Cisco Secure Dynamic Attributes Connector Configuration Guide 2.3

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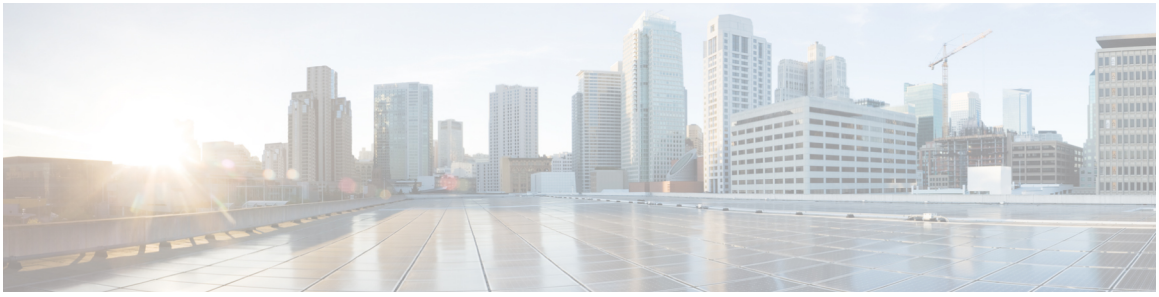

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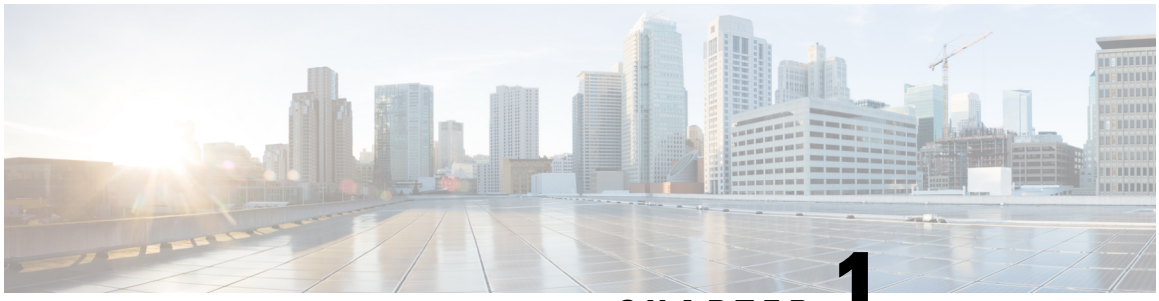


CHAPTER 1

About the Cisco Dynamic Attributes Connector

The Cisco Secure Dynamic Attributes Connector enables you to collect data (such as networks and IP addresses) from cloud providers and send it to the Ciso Secure Firewall Management Center (management center) so it can be used in access control rules.

The following topics provide background about the dynamic attributes connector:

About the Cisco Secure Dynamic Attributes Connector

The Cisco Secure Dynamic Attributes Connector enables you to use service tags and categories from various cloud service platforms in Secure Firewall Management Center (management center) access control rules.

Supported connectors

We currently support:

Table 1: List of supported connectors by Cisco Secure Dynamic Attributes Connector version and platform

CSDAC version/platform	AWS	AWS security groups	AWS service tags	Azure	Azure Service Tags	Cisco Cyber Vision	Generic Text	GitHub	Google Cloud	Microsoft Office 365	vCenter	Webex	Zoom
Version 1.1 (on-premises)	Yes	No	No	Yes	Yes	No	No	No	No	Yes	Yes	No	No
Version 2.0 (on-premises)	Yes	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No
Version 2.2 (on-premises)	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No
Version 2.3 (on-premises)	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Secure Firewall Management Center 7.4	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

More information about connectors:

- Amazon Web Services (AWS)

For more information, see a resource like Tagging AWS resources on the Amazon documentation site.

See Amazon Web Services Connector—About User Permissions and Imported Data, on page 16.

- GitHub

  For more information, see Create a GitHub Connector, on page 22.

- Google Cloud

  For more information, see Setting Up Your Environment in the Google Cloud documentation.

- Microsoft Azure

  For more information, see this page on the Azure documentation site.

  See Azure Connector—About User Permissions and Imported Data, on page 18.

- Microsoft Azure service tags

  For more information, see a resource like Virtual network service tags on Microsoft TechNet.

- Office 365 IP addresses

  For more information, see Office 365 URLs and IP address ranges on docs.microsoft.com.

- VMware categories and tags managed by vCenter and NSX-T

  For more information, see a resource like vSphere Tags and Attributes in the VMware documentation site.

- Webex IP addresses

  For more information, see Create a Webex Connector, on page 28.

- Zoom IP addresses

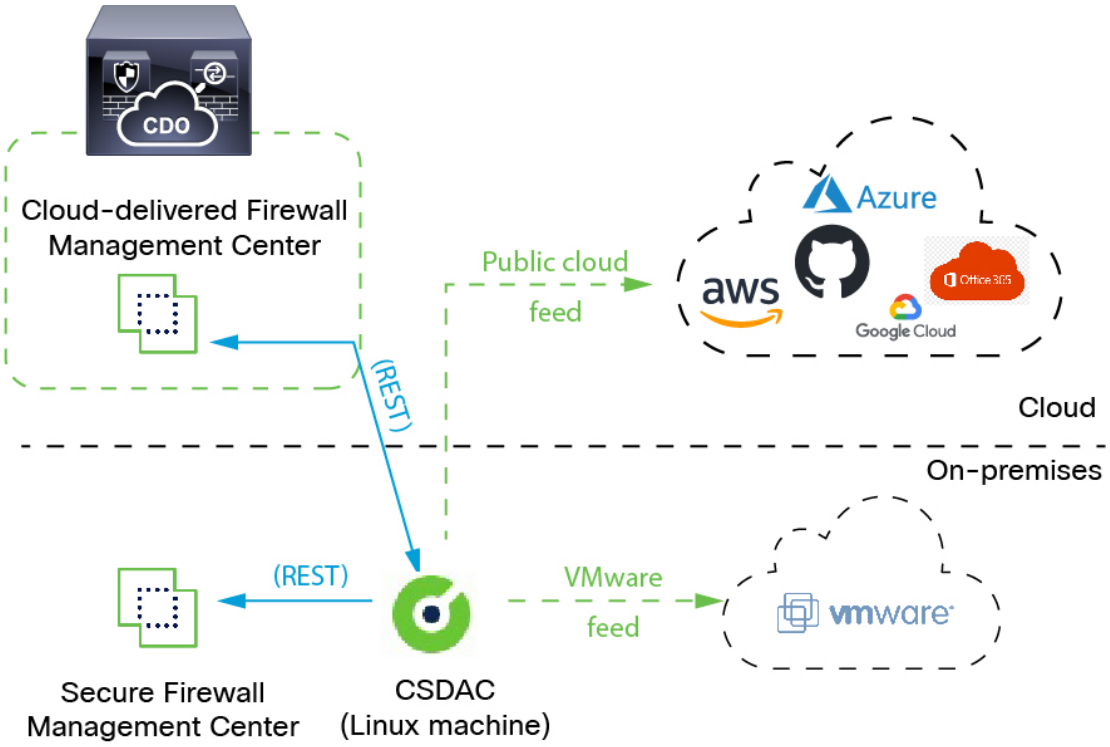
  For more information, see Create a Zoom Connector, on page 29.

How It Works

Network constructs such as IP address are not reliable in virtual, cloud and container environments due to the dynamic nature of the workloads and the inevitability of IP address overlap. Customers require policy rules to be defined based on non-network constructs such as VM name or security group, so that firewall policy is persistent even when the IP address or VLAN changes.

You can collect these tags and attributes using dynamic attributes connector Docker containers running on an Ubuntu, CentOS, or Red Hat Enterprise Linux virtual machine. Install the dynamic attributes connector on the Ubuntu host using an Ansible collection.

The following figure shows how the system functions at a high level.



- Install the dynamic attributes connector on a supported Linux virtual machine.

  For more information, see Supported Operating Systems and Third-Party Software, on page 5.

- The system supports certain public cloud providers.

  This topic discusses supported *connectors* (which are the connections to those providers).

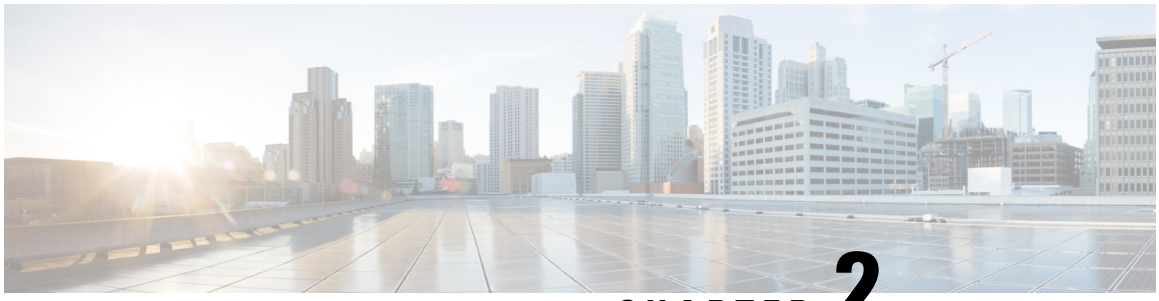
- The *adapter* defined by the dynamic attributes connector receives those dynamic attributes filters as *dynamic objects* and enables you to use them in access control rules.

  You can create the following types of adapters:

  - *On-Prem Firewall Management Center* for an on-premises Management Center device.

    This type of Management Center device might be managed by Cisco Defense Orchestrator (CDO) or it might be a standalone.

  - *Cloud-delivered Firewall Management Center* for devices managed by CDO.



CHAPTER 2

Install and Upgrade the Cisco Secure Dynamic Attributes Connector

This chapter discusses how to install and upgrade the Cisco Secure Dynamic Attributes Connector on all supported operating systems.

Supported Operating Systems and Third-Party Software

The dynamic attributes connector requires the following:

- Ubuntu 18.04 to 22.04.2
- CentOS 7 Linux
- Red Hat Enterprise Linux (RHEL) 7 or 8
- Python 3.6.x or later
- Ansible 2.9 or later

Minimum requirements for all operating systems:

- 4 CPUs
- 8GB RAM
- For new installations, 100GB available disk space

If you use a hypervisor:

VMware ESX or ESXi up to 8

If you wish to use vCenter attributes, we also require:

- vCenter up to 8
- VMware Tools must be installed on the virtual machine

Virtual machine sizing

We recommend you size your virtual machines as follows:

- 50 connectors, assuming 5 filters per connector and 20,000 workloads: 4 CPUs; 8GB RAM; 100GB available disk space
- 125 connectors, assuming 5 filters per connector and 50,000 workloads: 8 CPUs, 16 GBRAM, 100GB available disk space

Note Failure to size your virtual machines properly can cause the dynamic attributes connector to fail or not to start.

Install Prerequisite Software

Before you begin

Make sure you have physical or virtual set up and that the system that can communicate with your the On-Prem Firewall Management Center or Cloud-delivered Firewall Management Center.

Step 1 (Optional.) Use a text editor to edit `/etc/environment` to export the following variables to enable communication with the internet if your Ubuntu machine is behind an internet proxy.

Variable	Value
export http_proxy	Use with an HTTP proxy. *user*:*pass@host-or-ip*:*port*
export https_proxy	Use this with an HTTPS proxy. *user*:*pass@host-or-ip*:*port*
export no_proxy	Remove the proxy configuration. **export no_proxy="localhost,127.0.0.1"**

Examples:

HTTP proxy without authentication:

```
vi /etc/environment
export http_proxy="myproxy.example.com:8181"
```

HTTPS proxy with authentication:

```
vi /etc/environment
export https_proxy="ben.smith:bens-password@myproxy.example.com:8181"
```

Step 2 Use a different command window to confirm the settings:

```
env grep | proxy
```

Example result:

```
http_proxy=myproxy.example.com:8181
```

Step 3 Continue with one of the following sections.

Related Topics

Install Prerequisite Software—Ubuntu, on page 9
Install Prerequisite Software—CentOS, on page 7
Install Prerequisite Software—RHEL, on page 8

Install Prerequisite Software—CentOS

Before you begin

Do all of the following:

- Make sure your system meets the prerequisites discussed in Supported Operating Systems and Third-Party Software, on page 5.
- (Optional.) If you need proxy access to the dynamic attributes connector, see Install Prerequisite Software, on page 6.

Step 1 Make sure Docker is not installed and uninstall it if it is.

```
docker --version
```

If Docker is installed, uninstall it as discussed in Uninstall Docker Engine on Ubuntu.

Step 2 Update and upgrade your repositories.

CentOS 7:

```
sudo yum -y update && sudo yum -y upgrade
```

Step 3 Install the epel repository.

CentOS 7:

```
sudo yum -y install epel-release
```

Step 4 (CentOS 7 only.) Install Python 3.

```
sudo yum install -y python3 libselinux-python3
```

Step 5 Install Ansible.

CentOS 7:

```
sudo yum install -y ansible
```

Step 6 Verify the Ansible version is 2.9 or later.

CentOS 7:

```
ansible --version
  ansible 2.9.24
  config file = /etc/ansible/ansible.cfg
  configured module search path = [u'/home/admin/.ansible/plugins/modules',
u'/usr/share/ansible/plugins/modules']
```

```
ansible python module location = /usr/lib/python2.7/site-packages/ansible
executable location = /usr/bin/ansible
python version = 2.7.5 (default, Apr  2 2020, 13:16:51) [GCC 4.8.5 20150623 (Red Hat 4.8.5-39)]
```

Note It's normal for Ansible to reference Python 2.x as the preceding output shows. The connector will still use Python 3.

What to do next

Install the connector as discussed in Install the Cisco Secure Dynamic Attributes Connector, on page 10.

