

LDAP Servers for AAA

This chapter describes how to configure LDAP servers used in AAA.

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About LDAP and the ASA

The ASA is compatible with the most LDAPv3 directory servers, including:

- Sun Microsystems JAVA System Directory Server, now part of Oracle Directory Server Enterprise Edition, and formerly named the Sun ONE Directory Server
- Microsoft Active Directory
- Novell
- OpenLDAP

By default, the ASA autodetects whether it is connected to Microsoft Active Directory, Sun LDAP, Novell, OpenLDAP, or a generic LDAPv3 directory server. However, if autodetection fails to determine the LDAP server type, you can manually configure it.

How Authentication Works with LDAP

During authentication, the ASA acts as a client proxy to the LDAP server for the user, and authenticates to the LDAP server in either plain text or by using the SASL protocol. By default, the ASA passes authentication parameters, usually a username and password, to the LDAP server in plain text.

The ASA supports the following SASL mechanisms, listed in order of increasing strength:

- Digest-MD5—The ASA responds to the LDAP server with an MD5 value computed from the username and password.
- Kerberos—The ASA responds to the LDAP server by sending the username and realm using the GSSAPI Kerberos mechanism.

The ASA and LDAP server supports any combination of these SASL mechanisms. If you configure multiple mechanisms, the ASA retrieves the list of SASL mechanisms that are configured on the server, and sets the authentication mechanism to the strongest one configured on both the ASA and the server. For example, if both the LDAP server and the ASA support both mechanisms, the ASA selects Kerberos, the stronger of the two.

When user LDAP authentication has succeeded, the LDAP server returns the attributes for the authenticated user. For VPN authentication, these attributes generally include authorization data that is applied to the VPN session. In this case, using LDAP accomplishes authentication and authorization in a single step.

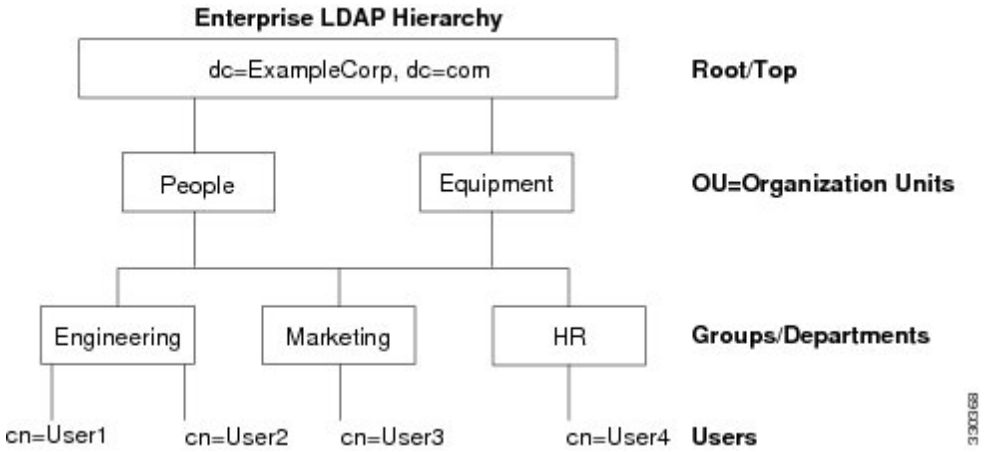
Note For more information about LDAP, see RFCs 1777, 2251, and 2849.

LDAP Hierarchy

Your LDAP configuration should reflect the logical hierarchy of your organization. For example, suppose an employee at your company, Example Corporation, is named Employee1. Employee1 works in the Engineering group. Your LDAP hierarchy could have one or many levels. You might decide to set up a single-level hierarchy in which Employee1 is considered a member of Example Corporation. Or you could set up a multi-level hierarchy in which Employee1 is considered to be a member of the department Engineering, which is a member of an organizational unit called People, which is itself a member of Example Corporation. See the following figure for an example of a multi-level hierarchy.

A multi-level hierarchy has more detail, but searches return results more quickly in a single-level hierarchy.

Figure 1: A Multi-Level LDAP Hierarchy



Search the LDAP Hierarchy

The ASA lets you tailor the search within the LDAP hierarchy. You configure the following three fields on the ASA to define where in the LDAP hierarchy that your search begins, the extent, and the type of information you are looking for. Together, these fields limit the search of the hierarchy to only the part that includes the user permissions.

- LDAP Base DN defines where in the LDAP hierarchy that the server should begin searching for user information when it receives an authorization request from the ASA.

