Cisco Catalyst Center Administrator Guide, Release 3.2.x

Cisco Catalyst Center
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1 New and Changed Information

Topics:

- New and changed information

New and changed information

This section provides information about the new and changed features for Catalyst Center Release 3.2.x.

This table summarizes the new and changed features in Catalyst Center 3.2.2 and tells you where they are documented.

Table 1: New and changed features in Catalyst Center 3.2.2

Feature	Description
Out-of-band AP image download	The wireless controller pushes the image to the APs after the image is distributed to it. Catalyst Center allows image download on APs from the wireless controller, over HTTPS. This out-of-band file transfer efficiently upgrades the AP image. Refer to Access point image transfer on page 53.
Reset CA certificate	The reset CA feature allows you to manage CA during renewal issues or expiration. You can create sub CAs with a defined lifetime. This feature allows you to reset the CA easily when a sub CA expires or when you want to switch to another sub CA. Refer to Reset CA certificate on page 39.
Site-based, role-based access control support	You can create custom roles for site users, enabling precise allocation of read/write access to Field Notices, EoX Status, Security Advisories, Network Bug Identifier, and Network Reasoner. Refer to Impact of SRBAC on Catalyst Center features on page 171.
Smart Licensing Using Policy reporting through On-Prem Cisco SSM	You can upload resource details to CSSM through On-Prem SSM. Refer to Smart Licensing Using Policy reporting through On-Prem CSSM on page 203.

2 Manage System Settings

Topics:

- About system settings
- User profile roles and permissions
- Security recommendations
- Use System 360
- View the services in System 360
- Typical node operations

About system settings

Information about system settings for Catalyst Center.

To start using Catalyst Center, you must first configure the system settings. This allows the server to communicate outside the network, ensures secure communications, authenticates users, and supports other key tasks. Use the procedures in this chapter to configure the system settings.

Note

- Any changes that you make to the Catalyst Center configuration–including changes to the proxy server settings–must be done from the Catalyst Center GUI.
- Any changes to your Catalyst Center appliance's configuration settings must be done with the `sudo maglev-config update` command. Run this command in a KVM console opened from Cisco IMC.

  In Catalyst Center 2.3.7.7 onwards:

  - Change the **maglev** user password by specifying a new one in the **Linux Password** and **Re-enter Linux Password** fields. Leave these fields blank to continue using the current password.
  - You can make the other configuration setting changes without entering the **maglev** user password.
- By default, the Catalyst Center system time zone is set to UTC. Do not change this time zone because the Catalyst Center GUI works with your browser time zone.
- Restricted or secure shell is enabled for enhanced security. However, if you want to access the root shell using the `_shell` command, or use any of the restricted commands, you must contact Cisco TAC for assistance.

User profile roles and permissions

This section provides information about user profile roles and permissions for role-based access control.

Catalyst Center supports role-based access control (RBAC). Your user role determines your permissions. Catalyst Center has these three main default user roles:

- SUPER-ADMIN-ROLE
- NETWORK-ADMIN-ROLE, and
- OBSERVER-ROLE.

The SUPER-ADMIN-ROLE allows comprehensive access and supports creating and assigning custom roles in the Catalyst Center GUI. The user roles for NETWORK-ADMIN-ROLE and OBSERVER-ROLE provide limited access.

You can create access groups that limit access to certain network sites. An access group combines a role and a site. You can log in to a specific access group at any time.

Catalyst Center supports these default access groups:

- **NW-ADMIN_Global** - For global access to the role NW-ADMIN
- **OBSERVER_Global** - For global access to the role OBSERVER, and
- **SUPER-ADMIN_Global** - For global access to the role SUPER-ADMIN.

The behavior of Catalyst Center features depends on the user role and site specified in the access group. For more information, see *Configure site-based, role-based access control* in the *Cisco Catalyst Center Administrator Guide*.

Security recommendations

Information about how to configure Catalyst Center for security.

Catalyst Center provides many security features for itself, for the hosts and network devices that it monitors and manages. You must clearly understand and configure the security features correctly. Follow these security recommendations:

- Deploy Catalyst Center in a private internal network and behind a firewall that does not expose Catalyst Center to an untrusted network, such as the internet.
- If you have separate management and enterprise networks, connect Catalyst Center's management and enterprise interfaces to your management and enterprise networks, respectively. Doing so ensures network isolation between the services used to administer and manage Catalyst Center and the services used to communicate with and manage your network devices.
- If deploying Catalyst Center in a three-node cluster setup, verify that the cluster interfaces are connected in an isolated network.
- Upgrade Catalyst Center with critical upgrades, including security patches, as soon as possible after a patch announcement. For more information, see the Catalyst Center Upgrade Guide.
- Restrict the remote URLs accessed by Catalyst Center using an HTTPS proxy server. Catalyst Center is configured to access the internet to download software updates, licenses, and device software, as well as provide up-to-date map information, user feedback, and so on. Providing internet connections for these purposes is a mandatory requirement. However, provide connections securely through an HTTPS proxy server.
- Restrict the ingress and egress management and enterprise network connections to and from Catalyst Center using a firewall, by only allowing known IP addresses and ranges and blocking network connections to unused ports.
- Replace the self-signed server certificate from Catalyst Center with the certificate signed by your internal certificate authority (CA).
- If possible in your network environment, disable SFTP Compatibility Mode. This mode allows legacy network devices to connect to Catalyst Center using older cipher suites.
- Disable the browser-based appliance configuration wizard, which comes with a self-signed certificate.

About restricted shell

Information about restricted shell.

For added security, access to the root shell is disabled. With restricted shell, users can't access the underlying operating system and file system, which reduces operational risk.

Restricted shell is enabled for security purposes. However, if you want to access the root shell temporarily, you must contact the Cisco TAC for assistance.

If necessary, you can use the following restricted list of commands:

Table 2: Restricted Shell Commands

Command	Description
cat	Concatenate and print files in restricted mode.
clear	Clear the terminal screen.

Command	Description
date	Display the current time in the given format or set the system date.
debug	Enable console debug logs.
df	File system information.
dmesg	Print or control the kernel ring buffer.
du	Summarize disk usage of the set of files recursively for directories.
free	Quick summary of memory usage.
history	Enable shell commands history.
htop	Interactive process viewer.
ip	Print routing, network devices, interfaces and tunnels.
kubectl	Interact with Kubernetes Cluster in a restricted manner.
last	Show a listing of last logged in users.
ls	Restricted file system view chrooted to maglev Home.
lscpu	Print information about the CPU architecture.
magctl	Tool to manage a Maglev deployment.
maglev-config	Tool to configure a Maglev deployment.
manufacture_check	Tool to perform manufacturing checks.
netstat	Print networking information.
nslookup	Query internet name servers interactively.
ntpq	Standard NTP query program.
ping	Send ICMP ECHO_REQUEST to network hosts.
ps	Check status of active processes in the system.
rca	Root cause analysis collection utilities.
reboot	Reboot the machine.
rm	Delete files in restricted mode.
route	Print the IP routing table.
runonce	Execute runonce scripts.
scp	Restricted secure copy.
sftp	Secure file transfer.
shutdown	Shut down the machine.
ssh	OpenSSH SSH client.

Command	Description
tail	Print the last 10 lines of each file to standard output.
top	Display a sorted list of system processes.
traceroute	Print the route packets trace to network host.
uname	Print system information.
uptime	Tell how long the system has been running.
vi	Text editor.
w	Show who is logged on and what they are doing.

Use System 360

Information about the **System 360** tab and the data it provides.

The **System 360** tab provides at-a-glance information about Catalyst Center.

Procedure

1. From the main menu, choose **System** > **System 360**.
2. On the **System 360** dashboard, review the following displayed data metrics:

   Cluster

   - **Hosts**: Displays information about the Catalyst Center hosts. The displayed information includes the hosts IP addresses and detailed data about the services running on the host. Click the **View Services** link to view detailed data about the services running on the hosts.

     > **Note**
     >
     > The host IP address has a color badge next to it. A green badge indicates that the host is healthy. A red badge indicates that the host is unhealthy.

     The side panel displays the following information:

     - **Node Status**: Displays the health status of the node.

       If the node health is unhealthy, hover over the status to view additional information for troubleshooting.

     - **Services Status**: Displays the health status of the services. Even if one service is down, the status is **Unhealthy**.
     - **Name**: Service name.
     - **Appstack**: App stack name.

       An app stack is a loosely coupled collection of services. In this environment, a service is a horizontally scalable application that adds instances when demand increases and removes instances when demand decreases.

- **Health**: Status of the service.
- **Version**: Version of the service.
- **Tools**: Displays metrics and logs for the service. Click the **Metrics** link to view service monitoring data in Grafana. Grafana is an open-source metric analytics and visualization suite. You can troubleshoot issues by reviewing the service monitoring data. For information about Grafana, see https://grafana.com/. Click the **Logs** link to view service logs in Kibana. Kibana is an open-source analytics and visualization platform. You can troubleshoot issues by reviewing the service logs. For information about Kibana, see https://www.elastic.co/products/kibana.
- **Actions**: Option available to restart the service. For some of the internal and system specific services, the **Actions** option is disabled.

- **High Availability**: Displays whether HA is enabled and active.

  For instructions on how to activate HA on your cluster, see Activate high availability on page 123.

  Important

  HA requires three or more hosts to operate in Catalyst Center.

  The three-node HA is not supported for Catalyst Center running on ESXi.

- **Cluster Tools**: Lets you access the following tools:
  - **Service Explorer**: Access the app stack and the associated services.
  - **Monitoring**: Access multiple dashboards of Catalyst Center components using Grafana, which is an open-source metric analytics and visualization suite. Use the **Monitoring** tool to review and analyze key Catalyst Center metrics, such as memory and CPU usage. For information about Grafana, see https://grafana.com/.

    Note

    In a multihost Catalyst Center environment, expect duplication in the Grafana data due to the multiple hosts.

  - **Log Explorer**: Access Catalyst Center activity and system logs using Kibana. Kibana is an open-source analytics and visualization platform designed to work with Elasticsearch. Use the **Log Explorer** tool to review detailed activity and system logs. In the Kibana left navigation pane, click **Dashboard**. Then, click **System Overview** and view all of the system logs. For information about Kibana, see https://www.elastic.co/products/kibana.

    Note

    All logging in Catalyst Center is enabled, by default.

System Management

- **Software Updates**: Displays the status of application or system updates. Click the **View** link to view the update details.

  > **Note**
  >
  > An update has a color badge next to it. A green badge indicates that the update or actions related to the update succeeded. A yellow badge indicates that there is an available update.

- **Backups**: Displays the status of the most recent backup. Click the **View** link to view all backup details.

  Additionally, it displays the status of the next scheduled backup (or indicates that no backup is scheduled).

  > **Note**
  >
  > A backup has a color badge next to it. A green badge indicates a successful backup with a timestamp. A yellow badge indicates that the next backup is not yet scheduled.

- **Application Health**: Displays the health of automation and Assurance.

  > **Note**
  >
  > Application health has a color badge next to it. A green badge indicates a healthy application. A red badge indicates that the application is unhealthy. Click the **View** link to troubleshoot.

Externally Connected Systems

Displays information about external network services used by Catalyst Center.

- **Identity Services Engine (ISE)**: Displays Cisco ISE configuration data, including the IP address and status of the primary and secondary Cisco ISE servers. Click the **Configure** link to configure Catalyst Center for integration with Cisco ISE.
- **IP Address Manager (IPAM)**: Displays IP address manager configuration data and the integration status. Click the **Configure** link to configure the IP Address Manager.

3. Click **System Health** and review the topology of your Catalyst Center appliances and the external systems that are connected to your network.

   For more information about the **System Health** window, see View the system topology on page 106.

View the services in System 360

Information about services in the **System 360** tab.

The **System 360** tab provides detailed information about the app stacks and services running on Catalyst Center. You can use this information to assist in troubleshooting issues with specific applications or services. For example, if you are having issues with Assurance, you can view monitoring data and logs for the NDP app stack and its component services.

Procedure

1. From the main menu, choose **System** > **System 360**.
2. In **System 360** window, click **Service Explorer** tab.
   The node clusters and the associated services are displayed in a tree-like structure in a new browser window.
   - Hover your cursor over the node to view the details such as serial number, product ID, and interface.
   - The Services table shows all the services associated with the node. The managed services are marked as (M).
   - In the Service table, click the global filter icon to filter services by app stack name, service health status (Up, Down, or In Progress), or managed services.
   - Enter a service name in the Global Search field to find a service. Click the service name to view the service in its associated node.
3. Click the service to launch the Service 360 view. The details include:
   - **Metrics**: Click the link to view the services monitoring data in Grafana.
   - **Logs**: Click the link to view the service logs in Kibana.
   - **Name**: The service name.
   - **Appstack**: The app stack name.
   - **Version**: The version of the service.
   - **Health**: The status of the service.
   - **Required Healthy Instances**: Shows the number of healthy instances and indicates whether the service is managed.
   - **Instances**: Click the instances to view details.
4. Enter the service name in the Search field to search the services listed in the table.
5. Click the filter icon in the services table to filter services by app stack name, service status (Up, Down, or In Progress), or managed service.

Typical node operations

This section describes typical node operations, such as disk return materials authorization (RMA).

Hardware peripherals RMA

We recommend that you perform a graceful shutdown of Catalyst Center when replacing hardware peripherals such as DIMMs, CPUs, or a single solid-state drive (SSD) during a return materials authorization (RMA) procedure.

Switch under maintenance without HA

If a directly linked switch in the Layer 2 network is undergoing maintenance without a fallback (HA) mechanism to uphold network service, we recommend that you perform a graceful shutdown. To achieve Layer 2 network redundancy, see "NIC Bonding Overview" in the *Cisco Catalyst Center Appliance Installation Guide*.

Power cycle the appliance

You can stop your Catalyst Center appliance before making hardware repairs. You can also initiate a warm restart after correcting software issues. See the "Power cycle the appliance" section in the *Cisco Catalyst Center Appliance Installation Guide*.

3 Manage Certificates

Topics:

- Configure the proxy
- Renew internal certificates
- Certificate and private key support
- Manage device certificates
- Configure the device certificate lifetime
- Certificate authority
- Configure the device certificate trustpoint
- Configure trusted certificates

Configure the proxy

Information about configuring access to a proxy server.

Incoming Proxy

If Catalyst Center has a proxy server configured as an intermediary between itself and the network devices that it manages, you must configure the proxy Certificate Authority (CA) so the CA is provisioned to the network device as trust anchor to connect to Catalyst Center via the proxy.

Outgoing Proxy

If Catalyst Center has a proxy server configured as an intermediary between itself and the internet, you must configure access to the proxy server.

Security recommendation: We recommend that you allow secure access only to URLs and FQDNs that are required by Catalyst Center, through an HTTPS proxy.

For more information, refer to "Required internet URLs and fully qualified domain names" and "Provide secure access to the internet" in the latest *Cisco Catalyst Center Appliance Installation Guide*.

Note

Catalyst Center does not support a proxy server that uses Windows New Technology LAN Manager (NTLM) authentication.

Procedure

1. From the main menu, choose **System** > **Settings** > **System Configuration**.
2. From the **System Configuration** drop-down list, choose **Proxy** > **Outgoing Proxy**.
3. Enter the proxy server URL address.
4. Enter the proxy server port number.

   Note

   - For HTTP, the port number is usually 80.
   - The port number ranges from 0 through 65535.

5. (Optional) If the proxy server requires authentication, click **Update** and enter the username and password for access to the proxy server.
6. Check the **Validate Settings** check box to have Catalyst Center validate your proxy configuration settings when applying them.
7. Review your selections and click **Save**.

   To cancel your selection, click **Reset**. To delete an existing proxy configuration, click **Delete**.

   After configuring the proxy, you can view the configuration in the **Proxy** window.

   Important

It can take up to five minutes for Catalyst Center services to get updated with the proxy server configuration.

Configure the proxy certificate

In some network configurations, proxy gateways might exist between Catalyst Center and the remote network it manages. Common ports such as 80 and 443 pass through the gateway proxy in the DMZ, and for this reason, SSL sessions from the network devices meant for Catalyst Center terminate at the proxy gateway. Therefore, these network devices can only communicate with Catalyst Center through the proxy gateway. For the network devices to establish secure and trusted connections with Catalyst Center or, if present, a proxy gateway, the network devices should have their PKI trust stores appropriately provisioned with the relevant CA root certificates or even the server's own certificate under certain circumstances.

In some network configurations, proxy gateways might exist between Catalyst Center and the remote network it manages (containing various network devices). Common ports, such as 80 and 443, pass through the gateway proxy in the DMZ, and for this reason, SSL sessions from the network devices meant for Catalyst Center terminate at the proxy gateway. Therefore, the network devices located within these remote networks can only communicate with Catalyst Center through the proxy gateway. For the network devices to establish secure and trusted connections with Catalyst Center, or, if present, a proxy gateway, the network devices should have their PKI trust stores appropriately provisioned with the relevant CA root certificates or the server's own certificate under certain circumstances.

If such a proxy is in place during onboarding of devices through PnP Discovery/Services, the proxy and the Catalyst Center server certificate must be the same so that network devices can trust and authenticate Catalyst Center securely.

In network topologies where a proxy gateway is present between Catalyst Center and the remote network it manages, import a proxy gateway certificate in to Catalyst Center:

Before you begin

- Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.
- You must use the proxy gateway's IP address to reach Catalyst Center and its services.
- You should have the certificate file that is currently being used by the proxy gateway. The certificate file contents should consist of any of these:
  - The proxy gateway's certificate in PEM or DER format, with the certificate being self-signed.
  - The proxy gateway's certificate in PEM or DER format, with the certificate being issued by a valid, well-known CA.
  - The proxy gateway's certificate and its chain in PEM or DER format.

The certificate used by the devices and the proxy gateway must be imported into Catalyst Center by following this procedure.

Procedure

1. From the main menu, choose **System** > **Settings** > **System Configuration**.
2. From the **System Configuration** drop-down list, choose **Proxy** > **Incoming Proxy**.
3. In the **Proxy Certificate** window, view the current proxy gateway certificate data (if it exists).

> **Note**
>
> The **Expiration Date and Time** is displayed in local time. A system notification appears in the Catalyst Center GUI two months before the certificate expires.

4. To add a proxy gateway certificate, drag and drop the self-signed or CA certificate into the **Drag and Drop Here** area.

> **Note**
>
> Only PEM or DER files (public-key cryptography standard file formats) can be imported into Catalyst Center using this area. Additionally, private keys are neither required nor uploaded into Catalyst Center for this procedure.

5. Click **Save**.
6. Refresh the **Proxy Certificate** window to view the updated proxy gateway certificate data.
   The information displayed in the **Proxy Certificate** window should have changed to reflect the new certificate name, issuer, and certificate authority.
7. Click the **Enable** button to enable the proxy gateway certificate functionality.

   If you click the **Enable** button, the controller returns the imported proxy gateway certificate when requested by a proxy gateway. If you don't click the **Enable** button, the controller returns its own self-signed or imported CA certificate to the proxy gateway.

   The **Enable** button is dimmed if the proxy gateway certificate functionality is used.

Upload an SSL intercept proxy certificate

If SSL decryption is enabled on the proxy server that is configured between Catalyst Center and the Cisco cloud from which it downloads software updates, upload an SSL intercept proxy certificate that is issued from an official certificate authority.

If SSL decryption is enabled on the proxy server that is configured between Catalyst Center and the Cisco cloud from which it downloads software updates, ensure that the proxy is configured with a certificate that is issued from an official certificate authority. If you are using a *private* certificate, complete the following steps.

> **Note**
>
> For added security, access to the root shell is disabled in Catalyst Center. With restricted shell, users can't access the underlying operating system and file system, which reduces operational risk. However, the commands in this section require that you contact the Cisco TAC to access the root shell temporarily.

Procedure

1. Transfer your proxy server's certificate (in PEM format) to a directory on the Catalyst Center server.

2. As a maglev user, SSH to the Catalyst Center server and enter this command:

```
# /usr/local/bin/update_cacerts.sh -v -a example.pem
```

The command returns output that is similar to this example.

```
Reading CA cert from file example.pem
Adding certificate
import_04:F7:6B:24:92:95:5A:20:3E:05:83:40:FA:19:8D:94:B2:B0:69:60.crt
Sending MKS Event..
(Attempt 1) Command to execute kubectl create -f /tmp/event_file.yaml
(Attempt 1) kubectl create -f /tmp/event_file.yaml completed successfully
Updating certificates in /etc/ssl/certs...
rehash: warning: skipping ca-certificates.crt,
it does not contain exactly one certificate or CRL
1 added, 0 removed; done.
Running hooks in /etc/ca-certificates/update.d...
done.
Attempting to restart containerd (Attempt 1)...
containerd restarted successfully.
[Attempt 1/10] Restarting Pod/Service that has a host mounted certificate
dependency.
Please wait for the pods to come back up and resume normal working. This might
 take a while
Successfully triggered a restart for the containers needing the certificates.
Deleting tempfiles /tmp/tmp.CMu8bA83SC /tmp/tmp.6STo8fQRNB /tmp/tmp.cjBhl4gw5b
```

3. Check the command output for the line " 1 added" and confirm that the number added is not zero. The number can be one or greater, based on the certificates in the chain.
4. In Catalyst Center, upload the same certificate and check the connectivity.
   a) Log in to the Catalyst Center GUI.
   b) Navigate to **System** > **Settings** > **Certificates** > **Trusted Certificates** and upload the same certificate.

      For more information, see Configure trusted certificates on page 40.

   c) Check the cloud, Cisco Connected Mobile Experiences (CMX), and Cisco Spaces connectivity.

Renew internal certificates

Information about renewing internal certificates for another year before they are set to expire.

Catalyst Center uses a number of certificates, such as the ones generated by Kubernetes and the ones used by Kong and Credential Manager Services. These certificates are valid for one year, which starts as soon as you install your cluster. Catalyst Center automatically renews these internal certificates for another year before they are set to expire.

- We recommend that you renew internal certificates before they expire, not after.
- You can only renew internal certificates that are set to expire up to 100 days from now. This procedure does not do anything to certificates that will expire later than that.
- The script refreshes only self-signed certificates, not third-party/certificate authority (CA)-signed certificates. For third-party/CA-signed certificates, the script updates the internal certificates used by Kubernetes and the Credential Manager.
- For self-signed certificates, the renewal process does not require you to push certificates back out to devices, because the root CA is unchanged.
- The term *cluster* applies to both single-node and three-node Catalyst Center setups.

Procedure

1. Ensure that each cluster node is healthy and not experiencing any issues.
2. To view a list of the certificates that are currently used by that node and their expiration date, enter this command:

   sudo maglev-config certs info

3. Renew the internal certificates that are set to expire soon by entering this command:

   sudo maglev-config certs refresh

4. Repeat the preceding steps for the other cluster nodes.
5. For utility help, enter:

```
$ sudo maglev-config certs --help
Usage: maglev-config certs [OPTIONS] COMMAND [ARGS]...

Options:
  --help  Show this message and exit.

Commands:
  info
  refresh
```

Certificate and private key support

Information about Catalyst Center digital certificates and private keys.

Catalyst Center supports the Certificate Authority Management feature, which is used to authenticate sessions (HTTPS). These sessions use commonly recognized trusted agents that are called CAs. Catalyst Center uses the Certificate Authority Management feature to import, store, and manage X.509 certificates from your internal CA. The imported certificate becomes an identity certificate for Catalyst Center, and Catalyst Center presents this certificate to its clients for authentication. The clients are the northbound API applications and network devices.

You can import these files (in either the PEM or PKCS file format) using the Catalyst Center GUI:

- X.509 certificate
- Private key

Note

For the private key, Catalyst Center supports the import of RSA and Elliptic Curve Digital Signature Algorithm (ECDSA) keys. Keep the private key secure in your own key management system. The private key must have a minimum modulus size of 2048 bits.

You must obtain a valid X.509 certificate and private key issued by your internal CA. The certificate must correspond to a private key in your possession before importing the files. After importing the files, the security functionality that is based on the X.509 certificate and private key is automatically activated. Catalyst Center presents the certificate to any device

or application that requests it. Northbound API applications and network devices can use these credentials to establish a trust relationship with Catalyst Center.

> **Note**
>
> Avoid importing and using a self-signed certificate to Catalyst Center. Import a valid X.509 certificate from your internal CA. Replace the default self-signed certificate with one signed by your internal CA to ensure proper Plug and Play functionality

Catalyst Center supports only one imported X.509 certificate and private key at a time. When you import a second certificate and private key, the latter overwrites the first (existing) imported certificate and private key values.

Certificate chain support

Information about Catalyst Center and certificate chain support.

Catalyst Center is able to import certificates and private keys through its GUI. If subordinate certificates are involved in a certificate chain leading to the certificate that is to be imported into Catalyst Center (signed certificate), both the subordinate certificates as well as the root certificate of these subordinate CAs must be appended together into a single file to be imported. When appending these certificates, you must append them in the same order as the actual chain of certification.

The following certificates should be pasted together into a single PEM file. Review the certificate subject name and issuer to ensure that the correct certificates are being imported and correct order is maintained. Ensure that all of the certificates in the chain are pasted together.

- **Signed Catalyst Center certificate**: Its Subject field includes CN=<*FQDN of Catalyst Center*>, and the issuer has the CN of the issuing authority.

  > **Note**
  >
  > If you install a certificate signed by your internal certificate authority (CA), ensure that the certificate specifies all of the DNS names (including the Catalyst Center FQDN) that are used to access Catalyst Center in the **alt_names** section. For more information, see "Generate a Certificate Request Using Open SSL" in the *Catalyst Center Security Best Practices Guide*.

- **Issuing (subordinate) CA certificate that issues the Catalyst Center certificate**: Its Subject field has CN of the (subordinate) CA that issues the Catalyst Center certificate, and the issuer is that of the root CA.
- **Next issuing (root/subordinate CA) certificate that issues the subordinate CA certificate**: Its Subject field is the root CA, and the issuer has the same value as the Subject field. If they are not the same, you must append the next issuer, and so on.

Update the Catalyst Center server certificate

Catalyst Center supports the import and storage of an X.509 certificate and private key into Catalyst Center.

Catalyst Center allows you to import and store an X.509 certificate from your certificate authority (CA) and private key that's generated by Catalyst Center. These can be used to create a secure and trusted environment between Catalyst Center, northbound API applications, and network devices. You can import a certificate and a private key on the **System Certificates** window.

To update the Catalyst Center server certificate:

1. Generate a Certificate Signing Request (CSR).
2. Submit the CSR to your CA to get a signed certificate.
3. Import the signed certificate and its chain into Catalyst Center.

This procedure uses Microsoft Active Directory Certificate Services as an example CA. If you use a different CA, adapt the steps accordingly.

Before you begin

You must obtain a valid X.509 certificate from your internal CA that corresponds to your private key.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **System Certificates**.

   When you first view the **System Certificates** window, the current certificate data is displayed in the Catalyst Center self-signed certificate. The self-signed certificate expires one year after its creation date.

   This window displays information about Catalyst Center server certificates and provides actions to manage those certificates. The **System Certificates** table displays this information for each certificate:

   - **Issued To**: Indicates who the certificate was issued to.
   - **Issued By**: Name of the entity that has signed and issued the certificate.
   - **Used For**: Indicates whether the certificate is used for the controller, disaster recovery, or both.
   - **Certificate Serial Number**: Shows the last five characters of the certificate serial number.
   - **Days Left**: Time left in the certificate life.
   - **Status**: Shows the certificate status.
   - **Valid From/Valid To**: Indicates when the certificate is valid.

     > **Note**
     >
     > The certificate's valid dates and times are displayed in local time. A system notification displays in the notification center two months before the certificate expires. Click the notifications icon in the top-right corner of the window to view it.

   - **Action**: Shows available actions to manage the certificate, such as view, copy, or replace.

2. Click **+ New Certificate Request (CSR)**.

   This **+ New Certificate Request (CSR)** link is enabled when you generate the CSR for the first time.

   If you don't want to use the existing CSR, delete the existing request.

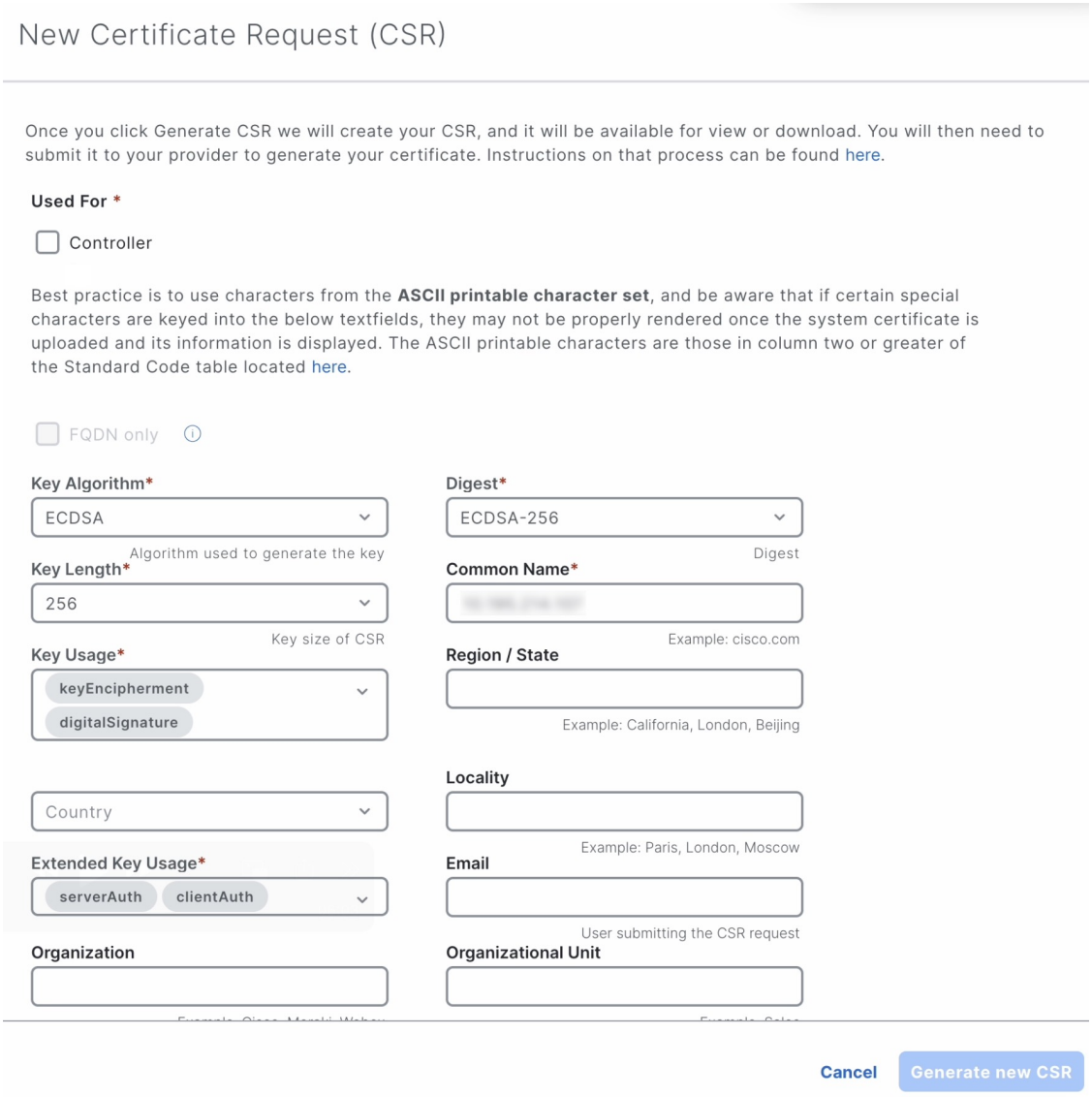
   a. In the table, locate the request that you want to delete.

   b. Under **Action**, hover your cursor over the vertical ellipsis (⋮) and click **Delete** for that request.

   c. In the **Delete CSR(s)** dialog box, check the **Controller** check box to indicate that you want to delete the CSR for the controller. Then, click **Delete**.

      The **+ New Certificate Request (CSR)** link is enabled.

3. In the **New Certificate Request (CSR)** slide-in pane, create the CSR.
   a. Under **Used For**, check the **Controller** check box to use the CSR for the controller.
   b. Enter the values for these required fields:
      - **Key Algorithm**: The algorithm (ECDSA or RSA) used to generate the key.
      - **Digest**: The digest algorithm used to secure and verify the CSR.
      - **Key Length**: The certificate key's bit size.
      - **Common Name**: The server's IP address, hostname, or FQDN.
      - **Key Usage**: Purpose of the certificate's key. Refer to RFC 5280, Section 4.2.1.3 for a description of the available values.
      - **Extended Key Usage**: Additional purpose of the certificate's key. Refer to RFC 5280, Section 4.2.1.12 for a description of the available values.



   c. Click **Generate new CSR**.

4. Download a copy of the CSR.

a. Under **Issued To**, click the hyperlinked text for the CSR.

b. In the **Certificate Signing Request** slide-in pane, click **Download CSR**.

The CSR is downloaded locally as a Base64 file.

c. Click **Done** to close the slide-in pane.

5. Submit a certificate request to the CA and download the issuer CA chain from the CA.

For example, you can submit a certificate request using Microsoft Active Directory Certificate Services by following these steps.

a. Copy the CSR that you just downloaded.

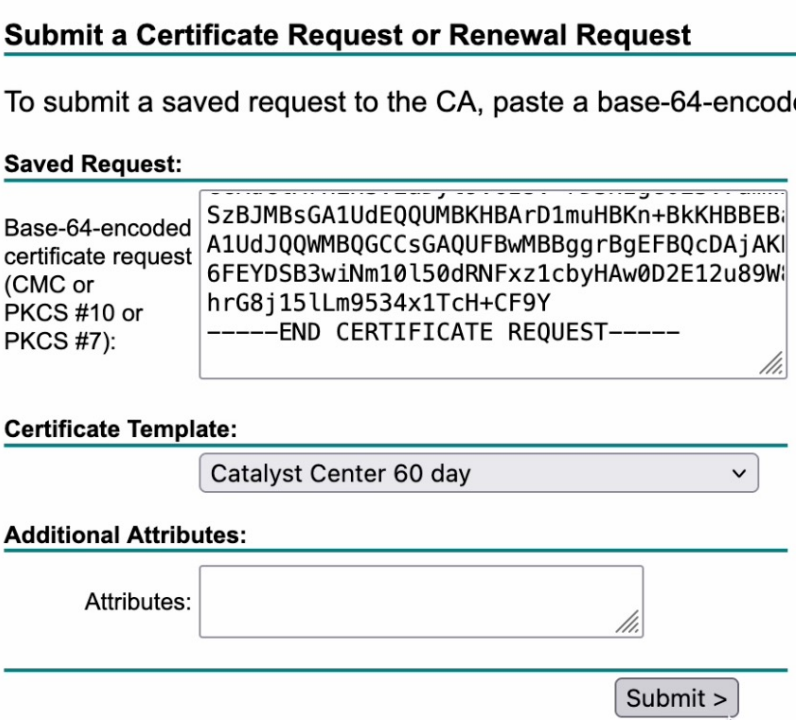
b. Open Active Directory Certificate Services in a new browser window.

c. On the **Welcome** page, click **Request a certificate**.

d. On the **Request a Certificate** page, click **advanced certificate request**.

e. On the **Submit a Certificate Request or Renewal Request** page, paste the request in the **Saved Request** field, select a certificate template, and click **Submit**.

Ensure that the selected certificate template is configured for both client and server authentication.



f. On the **Certificate Issued** page, select how you want the certificate encoded and click **Download certificate chain**.

The certificate chain is downloaded from the CA.

6. Confirm that the certificate issuer provided the certificate full chain (server and CA) in p7b. When in doubt, complete these steps to examine and assemble the chain:

a) Download the p7b bundle in DER format and save it as server-cert-chain.p7b.

b) Enter this command:

```
openssl pkcs7 -in server-cert-chain.p7b -inform DER -out
server-cert-chain.pem -print_certs
```

7. On the Catalyst Center GUI, in the **+ System Certificates** window, click **Import** under **Action** for the CSR.
8. In the **Import Certificate** slide-in pane, import the signed certificate with its certificate signed authority chain concatenated into Catalyst Center.
   a. Under **Used For**, check the **Controller** check box to use this certificate for the controller.
   b. Under **Type**, select the file format type for the certificate using this table.

Type	Description	Action
PEM Chain	Privacy-enhanced mail file format.	Click **PEM Chain**. If the certificate issuer provides the certificate and its issuer CA chain in loose files, complete these steps. 1. Gather the PEM (base64) files or use OpenSSL to convert DER files to the PEM format. 2. Concatenate the certificate and its issuer CA, starting with the certificate, followed by subordinate CA, all the way to the root CA, and output it to the server-cert-chain.pem file. cat certificate.pem subCA.pem rootCA.pem > server-cert-chain.pem
PKCS	Public-Key Cryptography Standard file format.	Click **PKCS**. **Note** **PKCS** file type is disabled if you chose the **+ New Certificate Request (CSR)** option to request a certificate.

   c. Upload the file based on its type.

If you upload a...	Then...
PEM file and, if applicable, the private key,	**1.** Drag and drop the PEM and private key files. **Note** • A PEM file must have a valid PEM format extension (.pem, .cer, or .crt). The maximum file size for the certificate is 1 MB. • Private keys must have a valid private key format extension (.key). The maximum file size for the private key is 1 MB. • If you used **+ New Certificate Request (CSR)** to create a CSR, there is no private key to import. The private key is stored within Catalyst Center. **2.** For the private key, under **Encrypted**, indicate if you want it encrypted. If you indicate **Yes**, enter the password for the private key in the **Password** field.
PKCS file	**1.** In the **Bundle Password** field, enter the password for the certificate. **2.** Drag and drop the PKCS file. **Note** A PKCS file must have a valid PKCS format extension (.pfx or .p12). The maximum file size for the certificate is 1 MB. After the upload succeeds, the system certificate is validated.

d. Click **Submit**.

Note

After the Catalyst Center server SSL certificate is replaced, you are automatically logged out. Because importing the certificate can take about two minutes, wait at least two minutes before logging back in.

9. After logging back in to Catalyst Center, go to the **System Certificates** window to view the updated certificate data.

For the updated certificate, under **Action**, hover your cursor over the vertical ellipsis (⋮) and click **View** to view a slide-in pane with information about the certificate, such as the valid dates.

Manage device certificates

Information about managing device certificates for managed devices to authenticate and identify the devices.

You can view and manage certificates that are issued by Catalyst Center for managed devices to authenticate and identify the devices.

As a best practice, when a device is no longer managed by Catalyst Center (for example, because the device is lost or no longer active), revoke or delete the device certificate.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **Device Certificates**.

   The **Device Certificates** window shows the status of issued certificates in separate tabs:

   - **All**: Shows the list of valid, expired, and expiring certificates.
   - **Expired**: Shows the list of expired certificates.
   - **Expiring**: Shows the list of certificates that are nearing the expiry date in ascending order.
   - **Revoked**: Shows the list of revoked certificates.

2. To revoke a valid certificate:
   a) Click **All**.
   b) In the **Action** column, click the **Revoke** icon that corresponds to the certificate that you want to revoke.
   c) In the confirmation window, click **OK**.
3. To delete an expired certificate:
   a) Click **All**.
   b) In the **Action** column, click the **Delete** icon that corresponds to the certificate that you want to delete.
   c) In the confirmation window, click **OK**.
4. If you want to export the certificate details in CSV format, click **Export**.

Configure the device certificate lifetime

Information about configuring device certificate lifetime. Catalyst Center lets you change the certificate lifetime of network devices that are managed and monitored by the private (internal) Catalyst Center's CA.

Catalyst Center lets you change the certificate lifetime of network devices that the private (internal) Catalyst Center CA manages and monitors. The Catalyst Center default value for the certificate lifetime is 365 days. After the certificate lifetime value is changed using the Catalyst Center GUI, network devices that subsequently request a certificate from Catalyst Center are assigned this lifetime value.

Note

The device certificate lifetime value cannot exceed the CA certificate lifetime value. Also, if the remaining lifetime of the CA certificate is less than the configured device's certificate lifetime, the device receives a certificate lifetime value equal to the remaining CA certificate lifetime.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **Device Certificates**.
2. Review the device certificate and the current device certificate lifetime.
3. In the **Device Certificates** window, click **Modify**.
4. In the **Device Certificates Lifetime** dialog box, enter the new value in days.
5. Click **Save**.

Certificate authority

A certificate authority (CA) is an entity that manages the certificates and keys that are used to establish and secure server-client connections.

A certificate authority (CA) is an entity that manages the certificates and keys that are used to establish and secure server-client connections. Catalyst Center provides a private (internal) Catalyst Center CA, which acts as the device CA. This Catalyst Center CA can either operate as a root CA or be configured as a subordinate CA, which cannot be reversed.

Change the role of the certificate authority from root to subordinate

Information about changing the role of the certificate authority from root to a subordinate.

The device CA, a private CA that is provided by Catalyst Center, manages the certificates and keys that are used to establish and secure server-client connections. To change the role of the device CA from a root CA to a subordinate CA, complete this procedure.

You can change the role of the private (internal) Catalyst Center CA from a root CA to a subordinate CA using the **Certificate Authority** window in the GUI. When making this change:

- If you want to have Catalyst Center act as a subordinate CA, ensure that you have a root CA, for example, Microsoft CA, and agree to use its certificate.
- As long as the subordinate CA is not fully configured, Catalyst Center continues to operate as an internal root CA.
- Generate a Certificate Signing Request file for Catalyst Center and ensure it is manually signed by your external root CA, as described in this procedure.

> **Note**
>
> Catalyst Center continues to run as an internal root CA during this time period.

- After the Certificate Signing Request is signed by the external root CA, this signed file must be imported back into Catalyst Center using the GUI (as described in this procedure).

  After the import, Catalyst Center initializes itself as the subordinate CA and provides all the existing functionalities of a subordinate CA.

- When you switch a CA's role from root to subordinate, the old CA is retired and the new subordinate CA's PKI chain takes over. The revocation list is published by a CA, and after the CA is retired, revocation is moot since trust cannot be established. If your organization's policy mandates that unused certificates are revoked first, you can revoke the certificate from the GUI's **Device Certificates** window before switching the CA's role from root to subordinate.

  Device controllability (enabled by default) will automatically update the device with a new certificate chain, sourced from the subordinate CA. New telemetry connections would only authenticate with this new certificate chain, which aligns with the trusted subordinate CA on the authenticator side.

- The subordinate CA certificate lifetime displayed in the GUI is read directly from the certificate and is not calculated using the system time. Therefore, if you install a certificate with a lifespan of 1 year today and look at it in the GUI the same time next year, the GUI will still show that the certificate has a 1-year lifetime.

- The subordinate CA certificate must be in one of these formats: .pem, .crt, .cer, .der.

- The subordinate CA does not interact with the higher CAs; therefore, it is not aware of revocation, if any, of the certificates at a higher level. Because of this, any information about certificate revocation is also not communicated from the subordinate CA to the network devices. Because the subordinate CA does not have this information, all the network devices use only the subordinate CA as the CRL Distribution Points (CDP) source.

- Consider that if you use EAP-Transport Level Security (EAP-TLS) authentication for AP profiles in Plug and Play (PnP), you cannot use a subordinate CA. You can only use a root CA.

Before you begin

You must have a copy of the root CA certificate.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificate Authority**.
2. Under **CA Management**, review the existing root or subordinate CA certificate configuration information: CA mode, certificate issuer, issued to, and lifetime value of the current certificate.
3. To change from a root CA to a subordinate CA, click **Enable SubCA Mode**.
4. Review the warnings that display:

   For example,

   - Changing from root CA to subordinate CA is a process that cannot be reversed.
   - You must ensure that no network devices have been enrolled or issued a certificate in root CA mode. Revoke any devices enrolled in root CA mode before changing to subordinate CA.
   - Network devices must come online only after the subordinate CA configuration process finishes.

5. Click **OK** to proceed.

6. Drag and drop your root CA certificate into the **Import External Root CA Certificate Chain** field and click **Upload**.

   The root CA certificate is uploaded into Catalyst Center and used to generate a Certificate Signing Request.

   After the upload process finishes, a `Certificate Uploaded Successfully` message is displayed.

7. Click **Next**.

   Catalyst Center generates and displays the Certificate Signing Request.

8. View the Catalyst Center-generated Certificate Signing Request in the GUI and do one of these actions:
   - Click the **Download** link to download a local copy of the Certificate Signing Request file.

     You can then attach this Certificate Signing Request file to an email to send to your root CA.
   - Click the **Copy to the Clipboard** link to copy the Certificate Signing Request file's content.

     You can then paste this Certificate Signing Request content to an email or include it as an attachment to an email and send it to your root CA.

9. Send the Certificate Signing Request file to your root CA.

   Your root CA will then return a subordinate CA file, which you must import back into Catalyst Center.

10. After receiving the subordinate CA file from your root CA, access the Catalyst Center GUI again and return to the **Certificate Authority** window.
11. Click the **CA Management** tab.
12. Click **Yes** for the **Change CA mode** button.

    After clicking **Yes**, the GUI view with the Certificate Signing Request display.

13. Click **Next**.

    The **Certificate Authority** window displays the **Import SubCA Certificate** field.

14. Drag and drop your subordinate CA certificate into the **Import SubCA Certificate** field and click **Save**.

    The subordinate CA certificate is uploaded into Catalyst Center.

    After the upload finishes, the GUI displays the subordinate CA mode under the **CA Management** tab.

15. Review the fields under the **CA Management** tab:
    - **Sub CA Certificate**: Displays the current subordinate CA certificate.
    - **External Root CA Certificate**: Displays the root CA certificate.
    - **Sub CA Certificate Lifetime**: Displays the lifetime value of the subordinate CA certificate.
    - **Current CA Mode**: Displays SubCA mode.

Provision a rollover subordinate CA certificate

Information about provisioning a rollover CA certificate after 70 percent of the existing subordinate CA lifetime has elapsed.

Catalyst Center lets you save a subordinate certificate as a rollover subordinate CA when 70 percent of the existing subordinate CA lifetime has elapsed.

Before you begin

- To initiate subordinate CA rollover provisioning, you must have changed the certificate authority role to subordinate CA mode. Refer to Change the role of the certificate authority from root to subordinate on page 34 .
- 70 percent or more of the lifetime of the current subordinate CA certificate must have expired. When this occurs, Catalyst Center displays a **Renew** button under the **CA Management** tab.
- You must have a signed copy of the rollover subordinate CA certificate.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **Certificate Authority**.
2. In the **CA Management** tab, review the CA certificate configuration information:
   - **Subordinate CA Certificate**: Displays the current subordinate CA certificate.
   - **External Root CA Certificate**: Displays the root CA certificate.
   - **Subordinate CA Certificate Lifetime**: Displays the lifetime value of the current subordinate CA certificate.
   - **Current CA Mode**: Displays SubCA mode.
3. Click **Renew**.

   Catalyst Center uses the existing subordinate CA to generate and display the rollover subordinate CA Certificate Signing Request.
4. View the generated Certificate Signing Request in the GUI and do one of these actions:
   - Click the **Download** link to download a local copy of the Certificate Signing Request file.

     You can then attach this Certificate Signing Request file to an email to send it to your root CA.
   - Click the **Copy to the Clipboard** link to copy the content of the Certificate Signing Request file.

     You can then paste this Certificate Signing Request content to an email or include it as an attachment to an email and send it to your root CA.
5. Send the Certificate Signing Request file to your root CA.

   Your root CA will then return a rollover subordinate CA file that you must import back into Catalyst Center.

   The Certificate Signing Request for the subordinate CA rollover must be signed by the same root CA who signed the subordinate CA you imported when you switched from RootCA mode to SubCA mode.
6. After receiving the rollover subordinate CA file from your root CA, return to the **Certificate Authority** window.
7. Click the **CA Management** tab.
8. Click **Next** in the GUI in which the Certificate Signing Request displays.

   The **Certificate Authority** window displays the **Import Sub CA Certificate** field.
9. Drag and drop your subordinate rollover CA certificate into the **Import Sub CA Certificate** field and click **Save**.

   The rollover subordinate CA certificate is uploaded into Catalyst Center.

   After the upload finishes, the GUI changes to disable the **Renew** button under the **CA Management** tab.

Use an external SCEP broker

Catalyst Center uses the Simple Certificate Enrollment Protocol (SCEP) for enrollment and the provisioning of certificates to network devices.

Catalyst Center uses the Simple Certificate Enrollment Protocol (SCEP) for enrollment and the provisioning of certificates to network devices. You can use your own SCEP broker and certificate service, or you can use an external SCEP broker. To set up an external SCEP broker, complete this procedure:

> **Note**
>
> For more information regarding SCEP, see Simple Certificate Enrollment Protocol Overview.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **Certificate Authority**.
2. In the **Certificate Authority** window, click the **Use external SCEP broker** radio button.
3. Use one of these options to upload an external certificate:
   - Choose a file
   - Drag and drop to upload

   > **Note**
   >
   > Only file types such as .pem, .crt, and .cer are accepted. The file size cannot exceed 1 MB.

4. Click **Upload**.
5. By default, **Manages Device Trustpoint** is enabled, meaning Catalyst Center configures the sdn-network-infra-iwan trustpoint on the device. You must complete these steps:
   a) Enter the enrollment URL where the device requests the certificate via SCEP.
   b) (Optional) Enter any optional subject fields used by the certificate, such as country, locality, state, organization, and organization unit. The common name (CN) is automatically configured by Catalyst Center with the device platform ID and device serial number.
   c) In the **Revocation Check** field, click the drop-down list and choose the appropriate revocation check option.
   d) (Optional) Check the **Auto Renew** check box and enter an auto enrollment percentage.

   If **Manages Device Trustpoint** is disabled, for devices to send wired and wireless Assurance telemetry to Catalyst Center, you must manually configure the sdn-network-infra-iwan trustpoint on the device and then import a certificate. See Configure the Device Certificate Trustpoint.

6. Click **Save**.

   The external CA certificate is uploaded.

   If you want to replace the uploaded external certificate, click **Replace Certificate** and enter the required details.

Switch back to an internal certificate authority

Information about switching back to an internal PKI certificate after uploading an external certificate.

After uploading an external certificate, to switch back to the internal certificate:

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **Certificate Authority**.
2. In the **Certificate Authority** window, click the **Use Catalyst Center** radio button.
3. In the **Switching back to Internal Certificate Authority** alert, click **Apply**.

   The **Settings have been updated** message appears. For more information, see Change the role of the certificate authority from root to subordinate on page 34.

Export the Catalyst Center certificate authority

You can download the device certificates that are required to set up an external entity such as a AAA server or Cisco ISE server to authenticate the devices.

Catalyst Center allows you to download the device certificates that are required to set up an external entity such as an AAA server or a Cisco ISE server to authenticate the devices.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **Certificate Authority**.
2. Click **Download** to export the device CA and add it as the trusted CA on the external entities.

Reset CA certificate

The reset CA feature helps users manage CA when there are issues with renewals or when a CA expires.

Use the reset CA feature to manage CA during renewal issues or expiration. You can create sub CAs with a defined lifetime. This feature allows you to reset the CA easily when a sub CA expires or when you want to switch to another sub CA.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **Certificate Authority**.
2. In the CA table, locate the request that you want to reset. Under **Action**, hover your cursor over the vertical ellipsis (⋮) and click **Reset to Default**.
3. Click **Yes** in the **Warning** message.

   Resetting the certificate to RootCA may take up to five minutes. Refresh the CA page after a few minutes to see the updated status.

Configure the device certificate trustpoint

Information about configuring the device certificate trustpoint for devices to send wired and wireless Assurance telemetry to Catalyst Center when **Manages Device Trustpoint** is disabled.

If **Manages Device Trustpoint** is disabled in Catalyst Center, for devices to send wired and wireless Assurance telemetry to Catalyst Center, you must manually configure the sdn-network-infra-iwan trustpoint on the device and then import a certificate.

This manual configuration procedure is required to enroll from an external CA via SCEP.

Procedure

1. Enter the following commands:

```
crypto pki trustpoint sdn-network-infra-iwan
  enrollment url http://<SCEP_enrollment_URL_to_external_CA>
  fqdn <device_FQDN>
  subject-name
CN=<device_platform_ID>_<device_serial_number>_sdn-network-infra-iwan
  revocation-check <crl, crl none, or none>  # to perform revocation check
with CRL, CRL fallback to no check, or no check
  rsakeypair sdn-network-infra-iwan
  fingerprint <CA_fingerprint> # to verify that the CA at the url connection
 matches the fingerprint given
```

2. (Optional, but recommended) Automatically renew the certificate and avoid certificate expiry:

```
auto-enroll 80 regenerate
```

3. (Optional) Specify the interface that is reachable to the enrollment URL. Otherwise, the default is the source interface of the http service.

```
source interface <interface>
```

Configure trusted certificates

Catalyst Center supports the import and storage of a trusted certificate bundle from Cisco. This trusted certificate bundle is used by Cisco networking devices to authenticate Catalyst Center and its applications, upon the presentation of a valid professional third-party vendor issued or self-signed digital certificate.

Catalyst Center contains a preinstalled Cisco trusted certificate bundle (Cisco Trusted External Root Bundle). Catalyst Center also supports the import and storage of an updated trusted certificate bundle from Cisco. The trusted certificate bundle is used by supported Cisco networking devices to establish a trust relationship with Catalyst Center and its applications.

Note

The Cisco trusted certificate bundle is a file called ios.p7b that only supported Cisco devices can unbundle and use. This ios.p7b file contains root certificates of valid certificate authorities, including Cisco. This Cisco trusted certificate bundle is available on the Cisco cloud (Cisco InfoSec). The bundle is located at https://www.cisco.com/security/pki/.

The trusted certificate bundle provides you with a safe and convenient way to use the same CA to manage all your network device certificates, as well as your Catalyst Center certificate. Catalyst Center uses the trusted certificate bundle to validate its own certificate and any proxy gateway certificate and to determine whether the certificates are valid CA-signed certificates. Additionally, the trusted certificate bundle is available for upload to Network PnP-enabled devices at the beginning of their PnP workflow so that they can trust Catalyst Center for subsequent HTTPS-based connections.

You import the Cisco trusted bundle using the **Trusted Certificates** window in the GUI.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **Trusted Certificates**.
2. In the **Trusted Certificates** window, click the **Update trusted certificates now** hyperlink to initiate a new download and install of the trusted certificate bundle.

   The hyperlink is displayed on the window only when an updated version of the ios.p7b file is available and internet access is available.

   After the new trusted certificate bundle is downloaded and installed on Catalyst Center, Catalyst Center makes this trusted certificate bundle available to supported Cisco devices for download.
3. If you want to import a new certificate file, click **Import**, choose a valid certificate file from your local system, and click **Import** in the **Import Certificate** window.
4. Click **Export** to export the certificate details.

4 Manage Cisco Accounts

Topics:

- Register Plug and Play
- Configure Cisco credentials
- Configure Smart Account
- Smart Licensing
- Configure connection mode

Register Plug and Play

Information about registering Catalyst Center as a controller for Plug and Play (PnP) to synchronize the device inventory from the Cisco PnP Connect cloud portal to PnP in Catalyst Center

You can register Catalyst Center as a controller for Cisco Plug and Play (PnP) Connect, in a Cisco Smart Account for redirection services. This lets you synchronize the device inventory from the Cisco PnP Connect cloud portal to PnP in Catalyst Center.