To optionally stop using a proxy with the dynamic attributes connector, edit `/etc/environment` and remove the proxy configuration.

Install Prerequisite Software—RHEL

Before you begin

Do all of the following:

- Make sure your system meets the prerequisites discussed in Supported Operating Systems and Third-Party Software, on page 5.
- (Optional.) If you need proxy access to the dynamic attributes connector, see Install Prerequisite Software, on page 6.

Step 1 Make sure Docker is not installed and uninstall it if it is.

```
docker --version
```

If Docker is installed, uninstall it as discussed in Uninstall Docker Engine on Ubuntu.

Step 2 Update your repositories.

RHEL 7:

```
sudo yum -y update && sudo yum -y upgrade
```

RHEL 8:

```
sudo dnf -y update && sudo dnf -y upgrade
```

Step 3 Install the epel repository.

RHEL 7:

```
sudo yum -y install https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
```

RHEL 8:

```
sudo dnf -y install https://dl.fedoraproject.org/pub/epel/epel-release-latest-8.noarch.rpm
```

Step 4 (RHEL 7 only.) Install Python 3.

```
sudo yum install -y python3 libselinux-python3
```

Step 5 Install Ansible.

RHEL 7:

```
sudo yum -y install ansible
```

RHEL 8:

```
sudo dnf install -y ansible
```

Step 6 Verify the Ansible version.

```
ansible --version
```

An example follows.

RHEL 7:

```
ansible 2.9.24
  config file = /etc/ansible/ansible.cfg
  configured module search path = [u'/home/stevej/.ansible/plugins/modules',
u'/usr/share/ansible/plugins/modules']
  ansible python module location = /usr/lib/python2.7/site-packages/ansible
  executable location = /usr/bin/ansible
  python version = 2.7.5 (default, Mar 20 2020, 17:08:22) [GCC 4.8.5 20150623 (Red Hat 4.8.5-39)]
```

Note It's normal for Ansible to reference Python 2.x as the preceding output shows. The connector will still use Python 3.

RHEL 8:

```
ansible 2.9.24
  config file = /etc/ansible/ansible.cfg
  configured module search path = ['/home/stevej/.ansible/plugins/modules',
'/usr/share/ansible/plugins/modules']
  ansible python module location = /usr/lib/python3.6/site-packages/ansible
  executable location = /usr/bin/ansible
  python version = 3.6.8 (default, Mar 18 2021, 08:58:41) [GCC 8.4.1 20200928 (Red Hat 8.4.1-1)]
```

What to do next

Install the connector as discussed in Install the Cisco Secure Dynamic Attributes Connector, on page 10.

To optionally stop using a proxy with the dynamic attributes connector, edit `/etc/environment` and remove the proxy configuration.

Install Prerequisite Software—Ubuntu

This task discusses how to install prerequisite software on Ubuntu.

Step 1 Make sure Docker is not installed and uninstall it if it is.

```
docker --version
```

If Docker is installed, uninstall it as discussed in Uninstall Docker Engine on Ubuntu.

Step 2 Update your repositories.

```
sudo apt -y update && sudo apt -y upgrade
```

Step 3 Confirm your Python version.

```
/usr/bin/python3 --version
```

If the version is earlier than 3.6, you must install version 3.6 or later.

Step 4 Install Python 3.6.

```
sudo apt -y install python3.6
```

Step 5 Install the common libraries.

```
sudo apt -y install software-properties-common
```

Step 6 Install Ansible.

```
sudo apt-add-repository -y -u ppa:ansible/ansible && sudo apt -y install ansible
```

Step 7 Verify the Ansible version.

```
ansible --version
```

An example follows.

```
ansible --version
ansible 2.9.19
  config file = /etc/ansible/ansible.cfg
  configured module search path = [u'/home/admin/.ansible/plugins/modules',
u'/usr/share/ansible/plugins/modules']
  ansible python module location = /usr/lib/python2.7/dist-packages/ansible
  executable location = /usr/bin/ansible
  python version = 2.7.17 (default, Feb 27 2021, 15:10:58) [GCC 7.5.0]
```

Note It's normal for Ansible to reference Python 2.x as the preceding output shows. The connector will still use Python 3.6.

What to do next

Install the connector as discussed in Install the Cisco Secure Dynamic Attributes Connector, on page 10.

To optionally stop using a proxy with the dynamic attributes connector, edit `/etc/environment` and remove the proxy configuration.

Install the Cisco Secure Dynamic Attributes Connector

About the installation

This topic discusses installing the Cisco Secure Dynamic Attributes Connector. You must install the connector as a user with `sudo` privileges but you can run the connector as a non-privileged user.

Before you begin

Make sure your system has the following prerequisite software:

- Ubuntu 18.04 to 22.04.2
- CentOS 7 Linux
- Red Hat Enterprise Linux (RHEL) 7 or 8

- Python 3.6.x or later
- Ansible 2.9 or later

Minimum requirements for all operating systems:

- 4 CPUs
- 8GB RAM
- For new installations, 100GB available disk space

We recommend you size your virtual machines as follows:

- 50 connectors, assuming 5 filters per connector and 20,000 workloads: 4 CPUs; 8GB RAM; 100GB available disk space
- 125 connectors, assuming 5 filters per connector and 50,000 workloads: 8 CPUs, 16 GBRAM, 100GB available disk space

Note Failure to size your virtual machines properly can cause the dynamic attributes connector to fail or not to start.

If you wish to use vCenter attributes, we also require:

- vCenter up to 8
- VMware Tools must be installed on the virtual machine

To install prerequisite software, see Install Prerequisite Software, on page 6.

View the Readme and Release Notes

For the latest installation information, see the following:

Readme: https://galaxy.ansible.com/cisco/csdac

Release Notes: Cisco Secure Dynamic Attributes Connector Release Notes

Get the Dynamic Attributes Connector software

To get the latest version of the dynamic attributes connector software, run the following command:

```
ansible-galaxy collection install cisco.csdac
```

Install the muster service

The muster service is another name for the dynamic attributes connector.

Run the following command from the `~/.ansible/collections/ansible_collections/cisco/csdac` directory.

ansible-playbook default_playbook.yml [--ask-become-pass] [--extra-vars " *vars* "]

Syntax Description

--ask-become-pass	Prompts you to enter the **sudo** password. Required if sudo is enabled on your machine.

--extra-vars

The following optional extra variables enable the dynamic attributes connector to use a proxy. The value you use must match the value in /etc/environment, which you configured as discussed in Install Prerequisite Software, on page 6.

- **csdac_proxy_enabled=true**
- **csdac_http_proxy_url=http://***PROXY_URL*

  csdac_https_proxy_url=*PROXY_URL*

The following optional extra variables create a self-signed certificate you can use to securely connect to the dynamic attributes connector. If you omit these parameters, the dynamic attributes connector uses a default certificate.

- **csdac_certificate_domain**

  domain name for autogenerated certificate. Default value is autodetected hostname of the host (detected by ansible)

- **csdac_certificate_country_name**

  Two-letter country code. (Default is `US`)

- **csdac_certificate_organization_name**

  Organization name. (Default is `Cisco`)

- **csdac_certificate_organization_unit_name**
- Organizational unit name (Default is `Cisco`)

Example installation with a default certificate

For example, to install the software with default options:

```
ansible-galaxy collection install cisco.csdac
cd ~/.ansible/collections/ansible_collections/cisco/csdac
ansible-playbook default_playbook.yml --ask-become-pass
```

Example installation with optional certificate

For example, to install the software with an optional certificate:

```
ansible-galaxy collection install cisco.csdac
cd ~/.ansible/collections/ansible_collections/cisco/csdac
ansible-playbook default_playbook.yml --ask-become-pass --extra-vars
"csdac_certificate_domain=domain.example.com csdac_certificate_country_name=US
csdac_certificate_organization_name=Cisco
csdac_certificate_organization_unit_name=Engineering"
```

After you create the certificate, import it into the web browser you'll use to access the connector. The certificate is created in the `~/csdac/app/config/certs` directory.

View the installation log

The installation log is located as follows:

```
~/.ansible/collections/ansible_collections/cisco/csdac/logs/csdac.log
```

Use your certificate to connect to the dynamic attributes connector

If you have a certificate and key, put them in the `~/csdac/app/config/certs` directory on your virtual machine.

After you perform the preceding task, restart the dynamic attributes connector's Docker container by entering the following command:

```
docker restart muster-ui
```

Log in to the connector

1. Access the dynamic attributes connector at `https://ip-address`
2. Log in.

   The initial login is username `admin`, password `admin`. You are required to change the password the first time you log in.

Upgrade the Cisco Secure Dynamic Attributes Connector

This topic discusses how to upgrade from any earlier Cisco Secure Dynamic Attributes Connector to the current version. These tasks can be performed regardless of Cisco Secure Dynamic Attributes Connector version or operating system.

Step 1 Log in to the machine you want to upgrade.

Step 2 Enter the following commands:

```
cd ~/.ansible/collections/ansible_collections/cisco/csdac
ansible-galaxy collection install cisco.csdac --force
ansible-playbook default_playbook.yml --ask-become-pass [--extra-vars vars]
```

Syntax Description

--ask-become-pass	Prompts you to enter the **sudo** password. Required if sudo is enabled on your machine.

--extra-vars

The following optional extra variables enable the dynamic attributes connector to use a proxy. The value you use must match the value in /etc/environment, which you configured as discussed in Install Prerequisite Software, on page 6.

- **csdac_proxy_enabled=true**
- **csdac_http_proxy_url=http://***PROXY_URL*

  csdac_https_proxy_url=*PROXY_URL*

The following optional extra variables create a self-signed certificate you can use to securely connect to the dynamic attributes connector. If you omit these parameters, the dynamic attributes connector uses a default certificate.

- **csdac_certificate_domain**

  domain name for autogenerated certificate. Default value is autodetected hostname of the host (detected by ansible)

- **csdac_certificate_country_name**

  Two-letter country code. (Default is `US`)

- **csdac_certificate_organization_name**

  Organization name. (Default is `Cisco`)

- **csdac_certificate_organization_unit_name**
- Organizational unit name (Default is `Cisco`)

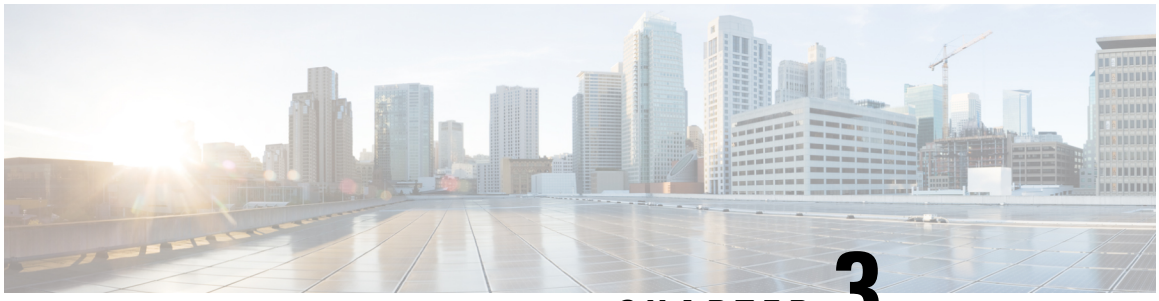
Step 3 Wait for the upgrade to complete.

Step 4 Upgrade logs are available in the following location:

```
~/.ansible/collections/ansible_collections/cisco/csdac/logs/csdac.log
```

What to do next

See Create a Connector, on page 15.



CHAPTER 3

Configure the Cisco Secure Dynamic Attributes Connector

Install the dynamic attributes connector and configure connectors, dynamic attributes filters, and adapters to provide management center with dynamic network data that can be used in access control rules.

The dynamic attributes connector enables you to configure connectors to provide the management center with dynamic network data that can be used in access control rules.

See the following topics for more information:

- Create a Connector, on page 15
- Create an Adapter, on page 30
- Create Dynamic Attributes Filters, on page 38
- Manually Get a Certificate Authority (CA) Chain, on page 41

Create a Connector

A *connector* is an interface with a cloud service. The connector retrieves network information from the cloud service so the network information can be used in access control policies on the management center.

We support the following:

Table 2: List of supported connectors by Cisco Secure Dynamic Attributes Connector version and platform

CSDAC version/platform	AWS	AWS security groups	AWS service tags	Azure	Azure Service Tags	Cisco Cyber Vision	Generic Text	GitHub	Google Cloud	Microsoft Office 365	vCenter	Webex	Zoom
Version 1.1 (on-premises)	Yes	No	No	Yes	Yes	No	No	No	No	Yes	Yes	No	No
Version 2.0 (on-premises)	Yes	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No
Version 2.2 (on-premises)	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No
Version 2.3 (on-premises)	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Secure Firewall Management Center 7.4	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

See one of the following sections for more information.

Amazon Web Services Connector—About User Permissions and Imported Data

The Cisco Secure Dynamic Attributes Connector imports dynamic attributes from AWS to the management center for use in access control policies.

Dynamic attributes imported

We import the following dynamic attributes from AWS:

- *Tags*, user-defined key-value pairs you can use to organize your AWS EC2 resources.

  For more information, see Tag your EC2 Resources in the AWS documentation

- *IP addresses* of virtual machines in AWS.

Minimum permissions required

The Cisco Secure Dynamic Attributes Connector requires a user at minimum with a policy that permits `ec2:DescribeTags`, `ec2:DescribeVpcs`, and `ec2:DescribeInstances` to be able to import dynamic attributes.

Create an AWS User with Minimal Permissions for the Cisco Secure Dynamic Attributes Connector

This task discusses how to set up a service account with minimum permissions to send dynamic attributes to the management center. For a list of these attributes, see Amazon Web Services Connector—About User Permissions and Imported Data, on page 16.