- Search Scope defines the extent of the search in the LDAP hierarchy. The search proceeds this many levels in the hierarchy below the LDAP Base DN. You can choose to have the server search only the level immediately below it, or it can search the entire subtree. A single level search is quicker, but a subtree search is more extensive.
- Naming Attribute(s) defines the RDN that uniquely identifies an entry in the LDAP server. Common naming attributes can include cn (Common Name), sAMAccountName, and userPrincipalName.

The figure shows a sample LDAP hierarchy for Example Corporation. Given this hierarchy, you could define your search in different ways. The following table shows two sample search configurations.

In the first example configuration, when Employee1 establishes the IPsec tunnel with LDAP authorization required, the ASA sends a search request to the LDAP server, indicating it should search for Employee1 in the Engineering group. This search is quick.

In the second example configuration, the ASA sends a search request indicating that the server should search for Employee1 within Example Corporation. This search takes longer.

Table 1: Example Search Configurations

No.	LDAP Base DN	Search Scope	Naming Attribute	Result
1	group= Engineering,ou=People,dc=ExampleCorporation, dc=com	One Level	cn=Employee1	Quicker search
2	dc=ExampleCorporation,dc=com	Subtree	cn=Employee1	Longer search

Bind to an LDAP Server

The ASA uses the login DN and login password to establish trust (bind) with an LDAP server. When performing a Microsoft Active Directory read-only operation (such as authentication, authorization, or group search), the ASA can bind using a login DN with fewer privileges. For example, the login DN can be a user whose AD "Member Of" designation is part of Domain Users. For VPN password management operations, the login DN needs elevated privileges, and must be part of the Account Operators AD group.

Note When configuring LDAP authentication on Firepower 1000/2100 devices, avoid using a backslash ("\") in the binding password. The presence of a backslash in the password causes the LDAP binding process to fail, resulting in unsuccessful external authentication.

The following is an example of a login DN:

```
cn=Binduser1,ou=Admins,ou=Users,dc=company_A,dc=com
```

The ASA supports the following authentication methods:

- Simple LDAP authentication with an unencrypted password on port 389
- Secure LDAP (LDAP-S) on port 636
- Simple Authentication and Security Layer (SASL) MD5

- SASL Kerberos

The ASA does not support anonymous authentication.

Note As an LDAP client, the ASA does not support the transmission of anonymous binds or requests.

LDAP Attribute Maps

The ASA can use an LDAP directory for authenticating users for:

- VPN remote access users
- Firewall network access/cut-through-proxy sessions
- Setting policy permissions (also called authorization attributes), such as ACLs, bookmark lists, DNS or WINS settings, and session timers.
- Setting the key attributes in a local group policy

The ASA uses LDAP attribute maps to translate native LDAP user attributes to ASA attributes. You can bind these attribute maps to LDAP servers or remove them. You can also show or clear attribute maps.

The LDAP attribute map does not support multi-valued attributes. For example, if a user is a member of several AD groups, and the LDAP attribute map matches more than one group, the value chosen is based on the alphabetization of the matched entries.

To use the attribute mapping features correctly, you need to understand LDAP attribute names and values, as well as the user-defined attribute names and values.

The names of frequently mapped LDAP attributes and the type of user-defined attributes that they would commonly be mapped to include the following:

- IETF-Radius-Class (Group_Policy in ASA version 8.2 and later)—Sets the group policy based on the directory department or user group (for example, Microsoft Active Directory memberOf) attribute value. The group policy attribute replaced the IETF-Radius-Class attribute with ASDM version 6.2/ASA version 8.2 or later.
- IETF-Radius-Filter-Id—Applies an access control list or ACL to VPN clients, IPsec, and SSL.
- IETF-Radius-Framed-IP-Address—Assigns a static IP address assigned to a VPN remote access client, IPsec, and SSL.
- Banner1—Displays a text banner when the VPN remote access user logs in.
- Tunneling-Protocols—Allows or denies the VPN remote access session based on the access type.

Note A single LDAP attribute map may contain one or many attributes. You can only map one LDAP attribute from a specific LDAP server.

Guidelines for LDAP Servers for AAA

This section includes the guidelines and limitations that you should check before configuring LDAP servers for AAA.

IPv6

The AAA server can use either an IPv4 or IPv6 address.