Before you begin

Only a user with **SUPER-ADMIN-ROLE** or **CUSTOM-ROLE** with system management permissions can perform this procedure.

In the Smart account, users are assigned roles that specify the functions and authorized to perform:

- Smart Account Admin user can access all the Virtual Accounts.
- Users can access assigned Virtual Accounts only.

Procedure

1. From the main menu, choose **System** > **Settings** > **Cisco Accounts** > **PnP Connect**.
   A table of PnP connected profiles is displayed.
2. If you have already configured the Cisco.com user, skip ahead to Step 3. If you haven't, complete these steps:
   a) Open an Incognito or private window in your browser (to avoid using previously cached credentials).
   b) Open another Catalyst Center GUI instance and log in.
   c) Open another instance of the **PnP Connect** window.
   d) In the **Cisco.com ID** field, click the **Add** link.
   e) In the **Information** pop-up window, check one or both of these check boxes and then click **Authenticate**:
      - Mandatory: **I am in private or incognito mode**
      - Optional: **Save credentials**
   f) In the **Activate your device** pop-up window, confirm that an activation code is displayed and then click **Next**.
   g) In the **Log in** pop-up window, enter the cisco.com user's email address and then click **Next**.
   h) In the **Verify with your password** pop-up window, enter the cisco.com user's password and then click **Verify**.
      The **Device activated** pop-up window appears.
   i) Close the **Device Activated** pop-up window.
   j) Refresh the **PnP Connect** window.
   k) In the **Cisco.com ID** field, confirm that the email address you entered for the user is displayed. Also confirm that you see the **Change** link.
3. Click **Register** to register a virtual account.
4. In the **Register Virtual Account** window, the Smart Account you configured is displayed in the **Select Smart Account** drop-down list. You can select an account from the **Select Virtual Account** drop-down list.
5. Click the required **IP** or **FQDN** radio button.
6. Enter the IP address or FQDN (Fully Qualified Domain Name) of the controller.
7. Enter the profile name. A profile is created for the selected virtual account with the configuration that you provided.
8. Select the **Use as Default Controller Profile** check box to register this Catalyst Center controller as the default controller in the Cisco PnP Connect cloud portal.

9. Click **Register**.

Create PnP event notifications

Information about creating event notifications to receive a notification when a Plug and Play (PnP) event takes place in Catalyst Center.

You receive a notification whenever a Plug and Play (PnP) event takes place in Catalyst Center by creating event notifications. See the "Work with Event Notifications" topic in the *Cisco Catalyst Center Platform User Guide* to configure the supported channels and create event notifications.

Ensure that you create event notifications for these PnP events:

Event name	Event ID	Description
Add device failed	NETWORK-TASK_FAILURE-3-008	Device(s) are not added through single or bulk import. An error occurs when adding devices through single or bulk import.
Add device successful	NETWORK-TASK_COMPLETE-4-007	Device(s) are added through single or bulk import successfully.
Device in error state	NETWORK-ERROR_1-002	Device goes to **Error** state.
Device in provisioned state	NETWORK-INFO_4-003	Device goes to **Provisioned** state.
Device stuck in onboarding state	NETWORK-TASK_PROGRESS-2-006	Device is stuck in onboarding state for more than 15 minutes.
Device waiting to be claimed	NETWORK-INFO_2-001	Device reaches **Unclaimed** state and is ready to be provisioned.
Smart Account sync failed	NETWORK-TASK_FAILURE-1-005	Smart Account sync is failed for some devices.
Smart Account sync successful	NETWORK-TASK_COMPLETE-4-004	Smart Account sync is successful for some devices.

Configure Cisco credentials

Information about configuring Cisco credentials for Catalyst Center.

Complete this procedure to configure the credentials Catalyst Center uses for software image and update downloads. These credentials are the username and password that you use to log in to the Cisco website

Important

- Cisco has implemented a new authentication infrastructure. As a result, if you back up data from Catalyst Center Release 2.3.7.7, where a Cisco.com user was configured, and restore the data in Catalyst Center Release 3.1.3, you must reauthenticate that user.
- Catalyst Center no longer stores the Cisco.com user's credentials locally, for security purposes.

Before you begin

Only users with SUPER-ADMIN-ROLE permissions or CUSTOM-ROLE with "Write" permission to System Settings can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Settings** > **Cisco Accounts** > **Cisco.com Credentials**.
2. Configure the Cisco.com user:
   a) Open an Incognito/private window in your browser (to avoid using previously cached credentials).
   b) Open another Catalyst Center GUI instance and log in.
   c) Open another instance of the **Cisco.com Credentials** window.
   d) In the **Cisco.com ID** field, click the **Add** link.
   e) In the **Information** pop-up window, check the **I am in private or incognito mode** check box and then click **Proceed**.
   f) In the **Activate your device** pop-up window, confirm that an activation code is displayed and then click **Next**.
   g) In the **Log in** pop-up window, enter the cisco.com user's email address and then click **Next**.
   h) In the **Verify with your password** pop-up window, enter the cisco.com user's password and then click **Verify**.

   The **Device activated** pop-up window appears.
3. Confirm that the user was configured successfully.
   a) Close the **Device Activated** pop-up window.
   b) Refresh the **Cisco.com Credentials** page.
   c) In the **Cisco.com ID** field, confirm that the email address you entered for the user is displayed. Also confirm that you see both the **Change** and **Delete** links.

Clear Cisco credentials

Information about clearing Cisco credentials for Catalyst Center. Cisco credentials are the username and password that you use to log in to the Cisco website to access software and services.

To delete the cisco.com credentials that are currently configured for Catalyst Center, complete this procedure.

Note

- When you perform any tasks that involve software downloads or device provisioning and cisco.com credentials are not configured, you'll be prompted to enter them before you can proceed. In the resulting dialog box, check the **Save For Later** check box in order to save these credentials for use throughout Catalyst Center. Otherwise, you'll need to enter credentials each time you perform these tasks.
- Completing this procedure will undo your acceptance of the end-user license agreement (EULA). See Accept the license agreement on page 58 for a description of how to reenter EULA acceptance.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions or CUSTOM-ROLE with "Write" permission to System Settings can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Settings** > **Cisco Accounts** > **Cisco.com Credentials**.
2. Click the **Delete** link.
3. In the resulting dialog box, click **Delete** to confirm the operation.

Configure Smart Account

Information about configuring Cisco Smart Account credentials. These credentials are used to connect to your Smart Licensing account.

Cisco Smart Account credentials are used for connecting to your Smart Licensing account. The License Manager tool uses the details of license information from this Smart Account for entitlement and license management.

Important

Cisco has implemented a new authentication infrastructure. As a result, if you back up data from Catalyst Center Release 2.3.7.7, where Smart Account credentials were configured, and restore the data in Catalyst Center Release 3.1.3, you must reauthenticate the associated Smart Accounts.

Before you begin

Ensure that you have SUPER-ADMIN-ROLE permissions or CUSTOM-ROLE with "Write" permission to System Settings.

Procedure

1. From the main menu, choose **System** > **Settings** > **Cisco Accounts** > **Smart Account**.
2. Link the appropriate Smart Account user and Smart Account name to your Smart Licensing account:
   a) Open an Incognito/private window in your browser (to avoid using previously cached credentials).
   b) Open another Catalyst Center GUI instance and log in.
   c) Open another instance of the **Smart Account** window.
   d) Click the **Add** link.
   e) In the **Information** pop-up window, check the **I am in private or incognito mode** check box and then click **Proceed**.
   f) In the **Activate your device** pop-up window, confirm that an activation code is displayed and then click **Next**.
   g) In the **Log in** pop-up window, enter the cisco.com user's email address and then click **Next**.
   h) In the **Verify with your password** pop-up window, enter the cisco.com user's password and then click **Verify**.

      The **Device activated** pop-up window appears.

   i) Confirm whether the Smart Account user you just added is listed in both the **Smart Account Credentials** and **Expired Smart Accounts** sections:

If the Smart Account user...	Then...
is listed in both sections,	delete the user from the **Expired Smart Accounts** section by clicking their trash icon in the **Actions** column.
is *not* listed in both sections,	proceed to Step 3.

3. If you want to change the selected Smart Account Name, click **Change**. You will be prompted to select the Smart Account that will be used for connecting to your Smart Licensing Account on Cisco SSM cloud.
   a) Choose the **Smart Account** from the drop-down list.
   b) Click **Save**.
4. Click **View all virtual accounts** to view all the virtual accounts associated with the Smart Account.

   Note

   Cisco Accounts supports multiple smart and virtual accounts.

5. (Optional) If you want to register smart license-enabled devices automatically to a virtual account, check the **Auto register smart license enabled devices** check box. A list of virtual accounts associated with the smart account is displayed.
6. Select the required virtual account. Whenever a smart license-enabled device is added in the inventory, it's automatically registered to the selected virtual account.
7. If you want to remove the licensed smart account users and their associated historical data, click **Delete historical information**.

   The **Delete Historical Data** slide-in pane displays the licensed smart account users. It also displays the existing smart accounts that aren't currently present in Catalyst Center, but their historical data is still available.
8. In the **Smart Account list** area check the check box next to the smart account that you want to delete.
9. Click **Delete**.
10. Click **Delete** in the subsequent confirmation window.
11. Check the **Delete the associated license historical information** check box to delete the historical information of the associated license.

Smart Licensing

Information about registering virtual account for Smart Licensing to view the available Catalyst Center licenses.

Cisco Smart licensing allows you to register Catalyst Center on to the Cisco SSM.

To use Smart Licensing, you must first set up a Smart Account on Cisco License Central. For a more detailed overview on Cisco Licensing, visit the Licensing Hub.

Note

Smart license registration for a Catalyst Center instance is supported using these connection modes:

- Direct
- On-Prem Cisco SSM, and
- Smart proxy.

Before you begin

- To enable Smart Licensing, you must configure Cisco Credentials (see Configure Cisco credentials on page 45) and upload Catalyst Center license conventions in Cisco SSM.
- To enable Smart Licensing, you must add a Smart Account in **System** > **Settings** > **Cisco Accounts** > **Smart Account**. For more information, see Configure Smart Account on page 47.

Procedure

1. From the main menu, choose **System** > **Settings** > **Cisco Accounts** > **Smart Licensing**.

   By default, **Smart Account** details are displayed.
2. Choose a virtual account from the **Search Virtual Account** drop-down list to register.
3. Click **Register**.
4. After successful registration, click the **View Available Licenses** link to view the available Catalyst Center licenses.

Configure connection mode

Information about configuring connection mode to manage the connections between smart-enabled devices in your network that interact with Catalyst Center and the Cisco Smart Software Manager (SSM).

Connection mode manages the connections between smart-enabled devices in your network that interact with Catalyst Center and the Cisco Smart Software Manager (SSM). Ensure that you have SUPER-ADMIN access permission to configure the different connection modes.

The SSL certificate for the SSM must include the associated IP address within the SAN field.

Procedure

1. From the main menu, choose **System** > **Settings** > **Cisco Accounts** > **SSM Connection Mode**.

   Connection modes include:

   - **Direct**
   - **On-Prem CSSM**
   - **Smart proxy**

2. Choose **Direct** to enable a direct connection to the Cisco SSM cloud.
3. If your organization is security sensitive, choose **On-Prem CSSM**. The on-prem option lets you access a subset of Cisco SSM functionality without using a direct internet connection to manage your licenses with the Cisco SSM cloud.
   a) Before you enable **On-Prem CSSM**, confirm that the satellite is deployed, up, and running in your network site.

      If the satellite is configured with FQDN, the call-home configuration of satellite FQDN is pushed instead of the IP address.

      In dual-stack IPv4/IPv6 deployments, on-premises CSSM requires the use of an FQDN. If you enter an IP address, Catalyst Center prompts you to enter an FQDN instead. This requirement applies to both new installations and system upgrades.

   b) Enter the details for the **On-Prem CSSM Host**, **Smart Account name**, **Client ID**, and **Client Secret**.

      In the Smart Account field, enter the name of one SSM on-prem account only. Do not use a space or an underscore in the name.

      You can change the host/IP value during On-Prem CSSM configuration. This is particularly useful during upgrades when you need to update existing settings to the required FQDN format. Be aware that changing the host/IP may cause your devices to become unsynchronized with the SSM Connection Mode settings.

      For information about how to retrieve the client ID and client secret, see the *Cisco Smart Software Manager On-Prem User Guide*.
   c) Click **Test Connection** to validate the Cisco SSM connection.
   d) Click **Save** and then **Confirm**.
   e) If there are devices that need to be registered again with the changed SSM, the **Need to Re-Register Devices** dialog box appears. Click **OK** in the dialog box.
   f) In the **Tools** > **License Manager** > **Devices** window, choose the devices that you want to register again and click **Sync Connection Mode**.

      > **Note**
      >
      > Such devices display the **Connection Mode out of sync** tag or message.

   g) In the **Resync Devices** dialog box:
      - Enter the **Smart Account**.
      - Enter the **Virtual Account**.
      - Click **Now** to start the resync immediately or click **Later** to schedule the resync at a specific time.
      - Click **Resync**.

      The **Recent Tasks** window shows the resync status of the devices.

4. Choose **Smart proxy** to register your smart-enabled devices with the Cisco SSM cloud through Catalyst Center. With this mode, devices do not need a direct connection to the Cisco SSM cloud. Catalyst Center proxies the requests from the device to the Cisco SSM cloud through itself.

   While provisioning the call-home configuration to the device, if the satellite is configured with FQDN, the FQDN of the satellite is pushed instead of the IP address.

5 Configure Device Settings

Topics:

- Configure an image distribution server
- Access point image transfer
- Enable PnP device authorization
- Device controllability
- Configure the network resync interval
- Configure SNMP properties
- Enable ICMP ping
- Configure AP location for PnP onboarding
- Configure device prompts
- Configure the automatic acceptance of SSH key changes
- Configure device configuration backup settings
- Configure an external server for archiving device configuration

Configure an image distribution server

Information about configuring an image distribution server to store and distribute software images.

An image distribution server helps in the storage and distribution of software images. You can configure up to three external image distribution servers to distribute software images. You can also set up one or more protocols for the newly added image distribution servers.

For information about the supported servers, see the "Server Requirements for Automation Data Backup" section in Backup server requirements on page 210.

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings** > **Image Distribution Servers**.
2. In the **Image Distribution Servers** window, click **Servers**.

   The table displays details about the host, username, SFTP, SCP, and connectivity of image distribution servers.
3. Click **Add** to add a new image distribution server.

   The **Add a New Image Distribution Server** slide-in pane is displayed.
4. Configure these image distribution server settings:
   - **Host**: Enter the hostname or IP address of the image distribution server.
   - **Root Location**: Enter the working root directory for file transfers.

     Note

     For Cisco AireOS Wireless Controllers, image distribution fails if the configured path is longer than 16 characters.

   - **Username**: Enter a username to log in to the image distribution server. The username must have read/write privileges in the working root directory of the server.
   - **Password**: Enter a password to log in to the image distribution server.
   - **Port Number**: Enter the port number on which the image distribution server is running.
5. Click **Save**.
6. Because some legacy wireless controller software versions support only weak ciphers (such as SHA1-based ciphers) for SFTP, Catalyst Center should enable SFTP compatibility mode for SFTP connections from wireless controllers for software image management and wireless assurance. You can temporarily enable support for weak ciphers on the Catalyst Center SFTP server for up to 90 days. To allow weak ciphers:
   a) Hover over the **i** icon next to the IP address of the SFTP server and click **Click here**.
   b) In the **Compatibility Mode** slide-in pane, check the **Compatibility Mode** check box and enter a duration (from 1 minute to 90 days).
   c) Click **Save**.
7. Optional: To edit the settings, click the **Edit** icon next to the corresponding image distribution server, make the required changes, and click **Save**.
8. Optional: To delete an image distribution server, click the **Delete** icon next to the corresponding image distribution server and click **Delete**.

Access point image transfer

Transfer image from wireless controller to APs over HTTPS.

The wireless controller pushes the image to the APs after the image is distributed to it. Catalyst Center allows image download on APs from the wireless controller, over HTTPS. This out-of-band file transfer efficiently upgrades the AP image.

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings** > **Software Image Management**.
2. Click **Access Point Image Transfer** tab.
3. Click the **Image Transfer Settings** drop-down list and choose **Use HTTPS Only**.

   This option will ensure that all image transfers from wireless controller to APs use only the HTTPS protocol. If HTTPS is not enabled on the wireless controller, it is enabled only for image transfer and then disabled after the image transfer.

Enable PnP device authorization

Information about enabling authorization for a Plug and Play (PnP) device.

To enable authorization on a device:

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings**.
2. From the **Device Settings** drop-down list, choose **PnP Device Authorization**.

   Note

   By default, devices are automatically authorized.

3. Check the **Device Authorization** check box to enable authorization on the device.
4. Click **Save**.

Device controllability

Describes a system-level process that automatically enforces state synchronization for features like SNMP, NETCONF, and Syslog, ensuring Catalyst Center can effectively manage and monitor network devices.

Device controllability is a system-level process on Catalyst Center that

- enforces state synchronization for some device-layer features
- helps deploy network settings required for device management, and

- runs discovery when changes are made to the network, such as when a device is added to inventory or is assigned to a site.

To view the configuration that is pushed to the device, go to **Provision** > **Inventory** and from the **Focus** drop-down list, choose **Provision**. In the **Provision Status** column, click **See Details**.

> **Note**
>
> When Catalyst Center configures or updates devices, the transactions are captured in the audit logs, which you can use to track changes and troubleshoot issues.

Device controllability enables these device settings:

- **Device Discovery**:
  - SNMP Credentials
  - NETCONF Credentials
- **Adding Devices to Inventory**
  - Cisco TrustSec (CTS) Credentials

> **Note**
>
> Cisco TrustSec (CTS) Credentials are pushed during inventory only if the **Global** site is configured with Cisco ISE as AAA. Otherwise, CTS is pushed to devices during Assign to Site when the site is configured with Cisco ISE as AAA.

- **Assigning Devices to a Site**
  - Wired Endpoint Data Collection Enablement
  - Controller Certificates

> **Note**
>
> For Cisco IOS devices, we recommend configuring the time zone from the device UI console to prevent issues in the processing of PKCS certificate expiration time.

  - SNMP Trap Server Definitions
  - Syslog Server Definitions
  - Application Visibility
  - Application QoS Policy
  - NetFlow Server Definitions

- Wireless Service Assurance (WSA)
- Wireless Telemetry
- DTLS Cipher suite
- AP Impersonation
- IPDT Enablement

By default, the system enables device controllability. If you do not want device controllability enabled, disable it manually. For more information, see Configure device controllability on page 58.

When device controllability is disabled, Catalyst Center does not configure any of the credentials or features on devices while running discovery or when the devices are assigned to a site.

Circumstances that dictate whether or not device controllability configures network settings on devices include:

- **Device Discovery**
  - If SNMP and NETCONF credentials are not already present on a device, these settings are configured during the discovery process.
  - When you enable NETCONF on IOS devices, you can configure up to six DNS servers. The system removes existing DNS servers only if all six are used and you need to add new servers. Otherwise, it leaves the existing servers unchanged.
- **Device in Inventory**
  - After a successful initial inventory collection, IPDT is configured on the devices.
  - In earlier releases, the following IPDT commands were configured:

```
ip device tracking
ip device tracking probe delay 60
ip device tracking probe use-svi
```

  - For each interface:

```
interface $physicalInterface
ip device tracking maximum 65535
```

  - In the current release, the following IPDT commands are configured for any newly discovered device:

```
device-tracking tracking
device-tracking policy IPDT_POLICY
tracking enable
```

  - For each interface:

```
interface $physicalInterface
device-tracking attach-policy IPDT_POLICY
```

> **Note**
>
> For the Cisco Catalyst 9410R Switch running software version 17.5.1 or later, ports ending with 4/0/48 are skipped during IPDT configuration.

- **Device Provisioning**
  - If the device does not have the required DTLS configuration and DNS settings that match user intent, both the DTLS cipher suite and DNS configuration are pushed.
  - If a Network Assurance certificate configuration already exists from Assign to Site, the system skips the configuration and retries failed attempts.
  - If WSA configurations and PKCS12 certificate were already enabled during Assign to Site, configuration is skipped.

    > **Note**
    >
    > If previous configuration attempts fail, the device controllability workflow retries the configuration during provisioning.

- **Device in Global Site**
  - When you successfully add, import, or discover a device, Catalyst Center places the device in the **Managed** state and assigns it to the **Global** site by default.
  - Even if you have defined SNMP server, Syslog server, and NetFlow collector settings for the **Global** site, Catalyst Center *does not* change these settings on the device.

- **Device Moved to Site**
  - If you move a device from the **Global** site to a new site that has SNMP server, Syslog server, NetFlow collector settings, telemetry subscriptions are configured, Catalyst Center changes these settings on the device to the settings configured for the new site.
  - If the device does not have the required DTLS configuration and DNS settings that match user intent, both the DTLS cipher suite and DNS configuration are pushed.
  - WSA configurations are enabled on the device based on applicability.
  - Network Assurance (NA) certificate configuration is created on the device.
  - Device controllability creates a PKCS trustpoint named sdn-network-infra-iwan and uses it to install the certificate. If a trustpoint with this name exists, it is replaced with the latest certificate.
  - If the wireless AP join certificate is not present, it is configured on the device.
  - During **Force Configuration Push**, the certificate is not re-pushed and is not recreated once configured.
  - If the required AP impersonation configuration is missing, it is pushed to the device.

- **Device Removed from Site**
  - If you remove a device from a site, Catalyst Center does not remove the SNMP server, Syslog server, and NetFlow collector settings from the device.

- **Device Deleted from Catalyst Center**
  - If you delete a device from Catalyst Center and check the **Clean Up Configuration** check box, the SNMP server, Syslog server, DNS settings, PKCS configurations, NetFlow collector settings, telemetry subscriptions, AP impersonation configuration, WSA configurations, and NA certificate configurations pushed by Catalyst Center are removed from the device.
  - During device delete, DTLS cipher suite configurations and wireless AP join certificate are not removed.
- **Device Moved from Site to Site**
  - If you move a device—for example, from Site A to Site B—Catalyst Center replaces the SNMP server, Syslog server, and NetFlow collector settings on the device with the settings assigned to Site B.
- **Update Site Telemetry Changes**

Configuration Types	Force Configuration Push NOT Enabled	Force Configuration Push ENABLED
DNS Configuration	Pushed if required DNS configuration is not available.	Not re-pushed if DNS configuration already exists.
WSA Configuration	Not re-pushed if configurations are available and valid. Retries if the last attempt failed.	Always re-pushed regardless of current device configuration.
DTLS Configuration	Pushed if required DTLS configuration is not available. Not re-pushed if already exists.	Not re-pushed if DTLS configuration already exists.
Wireless AP Join Certificate Configuration	Not re-pushed or recreated once configured.	Not re-pushed or recreated once configured.
PKCS12 Configuration	Not re-pushed if configurations are available and valid. Retries if the last attempt failed.	Always re-pushed regardless of current device state.
NA Certificate Configuration	Not re-pushed if configurations are available and valid. Retries if the last attempt failed.	Always re-pushed regardless of current device state.
Telemetry Subscription Configuration	Not re-pushed if already available. Retries if the last attempt failed	Re-pushed only if there is a difference between required and existing device configuration.
AP Impersonation Configuration	Pushed if required configuration is missing.	Not re-pushed even if configuration already exists.

Note

When device controllability is enabled, if Catalyst Center cannot connect to the device through the user-provided SNMP credentials and collect device information, Catalyst Center pushes the user-provided SNMP credentials to the device. For SNMPv3, the user is created under the *default* group.

For Cisco AireOS devices, the user-provided SNMPv3 passphrase must be between from 12 to 31 characters.

Configure device controllability

Information about configuring device controllability.

Device controllability deploys the required network settings that Catalyst Center needs to manage devices. Device controllability is enabled by default.

To manually disable device controllability, use this procedure.

Note

If you disable device controllability, Catalyst Center doesn't automatically configure discovered devices with essential settings, including SNMP credentials, trap servers, IP Device Tracking (IPDT), NetFlow, Syslog, and NETCONF.

If you assign a device to a site after disabling device controllability, Catalyst Center doesn't support out-of-band configuration change notifications and management of APs, because Catalyst Center is no longer registered as a trap receiver on the device.

Before you begin

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings** > **Device Controllability**.
2. Uncheck the **Enable Device Controllability** check box.
3. To prevent Catalyst Center from automatically correcting any issues identified in device telemetry configuration, leave the **Enable autocorrect telemetry config** check box unchecked.

   When autocorrect telemetry is enabled, Catalyst Center automatically detects and resolves certificate issues related to secure communication between devices and Catalyst Center. (This feature doesn’t address configuration issues with NetFlow, NBAR, or CBAR telemetry.) Catalyst Center checks each device for certificate changes every 15 minutes, and each device can be fixed only once within a 24-hour period.

   By default, this check box is disabled. You can only enable it when device controllability is enabled.
4. Click **Save**.

Accept the license agreement

Information about accepting the end-user license agreement (EULA) for software download or device provisioning.

You must accept the end-user license agreement (EULA) before you download software or provision a device.

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings** > **Device EULA Acceptance**.
2. If you have already configured the Cisco.com user, skip ahead to Step 3. If you haven't, complete these steps:
   a) Open an Incognito/private window in your browser (to avoid using previously cached credentials).
   b) Open another Catalyst Center GUI instance and log in.
   c) Open another instance of the **Device EULA Acceptance** window. From the main menu, choose **System** > **Settings** > **Device Settings** > **Device EULA Acceptance**.
   d) In the **Cisco.com ID** field, click the **Add** link.
   e) In the **Information** pop-up window, check the **I am in private or incognito mode** check box and then click **Proceed**.
   f) In the **Activate your device** pop-up window, confirm that an activation code is displayed and then click **Next**.
   g) In the **Log in** pop-up window, enter the cisco.com user's email address and then click **Next**.
   h) In the **Verify with your password** pop-up window, enter the cisco.com user's password and then click **Verify**.

      The **Device activated** pop-up window appears.

   i) Close the **Device Activated** pop-up window.
   j) Refresh the **Device EULA Acceptance** window.
   k) In the **Cisco.com ID** field, confirm that the email address you entered for the user is displayed. Also confirm that you see the **Change** link.
3. Open the **Cisco End User License Agreement Supplemental Product Terms** link in a new browser tab.
4. Open and read the Catalyst Center EULA.
5. Check the **I have read and accept the Device EULA** check box.
6. Click **Save**.

Configure the network resync interval

Information about configuring the network resync interval.

You can update the polling interval at the global level for all devices by choosing **System** > **Settings** > **Network Resync Interval**. Or, you can update the polling interval at the device level for a specific device by choosing **Device Inventory**. When you set the polling interval using the **Network Resync Interval**, that value takes precedence over the **Device Inventory** polling interval value.

Before you begin

- Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.
- Make sure that you have devices in your inventory. If not, discover devices using the Discovery feature.

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings** > **Network Resync Interval**.
2. In the **Resync Interval** field, enter a new time value (in minutes).
3. (Optional) Check the **Override for all devices** check box to override the existing configured polling interval for all devices.

4. Click **Save**.

Configure SNMP properties

Information about configuring SNMP properties, including retries and timeouts.

You can configure retry and timeout values for SNMP.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings** > **SNMP**.
2. Configure these fields:
   - **Retries**: Number of attempts allowed to connect to the device. Valid values are from 1 to 3. The default is 3.
   - **Timeout**: Number of seconds Catalyst Center waits when trying to establish a connection with a device before timing out. Valid values are from 1 to 300 seconds in intervals of 5 seconds. The default is 5 seconds.
3. Click **Save**.
4. (Optional) To return to the default settings, click **Reset** and **Save**.

Enable ICMP ping

Information about enabling Internet Control Message Protocol (ICMP) ping. Catalyst Center uses ICMP to ping the unreachable access points in FlexConnect mode.

When Internet Control Message Protocol (ICMP) ping is enabled and there are unreachable access points in FlexConnect mode, Catalyst Center uses ICMP to ping these access points every 5 minutes to enhance reachability.

To enable an ICMP ping:

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings** > **ICMP Ping**.
2. Check the **Enable ICMP ping for unreachable access points in FlexConnect mode** check box.
3. Click **Save**.

Configure AP location for PnP onboarding

You can configure the assigned site as the AP location during PnP onboarding using the **Configure AP Location** check box.

Catalyst Center allows you to use the site assigned during the PnP claim as the AP location for PnP onboarding. If you check the **Configure AP Location** check box, Catalyst Center configures the assigned site as the AP location for PnP onboarding. If you uncheck this check box, use the **Configure Access Points** workflow to configure the AP location for PnP onboarding. For more information, see "AP Configuration in Catalyst Center" in the *Catalyst Center User Guide*.

Note

These settings aren't applicable during the day-*n* operations. To configure the AP location for day-*n* operations, you can use the **Configure Access Points** workflow.

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings** > **PnP AP Location**.
2. Check the **Configure AP Location** check box.
3. Click **Save**.

Configure device prompts

Information about configuring devices to use custom prompts.

Catalyst Center allows you to create custom prompts for the username and password. You can configure the devices in your network to use custom prompts and collect information about the devices.

Create custom prompts

Information about creating custom prompts for username and password.

Procedure

1. From the main menu, choose **System** > **Settings** > **Device Settings** > **Device Prompts**.

   The **Device Prompts** window opens.

2. Click **Create Custom Prompt**.

   The **Create Custom Prompt** slide-in pane opens.

3. To create custom prompts for the username:
   a. From the **Prompt Type** drop-down list, choose **username**.
   b. In the **Prompt Text** field, enter the text in Regular Expression (Regex).
   c. Click **Save**.

4. To create custom prompts for the password,:
   a. From the **Prompt Type** drop-down list, choose **password**.
   b. In the **Prompt Text** field, enter the text in Regular Expression (Regex).
   c. Click **Save**.

> **Note**
>
> The custom prompts are displayed in the **Device Prompts** window. You can create up to eight custom prompts for the username and password.

5. Drag and drop the custom prompts in the order that you want.

> **Note**
>
> Catalyst Center maintains the order of the custom prompts and passes the prompts to the devices as comma-separated values. The custom prompt in the top order gets higher priority.

6. Click the edit icon to edit a custom prompt.
7. Click the delete icon to delete a custom prompt.

> **Note**
>
> Username prompts and password prompts must have unique Regex. Creating the same or similar Regex causes authentication issues with the devices.

Configure the automatic acceptance of SSH key changes

Configures whether Catalyst Center automatically accepts SSH key changes.

In the **SSH key configuration** window, you can configure whether Catalyst Center automatically accepts SSH key changes.

Important

When this option is enabled, you must manually resync every device on which SSH key verification failed.

Procedure

1. From the main menu, choose **System** > **Device Settings** > **SSH key trust**.
2. Click the **Accept all changes** toggle button to enable or disable the automatic acceptance of any SSH key changes that are made.

Configure device configuration backup settings

Information about configuring backup settings of the running configuration of your device.

Catalyst Center performs periodic backup of your device running configuration. You can choose the day and time for the backup and the total number of config drifts that can be saved per device.

Note

- Daily Backup: Catalyst Center performs an automated configuration backup that is scheduled to run every day at 11:00 p.m. (UTC time zone). During this process, Catalyst Center compares the timestamp of the last device configuration collection with the timestamp of the device configuration archived. If the difference is more than 30 minutes, the device configuration archive will be performed.

  Daily backup is not performed on the day when weekly backup is scheduled.
- Weekly Backup: Catalyst Center performs an automated configuration backup, that is scheduled to run every Sunday at 11:30 p.m. (UTC time zone).

Procedure

1. From the main menu, choose **System** > **Settings** > **Configuration Archive**.
2. In the **Configuration Archive** window, click the **Internal** tab.
3. Click the **Number of config drift per device** drop-down list and choose the number of config drifts to save per device.

   You can save 7–50 config drifts per device. The total config drifts to save include all the labeled configs for the device.

   Note

   By default, the number of config drifts to save per device is 15.

4. Choose the backup day and time.

   The selected backup date and time is based on the time zone of the Catalyst Center cluster deployed for your network.
5. Click **Save**.

   After the backup is scheduled, you can view it in the activity center.
6. Click the **External** tab to configure an external server for archiving the device configuration. For more information, see Configure an external server for archiving device configuration on page 63.

Configure an external server for archiving device configuration

Information about configuring an external server for archiving the running configuration of devices.

You can configure an external SFTP server for archiving the running configuration of devices.

Before you begin

Confirm that SSH, SFTP, and SCP are enabled on the external server.

Procedure

1. From the main menu, choose **System** > **Settings** > **Configuration Archive**.
2. In the **Configuration Archive** window, click the **External** tab.
3. Click **Add** to add an **External Repository**.

   Note

   Only one SFTP server can be added.

4. In the **Add New External Repository** slide-in pane, complete the following details:
   a) **Host**: Enter the host IP address.
   b) **Root Location**: Enter the location of the root folder.

      Note

      - Ensure the root location path is absolute and not relative.
      - The external server root location must be empty.

   c) **Server Protocol**: Enter the username, password, and port number of the SFTP server.
   d) Choose the **Backup Format**:
      - **RAW**: A full running configuration will be disclosed. All sensitive/private configurations are unmasked in the backup data. Enter a password to lock the backup file.

        Note

        File passwords are not saved on Catalyst Center. You must remember the password to access the files on the SFTP server.

      - **Sanitized (Masked)**: The sensitive/private configuration details in the running configuration will be masked.

        The password is applicable only when the raw backup format is selected.

   e) Schedule the backup cycle.

      Enter the backup date, time, time zone, and recurrence interval.

5. Click **Save**.

6. To edit the SFTP server details, click the edit button under the **Action** column.
7. To remove the SFTP server, click the delete button under the **Action** column.

6 Configure External Services

Topics:

- Configure Cisco AI Network Analytics
- Configure Cisco Spaces integration
- Catalyst Center and Cisco ISE integration
- Configure authentication and policy servers
- Integrity Verification
- Cisco SD-Access Compatibility Matrix
- Configure an IP address manager
- Update the Machine Reasoning Knowledge Base
- Configure Meraki integration
- Catalyst Center and Microsoft Teams integration
- Cloud access keys
- Configure Webex integration
- Configure ThousandEyes integration

Configure Cisco AI Network Analytics

Information about configuring Cisco AI Network Analytics. Cisco AI Network Analytics allows you to export network event data from network devices to Cisco AI Cloud.

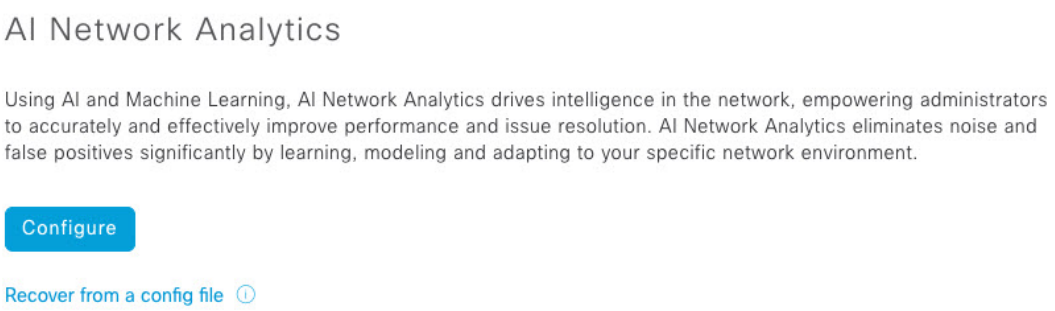
Use this procedure to enable the Cisco AI Analytics features to export network event data from network devices and inventory, site hierarchy, and topology data to the Cisco AI Cloud.

Before you begin

- Make sure that you have the Advantage software license for Catalyst Center. The **AI Network Analytics** application is part of the Advantage software license.
- Make sure that the latest version of the AI Network Analytics application is installed. See Download and install applications on page 144.
- Make sure that your network or HTTP proxy is configured to allow outbound HTTPS (TCP 443) access to these cloud hosts:
  - **api.use1.prd.kairos.ciscolabs.com** (US East Region)
  - **api.euc1.prd.kairos.ciscolabs.com** (EU Central Region)

Procedure

1. From the main menu, choose **System** > **Settings**.
2. Scroll down to **External Services** and select **Cisco AI Analytics**.
   The **AI Network Analytics** window opens.



3. Do one of these tasks:
   - If you have an earlier version of Cisco AI Network Analytics installed in your appliance, do these steps:
     a. Click **Recover from a config file**.
        The Restore AI Network Analytics window opens.
     b. Drag-and-drop the configuration files in the area provided or select the files from your file system.
     c. Click **Restore**.
        Cisco AI Network Analytics might take a few minutes to restore, and then the **Success** dialog box opens.
   - For the first-time configuration of Cisco AI Network Analytics, do these steps:
     a. Click **Configure**.

b. In the **Where should we securely store your data?** area, select the location to store your data. Options are: **Europe (Germany)** or **US East (North Virginia)**.

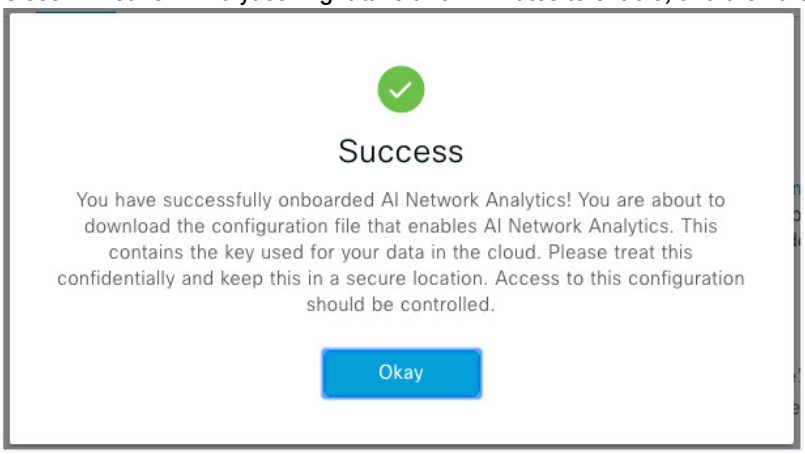
   The system starts testing cloud connectivity as indicated by the **Testing cloud connectivity...** tab. After cloud connectivity testing completes, the **Testing cloud connectivity...** tab changes to **Cloud connection verified**.

c. Click **Next**.

   The terms and conditions window opens.

d. Click the **Accept Cisco Universal Cloud Agreement** check box to agree to the terms and conditions, and then click **Enable**.

   Cisco AI Network Analytics might take a few minutes to enable, and then the **Success** dialog box opens.



4. In the **Success** dialog box, click **Okay**.
   The **AI Network Analytics** window opens, and the **Enable AI Network Analytics** toggle button displays ☑.
5. (Recommended) In the **AI Network Analytics** window, click **Download Configuration file**.

Client certificate renewal

Client certificates must be renewed before they expire to avoid losing cloud connectivity.

AI agents use X.509 client certificates to authenticate to the AI Cloud. Certificates are created and signed by the AI Cloud CA upon tenant onboarding to the AI Cloud and remain valid for three years (reduced to one year in August 2021). Before their expiration, client certificates must be renewed to avoid losing cloud connectivity. An automatic certificate renewal mechanism is in place. This mechanism requires that you manually back up the certificate after renewal. The backup is required in case you restore or migrate to a new Catalyst Center.

After renewal, a notification is shown on every AI Analytics window (Peer Comparison, Heatmap, Network Comparison, Trends and Insights) to tell you to back up the new AI Network Analytics configuration.

Disable Cisco AI Network Analytics data collection

Disable Cisco AI Network Analytics to disable the network event data collection.

To disable Cisco AI Network Analytics data collection, you must disable the AI Network Analytics feature:

Procedure

1. From the main menu, choose **System** > **Settings**.

2. Scroll down to **External Services** and choose **Cisco AI Analytics**.
   For each feature, a check mark ( ) indicates that the feature is enabled. If the check box is unchecked ( ), the feature is disabled.
3. In the **AI Network Analytics** area, click the **Enable AI Network Analytics** toggle button so that it's unchecked ( ).
4. Click **Update**.
5. To delete your network data from the Cisco AI Network Analytics cloud, contact the Cisco Technical Response Center (TAC) and open a support request.
6. If you have misplaced your previous configuration, click **Download configuration file**.

Configure Cisco Spaces integration

Use this procedure to integrate Catalyst Center and Cisco Spaces. This integration helps you manage physical spaces, use network infrastructure data, operate more efficiently, and monitor how spaces are used.

Use this procedure to integrate Catalyst Center and Cisco Spaces. This integration helps you manage physical spaces, use network infrastructure data, operate more efficiently, and monitor how spaces are used.

To configure Cisco Spaces integration:

Procedure

1. From the main menu, choose **System** > **Settings**.
2. Click **Cisco Spaces/CMX Servers**.
3. Do one of these tasks to activate your account credentials on cisco.com:
   - If your credentials are already saved in the system, you can continue with this activation. Credentials can be changed if needed.
   - If credentials are not configured in the system yet, click **Add** to log in to your cisco.com account, and activate the device.
   - If you only want to use your credentials for this activation, leave **Save Credentials** unchecked.
   - If you want to save your login for future use, select **Save Credentials**.
4. Enter your cisco.com credentials and click **Activate**.
   a. If you already have Cisco Spaces accounts linked to your credentials, you'll see them listed. Select one to continue.
      - If you do not have a Cisco Spaces account, a prompt appears to create a new account:
        1. Enter an account name.
        2. Select a Cisco Spaces region.
        3. Click **Create New Spaces account** to finish the setup.

> **Note**
>
> You cannot select Cisco Spaces accounts that have not been activated by accepting the Welcome Email or those that have expired.

b. Do one of these tasks to integrate Cisco Spaces with your **Global** site hierarchy:

- Select **Add Cisco Spaces integration to all sites** to integrate automatically.
- If you prefer to manually select specific **Site(s)** to enable for integration, deselect **Add Cisco Spaces integration to all sites**.

> **Note**
>
> (Optional) When **Add Cisco Spaces integration to all sites** is deselected, select one or more **Site(s)** to enable the Cisco Spaces activation and then click **Continue**.

After your selections are made, click **Continue**.

5. Review the final terms and conditions and click **Agree and Proceed** to start the activation with Cisco Spaces.
6. If a new Cisco Spaces account was created, go to your email and accept the invitation from Cisco Spaces to fully activate your account. Follow the prompts in the email to accept the terms and conditions and log in to your new account for the first time.

> **Note**
>
> For more information, see "Integrate Cisco Spaces with Catalyst Center" in the Cisco Spaces Configuration Guide.

Catalyst Center and Cisco ISE integration

Information about Catalyst Center and Cisco ISE integration. Cisco ISE has two different use cases in Catalyst Center. Cisco ISE can be used as a AAA server for user, device, and client authentication or it can be used with an access control policy to enforce access control. If you are not using access control policies or if you are not using Cisco ISE as a AAA server for device authentication, you do not need to install and configure Cisco ISE.

Cisco ISE has three use cases with Catalyst Center:

1. Cisco ISE can be used as a AAA (pronounced "triple A") server for user, device, and client authentication. If you are not using access control policies, or are not using Cisco ISE as a AAA server for device authentication, you do not have to install and configure Cisco ISE.
2. Access control policies use Cisco ISE to enforce access control. Before you create and use access control policies, integrate Catalyst Center and Cisco ISE. The process involves installing and configuring Cisco ISE with specific services,

and configuring Cisco ISE settings in Catalyst Center. For more information about installing and configuring Cisco ISE with Catalyst Center, see the *Cisco Catalyst Center Installation Guide*.

3. If your network uses Cisco ISE for user authentication, configure Assurance for Cisco ISE integration. This integration lets you see more information about wired clients, such as the username and operating system, in Assurance. For more information, see "About Cisco ISE configuration for Catalyst Center" in the *Cisco Catalyst Assurance User Guide*.

After Cisco ISE is successfully registered and its trust established with Catalyst Center, Catalyst Center shares information with Cisco ISE. Catalyst Center devices that are assigned to a site that is configured with Cisco ISE as its AAA server have their inventory data propagated to Cisco ISE. Additionally, any updates to these settings on these devices in Catalyst Center also updates Cisco ISE with the changes:

- Device hostname
- AAA server configurations under **Design** > **Network Settings** > **Servers**.
- Device credentials
- Device Loopback0 IP address
- Device management IP address
- Network Device Group (NDG) tag associated with the device

If a Catalyst Center device associated to a site with Cisco ISE as its AAA server is not propagated to Cisco ISE as expected, Catalyst Center automatically retries after waiting for a specific time interval. This subsequent attempt occurs when the initial Catalyst Center device push to Cisco ISE fails due to any networking issue, Cisco ISE downtime, or any other auto correctable errors. Catalyst Center attempts to establish eventual consistency with Cisco ISE by retrying to add the device or update its data to Cisco ISE. However, a retry is not attempted if the failure to propagate the device or device data to Cisco ISE is due to a rejection from Cisco ISE itself, as an input validation error.

If you change the RADIUS shared secret for Cisco ISE, Cisco ISE does not update Catalyst Center with the changes. To update the shared secret in Catalyst Center to match Cisco ISE, edit the AAA server with the new password. Catalyst Center downloads the new certificate from Cisco ISE, and updates Catalyst Center.

Cisco ISE does not share existing device information with Catalyst Center. The only way for Catalyst Center to know about the devices in Cisco ISE is if the devices have the same name in Catalyst Center; Catalyst Center and Cisco ISE uniquely identify devices for this integration through the device's hostname variable.

Note

The process that propagates Catalyst Center inventory devices to Cisco ISE and updates the changes to it are all captured in the Catalyst Center audit logs. If there are any issues in the Catalyst Center-to-Cisco ISE workflow, view the audit logs in the Catalyst Center GUI for information.

Catalyst Center integrates with the primary Administration ISE node. When you access Cisco ISE from Catalyst Center, you connect with this node.

Catalyst Center polls Cisco ISE every 15 minutes. If the Cisco ISE server is down, Catalyst Center shows the Cisco ISE server as red (unreachable).

When the Cisco ISE server is unreachable, Catalyst Center increases polling to 15 seconds, and then doubles the polling time to 30 seconds, 1 minute, 2 minutes, 4 minutes, and so on, until it reaches the maximum polling time of 15 minutes. Catalyst Center continues to poll every 15 minutes for 3 days. If Catalyst Center does not regain connectivity, it stops polling and updates the Cisco ISE server status to **Untrusted**. If this happens, you must reestablish trust between Catalyst Center and the Cisco ISE server.

Network Device Group (NDG) tags, which are prefixed with `NDG:`, are reflected in Cisco ISE.

When you delete devices integrated with Cisco ISE, those deleted devices are moved to the new NDG group in Cisco ISE.

Review these additional requirements and recommendations to verify Catalyst Center and Cisco ISE integration:

- Catalyst Center and Cisco ISE integration is not supported over a proxy server. If you have Cisco ISE configured with a proxy server in your network, configure Catalyst Center such that it does not use the proxy server; it can do this by bypassing the proxy server's IP address.
- Catalyst Center and Cisco ISE integration is not supported through a Catalyst Center virtual IP address (VIP). If you are using an enterprise CA-issued certificate for Catalyst Center, make sure the Catalyst Center certificate includes the IP addresses of all interfaces on Catalyst Center in the Subject Alternative Name (SAN) extension. If Catalyst Center is a three-node cluster, the IP addresses of all interfaces from all three nodes must be included in the SAN extension of the Catalyst Center certificate.
- You must have Admin-level access in Cisco ISE.
- Disable password expiry for the Admin user in Cisco ISE. Alternatively, make sure that you update the password before it expires.
- When the Cisco ISE certificate changes, Catalyst Center must be updated. To do that, edit the AAA server (Cisco ISE), reenter the password, and save. This forces Catalyst Center to download the certificate chain for the new admin certificate from Cisco ISE, and update Catalyst Center. If you are using Cisco ISE in HA mode, and the admin certificate changes on either the primary or secondary administrative node, you must update Catalyst Center.
- Catalyst Center configures certificates for itself and for Cisco ISE to connect over pxGrid. You can use other certificates with pxGrid for connections to other pxGrid clients, such as Firepower. These other connections do not interfere with the Catalyst Center and Cisco ISE pxGrid connection.
- You can change the RADIUS secret password. You provided the secret password when you configured Cisco ISE as a AAA server under **System** > **Settings** > **External Services** > **Authentication and Policy Servers**. To change the secret password, choose **Design** > **Network Settings** > **Network** and click the **Change Shared Secret** link. This causes Cisco ISE to use the new secret password when connecting to network devices managed by Catalyst Center.
- In distributed Cisco ISE clusters, each node performs only certain functions, such as PAN (Admin), MnT (Monitoring and Troubleshooting), or PSN (Policy Service). It is possible to have only Admin certificate usage on PAN nodes, and only EAP Authentication certificate usage on PSN nodes. However, this configuration prevents Catalyst Center and Cisco ISE integration for pxGrid. Therefore, we recommend that you enable EAP Authentication certificate usage on the Cisco ISE primary PAN node.
- To ensure that Catalyst Center recognizes a PSN after it's been upgraded, you must do this:

  1. Re-add the PAN that's associated with the PSN. In the *Cisco Identity Services Engine Administrator Guide*, see "Configure a Primary Policy Administration Node."
  2. Reintegrate Cisco ISE with Catalyst Center. In the *Cisco Catalyst Center Installation Guide*, see "Integrate Cisco ISE with Catalyst Center."

- Catalyst Center supports certificate revocation checks via CRL Distribution Point (CDP) and Online Certificate Status Protocol (OCSP). During integration, Catalyst Center receives the Cisco ISE admin certificate over port 9060 and verifies its validity based on the CDP and OCSP URLs inside that Cisco ISE admin certificate. If both CDP (which contains a list of CRLs) and OCSP are configured, Catalyst Center uses OCSP to verify the revocation status of the certificate and falls back to CDP if the OCSP URL is not accessible. If there are multiple CRLs present in CDP, Catalyst Center contacts the next CRL if the first CRL is not reachable. However, due to a JDK PKI Oracle bug, the system does not check for all CRL entries.

  Proxy is not supported for certificate verification. Catalyst Center contacts the CRL and OCSP servers without proxy.

  - OCSP and CRL entries are optional in the certificate.
  - LDAP is not supported as a protocol for certificate validation. Do not include LDAP URLs in CDP or AIA extensions.

- All URLs in CDP and OCSP must be reachable from Catalyst Center. Unreachable URLs can cause a poor integration experience, including a failed integration.

- The Cisco ISE certificates' subject name and issuer must adhere to ASN.1 PrintableString characters, where only spaces and these characters are allowed: A – Z, a – z, 0 – 9, ‘ ( ) + , - . / : = ?

Cisco ISE NAD dual-stack provisioning logic

When a device is assigned to a site managed by Cisco ISE, or when an existing device undergoes an update, the system determines the NAD management address based on the device's IP configuration and Loopback0 settings.

When a device is assigned to a site managed by Cisco ISE, or when an existing device undergoes an update, the system assigns your network access device (NAD) management address based on your device's IP configuration and Loopback0 settings.

In a dual-stack Catalyst Center environment, configure the Cisco ISE server to support both IPv4 and IPv6.

This table shows the persistence logic that applies to the NAD management address.

Device configuration	Loopback0 address	Resulting NAD management address
IPv6 device	IPv4 Loopback0	IPv6 management address
IPv6 device	IPv6 Loopback0	IPv6 Loopback0 address
IPv4 device	IPv6 Loopback0	IPv4 management address
IPv4 device	IPv4 Loopback0	IPv4 Loopback0 address
IPv6/IPv4 device	None	Corresponding management address
IPv6 device	Multiple IPv6 Loopback0	Last IPv6 Loopback0 address
IPv6 device	Both link local and global IPv6 addresses	Global IPv6 Loopback IP address

Configure authentication and policy servers

Information about configuring AAA servers and policy servers. Catalyst Center uses AAA servers and policy servers for user authentication and access control.

Catalyst Center uses AAA servers for user authentication and Cisco ISE for both user authentication and access control. Use this procedure to configure AAA servers, including Cisco ISE.

Before you begin

If you are using Cisco ISE to perform both policy and AAA functions, make sure that Catalyst Center and Cisco ISE are integrated.

If you are using another product (not Cisco ISE) to perform AAA functions, do these tasks:

- Register Catalyst Center with the AAA server, including defining the shared secret on both the AAA server and Catalyst Center.
- Define an attribute name for Catalyst Center on the AAA server.

- For a Catalyst Center multihost cluster configuration, define all individual host IP addresses and the virtual IP address for the multihost cluster on the AAA server.

Before you configure Cisco ISE, confirm that:

- You have deployed Cisco ISE on your network. For information on supported Cisco ISE versions, see the *Cisco Catalyst Center Compatibility Matrix*. For information on installing Cisco ISE, see the *Cisco Identity Services Engine Install and Upgrade guides*.
- If you have a standalone Cisco ISE deployment, you must integrate Catalyst Center with the Cisco ISE node and enable the pxGrid service and External RESTful Services (ERS) on that node.
- If you have a distributed Cisco ISE deployment:

  You must integrate Catalyst Center with the primary policy administration node (PAN), and enable ERS on the PAN.

  > **Note**
  >
  > We recommend that you use ERS through the PAN. However, for backup, you can enable ERS on the Policy Service Nodes (PSNs).

  You must enable the pxGrid service on one of the Cisco ISE nodes within the distributed deployment. Although you can decide to do so, you do not have to enable pxGrid on the PAN. You can enable pxGrid on any Cisco ISE node in your distributed deployment.

  The PSNs that you configure in Cisco ISE to handle TrustSec or SD Access content and Protected Access Credentials (PACs) must also be defined in **Work Centers** > **Trustsec** > **Trustsec Servers** > **Trustsec AAA Servers**. For more information, see the *Cisco Identity Services Engine Administrator Guide*.
- You must enable communication between Catalyst Center and Cisco ISE on these ports: 443, 5222, 8910, and 9060.
- The Cisco ISE host on which pxGrid is enabled must be reachable from Catalyst Center on the IP address of the Cisco ISE eth0 interface.
- The Cisco ISE node can reach the fabric underlay network via the appliance's NIC.
- The Cisco ISE admin node certificate must contain the Cisco ISE IP address or the fully qualified domain name (FQDN) in either the certificate subject name or the Subject Alternative Name (SAN).
- The Catalyst Center system certificate must list both the Catalyst Center appliance IP address and FQDN in the SAN field.

Procedure

1. From the main menu, choose **System** > **Settings** > **External Services** > **Authentication and Policy Servers**.
2. From the **Add** drop-down list, select **AAA** or **ISE**.
3. To configure the primary AAA server, enter this information:
   - **Server IP Address**: IP address of the AAA server.
   - **Shared Secret**: Key for device authentications. The shared secret must contain from 4 to 100 characters. It cannot contain a space, question mark (?), or less-than angle bracket (<).

> **Note**
>
> Make sure that you do not configure a PSN that is part of an existing Cisco ISE cluster as a primary AAA server.