Before you begin

You must already have set up your Amazon Web Services (AWS) account. For more information about doing that, see this article in the AWS documentation.

Step 1 Log in to the AWS console as a user with the admin role.

Step 2 From the Dashboard, click **Security, Identity & Compliance** > **IAM**.

Step 3 Click **Access Management** > **Users**.

Step 4 Click **Add Users**.

Step 5 In the **User Name** field, enter a name to identify the user.

Step 6 Click **Access Key - Programmatic Access**.

Step 7 At the Set permissions page, click **Next** without granting the user access to anything; you'll do this later.

Step 8 Add tags to the user if desired.

Step 9 Click **Create User**.

Step 10 Click **Download .csv** to download the user's key to your computer.

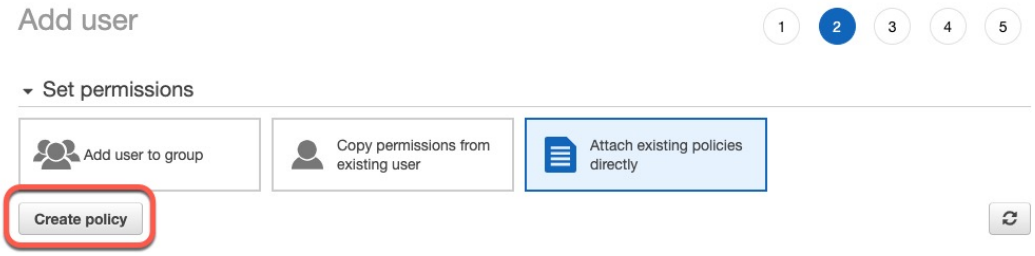
Note This is the only opportunity you have to retrieve the user's key.

Step 11 Click **Close**.

Step 12 At the Identity and Access Management (IAM) page in the left column, click **Access Management** > **Policies**.

Step 13 Click **Create Policy**.

Step 14 On the Create Policy page, click **JSON**.



Step 15 Enter the following policy in the field:

```
{
 "Version": "2012-10-17",
 "Statement": [
  {
   "Effect": "Allow",
   "Action": [
    "ec2:DescribeTags",
    "ec2:DescribeInstances",
    "ec2:DescribeVpcs"
   ],
   "Resource": "*"
  }
 ]
}
```

Step 16 Click **Next**.

Step 17 Click **Review**.

Step 18 On the Review Policy page, enter the requested information and click **Create Policy**.

Step 19 On the Policies page, enter all or part of the policy name in the search field and press Enter.

Step 20 Click the policy you just created.

Step 21 Click **Actions** > **Attach**.

Step 22 If necessary, enter all or part of the user name in the search field and press Enter.

Step 23 Click **Attach Policy**.

What to do next

Create an AWS Connector, on page 17.

Create an AWS Connector

This task discusses how to configure a connector that sends data from AWS to the management center for use in access control policies.

Before you begin

Create a user with at least the privileges discussed in Create an AWS User with Minimal Permissions for the Cisco Secure Dynamic Attributes Connector, on page 16.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Connectors**.

Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a name to uniquely identify this connector.
Description	Optional description.
Pull Interval	(Default 30 seconds.) Interval at which IP mappings are retrieved from AWS.
Region	(Required.) Enter your AWS region code.
Access Key	(Required.) Enter your access key.
Secret Key	(Required.) Enter your secret key.

Step 5 Click **Test** and make sure the test succeeds before you save the connector.

Step 6 Click **Save**.

Step 7 Make sure **Ok** is displayed in the Status column.

Azure Connector—About User Permissions and Imported Data

The Cisco Secure Dynamic Attributes Connector imports dynamic attributes from Azure to the management center for use in access control policies.

Dynamic attributes imported

We import the following dynamic attributes from Azure:

- *Tags*, key-value pairs associated with resources, resource groups, and subscriptions.

  For more information, see this page in the Microsoft documentation.

- *IP addresses* of virtual machines in Azure.

Minimum permissions required

The Cisco Secure Dynamic Attributes Connector requires a user at minimum with the **Reader** permission to be able to import dynamic attributes.

Create an Azure User with Minimal Permissions for the Cisco Secure Dynamic Attributes Connector

This task discusses how to set up a service account with minimum permissions to send dynamic attributes to the management center. For a list of these attributes, see Azure Connector—About User Permissions and Imported Data, on page 18.

Before you begin

You must already have a Microsoft Azure account. To set one up, see this page on the Azure documentation site.

Step 1 Log in to the Azure Portal as the owner of the subscription.

Step 2 Click **Azure Active Directory**.

Step 3 Find the instance of Azure Active Directory for the application you want to set up.

Step 4 Click **Add** > **App registration**.

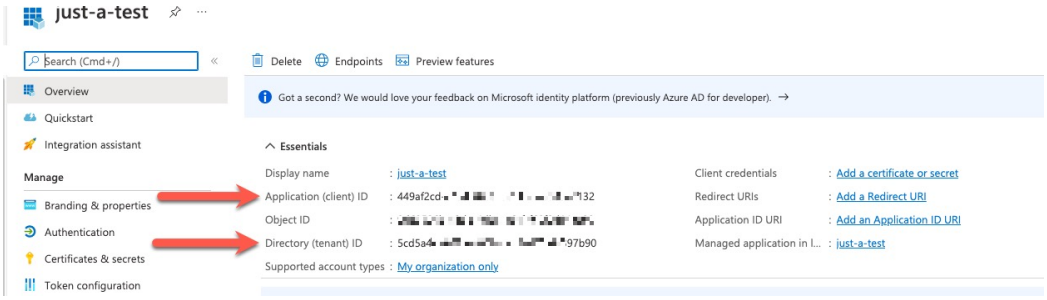
Step 5 In the **Name** field, enter a name to identify this application.

Step 6 Enter other information on this page as required by your organization.

Step 7 Click **Register**.

Step 8 On the next page, make note of the Client ID (also referred to as *application ID*) and the tenant ID (also referred to as the *directory ID*).

A sample follows.

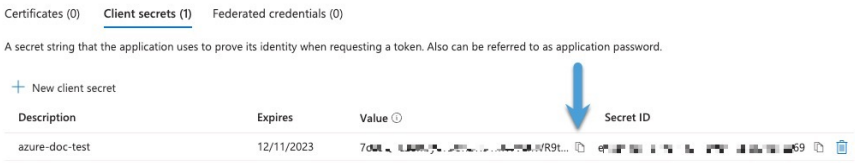


Step 9 Next to Client Credentials, click **Add a certificate or secret**.

Step 10 Click **New Client Secret**.

Step 11 Enter the requested information and click **Add**.

Step 12 Copy the value of the **Value** field to the clipboard. This value, *and not the **Secret ID***, is the client secret.



Step 13 Go back to the main Azure Portal page and click **Subscriptions**.

Step 14 Click the name of your subscription.

Step 15 Copy the subscription ID to the clipboard.

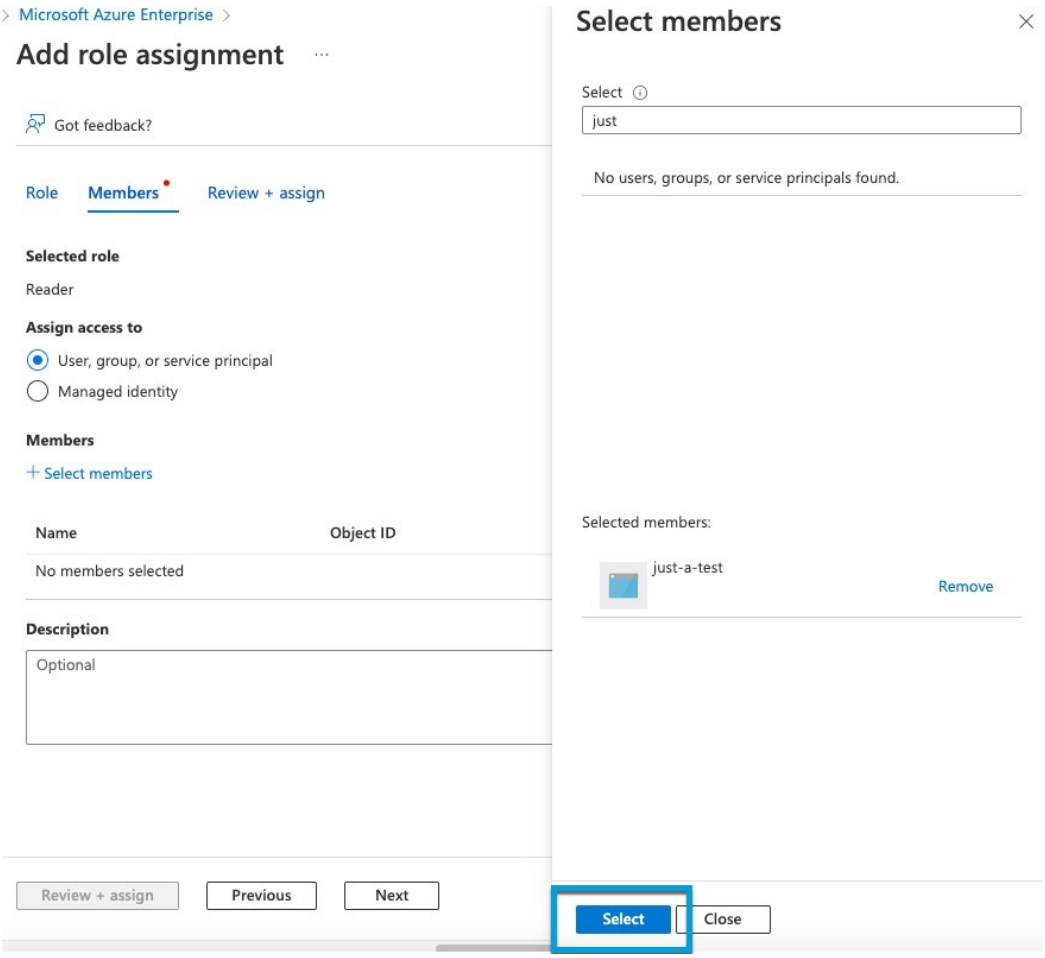
Step 16 Click **Access Control (IAM)**.

Step 17 Click **Add** > **Add role assignment**.

Step 18 Click **Reader** and click **Next**.

Step 19 Click **Select Members**.

Step 20 On the right side of the page, click the name of the app you registered and click **Select**.



Step 21 Click **Review + Assign** and follow the prompts to complete the action.

What to do next

See Create an Azure Connector, on page 21.

Create an Azure Connector

This task discusses how to create a connector to send data from Azure to management center for use in access control policies.

Before you begin

Create an Azure user with at least the privileges discussed in Create an Azure User with Minimal Permissions for the Cisco Secure Dynamic Attributes Connector, on page 19.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Connectors**.

Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a name to uniquely identify this connector.
Description	Optional description.
Pull Interval	(Default 30 seconds.) Interval at which IP mappings are retrieved from Azure.
Subscription Id	(Required.) Enter your Azure subscription ID.
Tenant Id	(Required.) Enter your tenant ID.
Client Id	(Required.) Enter your client ID.
Client Secret	(Required.) Enter your client secret.

Step 5 Click **Test** and make sure **Test connection succeeded** is displayed before you save the connector.

Step 6 Click **Save**.

Step 7 Make sure **Ok** is displayed in the Status column.

Create an Azure Service Tags Connector

This topic discusses how to create a connector for Azure service tags to the management center for use in access control policies. The IP addresses associated with these tags are updated every week by Microsoft.

For more information, see Virtual network service tags on Microsoft TechNet.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Connectors**.

Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a name to uniquely identify this connector.
Description	Optional description.
Pull Interval	(Default 30 seconds.) Interval at which IP mappings are retrieved from Azure.
Subscription Id	(Required.) Enter your Azure subscription ID.
Tenant Id	(Required.) Enter your tenant ID.
Client Id	(Required.) Enter your client ID.
Client Secret	(Required.) Enter your client secret.

Step 5 Click **Test** and make sure **Test connection succeeded** is displayed before you save the connector.

Step 6 Click **Save**.

Step 7 Make sure **Ok** is displayed in the Status column.

Create a GitHub Connector

This section discusses how to create a GitHub connector that sends data to the management center for use in access control policies. The IP addresses associated with these tags are maintained by GitHub. You do not have to create a dynamic attributes filters.

For more information, see About GitHub's IP addresses.

Note Do not change the URL because doing so will fail to retrieve any IP addresses.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Connectors**.

Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter a **Name** and an optional description.

Step 5 (Optional.) In the **Pull Interval** field, change the frequency, in seconds, at which the dynamic attributes connector retrieves IP addresses from GitHub. The default is 21,600 seconds (6 hours).

Step 6 Click **Test** and make sure the test succeeds before you save the connector.

Step 7 Click **Save**.

Step 8 Make sure **Ok** is displayed in the Status column.

Google Cloud Connector—About User Permissions and Imported Data

The Cisco Secure Dynamic Attributes Connector imports dynamic attributes from Google Cloud to the management center for use in access control policies.

Dynamic attributes imported

We import the following dynamic attributes from Google Cloud:

- *Labels*, key-value pairs you can use to organize your Google Cloud resources.

  For more information, see Creating and Managing Labels in the Google Cloud documentation.

- *Network tags*, key-value pairs associated with an organization, folder, or project.

  For more information, see Creating and Managing Tags in the Google Cloud documentation.

- *IP addresses* of virtual machines in Google Cloud.

Minimum permissions required

The Cisco Secure Dynamic Attributes Connector requires a user at minimum with the **Basic** > **Viewer** permission to be able to import dynamic attributes.

