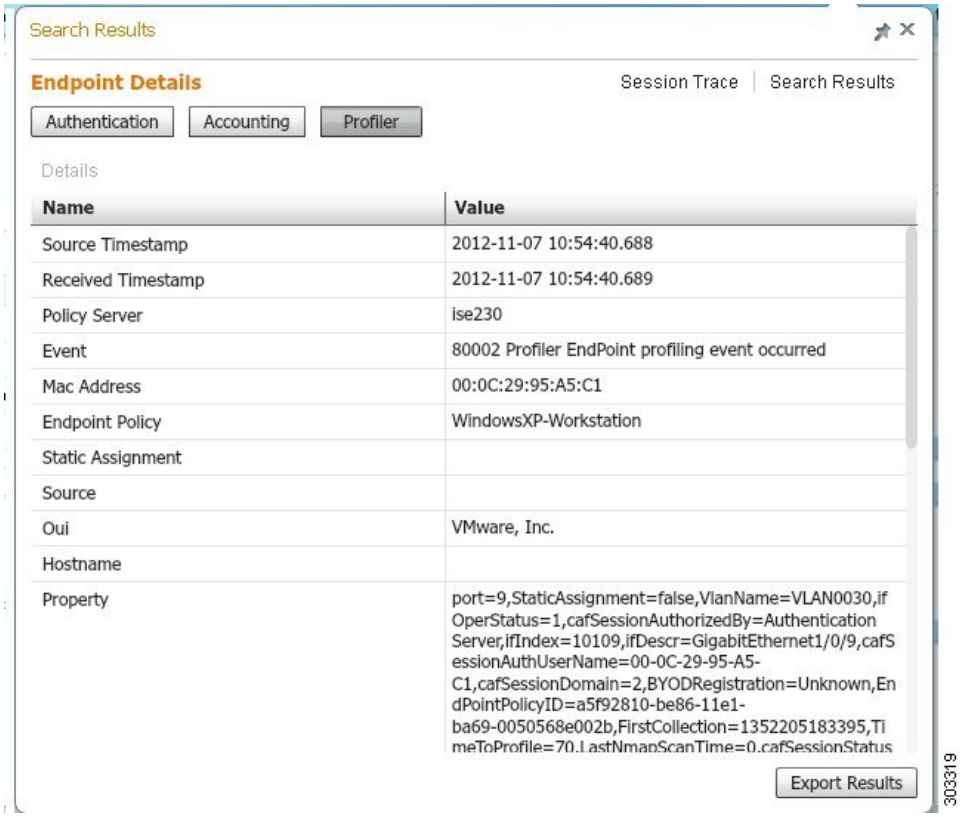
Figure 16: Session Trace of an Endpoint



You can use the clickable timeline at the top to see major authorization transitions. You can also export the results in .csv format by using the **Export Results** option. The report gets downloaded to your browser.

You can click the **Endpoint Details** link to see more authentication, accounting, and profiler information for a particular endpoint. The following figure shows an example of endpoint details information displayed for an endpoint.

Figure 17: Endpoint Details



Session Removal from the Directory

Sessions are cleaned from the session directory on the Monitoring and Troubleshooting node as follows:

- Terminated sessions are cleaned 15 minutes after termination.
- If there is authentication but no accounting, then such sessions are cleared after one hour.
- All inactive sessions are cleared after five days.

Global Search for Endpoints

You can use the global search box available at the top of the Cisco ISE home page to search for endpoints. You can use any of the following criteria to search for an endpoint:

- User name
- MAC Address
- IP Address
- Authorization Profile
- Endpoint Profile

- Failure Reason
- Identity Group
- Identity Store
- Network Device name
- Network Device Type
- Operating System
- Posture Status
- Location
- Security Group
- User Type

You should enter at least three characters for any of the search criteria in the Search field to display data.

Note If an endpoint has been authenticated by Cisco ISE, or its accounting update has been received, it can be found through the global search. Endpoints that have been manually added and are not authenticated by or accounted for in Cisco ISE will not show up in the search results.

The search result provides a detailed and at-a-glance information about the current status of the endpoint, which you can use for troubleshooting. Search results display only the top 25 entries. You can use filters to narrow down the results.

You can use any of the properties in the left panel to filter the results. You can also click on any endpoint to see more detailed information about the endpoint, such as:

- Session trace
- Authentication details
- Accounting details
- Posture details
- Profiler details
- Client Provisioning details
- Guest accounting and activity