4. To configure a Cisco ISE server, enter these details:
   - **Server IP Address**: IP address of the Cisco ISE server.
   - **Shared Secret**: Key for device authentications. The shared secret must contain from 4 to 100 characters. It cannot contain a space, question mark (?), or less-than angle bracket (<).
   - **Username**: Username that is used to log in to Cisco ISE via HTTPS.
   - **Password**: Password for the Cisco ISE HTTPS username.

     > **Note**
     >
     > The username and password must be an ISE admin account that belongs to the Super Admin.

   - **FQDN**: Fully qualified domain name (FQDN) of the Cisco ISE server.

     > **Note**
     >
     > - We recommend that you copy the FQDN that is defined in Cisco ISE (**Administration** > **Deployment** > **Deployment Nodes** > **List**) and paste it directly into this field.
     > - The FQDN that you enter must match the FQDN, Common Name (CN), or Subject Alternative Name (SAN) defined in the Cisco ISE certificate.

     The FQDN consists of two parts, a hostname and the domain name, in this format:

     hostname.domainname.com

     For example, the FQDN for a Cisco ISE server can be ise.cisco.com.

   - **Virtual IP Address(es)**: Virtual IP address of the load balancer behind which the Cisco ISE policy service nodes (PSNs) are located. If you have multiple PSN farms behind different load balancers, you can enter a maximum of six virtual IP addresses.

5. Click **Advanced Settings** and configure the settings:
   - **Connect to pxGrid**: Check this check box to enable a pxGrid connection.

     If you want to use the Catalyst Center system certificate as the pxGrid client certificate (sent to Cisco ISE to authenticate the Catalyst Center system as a pxGrid client), check the **Use Catalyst Center Certificate for pxGrid** check box. You can use this option if all the certificates that are used in your operating environments must be generated by the same Certificate Authority (CA). If this option is disabled, Catalyst Center will send a request to Cisco ISE to generate a pxGrid client certificate for the system to use.

When you enable this option, ensure that:

- The Catalyst Center certificate is generated by the same CA as is in use by Cisco ISE (otherwise, the pxGrid authentication fails).
- The Certificate Extended Key Use (EKU) field includes "Client Authentication."

- **Enable Multiple Catalyst Center operation**: Check this check box to integrate more than one Catalyst Center cluster with a single Cisco ISE system.
- **Protocol**: **RADIUS** (the default) and **TACACS**. You can select both protocols.

> **Attention**
>
> If you do not enable TACACS for a Cisco ISE server here, you cannot configure the Cisco ISE server as a TACACS server under **Design** > **Network Settings** > **Servers** when configuring a AAA server for network device authentication.

- **Authentication Port**: UDP port used to relay authentication messages to the AAA server. The default UDP port used for authentication is 1812.
- **Accounting Port**: UDP port used to relay important events to the AAA server. The default is UDP port 1812.
- **Port**: TCP port used to communicate with the TACACS server. The default TCP port used for TACACS is 49.
- **Retries**: Number of times that Catalyst Center attempts to connect with the AAA server before abandoning the attempt to connect. The default number of attempts is 3.
- **Timeout**: The time period for which the device waits for the AAA server to respond before abandoning the attempt to connect. The default timeout is 4 seconds.

> **Note**
>
> After the required information is provided, Cisco ISE is integrated with Catalyst Center in two phases. It takes several minutes for the integration to complete. The phase-wise integration status is shown in the **Authentication and Policy Servers** window and **System 360** window.
>
> Cisco ISE server registration phase:
>
> - **Authentication and Policy Servers** window: "In Progress"
> - **System 360** window: "Primary Available"
>
> pxGrid subscriptions registration phase:
>
> - **Authentication and Policy Servers** window: "Active"
> - **System 360** window: "Primary Available" and "pxGrid Available"
>
> If the status of the configured Cisco ISE server is shown as "FAILED" due to a password change, click **Retry**, and update the password to resynchronize the Cisco ISE connectivity.

6. Click **Add**.
7. To add a secondary server, repeat the preceding steps.

8. To view the Cisco ISE integration status of a device:
   a. From the main menu, choose **Provision** > **Inventory**.

      The **Inventory** window displays the device information.

   b. From the **Focus** drop-down menu, select **Provision**.

   c. In the **Devices** table, the **Provisioning Status** column displays information about the provisioning status of your device (**Success**, **Failed**, or **Not Provisioned**).

      Click **See Details** to open a slide-in pane with additional information.

   d. In the slide-in pane that appears, click **See Details**.

   e. Scroll down to the **ISE Device Integration** tile to view detailed information about the integration status of the device.

Integrity Verification

Information about Integrity Verification for Catalyst Center.

Integrity Verification (IV) monitors key device data for unexpected changes or invalid values that indicate possible compromise, if any of the devices are at risk. It does this by comparing each device's software, hardware, platform, and configuration settings against an authoritative set of Known Good Values (KGV) for these settings for all supported Cisco devices. The objective is to minimize the impact of a compromise by substantially reducing the time to detect unauthorized changes to a Cisco device.

> **Note**
>
> IV runs integrity verification checks on software images that are uploaded into Catalyst Center. To run these checks, the IV service needs the Known Good Value (KGV) file to be uploaded.

Upload the KGV file

Information about uploading the KGV file into Catalyst Center.

To provide security integrity, Cisco devices must be verified as running authentic and valid software. Currently, Cisco devices have no point of reference to determine whether they are running authentic Cisco software. IV uses a system to compare the collected image integrity data with the KGV for Cisco software.

Cisco produces and publishes a KGV data file that contains KGVs for many of its products. This KGV file is in standard JSON format, is signed by Cisco, and is bundled with other files into a single KGV file that can be retrieved from the Cisco website. The KGV file is posted at:

https://cscrdr.cloudapps.cisco.com/cscrdr/security/center/files/trust/Cisco_KnownGoodValues.tar

The KGV file is imported into IV and used to verify integrity measurements obtained from the network devices.

Note

Device integrity measurements are made available to and used entirely within the IV. Connectivity between IV and cisco.com is not required. The KGV file can be air-gap transferred into a protected environment and loaded into the IV.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Settings** > **External Services** > **Integrity Verification**.
2. Review the current KGV file information:
   - **File Name**: Name of the KGV tar file.
   - **Imported By**: Catalyst Center user who imported the KGV file. If it is automatically downloaded, the value is **System**.
   - **Imported Time**: Time at which the KGV file is imported.
   - **Imported Mode**: Local or remote import mode.
   - **Records**: Records processed.
   - **File Hash**: File hash for the KGV file.
   - **Published**: Publication date of the KGV file.
3. To import the KGV file, do one of these steps:
   - Click **Import New from Local** to import a KGV file locally.
   - Click **Import Latest from Cisco** to import a KGV file from cisco.com.

   Note

   The **Import Latest from Cisco** option does not require a firewall setup. However, if a firewall is already set up, only the connection to https://cscrdr.cloudapps.cisco.com must be open.
4. If you clicked **Import Latest from Cisco**, a connection is made to cisco.com and the latest KGV file is automatically imported to Catalyst Center.

> **Note**
>
> A secure connection is made using the certificates added to Catalyst Center and its proxy (if one was configured during the first-time setup).

5. If you clicked **Import New from Local**, the **Import KGV** window appears.
6. Do one of these procedures to import locally:
   - Drag and drop a local KGV file into the **Import KGV** field.
   - Click **Click here to select a KGV file from your computer** to select a KGV file from a folder on your computer.
   - Click the **Latest KGV file** link and download the latest KGV file before dragging and dropping it into the **Import KGV** field.
7. Click **Import**.

   The KGV file is imported into Catalyst Center.
8. After the import is finished, verify the current KGV file information in the GUI to ensure that it has been updated.

   IV automatically downloads the latest KGV file from cisco.com to your system 7 days after Catalyst Center is deployed. The auto downloads continue every 7 days. You can also download the KGV file manually to your local system and then import it to Catalyst Center. For example, if a new KGV file is available on a Friday and the auto download is every 7 days (on a Monday), you can download it manually.

   The KGV auto download information that displays includes:

   - **Frequency**: The frequency of the auto download.
   - **Last Attempt**: The last time the KGV scheduler was triggered.
   - **Status**: The status of the KGV scheduler's last attempt.
   - **Message**: A status message.

   > **Note**
   >
   > When you import the latest KGV file, if there is any error, an error message displays. These error messages are now translated into multiple languages.

What to do next

After importing the latest KGV file, choose **Design** > **Image Repository** to view the integrity of the imported images.

Note

The effect of importing a KGV file can be seen in the **Image Repository** window, if the images that are already imported have an **Unable to verify** status (physical or virtual). Additionally, future image imports, if any, will also refer to the newly uploaded KGV for verification.

Update the KGV bundle

Information about updating the KGV bundle in IV for Catalyst Center.

Catalyst Center allows you to cancel or clear all stale or stuck IV workflows and initiate a new workflow. This feature is asynchronous in nature because it takes some time for the functionality to come into effect.

With the IV KGV file download workflow, you trigger the latest KGV download directly from cisco.com, or you manually upload a new KGV. In addition, a scheduler runs daily to download or update the latest KGV bundle from cisco.com.

If a scheduler IV workflow or a user-triggered IV workflow gets stuck during the KGV file download or during another phase, you cannot submit a new request. Only one IV KGV workflow is allowed at a time. There is no option for you to submit a new request, other than raising a service request and doing a service restart. To overcome this issue, Catalyst Center has introduced a new API that allows you to cancel any stale or stuck IV workflow, clear the task entry associated with the canceled IV workflow, and reset the locking mechanism, which prevents a simultaneous request to submit a new IV workflow request.

Note

This cancellation function:

- Applies only if you choose **Import Latest From Cisco** while importing the KGV file.
- Works only for stale workflows, not for other scenarios.

Cisco SD-Access Compatibility Matrix

Explains how to import or download the latest SD-Access compatibility matrix information.

Catalyst Center periodically compares the operational SD-Access fabric nodes hardware and software attributes against information in the *Cisco SD-Access Compatibility Matrix*.

Any compatibility issues that are detected will be aggregated and displayed in the SD-Access Compliance state of each fabric site. The fabric site's aggregate Compliance state can be reviewed from the **Provision** > **SD-Access** > **Fabric Sites** window.

To import or download the latest SD-Access compatibility matrix information:

Procedure

1. From the main menu, choose **System** > **Settings** > **SD-Access Compatibility Matrix**.

   The **SD-Access Compatibility Matrix** window displays the information of the compatibility matrix that was last imported.

> **Note**
>
> Catalyst Center runs an autodownload for SD-Access compatibility matrix information that is scheduled to run once everyday.

The date and time of the autodownload is also displayed in the **SD-Access Compatibility Matrix** window.

2. To manually import the SD-Access compatibility matrix file, click the **Import Latest From Cisco** hyperlink.

> **Note**
>
> A banner is displayed at the top of the **SD-Access Compatibility Matrix** window if the latest version of the file already exists.

3. For air-gapped deployments, the ability to import the SD-Access compatibility matrix file from Cisco is not possible, so Catalyst Center provides the following upload process:
   a. Download the SD-Access compatibility matrix file from *Cisco SD-Access Compatibility Matrix* for your device role and Catalyst Center package version.

   > **Note**
   >
   > You should not make any changes to the downloaded JSON file.

   b. Click the **Import New From Local** hyperlink and do one of the following:
      - Click **Choose a file** to import the file.
      - Drag and drop the JSON file to the drag and drop area.

> **Note**
>
> The file size cannot exceed 10 MB.

Disable SD-Access image compatibility checks

Learn how to disable SD-Access image compatibility checks.

Catalyst Center 2.3.7.5 and later releases give you the option to disable SD-Access image compatibility checks.

> **Note**
>
> Always enable SD-Access image compatibility checks to ensure proper network operations.

To disable the SD-Access image compatibility checks:

Procedure

1. From the main menu, choose **System** > **Settings** > **SD-Access Compatibility Matrix**.
2. On the **SD-Access Compatibility Matrix** window, click the **SD-Access Image Compatibility Checks** toggle button so that it is unchecked.

Configure an IP address manager

Information about configuring an external IP address manager.

You can configure Catalyst Center to communicate with an external IP address manager (IPAM). When you use Catalyst Center to create, reserve, or delete any IP address pool, Catalyst Center conveys this information to your external IPAM.

Before you begin

Requirements for external IPAM integration:

- Create a role that has write permission to the IPAM function and assign it to the user account used for integration with Catalyst Center.
- To enable IP pool creation by LAN automation for point-to-point addressing, the role must include:
  - For Infoblox: Write permission for **Network Views**.
  - For Bluecat: Full access permission for **Configurations**.

Procedure

1. From the main menu, choose **System** > **Settings** > **External Services** > **IP Address Manager**.
2. In the **Server Name** field, enter the name of the IPAM server.
3. In the **Server URL** field, enter the URL or IP address of the IPAM server.

   A warning icon and message appear, indicating that the certificate is not trusted for this server. To import the trust certificate directly from the IPAM:

   a) Click the warning icon.

      A **Certificate Warning** dialog box appears.

   b) Verify the issuer, serial number, and validity dates for the certificate.
   c) If the information is correct, check the check box to allow Catalyst Center to access the IP address and add the untrusted certificate to the trusted certificates.
   d) Click **Allow**.
4. In the **Username** and **Password** fields, enter the IPAM credentials.

5. From the **Provider** drop-down list, choose a provider.
   - If you choose **BlueCat** as your provider, ensure that your user has been granted API access in the BlueCat Address Manager. See your Bluecat documentation for information about configuring API access for your user or users.

     To integrate Catalyst Center with Bluecat in Federal Information Processing Standards (FIPS) mode, use Bluecat 9.3.0.

6. From the **View** drop-down list, choose a default IPAM network view. If you only have one view configured, only **default** appears in the drop-down list. The network view is created in the IPAM and is used as a container for IP address pools.
7. If you want to synchronize the IP address pools on Catalyst Center with the IPAM, check the **Sync global pools from IP Address Pools to the selected view from IPAM server** check box. If you don't want to synchronize the IP pools, leave the check box unchecked.

   Note

   You should only skip the synchronization if you know that the view of the IPAM is already synchronized with the IP address pool on Catalyst Center. For example, this can occur when:
   - The IPAM has been upgraded through backup and restore to a new server instance
   - The IPAM was accidentally deleted and you want to reads it

   If you skip synchronization when adding or updating the IPAM when the view is out of sync with IP address pools on Catalyst Center, pool operations might fail in the future.

8. Click **Save**.

What to do next

Go to **System** > **Settings** > **Trust & Privacy** > **Trusted Certificates** to verify that the certificate has been successfully added.

Note

In trusted certificates, the certificate is referenced as a third-party trusted certificate.

Go to **System** > **System 360** and verify the information to ensure that your external IP address manager configuration succeeded.

Update the Machine Reasoning Knowledge Base

Information about updating the Machine Reasoning Knowledge Base. The Machine Reasoning Knowledge Base is a repository of knowledge packs (workflows) that are used by the Machine Reasoning Engine (MRE).

Machine Reasoning knowledge packs are step-by-step workflows that are used by the Machine Reasoning Engine (MRE) to identify security issues and improve automated root cause analysis. These knowledge packs are continuously updated

as more information is received. The Machine Reasoning Knowledge Base is a repository of these knowledge packs (workflows). To have access to the latest knowledge packs, you can either configure Catalyst Center to automatically update the Machine Reasoning Knowledge Base daily, or you can do a manual update.

Procedure

1. From the main menu, choose **System** > **Settings**.
2. Scroll down to **External Services** and select **Machine Reasoning Knowledge Base**.
   The **Machine Reasoning Knowledge Base** window shows this information:
   - **INSTALLED**: Shows the installed version and installation date of the Machine Reasoning Knowledge Base package.

   When there's a new update to the Machine Reasoning Knowledge Base, the **AVAILABLE UPDATE** area is displayed in the **Machine Reasoning Knowledge Base** window, which provides the **Version** and **Details** about the update.
   - **AUTO UPDATE**: Automatically updates the Machine Reasoning Knowledge Base in Catalyst Center daily.
   - **CISCO CX CLOUD SERVICE FOR NETWORK BUG IDENTIFIER, SECURITY ADVISORY, FIELD NOTICES AND EOX**: Integrates Catalyst Center with CX Cloud that allows you to perform an automated config. This integration provides enhanced vulnerability detection on devices directly from the security advisories tool on Catalyst Center.
3. (Recommended) Check the **AUTO UPDATE** check box to automatically update the Machine Reasoning Knowledge Base.
   The **Next Attempt** area shows the date and time of the next update.

   You can perform an automatic update only if Catalyst Center is successfully connected to the Machine Reasoning Engine in the cloud.
4. To manually update the Machine Reasoning Knowledge Base in Catalyst Center, do one of these tasks:
   - Under **AVAILABLE UPDATES**, click **Update**. A **Success** pop-up window appears with the status of the update.
   - Manually download the Machine Reason Knowledge Base to your local machine and import it to Catalyst Center. Do these steps:
     a. Click **Download**.

        The **Opening mre_workflow_signed** dialog box appears.
     b. Open or save the downloaded file to the desired location in your local machine, and then click **OK**.
     c. Click **Import** to import the downloaded Machine Reasoning Knowledge Base from your local machine to Catalyst Center.
5. Check the **CISCO CX CLOUD SERVICE FOR NETWORK BUG IDENTIFIER AND SECURITY ADVISORY** check box to enable Cisco CX Cloud connection with network bug identifier and security advisory.
6. In the **Security Advisories Settings** area click the **RECURRING SCAN** toggle button to enable or disable the weekly recurring scan.
7. Click the **CISCO CX CLOUD** toggle button to enable or disable the Cisco CX cloud.

Configure Meraki integration

Use this procedure to integrate Catalyst Center and the Meraki Dashboard to monitor your network deployment in one place.

Use this procedure to integrate Catalyst Center and the Meraki Dashboard to monitor your network deployment in one place.

For more information about configuring this integration on the Meraki Dashboard, see “Add Catalyst Center to Dashboard” in Meraki and Catalyst Center Global Overview.

Procedure

1. From the Meraki Dashboard, add Catalyst Center as a new organization:
   a) On the **Global Overview** page, under **Organizations**, click **Add organizations** and choose **Add Catalyst Center as an organization**.
   b) On the **Add Organization** dialog box, provide these details:
      - **Cloud hosting region**: Choose a cloud-hosting region.
      - **Organization name for the Catalyst Center**: Enter an organization name.
      - **Catalyst Center IP address or FQDN**: Enter the IP address or the FQDN for your Catalyst Center.
      - **Catalyst Center Member ID**: Enter your Catalyst Center member ID.

      Tip

      To view your Catalyst Center member ID:

      1. From Catalyst Center, in the top-right portion of the window, click the help icon and choose **About**.
      2. Click **Member ID**.

   c) Click **Add Organization**.

      The **Connect Catalyst Center** dialog box displays a successful creation message and provides instructions on how to connect the Meraki Dashboard with Catalyst Center.

2. From Catalyst Center, register your Catalyst Center with Cisco Catalyst Cloud:
   a) From the main menu, choose **System** > **Settings** > **External Services** > **Cisco Catalyst Cloud**.
   b) On the **Cisco Catalyst Cloud** page, click **Register**.
   c) On the **Activate your device** pop-up window, click **Next** to continue.

      Note

      The **Activation code** field is prepopulated.

   d) On the **Sign in** pop-up window, sign in to your Cisco account.

Your Catalyst Center is registered, and the **Cisco Catalyst Cloud** page displays the registration information.

3. On the **Cisco Catalyst Cloud** page, under Applications, locate the **Meraki Dashboard** tile and click **Activate** to connect Catalyst Center with the Meraki Dashboard.
4. From the Meraki Dashboard, refresh the **Global Overview** page to view the integrated Catalyst Center data.

Catalyst Center and Microsoft Teams integration

Introduces the topics that describe the Catalyst Center and Microsoft Teams integration.

Catalyst Center supports integration with Microsoft Teams. The topics in this section

- explain what you need to know when Catalyst Center is integrated with Microsoft Teams
- describe known limitations, and
- guide you through the integration of these two products.

Considerations for a Microsoft Teams integration

Introduces the topics in this section.

Keep these points in mind for a Catalyst Center and Microsoft Teams integration.

Data handling and privacy considerations

- Cisco Catalyst Cloud Portal obtains the following information from your Microsoft tenant and stores it locally in the cloud:
  - Microsoft Teams call records data
  - User profile data, such as ID, email address, first name, last name, display name, and office location
- Catalyst Cloud Portal stores data for one hour before deleting it.
- To view the privacy policy for Catalyst Center, refer to the Catalyst Center privacy data sheet.
- Only the Cisco Cloud Ops team can access your cloud database information.
- Catalyst Cloud Portal stores Microsoft Teams data in an encrypted file system using AWS EBS. It encrypts sensitive data, such as access tokens, and stores them in the database.
- Catalyst Cloud Portal requires these API permissions from Microsoft to retrieve your data:
  - User.ReadBasic.All
  - CallRecords.Read.All
  - User.Read

Integration and connectivity considerations

- An on-premises Catalyst Center instance polls Catalyst Cloud Portal every five minutes to retrieve data.
- When Catalyst Center is integrated with Microsoft Teams, Catalyst Cloud Portal uses these FQDNs:
  - dna.cisco.com
  - dnaservices.cisco.com

- *.ciscoconnectdna.com
- neoffers.cisco.com
- neoffers-de.cisco.com
- app-experience-connect.cisco.com
- app-experience-connect-de.cisco.com

- The Catalyst Cloud Portal service does not use any static IP addresses. If you need to control traffic, use domain names instead.
- You cannot integrate an air-gapped Catalyst Center deployment with Microsoft Teams because integration requires a connection to Catalyst Cloud Portal.
- For Catalyst Center versions up to 2.3.7.5, register an on-premises Catalyst Center instance in Catalyst Cloud Portal using either the US-West or EU Central region. For Catalyst Center 2.3.7.6 and later, you can only register using the US-West region.
- When connected, Catalyst Cloud Portal and Microsoft Teams use these APIs:
  - Authentication: {org tenant id}/adminconsent and {org tenant id}/oauth2/v2.0/token
  - Subscription: v1.0/subscriptions
  - Retrieving call records: v1.0/communications/callRecords/{call record id}?$expand=sessions($expand=segments) and v1.0/users/{user id}

Authentication and permissions considerations

- If your Microsoft Teams account uses multifactor authentication (MFA), MFA is used when you enter account details during the consent flow.
- Catalyst Center 2.3.7.6 and later use the OAuth2 standard device authentication flow. Earlier Catalyst Center versions used one-time password (OTP) authentication, where users generated a password in Catalyst Cloud Portal and used that password to complete the integration between Catalyst Center and Catalyst Cloud Portal.
- After you grant Catalyst Cloud Portal permission, Microsoft Teams issues standard OAuth access and refresh tokens. Catalyst Cloud Portal refreshes the access token every hour using a refresh token. User credentials are never sent to Catalyst Cloud Portal.
- Only Microsoft Teams users configured with these roles can initiate integration:
  - Global Administrator
  - Privileged Role Administrator
  - A custom role that has the permission to grant permissions to applications setting enabled

> **Note**
>
> For more information, refer to this article.

- During the integration process, complete these steps to provide the consent necessary to authenticate Microsoft Teams:

1. In the **Authenticate your application** page, click the **Click here to start the consent flow** link.

2. In the resulting dialog box, enter your Microsoft Teams password and then click **Sign in**.
3. In the **Permissions requested** dialog box, choose the first two check boxes and then click **Accept**.
4. Do one of the following:
   - If you're configured with one of the three roles described in the previous FAQ entry (which means you have admin privileges), first click **I am an Admin**. Next, in the **Permissions requested** dialog box, click all three check boxes. And finally, click **Accept**.
   - If you don't have admin privileges, first click **Copy URL**. Next, send this URL to a user with admin privileges. And finally, have that user open the URL and provide the necessary consent.

- The Application ID for the Catalyst Cloud Portal's OAuth application that is registered with Microsoft is `904c49f0-22c5-4a6f-a96c-613c2c319fc8`. The name of the application is Cisco Catalyst Center Applications Experience.

Integration scope considerations

- There are no differences in the limitations or restrictions you may encounter when Microsoft Teams has been integrated with a physical Catalyst Center appliance versus a virtual appliance.
- You can map one Catalyst Center instance to one Microsoft Teams tenant. Integrate a Catalyst Center instance with the appropriate Microsoft Teams account.
- You can register multiple Catalyst Center instances with a single Catalyst Cloud Portal account. Catalyst Cloud Portal collects data from your subscribed Microsoft Teams account. Each registered Catalyst Center instance retrieves data from its managed clients.

Logging and metrics considerations

- If your network only has Catalyst 9000 Series switches, only Microsoft Teams scores and metrics are available. Catalyst 9000 Series switches do not provide qualitative metrics (like packet loss, latency, and jitter), so network application performance management (APM) metrics are not available.

Known limitations

Describes known limitations for a Catalyst Center and Microsoft Teams integration.

You may encounter these limitations after integrating Catalyst Center with Microsoft Teams:

- Health data may not be available for meetings that are shorter than 10 minutes.
- After a call ends, Microsoft Teams may take a few hours to send a notification to Catalyst Cloud Portal.
- The on-premises version of Catalyst Center stores call record data for 14 days.

Configure an AppX MS-Teams integration

Information about configuring Microsoft Teams integration with Catalyst Center. Catalyst Center provides call quality metrics information.

When activated, Catalyst Center provides call quality metrics information for Application 360 and Client 360 dashboards.

Before you begin

You must have a Microsoft Teams account with admin privileges.

Procedure

1. From the main menu, choose **System** > **Settings** > **External Services** > **Cisco Catalyst – Cloud**.
2. From the **Region** drop-down list, select the Catalyst Cloud US region. For the integration to work, Microsoft Teams must be enabled in the same region (Catalyst Cloud US).
3. Click the icon, search by name, and locate **AppX MS-Teams**.
4. Click **Activate**.

   You are redirected to the **Cisco Catalyst – Cloud** window.

5. In the **Cisco Catalyst – Cloud** window:
   a) Log in to Cisco Catalyst - Cloud with your cisco.com credentials.

      If you do not have cisco.com credentials, you can create them.

   b) In the **Activate application on your product** window, click the consent flow link and do these tasks:
      - In the **Sign in to your account** window, enter the Microsoft admin username and password, and click **Sign In**.
      - Click **Accept**.

   c) In the **Activate application on your product** window, select Catalyst Center and click **Next**.

      To register a new Catalyst Center, click the **here** link and:
      - In the **Host Name/IP** field, enter the Catalyst Center IP address.
      - In the **Product Name** field, enter the Catalyst Center name.
      - In the **Type** field, enter the Catalyst Center type.
      - Click **Register**.

   d) **Cisco Catalyst – Cloud** synchronizes with Catalyst Center automatically; you are redirected to the **Choose the Scope for your Cisco Catalyst Center** window. Click **Next**.
   e) In the **Summary** window, review the configuration settings. To make any changes, click **Edit**.
   f) Click **Activate**.
   You are redirected back to Catalyst Center.

   Note

   If you want to deactivate the product or disconnect from AppX MS-Teams application, see Configure an AppX MS-Teams integration through Cisco Cloud Services on page 90.

Configure an AppX MS-Teams integration through Cisco Cloud Services

Learn how to activate, deactivate, or check the status of MS-Teams integration on the devices through Cisco Cloud Services.

Use this procedure to activate, deactivate, or check the status of MS-Teams integration on the devices through Cisco Cloud Services.

Before you begin

You must have a Microsoft Teams account with admin privileges.

Procedure

1. Log in to Cisco Cloud Services with your cisco.com credentials.

   If you do not have cisco.com credentials, you can create them.
2. From the main menu, choose **Applications and Products**.
3. From the **Region** drop-down list, select the Catalyst Cloud US region. For the integration to work, Microsoft Teams must be enabled in the same region (Catalyst Cloud US).
4. Click the icon, search by name, and locate **AppX MS-Teams**.
5. In the **AppX MS-Teams** tile, click **Activate**. For details, see Configure an AppX MS-Teams integration on page 89.
6. After the product is activated, click **Exit**.
7. You are redirected to the **Applications** window.
8. Click the **AppX MS-Team** tile to view the details in the **App 360** window.
9. (Optional) To activate products from the **App 360** window:
   a) In the **Product Activations** table, click **Add**.
   b) Choose the product that you want to activate and click **Next**.

   > **Note**
   >
   > You cannot select more than one product at a time.

   c) In the **Summary** window, review the configuration settings. To make any changes, click **Edit**. Otherwise, click **Activate**.
10. (Optional) To deactivate the product:
    a) Click the **AppX MS-Teams** tile.
    b) In the **Product Activations** table, check the check box next to the product that you want to deactivate.
    c) From the **More Action** drop-down list, choose **Deactivate**.
    d) In the confirmation window, click **Deactivate**.
11. (Optional) To disconnect the product from AppX MS-Teams application:
    a) Click the **AppX MS-Teams** tile to view the details in the **App 360** window.
    b) In the top menu bar, click **View all details**.
    The **Details** slide-in pane is displayed.
    c) Click **Disconnect now**.

Cloud access keys

Information about adding cloud access keys in Catalyst Center. Catalyst Center supports multiple cloud access keys.

You can register cloud access keys after installing the Cloud Device Provisioning Application package in Catalyst Center. The system supports multiple cloud access keys. Each key is used as a separate cloud profile that contains all the AWS infrastructure constructs or resources that are discovered by using that cloud access key. After a cloud access key is

added, an AWS VPC inventory collection is triggered automatically for it. The AWS infrastructure constructs resources that get discovered by VPC inventory collection for that cloud access key that can then be viewed and used for cloud provisioning of CSRs and wireless controllers.

Before you begin

- Obtain the access key ID and secret key from the Amazon Web Services (AWS) console.
- Subscribe to CSR or wireless controller products in the AWS marketplace and verify the image ID for the target region.
- Identify the key pair that CSRs will use during HA failover on AWS. The key pair's name is selected from a list in Catalyst Center when provisioning CSRs in that region.
- Identify the IAM role that CSRs will use during HA failover on AWS. The IAM role is selected from a list in Catalyst Center when provisioning CSRs.
- Configure the proxy for Catalyst Center to communicate with AWS via HTTPS REST APIs. See Configure the proxy on page 22.
- The Cloud Connect extension to the eNFV app is enabled by deploying a separate Cloud Device Provisioning Application package. The package is not included by default in the standard Catalyst Center installation. You must download and install the package from a catalog server. For more information, see Download and install applications on page 144.

Procedure

1. From the main menu, choose **System** > **Settings** > **Cloud Access Keys**.
2. Click **Add**.
3. Enter the **Access Key Name** and choose the **Cloud Platform** from the drop-down list. Enter the **Access Key ID** and **Secret Key** obtained from the AWS console.
4. Click **Save and Discover**.

What to do next

- After a cloud access key is added, an AWS VPC inventory collection is triggered automatically for it. It takes several minutes to synchronize with the cloud platform. Inventory collection is scheduled to occur at the default interval.
- After successful cloud inventory collection, the **Cloud** tab in the **Provision** section provides a view of the collected AWS VPC inventory.

Configure Webex integration

Information about configuring Webex integration for Client 360.

Catalyst Center provides Webex meeting session information for Client 360.

Procedure

1. From the main menu, choose **System** > **Settings** > **External Services** > **Webex Integration**.
2. Click **Authenticate to Webex**.
3. In the **Cisco Webex** pop-up window, enter the email address and click **Sign In**.
4. Enter the password and click **Sign In**.

   Webex authentication is completed successfully.

5. Under **Default Email Domain for Webex Meetings Sign-In**, enter the Webex user email domain and click **Save**.

   The Webex domain is organization-wide, and all users who use the domain can host or attend meetings.

6. Optional: Under **Authentication Token**, click **Delete** to delete Webex authentication.

Configure ThousandEyes integration

Information about configuring ThousandEyes integration using an authentication token. After integration, Catalyst Center provides ThousandEyes agent test data in the Application Health dashboard.

You can configure Catalyst Center to communicate with an external ThousandEyes API agent to enable ThousandEyes integration using an authentication token. After integration, Catalyst Center provides ThousandEyes agent test data in the Application Health dashboard.

Procedure

1. From the main menu, choose **System** > **Settings** > **External Services** > **ThousandEyes Integration**.
2. To connect ThousandEyes account to Catalyst Center:
   a. Click **Start set up**. The device authentication code is displayed.
   b. Click **Login** and enter the device authentication code in the **Cisco ThousandEyes authentication** pop-up window and click **Verify**.
   c. In the **ThousandEyes login** window, enter the ThousandEyes credentials and click **Login**.
3. To disconnect the ThousandEyes, click **Disconnect**.

7 Manage System Configurations

Topics:

- Monitor system health
- View audit logs
- Configure debugging logs
- Activate high availability
- Configure integration settings
- Enable visibility and control of configurations
- Configure geo map settings
- Set up a login message

Monitor system health

Information about monitoring the health of the physical components of Catalyst Center.

From the **System Health** page, you can monitor the health of the physical components on your Catalyst Center appliances and monitor any issues that may occur. Refer to the included topics, which describe how to enable this functionality and use it in your production environment.

Establish Cisco IMC connectivity

Information about how to establish Cisco Integrated Management Controller (IMC) connectivity.

To enable the **System Health** page, you must establish connectivity with Cisco Integrated Management Controller (Cisco IMC), which collects health information for your physical appliance hardware. Complete this procedure.

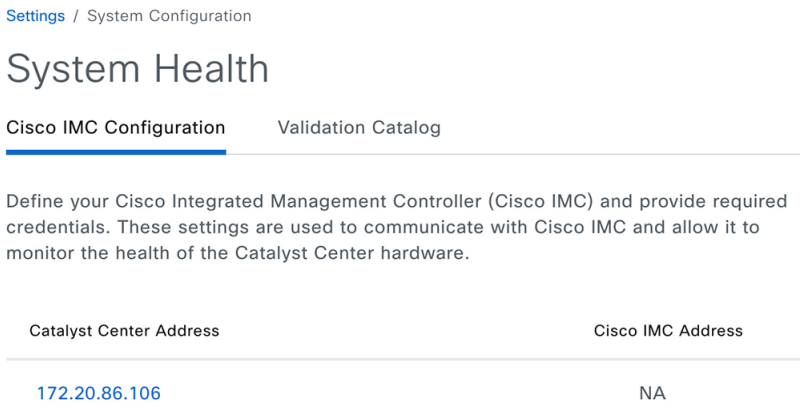
Before you begin

Users with SUPER-ADMIN-ROLE permissions or CUSTOM-ROLE with "Write" permission to System Settings can configure Cisco IMC connectivity settings for an appliance.

Procedure

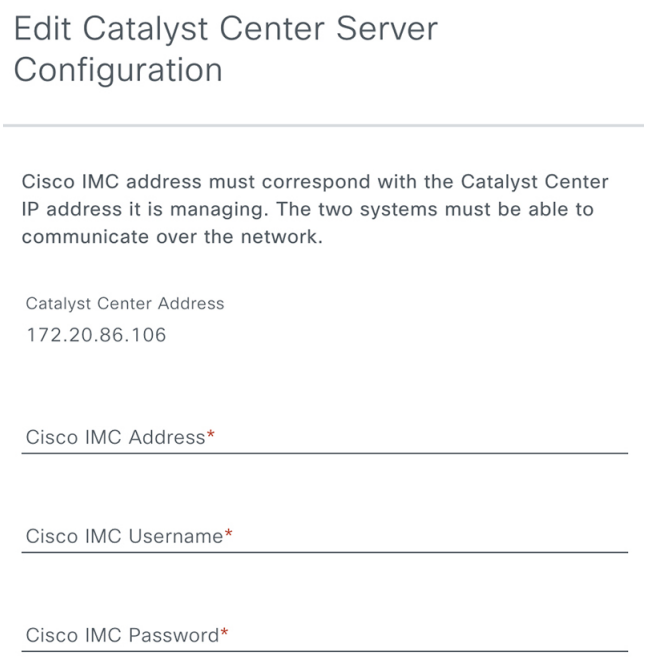
1. From the main menu, choose **System** > **Settings** > **System Configuration** > **System Health**.

   The IP address of each appliance in your cluster is listed in the **Catalyst Center Address** column.



2. Enter the information required to log in to Cisco IMC:
   a) Click the IP address for an appliance.

      The **Edit Catalyst Center Server Configuration** slide-in pane is displayed.



b) Enter the IP address configured for the appliance's Cisco IMC port.
c) Enter your Cisco IMC username and password and click **Save**:
d) If necessary, repeat this step for the other appliances in your cluster.

Delete Cisco IMC settings

This task explains how you can delete Cisco IMC connectivity settings.

To delete the Cisco IMC connectivity settings configured for a particular appliance, complete this procedure.

Before you begin

Users with SUPER-ADMIN-ROLE permissions or CUSTOM-ROLE with "Write" permission to System Settings can delete these settings.

Procedure

1. From the main menu, choose **System** > **Settings** > **System Configuration** > **System Health**.
2. To delete settings for an appliance, click the corresponding delete icon ( ) in the **Actions** column.
3. In the confirmation window, click **OK**.

Subscribe to system event notifications

Information about system event notifications.

After you establish connectivity with Cisco IMC, Catalyst Center collects event information from Cisco IMC and stores this information as raw system events. The rules engine then processes these raw events and converts them into system event notifications that are displayed in the System Health topology. Complete the procedure described in the "Work with Event Notifications" topic of the *Cisco Catalyst Center Platform User Guide*, to receive these notifications in one of the available formats. When completing this procedure, select and subscribe to these events:

Table 3: System notification events in Catalyst Center

Event name	Event ID	Domain	Sub domain	Description
System Backup v2	SYSTEM-BACKUP-v2	System	System Backup	A notification is sent when the backup operation fails.
System Restore v2	SYSTEM-RESTORE-v2	System	System Restore	The event is generated on failure during restore operation.
System Software Upgrade v2	SYSTEM-SOFTWARE-UPGRADE-v2	System	System Software Upgrade	A notification is sent when the software upgrade operation fails.
Disaster Recovery health status v2	SYSTEM-DISASTER-RECOVERY-v2	System	Disaster Recovery	A notification is sent when the state of the disaster recovery system changes.
CMX connectivity failure v2	SYSTEM-EXTERNAL-CMX-v2	External Integrations	CMX Connectivity	A notification is sent when there's no connectivity with CMX.
External IPAM provider connectivity failure v2	SYSTEM-EXTERNAL-IPAM-v2	External Integrations	IPAM Integration	A notification is sent when there's no connectivity with an external IPAM provider.
ISE AAA trust establishment failure v2	SYSTEM-EXTERNAL-ISE-AAA-TRUST-v2	External Integrations	Cisco ISE AAA Trust Establishment	A notification is sent when the ISE AAA trust establishment fails.
ISE PAN ERS connectivity failure v2	SYSTEM-EXTERNAL-ISE-PAN-ERS-v2	External Integrations	Cisco ISE PAN ERS Connectivity	A notification is sent when there is no connectivity with the Cisco ISE primary and secondary PAN ERS.
ISE PxGrid health state change notification v2	SYSTEM-EXTERNAL-ISE-PXGRID-v2	External Integrations	Cisco pxGrid	A notification is sent when the health state of Cisco ISE PxGrid connections changes.
External ITSM provider connectivity failure v2	SYSTEM-EXTERNAL-ITSM-v2	External Integrations	ITSM Integration	A notification is sent when there's no connectivity with an external ITSM provider.

Event name	Event ID	Domain	Sub domain	Description
Certificate Status Notification v2	SYSTEM-CERTIFICATE-v2	System	System Certificate	A notification is sent when a system certificate, built-in certificate, proxy certificate, disaster recovery certificate, or a third-party trusted certificate expires, is revoked, or will expire in less than 90 days.
Cisco IMC Certificate Status Notification v2	CISCO-IMC-CERTIFICATE-v2	Appliance	Cisco IMC Certificate	A notification is sent when the Cisco IMC certificate has expired, been revoked, or will expire in less than 90 days.
Cisco IMC Connectivity status v2	CISCO-IMC-v2	Appliance	Cisco IMC	A notification is sent whenever Cisco IMC's connectivity status changes.
System Appliance Configuration Status Notification v2	CISCO-IMC-CONFIGURATION-v2	Appliance	Cisco IMC Configuration	A notification is sent when the Cisco IMC hardware configurations are not compliant with the Cisco standards.
System Hardware health status v2	CISCO-IMC-HARDWARE-v2	Appliance	Cisco IMC Hardware Health Status	A notification is sent when the health status of any hardware component changes. Supported hardware components include: • CPU • Memory • Disk • NIC • Fan • Power Supply • RAID controller

Event name	Event ID	Domain	Sub domain	Description
System managed services v2	SYSTEM-MANAGED-SERVICES-v2	System	System Managed Services	A notification is sent when the status of a platform-provided managed service changes. **Note** For managed services, the probe interval (the time it takes for Catalyst Center to delete stale events from its database) is 60 minutes. When managed services that have been down become active again, it takes this long for the System Health GUI to reflect that the services have been restored.
System Performance: Filesystem Utilization v2	SYSTEM-PERFORMANCE-v2:	System	System Performance: Filesystem Utilization	A notification is sent when filesystem (partition) utilization is approaching capacity.
System Scale Limits v2	SYSTEM-SCALE-LIMITS-v2:	System	System Scale Limits	A notification is sent when scale limits have been exceeded.
Application Health v2	SYSTEM-APPLICATION-HEALTH-v2	System	Application Health	A notification is sent when the health state of an application registered for monitoring changes.
Cisco Trusted Certificate Update Notifications v2	CISCO-TRUSTED-CERTIFICATE-BUNDLE-v2	System	Cisco Trusted Certificates	A notification is sent when a newer Cisco-trusted certificate bundle is available.

Event name	Event ID	Domain	Sub domain	Description
Internet URL Accessible Notifications v2	INTERNET-URL-ACCESS-v2	System	Internet Access	A notification is sent when Catalyst Center is unable to reach any of the URLs listed in Check required URLs access on page 115.

Event notification information

Information about system health event notification.

This table presents the key information that Catalyst Center provides when it generates a system health notification message.

Subdomain	Tag	Instance	State	Message
Domain: System				
CPU	CPU	*<node-hostname>*:CPU-1	OK	Catalyst Center CPU-1 is working as expected on *<node-hostname>*
			NotOk	Catalyst Center CPU-1 has failed on *<node-hostname>*
			Disabled	Catalyst Center CPU-1 is disabled on *<node-hostname>*
Memory	Memory	*<node-hostname>*:DIMM_A1	OK	Catalyst Center RAM DIMM_A1 is working as expected on *<node-hostname>*
			NotOk	Catalyst Center RAM DIMM_A1 has failed on *<node-hostname>*
Disk	Disk	*<node-hostname>*:Disk1	OK	Catalyst Center Disk 2 is working as expected on *<node-hostname>*
			NotOk	Catalyst Center Disk 2 has failed on *<node-hostname>*
RAID Controller	RAIDController	*<node-hostname>*:Controller-1	OK	Catalyst Center RAID VD-2 is working as expected on *<node-hostname>*
			NotOk	Catalyst Center RAID VD-2 has degraded on *<node-hostname>*
			Disabled	Catalyst Center RAID VD-2 is offline on *<node-hostname>*
Network Interfaces	NIC	*<node-hostname>*:nic-1	OK	Catalyst Center network interfaces are working as expected
			NotOk	Catalyst Center: *<x>* network interfaces are missing for *<node-hostname>*: nic-1

Subdomain	Tag	Instance	State	Message
PSU_FAN	PSU	*<node-hostname>*:psu-1	OK	Catalyst Center power supply (PSU-1) is powered on and thermal condition is normal for *<node-hostname>*
			NotOk	Catalyst Center power supply (PSU-2) is powered off and thermal condition is critical for *<node-hostname>*
Disaster Recovery	DisasterRecovery	*<disaster-recovery-hostname>*	OK	• Disaster recovery cluster is up • Disaster recovery failover succeeded to *<site-name>*
			Degraded	• Disaster recovery failover triggered from *<site-name>* to *site-name* • Disaster recovery failed while failing over to *<site-name>* • Disaster recovery standby cluster on *<site-name>* is down; cannot failover • Disaster recovery witness is down; cannot failover • Disaster recovery replication halted; recovery point objective will be impacted • Disaster recovery pause failed • Disaster recovery route advertisement failed • Disaster recovery IPSec communication failed
			NotOk	• Disaster recovery configuration failed • Disaster recovery failed to rejoin the standby system
Platform Services	ManagedServices	<hostname>:<name>	OK	Managed Service *<service-name>* is Running
			NOTOK	Managed Service *<service-name>* is Interrupted

Subdomain	Tag	Instance	State	Message
Scale Limits	wired_concurrent_clients	<hostname>:<name>	OK	OK
			NOTOK	The number of concurrent wired clients exceeded 26250 (105% of limit)
			DEGRADED	The number of concurrent wired clients exceeded 21250 (85% of limit)
			CAUTION	The number of concurrent wired clients exceeded 18750 (75% of limit)
	wireless_concurrent_clients	<hostname>:<name>	OK	OK
			NOTOK	The number of concurrent wireless clients exceeded 18750 (75% of limit)
			DEGRADED	The number of concurrent wireless clients exceeded 21250 (85% of limit)
			CAUTION	The number of concurrent wireless clients exceeded 18750 (75% of limit)
	wired_devices	<hostname>:<name>	OK	OK
			NOTOK	The number of wired devices exceeded 1050 (105% of limit)
			DEGRADED	The number of wired devices exceeded 850 (85% of limit)
			CAUTION	The number of wired Devices exceeded 750 (75% of limit)
	wireless_devices	<hostname>:<name>	OK	OK
			NOTOK	The number of wireless devices exceeded 3800 (105% of limit)
			DEGRADED	The number of wireless devices exceeded 3400 (85% of limit)
			CAUTION	The number of wireless devices exceeded 3000 (75% of limit)
	interfaces	<hostname>:<name>	OK	OK
			NOTOK	The number of interfaces exceeded 1140000000 (95% of limit)
			DEGRADED	The number of interfaces exceeded 1020000000 (85% of limit)
			CAUTION	The number of interfaces exceeded 900000000 (75% of limit)
	ippools	<hostname>:<name>	OK	OK

Subdomain	Tag	Instance	State	Message
			NOTOK	The number of IP pools exceeded 47500 (95% of limit)
			DEGRADED	The number of IP pools exceeded 42500 (85% of limit)
			CAUTION	The number of IP pools exceeded 37500 (75% of limit)
	netflows	<hostname>:<name>	OK	OK
			NOTOK	The number of Netflows exceeded 37500 (75% of limit)
			DEGRADED	The number of Netflows exceeded xxx (x% of limit)
			CAUTION	The number of Netflows exceeded yyy (y% of limit)
	physical_ports	<hostname>:<name>	OK	OK
			NOTOK	The number of physical ports exceeded 50400 (95% of limit)
			DEGRADED	The number of physical ports exceeded 40800 (85% of limit)
			CAUTION	The number of physical ports exceeded 36000 (75% of limit)
	policy	<hostname>:<name>	OK	OK
			NOTOK	The number of policies exceeded 23750 (95% of limit)
			DEGRADED	The number of policies exceeded 21250 (85% of limit)
			CAUTION	The number of policies exceeded 18750 (75% of limit)
	security_group	<hostname>:<name>	OK	OK
			NOTOK	The number of security groups exceeded 3800 (95% of limit)
			DEGRADED	The number of security groups exceeded 3400 (85% of limit)
			CAUTION	The number of security groups exceeded 3000 (75% of limit)
	sites	<hostname>:<name>	OK	OK
			NOTOK	The number of sites exceeded 475 (95% of limit)
			DEGRADED	The number of sites exceeded 425 (85% of limit)
			CAUTION	The number of sites exceeded 375 (75% of limit)

Subdomain	Tag	Instance	State	Message
	transient_clients	<hostname>:<name>	OK	OK
			NOTOK	The number of transient clients exceeded 71250 (95% of limit)
			DEGRADED	The number of transient clients exceeded 63750 (85% of limit)
			CAUTION	The number of transient clients exceeded 56250 (75% of limit)
	MongoDB	<hostname>:<name>	CRITICAL	The disk usage exceeded 16.58 GB (80% of limit)
	Postgres	<hostname>:<name>	CRITICAL	The disk usage exceeded 65.53 GB (80% of limit)
Software Upgrade	Upgrade	<hostname>:<name>	OK	Successfully finished downloading package *<package-name>* with version *<package-version>*
			NOTOK	Catalog package download failed for *<package-name>*
Backup	Backup	<hostname>:<name>	OK	The backup completed successfully.
			NOTOK	Failed to backup
Restore	Restore	<hostname>:<name>	OK	The restore operation completed successfully.
			NOTOK	The configuration restore operation failed.
Domain: Connectivity				
ISE	ISE_ERS	*<Cisco-ISE-hostname>*	Success	ISE AAA trust establishment succeeded for ISE server *<ISE-server-details>*
			Failed	ISE AAA trust establishment failed for ISE server *<ISE-server-details>*
Domain: Integrations				
IPAM	IPAM	*<IPAM-hostname>*	OK	IPAM connection to Catalyst Center established. IPAM *<IPAM-IP-address>*.
			Critical	IPAM connection to Catalyst Center offline. IPAM *<IPAM-IP-address>*.
ISE	ISE_AAA	*<Cisco-ISE-hostname>*	Up	ISE AAA trust establishment succeeded for ISE server. ISE *<ISE-IP-address>*
			Down	ISE AAA trust establishment failed for ISE server. ISE *<ISE-IP-address>*

Subdomain	Tag	Instance	State	Message
CMX	CMX	*<CMX-hostname>*	serviceAvailable	CMX connection to Catalyst Center offline. CMX *<CMX-IP-address>*.
			serviceNotAvailable	CMX connection to Catalyst Center offline. CMX *<CMX-IP-address>*.
ITSM	ITSM	*<ITSM-hostname>*	Up	ITSM connection to Catalyst Center offline. ITSM *<ITSM-IP-address>*.
			Down	ITSM connection to Catalyst Center offline. ITSM *<ITSM-IP-address>*.

System health scale numbers

Information about system health scale numbers for the Catalyst Center appliance.

System Health monitors Catalyst Center appliances. It generates a notification whenever a network component exceeds a particular threshold. The priority of the notification depends on the measured percentage of the threshold.

System Health generates notifications at these threshold percentages:

- When 75% of a threshold is exceeded, an information (P3) notification is generated.
- When 85% of a threshold is exceeded, a warning (P2) notification is generated.
- When 95% of a threshold is exceeded, a critical (P1) notification is generated.

Note

- See the "Supported Hardware Appliances" topic in the *Release Notes for Cisco Catalyst Center* for a list of available Catalyst Center appliances.
- 1,000,000 notifications are maintained in the audit log for every appliance (regardless of type) and are stored for one year.
- To view the current appliance scale numbers, see the *Cisco Catalyst Center Data Sheet*.
- System Health isn't supported on Catalyst Center clusters consisting of three 44-core appliances.

View the system topology

The **System Health** window provides a graphical topology of your Catalyst Center appliances and connected external systems. Use this system topology to monitor network component status, identify issues, track certificate expiration, verify hardware compliance, and view disaster recovery information.

From the **System Health** window's topology, you can view a graphical representation of your Catalyst Center appliances and the external systems that are connected to your network, such as Cisco Connected Mobile Experiences (Cisco CMX) and Cisco Identity Services Engine (Cisco ISE). You can quickly identify any network components that are experiencing an issue and require further attention.

To display appliance and external system data on this page, complete the tasks described in these topics:

- Establish Cisco IMC connectivity on page 96
- Subscribe to system event notifications on page 97

To view this page, click the menu icon and choose **System** > **System 360**, then click the **System Health** tab. Topology data is polled every 30 seconds. If any new data is received, the topology automatically updates to reflect this data.

Note

- Catalyst Center supports IPv6. When viewing a cluster on which IPv6 is enabled, the topology also displays this information for that cluster's Enterprise virtual IP address:
  - **Pre** field: 16-bit prefix
  - **GID** field: 32-bit global ID
  - **Subnet** field: 16-bit subnet value

  The remainder of the cluster's Enterprise virtual IP address is used to label its topology icon.
- An IPv6-enabled cluster can only connect to and retrieve data from external systems that also support IPv6.
- Whenever a connected appliance or external system has a certificate installed that is set to expire, the topology does this:
  - If a certificate is set to expire within 90 days, the topology displays a warning.
  - If a certificate is set to expire within 30 days, the topology displays an error to bring your attention to the issue.
- System Health runs a hardware compliance check regularly and indicates whenever a connected appliance or external system does not meet the minimum configuration requirements. For example, System Health updates the topology to indicate when the **Write Through** cache write policy is not set for a connected virtual drive.
- If disaster recovery is operational in your production environment, System Health now provides hardware information for the appliances at both the main and recovery site. Previously, hardware information was provided only for main site appliances.

Troubleshoot appliance and external system issues

Information about troubleshooting appliance and external system issues.

When viewing the System Health topology, the minor issue icon (⚠) and major issue icon (⛔) indicate network components that require attention. To troubleshoot an issue experienced by a component, place your cursor over its topology icon. A pop-up window will display this information:

- A timestamp that indicates when the issue was detected.
- If you are viewing the pop-up window for a Catalyst Center appliance, the Cisco IMC firmware version that is installed on the appliance.
- A brief summary of the issue.
- The current state or severity of the issue.
- The domain, subdomain, and IP address or location associated with the issue.

If you open the pop-up window for a connected external system that has three or more associated servers or a Catalyst Center appliance that has three or more hardware components that are experiencing an issue, the **More Details** link is displayed. Click the link to open a slide-in pane that lists the relevant servers or components. You can then view information for a specific item by clicking **>** to maximize its entry.

> **Note**
>
> You can use the Support Bundle feature to access detailed root cause analysis (RCA) data. For more information about this feature, see the "Generate the Root Cause Analysis File from Catalyst Center" chapter in the *Cisco Catalyst Center User Guide*.

Troubleshoot external system connectivity issues

Information about troubleshooting external system connectivity issues.

If Catalyst Center is currently unable to communicate with an external system, use this procedure to ping that system and troubleshoot the connectivity issue.

Before you begin

Do the following before you complete this procedure:

- Install the Machine Reasoning package. See Download and install applications on page 144.
- Create a role with write permission to the Machine Reasoning function. Assign that role to the user who completes this procedure. To access this parameter in the **Create a User Role** wizard, expand the **System** row on the **Define the Access** page. For more information, see Configure role-based access control on page 154.

Procedure

1. From the top-right portion of the **System Health** window, choose **Tools** > **Network Ping** to open the **Ping Device** window.

   The window lists all the devices that Catalyst Center currently manages.

2. Click the radio button for any device whose reachability status is **Reachable** and then click the **Troubleshoot** link.

   The **Reasoner Inputs** window opens.

3. In the **Target IP Address** field, enter the IP address of the external system that cannot be reached.
4. Click **Run Machine Reasoning**.

   A dialog box is displayed after Catalyst Center has pinged the external system.

5. Click **View Details** to see whether the ping was successful.
6. If the ping failed, click the **View Relevant Activities** link to open the **Activity Details** slide-in pane and then click the **View Details** icon.