Create a Google Cloud User with Minimal Permissions for the Cisco Secure Dynamic Attributes Connector

This task discusses how to set up a service account with minimum permissions to send dynamic attributes to the management center. For a list of these attributes, see Google Cloud Connector—About User Permissions and Imported Data, on page 23.

Before you begin

You must already have set up your Google Cloud account. For more information about doing that, see Setting Up Your Environment in the Google Cloud documentation.

Step 1 Log in to your Google Cloud account as a user with the owner role.

Step 2 Click **IAM & Admin** > **Service Accounts** > **Create Service Account**.

Step 3 Enter the following information:

- **Service account name**: A name to identify this account; for example, `CSDAC`.
- **Service account ID**: Should be populated with a unique value after you enter the service account name.

- **Service account description**: Enter an optional description.

For more information about service accounts, see Understanding Service Accounts in the Google Cloud documentation.

Step 4 Click **Create and Continue**.

Step 5 Follow the prompts on your screen until the Grant users access to this service account section is displayed.

Step 6 Grant the user the **Basic** > **Viewer** role.

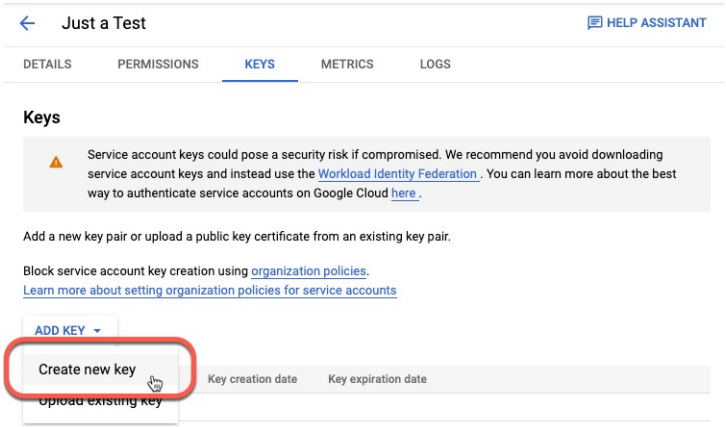
Step 7 Click **Done**.

A list of service accounts is displayed.

Step 8 Click **More** (⋮) at the end of the row of the service account you created.

Step 9 Click **Manage Keys**.

Step 10 Click **Add Key** > **Create New Key**.



Step 11 Click **JSON**.

Step 12 Click **Create**.

The JSON key is downloaded to your computer.

Step 13 Keep the key handy when you configure the GCP connector.

What to do next

See Create a Google Cloud Connector, on page 24.

Create a Google Cloud Connector

Before you begin

Have your Google Cloud JSON-formatted service account data ready; it's required to set up the connector.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Connectors**.

Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a name to uniquely identify this connector.
Description	Optional description.
Pull Interval	(Default 30 seconds.) Interval at which IP mappings are retrieved from AWS.
GCP region	(Required.) Enter the GCP region in which your Google Cloud is located. For more information, see Regions and Zones in the Google Cloud documentation.
Service account	Paste the JSON code for your Google Cloud service account.

Step 5 Click **Test** and make sure the test succeeds before you save the connector.

Step 6 Click **Save**.

Step 7 Make sure **Ok** is displayed in the Status column.

Create an Office 365 Connector

This task discusses how to create a connector for Office 365 tags to send data to the management center for use in access control policies. The IP addresses associated with these tags are updated every week by Microsoft. You do not have to create a dynamic attributes filter to use the data.

For more information, see Office 365 URLs and IP address ranges on docs.microsoft.com.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Connectors**.

Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a name to uniquely identify this connector.
Description	Optional description.

Value	Description
Pull Interval	(Default 30 seconds.) Interval at which IP mappings are retrieved from Azure.
Base API URL	(Required.) Enter the URL from which to retrieve Office 365 information, if it's different from the default. For more information, see Office 365 IP Address and URL web service on the Microsoft documentation site.
Instance name	(Required.) From the list, click an instance name. For more information, see Office 365 IP Address and URL web service on the Microsoft documentation site.
Disable optional IPs	(Required.) Enter **true** or **false**.

Step 5 Click **Test** and make sure the test succeeds before you save the connector.

Step 6 Click **Save**.

Step 7 Make sure **Ok** is displayed in the Status column.

vCenter Connector—About User Permissions and Imported Data

The Cisco Secure Dynamic Attributes Connector imports dynamic attributes from vCenter to the management center for use in access control policies.

Dynamic attributes imported

We import the following dynamic attributes from vCenter:

- *Operating system*
- *MAC address*
- *IP addresses*
- *NSX tags*

Minimum permissions required

The Cisco Secure Dynamic Attributes Connector requires a user at minimum with the **Read Only** permission to be able to import dynamic attributes.

Create a vCenter Connector

This task discusses how to create a connector for VMware vCenter to send data to the management center for use in access control policies.

Before you begin

If you use non-trusted certificates to communicate with vCenter, see Manually Get a Certificate Authority (CA) Chain, on page 35.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Connectors**.

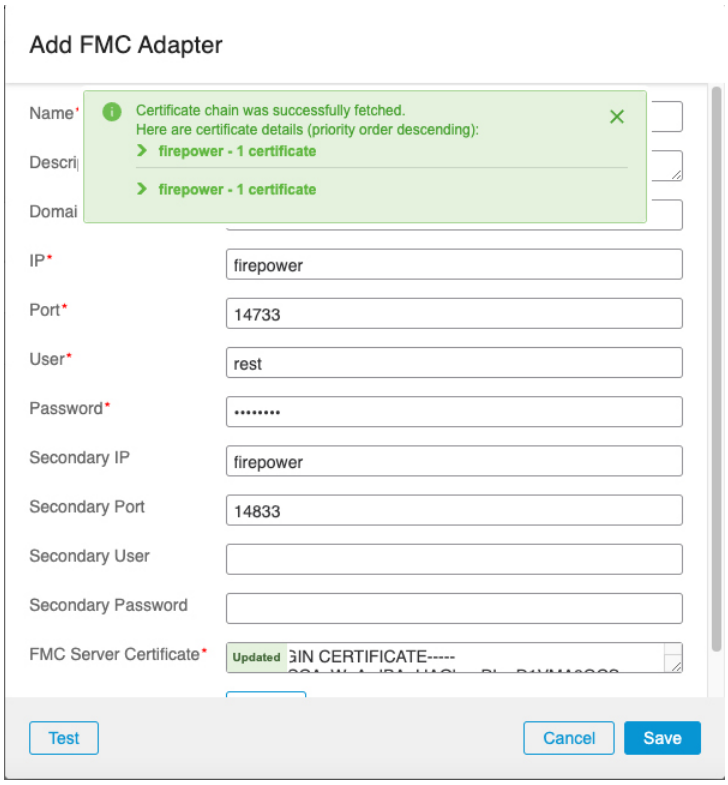
Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a name to uniquely identify this connector.
Description	Enter an optional description.
Pull Interval	(Default 30 seconds.) Interval at which IP mappings are retrieved from vCenter.
Host	(Required.) Enter any of the following: • vCenter's fully qualified host name • vCenter's IP address • (Optional.) A port *Do not* enter a scheme (such as **`https://`**) or trailing slash. For example, **`myvcenter.example.com`** or **`192.0.2.100:9090`**
User	(Required.) Enter the user name of a user with the Read-only role at minimum. User names are case-sensitive.
Password	(Required.) Enter the user's password.
NSX IP	If you use vCenter Network Security Visualization (NSX), enter its IP address.
NSX User	Enter the user name of an NSX user with the Auditor role at minimum.
NSX Type	Enter **NSX-T**.
NSX Password	Enter the NSX user's password.
vCenter Certificate	You have the following options: • Click **Get Certificate** > **Fetch** to automatically fetch the certificate or, if that is not possible, get the certificate manually as discussed in Manually Get a Certificate Authority (CA) Chain, on page 35. • Click **Get Certificate** > **Browse from file** to upload a certificate chain you downloaded previously.

Following is an example of successfully fetching a certificate chain:



Expanding the certificate CA chain at the top of the dialog box displays the certificates similar to the following.

If it's not possible to fetch the certificate this way, you can get the certificate chain manually as discussed in Manually Get a Certificate Authority (CA) Chain, on page 35.

Step 5 Click **Test** and make sure **Test connection succeeded** is displayed before you save the connector.

Step 6 Click **Save**.

Create a Webex Connector

This section discusses how to create a Webex connector that sends data to the management centerfor use in access control policies. The IP addresses associated with these tags are maintained by Webex. You do not have to create a dynamic attributes filters.

For more information, see Port Reference for Webex Calling.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Connectors**.

Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a name to uniquely identify this connector.
Description	Optional description.
Pull Interval	(Default 30 seconds.) Interval at which IP mappings are retrieved from Webex.
Provider Reserved IPs	(Required.) (Required.) Slide to enabled to retrieve any reserved IP addresses.

Step 5 Click **Test** and make sure the test succeeds before you save the connector.

Step 6 Click **Save**.

Step 7 Make sure **Ok** is displayed in the Status column.

Create a Zoom Connector

This section discusses how to create a Zoom connector that sends data to the management centerfor use in access control policies. The IP addresses associated with these tags are maintained by Zoom. You do not have to create a dynamic attributes filters.

For more information, see Zoom network firewall or proxy server settings.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Connectors**.

Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a name to uniquely identify this connector.
Description	Optional description.
Pull Interval	(Default 30 seconds.) Interval at which IP mappings are retrieved from Zoom.

Value	Description
Provider Reserved IPs	(Required.) Slide to enabled to retrieve any reserved IP addresses.

Step 5 Click **Test** and make sure the test succeeds before you save the connector.

Step 6 Click **Save**.

Step 7 Make sure **Ok** is displayed in the Status column.

Create an Adapter

An *adapter* is a secure connection to management center to which you push network information from cloud objects for use in access control policies.

First you can optionally fetch the certificate authority chain, which is required to securely connect to the management center.

Fetching the certificate authority chain requires only the management center host name; creating the adapter requires a user name, password, and other information.

Create a Secure Firewall Management Center User for the Dynamic Attributes Connector

We recommend you create a dedicated management center user for the dynamic attributes connector adapter. Creating a dedicated management center user avoids issues like unexpected logouts from the management center because the dynamic attributes connector periodically logs in using a REST API to update the management center with new and updated dynamic objects.

The management center user must have Access Admin privileges at least.

Step 1 Log in to the management center if you haven't already done so.

Step 2 Click **System** (⚙) > **Users**.

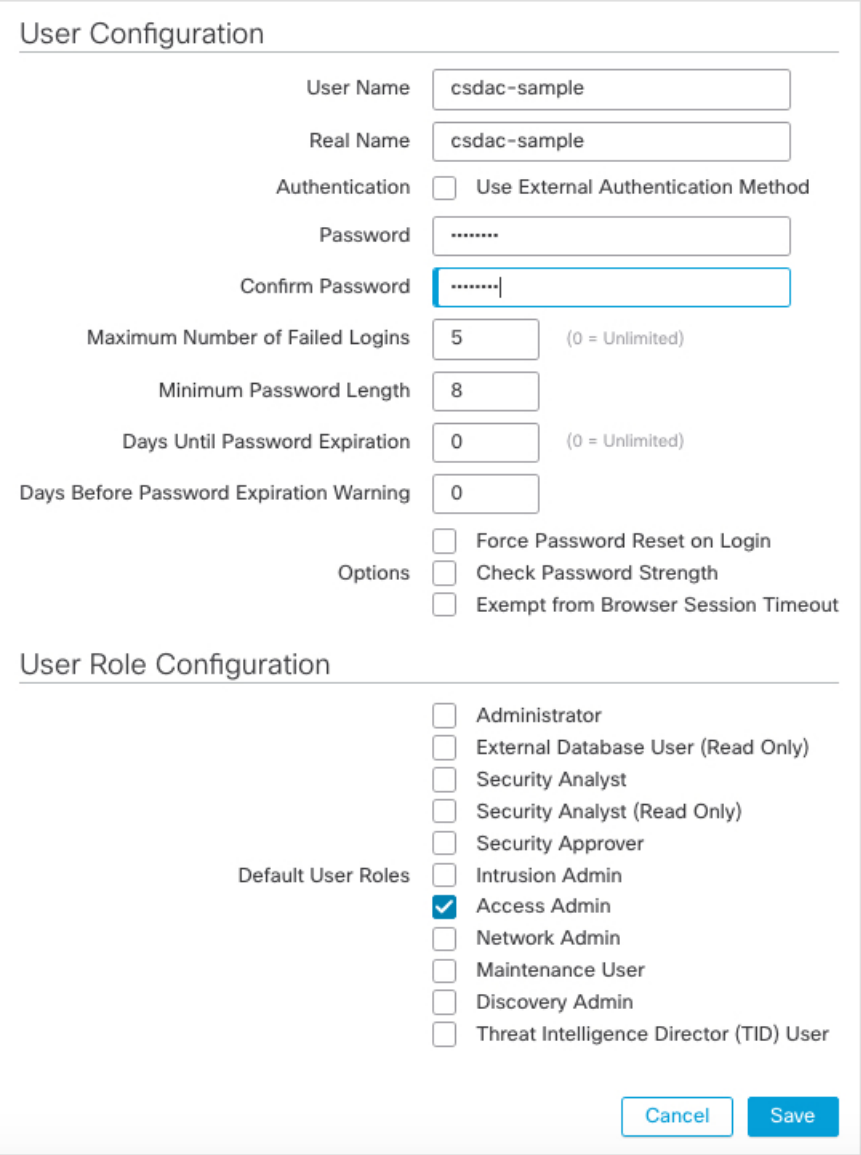
Step 3 Click **Create User**.

Step 4 Enter the information required to create the user.