Additional Guidelines

- The DN configured on the ASA to access a Sun directory server must be able to access the default password policy on that server. We recommend using the directory administrator, or a user with directory administrator privileges, as the DN. Alternatively, you can place an ACL on the default password policy.
- You must configure LDAP over SSL to enable password management with Microsoft Active Directory and Sun servers.
- The ASA does not support password management with Novell, OpenLDAP, and other LDAPv3 directory servers.
- Beginning with Version 7.1(x), the ASA performs authentication and authorization using the native LDAP schema, and the Cisco schema is no longer needed.
- You can have up to 200 server groups in single mode or 4 server groups per context in multiple mode.
- Each group can have up to 16 servers in single mode or 8 servers in multiple mode.
- When a user logs in, the LDAP servers are accessed one at a time, starting with the first server that you specify in the configuration, until a server responds. If all servers in the group are unavailable, the ASA tries the local database if you configured it as a fallback method (management authentication and authorization only). If you do not have a fallback method, the ASA continues to try the LDAP servers.

Configure LDAP Servers for AAA

This section describes how to configure LDAP servers for AAA.

Procedure

Step 1 Configure LDAP attribute maps. See Configure LDAP Attribute Maps, on page 6.

Step 2 Add an LDAP server group. See Configure LDAP Server Groups, on page 7.

Step 3 (Optional) Configure authorization from an LDAP server that is separate and distinct from the authentication mechanism. See Configure Authorization with LDAP for VPN, on page 10.

Configure LDAP Attribute Maps

To configure LDAP attribute maps, perform the following steps:

Procedure

Step 1 Create an unpopulated LDAP attribute map table.

ldap-attribute-map *map-name*

Example:

```
ciscoasa(config)# ldap-attribute-map att_map_1
```

Step 2 Map the user-defined attribute name department to the Cisco attribute.

map-name *user-attribute-name Cisco-attribute-name*

Example:

```
ciscoasa(config-ldap-attribute-map)# map-name department IETF-Radius-Class
```

Step 3 Map the user-defined map value department to the user-defined attribute value and the Cisco attribute value.

map-value *user-attribute-name Cisco-attribute-name*

Example:

```
ciscoasa(config-ldap-attribute-map)# map-value department Engineering group1
```

Step 4 Identify the server and the AAA server group to which it belongs.

aaa-server *server_group* [*interface_name*] **host** *server_ip*

Example:

```
ciscoasa(config)# aaa-server ldap_dir_1 host 10.1.1.4
```

Step 5 Bind the attribute map to the LDAP server.

ldap-attribute-map *map-name*

Example:

```
ciscoasa(config-aaa-server-host)# ldap-attribute-map att_map_1
```

Examples

The following example shows how to limit management sessions to the ASA based on an LDAP attribute called accessType. The accessType attribute may have one of these values:

- VPN
- admin
- helpdesk

The following example shows how each value is mapped to one of the valid IETF-Radius-Service-Type attributes that the ASA supports: remote-access (Service-Type 5) Outbound, admin (Service-Type 6) Administrative, and nas-prompt (Service-Type 7) NAS Prompt.

```
ciscoasa(config)# ldap attribute-map MGMT
ciscoasa(config-ldap-attribute-map)# map-name accessType IETF-Radius-Service-Type
ciscoasa(config-ldap-attribute-map)# map-value accessType VPN 5
ciscoasa(config-ldap-attribute-map)# map-value accessType admin 6
ciscoasa(config-ldap-attribute-map)# map-value accessType helpdesk 7

ciscoasa(config-ldap-attribute-map)# aaa-server LDAP protocol ldap
ciscoasa(config-aaa-server-group)# aaa-server LDAP (inside) host 10.1.254.91
ciscoasa(config-aaa-server-host)# ldap-base-dn CN=Users,DC=cisco,DC=local
ciscoasa(config-aaa-server-host)# ldap-scope subtree
ciscoasa(config-aaa-server-host)# ldap-login-password test
ciscoasa(config-aaa-server-host)# ldap-login-dn CN=Administrator,CN=Users,DC=cisco,DC=local
ciscoasa(config-aaa-server-host)# server-type auto-detect
ciscoasa(config-aaa-server-host)# ldap-attribute-map MGMT
```

The following example shows how to display the complete list of Cisco LDAP attribute names:

```
ciscoasa(config)# ldap attribute-map att_map_1
ciscoasa(config-ldap-attribute-map)# map-name att_map_1?

ldap mode commands/options:
cisco-attribute-names:
  Access-Hours
  Allow-Network-Extension-Mode
  Auth-Service-Type
  Authenticated-User-Idle-Timeout
  Authorization-Required
  Authorization-Type
 :
 :
  X509-Cert-Data
ciscoasa(config-ldap-attribute-map)#
```

Configure LDAP Server Groups

To create and configure an LDAP server group, then add an LDAP server to that group, perform the following steps:

Before you begin

You must add an attribute map before you may add an LDAP server to an LDAP server group.