   The **Device Command Output** window opens, listing possible causes for the inability to reach the external system.

Use the Validation tool

Information about the **Validation Tool** to test both the Catalyst Center appliance hardware and connected external systems.

The **Validation Tool** tests both the Catalyst Center appliance hardware and connected external systems. It identifies any issues that need to be addressed before they seriously impact your network. The validation process performs multiple checks, such as:

- The ability to connect to ciscoconnectdna.com to download system and package updates.
- The presence of expiring certificates.
- The current health of appliance hardware and back end services.
- The network components that have exceeded a scale number threshold.

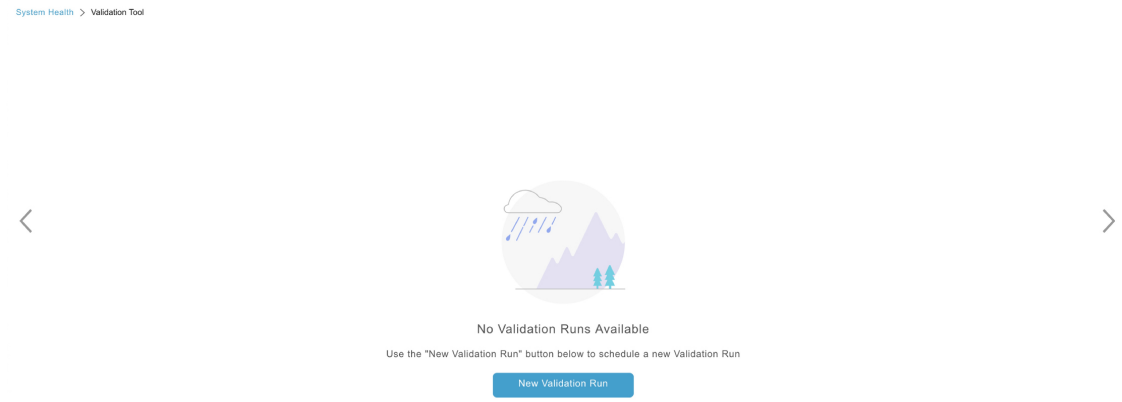
To access the tool:

1. From the main menu, choose **System** > **System 360**, and then click the **System Health** tab.
2. From the **Tools** drop-down menu, choose **Validation Tool**.

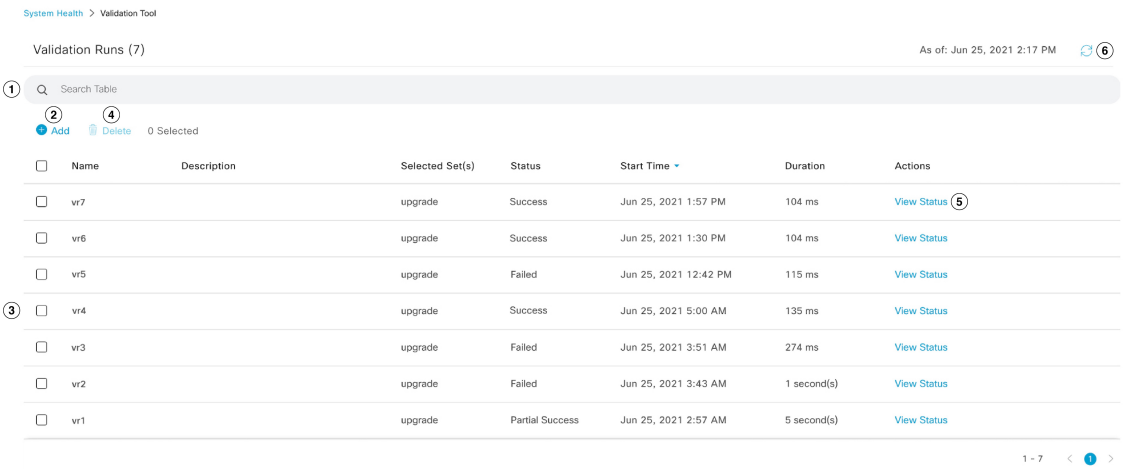
Navigate the Validation Tool window

Information about **Validation Tool** window navigation.

The contents of the **Validation Tool** window depend on whether Catalyst Center has information for any validation runs that completed previously. If it doesn't, the window looks like this:



If Catalyst Center has validation run information, the window looks like this:



This table describes the components that make up the **Validation Tool** window and their function when validation run information is available.

Callout	Description
1	**Search Table** field: Enter a search string to filter the validation runs that are listed on this window.

Callout	Description
2	**Add** button: Click to open the **New Validation Run** slide-in pane and enter the required settings for a new run. For more information, see Start a validation run on page 110.
3	**Validation Runs** table: Lists the validation runs that completed previously. For each run, the table provides information such as its name, applicable validation set, and completion status. **Note** • By default, the runs are ordered by start time, with the most recent run listed first. • A duration of zero is listed for any run that's currently in progress.
4	**Delete** button: With the check box for a validation run checked, click to delete the run. Then click **Ok** in the **Warning** dialog box to confirm deletion. **Note** You can't delete a run that is in progress.
5	**View Status** link: Click to view the details for a particular run. For more information, see View validation run details on page 111.
6	**Refresh** button: Click to refresh the information that is displayed on this window.

Start a validation run

Describes how to start a validation run.

To start a validation run, complete these steps.

Note

Only one validation run can take place at a time. If a validation run is already in progress, wait for it to complete before starting another run.

Procedure

1. Do one of these tasks in the **Validation Tool** window, depending on whether the **Validation Runs** table is displayed:
   - If the table is not displayed, it means that either previous validation runs have been deleted or a validation run hasn't been completed yet. Click **New Validation Run**.
   - If the **Validation Runs** table is displayed, click **Add**.

The **New Validation Run** slide-in pane opens.

2. In the **Name** field, enter a name for the validation run.

   Enter a unique name that contains only alphanumeric characters. Do not use special characters.

3. Optional: In the **Description** field, enter a brief description for the validation run you're about to start.

   You can enter a description that contains a maximum of 250 characters.

4. In the **Validation Set(s) Selection** area, check the check box for the validation sets you want to run.

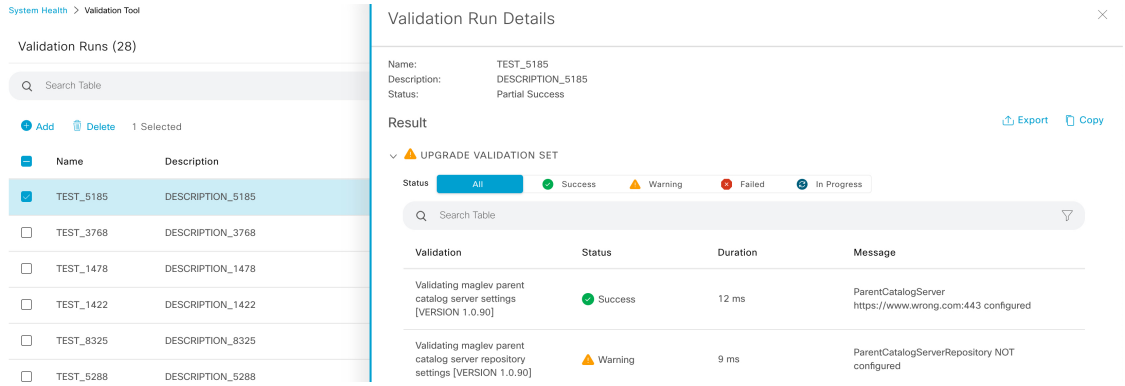
   You can maximize a validation set to view the checks it makes.

5. Click **Run**.

View validation run details

Information about viewing validation run details.

From the **Validation Run Details** slide-in pane, you can view the checks that were made during the selected run, completion status, duration, and any other relevant information.



From here, you can also do these tasks:

- To filter the information that's provided, in the **Search Table** field, enter a search string.
- To download the contents of this pane as a PDF file, click **Export**.
- To copy the contents of this pane, click **Copy**.

Update the validation set

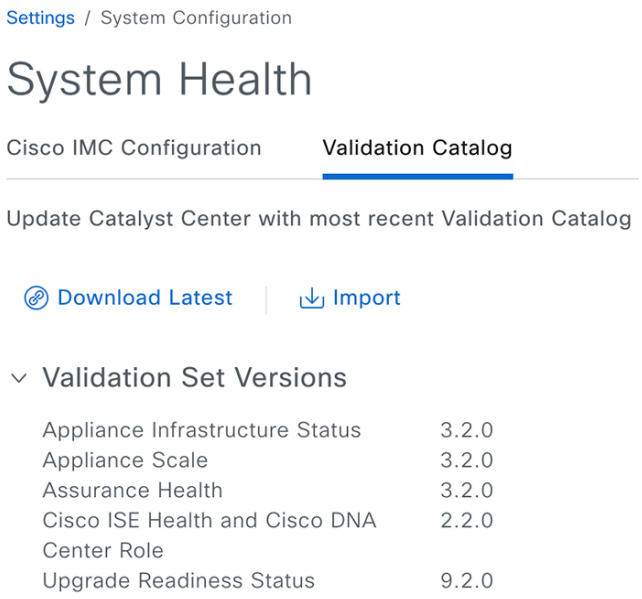
Information about how to update the validation set.

Validation sets should be updated whenever you upgrade Catalyst Center. In case you need to update validation sets manually, do this procedure:

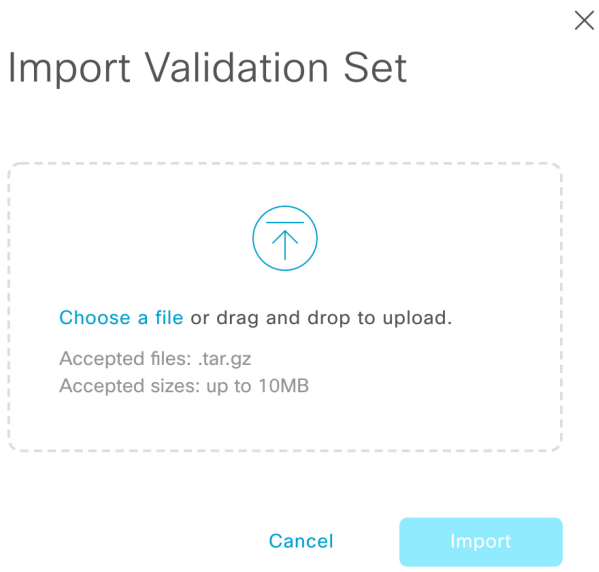
Procedure

---

1. From the main menu, choose **System** > **Settings** > **System Configuration** > **System Health**.



2. Click the **Validation Catalog** tab.
3. Click **Download Latest** to download a local copy of the latest available validation sets.
4. Import the validation set to Catalyst Center:
   a) Click **Import** to open the **Import Validation Set** dialog box.



   b) Do one of these tasks:
      - Click the **Choose a file** link and navigate to the .tar file that you want to import.
      - Drag and drop the appropriate .tar file from your desktop into the highlighted area.

   c) Click **Import**.

System topology notifications

Information about system topology notifications in the **System Health** page.

These tables list the various notifications that are displayed in the system topology of the **System Health** page for your Catalyst Center appliances and any connected external systems. Notifications are grouped by their corresponding severity:

- Severity 1 (Error): Indicates a critical error, such as a disabled RAID controller or faulty power supply.
- Severity 2 (Warning): Indicates an issue, such as the inability to establish trust with a Cisco ISE server.
- Severity 3 (Success): Indicates that a server or hardware component is operating as expected.

> **Note**
>
> If all the hardware components on an appliance are operating without any issues, an individual notification is not provided for each component. Instead, an OK notification is displayed.

Table 4: Catalyst Center appliance notifications

Component	Severity 1 notification	Severity 2 notification	Severity 3 notification
CPU	Processor CPU1 (SerialNumber - *xxxxxx*) State is Disabled	Processor CPU1 (SerialNumber - *xxxxxx*) Health is NotOk and State is Enabled	Processor CPU1 (SerialNumber - *xxxxxx*) Health is Ok and State is Enabled
Disk	Driver - PD1 State is Disabled	Driver - PD1 Health is Critical and State is Enabled	Driver - PD1 Health is Ok and State is Enabled
MemoryV1	Memory Summary (TOTALSYSTEMMEMORYGIB - 256) Health is NotOk	–	Memory Summary (TOTALSYSTEMMEMORYGIB - 256) Health is Ok
MemoryV2	Storage DIMM1 (SerialNumber - *xxxxx*) Status is NotOperable	–	Storage DIMM1 (SerialNumber - *xxxxx*) Status is Operable
NIC	NIC Adapter Card MLOM State is Disabled	NIC Adapter Card MLOM State is Enabled and port0 is Down	NIC Adapter Card MLOM State is Enabled and port0 is Up
Power supply	Power Supply PSU1 (SerialNumber - *xxxx*) State is Disabled	–	Power Supply PSU1 (SerialNumber - *xxxx*) State is Enabled
RAID	Cisco 12G SAS Modular Raid Controller (SerialNumber - *xxxxx*) State is Disabled	Cisco 12G SAS Modular Raid Controller (SerialNumber - *xxxxx*) Health is NotOK and State is Enabled	Cisco 12G SAS Modular Raid Controller (SerialNumber - *xxxxx*) Health is OK and State is Enabled

Table 5: Connected external system notifications

Component	Severity 1 notification	Severity 2 notification	Severity 3 notification
Cisco Connected Mobile Experiences (CMX) server	–	There is a critical issue with the integrated CMX server.	CMX server is integrated and servicing.

Component	Severity 1 notification	Severity 2 notification	Severity 3 notification
IP address management (IPAM) server	There is a critical issue with the connected third-party IPAM provider	–	• A third-party IPAM provider is connected. • There is no third-party IPAM provider connected. • The third-party IPAM provider is currently synchronizing.
Cisco ISE–External RESTful Services (ERS)	–	ISE PAN ERS connection: ISE ERS API call unauthorized	ISE PAN ERS connection: ERS reachability with ISE - Success
Cisco ISE–Trust	–	ISE AAA Trust Establishment: Trust Establishment Error	ISE AAA Trust Establishment: Successfully established trust and discovered PSNs from PAN
IT service management (ITSM) server	ServiceNow connection health status is not up and running	–	ServiceNow connection health status is up and running

Disk use event notifications

Information about System Health disk use notifications.

System Health monitors disk use by all nodes in your system. When disk use on any node reaches a level that could impact network operations, System Health automatically sends a notification.

When disk use exceeds 75 percent, a warning notification is sent.

When disk use exceeds 85 percent, a critical notification is sent.

To configure and subscribe to these notifications, complete the steps described in the "Work with Event Notifications" topic of the *Catalyst Center Platform User Guide*. When completing this procedure, select and subscribe to the **System Performance: Filesystem Utilization** event.

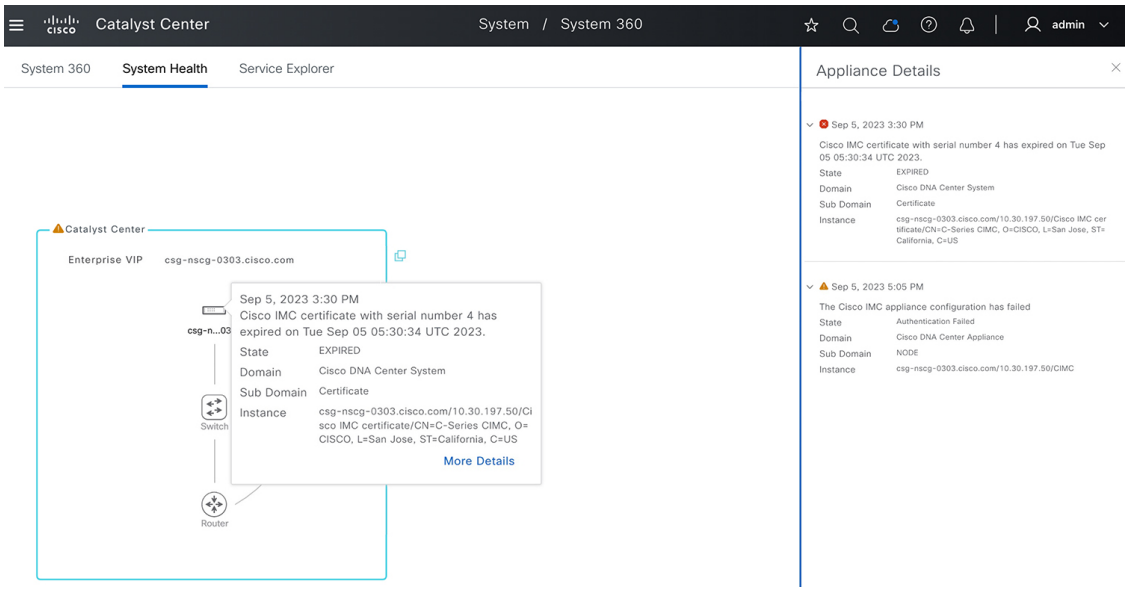
Note

- After you restore a backup file or upgrade Catalyst Center, System Health restarts the monitoring of disk use and collects hourly updates.
- In a three-node HA deployment, every configured partition on the three cluster nodes is monitored. Any generated notifications are specific to the relevant partition.
- In a deployment where disaster recovery is enabled, System Health monitors disk use by the nodes at both the active and standby site.

Check for revoked and expired certificates

Describes how the System Health topology window displays certificate event notifications.

Catalyst Center checks daily for certificates that have been revoked, expired, or will expire in the near future. If you want to receive notifications whenever one of these events takes place, subscribe to the SYSTEM-CERTIFICATE-v2 and CISCO-IMC-CERTIFICATE-v2 events (see Subscribe to system event notifications on page 97). In addition to the notifications you receive in the format of your choosing, Catalyst Center also updates the **System Health** window's topology to indicate certificate events. To view these notifications, place your cursor over an appliance. If available, you can also click the **More Details** link to view notifications in the **Appliance Details** slide-in pane.



Catalyst Center supports the storage and update of the Cisco trusted certificate bundle (**ios.p7b**) from the Cisco PKI web site. This bundle, which comes preinstalled with Catalyst Center, enables supported Cisco networking devices to authenticate the controller and its applications (such as Network Plug and Play) upon the presentation of a valid third-party vendor device certificate. Catalyst Center checks the status of the certificate bundle's third-party certificates individually. For Cisco-signed certificates, the system checks if a newer version of the bundle is available to download. To receive notifications when a third-party certificate or the trusted certificate bundle requires an update, subscribe to the CISCO-TRUSTED-CERTIFICATE-BUNDLE-v2 event.

Check required URLs access

Lists the URLs that Catalyst Center checks to ensure reachability.

Catalyst Center confirms whether these URLs are reachable:

- http://validation.identrust.com/crl/hydrantidcao1.crl
- http://commercial.ocsp.identrust.com
- https://www.ciscoconnectdna.com
- https://cdn.ciscoconnectdna.com
- https://registry.ciscoconnectdna.com
- https://registry-cdn.ciscoconnectdna.com

When any of these URLs are unreachable (especially the first two listed, as they're used to check the revocation status of system certificates), it could impact network operations. Subscribe to the INTERNET-URL-ACCESS-v2 event to receive a notification when this happens.

Suggested actions

Information about the likely issues and suggested actions while monitoring the system health.

This table lists the issues that you'll most likely encounter while monitoring the health of your system and suggests actions you can take to remedy those issues.

Component	Subcomponent	Issue	Suggested actions
Cisco ISE	External RESTful Services (ERS)–Reachability	Timeout elapsed (possibly because the Cisco ISE ERS API load threshold has been exceeded).	• Check your proxy configuration for a proxy server between Catalyst Center and Cisco ISE. • Check whether you can reach Cisco ISE from Catalyst Center.
		Unable to establish a connection with Cisco ISE.	• Check whether a firewall is configured. • Check your proxy configuration for a proxy server between Catalyst Center and Cisco ISE. • Check whether you can reach Cisco ISE from Catalyst Center.
	ERS–Availability	No response to ERS API call.	• Check which version of Cisco ISE is installed. • Check if ERS is enabled on Cisco ISE. See the "Enable External RESTful Services APIs" topic in the *Cisco Identity Services Engine Administrator Guide* for more information.
	ERS–Authentication	Cisco ISE ERS API call is unauthorized.	Check whether the AAA settings credentials and the Cisco ISE credentials are the same.
	ERS–Configuration	Cisco ISE certificate has been changed.	From the Catalyst Center GUI, reestablish trust. For more information, see the "Enable PKI in Cisco ISE" topic in the *Cisco Identity Services Engine Administrator Guide*.
	ERS–Unclassified/Generic Error	An undefined diagnostic error occurred.	1. Delete the AAA settings that are currently configured in Catalyst Center. 2. Reenter the appropriate AAA settings. For more information, see the "Integrate Cisco ISE with Catalyst Center" topic in the *Cisco Catalyst Center Second Generation Appliance Installation Guide*. 3. Reestablish trust. For more information, see the "Enable PKI in Cisco ISE" topic in the *Cisco Identity Services Engine Administrator Guide*.
	Trust–Reachability	Unable to establish an HTTPS connection.	Check whether the AAA settings credentials and the Cisco ISE credentials are the same.

Component	Subcomponent	Issue	Suggested actions
		The Catalyst Center endpoint URL configured for Cisco ISE certificate chain uploads is unreachable.	• Check your proxy configuration for a proxy server between Catalyst Center and Cisco ISE. • Check whether you can reach Cisco ISE from Catalyst Center.
	Trust–Configuration	Invalid Cisco ISE certificate chain.	• If necessary, regenerate the Cisco ISE internal root CA chain. For more information, see the "ISE CA Chain Regeneration" topic in the *Cisco Identity Services Engine Administrator Guide*. • Ensure that the internal CA certificate chain has not been removed from Cisco ISE.
		The Catalyst Center endpoint URL configured for Cisco ISE certificate chain uploads is forbidden.	• Launch the URL and check whether you can access the /aaa/Cisco ISE/certificate directory on the endpoint. • Check whether the **Use CSRF Check for Enhanced Security** option is enabled in Cisco ISE. For more information, see the "Enable External RESTful Services APIs" topic in the *Cisco Identity Services Engine Administrator Guide*.
	Trust–Authentication	The Cisco ISE password has expired.	• Regenerate the Cisco ISE admin password. For more information, see the "Administrative Access to Cisco ISE" topic in the *Cisco Identity Services Engine Administrator Guide*. • Ensure that you can log in to the Cisco ISE GUI.
	Trust–Unclassified/Generic Error	An undefined diagnostic error occurred.	1. Delete the AAA settings that are currently configured in Catalyst Center. 2. Reenter the appropriate AAA settings. For more information, see the "Integrate Cisco ISE with Catalyst Center" in the *Cisco Catalyst Center Second Generation Appliance Installation Guide*. 3. Reestablish trust. For more information, see the "Enable PKI in Cisco ISE" topic in the *Cisco Identity Services Engine Administrator Guide*.

Component	Subcomponent	Issue	Suggested actions
Cisco Connected Mobile Experiences (CMX) server IP address management (IPAM) server IT service management (ITSM) server	Reachability	Unable to establish connectivity with the server.	Check whether the server in question is currently down.
	Authentication	Unable to log in to the server.	Confirm that the correct login credentials are configured in Catalyst Center.
Hardware	Disk Fan Power supply Memory module CPU Networking card RAID controller	The specified hardware component is experiencing an issue.	Replace the faulty component.
	Networking	Interfaces are missing.	1. Connect to Cisco IMC. 2. If the PID is UCSC-C220-M4 or UCSC-C220-M4S, complete the following steps: a. From the main menu, choose **Compute** > **BIOS** > **Configure BIOS**. b. Click the **Advanced** tab. c. Expand **LOM and PCIe Slots Configuration**. d. Enable the disabled mLOMs and reboot the host. 3. For all other PIDs, replace the faulty component.

Component	Subcomponent	Issue	Suggested actions
System configuration	Hardware configuration	You cannot specify write-back as the write cache policy for the Catalyst Center *<IP_address>* virtual drive. The write policy must be write-through.	1. Connect to Cisco IMC. 2. From the main menu, choose **Storage** > **Raid Controller**. 3. Click the **Virtual Drive** tab. 4. Select a virtual drive and click **Edit**. If the write policy is not write-through, update the virtual drives. The write policy must be write-through.
System resources	Storage	The specified mount directory is full.	• Clear up storage space in the current directory by removing unnecessary data. • Specify a new mount directory that has more storage space.

View audit logs

Information about viewing audit logs. Audit logs collect information about the applications running on Catalyst Center, device public key infrastructure (PKI) notifications, and system events.

Audit logs capture information about the various applications running on Catalyst Center. Audit logs also capture information about device public key infrastructure (PKI) notifications. The information in these audit logs can be used to help in troubleshooting issues, if any, involving the applications or the device CA certificates.

Audit logs also record system events that occurred, when and where they occurred, and which users initiated them. With audit logging, configuration changes to the system get logged in separate log files for auditing.

Procedure

1. From the main menu, choose **Activities** > **Audit Logs**.

   The **Audit Logs** window opens, where you can view logs about the current policies in your network. These policies are applied to network devices by the applications installed on Catalyst Center.

2. Click the timeline slider to specify the time range of data you want displayed on the window:

   a. In the **Time Range** area, select a time range–**Last 2 Weeks**, **Last 7 Days**, **Last 24 Hours**, or **Last 3 Hours**.

   b. To specify a custom range, click **By Date** and specify the start and end date and time.

   c. Click **Apply**.

3. Click the arrow next to an audit log to view the corresponding child audit logs.

   Each audit log can be a parent to several child audit logs. By clicking the arrow, you can view a series of additional child audit logs.

> **Note**
>
> An audit log captures data about a task done by Catalyst Center. Child audit logs are subtasks to a task done by Catalyst Center.

4. (Optional) From the list of audit logs in the left pane, click a specific audit log message. In the right pane, click **Event ID** > **Copy Event ID to Clipboard**. With the copied ID, you can use the API to retrieve the audit log message based on the event ID.

   The audit log displays the **Description**, **User**, **Interface**, and **Destination** of each policy in the right pane.

   > **Note**
   >
   > The audit log displays northbound operation details such as POST, DELETE, and PUT with payload information, and southbound operation details such as the configuration pushed to a device. For detailed information about the APIs on Cisco DevNet, refer to Catalyst Center Platform Intent APIs.

5. (Optional) Click **Filter** to filter the log by **User ID**, **Log ID**, or **Description**.
6. Click the pencil icon to subscribe to the audit log events.

   A list of syslog servers is displayed.

7. Check the syslog server check box that you want to connect to and click **Save**.

   > **Note**
   >
   > Uncheck the syslog server check box to unsubscribe from the audit log events and click **Save**.

8. In the right pane, use the **Search** field to search for specific text in the log message.
9. From the main menu, choose **Activities** > **Tasks** to view the upcoming, in-progress, completed, and failed tasks (such as operating system updates or device replacements) and existing, pending-review, and failed work items.

Export audit logs to syslog servers

Information about exporting audit logs from Catalyst Center to syslog servers for secure and easier log monitoring.

Enabling syslogs for audit logs offers these benefits:

- Centralized logging: Collect and store logs in one place for easier monitoring.
- Security monitoring: Quickly detect unauthorized or suspicious activities.
- Compliance: Maintain tamper-proof records for audits and investigations.

You can export the audit logs from Catalyst Center to multiple syslog servers by connecting to them.

Before you begin

Configure the syslog servers in the **System** > **Settings** > **External Services** > **Destinations** > **Syslog** area.

Procedure

1. From the main menu, choose **Activities** > **Audit Logs**.
2. At the top of the window, click the pencil icon.
3. Select the syslog servers that you want to connect to and click **Save**.
4. Optional: To disconnect from a syslog server, deselect it and click **Save**.

Configure debugging logs

Information about configuring the debugging logs for services.

To assist in troubleshooting service issues, you can change the logging level for the Catalyst Center services.

A logging level determines the amount of data that is captured in the log files. Each logging level is cumulative; that is, each level contains all the data generated by the specified level and higher levels, if any. For example, setting the logging level to **Info** also captures **Warn** and **Error** logs. We recommend that you adjust the logging level to assist in troubleshooting issues by capturing more data. For example, by adjusting the logging level, you can capture more data to review in a root cause analysis or RCA support file.

The default logging level for services is informational (**Info**). You can change the logging level from informational to a different logging level (**Debug** or **Trace**) to capture more information.

Caution

Due to the type of information that might be disclosed, logs collected at the **Debug** level or higher should have restricted access.

Note

Log files are created and stored in a centralized location on your Catalyst Center host for display in the GUI. From this location, Catalyst Center can query and display logs in the GUI (**System** > **System 360** > **Log Explorer**). Logs are available to query for only the last 2 days. Logs that are older than 2 days are purged automatically from this location.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Settings** > **System Configuration** > **Debugging Logs**.

The **Debugging Logs** window is displayed.

2. From the **Service** drop-down list, choose a service to adjust its logging level.

   The **Service** drop-down list displays the services that are currently configured and running on Catalyst Center.

3. Enter the **Logger Name**.

   This is an advanced feature that has been added to control which software components emit messages into the logging framework. Use this feature with care. Misuse of this feature can result in loss of information needed for technical support purposes. Log messages will be written only for the loggers (packages) specified here. By default, the Logger Name includes packages that start with *com.cisco*. You can enter additional package names as comma-separated values. Do not remove the default values unless you are explicitly directed to do so. Use * to log all packages.

4. From the **Logging Level** drop-down list, choose the new logging level for the service.

   Catalyst Center supports logging levels in descending order of detail, including:

   - **Trace**: Trace messages
   - **Debug**: Debugging messages
   - **Info**: Normal, but significant condition messages
   - **Warn**: Warning condition messages
   - **Error**: Error condition messages

5. From the **Time Out** field, choose the time period for the logging level.

   Configure logging-level time periods in increments of 15 minutes up to an unlimited time period. If you specify an unlimited time period, the default level of logging should be reset each time a troubleshooting activity is completed.

6. Review your selection and click **Save**.

Activate high availability

Information about activating high availability (HA) on Catalyst Center. HA reduces the amount of downtime that results from failures, and makes your network more resilient.

Complete this procedure to activate high availability (HA) on your Catalyst Center cluster:

> **Note**
>
> The three-node HA is not supported for Catalyst Center running on ESXi.

Before you begin

Review these topics in the *Cisco Catalyst Center High Availability Guide* and confirm that your production environment meets the requirements they describe:

- "High availability requirements"
- "Supported appliances"

Procedure

1. From the main menu, choose **System** > **Settings** > **System Configuration** > **High Availability**.
2. Confirm that the page displays the three Catalyst Center appliances in your cluster.



3. Click **Activate High Availability**.
4. Confirm that HA has been enabled:
   - The **Status** field displays `Active`.
   - In the top-right corner of the **High Availability** page, click the **Activities** link. In the resulting table, verify that the status displayed for the HA activation event is `SUCCESS`.

Configure integration settings

Information about configuring integration settings. Integration settings are useful when firewalls or other rules exist between Catalyst Center and any third-party apps that need to reach the Catalyst Center platform.

In cases where firewalls or other rules exist between Catalyst Center and any third-party apps that need to reach the Catalyst Center platform, you must configure **Integration Settings**. These cases occur when the IP address of Catalyst Center is internally mapped to another IP address that connects to the internet or an external network.

Important

After a backup and restore of Catalyst Center, you need to access the **Integration Settings** page and update (if necessary) the **Callback URL Host Name** or **IP Address** using this procedure.

Before you begin

You have installed the Catalyst Center platform.

Procedure

1. From the main menu, choose **System** > **Settings** > **Integration Settings**.
2. Enter the **Callback URL Host Name** or **IP Address** that the third-party app needs to connect to when communicating with the Catalyst Center platform.

> **Note**
>
> The **Callback URL Host Name** or **IP Address** is the external facing hostname or IP address that is mapped internally to Catalyst Center. Configure the VIP address for a three-node cluster setup.

3. Click **Apply**.

Enable visibility and control of configurations

With the Visibility and Control of Configurations feature, you can enforce the previewing of device configurations and require ITSM approval before deploying them into your network. This feature allows you to further secure your devices.

The Visibility and Control of Configurations feature provides a solution to further secure your planned network configurations before deploying them on to your devices. With enhanced visibility, you can enforce the previewing of device configurations (CLI and NETCONF commands) before deploying them. Visibility is enabled by default. When visibility is enabled, you cannot deploy your device configurations until you review them. With enhanced control, you can send the planned network configurations to IT Service Management (ITSM) for approval. When control is enabled, you cannot deploy the configurations until an IT administrator approves them.

> **Note**
>
> If a provisioning workflow supports **Visibility and Control of Configurations**, this banner message displays when you schedule the deployment of your task:
>
> This workflow supports enforcing network administrators and other users to preview configurations before deploying them on the network devices. To configure this setting, go to **System** > **Settings** > **Visibility and Control of Configurations**.

Before you begin

Make sure that ITSM is enabled and configured in Catalyst Center so that you can enable **ITSM Approval**. For information about how to enable and configure ITSM, see “Configure the Catalyst Center Automation Events for ITSM (ServiceNow) Bundle” in the *Catalyst Center ITSM Integration Guide*.

Procedure

1. From the main menu, choose **System** > **Settings** > **System Configuration** > **Visibility and Control of Configurations**.
2. Click the **Configuration Preview** toggle button to enable or disable visibility.

   Enabling visibility means you must preview the device configurations before deploying them.

   Disabling visibility means you are not enforcing the previewing of device configurations before deploying them. When visibility is disabled, you can schedule and deploy the configurations with or without previewing them.
3. Optional: Click the **ITSM Approval** toggle button to enable or disable control.

Enabling control means you must submit the planned network configurations to an ITSM administrator for approval before deploying them.

Disabling control means you are not requiring ITSM approval before the deployment of planned network configurations. When control is disabled, you can deploy the configurations without ITSM approval.

View, search, and filter for task and work item details

You can view, search, and filter for task and work item details on the **Tasks** window.

You can view, search, and filter for task and work item details on the **Tasks** window.

Procedure

1. From the main menu, choose **Activities** > **Tasks**.

   By default, the **Tasks** window displays all the upcoming, in-progress, failed, and successful tasks and existing, pending-review, and failed work items. All failed tasks have a trace ID that provides a hint to analyze the error log quickly. The left **SUMMARY** pane displays filtering options for you to refine the list of displayed tasks and work items. You can expand and collapse the **SUMMARY** pane by clicking the arrow icon.

2. Use this table to view, search, and filter for task and work item details on the **Tasks** window.

Action	Steps
Filter for specific task and work item details.	**a.** In the **SUMMARY** pane, under **Type**, click **Task** to filter for only tasks or **Work Item** to filter for only work items. **b.** Filter for task and work item details using the filter options available under **Status**, **Review Status**, **Last Updated**, **Categories**, and **Recurring**. The **Tasks** window displays the results of applied filters. **Tip** Under **Categories**, you can search for a specific category by clicking **Show all** and using the **Search** field.
Remove an applied filter.	**a.** In the **SUMMARY** pane, under **FILTERED BY**, click **x** next to the applied filter. The **Tasks** window displays the results of removing the filter. **b.** You can also remove the **Status**, **Review Status**, and **Categories** filters by unchecking the check boxes.

Action	Steps
Search for a task and work item by title or username.	By default, the **Search** field, searches tasks and work items by description. If any filters are applied when you search for a task or work item, the system searches within the applied filters. For example, if you applied the **In Progress** filter and search for all tasks and work items with "provision" in the name, the system searches only in-progress tasks and work items for this keyword. **a.** In the **Search by description** field, enter a description of the task or work item. The **Tasks** window displays the filtered list of tasks and work items based on the entered description. **b.** To search by username, in the **Search** field, do the following: **1.** Click the filter icon. **2.** Click **username**. **3.** Enter a username in the **Search by username** field. **4.** Click **Apply**.
Sort the list of tasks and work items.	By default, the tasks and work items are listed by when they were last updated. You can sort tasks and work items by their start time or update time. **a.** To the right of the **Search** field, hover your cursor over the sort drop-down list and choose a sorting option. The **Tasks** window displays the sorted list of tasks and work items based on the chosen sorting option.

View, edit, stop, and delete tasks

A task is an operation that you or the system scheduled, which can reoccur. You can view in-progress, completed, and failed tasks and pending-review, completed, and failed work items on the **Tasks** window.

You can view information about all the upcoming, in-progress, failed, and successful tasks running on Catalyst Center.

A task is an operation that you or the system scheduled, which can reoccur. If you have a task, this means that you have no corresponding work items to complete for it to deploy as scheduled.

The information available in a task depends on its category, and there are a variety of categories. Common task categories include provision, config archive, inventory, and security advisories. However, all tasks display the following details: who initiated the task, its category, its completion status, its success status, and its start date, last updated date, and end date.

Procedure

1. From the main menu, choose **Activities** > **Tasks**.

   By default, the **Tasks** window displays all the upcoming, in-progress, failed, and successful tasks and existing, pending-review, and failed work items.

> **Note**
>
> If you enabled Site Settings for multiple devices in different time zones in a task, the **Starts** field displays the start time of the device in the earliest time zone based on your local time zone. For example, let's say that you are in the Pacific Time Zone, and you have two devices scheduled to deploy on May 8, 2024, at 12 PM. One device is in San Jose, CA, and the other device is in Bengaluru, India. The **Starts** field displays May 8, 2024, at 12:00 PM, because your local time zone aligns with the device in the earliest time zone. If you are in Bengaluru, India, this field displays May 9, 2024, at 12:30 AM, because your local time is 12 hours and 30 minutes ahead of the device in the earliest time zone.

2. Use this table to view, edit, or delete a task on the **Tasks** window.

Action	Steps
View a task.	**a.** Click the task name to open a slide-in pane with more information. The task details depend on what type of task you're viewing. **b.** In the slide-in pane, depending on the details displayed, you can do the following: • View device and provisioning details by clicking **Device Details** or **Provision Details**. • View more information about in-progress, completed, and failed tasks by clicking **View Details** or **See Details**. • Search for a task using **Search Table**. • Filter for a task using the filter icon in the top-right corner of the table. • Download an error report of a failed task by clicking **Download Error Report**. A tar file is created and saved to your local machine. **Tip** While creating a support case, you can attach the downloaded error report in addition to other details you may want to include.
Edit the schedule of a recurring task.	**a.** Locate the task and click **Edit**. **b.** In the **Edit Schedule** slide-in pane, define the **Start Date** and **Start Time**. **c.** Using the **Recurrence** toggle button, click a recurrence interval. **d.** In the **Run at Interval** field, enter a value. **e.** (Optional) To schedule an end date and time for this task, do the following: **1.** Check the **Set Schedule End** check box. **2.** To end the task on a specific date, click **End Date** and choose the date. **3.** To end the task after a number of occurrences, click **End After** and in the **Occurrences** field, enter a numerical value. **f.** Click **Preview** to review the changes in the table. **g.** Ensure the table's listed **Site Time** (the device's time zone) and **Local Time** (your time zone) for each device reflect the intended scheduled time **h.** When you're ready, click **Save**.

Action	Steps
Stop a task.	**a.** Click the task name to open a slide-in pane with more information. **b.** Click **Stop**. **Note** **Stop** is disabled if the provisioning workflow doesn't support this capability. **c.** In the **Stop** dialog box, click **Yes** to confirm the stoppage of the task. A task can only be stopped when it is in progress. When the system starts configuring devices, the task can't be stopped. Only the devices pending provisioning are stopped.
Delete a task.	**a.** Locate the task and click **Delete**.

View and discard work items

If you enabled the Visibility and Control of Configurations feature, a work item is created when you choose **Generate configuration preview** during any workflow. When the configurations are reviewed and ready for deployment, the work item becomes a task. You can view work items on the **Tasks** window.

If you enabled the Visibility and Control of Configurations feature, a work item is created when you choose **Generate configuration preview** during any workflow. When the configurations are reviewed and ready for deployment, the work item becomes a task.

To enable Visibility and Control of Configurations, see Enable visibility and control of configurations on page 125.

Procedure

1. From the main menu, choose **Activities** > **Tasks**.

   By default, the **Tasks** window displays all the upcoming, in-progress, failed, and successful tasks and existing, pending-review, and failed work items.

2. Use this table to view and discard a work item on the **Tasks** window.

Action	Steps
View a work item.	

Action	Steps
	a. In the **SUMMARY** pane, under **Type**, click **Work Item**. The **Tasks** window filters for and displays only work items. **b.** Click the work item name to open a slide-in pane with more information. The first listed device's configuration preview is displayed. **c.** In the slide-in pane, you can do the following: • Preview a device's configurations by choosing a device in the left pane. • Filter the data in the configuration preview pane with the **View by Configuration Source** drop-down list. • View a side-by-side comparison view of the planned configuration and the running configuration or view only the planned configuration by clicking the view switcher (). **Note** Viewing YANG configurations in the side-by-side comparison view isn't supported. • Click one command in one configuration to highlight the corresponding command in the other configuration when you're in the side-by-side comparison view. **Note** Keep the following limitations in mind: • The system supports only side-by-side highlighting for first-level commands, not sublevel commands. • All commands must be a complete match for the system to display the side-by-side highlighting between configurations. • If you click any commands starting with `No` in one configuration, the system will ignore the `No` portion when checking for a match in the other configuration. • Search for a value in the displayed configuration with the **Search configuration** field. • Display the workflow progression view for the selected device by clicking **Back to workflow progress** in the top-right corner of the right pane. To return to the configuration preview pane, click **Go to generated config**. **Note**

Action	Steps
	Back to workflow progress and **Go to generated config** are only available if the workflow supports the workflow progression view.
Discard a work item.	**a.** Locate the work item and click **Discard**. You can also click the work item name to open a slide-in pane and then click **Discard**. **b.** In the **Discard** dialog box, do one of the following: • If you want to discard the work item and return to the current activity, click **Discard**. **Note** Discarding the work item means you can't recover it later. • If you want to retain any generated configurations and discard all other resources, check the **Retain generated configs (if any)** check box and click **Accept**. After retaining any generated configurations and discarding all other resources, the work item displays **Exit** instead of **Exit and Preview Later** because you've previewed all the configurations and chosen to discard the nongenerated ones. **Tip** Consider retaining any generated configurations and discarding all other resources if a configuration preview fails so that you or your IT administrator can further inspect the issue.

What to do next

To deploy the previewed device configurations or submit the planned network configurations for ITSM approval, see "Visibility and Control of Configurations Workflow," “Visibility and Control of Wireless Device Configurations,” or “Visibility and Control of Fabric Configurations” in the *Cisco Catalyst Center User Guide*.

Configure geo map settings

This topic describes how to configure geo map settings in Catalyst Center.

You can configure geo map settings in Catalyst Center.

Procedure

1. From the main menu, choose **System** > **Settings** > **System Configuration** > **Geo Map Settings**.
2. Choose any one of the available administrative boundaries that identify geographic features with characteristics defined differently by audiences belonging to various regional, cultural, or political groups.
   - China (CN)
   - India (IN)
   - Japan (JP)
   - United States (US) (default)
3. Click **Save**.

Set up a login message

Information about setting up a login message that is displayed to the users when they log in to Catalyst Center.

You can set up a message that is displayed to all users after they log in to Catalyst Center.

Before you begin

Only a user with **SUPER-ADMIN-ROLE** or **CUSTOM-ROLE** with system management permissions can perform this procedure.

Procedure

1. From the main menu, choose **System** > **Settings** > **System Configuration** > **Login Message**.
2. In the **Login Message** text box, enter the message.
3. Click **Save**.

   The message appears below the **Log In** button on the Catalyst Center login page.

   Later, if you want to remove this message, do the following:

   a. Return to the **Login Message** settings page.

   b. Click **Clear** and then click **Save**.

8 Manage Terms and Conditions

Topics:

- About product telemetry

About product telemetry

Cisco collects Customer Systems Information to improve your product experience.

The *Catalyst Center Offer Disclosure* provides detailed information about data handling practices, security controls, and AI features specific to Catalyst Center. It complements the *General Disclosures*, which outline Cisco's overarching approach to handling Customer Systems Information and Customer Content, and the *Cisco Online Privacy Statement*, which offers a more in-depth explanation of how Cisco manages personal data. Together, these documents provide transparency by addressing data handling at both a high level and an Offer-specific level, helping you understand how Cisco protects and processes information across its Offers.

From the main menu, choose **System** > **Settings** > **Terms and Conditions**. You can review the license agreement, the privacy statement, and the privacy data sheet from the **Product Telemetry** window.

9 Manage Trust and Privacy Settings

Topics:

- Account lockout
- Password expiry
- IP access control
- Anonymize data

Account lockout

Information about configuring account lockout policy to manage user login attempts, account lockout period, and number of login entries.

You can configure the account lockout policy to manage user login attempts, account lockout period, and number of login retries.

By default, account lockout uses dual-layer security that tracks failed attempts against both username and source IP address. When triggered, both elements lock simultaneously: the IP address is blocked from all authentication attempts, and the username is locked across all IP addresses.

Account lockout impacts only local users, not external authentication users.

Procedure

1. From the main menu, choose **System** > **Settings** > **Trust & Privacy** > **Account Lockout**.
2. Click the **Enforce Account Lockout** toggle button so that you see a check mark.
3. Enter values for these **Enforce Account Lockout** parameters:
   - Maximum Login Retries
   - Lockout Effective Periods (minutes)
   - Reset Login Retries after (minutes)

   Note

   Hover your cursor over **Info** to view details for each parameter.

4. Select the **Idle Session Timeout** value (the duration after which the session expires and users are redirected to the login page). The default is 1 hour.
5. Click **Save**.

   If you leave the session idle, a **Session Timeout** dialog box appears five minutes before the session timeout.

   To continue, do one of these tasks:
   - If you want to continue the session, click **Stay signed in**.
   - To end the session immediately, click **Sign out**.

Password expiry

Information about configuring password expiration policy.

You can configure the password expiration policy to manage:

- Password expiration frequency
- Number of days that users are notified before their password expires

- Grace period

Procedure

1. From the main menu, choose **System** > **Settings** > **Trust & Privacy** > **Password Expiry**.
2. Click the **Enforce Password Expiry** toggle button so that you see a check mark.
3. Enter values for the following **Enforce Password Expiry** parameters:
   - Password Expiry Period (days)
   - Password Expiration Warning (days)
   - Grace Period (days)

   Note

   Hover your cursor over **Info** to view details for each parameter.

4. Click **Save** to set the password expiry settings.

IP access control

Information about IP access control to control the access to Catalyst Center based on the IP address of the host or network.

IP access control allows you to control the access to Catalyst Center based on the IP address of the host or network. This feature controls access to the Catalyst Center GUI only; this feature doesn't control enterprise-wide network access.

Catalyst Center provides options for IP access control, including:

- Allow all IP addresses to access Catalyst Center (the default).
- Allow only selected IP addresses to access Catalyst Center.

Configure IP access control

Information about configuring IP access control to allow only selected IP addresses to access Catalyst Center.

To configure IP access control and allow only selected IP addresses to access Catalyst Center:

1. Enable IP access control on page 139
2. Add an IP address to the IP access list on page 140
3. (Optional) Delete an IP address from the IP access list on page 141

Enable IP access control

Information about enabling IP access control to only selected IP addresses to access Catalyst Center.

Before you begin

- Ensure that you have SUPER-ADMIN-ROLE permissions.

- Add the Catalyst Center services subnet, cluster service subnet, and cluster interface subnet to the list of allowed subnets.

Procedure

1. From the main menu, choose **System** > **Settings** > **Trust & Privacy** > **IP Access Control**.
2. Click the **Allow only listed IP addresses to connect** radio button.
3. Click **Add IP List**.
4. In the **IP Address** field of the **Add IP** slide-in pane, enter your IP address.

   Note

   If you don't add your IP address to the IP access list, you may lose access to Catalyst Center.

5. In the **Subnet Mask** field, enter the subnet mask.

   The valid range for subnet mask is from 0 through 32.

6. Click **Save**.

Add an IP address to the IP access list

Information about adding an IP address to the IP access list.

To add more IP addresses to the IP access list:

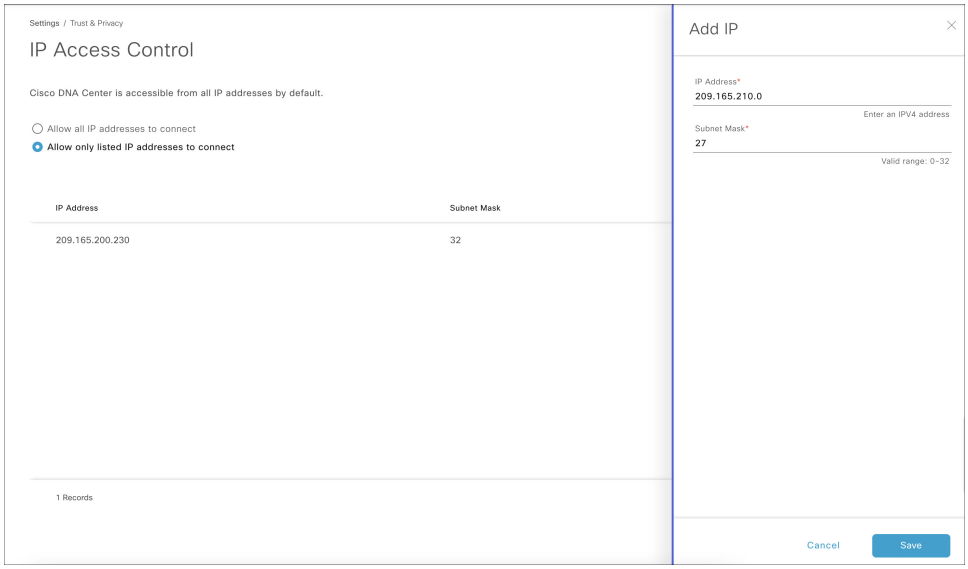
Before you begin

Ensure that you enable IP access control. For more information, see Enable IP access control on page 139.

Procedure

1. From the main menu, choose **System** > **Settings** > **Trust & Privacy** > **IP Access Control**.
2. Click **Add**.
3. In the **IP Address** field of the **Add IP** slide-in pane, enter the IP address of the host or network.
4. In the **Subnet Mask** field, enter the subnet mask.

   The valid range for subnet mask is from 0 through 32.



5. Click **Save**.

Delete an IP address from the IP access list

Information about deleting an IP address from the IP access list to disable its access to Catalyst Center.

To delete an IP address from the IP access list and disable its access to Catalyst Center:

Before you begin

Ensure that you have enabled IP access control and added IP addresses to the IP access list. For more information, see Enable IP access control on page 139 and Add an IP address to the IP access list on page 140.

Procedure

---

1. From the main menu, choose **System** > **Settings** > **Trust & Privacy** > **IP Access Control**.
2. In the **Action** column, click the **Delete** icon for the corresponding IP address.
3. Click **Delete**.

Disable IP access control

Information about disabling IP access control to allow all IP addresses to access Catalyst Center.

To disable IP access control and allow all IP addresses to access Catalyst Center:

Before you begin

Ensure that you have SUPER-ADMIN-ROLE permissions.

Procedure

---

1. From the main menu, choose **System** > **Settings** > **Trust & Privacy** > **IP Access Control**.
2. Click the **Allow all IP addresses to connect** radio button.

Anonymize data

Catalyst Center allows you to anonymize personally identifiable data. When you enable anonymization, you can only search for the device using nonanonymized information such as the MAC address and IP address.

Catalyst Center allows you to anonymize wired and wireless endpoints data. You can scramble personally identifiable data, such as the user ID, and device hostname of wired and wireless endpoints.

Ensure that you enable anonymization before you run Discovery. If you anonymize the data after you run Discovery, the new data coming into the system is anonymized, but the existing data isn't anonymized.

Procedure

1. From the main menu, choose **System** > **Settings** > **Trust & Privacy** > **Anonymize Data**.
2. In the **Anonymize Data** window, check the **Enable Anonymization** check box.
3. Click **Save**.
   After you enable anonymization, you can only search for the device using nonanonymized information such as the MAC address, IP address, and so on.

10 Manage Applications

Topics:

- Application management
- Download and install applications
- View an upgrade summary report
- Uninstall an application

Information about managing applications on Catalyst Center.

Application management

Information about application management for the Catalyst Center. Catalyst Center treats many of its functions as individual applications, packaged separately from the Catalyst Center core infrastructure. This permits you to install and run the applications you want, and uninstall those you are not using, depending on your preferences.

Catalyst Center provides many of its functions as individual applications, packaged separately from the core infrastructure. This enables you to install and run the applications that you want and uninstall those you are not using, depending on your preferences.

The number and type of application packages shown in the **Software Management** window vary depending on your Catalyst Center release and your Catalyst Center licensing level. All the application packages that are available to you are shown, whether or not they are currently installed.

Some applications are basic that they are required on nearly every Catalyst Center deployment. For a description of a package, click the **View Installed Applications** link and place your cursor over its name.

Each Catalyst Center application package consists of service bundles, metadata files, and scripts.

Note

- Avoid using any CLI command for package management activities. If you encounter issues with package install or upgrade tasks in Catalyst Center, contact Cisco TAC for assistance.
- From the **Software Maintenance** window, you can upgrade to the latest available Catalyst Center release. For upgrade instructions, see the *Cisco Catalyst Center Upgrade Guide*.

Download and install applications

Information about downloading and installing applications on Catalyst Center.

Catalyst Center treats individual applications as separate from the core infrastructure. Specifically, individual packages for applications can be installed to run on Catalyst Center.

Installing and deploying application packages may take time, so schedule it during a maintenance period for your network.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Software Management**.

   Important

   At this point, Catalyst Center performs a connectivity check. If there is a connectivity issue, the **Software Management** window won't display the applications that are currently available.

2. At the bottom of the window, choose which applications to install.

You can either

- Select all applications: Click **Select All**.
- Individual application: Check the check box.

> **Note**
>
> View more details about an available application by clicking **View Details** in any application card.

3. Click **Install**.

> **Note**
>
> During installation, dependencies are checked and installed automatically.

At the top of the window, an in-progress banner message is displayed.

To view real-time, in-progress details, click **View Release Activities**. For the relevant activity, hover your cursor over the ellipsis (•••) in the **Actions** column and choose **View Status**.

4. Click **View Installed Applications** and confirm that the selected applications are installed.

Package download and upgrade event notifications

Information about notifications for package download and upgrade events.

You can receive a notification whenever a package download or upgrade event takes place. To configure and subscribe to these notifications, complete the steps described in the *Work with Event Notifications* topic of the *Cisco Catalyst Center Platform User Guide*. When completing this procedure, ensure that you select and subscribe to the SYSTEM-SOFTWARE-UPGRADE-v2 event.

Notifications are generated and sent when:

- The download of a package upgrade failed. This failure typically happens because your Catalyst Center appliance doesn't have the necessary disk space or you're attempting to download a corrupted package.
- The installation of a package upgrade failed (possibly because the service that's associated with the package is currently down).
- The download or installation of a package upgrade succeeded.

> **Note**
>
> A notification is sent only if the previous attempt to complete the operation failed.

View an upgrade summary report

Describes how to open the Upgrade Summary Report slide-in pane and the information it provides.