Step 5 Under User Role Configuration, check any of the following default roles or a custom role with the same privilege level:

- **Administrator**
- **Access Admin**
- **Network Admin**

The following figure shows an example.



You can also choose a custom role with sufficient privileges to allow REST actions or a different default role with sufficient privileges. For more information about default roles, see the User Roles section in the chapter on user accounts.

What to do next

Create an Adapter, on page 30

How to Create an On-Prem Firewall Management Center Adapter

This topic discusses how to create an adapter to push dynamic objects from the dynamic attributes connector to the management center.

Before you begin

See Create a Secure Firewall Management Center User for the Dynamic Attributes Connector, on page 30.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Adapters**.

Step 3 Do any of the following:

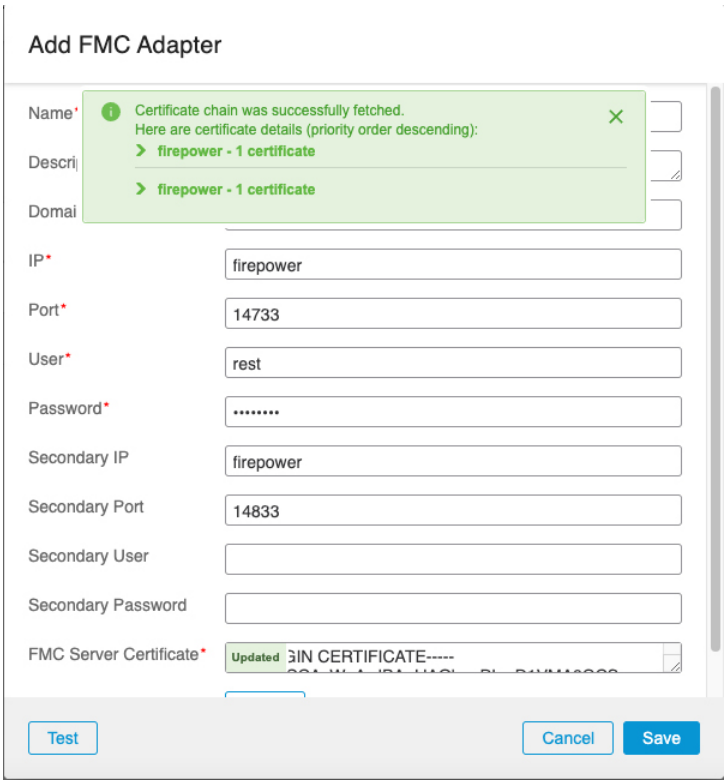
- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a unique name to identify this adapter.
Description	Optional description of the adapter.
Domain	Enter the Secure Firewall Management Center Virtual domain in which to create dynamic objects. Leave the field blank to create dynamic objects in the Global domain. For example, `Global/MySubdomain`
IP	(Required.) Enter your Secure Firewall Management Center Virtual's host name or IP address. The host name or IP you enter must exactly match the Common Name of the CA certificate used to securely connect to it.
Port	(Required.) Enter the TLS port used by your Secure Firewall Management Center Virtual.
User	(Required.) Enter the name of an Secure Firewall Management Center Virtual user with the Network Admin role at minimum.
Password	(Required.) Enter the user's password.
Secondary IP	(High availability only.) Enter the secondary Secure Firewall Management Center Virtuals host name or IP address. The host name or IP you enter must exactly match the Common Name of the CA certificate used to securely connect to it.
Secondary Port	(High availability only.) Enter the TLS port used by your secondary Secure Firewall Management Center Virtual.
Secondary User	(High availability only.) Enter the name of a secondary Secure Firewall Management Center Virtual user with the Network Admin role at minimum.
Secondary Password	(High availability only.) Enter the user's password.

Value	Description
Server Certificate	You have the following options: • Click **Get Certificate** > **Fetch** to automatically fetch the certificate or, if that is not possible, get the certificate manually as discussed in Manually Get a Certificate Authority (CA) Chain, on page 35. • Click **Get Certificate** > **Browse from file** to upload a certificate chain you downloaded previously.

Following is an example of successfully fetching a certificate chain:



Expanding the certificate CA chain at the top of the dialog box displays the certificates similar to the following.

If it's not possible to fetch the certificate this way, you can get the certificate chain manually as discussed in Manually Get a Certificate Authority (CA) Chain, on page 35.

Step 5 Click **Test** and make sure the test succeeds before you save the adapter.

Step 6 Click **Save**.

Create a Cloud-delivered Firewall Management Center Adapter

This topic discusses how to create an adapter to push dynamic objects from the dynamic attributes connector to a managed management center on the Cisco Defense Orchestrator.

Before you can create a Cloud-delivered Firewall Management Center, get the following information first: Get Your Base URL and API Token, on page 34.

Get Your Base URL and API Token

This task dicusses how to get the URL and API token from CDO that are required to create a Cloud-delivered Firewall Management Center adapter.

Before you begin

You must be a CDO Super Admin to complete the tasks discussed in this section.

Step 1 Log in to CDO as a user with the Super Admin role.

Step 2 In the upper right corner of the page, click **Settings**.

Step 3 Click **General Settings**.

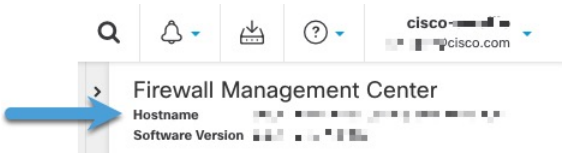
Step 4 Next to API Token, click **Refresh**.

Step 5 Copy the API token to a text file for later use.

Step 6 Click **Tools & Services** > **Firewall Management Center**.

Step 7 Click the name of the management center to which to send dynamic attributes connector data.

Step 8 The value of **Hostname**, preceded by **https://**, is the base URL.
An example follows:



What to do next

How to Create a Cloud-delivered Firewall Management Center Adapter, on page 34.

How to Create a Cloud-delivered Firewall Management Center Adapter

This task discusses how to create a Cloud-delivered Firewall Management Center adpater that sends data from the dynamic attributes connector to a device managed by CDO.

Before you begin

You must get the management center base URL and API token from CDO before you can complete this task. For more information, see Get Your Base URL and API Token, on page 34.

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Adapters**.

Step 3 Do any of the following:

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 Enter the following information.

Value	Description
Name	(Required.) Enter a unique name to identify this adapter.
Description	Optional description of the adapter.
Base Url	(Required.) Use the Base URL you found in Get Your Base URL and API Token, on page 34.
API Token	(Required.) Use the API token you found in Get Your Base URL and API Token, on page 34.

Step 5 Click **Test** and make sure the test succeeds before you save the adapter.

Step 6 Click **Save**.

What to do next

Create Dynamic Attributes Filters, on page 38.

Manually Get a Certificate Authority (CA) Chain

In the event you cannot automatically fetch the certificate authority chain, use one of the following browser-specific procedures to get a certificate chain used to connect securely to vCenter, NSX, or the Management Center.

The *certificate chain* is the root certificate and all subordinate certificates.

You must use one of these procedures to connect to the following:

- vCenter or NSX

  It is not necessary to get a certificate chain for connecting to Azure or AWS.

- Management Center

Before you use this procedure, see the section on automatically fetching the certificate authority chain in:

- Create a vCenter Connector, on page 26

Get a Certificate Chain—Mac (Chrome and Firefox)

Use this procedure to get a certificate chain using the Chrome and Firefox browsers on Mac OS.

1. Open a Terminal window.

2. Enter the following command.

   ```
   security verify-cert -P url[:port]
   ```

   where url is the URL (including scheme) to vCenter or Management Center. For example:

   ```
   security verify-cert -P https://myvcenter.example.com
   ```

   If you access vCenter or the management center using NAT or PAT, you can add a port as follows:

   ```
   security verify-cert -P https://myvcenter.example.com:12345
   ```

3. Save the entire certificate chain to a plaintext file.
   - *Include* all `-----BEGIN CERTIFICATE-----` and `-----END CERTIFICATE-----` delimiters.
   - *Exclude* any extraneous text (for example, the name of the certificate and any text contained in angle brackets (< and >) as well as the angle brackets themselves.

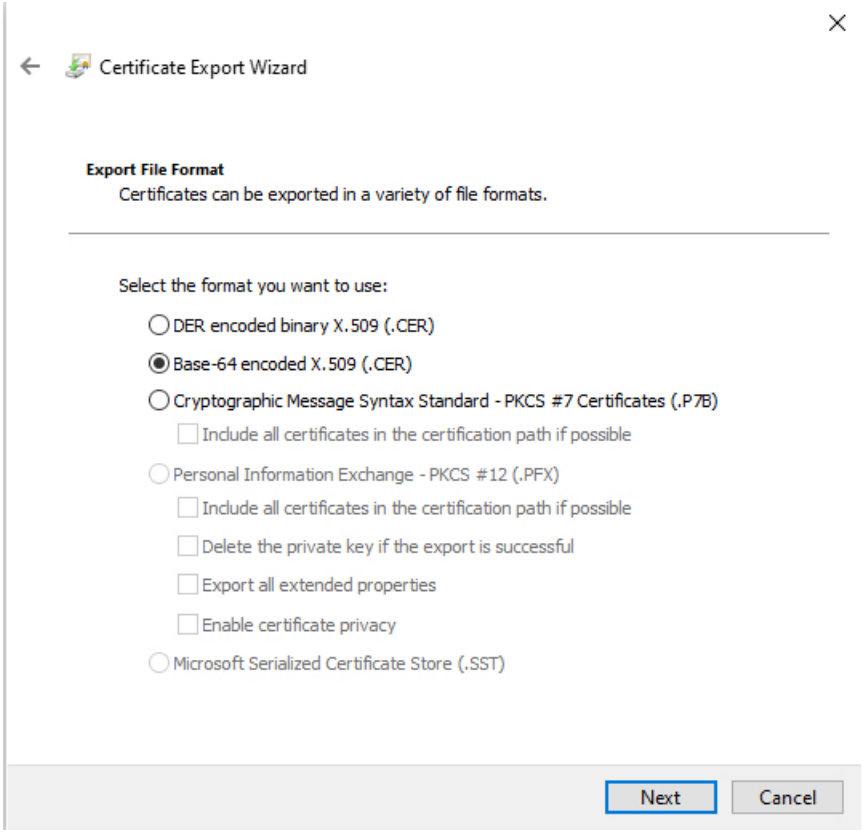
4. Repeat these tasks for both vCenter and the Management Center.

Get a Certificate Chain—Windows Chrome

Use this procedure to get a certificate chain using the Chrome browser on Windows.

1. Log in to vCenter or the Management Center using Chrome.
2. In the browser address bar, click the lock to the left of the host name.
3. Click **Certificate**.
4. Click the **Certification Path** tab.
5. Click the top (that is, first) certificate in the chain.
6. Click **View Certificate**.
7. Click the **Details** tab.
8. Click **Copy to File**.
9. Follow the prompts to create a CER-formatted certificate file that includes the entire certificate chain.

   When you're prompted to choose an export file format, click **Base 64-Encoded X.509 (.CER)** as the following figure shows.



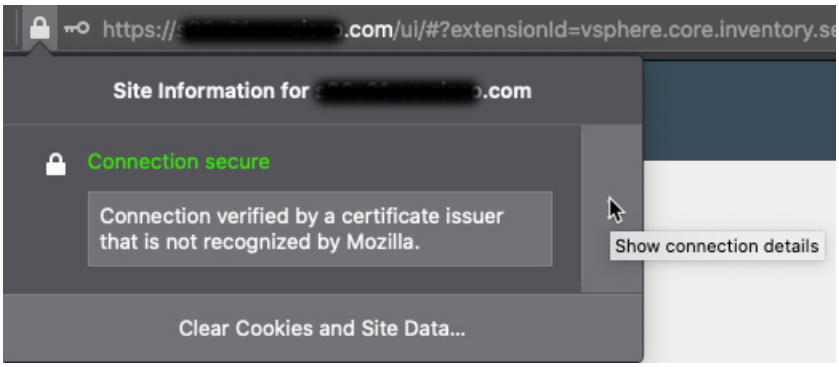
10. Follow the prompts to complete the export.
11. Open the certificate in a text editor.
12. Repeat the process for all certificates in the chain.

    You must paste each certificate in the text editor in order, first to last.
13. Repeat these tasks for both vCenter and the FMC.

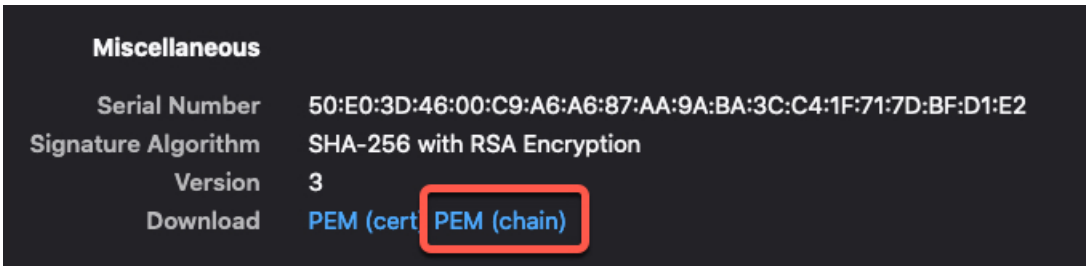
Get a Certificate Chain—Windows Firefox

Use the following procedure to get a certificate chain for the Firefox browser on either Windows or Mac OS.

1. Log in to vCenter or the Management Center using Firefox.
2. Click the lock to the left of the host name.
3. Click the right arrow (**Show connection details**). The following figure shows an example.



4. Click **More Information**.
5. Click **View Certificate**.
6. If the resulting dialog box has tab pages, click the tab page corresponding to the top-level CA.
7. Scroll to the Miscellaneous section.
8. Click **PEM (chain)** in the Download row. The following figure shows an example.