Procedure

Step 1 Identify the server group name and the protocol.

aaa-server *server_tag* **protocol ldap**

Example:

```
ciscoasa(config)# aaa-server servergroup1 protocol ldap
ciscoasa(config-aaa-server-group)#
```

When you enter the **aaa-server protocol** command, you enter aaa-server group configuration mode.

Step 2 Specify the maximum number of failed AAA transactions with an LDAP server in the group before trying the next server.

max-failed-attempts *number*

Example:

```
ciscoasa(config-aaa-server-group)# max-failed-attempts 2
```

The *number* argument can range from 1 and 5. The default is 3.

If you configured a fallback method using the local database (for management access only) to configure the fallback mechanism, and all the servers in the group fail to respond, or their responses are invalid, then the group is considered to be unresponsive, and the fallback method is tried. The server group remains marked as unresponsive for a period of 10 minutes (by default), so that additional AAA requests within that period do not attempt to contact the server group, and the fallback method is used immediately. To change the unresponsive period from the default, see the **reactivation-mode** command in the next step.

If you do not have a fallback method, the ASA continues to retry the servers in the group.

Step 3 Specify the method (reactivation policy) by which failed servers in a group are reactivated.

reactivation-mode {**depletion** [**deadtime** *minutes*] | **timed**}

Example:

```
ciscoasa(config-aaa-server-group)# reactivation-mode deadtime 20
```

The **depletion** keyword reactivates failed servers only after all of the servers in the group are inactive.

The **deadtime** *minutes* keyword-argument pair specifies the amount of time in minutes, between 0 and 1440, that elapses between the disabling of the last server in the group and the subsequent reenabling of all servers. Deadtime applies only if you configure fallback to the local database; authentication is attempted locally until the deadtime elapses. The default is 10 minutes.

The **timed** keyword reactivates failed servers after 30 seconds of down time.

Step 4 Identify the LDAP server and AAA server group to which it belongs.

aaa-server *server_group* [**(***interface_name***)**] **host** *server_ip*

Example:

```
ciscoasa(config)# aaa-server servergroup1 outside host 10.10.1.1
```

If you do not specify an **(***interface_name***)**, then the ASA uses the **inside** interface by default.

When you enter the **aaa-server host** command, you enter aaa-server host configuration mode. As needed, use host configuration mode commands to further configure the AAA server.

The following table lists the available commands for LDAP servers, and whether or not a new LDAP server definition has a default value for that command. If no default value is provided (indicated by "—"), use the command to specify the value.

Table 2: Host Mode Commands and Defaults

Command	Default Value	Description
ldap-attribute-map	—	—
ldap-base-dn	—	—
ldap-login-dn	—	—
ldap-login-password	—	—
ldap-naming-attribute	—	—
ldap-over-ssl	636	If not set, the ASA uses sAMAccountName for LDAP requests. Whether using SASL or plain text, you can secure communications between the ASA and the LDAP server with SSL. If you do not configure SASL, we strongly recommend that you secure LDAP communications with SSL. You can use the **reference-identity** submode command to configure the reference identity name that ASA would use to validate the LDAPS (SSL) server identity. When configured, ASA validates the aaa-ldap server with the matching criteria configured under **crypto ca reference-identity** <*name*>. If there is no match found in the certificate Subject Name or SAN, or if the host specified with reference-identity does not resolve, the connection is terminated.
ldap-scope	—	—
sasl-mechanism	—	—
server-port	389	—
server-type	autodiscovery	If autodetection fails to determine the LDAP server type, and you know the server is either a Microsoft, Sun or generic LDAP server, you can manually configure the server type.

Command	Default Value	Description
ssl-client-certificate	—	The certificate that the ASA should present to the LDAP server as the client certificate. This certificate is needed if you configure the LDAP server to verify the client certificate. You must also enable **ldap-over-ssl**. If you do not configure a certificate, the ASA does not present one when the LDAP server asks for it. If an LDAP server is configured to require a peer certificate, the secure LDAP session will not complete and authentication/authorization requests will fail.
timeout	10 seconds	—

Example

The following example shows how to configure an LDAP server group named watchdogs and add an LDAP server to the group. Because the example does not define a retry interval or the port that the LDAP server listens to, the ASA uses the default values for these two server-specific parameters.

```
ciscoasa(config)# aaa-server watchdogs protocol ldap
ciscoasa(config-aaa-server-group)# aaa-server watchdogs host 192.168.3.4
ciscoasa(config-aaa-server-host)# exit
ciscoasa(config)#
```

Configure Authorization with LDAP for VPN

When LDAP user authentication for VPN access has succeeded, the ASA queries the LDAP server, which returns LDAP attributes. These attributes generally include authorization data that applies to the VPN session. Using LDAP in this way accomplishes authentication and authorization in a single step.