From the **Upgrade Summary Report** slide-in pane, you can view the results of the latest upgrade of Catalyst Center and its applications. This report allows you to:

- Identify the previous Catalyst Center version that was installed on your appliance.
- Determine when the upgrade took place.
- In the **Post-check** tab, see whether the post-upgrade checks Catalyst Center makes completed successfully. If a problem occurs for a particular check, click its information (**i**) icon in the **Issues** column for a description of the problem.
- In the **Packages** tab, view the application packages that were upgraded and their current version number.

Complete the following steps to open this report.

Procedure

1. From the main menu, choose **System** > **Software Management**.
2. Click the **Upgrade Summary Report** link.

Uninstall an application

Information about uninstalling an application on Catalyst Center.

Catalyst Center treats individual applications as separate from the core infrastructure. Specifically, individual packages for applications can be uninstalled from Catalyst Center.

You can uninstall only packages for applications that are not system critical.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Software Management**.
2. Click **View Installed Applications** to view all the applications that are installed on Catalyst Center.
3. For the package that you want to remove, check its **Uninstall** check box.

Note

- You can uninstall multiple packages simultaneously.
- You can uninstall only optional packages.

4. Click **Uninstall** to confirm that you want to uninstall the application.

   At the top of the window, an in-progress banner message is displayed. To view real-time in-progress details, click **View Release Activities** on the **Software Management** window. For the relevant activity, hover your cursor over the ellipsis (•••) in the **Actions** column and choose **View Status**.

5. Click **View Installed Applications** and confirm that the application is uninstalled.

11 Manage Users

Topics:

- About user profiles
- About user roles
- Create an internal user
- Edit a user
- Delete a user
- Password policy
- Password requirements
- Reset a user password
- Change your own user password
- Reset a forgotten password
- Configure role-based access control
- Display role-based access control statistics
- Configure site-based, role-based access control
- Use case example: assign multiple access groups to an internal user
- Use case example: assign multiple access groups to an external user
- Impact of SRBAC on Catalyst Center features
- Configure external authentication
- Two-factor authentication
- Display external users

Information about managing users on Catalyst Center.

About user profiles

User profile information in Catalyst Center.

A user profile defines the login, password, email, and role (permissions) of a user.

You can configure both internal and external profiles for users. Internal user profiles reside in Catalyst Center, and external user profiles reside on an external AAA server.

A default user profile with SUPER-ADMIN-ROLE permissions is created when you install Catalyst Center.

About user roles

Lists the available user roles in Catalyst Center.

Each user is assigned a user role that specifies the functions the user is permitted to perform:

- **Administrator (SUPER-ADMIN-ROLE)**: Users with this role have full access to all Catalyst Center functions. They can create other user profiles with various roles, including those with the SUPER-ADMIN-ROLE.
- **Network Administrator (NETWORK-ADMIN-ROLE)**: Users with this role have full access to all of the network-related Catalyst Center functions. However, they do not have access to system-related functions, such as backup and restore.
- **Observer (OBSERVER-ROLE)**: Users with this role have view-only access to the Catalyst Center functions. Users with the observer role cannot access functions that configure or control Catalyst Center or the devices it manages.

  > **Note**
  >
  > To access database diagnostics and other system-level diagnostic tools, your assigned role must include permissions beyond those granted by the **OBSERVER-ROLE**. Users assigned only the **OBSERVER-ROLE** cannot access these tools.

- **Customized Role**: User with SUPER-ADMIN-ROLE privileges can define custom roles that permit or restrict user access to specific Catalyst Center functions.

Create an internal user

Information about creating an internal user and assigning a user role in Catalyst Center.

You can create a user and assign a role to them.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Users & Roles** > **User Management**.

2. Click **Add**.
3. Enter the first name, last name, email address, and username for the new user.

   The email address must comply with the requirements defined by the Apache EmailValidator class.
4. Under **Role List**, choose one of the following roles: **SUPER-ADMIN-ROLE**, **NETWORK-ADMIN-ROLE**, or **OBSERVER-ROLE**.
5. Enter a password and confirm it.
6. Click **Save**.

Edit a user

Information about editing the properties for a user in Catalyst Center.

You can edit some user properties (but not the username).

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Users & Roles** > **User Management**.
2. Click the radio button next to the user that you want to edit.
3. Click **Edit**.
4. Edit the first name, last name, or email address, if needed.
5. Under **Role List**, choose a new role, if needed: **SUPER-ADMIN-ROLE**, **NETWORK-ADMIN-ROLE**, or **OBSERVER-ROLE**.
6. Click **Save**.

Delete a user

Information about deleting a user in Catalyst Center.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Users & Roles** > **User Management**.
2. Click the radio button next to the user you want to delete.
3. Click **Delete**.

4. At the confirmation prompt, click **Continue**.

Password policy

Describes the password policy in Catalyst Center.

After you have deployed Catalyst Center, review these password policy requirements.

Fresh Catalyst Center deployments

This section describes password policies for new deployments.

- The default password for the maglev user and admin superuser is **P@ssword9**.

  You are prompted to change the password for the admin superuser after you log in to the Catalyst Center GUI for the first time.

- When you change any user's password or configure a new user, ensure their password complies with the new requirements.

Catalyst Center upgrades

This section explains password behavior during system upgrades.

- Role-Based Access Control (RBAC) users configured in an earlier release of Catalyst Center can continue using their current password to log in to Catalyst Center 2.3.7.9 and later.

  For example, you upgraded an appliance from release 2.3.7.6 to 2.3.7.11. You backed up the data from the appliance. Later, you restored the backup file onto another appliance with Catalyst Center 2.3.7.11 installed. Existing RBAC users can log in using their current password.

- When you change any user's password or configure a new RBAC user, ensure their password complies with the new requirements.

Refer to Password requirements on page 152 to learn the criteria your new password must meet.

Password requirements

Describes password requirements for Catalyst Center.

Any user password you configure in Catalyst Center 2.3.7.11 or later must meet these requirements:

- Is at least nine characters in length.
- Includes characters from at least three of these categories:
  - Uppercase letters (A through Z)
  - Lowercase letters (a through z)
  - Numbers (0 through 9)
  - Special characters (such as !, $, and #)
- Does not contain more than four consecutive characters on an English QWERTY keyboard.

  For example, `59Asdfpj!` is not a valid password because it contains the characters `a`, `s`, `d`, and `f` in succession.
- Does not contain two or more consecutive characters from the associated username.

- Does not contain a complete word from any language.
- Does not contain a phrase based on personal information.

> **Note**
>
> You can reuse a previous password only after you use 24 different passwords.

Reset a user password

Information about resetting a user password.

You can reset another user's password.

For security reasons, passwords are not displayed to any user, including administrators.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.

Procedure

1. From the main menu, choose **System** > **Users & Roles** > **User Management**.
2. Click the radio button next to the user whose password you want to reset.
3. From the **More Actions** drop-down list, click **Reset Password**.
4. Enter a new password and confirm it.
5. Click **Save**.

Change your own user password

Information about changing your own user password.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About User Roles.

Procedure

1. From the main menu, choose **System** > **Users & Roles** > **Change Password**.
2. Enter information in the required fields.
3. Click **Update**.

Change your own user password without admin permission

Information about changing your own user password without admin permission.

The following procedure describes how to change your password without admin permission.

Procedure

1. From the top-right corner, click your displayed username and choose **My Profile and Settings** > **My Account**.
2. In the **Password** field, click **Update Password**.
3. In the **Update Password** dialog box, enter the new password and confirm the new password.
4. Click **Update**.

Reset a forgotten password

Information about resetting a forgotten password.

If you forgot your password, you can reset it through the CLI.

> **Note**
>
> This procedure supports password resets for local Catalyst Center users only. This procedure does not support password resets for users authenticated through an external AAA server, such as TACACS.

Procedure

1. Enter this command to reset the password.

   `magctl user password update` *`username`* `TNT0`

   You are prompted to enter a new password.

2. Enter the new password.

   You are prompted to reenter the new password to confirm.

3. Enter the new password.

   The password is reset, and you can log in to Catalyst Center using the new password.

Configure role-based access control

Information about configuring role-based access control to define custom roles that permit or restrict user access to certain Catalyst Center functions.

Catalyst Center supports role-based access control (RBAC), which enables a user with SUPER-ADMIN-ROLE privileges to define custom roles that permit or restrict user access to certain Catalyst Center functions and sites.

Define a custom role and then assign a user to that role.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure.

Procedure

1. Define a custom role.
   a) From the main menu, choose **System** > **Users & Roles** > **Role Based Access Control**.
   b) Click **Create a New Role**.
   c) If a task overview window opens, click **Let's do it** to go directly to the workflow.
   d) In the **Create a New Role** window, enter a name for the role. Then, click **Next**.
   e) In the **Define the Access** window, click the **>** icon corresponding to the desired function to view the associated features.
   f) Set the permission level to **Deny**, **Read**, or **Write** for the desired features. Click **Next**.

      If you set the permission level of a feature to **Deny**, the user to whom you assign this role cannot view this feature in the GUI.

      For dependent features, if you override the recommended permission level settings, a warning message indicating the permission level violation of dependent features is shown in the **Summary** window.

   g) Review the configuration settings. To make any changes, click **Edit**.
   h) Click **Create Role**.
2. To assign a user to the custom role you created, go to **Users & Roles** > **User Management**.
   - To assign the custom role to an existing user:
     a. In the **User Management** window, click the radio button corresponding to the user to whom you want to assign the custom role, and then click **Edit**.
     b. In the **Update Internal User** slide-in pane, click the **Roles** drop-down list and choose the custom role.
     c. Click **Save**.
   - To assign the custom role to a new user:
     a. In the **User Management** window, click **Add**.
     b. In the **Create Internal User** slide-in pane, enter the first name, last name, and username.
     c. From the **Roles** drop-down list, choose the custom role.
     d. Enter the password and then confirm it.
     e. Click **Save**.
3. If you were logged in while the administrator updated your access permissions, log out of Catalyst Center. Then log in again to apply the new permissions.

Catalyst Center user role permissions

Lists the user role permissions in Catalyst Center.

Table 6: Catalyst Center user role permissions

Capability	Description	Recommended permission settings for dependent capabilities
Assurance	Assure consistent service levels with complete visibility across all aspects of your network.	–
Monitoring	Monitor and manage the health of your network with issue troubleshooting and remediation, proactive network monitoring, and insights driven by AI Network Analytics. This role lets you: • Resolve, close, and ignore issues. • Run Machine Reasoning Engine (MRE) workflows. • Analyze trends and insights. • Troubleshoot issues, including path trace, sensor dashboards, and rogue management. • Run workflows for rogue and Cisco Advanced Wireless Intrusion Prevention System (aWIPS). These workflows include AP-allowed list, vendor-allowed list, aWIPS profile creation, assigning an aWIPS profile, and so on.	• Network Management > Hierarchy: Read • Network Management > Inventory: Read • Network Design > Profiles and Settings: Read • Utilities > Machine Reasoner: Read • Utilities > Reports: Read • Utilities > App Hosting: Read • Utilities > Command Runner: Read
Settings	Configure and manage issues. Update network, client, and application health thresholds.	• Assurance > Monitoring: Read • Network Management > Hierarchy: Read • Network Management > Inventory: Read • Utilities > App Hosting: Read
Troubleshooting	Create and manage sensor tests. Schedule on-demand forensic packet captures (Intelligent Capture) for troubleshooting clients.	• Assurance > Monitoring: Read • Assurance > Troubleshooting: Write • Network Provision > Device Provision: Write • Network Management > Hierarchy: Read • Network Management > Inventory: Read • Network Design > Profiles and Settings: Read • Utilities > Machine Reasoner: Read • Utilities > App Hosting: Read • Utilities > Command Runner: Read

Capability	Description	Recommended permission settings for dependent capabilities
Extensions	Open platform for accessible intent-based workflows, data exchange, notifications, and third-party app integrations. **Note** This permission cannot be assigned to a site-scoped (non-global) access group if set to Read/Write.	–
Event Subscription	Subscribe to near real-time notifications of network and system events. Initiate corrective actions. **Note** This permission must be set as Write when ITSM is integrated with Visibility and Control of Configurations.	• System > System Settings: Read
ITSM	Configure and activate preconfigured bundles for ITSM integration. **Note** This permission cannot be assigned to a site-scoped (non-global) access group if set to Read/Write.	• Extensions > Intent API: Write
Intent API	Access the product through REST APIs.	–
Network Design	Configure network profiles and settings. Manage templates. Update the software image repository. Configure wireless maps for managing your sites and network devices.	–

Capability	Description	Recommended permission settings for dependent capabilities
Profiles and Settings	Manage site-wide network settings such as AAA, NTP, and DHCP. Manage wireless designs: SSIDs, RF profiles, interfaces and VLAN groups, AP profiles, FlexConnect settings, anchor groups, security settings—including pre-auth access control lists, AP authorization list, AP impersonation, DTLS ciphersuites—power profiles, antenna radio profiles, Cisco Spaces and Cisco CMX servers, remote teleworker configurations, and 802.11be profiles. Manage (create, update and delete) IP pools. Manage telemetry and profiles.	• Network Management > Hierarchy: Read
Wireless Maps	Visualize your wireless network and configure wireless maps.	• Network Management > Hierarchy: Write • Network Management > Inventory: Write • Network Design > Profiles and Settings: Write • Assurance > Monitoring: Read
Network Management	Discover and build your network.	–
Discovery	Discover new devices on your network.	• Network Management > Hierarchy: Write • Network Management > Inventory: Write • Network Design > Profiles and Settings: Read
Hierarchy	Create a network hierarchy of areas, buildings, and floors based on geographic location. This role also includes Cisco CMX server settings.	–
Inventory	You must have Write permission to add, update, and delete network devices. With Write permission, you can update or delete credentials associated with network devices and access points. If these credentials are updated or deleted incorrectly, Catalyst Center may not be able to communicate directly with the affected devices.	• Network Management > Hierarchy: Read • Network Design > Profiles and Settings: Read
License	Manage software and network assets relative to license usage and compliance.	• Assurance > Monitoring: Read

Capability	Description	Recommended permission settings for dependent capabilities
Network-wide Settings	Configure network-wide settings to monitor your network and device. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Read/Write.	–
Network Operations	Manage and maintain your network devices.	–
Compliance	Monitor device compliance and out-of-band changes. Manage Cisco field notices and view EoX statuses.	• Network Management > Hierarchy: Read • Network Management > Network-wide Settings: Read • Security > Security Advisory: Read • Network Operations > SWIM: Read
LAN Automation	Provision your network through LAN automation.	• Network Management > Hierarchy: Read • Network Management > Network-wide Settings: Read • Network Management > Inventory: Read • Network Design > Profiles and Settings: Read
Plug and Play	Automatically onboard new devices, assign them to sites, and configure them with site-specific settings.	• Network Management > Hierarchy: Read • Network Management > Network-wide Settings: Read • Network Management > Inventory: Read • Network Design > Profiles and Settings: Read
RMA	Replace faulty devices in your network.	• Network Management > Hierarchy: Read • Network Management > License: Read • Network Management > Inventory: Read • Network Operations > Plug and Play: Write • Network Operations > SWIM: Write

Capability	Description	Recommended permission settings for dependent capabilities
SWIM	Manage software images. Update physical and virtual network entities.	• Network Management > Hierarchy: Read • Network Management > Inventory: Read
Network Provision	Configure, upgrade, provision, and manage network devices.	–
Device Provision	Provision devices with site-specific settings and policies that are configured for the network. This role includes Application Policy, Application Visibility, Cloud, Site-to-Site VPN, Network/Application Telemetry, Security Service Insertion, Stealthwatch, and Umbrella provisioning.	• Network Management > Hierarchy: Read • Network Management > Inventory: Read • Network Design > Profiles and Settings: Read • Network Design > Template: Write • Network Operations > Plug and Play: Write • Network Operations > Compliance: Read • Utilities > Command Runner: Write • System > System Settings: Read

Capability	Description	Recommended permission settings for dependent capabilities
Network-wide Config	Manage virtual networks, extranet policies, and other network-wide configurations. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	–
SD-Access	Configure, manage, and monitor an SD-Access Fabric.	• Network Management > Hierarchy: Read • Network Management > Inventory: Read • Network Management > Discovery: Read • Network Management > Network-wide Settings: Read • Network Provision > Device Provision: Write • Network Design > Template: Write • Network Operations > Plug and Play: Write • Network Operations > Network-wide Config: Read • Policy > Group-based Policy: Read • Network Operations > LAN Automation: Read • Network Operations > SWIM: Read • Network Operations > Compliance: Read • Network Design > Profiles and Settings: Read • Utilities > Event Viewer: Read

Capability	Description	Recommended permission settings for dependent capabilities
Policy	Configure and manage policies that reflect your organization's business intent. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Read/Write.	–
Application Policy	Manage QoS policies to make efficient use of network resources.	• Network Management > Hierarchy: Read • Network Management > Inventory: Read • Network Design > Profiles and Settings: Read • Network Operations > Compliance: Read • Utilities > Command Runner: Write • System > System Settings: Read
Group-Based Policy	Manage group-based policies that enforce network segmentation and access control. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	–
IP-Based Access Control	Manage IP-based access control lists that enforce network segmentation. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	–
Security	Manage and control secure access to the network.	–

Capability	Description	Recommended permission settings for dependent capabilities
Audit Log	View logs of changes made through the UI or API to the system, network devices, and settings.	–
Rogue and aWIPS	Monitor rogue and aWIPS threats in your network.	• Network Management > Hierarchy: Read • Network Management > Inventory: Read • Network Provision > Device Provision: Write • Assurance > Monitoring: Read • Assurance > Troubleshooting: Read • Network Design > Profiles and Settings: Write • Security > Audit Log: Write • System > System Settings: Read • Utilities > Reports: Write

Capability	Description	Recommended permission settings for dependent capabilities
Security Advisory	Scan the network for Cisco security advisories. Review the impact of published security advisories that may affect your network. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	• Network Management > Hierarchy: Read • Network Management > Inventory: Read
Stealthwatch	Configure network elements to send data to Cisco Stealthwatch to detect and mitigate threats, even in encrypted traffic. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	• Network Management > Hierarchy: Read • Network Management > Inventory: Read • Network Design > Profiles and Settings: Write • Network Provision > Device Provision: Write • System > System Settings: Read • System > System Administration: Read
Umbrella	Configure network elements to use Cisco Umbrella as the first line of defense against cybersecurity threats. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	–
System	Perform centralized administration for configuration management, network connectivity, software upgrades, and more.	–

Capability	Description	Recommended permission settings for dependent capabilities
System Administration	Manage core system administrative capabilities including HA, Disaster Recovery, and Backup and Restore. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	• System > System Settings: Write
System Settings	Manage core system connectivity settings. This role includes Integrity Verification, Integration Settings, Debugging Logs, Telemetry Collection, System EULA, IPAM, Data Platform, Cisco Credentials, Smart account, Smart Licensing, SSM Connection Mode, and Device EULA. This role also includes permissions related to certificate management. This role enables the configuration of automatic updates to the machine reasoning knowledge base. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	–
Utilities	Use common utilities to help manage your network.	–
App Hosting	Deploy, manage, and monitor virtualized and container-based applications running on devices.	–

Capability	Description	Recommended permission settings for dependent capabilities
Bonjour	Use the wide-area bonjour service to enable policy-based service discovery across your network. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	–
Command Runner	Display the running configuration of a device.	• Network Management > Inventory: Read
Event Viewer	View device and client events for troubleshooting.	–
Machine Reasoner	Scan the network for defects or bugs known by Cisco and troubleshoot various issues on your network through workflows. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	• Network Management > Inventory: Read • Network Management > Hierarchy: Read
Remote Device Support	Allow Cisco support personnel to remotely troubleshoot managed network devices. **Note** This permission set cannot be assigned to a site-scoped (non-global) access group if set to Write.	–
Reports	Use predefined reporting templates to generate reports for all areas of your network.	–

Display role-based access control statistics

Information about displaying role-based access control statistics.

You can display statistics that show how many users belong to each user role. You can also drill down to view the list of users who have a selected role.

Procedure

1. From the main menu, choose **System** > **Users & Roles** > **Role Based Access Control**.

   All default user roles and custom roles are displayed.

2. Click the number corresponding to each user role to view the list of users who have that role.

Configure site-based, role-based access control

Describes how to define access groups that limit user access to specific network sites.

Catalyst Center supports site-based, role-based access control (SRBAC). SRBAC enables you to create access groups that limit access to specific network sites. An access group is a combination of a role and a site. The site can be the global site or a specific site. At any point, you can log in to one specific access group.

Catalyst Center supports these default access groups:

- **NW-ADMIN_Global**: Access group for global access to the role NW-ADMIN
- **OBSERVER_Global**: Access group for global access to the role OBSERVER
- **SUPER-ADMIN_Global**: Access group for global access to the role SUPER-ADMIN

Use this procedure to define an access group and then assign a user to the access group. You can also assign more than one access group to a user.

Procedure

1. Define an access group.
   a) From the main menu, choose **System** > **Users & Roles** > **Access Group**.
   b) Click **Create Access Group** to create a new access group.
   c) In the **Create Your Access Group** window, enter this information:
      - **Name**: Enter a unique name for the access group.
      - **Role**: Choose a role from the available list.
      - **Scope**: Choose the site hierarchy.

      > **Note**
      >
      > External users are mapped to the default access group with global scope. This option is not applicable for external users.

   d) Click **Next** and review the access group composition in the **Summary** window.
   e) Click **Create Access Group**.

In the success message, click the **Back to Access Group** link to view the newly created access group in the **Access Group** window.

f) To edit the access group, choose the access group and click **Edit Access Group**.

In the access group slide-in pane, edit the role or site hierarchy and click **Save**.

2. To assign a user to the access group you created, go to **Users & Roles** > **User Management**.
   - To assign the access group to an existing user:
     a. In the **User Management** window, click the radio button corresponding to the user to whom you want to assign the access group, and then click **Edit**.
     b. In the **Update Internal User** slide-in pane, click the **Access Group** drop-down list and choose the access group.
     c. Click **Save**.
   - To assign the access group to a new user:
     a. In the **User Management** window, click **Add**.
     b. In the **Create Internal User** slide-in pane, enter the first name, last name, and username.
     c. From the **Access Group** drop-down list, choose the access group.
     d. Enter the password and then confirm it.
     e. Click **Save**.

Use case example: assign multiple access groups to an internal user

Shows an example of how to create three different access groups and assign them to a new internal user.

This sample use case shows how to create three different access groups and assign them to a new internal user, *User1*.

Username	Access groups
User1	AG1, AG2, AG3

Access group	Role	Scope	Description
AG1	Custom-role1	Global	Grants global access to the role Custom-role1.
AG2	Custom-role2	IN-BGL	Grants access for the Bangalore site to the role Custom-role2.
AG3	Custom-role3	US-SJ	Grants access for the San Jose site to the role Custom-role3.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure.

Procedure

1. Define the custom roles *Custom-role1*, *Custom-role2* and *Custom-role3*.
   a) From the main menu, choose **System** > **Users & Roles** > **Role Based Access Control**.
   b) Click **Create a New Role**.
   c) If a task overview window opens, click **Let's do it** to go directly to the workflow.
   d) In the **Create a New Role** window, enter a name for the role and then click **Next**.
   e) In the **Define the Access** window, click the **>** icon corresponding to the desired function to view the associated features.
   f) Set the permission level to **Deny**, **Read**, or **Write** for the desired features. Click **Next**.

      If you set the permission level of a feature to **Deny**, the user to whom you assign this role cannot view this feature in the GUI.

      If you override the recommended permission level settings for dependent features, you see a warning message in the **Summary** window indicating the violation.

   g) Review the configuration settings. To make any changes, click **Edit**.
   h) Click **Create Role**.
2. Define the access groups *AG1*, *AG2*, and *AG3*.
   a) From the main menu, choose **System** > **Users & Roles** > **Access Group**.
   b) Click **Create Access Group** to create a new access group.
   c) In the **Create Your Access Group** window, enter this information:
      - **Name**: Enter a unique name for the access group.
      - **Role**: Choose a role from the available list.
      - **Scope**: Choose the site hierarchy.
   d) Click **Next** and review the access group composition in the **Summary** window.
   e) Click **Create Access Group**.

      In the success message, click the **Back to Access Group** link to view the newly created access group in the **Access Group** window.

   f) To edit the access group, choose the access group and click **Edit Access Group**.

      In the access group slide-in pane, edit the role or site hierarchy and click **Save**.
3. Assign the access groups *AG1*, *AG2*, and *AG3* to a new user, *User1*.
   a) Navigate to **Users & Roles** > **User Management**.
   b) In the **User Management** window, click **Add**.
   c) In the **Create Internal User** slide-in pane, enter the first name, last name, and username.
   d) From the **Access Group** drop-down list, choose the access groups.
   e) Enter the password and then confirm it.
   f) Click **Save**.

Use case example: assign multiple access groups to an external user

Shows an example of how to create three access groups and assign them to an external user.

This sample use case shows how to create three access groups and assign them to an external user, *User-ise*, created in Cisco ISE.

Username	Access groups
User-ise	AG4, AG5, AG6

Access group	Role	Scope	Description
AG4	Custom-role4	Global	Grants global access to the role Custom-role4.
AG5	Custom-role5	IN-BGL	Grants Bangalore site access to the role Custom-role5.
AG6	Custom-role6	US-SJ	Grants San Jose site access to the role Custom-role6.

Before you begin

Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure.

Procedure

1. Define the custom roles *custom-role4*, *custom-role5*, and *custom-role6*.
   a) From the main menu, choose **System** > **Users & Roles** > **Role Based Access Control**.
   b) Click **Create a New Role**.
   c) If a task overview window opens, click **Let's do it** to go directly to the workflow.
   d) In the **Create a New Role** window, enter a name for the role and then click **Next**.
   e) In the **Define the Access** window, click the **>** icon corresponding to the desired function to view the associated features.
   f) Set the permission level to **Deny**, **Read**, or **Write** for the desired features and click **Next**.

      If you set the permission level of a feature to **Deny**, the user to whom you assign this role cannot view this feature in the GUI.

      If you override the recommended permission level for dependent features, a warning message appears in the **Summary** window.

   g) Review the configuration settings. To make any changes, click **Edit**.
   h) Click **Create Role**.
2. Define the access groups *AG4*, *AG5*, and *AG6*.
   a) From the main menu, choose **System** > **Users & Roles** > **Access Group**.
   b) Click **Create Access Group** to create a new access group.
   c) In the **Create Your Access Group** window, enter this information:
      - **Name**: Enter a unique name for the access group.
      - **Role**: Choose a role from the available list.
      - **Scope**: Choose the site hierarchy.
   d) Click **Next** and review the access group composition in the **Summary** window.
   e) Click **Create Access Group**.

      In the success message, click the **Back to Access Group** link to view the newly created access group in the **Access Group** window.

   f) To edit the access group, choose the access group and click **Edit Access Group**.

      In the access group slide-in pane, edit the role or site hierarchy and click **Save**.

3. Define the access groups *AG4*, *AG5*, and *AG6* in Cisco ISE server and assign the access groups to external user, *User-ise*.

   For more information, see Configure external authentication on page 177.

Impact of SRBAC on Catalyst Center features

Behavior of Catalyst Center features based on SRBAC

The behavior of Catalyst Center features depends on the user role and site specified in the access group.

This table describes how SRBAC affects Catalyst Center features.

Table 7: SRBAC effect on Catalyst Center features

Feature	Effect of SRBAC
Discovery	**Discovery job** • When a site user creates a discovery job, only users in that user's access group and the parent site hierarchy access group can see it. • A parent site hierarchy user has the ability to re-run discovery jobs that were initially created by a child site hierarchy user. • The devices discovered are limited to those accessible to the user initiating the discovery. **Note** The results of discovery jobs might differ if two users perform them, because their access group site hierarchies differ. **Global credentials** • **Credentials created by any site administrator are accessible to all site users in read-only mode.** • **Credentials can only be edited or deleted by the user who created them or by super users within the same hierarchy, provided they have write access.**

Feature	Effect of SRBAC
Inventory	**Add device** • Devices added by a site user will be visible only to users in the site user's access group, and its parent site hierarchy access group. • If a device is added by a user with parent site hierarchy access group, it will not be visible to the users in the child site hierarchy access groups. • If a child site hierarchy user tries to re-add or import a device that already exists, an error states that the device exists. However, the child site hierarchy user still cannot view the device in the inventory. **EoX status** • A site user with write permission to **Network Operations > Compliance** can initiate a scan. • If a site user schedules EoX scan, the devices related to that site will be scanned. The Inventory page shows EoX status only for devices related to that site. • For a site user, the EoX status tile in the Catalyst Center home page displays a summary of scans for the sites associated with the user.
Topology	**Shared custom view layouts** • When lower-level access group users create custom views, higher-level access group users can access those views; however, lower-level access group users cannot access views created by higher-level access group users. • Users can view only the devices and site hierarchy associated with their access group.

Feature	Effect of SRBAC	
Plug and Play	**Method of adding device**	**Visibility rules**
	Plug and play discovery	Initially visible to all users. After claiming to a site, the discovered devices are visible only to access group users and parent site hierarchy access group users.
	Add a device manually using plug and play	Visible only to access group users and parent site hierarchy access group users.
	Add a device from Cisco smart account	Visible only to access group users and parent site hierarchy access group users who added the devices.
	Claim device to a site • **When a device is claimed to a site on plug and play, it will be visible to access group users of that specific site hierarchy and its parent site hierarchy.** • **The device's plug and play history is visible to all the users in the site access group irrespective of any prior access groups of the device.** • **All related plug and play workflows associated with the device are assigned to the specific site hierarchy to which the device was claimed.**	
	After a device has been onboarded through plug and play and added to inventory, if the device is assigned to a different site, the device record in plug and play is updated with the *siteHierarchyId* of the new site and is visible to access group users of the new site.	
RMA and Network Refresh	• Users associated with an access group can mark or unmark the devices belonging to the current access group or lower-level access group for replacement or refresh. • To mark a fabric device faulty, the user must have access to all its neighbor devices. • After a user marks a device for replacement or refresh, users from the current or higher-level access group can trigger the replacement workflow. • Users associated to the access group can schedule the workflow. Users from higher-level access groups can modify or cancel the workflow.	
Tagging	Tags created by site users will be visible to all the other site users. However, editing of tags such as renaming and changing dynamic rules can be done only by the access group users who created the tags.	
Licensing	You cannot assign the Licensing and System Settings permission sets to site-scoped (non-global) access groups if they have Read/Write access. A site-scoped user cannot see licensing or system settings pages.	

Feature	Effect of SRBAC
Network Settings	• Site profiles can only be edited or deleted from the access groups in which they were created. However, any site in the system can be assigned to any profile. • AAA and ISE server settings are global resources. Only users with a global site access group can create, edit, or delete these settings. • All wireless settings, such as SSID and RF Profile, are global and can be created only by users with a global site access group. In addition, users with access to a specific site can override settings for that site. • User with access group of a specific site can override the settings of that specific site.
Wireless controller provision	**Managed AP Location** • Site user can choose the Managed AP Location based on the site associated with the access group. • Catalyst Center validates the accessibility for both the wireless controller location and managed AP location. • To provision a wireless controller with multiple managed AP locations, the user must have access to a parent site for all managed AP locations. For example, if the network hierarchy includes *Area 1* (parent site) with *Sub-area 1* and *Sub-area 2* (child sites), to provision a wireless controller that is managing APs in *Sub-area 1* and *Sub-area 2*, user must have access to *Area 1*. If the site user has access only to *Sub-area 1* or *Sub-area 2*, provisioning fails.
AP provision	• An access group user can provision APs to the sites associated with the access group. • AP provisioning is allowed based on the user's access to the associated controller's physical and managed AP locations. • The user must have access to the AP's associated controller and its managed locations. • The user must have access to AP's secondary controller and its managed locations.
Certificate	Certificates are associated with a specific site or access group. Access group user can view only the certificates of devices assigned to the site associated with the access group.

Feature	Effect of SRBAC
Rogue and aWIPS	• Users with global site access only can enable or disable Rogue and aWIPS feature from Rogue Overview dashboard. • The Threats table in the Overview dashboard shows only the rogues strongly detected by the APs located in sites owned by the currently logged-in user. The Detecting AP site in the table must be one of the sites owned by the user. • Wireless Rogue containment operation is allowed only if the user is able to access the strongest detecting wireless controller for that rogue. Wired Rogue containment operation is allowed only if the user is able to access the switch where the rogue is detected. • Access group users with access to global site can create or remove the MAC addresses from Allowed List. • Users can view all the profiles created by others. However, users can edit, delete, or assign site only if they own all the sites that are part of the profile. If users do not own all the sites that are part of the profile, read only details will be displayed when they click on the profile name. **aWIPS profile configuration** • **Any admin can create the profile but can only map it to the devices under the sites they own.** • **Edit or delete of mapped profile is only allowed if the user has access to all the wireless controllers mapped on that profile. If the user has mapped a profile to one of the devices and then later the device is moved to another site which the user doesn't have access to, the user cannot edit or delete that profile.** • **In the profile assignment screen, only the devices which are accessible to the current user will be displayed.**

Feature	Effect of SRBAC
SD-Access	**REP** A REP ring created by a site user is visible to: • Users in the site user's access group. • Users in the parent site's hierarchy access group. • Users in the access group that is the closest common parent of all ring members in the site hierarchy. **PRP** • **A user with access to both LAN-A and LAN-B fabric sites is allowed to configure and view PRP.** • **A user with access only to the LAN-A site will see partial data with a banner message indicating limited access.** **MRP** • **A user with access to all ring members can see the complete MRP ring details.** • **A user with access to partial ring members will see partial data with a banner message indicating limited access.**
Field Notices	• A site user with write permission to **Network Operations > Compliance** can initiate a scan. • When a site user initiates a scan, only devices associated with their site are scanned. The results are site-specific. • For a site user, the Field Notices tile in the Catalyst Center home page displays scan summaries for specific sites associated with that user.
Security Advisories	• A site user with write permission to **Security > Security Advisories** can initiate a scan. • When a site user initiates a scan, only devices associated with their site are scanned. The results are site-specific. • A site user can address security advisories pertinent to their location without exposure to data from other sites.
Network Bug Identifier	• A site user with write permission to **Network Reasoner** can initiate a scan. • When a site user initiates a scan, only devices associated with their site are scanned. The results are site-specific. • The summary displays only bugs affecting devices managed by the site user.

Feature	Effect of SRBAC
Network Reasoner	• The site user can access only workflows relevant to their assigned site and role. • Site users can see and interact only with devices and resources assigned to their site. For example, when triggering a workflow like CPU utilization, only devices assigned to their site are available for analysis.

Configure external authentication

Information about configuring external authentication when you are using an external server for authentication and authorization of external users.

To use an external server for authentication and authorization of external users, enable external authentication in Catalyst Center.

Before you begin

- Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure. For more information, see About user roles on page 150.
- You must configure at least one authentication server.
- For SRBAC, you must define the access group on the Cisco ISE server.

  Configure the Cisco ISE server similar to how roles are configured in Catalyst Center. For example, <AAA attribute name>=rds=<comma separated list of rd names>. The first rd can be treated as the default access group profile.
- With SRBAC support in Catalyst Center 3.1.3 and later, use access groups on Cisco ISE to configure user authorization. If you migrate from a release without SRBAC support, your roles are mapped to the appropriate global access groups.

Note

If Catalyst Center is deployed on a physical appliance, review this note.

When external authentication is enabled:

- Catalyst Center does not fall back to local users if the AAA server is unreachable or the AAA server rejects an unknown username.
- Local fallback is enabled by default for users with SUPER-ADMIN-ROLE permissions and can't be disabled.

To re-enable external authentication fallback, SSH to the Catalyst Center instance and enter this CLI command:

```
magctl rbac external_auth_fallback enable
```

Procedure

1. From the main menu, choose **System** > **Users & Roles** > **External Authentication**.
2. To enable external authentication in Catalyst Center, check the **Enable External User** check box.

3. Optional: Configure the AAA attribute.

   For TACACS authentication, the following AAA attributes are supported:

Catalyst Center	TACACS
Empty	cisco-av-pair
cisco-av-pair	cisco-av-pair
Cisco-AVPair	Cisco-AVPair

   For RADIUS authentication, the following AAA attributes are supported:

Catalyst Center	RADIUS
Empty	cisco-av-pair
Cisco-AVPair	cisco-av-pair

   a) In the **AAA Attribute** field, enter the appropriate attribute for your use case as described in the tables. The default value of the **AAA Attribute** field is null.
   b) Click **Update**.

4. Optional: Configure the AAA server or servers.

   Configure these settings only if you want to swap the current primary or secondary AAA servers or define different AAA servers.

   From the main menu, choose **System** > **Settings** > **External Services** > **Authentication and Policy Servers**

   a) From the **Primary AAA Server IP Address** drop-down list, choose the IP address of one of the preconfigured AAA servers.
   b) From the **Secondary AAA Server IP Address** drop-down list, choose the IP address of one of the preconfigured AAA servers.
   c) Optional: If you are using a Cisco ISE server, you can update the settings, if necessary.

      For information about Cisco ISE policies, see "Segmentation" in the *Cisco Identity Services Engine Administrator Guide*.

      Table 8: Cisco ISE server settings

Name	Description
Shared Secret	The key is used for device authentications. The shared secret can contain up to 100 characters. Provide the shared secret before you update the AAA address.
Username	Name that is used to log in to the Cisco ISE CLI.
Password	Password for the Cisco ISE CLI username.
FQDN	Fully qualified domain name (FQDN) of the Cisco ISE server. The FQDN consists of two parts, a hostname and the domain name, in this format: *hostname.domainname.com* For example, the FQDN for a Cisco ISE server might be ise.cisco.com.

Name	Description
Subscriber Name	A unique text string—for example, `acme`—that is used during Catalyst Center-to-Cisco ISE integration to set up a new pxGrid client in Cisco ISE.
Virtual IP Address(es)	Virtual IP address of the load balancer behind which the Cisco ISE policy service nodes (PSNs) are located. If you have multiple PSN farms behind different load balancers, you can enter a maximum of six virtual IP addresses.

d) Optional: To update advanced settings, click **View Advanced Settings** and update the settings, if necessary.

Table 9: AAA server advanced settings

Name	Description
Protocol	TACACS or RADIUS.
Authentication Port	Port used to relay authentication messages to the AAA server. • For RADIUS, the default is UDP port 1812. • For TACACS, the port is 49 and can't be changed.
Accounting Port	Port used to relay important events to the AAA server. The information in these events is used for security and billing purposes. • For RADIUS, the default UDP port is 1813. • For TACACS, the port is 49 and can't be changed.
Retries	Number of times that Catalyst Center can attempt to connect with Cisco ISE.
Timeout	Length of time that Catalyst Center waits for Cisco ISE to respond. The maximum timeout value is 60 seconds.

e) Click **Update**.

Two-factor authentication

Two-factor authentication uses an identifier method in addition to the username and password for user identification.

Two-factor authentication, also known as 2FA, adds a layer of security to user verification by requiring an identifier method in addition to a user's name and password. This identifier method is typically something that only the intended user possesses, such as a phone app or keyfob, and is kept separate from the original login method.

The Catalyst Center implementation of two-factor authentication uses a token client, a token server, and an authentication server. The token client generates single-use token codes after the correct PIN is entered. The token server validates token codes. The authentication server manages user access. Authentication can be handled using either the RADIUS or TACACS+ protocol.

Prerequisites for two-factor authentication

Lists the prerequisites for two-factor authentication.

These prerequisites must be in place to set up two-factor authentication for use with Catalyst Center:

- An authentication server that is able to return attribute-value pairs to convey RBAC role authorizations for authenticated Catalyst Center users. For example, Cisco Identity Services Engine (Cisco ISE) 2.3 Patch 1 is used.
- A two-factor token server that you will integrate with your authentication server. For example, RSA Authentication Manager 7.2.
- A token card application on the client's machine that generates software tokens. In our example, we use RSA SecurID Software Token.

Two-factor authentication workflow

Describes the process for two-factor authentication.

This section describes the sequence of events that occur when a user logs in to a Catalyst Center appliance on which two-factor authentication configured:

1. In an RSA SecurID token client, a user enters their PIN to get a token code.
2. In the Catalyst Center login page, they enter their username and token code.
3. Catalyst Center sends the login request to Cisco ISE using either the RADIUS or TACACS+ protocol.
4. Cisco ISE sends the request to the RSA Authentication Manager server.
5. RSA Authentication Manager validates the token code and informs Cisco ISE whether the user has been authenticated successfully.
6. If the user has been authenticated, Cisco ISE matches the authenticated user with their configured authorization profile. Then, it returns the **role=NETWORK-ADMIN-ROLE** attribute-value pair.
7. Catalyst Center grants access to the features and pages associated with the user's role-based access control (RBAC) role.

Configure two-factor authentication

Instructions to configure two-factor authentication for Catalyst Center.

To configure two-factor authentication on your Catalyst Center appliance, complete this procedure.

Procedure

1. Integrate RSA Authentication Manager with Cisco ISE:
   a) In RSA Authentication Manager, create two users: `cdnac_admin` (for the Admin user role) and `cdnac_observer` (for the Observer role).

      For more information, see the "Add a User to the Internal Database" topic in the RSA Self-Service Console Help. To access this topic, do the following:

      1. Open the *RSA Self-Service Console Help*.
      2. In the **Search help** field, enter `Add a User to the Internal Database` and then click **Search help**.

   b) Create a new authentication agent.

      For more information, see the "Add an Authentication Agent" topic in the *RSA Self-Service Console Help*.

   c) Generate the Authentication Manager agent configuration file (sdconf.rec):

      1. From the RSA Security Console, choose **Access** > **Authentication Agents** > **Generate Configuration File**.

The **Configure Agent Timeout and Retries** tab opens.

2. For the **Maximum Retries** and **Maximum Time Between Each Retry** fields, use the default values.
3. Click **Generate Configuration File**.

   The **Download Configuration File** tab opens.
4. Click the **Download Now** link.
5. When prompted, click **Save to Disk** to save a local copy of the zip file.
6. Unzip the file. Use this version of the sdconf.rec file to overwrite the version that is currently installed on the agent.

d) Generate a PIN for the `cdnac_admin` and `cdnac_observer` users created earlier.

For more information, see the "Create My On-Demand Authentication PIN" topic in the *RSA Self-Service Console Help*.

e) Start Cisco ISE, choose **Administration** > **Identity Management** > **External Identity Sources** > **RSA SecurID**, and then click **Add**.

f) In the **RSA SecurID Identity Sources** page, click **Browse**, choose the sdconf.rec file you downloaded, and then click **Open**.

g) Check the **Reauthenticate on Change PIN** check box, then click **Submit**.

2. Create two authorization profiles, one for the Admin user role and one for the Observer user role.

a) In Cisco ISE, choose **Policy** > **Policy Elements** > **Results** > **Authorization** > **Authorization Profiles**.

b) For both profiles, enter the following information:

- **Name**: Enter the profile name.
- **Access Type**: Choose **ACCESS_ACCEPT**.
- **Advanced Attributes Settings** area: Choose **Cisco:cisco-av-pair** from the first drop-down list.

  If you are creating an authorization profile for the Admin user role, choose **Role=NETWORK-ADMIN-ROLE** from the second drop-down list.

  If you are creating an authorization profile for the Observer user role, choose **Role=OBSERVER-ROLE** from the second drop-down list.

3. Create an authentication policy for your Catalyst Center appliance.

   In the *Cisco Identity Services Engine Administrator Guide*, see the "Configure Authentication Policies" topic.

4. Create two authorization policies, one for the Admin user role and one for the Observer user role.

   In the *Cisco Identity Services Engine Administrator Guide*, see the "Configure Authorization Policies" topic.

5. In the RSA Authentication Manager Security Console, verify that software tokens have been assigned to both users.

   For more information, see the "View a Token" topic in the *RSA Self-Service Console Help*.

> **Note**
>
> If you need to assign tokens, complete the steps described in the "Assign a Software Token to a User" topic.

Enable two-factor authentication using RADIUS

Information about enabling two-factor authentication when a Cisco ISE server is configured for RADIUS.

To enable two-factor authentication that uses a Cisco ISE server configured for RADIUS, complete this procedure:

Procedure

1. Integrate Cisco ISE with Catalyst Center.

   In the *Catalyst Center Installation Guide*, see the "Integrate Cisco ISE with Catalyst Center" topic.

2. Configure Catalyst Center to use your Cisco ISE server for authentication.

   See Configure External Authentication.

   Important

   Ensure that you specify the same shared secret for both Cisco ISE and Catalyst Center.

Enable two-factor authentication using TACACS+

Information about enabling two-factor authentication using a Cisco ISE server configured for TACACS+.

To enable two-factor authentication that uses a Cisco ISE server configured for TACACS+, complete this procedure:

Procedure

1. In Cisco ISE, choose **Administration** > **Network Resources** > **Network Devices** to open the **Network Devices** window.
2. Click **TACACS Authentication Settings** to view its contents. Ensure that a shared secret has already been configured for the Catalyst Center device that you added previously.
3. Choose **Work Centers** > **Device Administration** > **Policy Elements** to open the **TACACS Profiles** window.
4. Create TACACS+ profiles for the example_admin and example_observer user roles:
   a) Click **Add**.
   b) Complete these tasks:
      - Enter the profile name.
      - After clicking the **Raw View** tab, enter this text into the **Profile Attributes** text box:
        - For the example_admin user role, enter `Cisco-AVPair=ROLE=NETWORK-ADMIN-ROLE`
        - For the example_observer user role, enter `Cisco-AVPair=ROLE=OBSERVER-ROLE`

   c) Click **Save**.
5. Integrate Cisco ISE with Catalyst Center.

   In the *Catalyst Center Installation Guide*, see the "Integrate Cisco ISE with Catalyst Center" topic.

6. Configure Catalyst Center to use your Cisco ISE server for authentication.

   See Configure External Authentication.

Important

Ensure that you specify the same shared secret for both Cisco ISE and Catalyst Center.

Log in using two-factor authentication

Instructions to log in to Catalyst Center using two-factor authentication.

To log in to Catalyst Center using two-factor authentication, complete this procedure:

Procedure

1. From the Catalyst Center login page, enter the appropriate username.
2. Open the RSA SecurID token client and enter the PIN you configured previously to generate a one-time token.
3. Copy this token. Paste it into the **Password** field of the Catalyst Center login page.
4. Click **Log In**.

Display external users

Information about how to display external users who have logged in through RADIUS or TACACS for the first time.

You can view the list of external users who have logged in through RADIUS or TACACS for the first time. The information that is displayed includes their usernames and roles.

Procedure

1. From the main menu, choose **System** > **Users & Roles** > **External Authentication**.
2. Scroll to the bottom of the window. The **External Users** area lists the external users.

   For Cisco ISE users, Cisco ISE doesn't include the email address in the RADIUS accept packet. As a result, the email address doesn't display the domain.

12 Manage Licenses

Topics:

- License Manager overview
- Integration with Cisco Smart Accounts
- Set up License Manager
- Cisco Networking Subscription licenses
- Visualize license use and expiration
- View historical trends for license consumption
- View license details
- Change license level
- Auto registration of Smart License-enabled devices
- Day-zero configuration for Smart License-enabled devices
- Configure licenses for worldwide safe mode-enabled devices
- Apply specific license reservation or permanent license reservation to devices
- Cancel SLR or PLR applied to devices
- Install the authorization code and enable the high security license
- Disable the high security license
- Upload resource use details to CSSM
- Smart Licensing Using Policy reporting through On-Prem CSSM
- Sync licensing connection mode
- Change device throughput
- Transfer licenses between virtual accounts
- Manage customer tags on Smart License-enabled devices
- Modify license policy

Information about managing licenses on Catalyst Center.

License Manager overview

Information about the Catalyst Center License Manager.

The Catalyst Center License Manager feature helps you visualize and manage all your Cisco product licenses, including Smart Account licenses.

To access License Manager, click the menu icon and choose**Tools** > **License Manager**. The **License Manager** window contains tabs with information, including:

- **Overview**:

  The **Overview** tab displays details based on the selected **Smart Account** and **Virtual Account.**

  - Switch: Shows purchased and in-use license information for all switches.
  - Router: Shows the used count for nonunified license devices.
  - Wireless: Shows purchased and in-use license information for all wireless controllers and APs.
  - ISE: Shows purchased and in-use license information for devices managed by Cisco Identity Services Engine (ISE).

- **Licenses**: The **License Summary** shows the total licenses purchased from Cisco Smart Software Management (CSSM), the number of licenses that are about to expire, and out-of-compliance details for all types of licenses for all Cisco devices as received from CSSM.
- **Devices**: The **Devices** table shows the license type, license expiry, license mode, virtual account, associate site, and Smart Account/Virtual Account registration status of each device managed by Catalyst Center.
- **Reporting**: The **Smart License Compliance** card allows you to launch the **Smart License Compliance** workflow.
- **Sync Status**: Shows the Resource Utilization Measurement (RUM) sync status.

To manage licenses, you can use the controls shown above the table listings in each tab. This table describes each control.

> **Note**
>
> Not all controls are available in every tab.

Table 10: License management controls

Control	Description
Filter	Click **Filter** to specify one or more filter values and then click **Apply**. You can apply multiple filters. To remove a filter, click the **x** icon next to the corresponding filter value.
Change Cisco License	Select one or more licenses and choose **Actions** > **Change Cisco License** to change the level of a selected license to Essentials or Advantage. You can also use this control to remove a license. For more information, see Change license level on page 195.
Change Virtual Account	Select one or more licenses and choose **Actions** > **Change Virtual Account** to specify the Virtual Account used to manage these licenses.

Control	Description
Manage Smart License > Register	Select one or more Smart License-enabled devices and choose **Actions** > **Manage Smart License** > **Register** to register the Smart License-enabled devices.
Manage Smart License > Deregister	Select one or more Smart License-enabled devices and choose **Actions** > **Manage Smart License** > **Deregister** to unregister the Smart License-enabled devices.
Manage License Reservation > Enable License Reservation	Choose the device for which you want to apply Specific License Reservation (SLR) or Permanent License Reservation (PLR), then choose **Actions** > **Manage License Reservation** > **Enable License Reservation**.
Manage License Reservation > Update License Reservation	The device must be in the SLR registered state. You can update the SLR applied to a wireless device or switch with a wireless controller package. Choose the device for which you want to update the SLR, then choose **Actions** > **Manage License Reservation** > **Update License Reservation**.
Manage License Reservation > Cancel/Return License Reservation	Choose the device and choose **Actions** > **Manage License Reservation** > **Cancel/Return License Reservation** to cancel or return the SLR or PLR applied to the device.
Manage License Reservation > Factory License Reservation	Choose the device and choose **Actions** > **Manage License Reservation** > **Factory License Reservation** to enable the factory-installed SLR on the device.
Recent Tasks	Click **Recent Tasks** to see a list of all 50 of the most recently performed Catalyst Center tasks. Use the drop-down to show only tasks with a status of **Success**, **Failure**, or **In Progress**.
License Usage	Click **License Usage** to see the license utilization percentage for all types of licenses.
Refresh	Click **Refresh** to reload the window with current data.
Find	Enter a search term in the **Find** field to find all licenses in the list that have that term in any column. Use the asterisk (*) character as a wildcard anywhere in the search string.
Show Records	Select the total number of records to display in each page of the table.

The Licenses table displays the information shown for each device. All columns support sorting. Click the column header to sort the rows in ascending order. Click the column header again to sort the rows in descending order.

Note

Not all columns are used in every tab. Also, some of the columns are hidden in the default column view setting. To view the hidden columns, click the gear icon and under **Edit Table Columns**, choose the columns you want displayed in the table.

Table 11: License use information

Column	Description
Device Type: Device Series	Name of the device product series (for example, Catalyst 3850 Series Ethernet Stackable Switch). For more information, see View license details on page 194.
Device Type: Total Devices	The total number of devices in this product series that are under active management by Catalyst Center.
Purchased Cisco Licenses	The total number of purchased Catalyst Center subscription licenses for the devices in this product series.
Purchased Licenses: Network/Legacy/OS	The total number of purchased perpetual licenses for the devices in this product series: • Network • Legacy • OS
Used Licenses	The total number of Catalyst Center subscription licenses applied to the devices in this product series.
Used Licenses: Network/Legacy/OS	The total number of perpetual licenses for the devices in this product series: • Network • Legacy • OS
Feature Licenses (applicable only for Routers)	The number of licenses purchased for specific features such as security, AVC, and so on.

Table 12: All license information

Column	Description
Device Name	Name of the device. For more information, see View license details on page 194.
Device Family	The category of the device, such as Switches and Hubs, as defined by Catalyst Center.
IP Address	IP address of the device.
Device Series	The full name of the Cisco product series to which the listed device belongs (for example, Cisco Catalyst 3850 Series Ethernet Stackable Switch).

Column	Description
Cisco License	The Catalyst Center license level.
Cisco License Expiry	The expiration date of the Catalyst Center license.
License Mode	The Catalyst Center license mode.
Device License	The type of device license.
Virtual Account	The name of the Cisco Virtual Account managing the license for the device. The Virtual Account and the site hierarchy are distinct entities and aren't interconnected. Licensing operations might fail if the virtual account name contains any of these characters: /, \, =. We recommend that you remove these characters from your virtual account name through the Cisco SSM portal (software.cisco.com) and then perform a refresh from the **License Manager Overview** window.
Site	The Catalyst Center site where the device is located.
Registration Status	The registration status of the device.
Authorization Status	The authorization status of the device.
Reservation Status	The reservation status of the device.
Last Updated Time	The last time this entry in the table was updated.
MAC Address	The MAC address of the licensed device.
Term	The total term during which the Catalyst Center subscription license is in effect.
Days to Expiry	The number of days remaining until the Catalyst Center license term expires.
Software Version	The version of the network operating system currently running on the device.

Integration with Cisco Smart Accounts

Catalyst Center integrates with Cisco Smart Accounts to simplify license management.

Smart Accounts provide a centralized, organized, and simple-to-use solution for managing Cisco software licenses across an entire organization. They act as a container that holds all Cisco software assets, allowing customers to view, store, manage, and move these assets as needed. Smart Accounts enable full visibility into license entitlements and usage, helping optimize software management. Smart Accounts support license pooling, portability, and provide compliance reporting.

Virtual Accounts are customizable subaccounts within a Smart Account used to organize and optimize Cisco licenses. They can be structured to reflect business units, product types, or geographic locations, allowing better planning and utilization of assets.

If you have multiple Smart Accounts, one account is set as your default account. You can change the default account that the License Manager uses for visualization and licensing operations, such as registration and license level changes.

Each device can synchronize with only one Smart Account at a time. If you have multiple Smart Accounts, you must select one for synchronization. You may change your selected Smart Account as needed; however, if you delete the Smart Account currently associated with your device, the synchronization process will fail.

After changing the default Smart Account, it takes several minutes to retrieve the data from CSSM and display it on the License Manager Overview and All License windows.

If you already have a Cisco Smart Account, you can use Catalyst Center to:

- Track your license consumption and expiration dates,
- Apply and activate new licenses without user intervention,
- Promote each device's license level from Essentials to Advantage (or vice versa) and reboot the device with the new feature license level, and
- Identify and reapply unused licenses.

You can accomplish this automatically, without leaving Catalyst Center.

Set up License Manager

Information about setting up access to your Cisco Smart Account before you can use the Catalyst Center License Manager.