9. Save the file.
10. Repeat these tasks for both vCenter and the Management Center.

Create Dynamic Attributes Filters

Dynamic attributes filters that you define using the Cisco Secure Dynamic Attributes Connector are exposed in the management center as dynamic objects that can be used in access control policies. For example, you could restrict access to an AWS server for the Finance Department to only members of the Finance group defined in Microsoft Active Directory.

Note You cannot create dynamic attributes filters for GitHub, Office 365, Azure Service Tags, Webex, or Zoom. These types of cloud objects provide their own IP addresses.

For more information about access control rules, see Create Access Control Rules Using Dynamic Attributes Filters, on page 45.

Before you begin

Create a Connector, on page 15

Step 1 Log in to the dynamic attributes connector.

Step 2 Click **Dynamic Attributes Filters**.

- Add a new connector: click Add icon (), then click the name of the connector.
- Edit or delete a connector: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 3 Enter the following information.

Item	Description
Name	Unique name to identify the dynamic filter (as a dynamic object) in access control policy and in the management center Object Manager (**External Attributes** > **Dynamic Object**).
Connector	From the list, click the name of a connector to use.
Query	• Add a new filter: click Add icon (). • Edit or delete a filter: Click **More** (), then click **Edit** or **Delete** at the end of the row.

Step 4 To add or edit a query, enter the following information.

Item	Description
Key	Click a key from the list. Keys are fetched from the connector.
Operation	Click one of the following: • **Equals** to exactly match the key to the value. • **Contains** to match the key to the value if any part of the value matches.
Values	Click either **Any** or **All** and click one or more values from the list. Click **Add another value** to add values to your query.

Step 5 Click **Show Preview** to display a list of networks or IP addresses returned by your query.

Step 6 When you're finished, click **Save**.

Step 7 (Optional.) Verify the dynamic object in the management center.

a) Log in to the management center as a user with the Network Admin role at minimum.
b) Click **Objects** > **Object Management**.
c) In the left pane, click **External Attributes** > **Dynamic Object**.

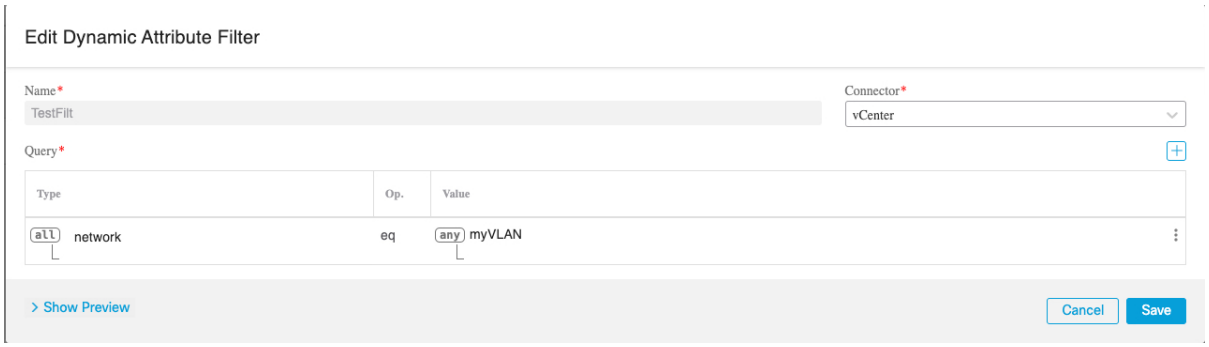
The dynamic attribute query you created should be displayed as a dynamic object.

Dynamic Attribute Filter Examples

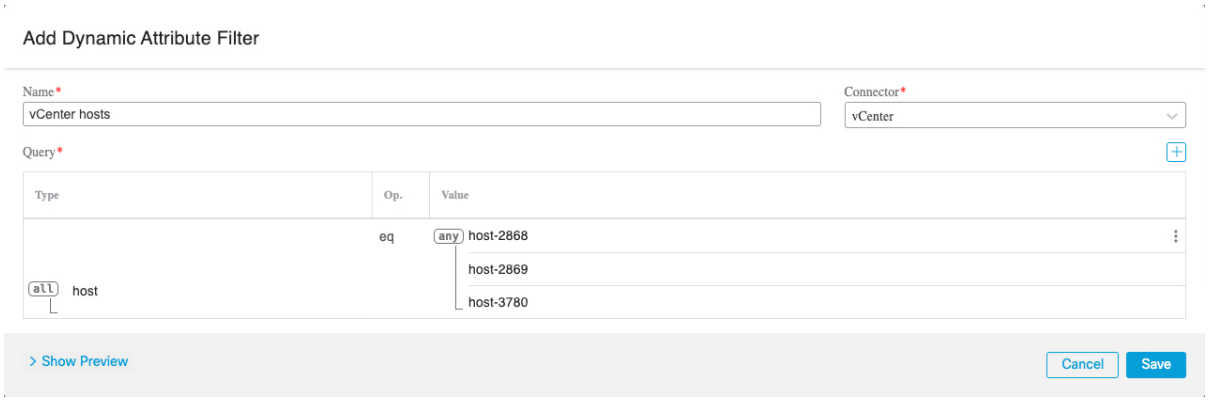
This topic provides some examples of setting up dynamic attribute filters.

Examples: vCenter

The following example shows one criterion: a VLAN.

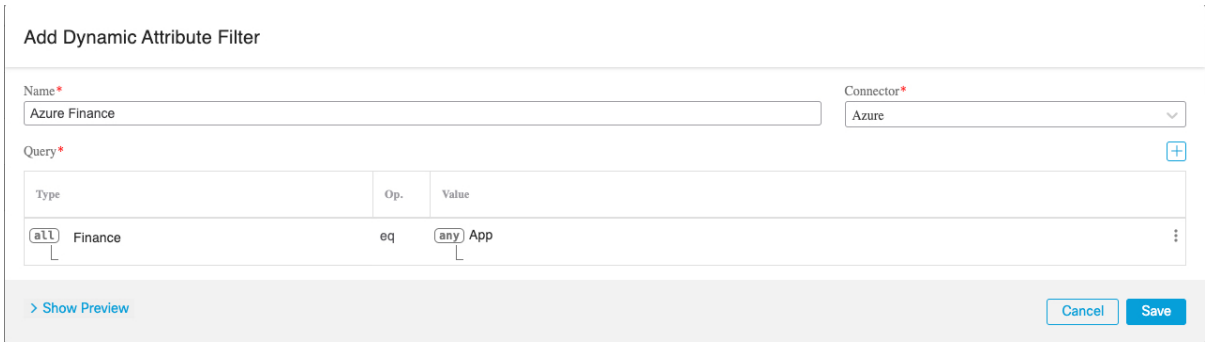


The following example shows three criteria that are joined with OR: the query matches any of three hosts.



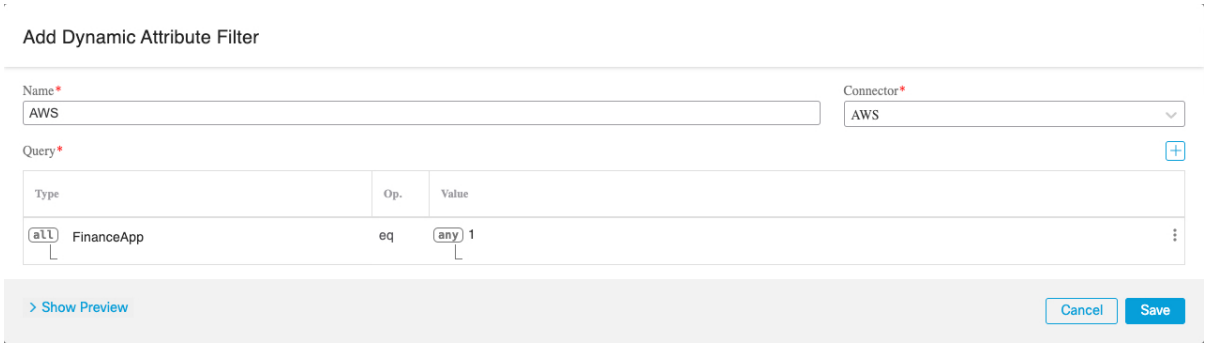
Example: Azure

The following example shows one criterion: a server tagged as a Finance app.



Example: AWS

The following example shows one criterion: a FinanceApp with a value of 1.



Manually Get a Certificate Authority (CA) Chain

In the event you cannot automatically fetch the certificate authority chain, use one of the following browser-specific procedures to get a certificate chain used to connect securely to vCenter, NSX, or the Management Center.

The *certificate chain* is the root certificate and all subordinate certificates.

You must use one of these procedures to connect to the following:

- vCenter or NSX

  It is not necessary to get a certificate chain for connecting to Azure or AWS.

- Management Center

Before you use this procedure, see the section on automatically fetching the certificate authority chain in:

- Create a vCenter Connector, on page 26

Get a Certificate Chain—Mac (Chrome and Firefox)

Use this procedure to get a certificate chain using the Chrome and Firefox browsers on Mac OS.

1. Open a Terminal window.

2. Enter the following command.

   `security verify-cert -P url[:port]`

   where url is the URL (including scheme) to vCenter or Management Center. For example:

   `security verify-cert -P https://myvcenter.example.com`

   If you access vCenter or the management center using NAT or PAT, you can add a port as follows:

   `security verify-cert -P https://myvcenter.example.com:12345`

3. Save the entire certificate chain to a plaintext file.
   - *Include* all `-----BEGIN CERTIFICATE-----` and `-----END CERTIFICATE-----` delimiters.
   - *Exclude* any extraneous text (for example, the name of the certificate and any text contained in angle brackets (< and >) as well as the angle brackets themselves.

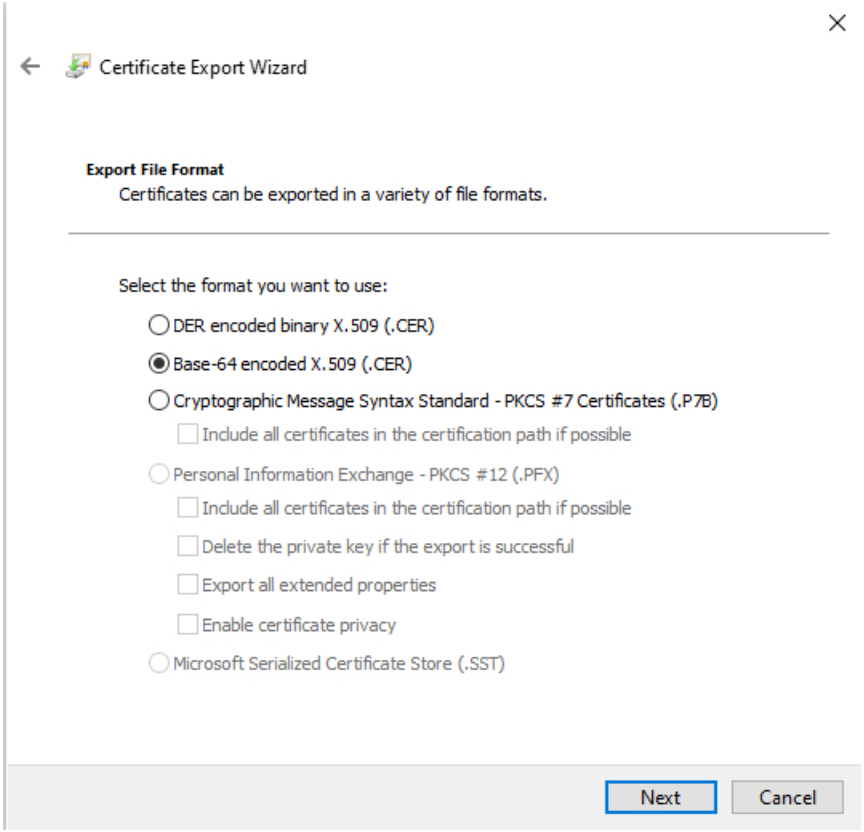
4. Repeat these tasks for both vCenter and the Management Center.

Get a Certificate Chain—Windows Chrome

Use this procedure to get a certificate chain using the Chrome browser on Windows.

1. Log in to vCenter or the Management Center using Chrome.
2. In the browser address bar, click the lock to the left of the host name.
3. Click **Certificate**.
4. Click the **Certification Path** tab.
5. Click the top (that is, first) certificate in the chain.
6. Click **View Certificate**.
7. Click the **Details** tab.
8. Click **Copy to File**.
9. Follow the prompts to create a CER-formatted certificate file that includes the entire certificate chain.

   When you're prompted to choose an export file format, click **Base 64-Encoded X.509 (.CER)** as the following figure shows.



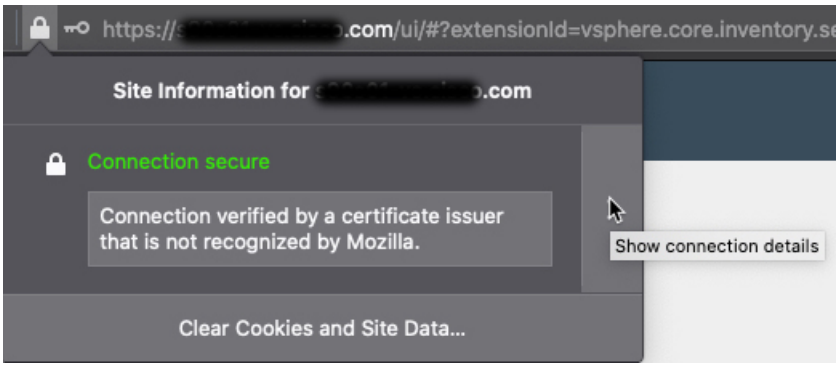
10. Follow the prompts to complete the export.
11. Open the certificate in a text editor.
12. Repeat the process for all certificates in the chain.