There may be cases, however, where you require authorization from an LDAP directory server that is separate and distinct from the authentication mechanism. For example, if you use an SDI or certificate server for authentication, no authorization information is returned. For user authorizations in this case, you can query an LDAP directory after successful authentication, accomplishing authentication and authorization in two steps.

To set up VPN user authorization using LDAP, perform the following steps.

Procedure

Step 1 Create an IPsec remote access tunnel group named remotegrp.

tunnel-group *groupname*

Example:

```
ciscoasa(config)# tunnel-group remotegrp
```

Step 2 Associate the server group and the tunnel group.

tunnel-group *groupname* **general-attributes**

Example:

```
ciscoasa(config)# tunnel-group remotegrp general-attributes
```

Step 3 Assign a new tunnel group to a previously created AAA server group for authorization.

authorization-server-group *group-tag*

Example:

```
ciscoasa(config-general)# authorization-server-group ldap_dir_1
```

Example

While there are other authorization-related commands and options available for specific requirements, the following example shows commands for enabling user authorization with LDAP. The example then creates an IPsec remote access tunnel group named remote-1, and assigns that new tunnel group to the previously created ldap_dir_1 AAA server group for authorization:

```
ciscoasa(config)# tunnel-group remote-1 type ipsec-ra
ciscoasa(config)# tunnel-group remote-1 general-attributes
ciscoasa(config-general)# authorization-server-group ldap_dir_1
ciscoasa(config-general)#
```

After you complete this configuration work, you can then configure additional LDAP authorization parameters such as a directory password, a starting point for searching a directory, and the scope of a directory search by entering the following commands:

```
ciscoasa(config)# aaa-server ldap_dir_1 protocol ldap
ciscoasa(config-aaa-server-group)# aaa-server ldap_dir_1 host 10.1.1.4
ciscoasa(config-aaa-server-host)# ldap-login-dn obscurepassword
ciscoasa(config-aaa-server-host)# ldap-base-dn starthere
ciscoasa(config-aaa-server-host)# ldap-scope subtree
ciscoasa(config-aaa-server-host)#
```

Monitoring LDAP Servers for AAA

See the following commands for monitoring LDAP servers for AAA:

- **show aaa-server**

  This command shows the configured AAA server statistics. Use the **clear aaa-server statistics** command to clear the AAA server statistics.

- **show running-config aaa-server**

  This command shows the AAA server running configuration. Use the **clear configure aaa-server** command to clear AAA server configuration.

History for LDAP Servers for AAA

Table 3: History for AAA Servers

Feature Name	Platform Releases	Description
LDAP Servers for AAA	7.0(1)	LDAP Servers describe support for AAA and how to configure LDAP servers. We introduced the following commands: **username**, **aaa authorization exec authentication-server**, **aaa authentication console LOCAL**, **aaa authorization exec LOCAL**, **service-type, ldap attribute-map**, **aaa-server protocol**, **aaa authentication telnet** | **ssh** | **serial**} **console LOCAL**, **aaa authentication http console LOCAL**, **aaa authentication enable console LOCAL**, **max-failed-attempts**, **reactivation-mode**, **accounting-mode simultaneous**, **aaa-server host**, **authorization-server-group**, **tunnel-group**, **tunnel-group general-attributes**, **map-name**, **map-value**, **ldap-attribute-map**.
LDAP servers with IPv6 addresses for AAA	9.7(1)	You can now use either an IPv4 or IPv6 address for the AAA server.
Increased limits for AAA server groups and servers per group.	9.13(1)	You can configure more AAA server groups. In single context mode, you can configure 200 AAA server groups (the former limit was 100). In multiple context mode, you can configure 8 (the former limit was 4). In addition, in multiple context mode, you can configure 8 servers per group (the former limit was 4 servers per group). The single context mode per-group limit of 16 remains unchanged. We modified the following commands to accept these new limits: **aaa-server**, **aaa-server host**.
Mutual LDAPS authentication.	9.18(1)	You can configure a client certificate for the ASA to present to the LDAP server when it requests a certificate to authenticate. This feature applies when using LDAP over SSL. If an LDAP server is configured to require a peer certificate, the secure LDAP session will not complete and authentication/authorization requests will fail. We added the following command: **ssl-client-certificate**.