You must set up access to your Cisco Smart Account before you can use the Catalyst Center License Manager tools.

Before you begin

- Ensure that you have SUPER-ADMIN-ROLE permissions or the appropriate RBAC scope to perform this procedure.
- Collect the Cisco user ID and password for your Smart Account.
- If you have multiple Smart Accounts, select the Smart Account to use with Catalyst Center and collect that account's user ID and password.
- To apply licenses to a device in Catalyst Center, ensure the device is present in Inventory, has a site assigned, and is connected to the required domains.
  - id.cisco.com
  - apx.cisco.com

    Deprecated in Catalyst Center 2.3.7.6 and later releases.
  - apix.cisco.com
  - commerce.cisco.com, and
  - smartreceiver.cisco.com.
- Verify that all allowed ports, FQDNs, and URLs listed in the *Cisco Catalyst Center Installation Guide* are permitted through any firewall or proxy.

Procedure

1. Log in using a Catalyst Center system administrator username and password.
2. From the main menu, choose **System** > **Settings** > **Cisco.com Credentials**.
3. Under **Cisco.com Credentials**, enter the username and password for your cisco.com account.
4. In the **Information** pop-up window, check the **I am inprivate or incognito mode** check box and then click **Proceed**.
5. From the main menu, choose **System** > **Settings** > **Smart Account**.
6. Under **Smart Account**, click **Add** and enter the username and password for your Smart Account.

7. In the **Information** pop-up window, check the **I am inprivate or incognito mode** check box and then click **Proceed**.
8. Click **Save**.
9. If you have multiple Smart Accounts, click **Add** and enter your additional accounts.
10. If you have multiple Smart Accounts, select one account to be the default. The License Manager uses the default account for visualization and licensing operations. To change the default Smart Account:
    a) Click **Change** next to the selected Smart Account name.
    b) Change the active Smart Account and select a Smart Account to be the default.
    c) Click **Apply**.
    After changing the default account, it takes several minutes to retrieve the data from CSSM and display it on the License Manager Overview and All License windows.
11. To edit a Smart Account, click the three dots in the Actions column and select **Edit**.
12. To delete a Smart Account, click the three dots in the Actions column and select **Delete**.
13. To access your Smart Account using a virtual or subordinate Smart Account name and password, under **Link Your Smart Account**, select:
    - **Use Cisco.com user ID** if your cisco.com and Smart Account credentials are the same.
    - **Use different credentials** if your cisco.com and Smart Account credentials are different, and then enter your Smart Account credentials.
14. Click **View all virtual accounts** to view all virtual Smart License Accounts.

What to do next

Register the Catalyst Center controller as a controller for Cisco Plug and Play Connect in a Cisco Smart Account, for redirection services. You can synchronize the device inventory from the Cisco Plug and Play Connect cloud portal to Catalyst Center Plug and Play. For more information, see "Register or Edit a Virtual Account Profile" in the *Cisco Catalyst Center User Guide*.

Cisco Networking Subscription licenses

Provides an overview of License Manager support for Cisco Networking Subscription (CNS) licenses.

With the release of Wi-Fi 7 APs, Catalyst Center License Manager supports Cisco Networking Subscription (CNS) licenses. You have visibility to the AP license status, compliance, and reason for noncompliance. After synchronizing the wireless controller with CSSM, the Wi-Fi 7 AP is compliant and displays the CNS Essentials or Advantage subscription.

License Manager reports include all devices; you can filter by compliant and noncompliant devices. Banners across Catalyst Center show which APs aren't registered with a required subscription and navigate back to License Manager to remediate.

To comply with CNS licensing, you must:

- Configure Smart Accounts.
- Choose the Cisco Smart Software Management connection mode.

  Registration of next-generation devices, including Wi-Fi 7, isn't supported in Cisco Smart Software Manager On-Prem connection mode.
- Enable Assurance telemetry for the device.
- Assign the device to a site.
- Enable NTP.

Visualize license use and expiration

Information about viewing the license use and expiration data.

Catalyst Center can display graphical representations of your purchased licenses, how many of them are in use (that is, assigned to devices), and their duration.

Procedure

1. From the main menu, choose **Tools** > **License Manager**.
2. In the **Overview** tab, Catalyst Center displays the name of the active Smart Account. From the **Virtual Account** drop-down list, choose a virtual account to display the license details.
3. Click a device category button to view the corresponding license usage details: **Switches**, **Routers**, **WLC**, or **ISE**.

   The license usage pie charts display the aggregate number of purchased licenses and the number of licenses currently in use for the selected device category. The charts also indicate the proportion of Essentials and Advantage licenses within each total.

   The number of purchased licenses is obtained from the Cisco Smart Software Manager (CSSM). The number of used licenses is sourced from the devices managed by Catalyst Center.

   The license usage table shows the subtotals for used and available licenses, listed alphabetically by product family name.
4. To see details for a particular product family, click the name of the product family under the **Device Series** column.

   Catalyst Center displays details about the product family that you selected.
5. To see a graphical representation of license duration, scroll down to the **Cisco License Timeline** section. The timeline graph for each product family visually shows the expiration dates for the licenses in the configured Smart Account.

   > **Note**
   >
   > This section isn't available for the **ISE** device category.

View historical trends for license consumption

Information about viewing the historical trends for license consumption.

Catalyst Center allows you to view historical trends for all purchased and consumed licenses in CSSM on a daily, weekly, and monthly basis. CSSM stores historical information for up to one year.

Use this procedure to view the historical trends for license consumption.

Before you begin

Register Catalyst Center to a smart account in CSSM. For more information, see Integration with Cisco Smart Accounts on page 189.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Licenses**.
   - In the **License Summary** area, view the total number of purchased Catalyst Center subscription licenses from CSSM .
   - In the **Smart Account** area, view details about the smart account.
   - In these areas, view the corresponding total number, expiring, and noncompliant subscription licenses:
     - **CNS ESSENTIALS**
     - **CNS ADVANTAGE**
     - **DNA ESSENTIALS**
     - **DNA ADVANTAGE**
     - **NETWORK ESSENTIALS**
     - **NETWORK ADVANTAGE**
     - **OS ESSENTIALS**
     - **OS ADVANTAGE**
   - In the **License** window, a table displays your discovered devices and their licenses. You can choose the required view from the **Focus** drop-down list:
     - Virtual account view
     - Licenses view
     - Device series view
     - Device type view
     - License type view
2. To view the historical information of a chosen license, click the license link in the row for that device.

   The license details slide-in pane shows the complete license details and license history of the chosen device.

   > **Note**
   >
   > The title of the license details slide-in pane matches the title of the chosen device.

3. In the license-details slide-in pane, choose the frequency of historical information from the **Frequency** drop-down list.

   The available options include:
   - **Daily**: Displays the license data snapshot on the first day.
   - **Weekly**: Displays the license data snapshot on Monday.
   - **Monthly**: Displays the license data snapshot on the first day of the month.

Depending on the frequency selection, a graph is displayed that shows the license data for **Purchased**, **In Use**, and **Balance** licenses.

Depending on the frequency selection, the **License History** table filters the license historical information based on **Date**, **Purchased**, **In Use**, and **Balance**.

> **Note**
>
> License historical information is always one day old because CSSM provides only the data from the previous day. Catalyst Center periodically retrieves the license historical information from CSSM daily.

View license details

Information about viewing the license details in Catalyst Center.

You can find and view license details in several ways in Catalyst Center. For example, you can click the license usage and term graphs on the **Switches**, **Routers**, **Wireless**, **ISE**, or **Devices** tabs in the **License Manager** window. Each graph provides aggregated information for the licenses within its product family.

Use the **Devices** table in License Manager to view all license details for a single device.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Devices**.

   The License Manager window displays a table listing all of your discovered devices and their licenses. The table includes basic device and license details, such as device type and license expiration dates.

2. Scroll through the table to find the device whose license details you want to see. If you are unable to locate the device, you can use these options:

   - Filter: Click and then enter your filter criteria in the appropriate field. (For example, enter all or part of the device name in the **Device Name** field.) You can enter filter criteria in multiple fields. When you click **Apply**, the table displays only the rows displaying information that matches your filter criteria.

     If you want to view the devices that belong to a particular site, navigate to the site in the left pane, and click the site. The devices are filtered accordingly. A site marker indicating the site hierarchy is displayed at the top of the page.

   - Find: Click in the **Find** field and enter the text you want to find in any of the table columns. When you press **Enter**, the table scrolls to the first row with text that matches your entry in the **Find** field.

   - Customize: Click the gear icon and under **Edit Table Columns**, choose the columns you want displayed in the table. For example, deselect **Device Series** or select **Days to Expiry**. When you click **Apply**, the table displays only the columns you selected.

3. When you find the device that you want, click the **Device Name** link in the row for that device.

   Catalyst Center displays the **License Details** slide-in pane with complete license details and license history for the device that you selected. **Actions** displays actions that can be performed on the device or its licenses.

When you are finished, click × to close the **License Details** slide-in pane.

Change license level

Information about changing the feature level of your device licenses.

You can upgrade or downgrade your device license level to Essentials or Advantage for these license types:

- DNA
- CNS
- OS

Note

- You can't change the license type for a device. You can only change the license level for the corresponding license type.
- Network license conversion is available only for products in the Cisco Catalyst 9000 device family. This conversion is handled implicitly when the Catalyst Center license level is changed.
- You can change the license level for devices from only one family at a time, such as routers, switches, or wireless controllers.
- If you use UL-supported devices, you can only use device licenses.
- If your device supports only OS Advantage licenses, you cannot modify the license for that device.

You can update the license level with Catalyst Center subscription licenses. When you change the license level of a device, Catalyst Center automatically downloads and applies the licenses using your Smart Account.

After you change the license level, the change takes effect when the device reboots. For devices such as Cisco Catalyst 3560-CX Series Switches and Cisco AireOS Wireless Controller, a reboot is not necessary.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Devices**.

   The **License Manager** window displays a table listing the discovered devices and their licenses.
2. Use **Find** or scroll through the table to find the devices whose license level you want to change. If you're having trouble finding the device you want, or want to choose multiple devices, see View license details on page 194 to change the table to display only the devices you want.
3. Check the check box next to the devices for which you want to change the license level.
4. Choose **Actions** > **Change License** > **Change Cisco License**.
5. If you chose devices from more than one device family (for example, switches and wireless controllers), complete these steps.
   a) Click the radio button next to the device family for which you want to change the license level: **Routers**, **Switch**, or **Wireless**.
   b) Click **Continue**.

6. Choose the required license level.
   a) Click the required license level for the devices.

      Based on the current license level, Catalyst Center displays only the available license level: **Essentials** or **Advantage**.

      To remove the license from the device, click **Remove**.

      > **Note**
      >
      > You can't remove the CNS license from a device. When you remove the CNS license, the device uses the CNS Advantage license by default.

   b) Click the required license type:
      - **All**
      - **DNA**
      - **CNS**
      - **OS**

   c) Click **Continue**.
7. Check the **Reboot device on update** check box to reboot the device when its license level is updated.
8. Optional: In the **Task Name** field, update the task name.
9. Choose a schedule for updating the license level for your devices.
   - **Now**: Immediately update the license level and reboot the devices.
   - **Later**: Schedule the date and time to update the license level and reboot the devices.
10. Click **Confirm**.
11. Click the **Recent Tasks** link to launch the **Recent Tasks** window.

    You can view the license level change task status in the **Recent Tasks** window.

Auto registration of Smart License-enabled devices

Information about enabling auto registration of Smart License (SL)-enabled devices.

You can enable auto registration of Smart License (SL)-enabled devices. When auto registration is enabled, any SL-enabled devices (but not Smart License Policy [SLP]-enabled devices) added to Catalyst Center are automatically registered to the chosen virtual account.

> **Note**
>
> Auto registration is not supported in Smart Proxy mode.

Procedure

1. Log in using a Catalyst Center system administrator username and password.
2. From the main menu, choose **System** > **Settings** > **Cisco Accounts** > **Smart Account**.
3. Click **License**.
4. Check the **Auto register smart license enabled devices** check box.
5. Choose a virtual account.
6. Click **Apply**.

Day-zero configuration for Smart License-enabled devices

Information about day-zero configuration for smart license-enabled devices.

Devices that are already added to Catalyst Center before auto registration is enabled are not automatically registered. To view the Smart License-enabled devices that have not been registered, open the **All Licenses** window.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Devices**.

   The **License Manager** window displays a banner message with the number of SL-enabled devices that are not auto registered and a table listing all of your discovered devices and their licenses with a link to set up auto registration.

   Alternatively, you can filter the unregistered devices by selecting the **Registration Status** column.
2. Select the SL-enabled devices to register, and then choose **Actions** > **Manage Smart License** > **Register**.
3. Choose the virtual account and click **Continue**.
4. To register the devices:
   - If you want to register the devices immediately, choose **Now** and click **Confirm**.
   - If you want to register the devices later, choose **Later** and specify a date and time. After specifying the schedule parameters, click **Confirm**.

Configure licenses for worldwide safe mode-enabled devices

For worldwide safe mode-enabled devices, the radio functionality is restricted until you configure the licenses.

Worldwide safe mode (WWSM)-enabled devices are in WWSM on day zero and when they don't meet the license requirements. You must enable the CNS licenses on the devices to disable WWSM.

Use this procedure to configure licenses and disable WWSM on WWSM-enabled devices.

Before you begin

Ensure that a CNS license is available for the device in the smart account.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Reporting**.
2. Click **Smart License Compliance**.

   Alternatively, instead of the first two steps, click the menu icon and choose and choose **Workflows** > **Smart License Compliance**.
3. In the **Smart License Compliance** dialog box, click **Let's Do It**.

   To skip the task overview in the future, check the **Don't show this to me again** check box.
4. In the **Select Smart Account** window, do these steps:
   a) Optional: In the **Workflow Name** field, update the task name.
   b) From the **Smart Account** drop-down list, choose the smart account that contains the CNS licenses.
   c) From the **Virtual Account** drop-down list, choose the virtual account.
   d) Click **Next**.
5. In the **Choose Sites and Devices** window, do these steps:
   a) Optional: In the left pane, choose the required site.
   b) Check the check box next to the devices for which you want to configure the licenses.

      You can use the **Search** field to search for devices by their name.

      You can click the filter icon ( ) to filter the devices in the table based on the column headers.
   c) Click **Next**.
6. In the **Modify Policy** window, do these steps:
   a) Review the CSSM policy.

      (Optional) To modify the reporting interval, click **Modify**, and do these steps in the **Change Reporting Interval** dialog box:

      1. In the **Reporting Interval in Days** field, enter the reporting interval at which devices report their resource usage to CSSM.
      2. Click **Save**.

   b) Click **Next**.
7. In the **Sync Data with Cisco** window, click **Submit**.
8. In the **Summary** window, click **Finish**.

Apply specific license reservation or permanent license reservation to devices

Information about Specific License Reservation (SLR) or Permanent License Reservation (PLR). The License Manager enables Catalyst Center customers to reserve licenses securely from CSSM using an API-based workflow.

Smart Licensing requires a smart device instance to regularly sync with Cisco Smart Software Management (CSSM) so that the latest license status is refreshed and compliance is reported. Some customers have devices that are within highly secured networks with limited internet access. In these types of networks, devices cannot regularly sync with CSSM and show out of compliance. To support these customer environments, Specific License Reservation (SLR) and Permanent

License Reservation (PLR) have been introduced. The License Manager enables Catalyst Center customers to reserve licenses securely from CSSM using an API-based workflow. In Catalyst Center, it requires a one-time connectivity to CSSM in the staging environment, then the devices never need to connect to Cisco in SLR or PLR mode. If no connectivity to CSSM or staging is possible, you can resort to the manual SLR/PLR workflow available in CSSM.

SLR lets you install a node-locked license file (SLR authorization code) on a product instance. This license file enables individual (specific) licenses (entitlement tags).

PLR lets you install an authorization code that enables all licensed features on the product.

Both SLR and PLR require preapproval at the Smart Account level. Contact licensing@cisco.com for support.

To enable SLR or PLR when both the device and Catalyst Center are connected to CSSM, see Enable SLR or PLR when the devices and Catalyst Center are connected to CSSM on page 199.

To enable SLR or PLR when the device and Catalyst Center do not have connectivity to CSSM, see Enable SLR or PLR when the devices and Catalyst Center are not connected to CSSM on page 199.

Enable SLR or PLR when the devices and Catalyst Center are connected to CSSM

Information about enabling Specific License Reservation (SLR) or Permanent License Reservation (PLR) when the devices and Catalyst Center are connected to CSSM.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Devices**.
2. Select the devices for which you want to apply SLR or PLR, and choose **Actions** > **Manage License Reservation** > **Enable License Reservation**.
3. Choose **Specific License Reservation (SLR)** or **Permanent License Reservation (PLR)** and click **Continue** to obtain the request codes for the selected devices.
4. After the request codes are generated for the selected devices, click **Continue**.
5. Choose a virtual account from which you want to reserve licenses and click **Continue** to generate the authorization codes for the selected devices.
6. After the authorization codes are generated, do any of the following:
   - To apply SLR immediately, choose the devices and click **Continue**.
   - To apply SLR later, click **Apply Later**.
7. Click **Confirm** to apply SLR/PLR to the selected device.

   You can now view the updated status of the devices under **Reservation Status** on the **All Licenses** window.

Enable SLR or PLR when the devices and Catalyst Center are not connected to CSSM

Information about enabling Specific License Reservation (SLR) or Permanent License Reservation (PLR) when the devices and Catalyst Center are not connected to CSSM.

Use this procedure to enable SLR or PLR for the devices that are not connected to CSSM.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Devices**.
2. Select the devices for which you want to apply SLR or PLR, and choose **Actions** > **Manage License Reservation** > **Enable License Reservation**.

3. Choose **Specific License Reservation (SLR)** or **Permanent License Reservation (PLR)** and click **Continue** to obtain the request codes for the selected devices.

   You also can connect to the device through Telnet to obtain the request code.

4. After the request codes are generated for the selected devices, click **Export**. This downloads the requestcodes.csv file, which contains the IP address, serial number of the device, and the request code.
5. Save the file to your preferred location.
6. Obtain the authorization code for each device from CSSM and update it in the CSV file. See Generate Authorization Code from CSSM.
7. Click the **Upload CSV** link.
8. Click the **Select a file from your computer** link to select the saved CSV file.
9. Click **Continue**.
10. Choose a virtual account from which you want to reserve licenses and click **Continue**. SLR or PLR is applied to the selected devices.

    You can now view the updated status of the devices under **Reservation Status** on the **All Licenses** window.

Generate the authorization code from CSSM

Information about generating the authorization code from CSSM.

Before you begin

You must have Smart Account credentials to log in to CSSM.

Procedure

1. Log in to **CSSM**.
2. Choose **Inventory** > **Licenses** > **License Reservation**. The Smart License Reservation wizard appears.

   The **License Reservation** button is visible on the **Licenses** tab only if you have specific license reservation enabled for your Smart Account.

3. In the **Step 1: Enter Request Code** tab, enter the request code in the **Reservation Request Code** field and click **Next**.
4. In the **Step 2: Select Licenses** tab, check the **Reserve a specific license** check box.
5. In the **Quantity to Reserve** field, enter the number of licenses that you want to reserve and click **Next**.
6. In the **Step 3: Review and Confirm** tab, click **Generate Authorization Code**.
7. Get the authorization code from the **Step 4: Authorize Code** tab.

Cancel SLR or PLR applied to devices

Information about canceling Specific License Reservation (SLR) or Permanent License Reservation (PLR) that is applied to devices.

You can cancel or return the SLR or PLR that is applied to a device.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Licenses**.
2. Click the device, then select **Actions** > **Manage License Reservation** > **Cancel/Return License Reservation**.
3. Click **Cancel** to return the licenses.

   You can view the updated status of the devices under **Reservation Status** on the **All Licenses** window.

Install the authorization code and enable the high security license

Information about installing authorization code and enabling a high security license. To increase the device throughput to more than 250 Mbps, you must get the authorization code from Cisco. You can install the authorization code and enable the High Security (HSEC) license.

Cisco offers a throughput of 250 Mbps by default. To increase the device throughput to more than 250 Mbps, you must get the authorization code from Cisco. You can install the authorization code and enable the High Security (HSEC) license in a single workflow or in separate workflows, as required.

Before you begin
Ensure that the device is running Cisco IOS XE Release 17.3.2 or later.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Reporting**.

   Alternatively, you can use **Workflows** > **Smart License Compliance**.
2. Click the **Smart License Compliance** card.
3. In the **Smart License Compliance** window, click **Let's Do It**.

   To skip this window in the future, check **Don't show this to me again**.
4. In the **Select Smart Account** window, choose **Smart Account** and **Virtual Account** from the drop-down list.
5. Click **Next**.
6. In the **Choose Sites and Devices** window, choose the devices on which you want to install the authorization code, then click **Next**.
7. In the **Policy Settings** window, review the CSSM policies and click **Next**.
8. In the **Choose Device Features** window, do these steps:
   a) Choose the devices.
   b) From the **Auth Codes** drop-down list, choose **Install**.
   c) From the **HSEC** drop-down list, choose **Enable**.
   d) Click **Next**.
9. In the **Review Device Features** window, click **Next**.
10. In the **Installing Device Features** window, view the authorization code and HSEC installation status and click **Next**.
11. In the **Sync Data with Cisco** window, click **Next**.

12. In the **Summary** window, review the authorization code and HSEC installation status, then click **Finish**.

Disable the high security license

Information about disabling a high security license.

You can disable the HSEC license on a device to avoid unnecessary consumption.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Reporting**.
2. Click the **Smart License Compliance** card.
3. In the **Smart License Compliance** window, click **Let's Do It**.

   To skip this window in the future, check **Don't show this to me again**.
4. In the **Select Smart Account** window, choose **Smart Account** and **Virtual Account** from the drop-down list.
5. Click **Next**.
6. In the **Choose Sites and Devices** window, choose the devices from which you want to disable the HSEC license and click **Next**.
7. In the **Policy Settings** window, click **Next**.
8. In the **Choose Device Features** window, complete these actions:
   a) Choose the devices.
   b) From the **HSEC** drop-down list, choose **Disable**.
   c) Click **Next**.
9. In the **Review Device Features** window, click **Next**.
10. In the **Installing Device Features** window, view the HSEC disable operation status and click **Next**.
11. In the **Sync Data with Cisco** window, click **Next**.
12. In the **Summary** window, click **Finish**.

Upload resource use details to CSSM

Information about uploading resource use details to CSSM.

You can upload resource use details to CSSM instantly or schedule an upload.

To upload resource use details to CSSM, you do not need to enable NETCONF or add devices to the site.

Add non-IoT devices with at least a Network Essentials license. Confirm that no task is in progress. Verify that at least one AP is associated with a wireless controller.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Reporting**.
2. Click the **Smart License Compliance** card.
3. In the **Smart License Compliance** window, click **Let's Do It**.

To skip this window in the future, check **Don't show this to me again**.

4. In the **Select Smart Account** window, choose **Smart Account** and **Virtual Account** from the drop-down list.
5. Click **Next**.
6. In the **Choose Sites and Devices** window, choose the devices from which you want to retrieve the resource utilization details and click **Next**.
7. To upload the resource utilization details instantly, click **Next** in the **Modify Policy** window. To modify the scheduled reporting frequency:
   a) Under **Policy Settings**, click **Modify** corresponding to the **Reporting Interval** field.
   b) In the **Change Reporting Interval** window, enter the value.

      The reporting interval (in days) denotes the frequency of scheduled upload of resource utilization details from Catalyst Center to CSSM. The frequency of uploads can be increased but cannot be reduced below the minimum reporting frequency.

   c) Click **Save**.
8. In the **Sync Data with Cisco** window, click **Next**.
9. In the **Summary** window, click **Finish**.

   After synchronization with CSSM is successful, you receive an acknowledgment on your devices.

What to do next

The number of devices for which the license usage reporting has failed is shown in a separate **Smart License Compliance** card with the **Retry** option. Click the **Smart License Compliance** card and redo the procedure to send the license usage reports from the failed devices to CSSM.

Smart Licensing Using Policy reporting through On-Prem CSSM

Upload resource details to CSSM through On-Prem SSM.

You can upload resource details to CSSM through On-Prem SSM.

Before you begin

You must enable On-Prem SSM connection mode. For more information refer to Configure connection mode on page 49.

Procedure

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1. From the main menu, choose **Tools** > **License Manager** > **Reporting**.
2. Click the **Smart License Compliance** card.
3. In the **Smart License Compliance** window, click **Let's Do It**.

   To skip this window in the future, check **Don't show this to me again**.
4. In the **Select Smart Account** window, choose **Smart Account** and **Virtual Account** from the drop-down list.
5. Click **Next**.
6. In the **Choose Sites and Devices** window, choose the devices from which you want to retrieve the resource utilization details and click **Next**.

7. To upload the resource utilization details instantly, click **Next** in the **Modify Policy** window. If you want to modify the scheduled reporting frequency, use the options provided.
   a) Under **Policy Settings**, click **Modify** corresponding to the **Reporting Interval** field.
   b) In the **Change Reporting Interval** window, enter the value.

      The reporting interval (in days) denotes the frequency of scheduled upload of resource utilization details from on-premise SSM to Cisco Cloud SSM. The frequency of uploads can be increased but cannot be reduced below the minimum reporting frequency (24 hours).

   c) Click **Save**.
8. In the **Sync Data with Cisco** window, click **Next**.
9. In the **Summary** window, click **Finish**.

   After synchronization with CSSM is successful, you receive an acknowledgment on your devices.

Sync licensing connection mode

Change connection mode from smart call home to smart transport.

Smart Call Home (SCH) support for Smart Licensing reaches end-of-life from Catalyst Center 2.3.7.6. If you're using SCH with Smart Licensing, transition to Smart Transport.

Devices are flagged with the **Connection Mode Out of Sync** tag in the device name column in **Tools** > **License Manager** > **Devices** when any of these scenarios occur.

- Whenever you change the SSM Connection mode on **System** > **Settings** > **SSM Connection mode**
- Whenever you change the FQDN on the Catalyst Center setup
- Whenever you change the SSM connection mode, or the enterprise VIP IP address changes
- If the smart transport configured manually on the device does not match the SSM connection mode of the Catalyst Center setup
- After upgrading Catalyst Center from earlier releases to 2.3.7.6 or later releases

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Devices**.

   If you see a **Connection mode out of sync** warning message for the Smart License-enabled devices, click the warning message to view the connection mode out of sync details.
2. In the **License Manager window**, click **Sync Connection Mode**.

   The connection mode transition from SCH to Smart Transport occurs in this sequence:

   a. Deregister SCH

   b. Push the Smart Transport URL to the device

   c. Complete Smart Licensing registration

   In dual-stack IPv4/IPv6 environments using On-Prem CSSM, the **Sync Connection Mode** action is blocked for IPv6 devices. To enable synchronization, you must change the On-Prem CSSM host address from an IP address to an FQDN on the **SSM Connection Mode** window.

3. Optional: From the main menu, choose **Activities** > **Tasks** to view the **Sync Connection Mode** task status.
4. Optional: From the main menu, choose **Activities** > **Audit Logs** to view the configuration changes to the device.

Change device throughput

Information about changing the throughput of Smart License-enabled routers.

You can change the throughput of Smart License-enabled routers.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Reporting**.
2. Choose the device that you want to change.
3. Click **More Actions** and choose **Change Throughput**.
4. In the **Choose Throughput** window, choose the throughput value and click **Next**.
5. In the **Apply Throughput** window, click **Next**.
6. Click the **Recent Tasks** link to launch the **Recent Tasks** window.

   You can view the **Change Throughput** task status in the **Recent Tasks** window.

Transfer licenses between virtual accounts

Information about transferring licenses between virtual accounts.

You can transfer licenses between virtual accounts.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Licenses**.
2. Choose the licenses that you want to transfer and click **Transfer Licenses**.
3. In the **Transfer Licenses** window, choose the virtual account.
4. Enter the **Transfer License Count** for each of the chosen licenses and click **Transfer**.
5. Click the **Recent Tasks** link to launch the **Recent Tasks** window.

   You can view the **License Transfer** task status in the **Recent Tasks** window.

Manage customer tags on Smart License-enabled devices

Information about managing customer tags on a Smart License-enabled device. You can add up to four customer tags to a Smart License-enabled device. You can also update and delete the customer tags.

You can add up to four customer tags to a Smart License-enabled device to help identify telemetry data for a product instance. You can also update or delete the customer tags.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Reporting**.
2. Choose the devices on which you want to add customer tags.
3. Click **More Actions**, and choose **Manage Free Form Fields** to add, update, or delete customer tags.
4. To add or update customer tags, in the **Free Form Fields** window:
   a) Enter the customer tags.
   b) Click **Save**.
5. To delete customer tags, in the **Free Form Fields** window:
   a) Click the delete icon for the customer tags that you want to delete.
   b) Click **Save**.
   c) In the **Warning** window, click **Continue**.
6. Click the **Recent Tasks** link to launch the **Recent Tasks** window.

   You can view the **Manage Customer Tags** task status in the **Recent Tasks** window.

Modify license policy

Information about modifying license policy. You can modify the reporting interval at which the network devices report their feature usage to CSSM.

You can modify the reporting interval at which network devices report their feature usage to CSSM.

Procedure

1. From the main menu, choose **Tools** > **License Manager** > **Reporting**.
2. In the **Smart License** table, click **Modify Policy**.

   The **Modify Policy** window shows the policy settings and CSSM policy details.
3. Under **Policy Settings**, click **Modify**.
4. In the **Change Reporting Interval** window, enter a value for the reporting interval.
5. Click **Save**.

13 Backup and Restore

Topics:

- About backup and restore
- Backup server requirements
- Backup storage requirements
- Bandwidth and latency requirements
- Set up a file share
- Add the NFS server
- Configure the location to store backup files
- Configure a remote SSH server
- Create a backup
- Schedule data backup
- Add a physical disk for backup and restore
- Restore data from backups
- Restore data from a physical disk for a faulty virtual appliance

Information about backup and restore functions to create backup files to restore.

About backup and restore

Information about backing up and restoring the Catalyst Center.

The backup and restore functions enable you to create backup files and restore them on a different appliance if necessary for your network configuration.

Backup

- You can back up automation data only or both automation and Assurance data.

  Important

  NetFlow data is not backed up when you back up Catalyst Center's automation and Assurance data.

- Automation data consists of Catalyst Center databases, credentials, file systems, and files. The automation backup is a backup of all data.
- The Assurance data consists of network assurance and analytics data. The first backup of Assurance data is a backup of all data. After that, backups are incremental.

  Important

  - Do not modify or delete the backup files. If you do, you might not be able to restore the backup files to Catalyst Center.
  - A backup can only be restored on a Catalyst Center cluster that has the same FIPS mode setting configured as the source cluster. Backup and restore operations involving clusters with different FIPS mode settings will fail (since Catalyst Center will label backups as incompatible).

- Catalyst Center creates the backup files and posts them to a remote server. Each backup is uniquely stored using the UUID as the directory name. For information about the remote server requirements, see Backup server requirements on page 210.
- Only a single backup can be performed at a time. Performing multiple backups at once is not supported.
- When a backup is being performed, you cannot delete the files that have been uploaded to the file service, and changes that you make to these files might not be captured by the backup process.
- We recommend:
  - Perform a daily backup to maintain a current version of your database and files.
  - Perform a backup after making changes to your configuration. For example, when changing or creating a new policy on a device.
  - Perform a backup only during a low-impact or maintenance period.
- You can schedule weekly backups on a specific day of the week and time.

Restore

- You can restore the backup files from the remote server using Catalyst Center.

- When you restore the backup files, Catalyst Center removes and replaces the existing database and files with the backup database and files. While a restore is being performed, Catalyst Center is unavailable.
- Catalyst Center supports cross-version backup and restore. That is, you can create a backup from either of the two previous versions of Catalyst Center and restore it to the latest version of Catalyst Center. For example, a backup on Catalyst Center 3.1.3-75710 version or Catalyst Center 3.1.5-75246 version can be restored to Catalyst Center 3.1.6-75205 version. The same applies to the later releases of Catalyst Center. For more information, see the *Release Notes for Cisco Catalyst Center*.
- Refer to these topics in the *Cisco Catalyst Center Data Migration* article:
  - The procedure for migration scenarios 2, 3, 5, and 8 describe how to restore a backup to a Catalyst Center appliance with a different IP address. This situation could happen if the IP address is changed on Catalyst Center and you need to restore from an older system.

    Important

    After a backup and restore of Catalyst Center:

    - You must access the **Integration Settings** window and update (if necessary) the **Callback URL Host Name** or **IP Address**. For more information, see Configure integration settings.
    - Integration with Cisco Spaces is interrupted if the Catalyst Center member ID changes. This occurs, for example, when restoring on a different hardware appliance, or migrating from a hardware appliance to a virtual appliance. For more information, see "Integrate Cisco Spaces with Catalyst Center" in the *Cisco Spaces Configuration Guide*.

  - The "Conversion and appliance upgrade considerations" topic describes additional points to keep in mind when restoring a backup file and upgrading to a higher-end Catalyst Center appliance.

Backup and restore event notifications

Information about backup and restore event notifications.

You can receive a notification whenever a backup or restore event takes place. To configure and subscribe to these notifications, complete the steps described in the "Work with event notifications" topic of the *Cisco Catalyst Center Platform User Guide*. When completing this procedure, ensure that you select and subscribe to the SYSTEM-BACKUP-v2 and SYSTEM-RESTORE-v2 events.

A notification is generated and sent whenever an event listed in this table occurs:

Operation	Event
Backup	The process to create a backup file for your system has started. A backup file could not be created for your system. This event typically happens because: • The necessary disk space is not available on remote storage. • You can't retrieve the status of your system's server, which is a precheck for the backup operation. • You encountered connectivity issues or latency while creating a backup file on your system.

Operation	Event
Restore	The process to restore a backup file has started. The restoration of a backup file failed. This event typically happens because: • The backup file is corrupted. • You encountered connectivity issues or latency while creating a backup file from your system.

Backup server requirements

Information about the requirements for the backup server.

The backup server must run one of the supported operating systems:

- Red Hat Enterprise 8 or later
- Ubuntu 16.04 (or Mint, and so on) or later

Server requirements for Assurance backup

To support Assurance data backups, the server can be a Linux- or Windows-based NFS server, or an NFS provided by a storage vendor (such as NetApp, Isilon, and so on) that meets these requirements:

- Support NFS v4 and NFS v3. (To verify this support, from the server, enter **nfsstat -s**.)
- Have read and write permissions on the NFS export directory.
- Have a stable network connection between Catalyst Center and the NFS server.
- Have sufficient network speed between Catalyst Center and the NFS server.

You cannot use an NFS-mounted directory as the Catalyst Center backup server. A cascaded NFS mount adds a layer of latency and is therefore not supported.

The supported backup server types depend on your Catalyst Center deployment model. (Containerized backup servers are not supported for any deployment type.)

Catalyst Center deployment	Supported backup server types
Bare-metal or virtual appliance	Physical, VM-based
Cloud-based (such as AWS, Azure)	On-prem, cloud-based

Requirements for multiple Catalyst Center deployments

If your network includes multiple Catalyst Center clusters, this example configuration shows how to name your NFS server backup directory structure.

Resource	Example configuration
Catalyst Center clusters	1. *cluster1* 2. *cluster2*

Resource	Example configuration
Backup server hosting automation and Assurance backups	The example directory is `/data/`, which has ample space to host both types of backups.
NFS export configuration	The content of the `/etc/exports` file: `/data/cluster1 *(rw,sync,no_subtree_check,all_squash) /data/cluster2 *(rw,sync,no_subtree_check,all_squash)`

Backup server directory layout

Information about the directory layout for your backup server.

To simplify backups, we recommend that you use this directory layout for your backup server:

Single Catalyst Center cluster deployment

cluster1: /data/automation/cluster1

Multiple Catalyst Center cluster deployment

- cluster1: /data/automation/cluster1
- cluster2: /data/automation/cluster2

Backup storage requirements

Information about backup storage requirements. You must allocate enough external storage for your backups to cover the required retention of Assurance and automation data.

Catalyst Center stores backup copies of Assurance and automation data on an external NFS location. You must allocate enough external storage for your backups to cover the required retention. We recommend this storage:

Machine profile	Machine profile alias	Cisco part number	NFS storage (14 days incremental)	Automation storage on NFS server (daily full)
medium	medium	Second-generation appliance: • DN2-HW-APL • DN2-HW-APL-U (promotional) Third-generation appliance: DN3-HW-APL	1.7 TB	50 GB

Machine profile	Machine profile alias	Cisco part number	NFS storage (14 days incremental)	Automation storage on NFS server (daily full)
t2_large	large	Second-generation appliance: • DN2-HW-APL-L • DN2-HW-APL-L-U (promotional) Third-generation appliance: DN3-HW-APL-L	3 TB	100 GB
t2_2xlarge	extra large	Second-generation appliance: • DN2-HW-APL-XL • DN2-HW-APL-XL-U (promotional) Third-generation appliance: DN3-HW-APL-XL	8.4 TB	300 GB

Bandwidth and latency requirements

Learn about bandwidth and latency requirements to back up your server.

Catalyst Center requires specific bandwidth and latency for backing up your server. Use these tables to estimate the time needed to transfer backups for each appliance profile, excluding the time taken to generate the backup. The estimates show times for initial backup of all data. Subsequent incremental backups take less time.

To check the "NFS mount write" speed, enter `magctl disk check -d <NFS_MOUNT_DIRECTORY> -c 4096` in the Catalyst Center shell. The <NFS_MOUNT_DIRECTORY> variable represents the actual mount directory path. Run `df -h | grep external` to identify the correct path.

If you have a three-node HA cluster, enter the command on each node after you configure the NFS in Catalyst Center.

Automation-only backup

Appliance profile	Database size	NFS mount write speed	Bandwidth	Transfer time
Medium	50 GB	100–125 MB/s	1 Gbps	7 minutes
Medium	50 GB	1000–1250 MB/s	10 Gbps	1 minute
Large	100 GB	100–125 MB/s	1 Gbps	13 minutes
Large	100 GB	1000–1250 MB/s	10 Gbps	2 minutes
Extra large	300 GB	100–125 MB/s	1 Gbps	42 minutes
Extra large	300 GB	1000–1250 MB/s	10 Gbps	4 minutes

All data backup

Appliance profile	All data backup size	NFS mount write speed	Bandwidth	Transfer time
Medium	1.75 TB	100–125 MB/s	1 Gbps	4 hours
Medium	1.75 TB	1000–1250 MB/s	10 Gbps	25 minutes
Large	3.1 TB	100–125 MB/s	1 Gbps	7 hours
Large	3.1 TB	1000–1250 MB/s	10 Gbps	43 minutes
Extra large	8.69 TB	100–125 MB/s	1 Gbps	20 hours
Extra large	8.69 TB	1000–1250 MB/s	10 Gbps	2 hours

Set up a file share

Explains how to set up Linux- and Windows-based NFS.

There are a few use cases that require the use of a file share, such as

- completing backup and restore operations
- installing Catalyst Center remotely, and
- creating a repository to store RCA log bundles.

The topics in this section describe how to set up both Linux- and Windows-based NFS.

Configure a Linux-based NFS file share

This topic explains how to configure an NFS file share in Ubuntu and Red Hat Linux distributions.

This section describes how to configure an NFS file share in Ubuntu and Red Hat Linux distributions.

> **Note**
>
> If you are configuring a VMware VM, we recommend that you use the **vmxnet** driver, which provides 10G support and low overhead.

Configure a file share in an Ubuntu distribution

Learn how to configure a file share in an Ubuntu distribution.

To configure a file share in an Ubuntu distribution, complete the steps that are detailed here.

Procedure

1. Install the NFS package: **apt-get install -y nfs-kernel-server**

2. Enable and start the NFS service:

```
systemctl enable nfs-server
systemctl start nfs-server
```

3. Verify that the NFS service is enabled and has started (this should happen by default): **systemctl status nfs-kernel-server**

   The resulting output should resemble this example:

```
nfs-server.service - NFS server and services
Loaded: loaded (/lib/systemd/system/nfs-server.service; enabled; vendor preset:
 enabled)
Active: active (exited) since Sun 2020-03-22 15:35:12 UTC; 18min ago
Main PID: 19253 (code=exited, status=0/SUCCESS)
Tasks: 0 (limit: 4915)
CGroup: /system.slice/nfs-server.service
Mar 22 15:35:12 k8smaster systemd[1]: Starting NFS server and services...
Mar 22 15:35:12 k8smaster systemd[1]: Started NFS server and services.
```

4. Configure NFS export by completing these tasks.

   a. Set up the NFS file share directory:

```
sudo mkdir -p /srv/nfs
sudo chmod 755 -R /srv/nfs/
sudo chown -R nobody:nobody /srv/nfs/
```

   b. Add the NFS file share entry to the /etc/exports file.

      - Open the file: **sudo vim /etc/exports**
      - Add this line: **/srv/nfs *(rw,sync,no_subtree_check,all_squash)**

   c. Export the NFS file share: **sudo exportfs -rv**

      You should see this message: `exporting *:/srv/nfs`

   d. Verify the NFS export.

      To check the availability of NFS file share, enter the **showmount -e** *NFS-server-IP-address* command from a different Linux machine. The resulting output should resemble this example.

```
Export list for NFS-server-IP-address:
/srv/nfs *
```

5. Configure the firewall rules to allow NFS.

   a. Confirm whether a firewall is enabled (its status is `active`): **sudo ufw status**

      By default, a firewall is disabled in Ubuntu/Debian distributions. If necessary, enable a firewall before completing this step.

   b. Set the static port for mountd:

      - Open the **/etc/default/nfs-kernel-server** file.
      - Find the `RPCMOUNTDOPTS="--manage-gids` line.
      - Add a space and **--port 32767** to the end of this line.

c. Add the mountd port by adding these lines to the **/etc/services** file:

```
mountd 32767/tcp
mountd 32767/udp
```

d. Restart NFS services: **sudo systemctl restart nfs-kernel-server nfs-mountd portmap**

e. Add the firewall rules to allow NFS:

```
sudo ufw allow portmapper
sudo ufw allow nfs
sudo ufw allow mountd
```

Configure a file share in a Red Hat or CentOS distribution

Learn how to configure a file share in a Red Hat or CentOS distribution.

To configure a file share in Red Hat or CentOS distribution, complete the steps that are detailed here.

Procedure

---

1. Install the NFS package: **yum install -y nfs-utils**
2. Enable and start the NFS service:

```
systemctl enable nfs-server
systemctl start nfs-server
```

3. Check the service's status: **systemctl status nfs-server**

   The resulting output will resemble this example.

```
nfs-server.service - NFS server and services
Loaded: loaded (/usr/lib/systemd/system/nfs-server.service; enabled; vendor
preset: disabled)
Active: active (exited) since Sun 2020-03-22 12:14:30 EDT; 2s ago
Process: 10418 ExecStart=/bin/sh -c if systemctl -q is-active gssproxy; then
 systemctl reload gssproxy ; fi (code=exited, status=0/SUCCESS)
Process: 10404 ExecStart=/usr/sbin/rpc.nfsd (code=exited, status=0/SUCCESS)
Process: 10402 ExecStartPre=/usr/sbin/exportfs -r (code=exited,
status=0/SUCCESS)
Main PID: 10418 (code=exited, status=0/SUCCESS)
Mar 22 12:14:30 cene8.ecrt.local systemd[1]: Starting NFS server and
services...
Mar 22 12:14:30 cene8.ecrt.local systemd[1]: Started NFS server and services.
```

4. Configure the NFS export by completing these tasks.

   a. Set up the NFS file share directory:

```
sudo mkdir -p /srv/nfs
sudo chmod 755 -R /srv/nfs/
sudo chown -R nobody:nobody /srv/nfs/
```

   b. Add the NFS file share entry to the /etc/exports file.

      - Open the file: **sudo vim /etc/exports**

- Add this line: **/srv/nfs *(rw,sync,no_subtree_check,all_squash)**

c. Export the NFS file share: **sudo exportfs -rv**

You should see this message: `exporting *:/srv/nfs`

d. Verify the NFS export.

To check the availability of NFS file share, enter the **showmount -e** *NFS-server-IP-address* command from a different Linux machine. The resulting output should resemble this example.

```
Export list for NFS-server-IP-address:
/srv/nfs *
```

e. Check whether a mountd port has been configured in the nfs.conf file: **grep -A2 mountd /etc/nfs.conf**

If the resulting output looks like this, it indicates that you need to configure the mountd port.

```
#[mountd]
# debug=0
# manage-gids=n
```

In this is the case, add these lines to the **nfs.conf** file:

```
[mountd]
manage-gids = 1
port = 20048
```

f. Restart NFS services: **sudo systemctl restart nfs-server rpcbind nfs-mountd**

By default, a firewall (managed by the **firewalld** service) is enabled in Red Hat/CentOS version 7 and later (earlier versions use iptables). When NFS is running on the server, this will prevent file share access. From an external client, enter the **showmount -e** *NFS-server-IP-address* command. The resulting output should resemble this example.

```
clnt_create: RPC: Port mapper failure - Unable to receive: errno 113 (No
route to host)
```

5. Add the firewall rules to allow NFS:

```
firewall-cmd --permanent --add-service={nfs,rpc-bind,mountd}
firewall-cmd --reload
```

6. Configure SELinux for NFS.

> **Note**
>
> SELinux is enabled by default in Red Hat and CentOS distributions.

a. Enable NFS read/write boolean options.

If you want to ...	Then ...
enable read-only NFS exports,	enter the **setsebool -P nfs_export_all_ro 1** command.

If you want to ...	Then ...
enable read/write NFS exports,	enter these commands: • **setsebool nfsd_anon_write on** • **setsebool -P nfs_export_all_rw 0**

b. Verify booleans are set:

```
getsebool -a |grep nfs_expo
nfs_export_all_ro --> on
nfs_export_all_rw --> off
```

c. Set the SELinux context on the NFS directory:

```
semanage fcontext -a -t public_content_rw_t "/srv/nfs(/.*)?"
restorecon -Rv /srv/nfs/
```

Configure a Windows-based NFS file share

Describes how to configure a Windows-based NFS file share.

Complete these steps to configure a Windows-based NFS file share for your Catalyst Center deployment.

Procedure

1. Start Server Manager.
2. Install the NFS service:
   a) Choose **Manage** > **Add Roles and Features** to start the Add Roles and Features wizard.
   b) Click **Next** three times to skip the **Before You Begin**, **Installation Type**, and **Server Selection** wizard screens.
   c) In the **Server Roles** wizard screen, select these options:
      - Check the **File Server Resource Manager (Installed)** check box.
      - Check the **Server for NFS** check box.
      - Click **Next**.
   d) In the **Features** wizard screen, check the **Services for Network File System Management** check box, and then click **Next**.
   e) In the **Confirmation** wizard screen, verify that the options you selected are listed.
   f) Click **Install**.
3. Start the New Share wizard:
   a) In Server Manager's navigation pane, click **File and Storage Services**.

      The **File and Storage Services** page opens.
   b) In this page's navigation pane, click **Shares**.
   c) Click **Tasks**, then choose **New Share**.

      The New Share wizard opens.

4. Complete the New Share wizard:
   a) In the **Select the profile for this share** wizard screen, click the **NFS Share - Advanced** profile, and then click **Next**.
   b) In the **Select the server and path for this share** wizard screen, specify where the file share will reside, and then click **Next**.

If...	Then...
you want the share to reside on a dedicated disk or partition within a folder in the **Shares** directory,	1. Click the **Select by volume** radio button. 2. Click the disk or partition you want to use.
you want to navigate to the location where the share will reside,	1. Click the **Type a custom path** radio button. 2. Click the text field to open the **Select Folder** dialog box. 3. Navigate to the folder where you want the share to reside. 4. Click **Select Folder**.

   c) In the **Specify share name** wizard screen, enter the share's name and then click **Next**.
   d) In the **Specify authentication methods** wizard screen, choose these options and then click **Next**:
      - **No server authentication (AUTH/SYS)**
      - **Enable unmapped user access**
      - **Allow unmapped user access by UID/GID**
   e) In the **Specify the share permissions** wizard screen, click **Add**.
   f) Complete these tasks in the **Add Permissions** dialog box, then click **Next**:
      1. Click **Add**.
      2. Set the host, client group, or netgroup that can access this share.
      3. In the **Share permissions** drop-down list, choose **Read/Write**.
      4. Check the **Allow root access (not recommended)** check box.

> **Note**
>
> The permissions rule for the built-in "All Machines" group cannot be removed. If you set this rule to "No Access," all NFS clients are blocked unless a specific 'host' rule matches the Catalyst Center source IP (or IPs, in the case of a 3-node cluster) with Read/Write access and is configured before the "All Machines" rule.

   g) Complete these tasks in the **Permissions** wizard screen, then click **Next**:
      1. Click **Customize permissions** to open the Advanced Security Settings for *share-name* dialog box.
      2. Click **Add** to open the Permission Entry for *share-name* dialog box.
      3. Click the **Select a principal** link to open the **Select User, Computer, Service Account, or Group** dialog box.

4. In the last text box, enter **Everyone** and then click **Check Names**. When **Everyone** is displayed, click **OK**.
5. In the **Basic permissions** area, select all available options (including **Full control**) and then click **OK**.
6. Repeat the previous two steps for the **Anonymous LOGON** user.

h) Click **Next** twice to skip the **Management Properties** and **Quota** wizard screens.
i) In the **Confirmation** wizard screen, click **Create**.

5. Secure the Windows NFS server:
   a) In Server Manager's main menu, choose **Tools** > **Windows Firewall with Advanced Security**.
   b) In the **Inbound Rules** table, there are two **Server for NFS** services (NFS-TCP-in and NFS-UDP-in). Complete these tasks for both services:
      1. Double-click a service to open its **Properties** dialog box.
      2. Click the **Scope** tab.
      3. In the **Remote IP address** section, restrict host access by entering the IP addresses configured for Catalyst Center (including the VIP for the NIC that interfaces with the Windows NFS server).
      4. Click **OK**.

Add the NFS server

Catalyst Center allows you to add multiple Network File System (NFS) servers for backup purposes.

Use this procedure to add an NFS server that can be used for the backup operation.

Procedure

1. From the main menu, choose **System** > **Settings** > **Backup Configuration**.
2. Click **Add NFS**.
3. In the **Add NFS** slide-in pane, complete these steps:
   a) Enter the **Server Host** and **Source Path** in the respective fields.
   b) Choose **NFS Version** from the drop-down list.
   c) The **Port** is added by default. You can leave the field empty.
   d) (Optional) Enter the **Port Mapper** number.
   e) Click **Save**.
4. Click **View NFS List** to view the available NFS servers.

   The **NFS** slide-in pane displays the list of NFS servers, along with details.
5. In the **NFS** slide-in pane, click the ellipsis under **Actions** to **Delete** the NFS server.

> **Note**
>
> You can delete the NFS server only when there is no backup job in progress.

What to do next

Configure the added NFS server for backup. For more information, see Configure the location to store backup files on page 220.

Configure the location to store backup files

Describes how to configure backups for automation and Assurance data.

Catalyst Center allows you to configure backups for automation and Assurance data.

Use this procedure to configure the storage location for backup files.

Before you begin

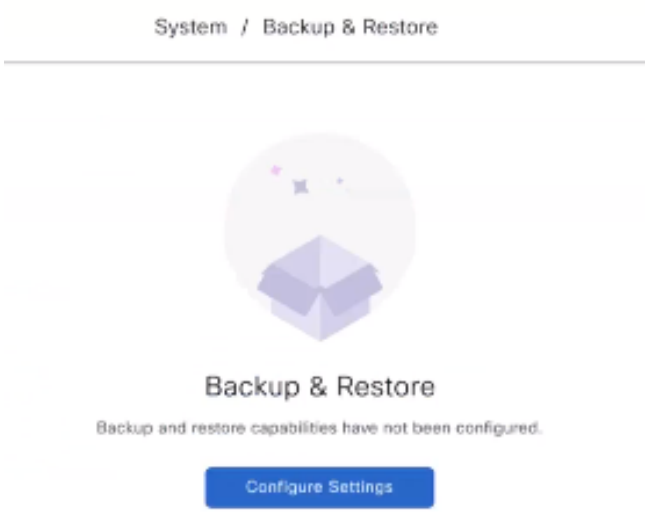
Make sure that the following requirements are met:

- Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure.
- The data backup server must meet the requirements described in Backup server requirements on page 210.

Procedure

1. From the main menu, choose **System** > **Backup and Restore**.

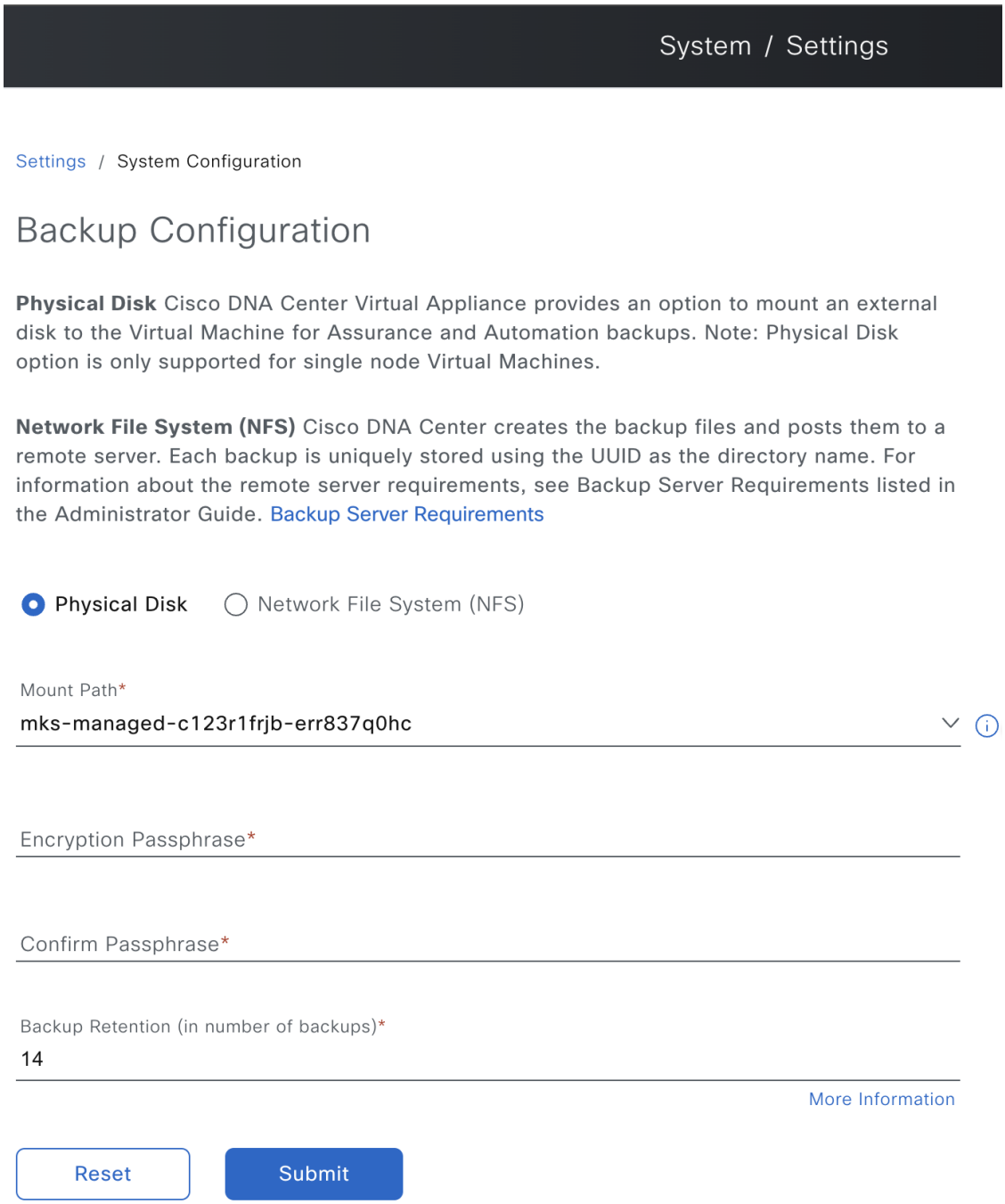
   You can view this window:



2. Click **Configure Settings**.

Alternatively, choose **System** > **Settings** > **System Configuration** > **Backup Configuration**.