    You must paste each certificate in the text editor in order, first to last.
13. Repeat these tasks for both vCenter and the FMC.

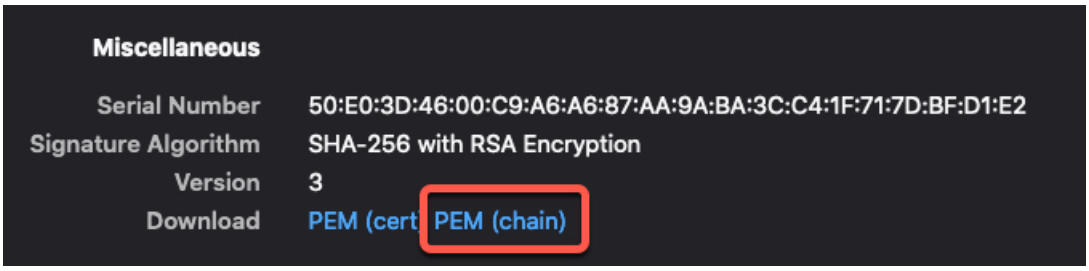
Get a Certificate Chain—Windows Firefox

Use the following procedure to get a certificate chain for the Firefox browser on either Windows or Mac OS.

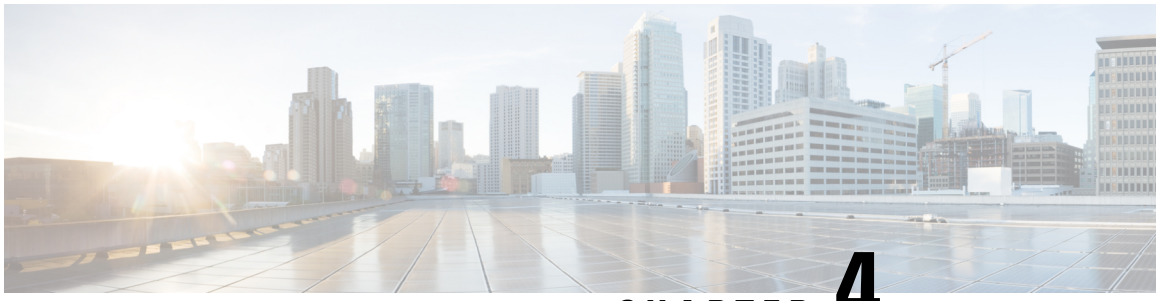
1. Log in to vCenter or the Management Center using Firefox.
2. Click the lock to the left of the host name.
3. Click the right arrow (**Show connection details**). The following figure shows an example.



4. Click **More Information**.
5. Click **View Certificate**.
6. If the resulting dialog box has tab pages, click the tab page corresponding to the top-level CA.
7. Scroll to the Miscellaneous section.
8. Click **PEM (chain)** in the Download row. The following figure shows an example.



9. Save the file.
10. Repeat these tasks for both vCenter and the Management Center.



CHAPTER 4

Use Dynamic Objects in Access Control Policies

The dynamic attributes connector enables you to configure dynamic filters, seen in the management center as dynamic objects, in access control rules.

About Dynamic Objects in Access Control Rules

A *dynamic object* is automatically pushed from the dynamic attributes connector to the Secure Firewall Manager after you create connectors and save a dynamic attributes filter on the connector.

You can use these dynamic objects on the access control rule's Dynamic Attributes tab page, similarly to the way you used Security Group Tags (SGTs). You can add dynamic objects as source or destination attributes; for example, in an access control block rule, you can add a Finance dynamic object as a destination attribute to block access to Finance servers by whatever objects match the other criteria in the rule.

Note You cannot create dynamic attributes filters for GitHub, Office 365, Azure Service Tags, Webex, or Zoom. These types of cloud objects provide their own IP addresses.

Create Access Control Rules Using Dynamic Attributes Filters

This topic discusses how to create access control rules using dynamic objects (these dynamic objects are named after the dynamic attributes filters you created previously).

Before you begin

Create dynamic attributes filters as discussed in Create Dynamic Attributes Filters, on page 38.

Note You cannot create dynamic attributes filters for GitHub, Office 365, Azure Service Tags, Webex, or Zoom. These types of cloud objects provide their own IP addresses.

Step 1 Log in to the management center.

Step 2 Click **Policies** > **Access Control**.

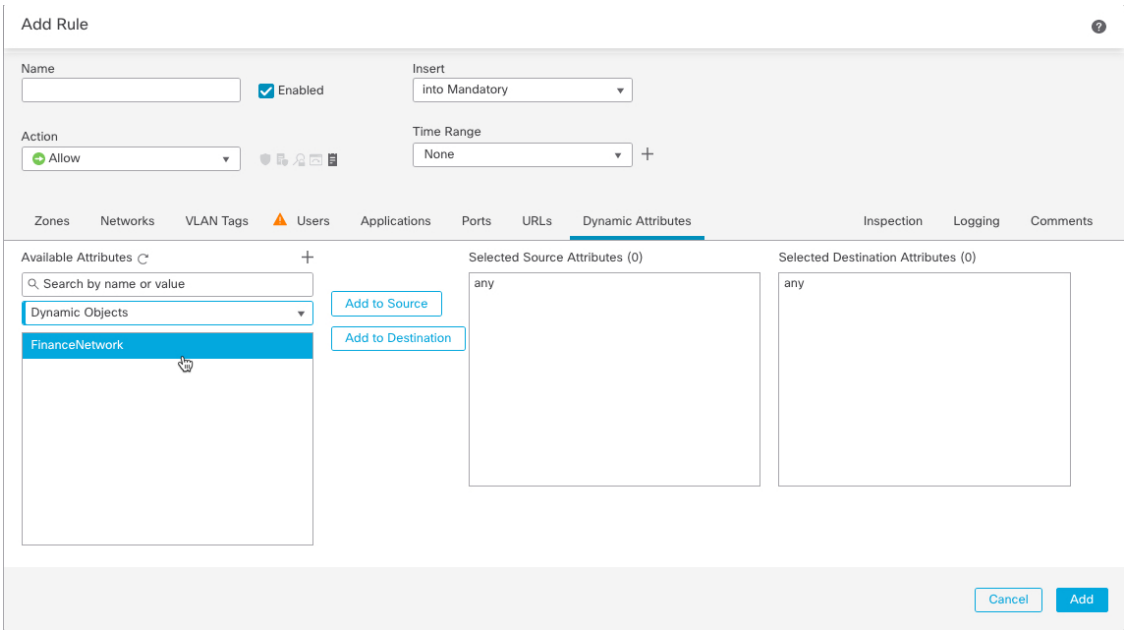
Step 3 Click **Edit** (✎) next to an access control policy.

Step 4 Click **Add Rule**.

Step 5 Click the **Dynamic Attributes** tab.

Step 6 In the Available Attributes section, from the list, click **Dynamic Objects**.

The following figure shows an example.



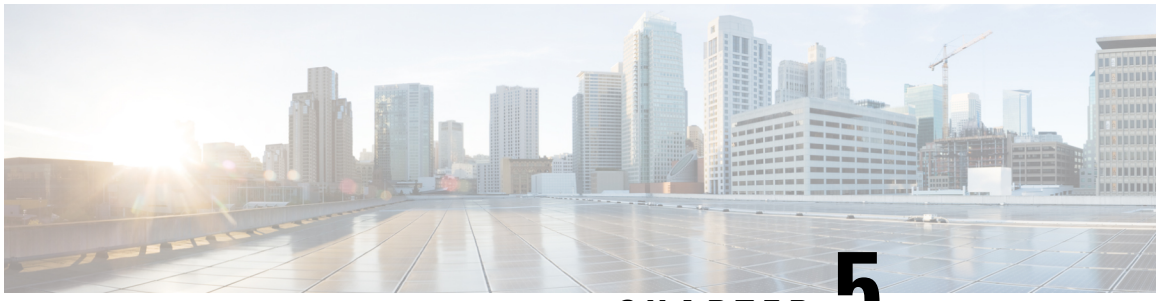
The preceding example shows a dynamic object named `FinanceNetwork` that corresponds to the dynamic attribute filter created in the Cisco Secure Dynamic Attributes Connector.

Step 7 Add the desired object to source or destination attributes.

Step 8 Add other conditions to the rule if desired.

What to do next

Access Control chapter in the *Cisco Secure Firewall Management Center Device Configuration Guide* (link to chapter)



CHAPTER 5

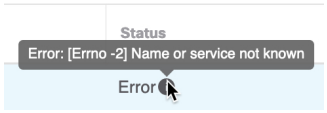
Troubleshoot the Dynamic Attributes Connector

How to troubleshoot issues with the dynamic attributes connector, including using provided tools.

Troubleshoot Error Messages

Problem: Name or service not known error

This error is displayed as a tooltip when you hover the mouse over an error condition on a connector. An example follows; yours might look different.



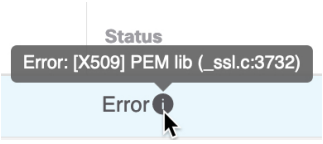
Solution: Edit the connector and check for:

- A trailing slash on a host name
- (On-Prem Firewall Management Center adapter only.) A scheme at the beginning of a host name (for example, `https://`)
- Verify the password is correct
- For an On-Prem Firewall Management Center adapter, verify the contents of the **FMC Server Certificate** field.

  For more information, see Manually Get a Certificate Authority (CA) Chain, on page 35.

Problem: [X509 PEM lib]

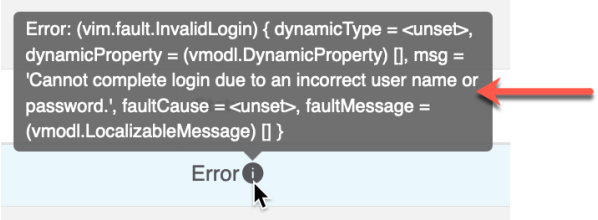
This error is displayed as a tooltip when you hover the mouse over an error condition on a connector.



Solution: Edit the connector and check the CA chain. For more information, see Manually Get a Certificate Authority (CA) Chain, on page 35.

Problem: Incorrect username or password

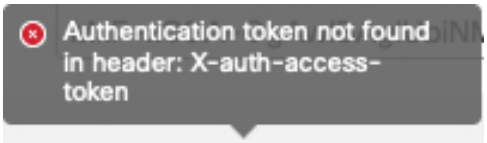
This error is displayed as a tooltip when you hover the mouse over an error condition on a connector.



Solution: Edit the connector and change the user name or password.

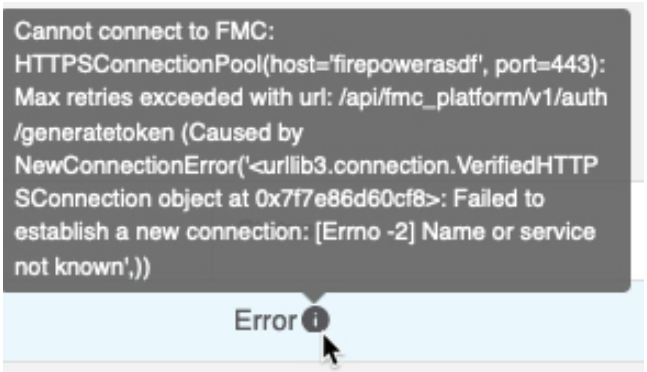
Problem: Authentication token not found in header

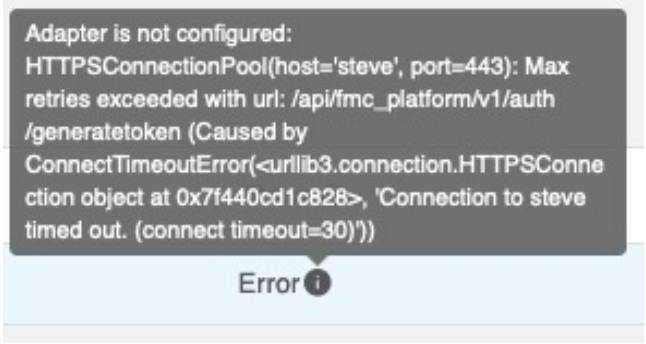
This error is displayed when you attempt to test the connection with an adapter user that does not have sufficient privileges on the management center:



Problem: Timeout or max retries error for an adapter

This error is displayed as a tooltip when you hover the mouse over an error condition on an adapter.





Solution: Do all of the following:

- Verify the management center is running and that it can be reached from the dynamic attributes connector.
- Verify the contents of the **FMC Server Certificate** field.
- Make sure the value you entered in the **IP** field exactly matches the certificate's Common Name.

For more information, see Manually Get a Certificate Authority (CA) Chain, on page 35.

Troubleshoot Using the Command Line

To assist you with advanced troubleshooting and working with Cisco TAC, we provide the following troubleshooting tools. To use these tools, log in as any user to the Ubuntu host on which the dynamic attributes connector is running.