3. Choose the **Physical Disk** or **NFS** server option.



4. **Physical Disk**: Catalyst Center provides an option to mount an external disk to the virtual machine, to store a backup copy of Assurance and automation data. To configure a physical disk, click the **Physical Disk** radio button and define these settings:

> **Note**
>
> The physical disk option is only supported for single-node virtual machines.

Field	Description
Mount Path	Location of the external disk.
Encryption Passphrase	Passphrase used to encrypt the security-sensitive components of the backup. These security-sensitive components include certificates and credentials. This passphrase is required, and you will be prompted to enter this passphrase when restoring the backup files. Without this passphrase, backup files are not restored. After the passphrase is configured, if you want to change the passphrase, click **Update Passphrase**.
Backup Retention	Number of backups for which the data is retained. Data older than the specified number of backups is deleted.

5. **NFS**: Catalyst Center creates the backup files and posts them to a remote NFS server. For information about the remote server requirements, see Backup server requirements on page 210. To configure an NFS backup server, click the **NFS** radio button and define these settings:

Field	Description
Mount Path	Location of the remote server.
Encryption Passphrase	Passphrase used to encrypt the security-sensitive components of the backup. These security-sensitive components include certificates and credentials. This passphrase is required, and you will be prompted to enter this passphrase when restoring the backup files. Without this passphrase, backup files are not restored. After the passphrase is configured, if you want to change the passphrase, click **Update Passphrase**.
Backup Retention	Number of backups for which the data is retained. Data older than the specified number of backups is deleted.

6. Click **Submit**.

   After the request is submitted, you can view the configured physical disk or NFS server under **System** > **Backup & Restore**.

Configure a remote SSH server

Add a remote SSH server for automation-only backups.

Use this procedure to configure a remote server for automation-only backups.

Note

Remote backup server support is available for automation-only backups.

Procedure

1. From the main menu, choose **System** > **System Configuration** > **Backup Configuration**.
2. On the **Backup Configuration** page, select **SSH (Remote Server)**, and then click **Add SSH**.
3. In the **Add SSH** slide-in pane, enter the remote SSH server details, and then click **Save**.
   a) In the **SSH IP Address** field, enter the IP address of the server.
   b) In the **SSH Port** field, enter the SSH port number.
   c) In the **Username** field, enter the user name for the server.
   d) In the **Password** field, enter the password for the server.
   e) In the **Server Path** field, enter the backup directory path.
4. On the **Backup Configuration** page, click **View SSH List** to confirm the server is successfully added.

   The **SSH List** slide-in pane displays the added server and its details.
5. On the **Backup Configuration** page, configure the server path for backup storage:
   a) Click **Refresh**.
   b) From the **Server Path** drop-down list, choose the server path.
   c) Click **Submit**.

The remote SSH server is configured and available for automation-only backups.

Create a backup

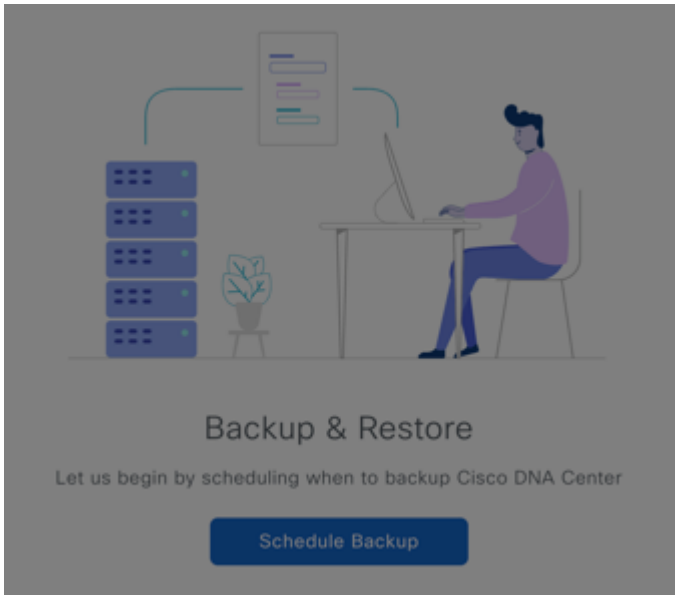
Describes the steps you need to complete to prepare your appliance for backup.

Use this procedure to create a backup of your appliance.

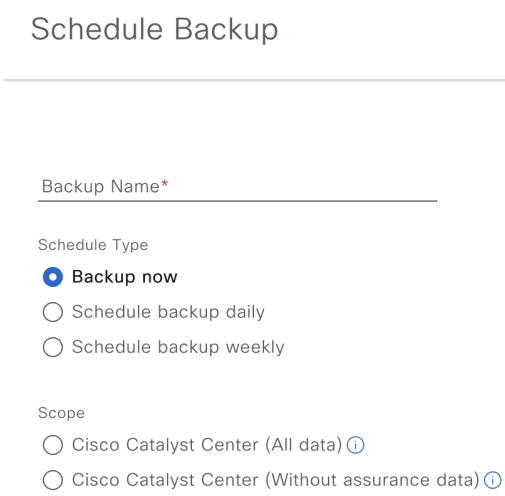
Before you begin
You must configure the backup location. For more information, see Configure the location to store backup files on page 220.

Procedure

1. From the main menu, choose **System** > **Backup & Restore**.
2. Click **Schedule Backup**.



The **Schedule Backup** slide-in pane opens.



Do the following in the **Schedule Backup** slide-in pane:

a. Enter a unique name for the backup.

b. In the **Schedule Type** area, choose one of the following options:

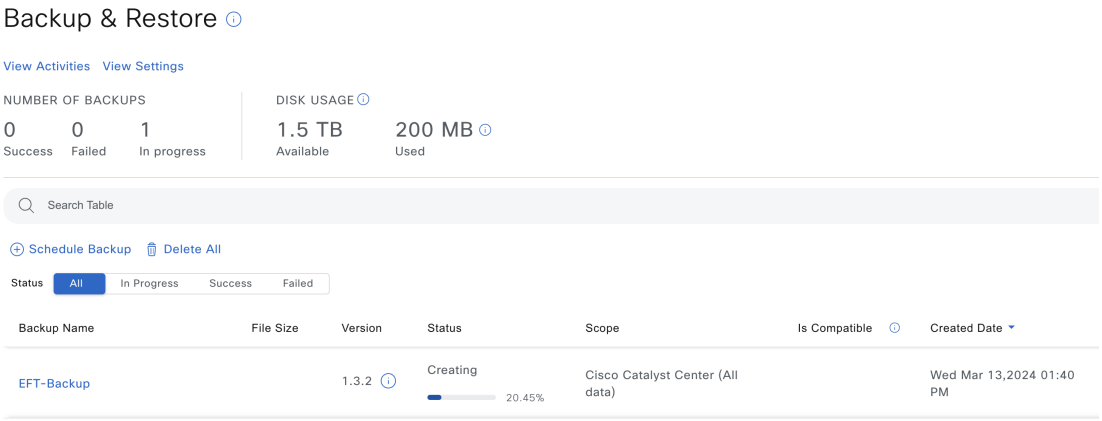
- **Backup Now**: To immediately create a backup.
- **Schedule Backup Daily**: To schedule the backup on a daily basis.
- **Schedule Backup Weekly**: To schedule the backup on a weekly basis.

c. In the **Scope** area, choose one of the following options:

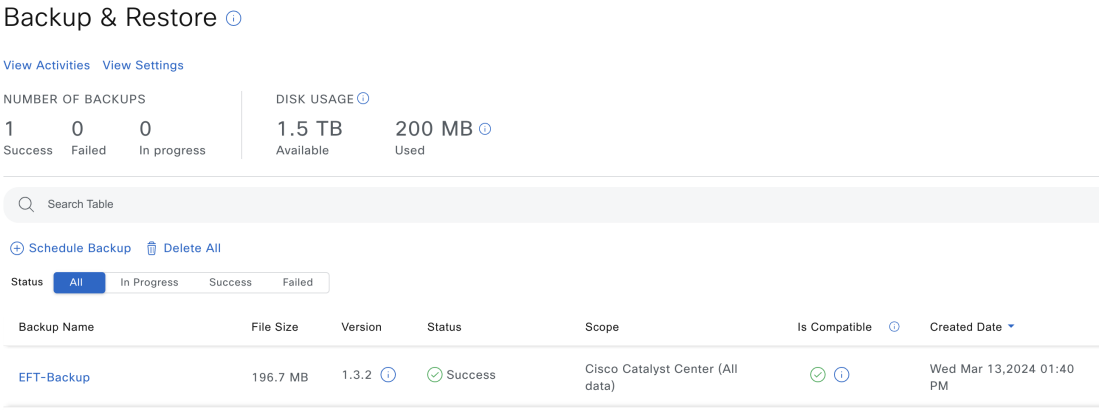
- **Cisco Catalyst Center (All Data)**: Choose this option to create a backup for automation and Assurance data.
- **Cisco Catalyst Center (Without Assurance Data)**: Choose this option to create a backup only for automation data.

d. Click **Save**.

3. Catalyst Center begins the backup process. An entry for the backup is added to the **Backup & Restore** window.



When the backup is complete, its status changes from `Creating` to `Success`.



Schedule data backup

Explains how to schedule recurring backups and define the day of the week and the time of day when they will occur.

Before you begin

Make sure that the following requirements are met:

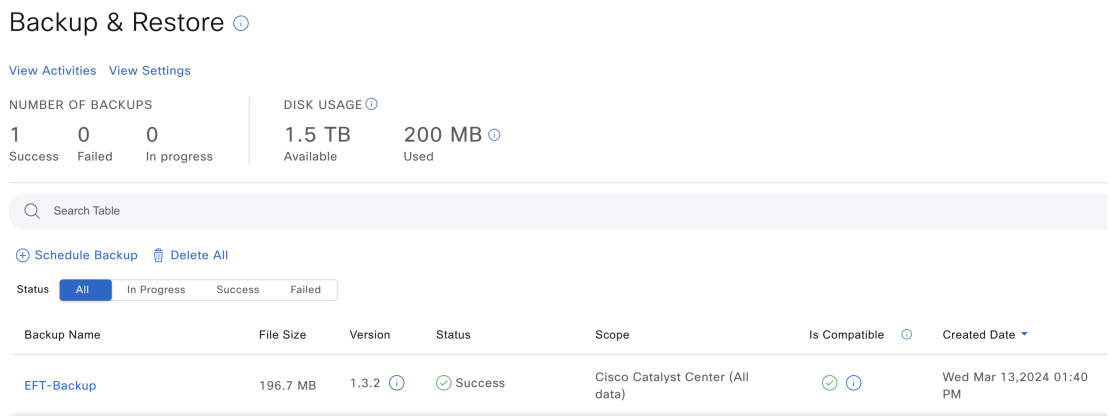
- Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure.
- The data backup server must meet the requirements described in Backup server requirements on page 210.
- Backup servers have been configured in Catalyst Center. For more information, see Configure the location to store backup files on page 220.

Procedure

1. From the main menu, choose **System** > **Backup & Restore**.
The **Backup & Restore** window is displayed.

2. Click **Schedule Backup**.

> **Note**
>
> You can schedule a new backup only when there is no backup job in progress.



3. In the **Schedule Backup** slide-in pane, do the following:
   a. In the **Backup Name** field, enter a unique name for the backup.
   b. Choose a schedule option:
      - **Schedule Backup Daily**: To schedule a daily backup job, choose the time of day when you want the backup to occur.
      - **Schedule Backup Weekly**: To schedule a weekly backup job, choose the days of the week and time of day when you want the backup to occur.
   c. Define the scope of the backup:
      - **Cisco Catalyst Center (All data)**: This option allows the system administrator to create a backup for automation, Assurance, and system-specific sets.
      - **Cisco Catalyst Center (without Assurance data)**: This option allows the administrator to create a backup for automation and system-specific sets.
   d. Click **Save**.

   The **Backup & Restore** window displays a banner message that shows the day and time for which the backup is scheduled.
4. Optional: Click **View Upcoming Backups** to make any changes to the upcoming schedules. If you don't want the backup to occur on a scheduled date and time, in the **Upcoming Schedules** slide-in pane, click the toggle button to disable a particular schedule.
5. Optional: Click **Edit Schedule** to edit the schedule.
6. Optional: Click **Delete Schedule** to delete the schedule.
7. After the backup starts, it appears in the **Backup & Restore** window. Click the backup name to view the lists of steps executed.

   Alternatively, you can click **View Activities** at the top left of the **Backup & Restore** window and click the **Execution ID**. The **Create Backup Details** slide-in pane opens and shows the list of steps executed.

8. In the **Backup & Restore** window, click the **In Progress**, **Success**, or **Failure** tab to filter the list of backups to show only those tasks with a status of In Progress, Success, or Failure.

   During the backup process, Catalyst Center creates the backup database and files. The backup files are saved to the specified location. You are not limited to a single set of backup files, but can create multiple backup files that are identified with their unique names. The status of the backup job changes from **In Progress** to **Success** when the process is finished.

   > **Note**
   >
   > If the backup process fails, there is no impact to the appliance or its database. The most common reason for a failed backup is insufficient disk space. If your backup process fails, make sure that there is sufficient disk space on the remote server and attempt another backup.

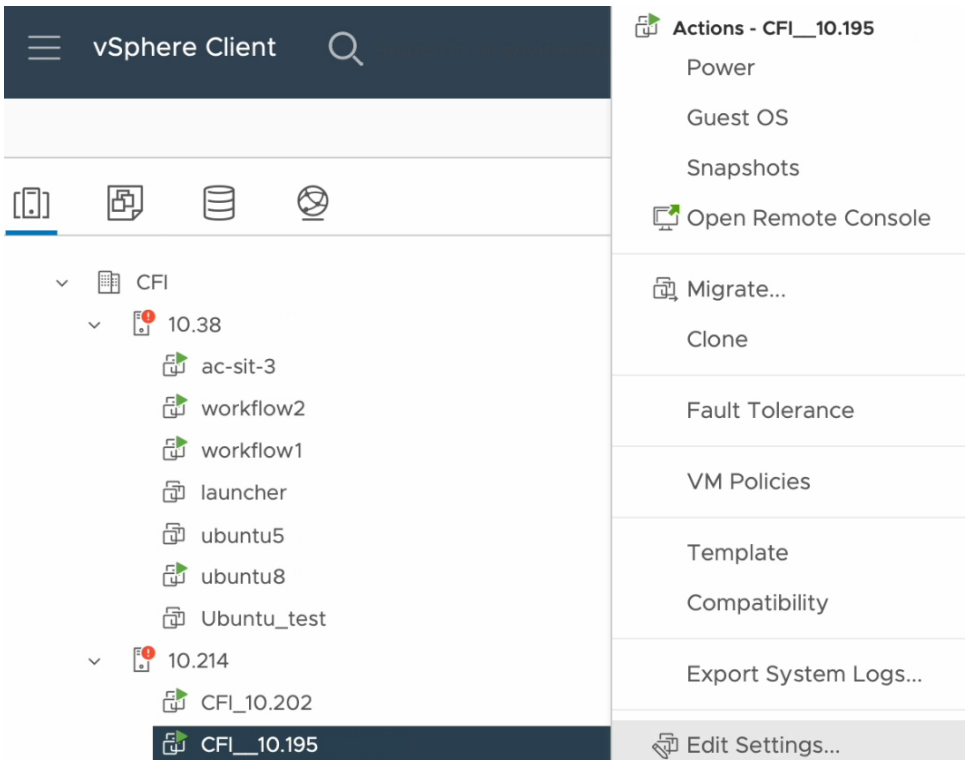
Add a physical disk for backup and restore

Details how to add a physical disk for backup and restore operations.

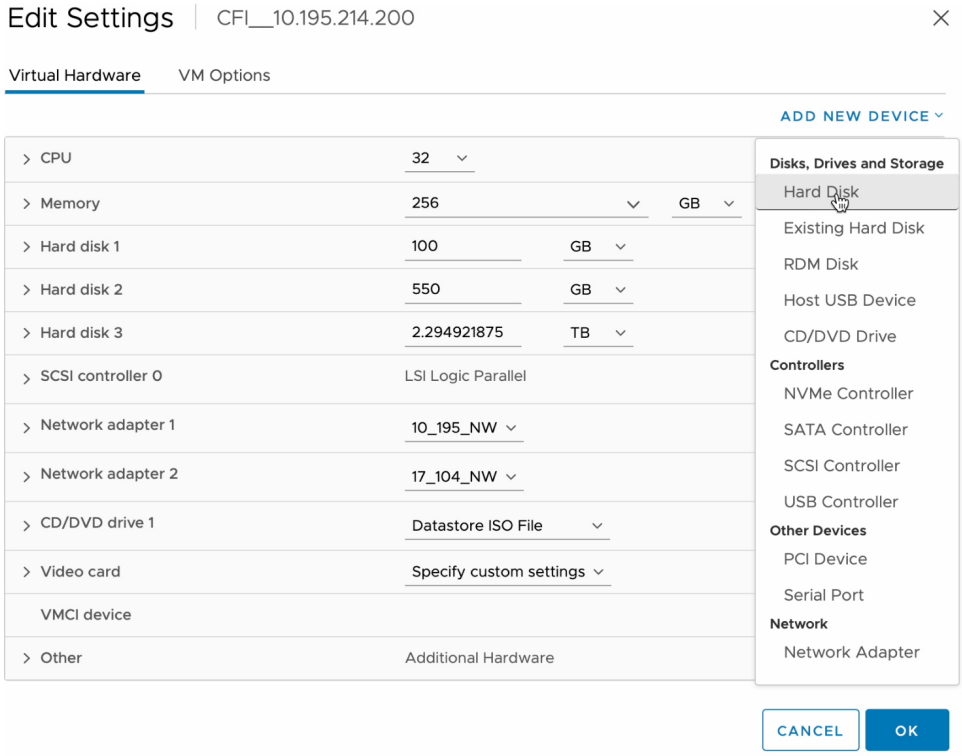
Use this procedure to add a physical disk that can be used for only Catalyst Center on ESXi backup and restore operations.

Procedure

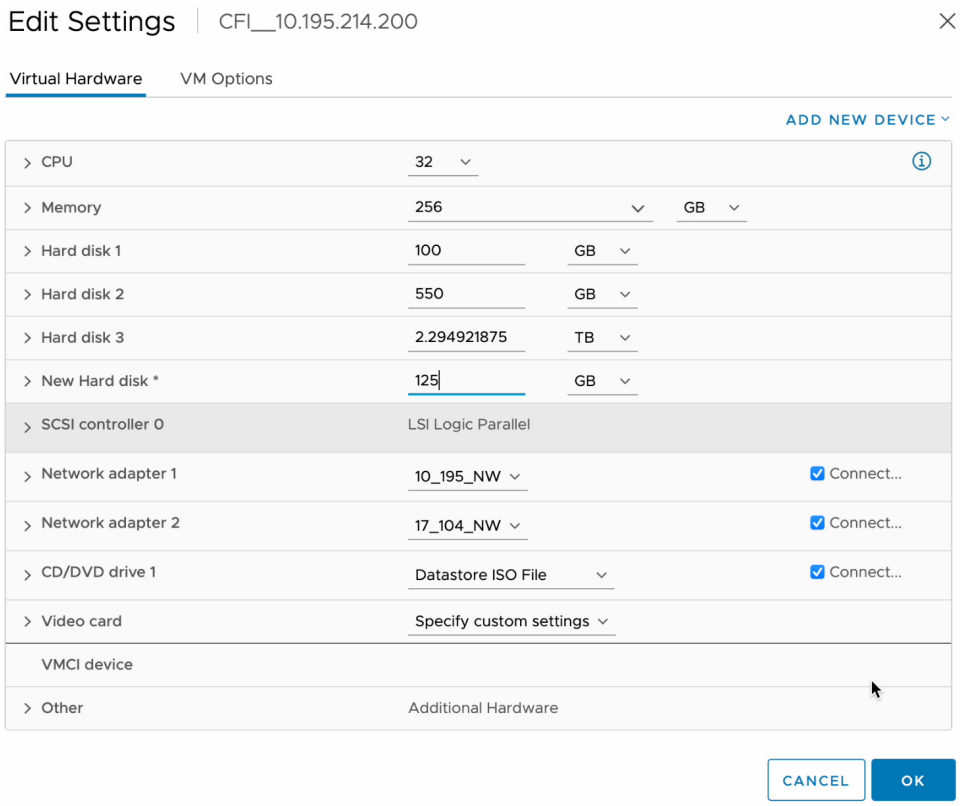
1. Power off the Catalyst Center on ESXi virtual appliance by shutting it down from a console session with the **sudo shutdown** command.
2. Log in to VMware vSphere and verify that it is powered off.
3. From the vSphere client left pane, right-click the ESXi host and then choose **Edit Settings**.



4. In the **Edit Settings** dialog box, click **Add New Device** and then choose **Hard Disk**.



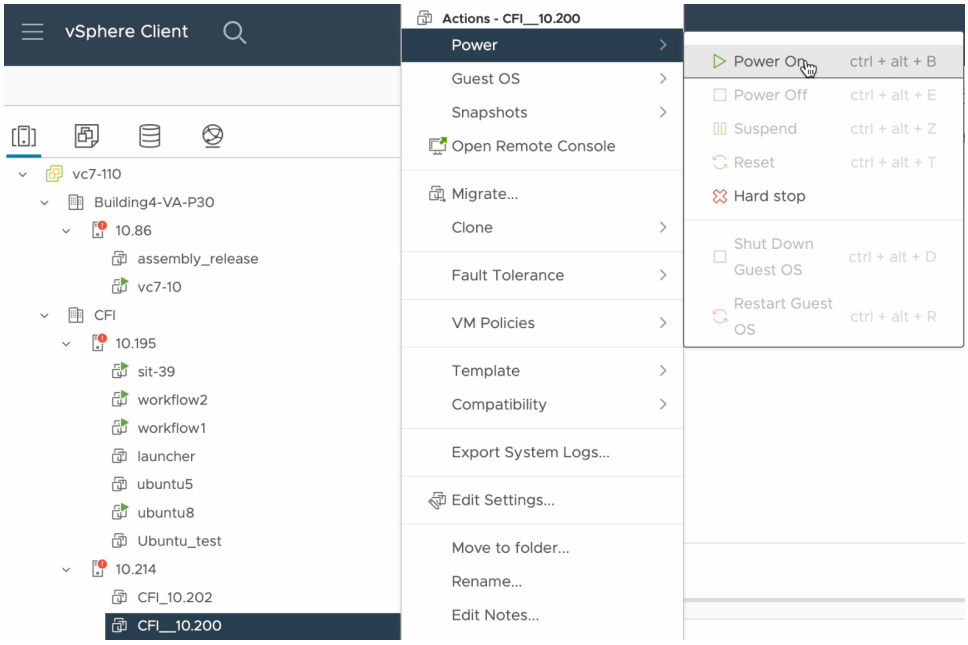
5. In the **New Hard disk** field, enter the desired storage size.



Note

For information on the recommended storage space for backup, see Backup storage requirements on page 211.

6. Click **OK**.
7. Power on the appliance's virtual machine.



What to do next

You can now configure the added physical disk for backup. For information on how to configure the physical disk, see Configure the location to store backup files on page 220.

Restore data from backups

Explains how to restore backup data from an NFS server.

Use this procedure to restore backup data from an NFS server.

> **Caution**
>
> The Catalyst Center restore process restores only the database and files. The restore process does not restore your network state or any changes that were made since the last backup, including any new or updated network policies, passwords, certificates, or trustpool bundles.

Before you begin

Make sure that the following requirements are met:

- Only a user with SUPER-ADMIN-ROLE permissions can perform this procedure.
- You have backups from which to restore data.

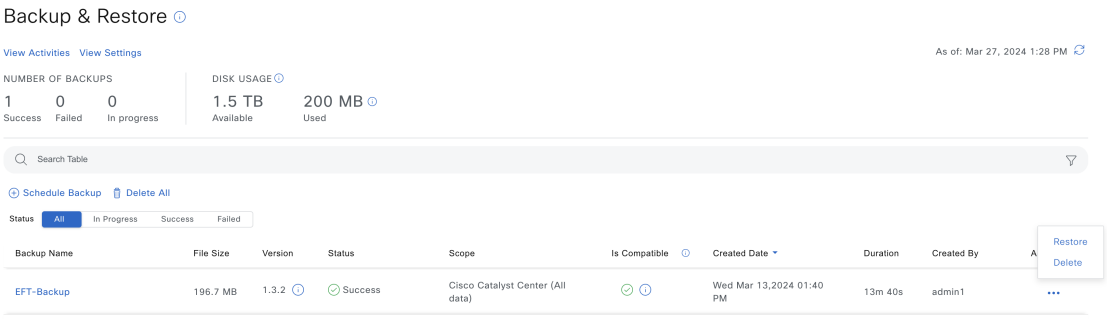
When you restore data, Catalyst Center enters maintenance mode and is unavailable until the restore process completes. Make sure that you restore data at a time when Catalyst Center can be unavailable.

Procedure

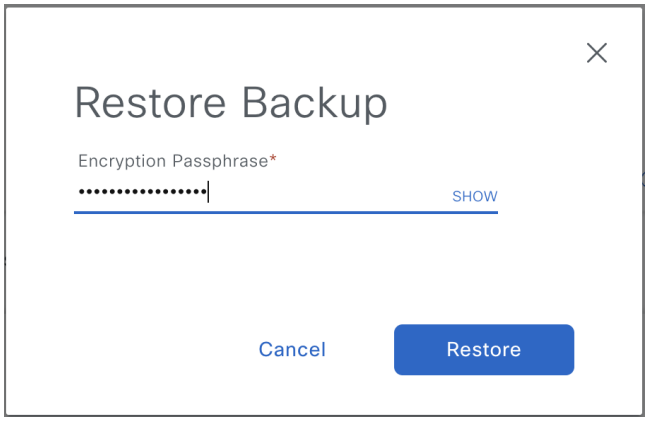
1. From the main menu, choose **System** > **Backup & Restore**.

   If you have created a backup, it appears in the **Backup & Restore** window.

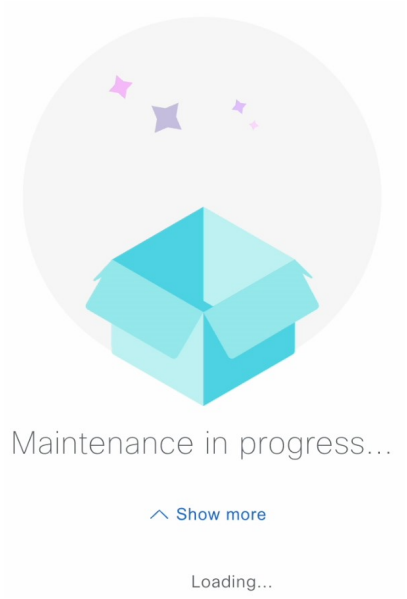
2. In the **Backup Name** column, locate the backup that you want to restore.
3. In the **Actions** column, click the ellipsis and choose **Restore**.



4. In the **Restore Backup** dialog box, enter the **Encryption Passphrase** that you used while configuring the backup location and click **Restore**.



The appliance goes into maintenance mode and starts the restore process.



When the restore operation is complete, its status in the **Backup & Restore** window table changes to `Success`.

5. After the restore operation completes, click **Log In** to log back in to Catalyst Center.
6. Enter the admin user's username and password, then click **Login**.

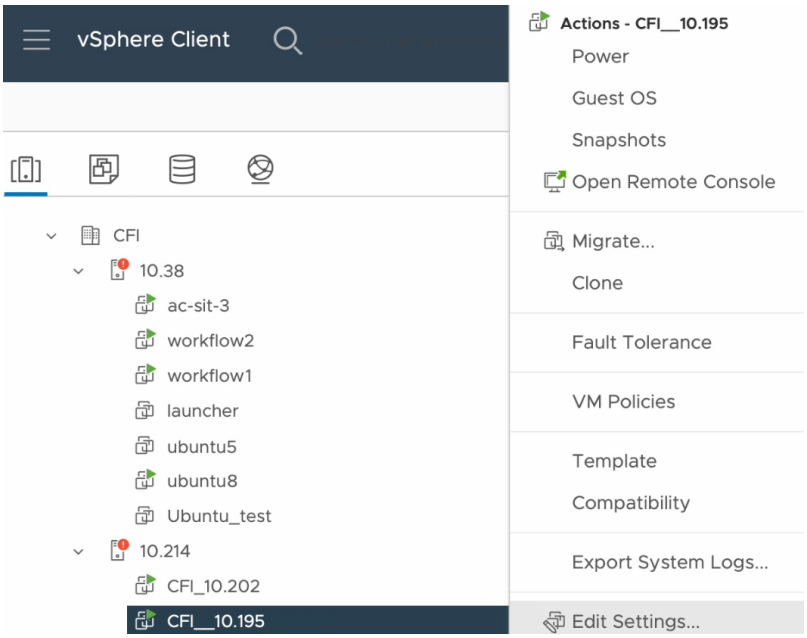
Restore data from a physical disk for a faulty virtual appliance

Describes the steps that you need to complete to prepare your faulty virtual appliance for restore operation using a physical disk

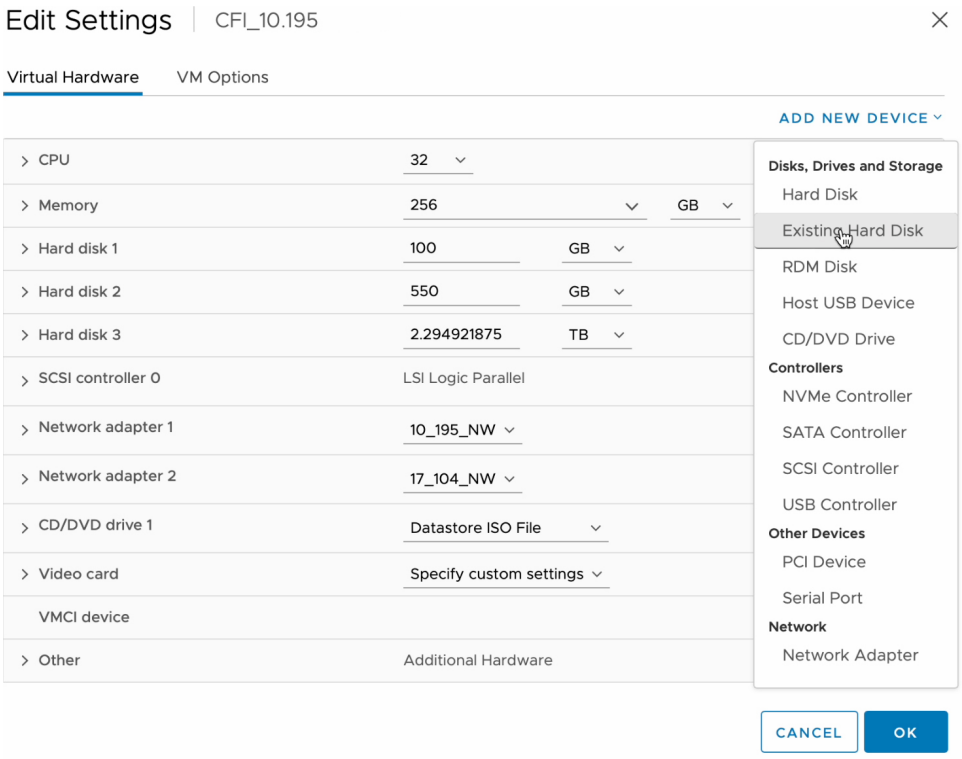
Use this procedure to restore data from a physical disk for a virtual appliance that has failed or is faulty.

Procedure

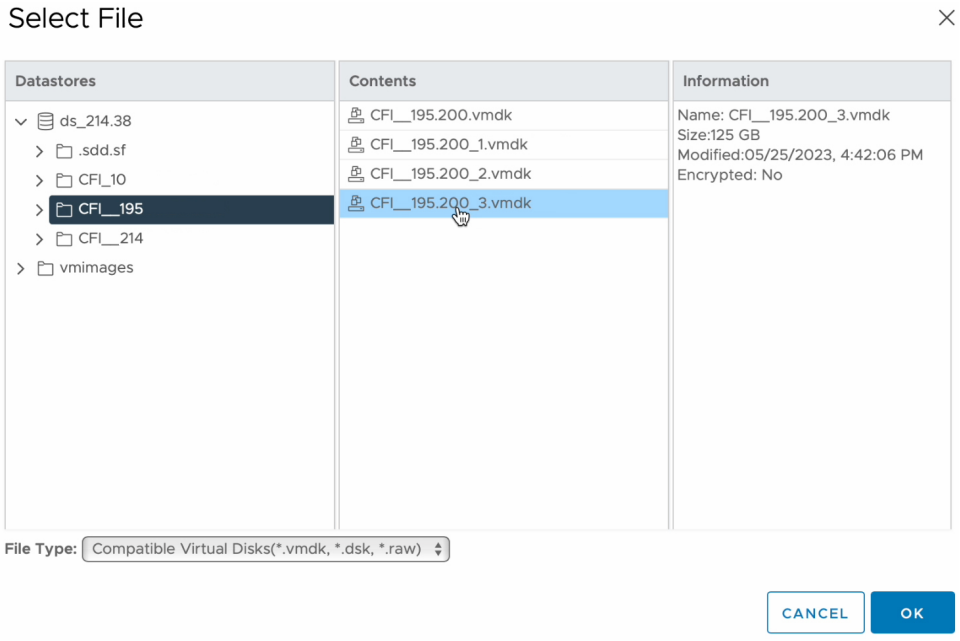
1. For your new virtual appliance, complete these steps to configure Catalyst Center to use the storage disk that you configured for the faulty virtual appliance:
   a. Power OFF the appliance's virtual machine.
   b. Open a vSphere Client, right-click the Catalyst Center virtual machine in the left pane, and then choose **Edit Settings**.



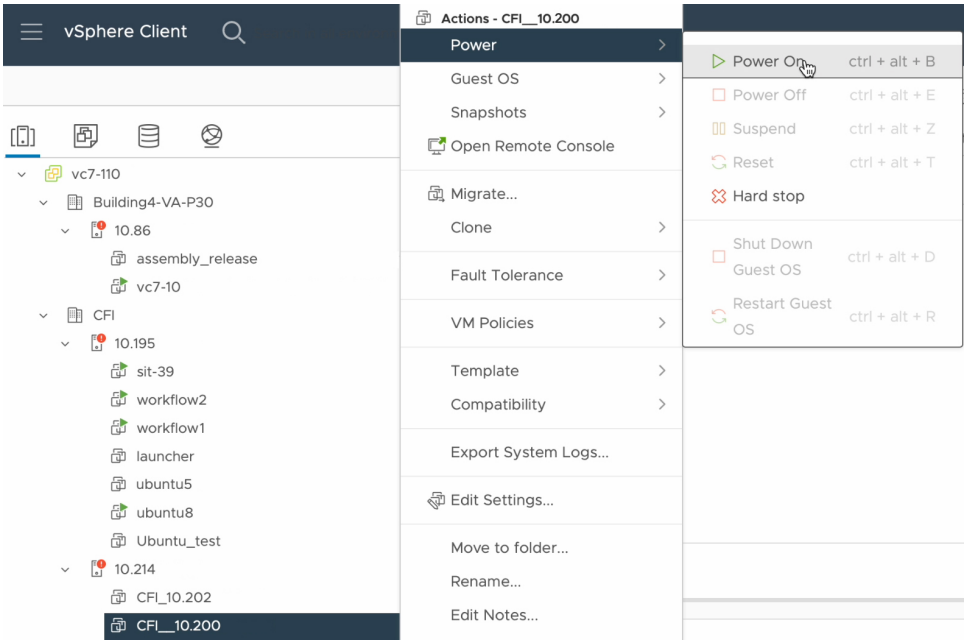
   c. In the **Edit Settings** dialog box, click **Add New Device** and then choose **Existing Hard Disk**.



d. In the **Select File** dialog box, click your ESXi host, click the storage disk (.vmdk) that was created, and then click **OK**.



e. Power on the appliance's virtual machine.

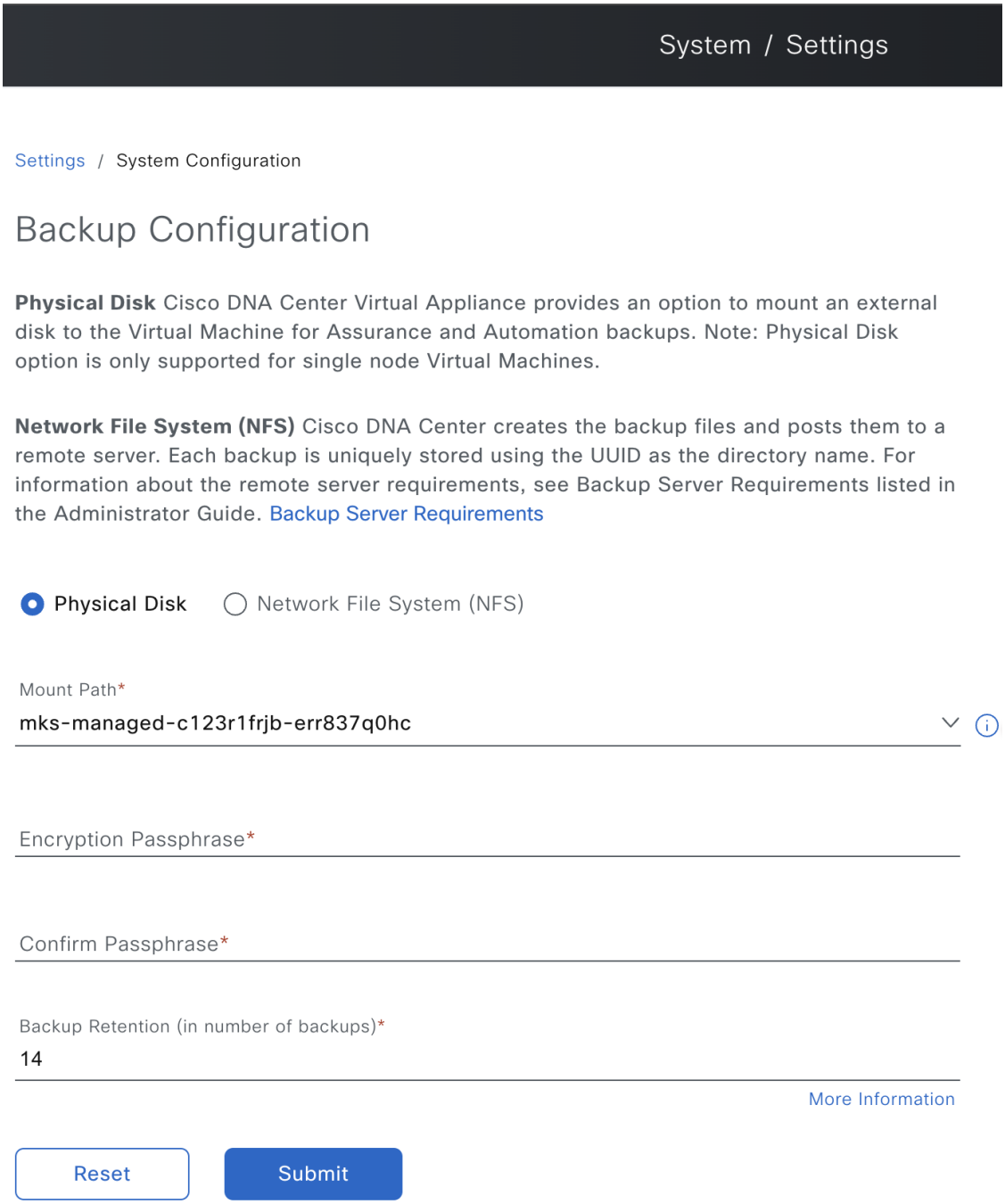


It takes approximately 45 minutes for all the services to restart.

Note

After the virtual machine comes back up, run the **magctl appstack status** command to confirm that the services are running.

2. To configure the storage location for the backup, complete these steps:
   a) From the Catalyst Center menu, choose **System** > **Settings** > **System Configuration** > **Backup Configuration**.
   b) Click the **Physical Disk** radio button.
   c) Choose the physical disk from the **Mount Path** drop-down list.



d) Enter the passphrase that will be used to encrypt the security-sensitive components of the backup (such as certificates and credentials).

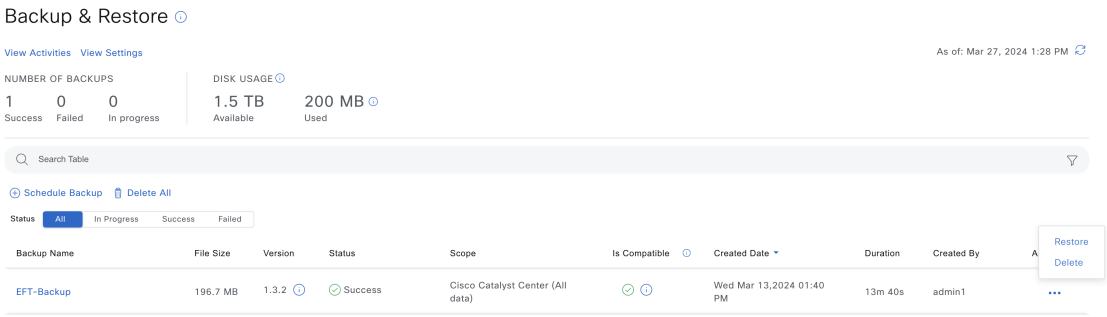
Important

Make sure that you don't lose this passphrase. You'll need to enter it later in the succeeding steps and won't be able to restore the backup you're about to create without it.

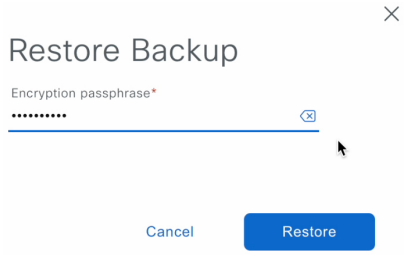
e) Set how long backup files are kept before they are deleted.

f) Click **Submit**.

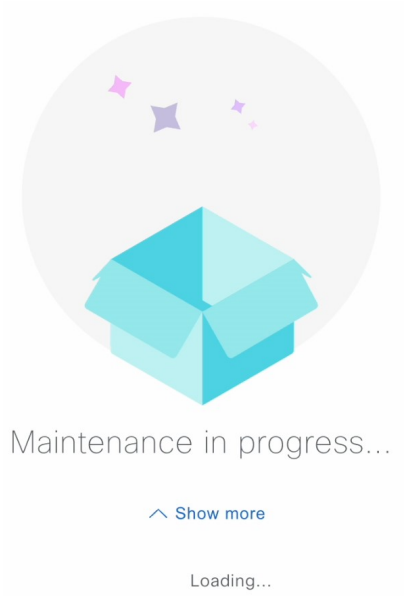
3. To restore the backup, complete these steps:
   a) From the Catalyst Center menu, choose **System** > **Backup & Restore**.
   b) Locate the backup in the **Backup & Restore** window, click the ellipsis under **Actions** column, and choose **Restore**.



   c) Enter the same encryption passphrase that you entered in the preceding step, and click **Restore**.



   The appliance goes into maintenance mode and starts the restore process.



   When the restore operation is complete, its status in the **Backup & Restore** window changes to `Success`.
   d) After the restore operation completes, click **Log In** to log back in to Catalyst Center.
   e) Enter the admin user's username and password, then click **Login**.

14 Implement Disaster Recovery

Topics:

- Overview
- Prerequisites
- Install the witness site
- Set up disaster recovery
- Pause your disaster recovery system
- Rejoin your system
- Failovers: an overview
- Deregister your system
- Disaster recovery system considerations
- Administer your disaster recovery system
- Disaster recovery event notifications
- Troubleshoot your disaster recovery system
- Upgrade Catalyst Center disaster recovery deployment

Information about implementing disaster recovery to safeguard against network downtime.

Overview

Information about disaster recovery on Catalyst Center.

Disaster recovery adds another layer of redundancy to safeguard against network downtime. It responds to a cluster failure by handing off network management duties to a connected cluster (referred to as a site going forward). Disaster recovery implementation on Catalyst Center consists of three components: the main site, the recovery site, and the witness site.

At any given time, the main and recovery sites are operating in either the active or standby role. The active site manages your network while the standby site maintains a continuously updated copy of the active site's data and managed services. Whenever an active site goes down, Catalyst Center automatically initiates a failover, completing the tasks necessary to designate the former standby site as the new active site.

These topics provide information about how to set up and use disaster recovery in your production environment.

Key terms

Information about the key terms to understand disaster recovery implementation on Catalyst Center.

Key terms for understanding disaster recovery implementation on Catalyst Center include:

- **Main Site**: The first site you configure when setting up your disaster recovery system. By default, it operates as the active site that manages your network. For information about how to configure the sites in your system, see Set up disaster recovery on page 251.
- **Recovery Site**: The second site you configure when setting up your disaster recovery system. By default, it acts as your system's standby site.
- **Witness Site**: The third site you configure when setting up your disaster recovery system. This site, which resides on a virtual machine or separate server, is not involved with the replication of data or managed services. Its role is to give the current active site the quorum it needs to carry out disaster recovery tasks. This situation is known as a split-brain event, which can occur in a two-member system when the sites cannot communicate with each other. Each site thinks it should become active, which results in two active sites. Catalyst Center uses the witness site to arbitrate between the active and standby sites, allowing only one active site at any given time. For information about witness site requirements, see Prerequisites on page 242.
- **Register**: To add a site to a disaster recovery system, you must first register it with the system by providing information such as your main site's VIP. When registering your recovery or witness site, you will also need to provide the token that is generated when you register your main site. For more information, see Set up disaster recovery on page 251.
- **Configure Active**: The process of establishing a site as the active site, which involves tasks such as exposing the appropriate managed service ports.
- **Active site**: The site that is currently managing your network. Catalyst Center continuously replicates its data to your standby site.
- **Configure Standby**: The process of establishing a site as the standby site, which involves tasks such as configuring the replication of the active site's data and disabling the services which manage the network on the standby site.
- **Standby Ready**: When an isolated site meets the prerequisites to become a standby site, Catalyst Center moves it to this state. To establish this site as your system's standby site, click **Rejoin** in the **Action** area.
- **Standby site**: The site that maintains an up-to-date copy of your active site's data and managed services. If your active site goes down, your system initiates a failover and your standby site takes over as the active site.

> **Note**
>
> A message will indicate when you are currently viewing your system's standby site. You need to initiate all disaster recovery tasks from the active site.

- **Failover**: Catalyst Center supports two types of failover:
  - System-triggered: As soon as your active site goes down, Catalyst Center detect this and automatically performs the tasks required to establish your standby site as the new active site. You can monitor these tasks from the Monitor the event timeline on page 278 .
  - Manual: You can initiate a manual failover to designate the current standby site as the new active site. For more information, see Initiate a manual failover on page 268.

> **Note**
>
> - After a failover, Assurance restarts and processes a fresh set of data on the new active site. Historical Assurance data from the former active site is *not* migrated over.
> - After a failover, the Catalyst Center inventory service triggers a full device sync. This can take anywhere from a few minutes to a few hours, depending on the number of devices that are managed. As is the case when Catalyst Center's normally scheduled device sync is running, you will not be able to provision devices on the newly activated cluster until the device sync triggered by a failover completes.

- **Isolate**: During a failover, the former active site is separated from the disaster recovery system. Catalyst Center suspends its services and stops advertising its virtual IP address (VIP). From here, Catalyst Center completes the tasks necessary to establish the former standby site as the new active site.
- **Pause**: Temporarily suspend your disaster recovery system in order to separate the sites that make up your system and stop data and service replication. For more information, see Pause your disaster recovery system on page 264.
- **Rejoin**: From the **Disaster Recovery** > **Monitoring** tab, click this button in the **Action** area in order to add a Standby Ready or Paused site back into a disaster recovery system as the new standby site (after a failover has taken place). You would also click this button in order to restart a disaster recovery system that is currently paused.
- **Activate DR**: User-initiated operation that creates your system's active and standby sites. This operation entails setting up intracluster communication, verifying that the sites meet disaster recovery prerequisites, and replicating data between the two sites.
- **Deregister**: Click this button in the **Action** area to remove the three sites you have configured for your disaster recovery system. You must do so in order to make changes to any of the site settings you have entered previously.
- **Retry**: In the **Action** area, click this button in order to reinitiate any action that failed previously.
- **VIP Promotion**: When this option is enabled, the Enterprise interface VIP configured for your Catalyst Center deployment is promoted for use as your system's disaster recovery VIP. For more information, see the "VIP Promotion" section in Main site registration considerations on page 251.

Data replication overview

Information about the data replication process on Catalyst Center.

The data replication process synchronizes data between your disaster recovery system's main site and recovery site. The duration of the data replication process depends on several factors. These factors include the amount of data to be replicated, the network's effective bandwidth, and the latency between the main and recovery sites. When disaster recovery is active for your Catalyst Center deployment, data replication does *not* affect operations or application use on the current active site, which manages your network.

Important

After a failover, Assurance data from the failed site is *not* replicated. The site that becomes the new active site collects a new set of Assurance data.

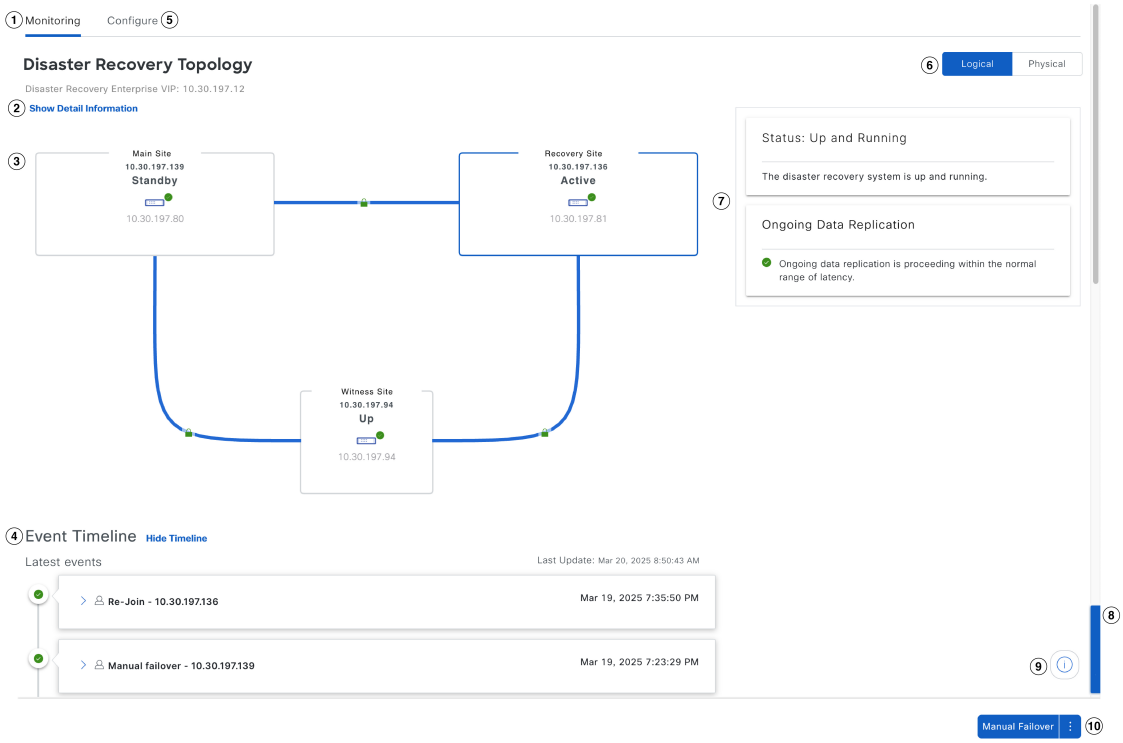
Either a full or incremental replication of data takes place, depending on which of these scenarios is applicable:

- **After initial activation**: After the initial configuration and activation of your disaster recovery system, the recovery site does not have any data. In this scenario, a full replication of data between the main and recovery sites happens.
- **After a failover**: Whenever the current active site fails, the disaster recovery system triggers a failover. In this scenario, a full data replication between the main and recovery sites occurs after the failed site rejoins the system.
- **During normal operation**: This scenario will typically apply to your system. During its daily operation, changes that take place on the current active site are continuously synced with the current standby site.

Navigate the disaster recovery GUI

Information about navigating the disaster recovery GUI on Catalyst Center.

The table describes the components that make up the disaster recovery GUI for Catalyst Center and their function.



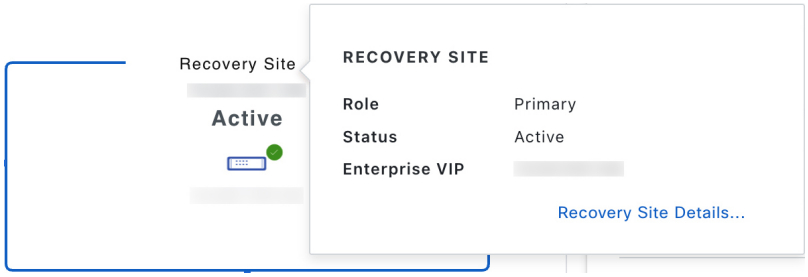
Callout	Description
1	**Monitoring** tab: Click to perform these actions: • View a topology of the sites that make up your system. • Determine the current status of your system. • Perform disaster recovery tasks. • View a listing of the tasks that have been completed to date.
2	**Show Detail Information** link: Click to open the **Disaster Recovery System** slide-in pane. See View disaster recovery system status on page 241 for more information.
3	**Topology**: Displays either a logical or physical topology of your system and indicates the current status of your sites and their members. • In both the logical and physical topologies, a blue box indicates the site that is currently acting as the active site for your system. • In the logical topology, a blue line shows that the IPSec tunnel linking two sites is operational, while a red line shows the tunnel is down. • To view a description of the possible site states, see System and site states on page 281.
4	**Event Timeline**: Lists all disaster recovery tasks that are in progress or completed for your system. For more information, see Monitor the event timeline on page 278.
5	**Configure** tab: Click to enter the settings necessary to establish a connection between the sites in your disaster recovery system. See Set up disaster recovery on page 251 for more information.
6	**Logical** and **Physical** tabs: Click the appropriate tab to toggle between a logical and physical topology of your system.
7	• **Status** area: Indicates the current status of your system. To view a description of the possible system states, see System and site states on page 281. • **Ongoing Data Replication** area: Indicates the replication status of GlusterFS, MongoDB, and Postgres data between the sites in your system. For more information, see Monitor managed services replication on page 280.
8	**Interactive Help** button: Click to open a slide-in pane that provides links to walkthroughs that provide on-screen guidance to help you complete specific tasks in Catalyst Center.
9	**Legend**: Indicates what the topology icons represent. To view the legend, click ⓘ in the bottom right corner of the **Disaster Recovery** window.
10	**Action** area: Displays the disaster recovery tasks you can initiate. Available tasks vary depending on your system's status and site configuration.