Check container status

To check the status of the dynamic attributes connector Docker containers, enter the following commands:

```
cd ~/csdac/app
sudo ./muster-cli status
```

Sample output follows:

```
============================== CORE SERVICES ==============================
      Name                     Command                  State    Ports
-----------------------------------------------------------------------------------------------
muster-bee     ./docker-entrypoint.sh run ...   Up             50049/tcp, 50050/tcp
muster-etcd    etcd                             Up             2379/tcp, 2380/tcp

muster-ui      /docker-entrypoint.sh runs ...   Up (healthy)
0.0.0.0:443->8443/tcp,:::443->8443/tcp
muster-ui-backend   ./docker-entrypoint.sh run ...   Up             50031/tcp
========================== CONNECTORS AND ADAPTERS ==========================
           Name                          Command               State     Ports
-------------------------------------------------------------------------------
muster-adapter-fmc.1         ./docker-entrypoint.sh run ...   Up      50070/tcp
muster-connector-vcenter.1   ./docker-entrypoint.sh run ...   Up      50070/tcp
```

Stop, start, or restart the Dynamic Attributes Connector Docker containers

If the **./muster-cli status** indicates containers are down or to restart containers in the event of issues, you can enter the following commands:

Stop and restart:

```
cd ~/csdac/app
sudo ./muster-cli stop
sudo ./muster-cli start
```

Start only:

```
cd ~/csdac/app
sudo ./muster-cli start
```

Enable application debug logging and generate troubleshoot files

If advised to do so by Cisco TAC, enable debug logging and generate troubleshoot files as follows:

```
cd ~/csdac/app
sudo ./muster-cli debug-on
sudo ./muster-cli ts-gen
```

The troubleshoot file name is **ts-bundle-***timestamp***.tar** and is created in the same directory.

The following table shows the location of troubleshoot files and logs in the troubleshoot file.

Location	What it contains
/csdac/app/ts-bundle-*timestamp***/info**	`etcd` database contents
/csdac/app/ts-bundle-*timestamp***/logs**	Container log files
/csdac/app/ts-bundle-*timestamp***/status.log**	Container status, versions, and image status

Verify dynamic objects on the

To verify your connectors are creating objects on the management center, you can use the following command on the management center as an administrator:

```
sudo tail f /var/opt/CSCOpx/MDC/log/operation/usmsharedsvcs.log
```

Example: Successful object creation

```
26-Aug-2021 12:41:35.912,[INFO],(DefenseCenterServiceImpl.java:1442)
com.cisco.nm.vms.api.dc.DefenseCenterServiceImpl, ajp-nio-127.0.0.1-9009-exec-10
** REST Request [ CSM ]
** ID : 18b25356-fd6b-4cc4-8d27-bbccb52a6275
** URL: POST /audit
{
  "version": "7.1.0",
  "requestId": "18b25356-fd6b-4cc4-8d27-bbccb52a6275",
  "data": {
    "userName": "csdac-centos7",
    "subsystem": "API",
    "message": "POST
https://myfmc.example.com/api/fmc_config/v1/domain/e276abec-e0f2-11e3-8169-6d9ed49b625f
/object/dynamicobjects Created (201) - The request has been fulfilled and resulted in a new
 resource being created",
    "sourceIP": "192.0.2.103",
    "domainUuid": "e276abec-e0f2-11e3-8169-6d9ed49b625f",
    "time": "1629981695431"
  },
  "deleteList": []
}
```

Manually Get a Certificate Authority (CA) Chain

In the event you cannot automatically fetch the certificate authority chain, use one of the following browser-specific procedures to get a certificate chain used to connect securely to vCenter, NSX, or the Management Center.

The *certificate chain* is the root certificate and all subordinate certificates.

You must use one of these procedures to connect to the following:

- vCenter or NSX

  It is not necessary to get a certificate chain for connecting to Azure or AWS.

- Management Center

Before you use this procedure, see the section on automatically fetching the certificate authority chain in:

- Create a vCenter Connector, on page 26

Get a Certificate Chain—Mac (Chrome and Firefox)

Use this procedure to get a certificate chain using the Chrome and Firefox browsers on Mac OS.

1. Open a Terminal window.
2. Enter the following command.

   `security verify-cert -P url[:port]`

   where url is the URL (including scheme) to vCenter or Management Center. For example:

   ```
   security verify-cert -P https://myvcenter.example.com
   ```

   If you access vCenter or the management center using NAT or PAT, you can add a port as follows:

   ```
   security verify-cert -P https://myvcenter.example.com:12345
   ```

3. Save the entire certificate chain to a plaintext file.
   - *Include* all `-----BEGIN CERTIFICATE-----` and `-----END CERTIFICATE-----` delimiters.
   - *Exclude* any extraneous text (for example, the name of the certificate and any text contained in angle brackets (< and >) as well as the angle brackets themselves.
4. Repeat these tasks for both vCenter and the Management Center.

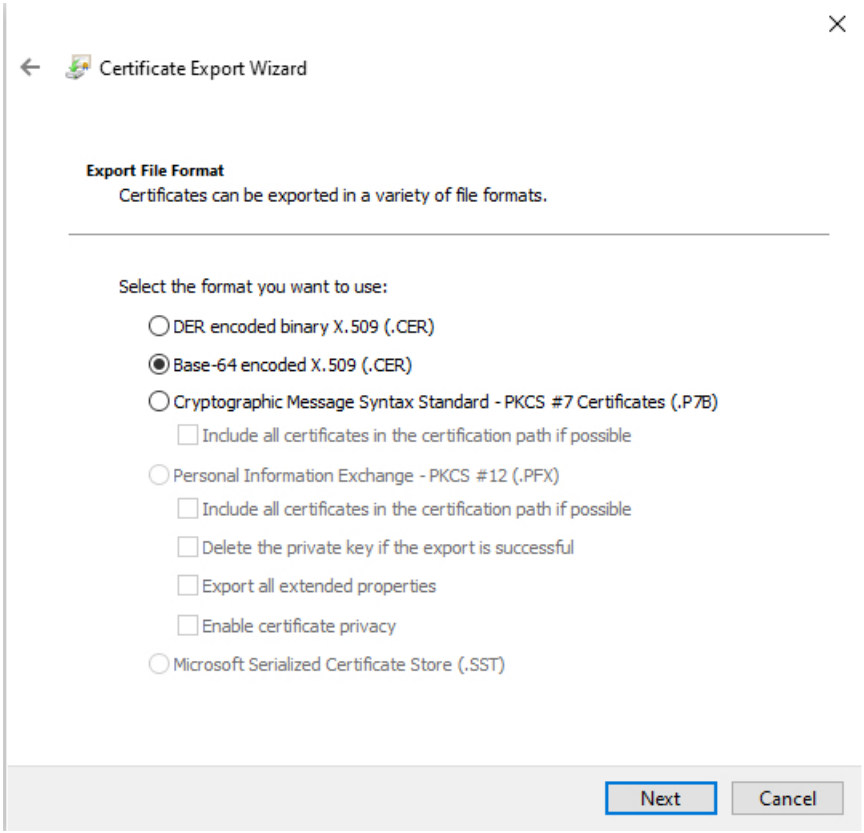
Get a Certificate Chain—Windows Chrome

Use this procedure to get a certificate chain using the Chrome browser on Windows.

1. Log in to vCenter or the Management Center using Chrome.
2. In the browser address bar, click the lock to the left of the host name.
3. Click **Certificate**.
4. Click the **Certification Path** tab.

5. Click the top (that is, first) certificate in the chain.
6. Click **View Certificate**.
7. Click the **Details** tab.
8. Click **Copy to File**.
9. Follow the prompts to create a CER-formatted certificate file that includes the entire certificate chain.

   When you're prompted to choose an export file format, click **Base 64-Encoded X.509 (.CER)** as the following figure shows.



10. Follow the prompts to complete the export.
11. Open the certificate in a text editor.
12. Repeat the process for all certificates in the chain.

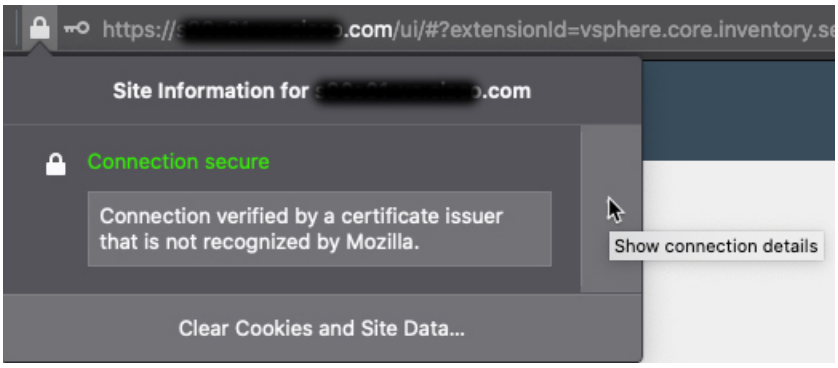
    You must paste each certificate in the text editor in order, first to last.
13. Repeat these tasks for both vCenter and the FMC.

Get a Certificate Chain—Windows Firefox

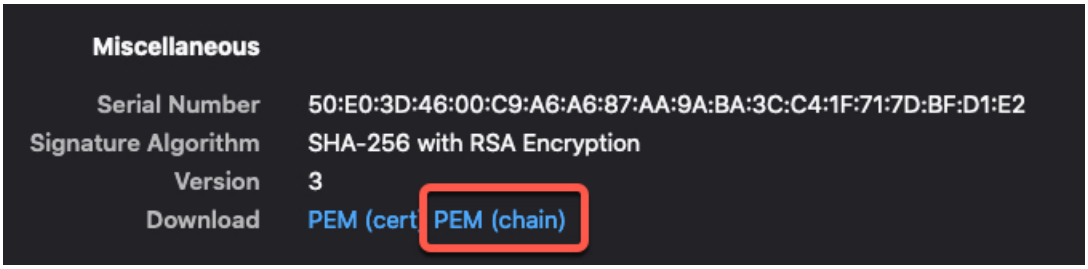
Use the following procedure to get a certificate chain for the Firefox browser on either Windows or Mac OS.

1. Log in to vCenter or the Management Center using Firefox.

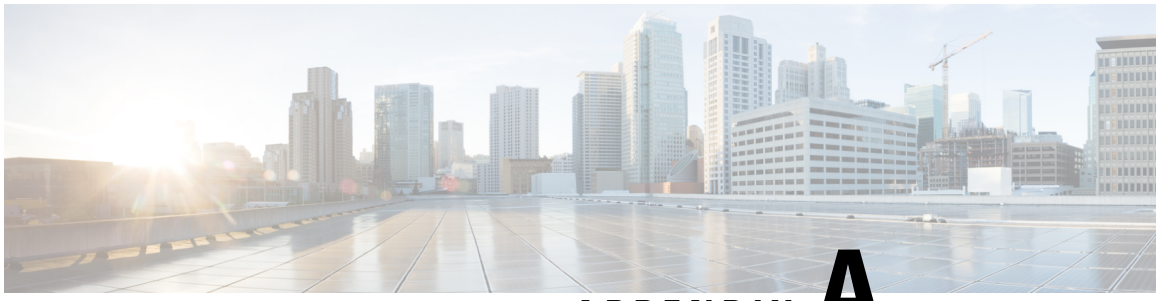
2. Click the lock to the left of the host name.
3. Click the right arrow (**Show connection details**). The following figure shows an example.



4. Click **More Information**.
5. Click **View Certificate**.
6. If the resulting dialog box has tab pages, click the tab page corresponding to the top-level CA.
7. Scroll to the Miscellaneous section.
8. Click **PEM (chain)** in the Download row. The following figure shows an example.



9. Save the file.
10. Repeat these tasks for both vCenter and the Management Center.



APPENDIX A

Security and Internet Access

Lists of URLs used by the dynamic attributes connector when communicating with cloud service providers and the management center.

Security Requirements

To safeguard the Cisco Secure Dynamic Attributes Connector, you should install it on a protected internal network. Although the dynamic attributes connector is configured to have only the necessary services and ports available, you must make sure that attacks cannot reach it.

If the dynamic attributes connector and the management center reside on the same network, you can connect the management center to the same protected internal network as the dynamic attributes connector.

Regardless of how you deploy your appliances, inter-system communication is encrypted. However, you must still take steps to ensure that communications between appliances cannot be interrupted, blocked, or tampered with; for example, with a distributed denial of service (DDoS) or man-in-the-middle attack.

Internet Access Requirements

By default, the dynamic attributes connector is configured to communicate with the Firepower System over the internet using HTTPS on port 443/tcp (HTTPS). If you do not want the dynamic attributes connector to have direct access to the internet, you can configure a proxy server.

The following information informs you of the URLs the dynamic attributes connector use to communicate with the management center and with external servers.

Table 3: Dynamic Attributes Connector management center access requirements

URL	Reason
https://*fmc-ip***/api/fmc_platform/v1/auth/generatetoken**	Authentication
https://*fmc-ip***/api/fmc_config/v1/domain/***domain-id***/object/dynamicobjects**	GET and POST dynamic objects

URL	Reason
https://*fmc-ip***/api/fmc_config/ v1/domain/***domain-id***/object/dynamicobjects/***object-id***/mappings?action=add**	Add mappings
https://*fmc-ip***/api/fmc_config/ v1/domain/***domain-id* **/object/dynamicobjects/***object-id***/mappings?action=remove**	Remove mappings

Table 4: Dynamic Attributes Connector vCenter access requirements

URL	Reason
https://*vcenter-ip***/rest/com/vmware/cis/session**	Authentication
https://*vcenter-ip***/rest/vcenter/vm**	Get VM information
https://*nsx-ip***/api/v1/fabric/virtual-machines/***vm-id*	Get NSX-T tag associated with the virtual machine

Migration from DockerHub to Amazon ECR

Docker images for the Cisco Secure Dynamic Attributes Connector are being migrated from Docker Hub to Amazon Elastic Container Registry (Amazon ECR).

To use the new field packages, you must allow access through your firewall or proxy to all of the following URLs:

- https://public.ecr.aws
- https://csdac-cosign.s3.us-west-1.amazonaws.com

Dynamic Attributes Connector Azure access requirements

The dynamic attributes connector calls built-in SDK methods to get instance information. These methods internally call call https://login.microsoft.com (for authentication) and https://management.azure.com (to get instance information).