View disaster recovery system status

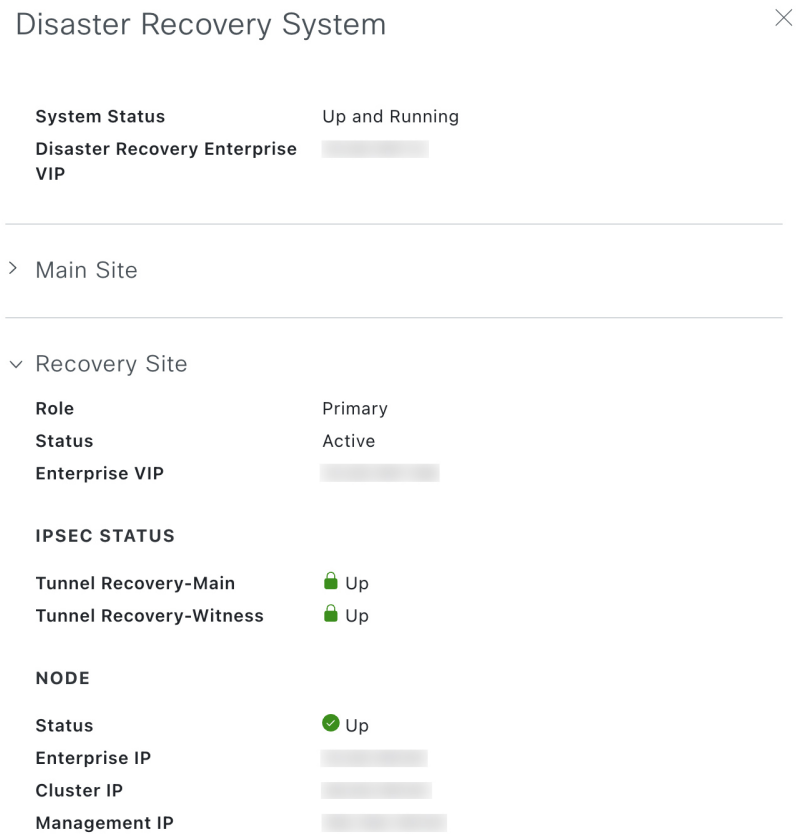
Information about viewing the disaster recovery system status.

The topology provides a graphical representation of the current status of your disaster recovery system. To view this information in a table, use the **Disaster Recovery System** slide-in pane. To open this pane, complete one of these tasks:

- Click the **Show Detail Information** link. Expand the site where you want to view the status in the slide-in pane.
- In the topology, place your cursor over the Enterprise virtual IP address of a site or the icon of a specific node. In the dialog box that opens, click the link in the bottom-right corner.



The slide-in pane opens and displays the relevant site information.



Prerequisites

Before you enable disaster recovery in your production environment, ensure that the prerequisites are met.

Witness Prerequisites

Important

- If you plan to upgrade to the latest Catalyst Center version, you must complete several steps to ensure that disaster recovery works properly after the upgrade. See Configure disaster recovery on an upgraded Catalyst Center appliance on page 247.

- Disaster recovery does not support IPv6.

General Prerequisites

- Catalyst Center supports two disaster recovery setups:
  - **1+1+1 setup**: One Catalyst Center appliance functions as your Main Site, a second appliance serves as your Recovery Site, and a third system (residing on a virtual machine) acts as your Witness Site. These appliances and versions support this setup:
    - DN2-HW-APL (44-core second-generation appliance): Catalyst Center 2.2.2.x and later
    - DN3-HW-APL (32-core third-generation appliance): Catalyst Center 2.3.7.6 and later
    - DN2-HW-APL-L (56-core second-generation appliance): Catalyst Center 2.2.1.x and later
    - DN3-HW-APL-L (56-core third-generation appliance): Catalyst Center 2.3.7.6 and later
    - DN2-HW-APL-XL (112-core second-generation appliance): Catalyst Center 2.2.1.x and later
    - DN3-HW-APL-XL (80-core third-generation appliance): Catalyst Center 2.3.7.6 and later
  - **3+3+1 setup**: One three-node Catalyst Center cluster functions as your Main Site, a second three-node cluster serves as your Recovery Site, and a third system (residing on a virtual machine) acts as your Witness Site. These appliances and versions support this setup:
    - DN2-HW-APL (44-core second-generation appliance): Catalyst Center 2.2.2.x and later
    - DN3-HW-APL (32-core third-generation appliance): Catalyst Center 2.3.7.6 and later
    - DN2-HW-APL-L (56-core second-generation appliance): Catalyst Center 2.1.2.x and later
    - DN3-HW-APL-L (56-core third-generation appliance): Catalyst Center 2.3.7.6 and later
    - DN2-HW-APL-XL (112-core second-generation appliance): Catalyst Center 2.1.2.x and later
    - DN3-HW-APL-XL (80-core third-generation appliance): Catalyst Center 2.3.7.6 and later
- You have configured a VIP for the Enterprise port interface on your Catalyst Center appliances. This is required because disaster recovery uses the Enterprise network for intrasite communication. In the Catalyst Center Appliance Installation guide, refer to these topics:
  - For more information about the Enterprise port, see the "Interface Cable Connections" topic.
  - For more information about Enterprise port configuration, see either the "Configure the Primary Node Using the Maglev Wizard" or "Configure the Primary Node Using the Advanced Install Configuration Wizard" topic.
- You have assigned a super-admin user to carry out disaster recovery tasks. Only users with this privilege level can access this functionality.
- You have confirmed that the links connecting the following sites are 1 Gbps with at most 350 ms RTT latency.
  - Main and recovery sites
  - Main and witness sites
  - Recovery and witness sites

> **Note**
>
> Although a one Gbps link is recommended for connections with the witness site, the actual bandwidth the witness site uses is 50 Mbps. As long as the link speed is faster than this, you should not encounter any issues.

- The disaster recovery IPSec certificates installed on both the main and recovery sites should be signed by the same Root CA. Otherwise, site registration and rejoins fail.

> **Note**
>
> Catalyst Center copies this certificate to the witness site automatically during the registration process.

  Ensure that all of the IP addresses (especially the Enterprise port virtual IP address) and fully qualified domain names (**FQDN**) that the main and recovery sites use are included in this certificate. Also ensure that **digitalSignature** is specified for the certificate **keyUsage** parameter. For a description of how to generate a third-party certificate, see Generate a Certificate Request Using Open SSL in the *Catalyst Center Security Best Practices Guide*.

- You have opened all of the ports listed in the Catalyst Center Security Best Practices Guide's "Disaster Recovery Ports" topic.
- If you are using an FQDN-only certificate, ensure that the same **cluster_hostname**—that is, the FQDN for Catalyst Center (set in the Catalyst Center configuration wizard)—is configured on both the main and recovery sites, as well as Disaster Recovery VIP.
- If your network resides behind a firewall, enable ICMP on the firewall. Catalyst Center periodically sends an ICMP ping to track connectivity between a disaster recovery system main, recovery, and witness sites.

Main and Recovery Site Prerequisites

- Both your main and recovery site must consist of the same number of nodes. Catalyst Center does not allow you to register and activate a disaster recovery system that does not meet this requirement.
- Both your main and recovery site must consist of Catalyst Center appliances that have the same hardware profile. For example, a site can consist of second-generation 112-core and third-generation 80-core appliances. This table lists the appliances that support disaster recovery and their corresponding Cisco part number:

Table 13: Supported Catalyst Center appliances

Machine Profile	Machine Profile Alias	Cisco Part Number	Number of Cores
medium	medium	First-generation: • DN1-HW-APL • DN1-HW-APL-U (promotional) Second-generation: • DN2-HW-APL • DN2-HW-APL-U (promotional) Third-generation: DN3-HW-APL	44 32
t2_large	large	Second-generation: • DN2-HW-APL-L • DN2-HW-APL-L-U (promotional) Third-generation: DN3-HW-APL-L	56
t2_2xlarge	extra large	Second-generation: • DN2-HW-APL-XL • DN2-HW-APL-XL-U (promotional) Third-generation: DN3-HW-APL-XL	112 80

Also ensure that your main and recovery site are running the same Catalyst Center version.

- Catalyst Center 2.3.7.9 and later support mixed three-node clusters that have HA enabled. A valid mixed cluster meets these requirements:
  - It consists of second- and third-generation Catalyst Center appliances. First-generation appliances are not supported.
  - Its three appliances have the same machine profile. For example, a cluster with two second-generation large appliances and one third-generation large appliance is a valid mixed cluster.
- You have configured and enabled high availability (HA) on both your main and recovery site. Otherwise, the registration of these sites fails. For more information, see the latest Catalyst Center High Availability guide.

  Important

  This is applicable to three-node setups only.

- Ensure that the main and recovery site have the same Federal Information Processing Standards (FIPS) mode setting. If FIPS mode is enabled on one site and disabled on the other, the registration of your disaster recovery system fails because of a validation error. For more information on FIPS mode, see the description of the **IP addressing mode**

used for the services screen (located in the Catalyst Center Appliance Installation guide's "Configure the Primary Node Using the Maglev Wizard" topic).

- If you want to use Border Gateway Protocol (BGP) to advertise your system's virtual IP address routes, you need to configure your system's Enterprise virtual IP address on each of the main and recovery site's neighbor routers. The configuration you need to enter will look similar to one the following examples:

  Interior BGP (iBGP) Configuration Example

  ```
  router bgp 64555
   bgp router-id 10.30.197.57
   neighbor 172.25.119.175 remote-as 64555
   neighbor 172.25.119.175 update-source 10.30.197.57
   neighbor 172.25.119.175 next-hop-self
  ```

  where:

  - `64555` is the neighbor router local and remote AS number.
  - `10.30.197.57` is the neighbor router IP address.
  - `172.25.119.175` is your system Enterprise virtual IP address.

  Exterior BGP (eBGP) Configuration Example

  ```
  router bgp 62121
   bgp router-id 10.30.197.57
   neighbor 172.25.119.175 remote-as 64555
   neighbor 172.25.119.175 update-source 10.30.197.57
   neighbor 172.25.119.175 next-hop-self
   neighbor 172.25.119.175 ebgp-multihop 255
  ```

  where:

  - `62121` is the neighbor router local AS number.
  - `64555` is the neighbor router remote AS number.
  - `10.30.197.57` is the neighbor router IP address.
  - `172.25.119.175` is your system Enterprise virtual IP address.

- If you enable BGP route advertisement (as described in the previous bullet), we recommend that you filter routes towards Catalyst Center in order to improve its performance. To do so, enter this configuration:

  ```
  neighbor system's-Enterprise-virtual-IP-address route-map DENY_ALL out
  !
  ip prefix-list DENY_ALL seq 5 deny 0.0.0.0/0 le 32
  !
  route-map DENY_ALL permit 10
  match ip address prefix-list DENY_ALL
  ```

Witness Site Prerequisites

- You have confirmed that the virtual machine that hosts your witness site is running (at a minimum) VMware ESXi hypervisor version 7.0 or later with a 2.1-GHz core and two virtual CPUs, 4 GB of RAM, and 15 GB of hard disk space.
- Confirm that the hostname of the witness site's VM contains a maximum of 20 characters. Configuration of the witness site and disaster recovery system might fail if the witness site's hostname exceeds this limit.
- Witness site deployment in a public cloud is not supported.

- You have set up your witness site in a different location than your main and recovery sites and confirmed that it is reachable from both of these sites.
- You have configured an NTP server that is accessible by the witness site. You must synchronize this NTP server with the NTP servers that are used by the main and recovery sites.
- The witness site utilizes approximately 50 Mbps of actual bandwidth. This bandwidth is used primarily to monitor connections, including WAN, LAN, and private circuits, between the witness site and the primary or standby sites.

Certificate Prerequisites

- The disaster recovery IPSec certificates installed on both the main and recovery sites should be signed by the same Root CA. Otherwise, site registration and rejoins fail.

  Note

  Catalyst Center copies this certificate to the witness site automatically during the registration process.

  Ensure that all of the IP addresses (especially the Enterprise port's virtual IP address) and fully qualified domain names (**FQDN**) that the main and recovery sites use are included in this certificate. Also ensure that **digitalSignature** is specified for the certificate's **keyUsage** parameter. For a description of how to generate a third-party certificate, see Generate a Certificate Request Using Open SSL in the *Catalyst Center Security Best Practices Guide*.
- In the certificates installed on the main and recovery sites, make sure that the first non-wildcard DNS name specified in each certificate match. If you use the same certificate for Catalyst Center, confirm that its certificate's first non-wildcard DNS name also matches.
- If you are using an FQDN-only certificate, ensure that the same **cluster_hostname**—that is, the FQDN for Catalyst Center (set in the Catalyst Center configuration wizard)—is configured on both the main and recovery sites, as well as Disaster Recovery's VIP.

Configure disaster recovery on an upgraded Catalyst Center appliance

Information about configuring disaster recovery after upgrading Catalyst Center.

To successfully configure disaster recovery after upgrading your system to the latest Catalyst Center version, complete these steps:

Procedure

1. Install the witness site on page 249.
2. Set up disaster recovery on page 251.

Add the disaster recovery certificate

Catalyst Center supports the import and storage of an X.509 certificate and private key into Catalyst Center. The disaster recovery certificate is used for intracluster communications.

Catalyst Center supports the import and storage of an X.509 certificate and private key into Catalyst Center. Use the disaster recovery certificate for communications between clusters.

You must obtain a valid X.509 certificate that is issued by your internal CA. Ensure that your certificate matches the private key in your possession.

Note

- If you want your disaster recovery system to use the same certificate that Catalyst Center uses, you can skip this procedure. When you configure the certificate, select the **DR** check box (see Update the Catalyst Center server certificate on page 27).
- For more information about the disaster recovery certificate requirements, reference the Security Best Practices Guide.

Procedure

1. From the main menu, choose **System** > **Settings** > **Certificates** > **System Certificates**.
2. Click **+ New Certificate Request (CSR)**.
3. Choose the file format type for the certificate that you are importing into Catalyst Center:
   - **PEM**: privacy-enhanced mail file format
   - **PKCS**: public-key cryptography standard file format
4. If you chose **PEM**, perform these tasks:
   a) Import the certificate by dragging and dropping the PEM file into the highlighted area.

   Note

   A PEM file must have a valid PEM format extension (.pem). The maximum file size for the certificate is 10 MB.

   After the upload succeeds, the system validates the certificate.

   b) In the **Private Key** area, import the private key by dragging and dropping it into the highlighted area.

   Note

   Private keys must have a valid private key format extension (.key). The maximum file size for the private key is 10 MB.

   After the upload succeeds, the private key is validated.

   c) Specify whether the private key will be encrypted by clicking the appropriate radio button.
   d) If the private key will be encrypted, enter its password in the **Password** field.
5. If you chose **PKCS**, do these tasks:
   a) Import the certificate by dragging and dropping the PKCS file into the highlighted area.

> **Note**
>
> A PKCS file must have a valid PKCS format extension (.pfx or .p12). The maximum file size for the certificate is 10 MB.
>
> After the upload succeeds, the system certificate is validated.

b) In the **Password** field, enter the certificate's password (a PKCS requirement).
c) Specify whether the private key will be encrypted by clicking the appropriate radio button.
d) If the private key will be encrypted, enter its password in the **Password** field.

6. Click **Save**.

   After the SSL certificate on the Catalyst Center server is replaced, you are automatically logged out. You must log in again to continue.

Install the witness site

Information about setting up a virtual machine that serves as the witness site for the disaster recovery system on Catalyst Center.

Complete this procedure to set up the virtual machine to serve as the witness site for your disaster recovery system.

Procedure

1. Download the OVF package that's specific to the Catalyst Center version that the witness site is running:
   a) Open https://software.cisco.com/download/home/286316341/type.

   > **Note**
   >
   > You need a Cisco.com account to access this URL. See the following page for a description of how to create an account: https://www.cisco.com/c/en/us/about/help/registration-benefits-help.html

   b) In the **Select a Software Type** area, click the Catalyst Center software link.

      The **Software Download** page updates, listing the software available for the latest Catalyst Center release.

   c) Do one of these:
      - If the OVF package (*.ova) you need is already listed, click its **Download** icon.
      - Enter the relevant version number in the **Search** field, click its link in the navigation pane, and then click the **Download** icon for that version's OVF package.

2. Copy this package to a local machine running VMware vSphere 7.0 or later.
3. From the vSphere client, choose **File** > **Deploy OVF Template**.
4. Complete the **Deploy OVF Template** wizard:

a) Follow the instructions in the **Source** screen:

1. Click **Browse**.
2. Navigate to the witness site OVF package (.ova).
3. Click **Open**.
4. In the **Deploy from a file or URL** field, verify that the package path displays and then click **Next**.

   The **OVF Template Details** screen opens.

b) Click **Next >**.

c) Following the instructions in the **Name and Location** screen:

- In the **Name** field, enter the name you want to set for the package.
- In the **Inventory Location** field, select the folder that you want the package to reside in.
- Click **Next >**.

The **Host/Cluster** screen opens.

d) Click the host or cluster on which you want to run the deployed template and then click **Next >**.

The **Storage** screen opens.

e) Click the storage drive for the virtual machine files to reside on and then click **Next >**.

The **Disk Format** screen opens.

f) Click the **Thick Provision** radio button and then click **Next**.

g) Follow the instructions in the **Network Mapping** screen and then click **Next**:

1. Click the IP address that is listed in the **Destination Networks** column.
2. In the resulting drop-down list, choose the network that the deployed template should use.

The **Ready to Complete** screen opens, displaying all of the settings that you have entered.

h) Check the **Power on after deployment** check box and then click **Finish**.

i) When the **Deployment Completed Successfully** dialog box opens, click **Close**.

5. Enter the network settings for your witness site:

a) Open a console to the virtual machine you just created by doing one of these tasks:

- Right-click the virtual machine from the vSphere Client list and choose **Open Console**.
- Click the **Open Console** icon in the vSphere Client menu.

The **Witness User Configuration** window opens.

b) Enter and confirm the desired password for the admin user (*maglev*), then press **N** to proceed.

c) Enter these settings, then press **N** to proceed:

- Its IP address
- The netmask associated with the virtual machine IP address
- The IP address of your default gateway
- **(Optional)** The IP address of the preferred DNS server

d) Enter one or more NTP server addresses or hostnames (separated by spaces), then press **S** to submit your settings and begin the configuration of the witness site.

At least one NTP address or hostname is required.

e) Verify that configuration has completed by using SSH port 2222 to log in to the IP address you configured for the witness site.

> **Note**
>
> Later, if you need to change the password configured for the **maglev** user on the witness site's VM, use the standard Linux **passwd** utility. You don't need to pause the disaster recovery system before doing this, and the password change will have no functional impact on disaster recovery operation.

Set up disaster recovery

Provides a quick overview of the disaster recovery setup process.

Setting up disaster recovery in your Catalyst Center deployment is a two-step process. The first step is to register the sites that will comprise your disaster recovery system. The second step is to activate your system, enabling disaster recovery. Refer to this section's topics for a description of the steps you need to complete, as well as information on the errors you may encounter during this process and how to deal with them.

Main site registration considerations

Describes VIP promotion and route advertisement. Also provides information to help you decide whether your disaster recovery system will use these two features.

Before you register your disaster recovery system's main site, you'll need to decide how to make use of the following features.

VIP Promotion

You'll need to decide whether you want to use the Enterprise interface VIP configured for your Catalyst Center deployment as your system's disaster recovery VIP. VIP promotion is suitable only if all of these items are applicable:

- You have a brownfield deployment, where an existing Catalyst Center instance is managing the network and all devices are configured with the instance's Enterprise VIP. This instance will act as your disaster recovery system's main site.
- The existing Enterprise interface VIP address is allowed to float between the two data centers where your main and recovery sites will reside. This is usually applicable in the case of an extended L2 network that spans multiple data centers.
- You don't want the existing devices to be reconfigured when the new disaster recovery system's Enterprise interface VIP.

If you want to use VIP promotion, complete Steps 2b through 2e in Register the main site on page 252, clicking the **Yes** radio button in Step 2b.

Route Advertisement Options

You'll then need to decide the route advertisement option your deployment will use. One of disaster recovery's main objectives is to enable continuous network operation after a failover takes place without the need for device reprovisioning. This is achieved by specifying a floating VIP that's automatically configured on the disaster recovery system's current active site. Whenever a failover occurs, this VIP (referred to as the disaster recovery VIP in this chapter) is cleared from the previous active site and set on the new active site. This ensures that your network's devices can continue to

communicate with Catalyst Center, regardless of which site is currently active. There are three route advertisement option to choose from when you complete Step 2g in Register the main site on page 252:

- **Border Gateway Protocol (BGP)**: This option, which is recommended for most disaster recovery systems, is selected by default. BGP route advertisement ensures that you can access your system's current active site, which is critical after a failover takes place.

  Important

  - If you want to use this option, first complete the steps described in the last two bullets of the "Main and Recovery Site Prerequisites" section (which can be found in the Prerequisites on page 242 topic).
  - The peer router must use BGP. Beyond the peer router, you can use any IGP protocol such as OSPF and EIGP.

- **Disaster recovery VIPs without route advertisement**: Choose this option if you want to configure virtual IP addresses for your system whose routes are not advertised using BGP. This option is suitable for data centers where both the main and recovery sites can access the subnet that the system's global virtual IP addresses reside within.
- **No disaster recovery VIPs**: When this option is selected, the virtual IP address that's configured for a site is automatically configured on the devices that belong to that site. Each time a failover takes place, this virtual IP address is reconfigured on the devices.

Register the main site

Learn how to register the main cluster site for the disaster recovery system.

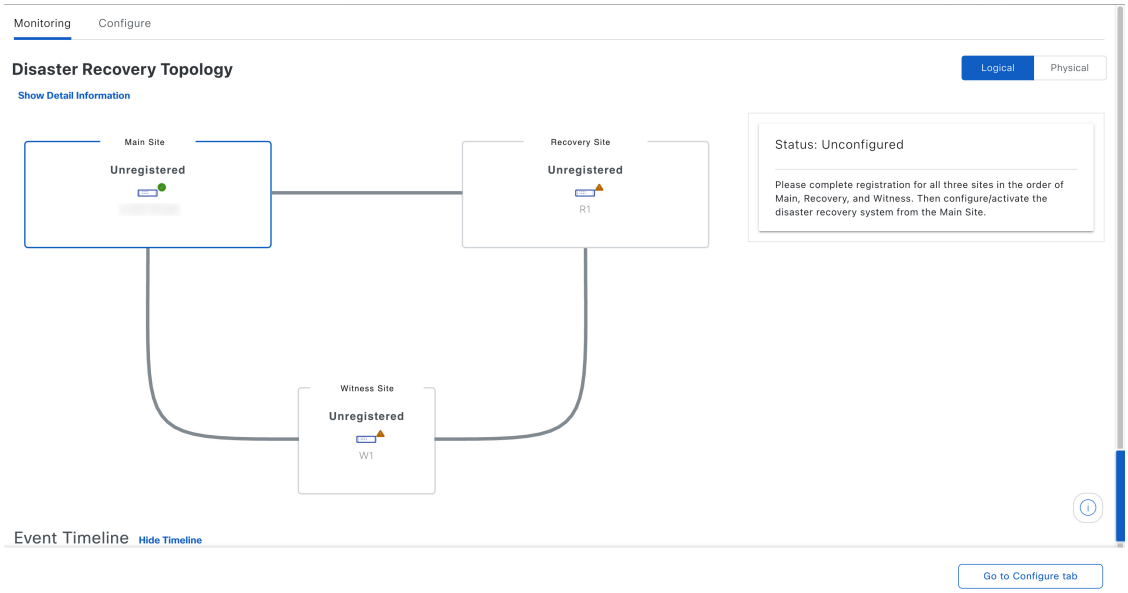
Complete this procedure to register your system's main site.

Before you begin

- Ensure that you've reviewed Main site registration considerations on page 251.
- On the Catalyst Center appliances or clusters where your disaster recovery system's main and recovery site will reside, do these tasks:
  - Configure the same backup schedule and proxy server. If you don't take care of this before you activate your system, you'll need to specify these two settings again after a failover occurs and the recovery site becomes the active site.
  - Configure an NFS backup configuration where each site points to a different NFS device.

Procedure

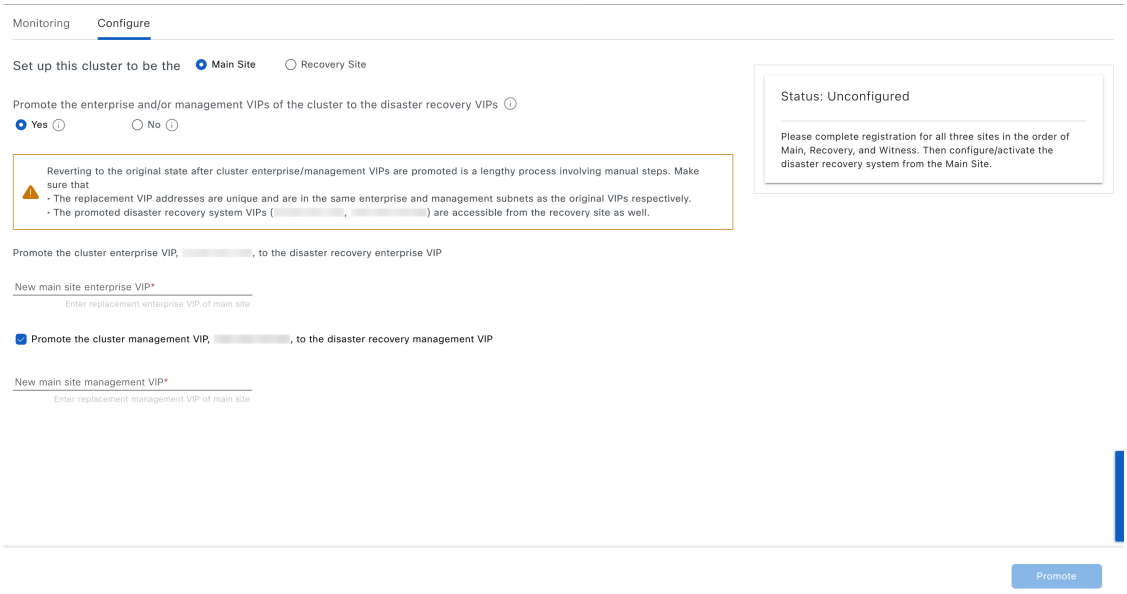
1. From the main menu, choose **System** > **Disaster Recovery** to open the **Disaster Recovery** page.



The **Monitoring** tab is selected, by default.

2. Register your main site:
   a) Click the **Configure** tab.

      The **Main Site** radio button should already be selected.



   b) In the **Promote the enterprise and/or management VIPs of the cluster to the disaster recovery VIPs** area, click one of these radio buttons:

      - Click **Yes** to set up a cluster as the main site and automatically propagate virtual IP address changes to the devices that are connected to this cluster. This is accomplished by promoting the virtual IP addresses that are currently configured for the cluster and assigning them as your disaster recovery system's global virtual IP addresses. We recommend choosing this option if you are enabling disaster recovery on a cluster that has a lot of connected devices. Otherwise, these devices will need to be reconfigured to communicate with the new disaster recovery virtual IP address. If you choose this option:

1. In the **New main site enterprise VIP** field, enter a new virtual IP address for the site's Enterprise network. This will replace the address that is going to be promoted. Ensure that it is a unique address that is not already used and that it resides in the same subnet as the previous virtual IP address.
2. (Optional) Check the **Promote the cluster management VIP, <*IP-address*>, to the disaster recovery management VIP** check box.
3. (Optional) In the **New main site management VIP** field, enter a new virtual IP address for the site's Management network. This will replace the address that is going to be promoted. Ensure that it is a unique address that is not already used and that it resides in the same subnet as the previous virtual IP address.

- Click **No** to set up a cluster as the main site without propagating virtual IP address changes to connected devices. We recommend this option for a brand-new cluster that isn't connected to any devices yet or is only connected to a few devices. If you choose this option, skip ahead to Step 2f.

c) In the **Action** area, click **Promote**.

The **Disaster Recovery VIP Promotion** dialog opens.

d) Click **Continue**.

Catalyst Center validates the virtual IP addresses you entered.

e) In the **VIP Promotion Status** area, view the validation status:

- If any of the addresses you entered are invalid (likely because it doesn't reside in the same subnet as the address it's replacing), make the necessary corrections and repeat Step 2c.
- If the addresses you entered are successfully validated, the **VIP Promotion Status** area lists all of the virtual IP addresses that will be configured for your disaster recovery system. Proceed to the next step.

f) Enter this information in the **Site VIP/IP addresses** area:

- **Main Site VIP**: The virtual IP address that manages traffic between the active site's cluster nodes and your Enterprise network. Catalyst Center prepopulates this field, based on your system's information.
- **Recovery Site VIP**: The Enterprise virtual IP address that manages traffic between the recovery site's cluster nodes and your Enterprise network.
- **Witness Site IP**: The IP address that manages traffic between the witness site's virtual machine and your Enterprise network.

Important

Ensure that the addresses that you enter are currently reachable. Otherwise, the registration of your system's sites will fail.

Note

At any point between Steps 2f and Step 2j, you can click **Reset** to clear all of the settings that you have entered. You will then need to repeat Step 2f and enter the correct settings before you register the main site.

g) Click one of these radio buttons in the **Route advertisement** area:

- **Border Gateway Protocol (BGP)**: This is the recommeded option.

- **Disaster recovery VIPs without route advertisement**
- **No disaster recovery VIPs**: Skip ahead to Step 2k if you click this radio button.

h) If you clicked either of the first two radio buttons in the previous step, enter a value in the **Enterprise VIP for Disaster Recovery** field.

When configured, this floating virtual IP address automatically moves to and operates on the site that is currently acting as your network's active site. This address manages traffic between your disaster recovery system and your Enterprise network.

> **Note**
>
> - If you clicked the **Border Gateway Protocol (BGP)** radio button and don't want to configure a Management virtual IP address, skip ahead to Step 2j.
> - If you clicked the **Disaster recovery VIPs without route advertisement** radio button and don't want to configure a Management virtual IP address, skip ahead to Step 2k.

i) Optional: Enter a value in the **Management VIP for Disaster Recovery** field.

When configured, this floating virtual IP address automatically moves to and operates on the site that is currently acting as your network's active site. This address manages traffic between your disaster recovery system and your Management network.

j) If you clicked the **Border Gateway Protocol (BGP)** radio button, enter the information required to enable route advertisement:

- In the **Border Gateway Protocol Type** area, specify whether your BGP peers will establish exterior (**Exterior BGP (eBGP)**) or interior (**Interior BGP (iBGP)**) sessions with one another.
- In the **Main Site Router Settings for Enterprise Network** and **Recovery Site Router Settings for Enterprise Network** areas, enter the IP address of the remote router that Catalyst Center will use to advertise the Enterprise virtual IP address that's configured for the disaster recovery system's Main and Recovery sites. Also enter the router's remote and local AS numbers.

  Note these points:

  - Click the **Add** (**+**) icon if you want to configure an additional remote router. You can configure a maximum of two routers for each site.
  - When entering an AS number, ensure that it's a 32-bit unsigned number that falls within the 1-4,294,967,295 range.
  - When the **iBGP** option is selected, Catalyst Center will automatically set the local AS number to the value you enter as the remote AS number.
  - If you configured a Management virtual IP address in the previous step, the **Main Site Router Settings for Management Network** and **Recovery Site Router Settings for Management Network** areas are also displayed. Enter the appropriate information for the remote router that Catalyst Center will use to advertise this virtual IP address.

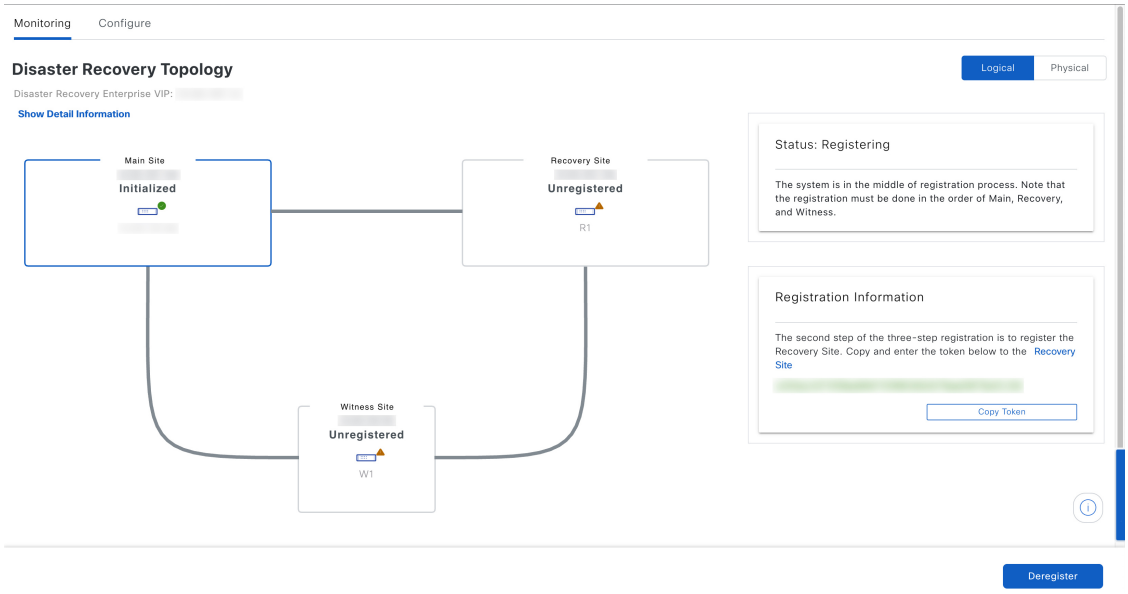
k) From the **Action** area, click **Register**.

The **Disaster Recovery Registration** dialog opens.

l) Click **Continue**.

The token that your recovery and witness sites need to use in order to register with your main site is generated.

3. In the **Registration Information** area, click **Copy Token**.



Main site registration errors

This topic lists common validation errors and resolution for issues that may occur during main site registration.

You may encounter errors when registering your system's main site. This topic describes these errors and how to deal with them.

Validation Type	Validation Made	Error Resolution
VIP reachability	Checks whether a TCP socket can be opened on the recovery site's port 443.	Make sure the recovery site's VIP matches the Enterprise VIP configured for the recovery site's Catalyst Center instance and that it's reachable from the main site.
	Checks whether a TCP socket can be opened on the witness site's port 2222.	Make sure the witness site's IP address is configured correctly and reachable from the main site.

Validation Type	Validation Made	Error Resolution
Enterprise and Management interface VIP reachability	Confirms whether the disaster recovery system's VIP can be reached via the Enterprise interface by looking for these items: • A static route defined on the Enterprise interface for the disaster recovery system's VIP • A default gateway configured on the Enterprise interface If neither of these items are present, the validation fails.	Define either a static route on the Enterprise interface for the disaster recovery system's Enterprise VIP or a default gateway on the Enterprise interface.
	Confirms whether the disaster recovery system's VIP can be reached via the Management interface by looking for these items: • A static route defined on the Management interface for the disaster recovery system's VIP • A default gateway configured on the Management interface If neither of these items are present, the validation fails.	Define either a static route on the Management interface for the disaster recovery system's Management VIP or a default gateway on the Management interface.
Certificate upload	Confirms whether a third-party certificate has been uploaded. If so, Catalyst Center also confirms that the certificate is not self-signed. In the **System Certificates** page (**System** > **Settings** > **Certificates** > **System Certificates**), checks that one of these is true: • The **Use System Certificate for Disaster Recovery as well** option is selected. • A certificate that's specific to disaster recovery has been uploaded. In both cases, the certificate must have a nonwildcard DNS name specified as the first entry in its **SAN** field.	

For errors not described above, their cause will be identified in the Status area. Make the necessary corrections and proceed by choosing one of these options from the **Action** area:

- **Retry**: If the cause of the error is fixed or the error was caused by an intermittent issue (such as the restart of a dependent service during the registration process), try this option to continue registration.
- **Deregister**: If you want to change any configuration or start over with the registration, use this option so that you can enter the details and options from the beginning.

Register the recovery site

Learn how to register the recovery cluster site to enable data replication.

Complete these steps to register the recovery site.

> **Note**
>
> At any point before Step 4, you can click **Reset** to clear all of the settings that you have entered. You will then need to repeat this procedure from the beginning and enter the correct settings before you register the recovery site.

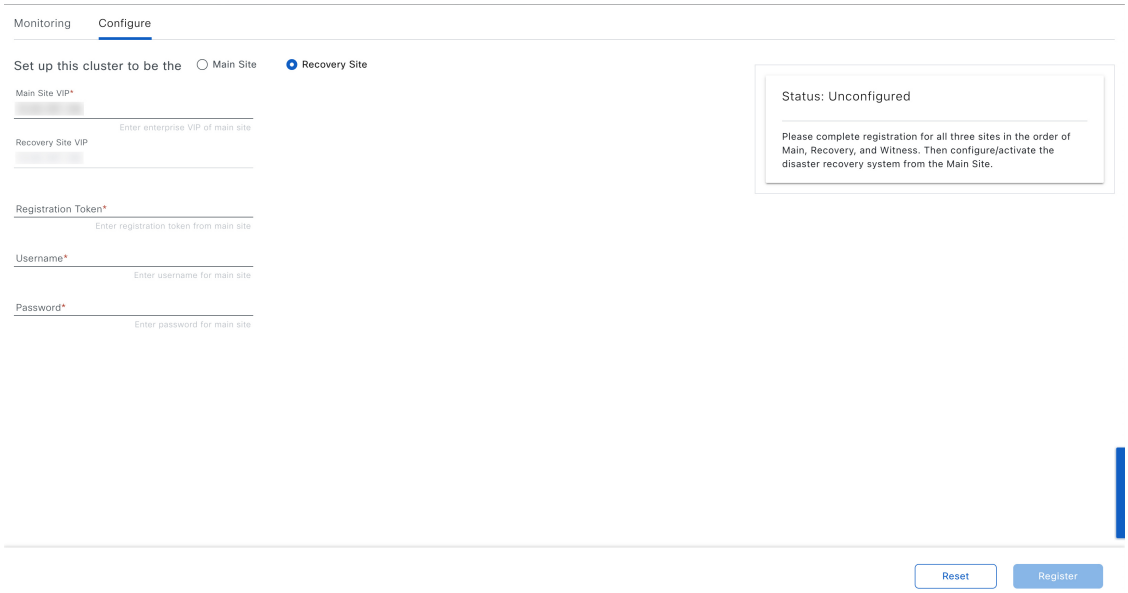
Before you begin

View the Prerequisites on page 242 topic and ensure that the requirements described in the "Main and Recovery Site Prerequisites" section have been met.

Procedure

1. From the **Registration Information** area, right-click the **Recovery Site** link and open the resulting page in a new browser tab.
2. If necessary, enter the appropriate username and password to log in to your recovery site.

   The **Disaster Recovery** page's **Configure** tab opens, with the **Recovery Site** radio button already selected.



3. Enter this information:
   - **Main Site VIP**: The virtual IP address that manages traffic between the active site's cluster nodes and your Enterprise network.

- **Recovery Site VIP**: The virtual IP address that manages traffic between the recovery site's cluster nodes and your Enterprise network. Catalyst Center prepopulates this field, based on your system's information.

  > **Note**
  >
  > After a IPSec tunnel has been configured between the main and recovery sites, Enterprise traffic on the node(s) hosting the VIP will be sourced via the Enterprise VIP (UDP/TCP/ICMP).

- The registration token that you generated while registering the main site.
- The username and password configured for your active site's super-admin user.

4. From the **Action** area, click **Register**.

   The **Disaster Recovery Registration** dialog opens.

5. Click **Continue**.

   The topology updates the status for the main and recovery sites after they have been connected.

Register the witness site

Learn how to register the witness site to ensure proper site connectivity.

Complete these steps to register the witness site.

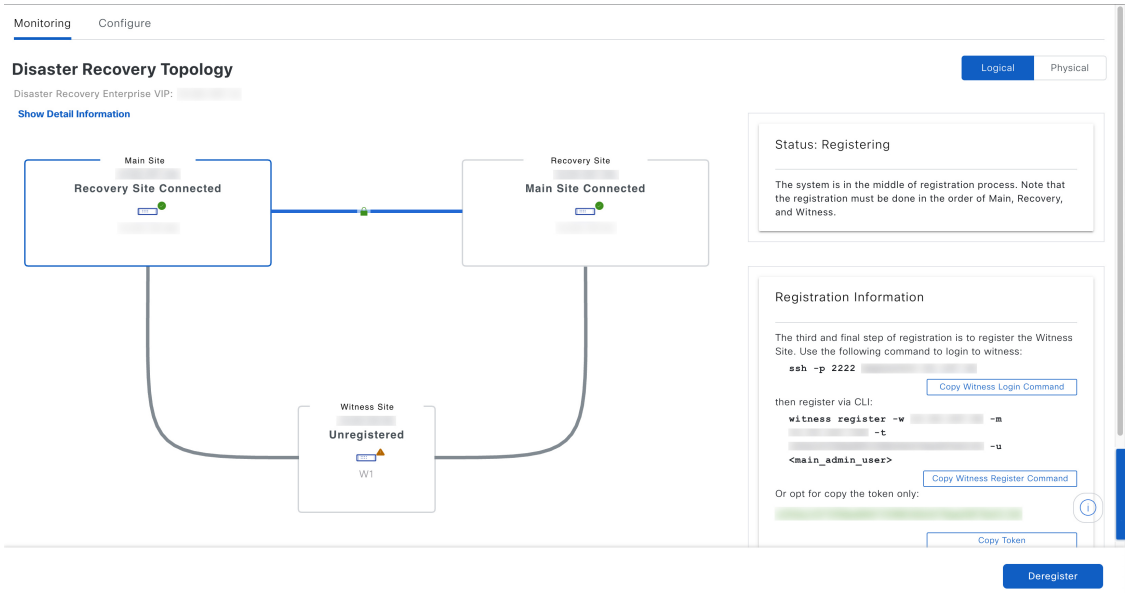
Before you begin

Ensure that these conditions are true before you register your disaster recovery system's witness site:

- The witness site is reachable from both the main and recovery site.
- The VIPs configured for the main and recovery site are reachable from the witness site.

Procedure

1. Return to the main site's browser tab.



2. From the **Registration Information** area, click **Copy Witness Login Command**.
3. Open an SSH console to the witness site, paste the command you just copied, and then run it to log in.
4. When prompted, enter the default (maglev) user's password.
5. Return to the **Registration Information** area and click **Copy Witness Register Command**.
6. In the SSH console, paste the command you just copied.
7. Replace `<main_admin_user>` with the super-admin user's username and then run the command.
8. When prompted, enter the super-admin user's password.

Witness site registration errors

This topic provides troubleshooting guidance for common errors that may occur during the witness site registration process.

This topic describes errors you may encounter when registering the witness site and how to deal with them.

Error Type	Validation Made	Resolution
IP validation	Validates that the witness site IP address entered during main site registration matches the IP address entered during witness site registration.	Ensure that you enter the same IP address for the witness site when registering the main and witness sites.
Version validation	Validates that the witness site's OVA package is the correct version for the Catalyst Center version that's installed on your system's main and recovery sites. Each Catalyst Center version supports only one OVA version.	Deploy the witness site OVA package version listed in the error message.

For errors that don't involve validation checks, their cause is identified in the **Status** area. Make the necessary corrections and proceed by doing one of these tasks:

- After logging in to the witness site, run the **witness reset** command.

- To make any registration setting changes or restart the process from the beginning, click **Deregister** from the **Action** area.

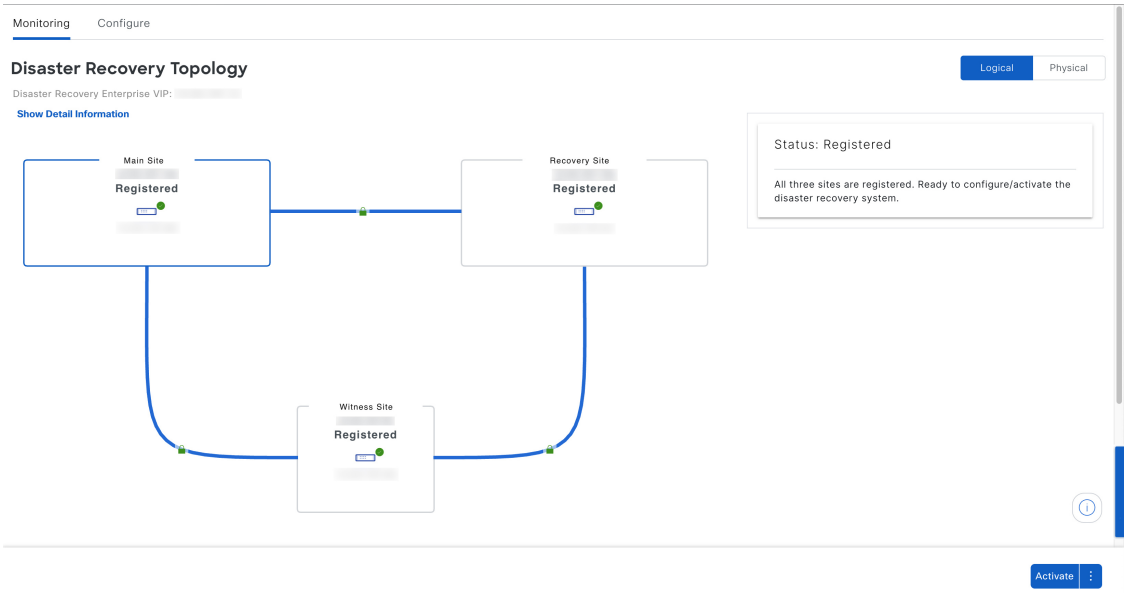
Activate your disaster recovery system

Learn how to activate your disaster recovery system after registering your system sites.

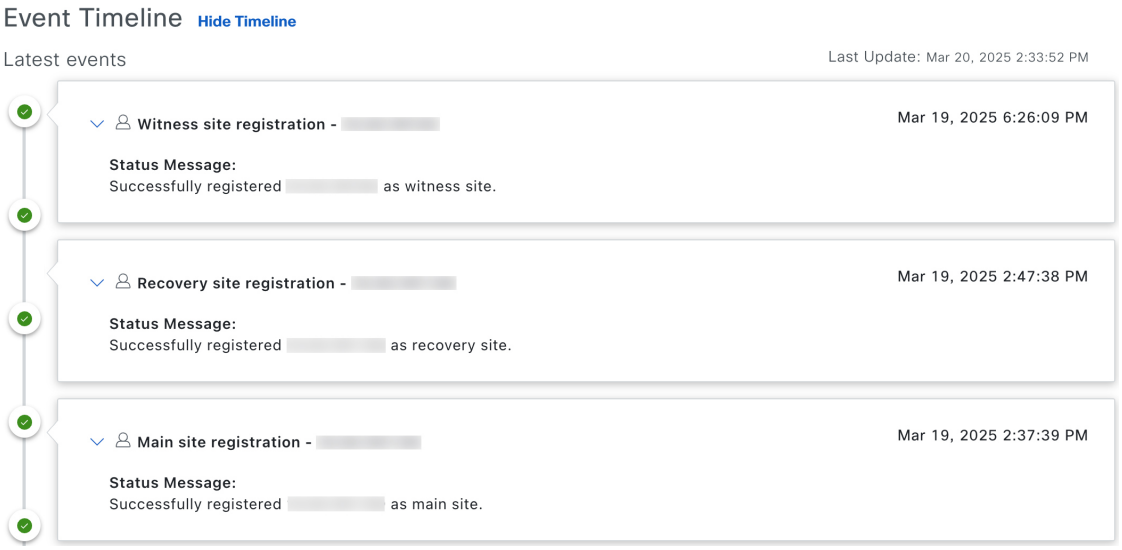
After registering your system's sites, complete this procedure to activate the system for use in your Catalyst Center deployment.

Procedure

1. Verify that your main, recovery, and witness sites registered successfully:
   a) Return to the main site's browser tab and click **Monitoring** to view the Disaster Recovery **Monitoring** tab.



   b) In the **Logical Topology** area, confirm that the three sites are displayed and their status is **Registered**.
   c) In the **Event Timeline** area, confirm that the registration of each site is listed as an event and that each task completed successfully.



2. In the **Action** area, click **Activate**.

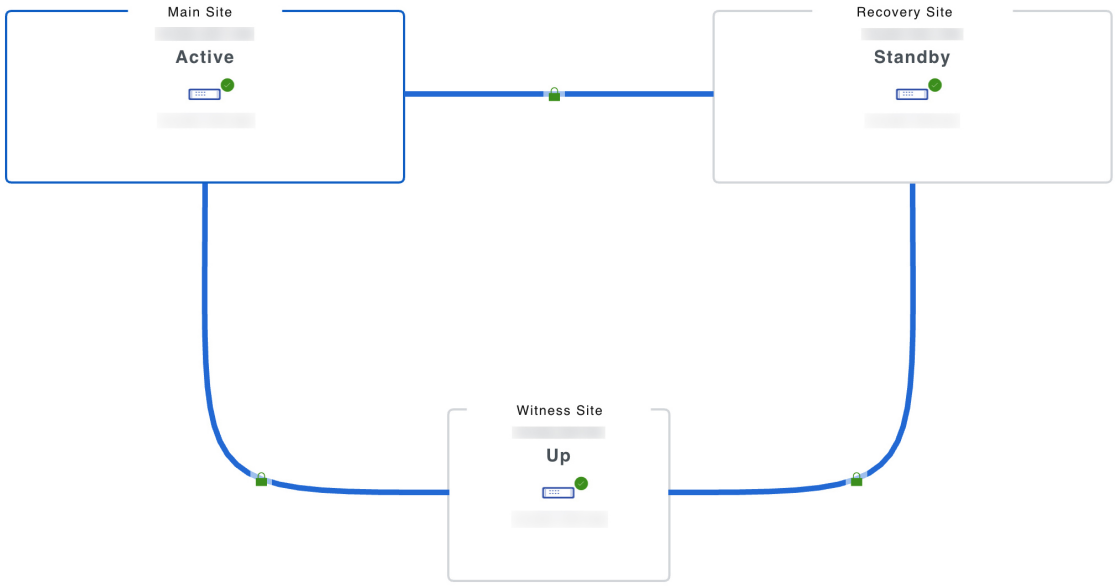
   A dialog box opens, indicating that all the data that currently resides in your recovery site will be erased.

3. To begin the configuration of your disaster recovery system and the replication of your main site's data to the recovery site, click **Continue**.

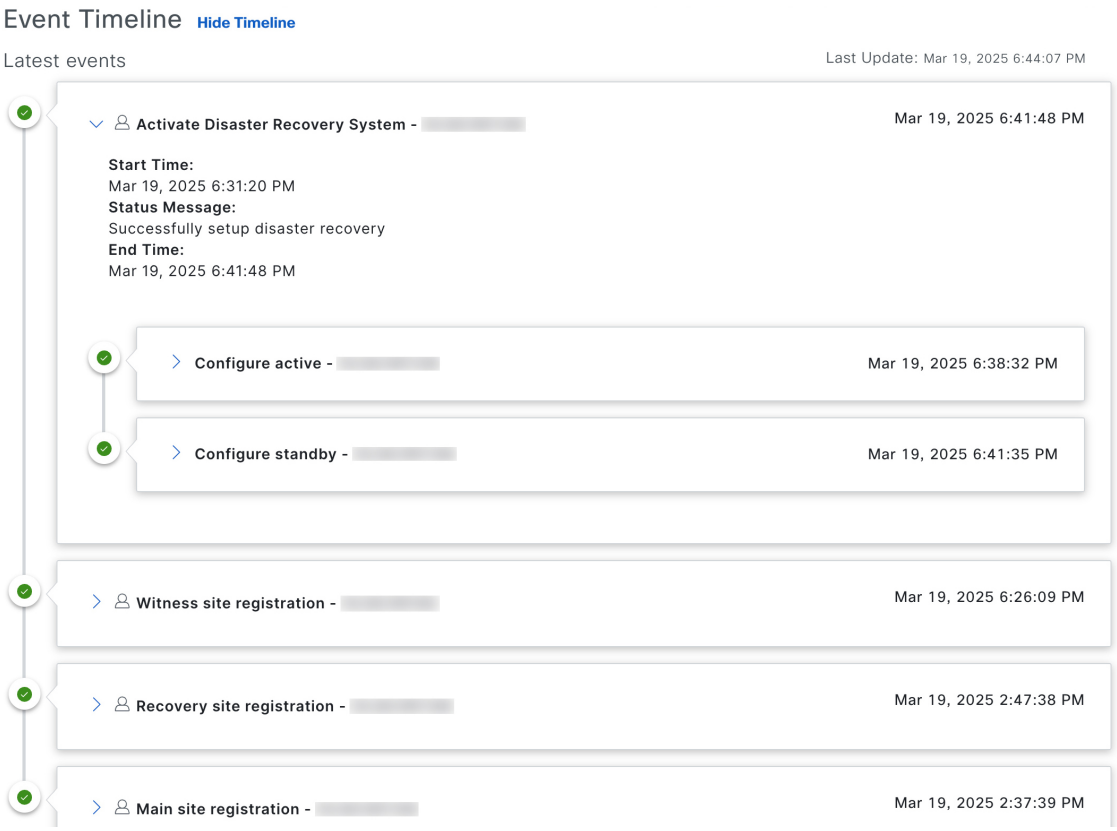
   > **Note**
   >
   > The activation process may take some time to complete. View the Event Timeline in order to monitor its progress.

4. After Catalyst Center has completed the necessary tasks, verify that your system is operational:

   a. View its topology and confirm that the following status is displayed for your respective sites:



   b. View the Event Timeline and confirm that the **Activate Disaster Recovery System** task completed successfully.



c. Verify that your sites are reachable by pinging them from the main site.

Disaster recovery system validations

Describes the validations that the disaster recovery system makes after initiating an Activate or Rejoin operation.

This table describes the validations that the disaster recovery system makes after the **Activate** and **Rejoin** operations have been initiated.

Validation	Description
Package match	Confirms whether the packages installed on both the main and recovery sites are the same version.
Key services health	Checks the health of managed services and other key services that are critical for disaster recovery operations.
IPsec status and transmission	Confirms whether the IPSec tunnel is up for all of the disaster recovery system's sites.
Consul connectivity	Determines if the consul (the distributed database shared by the main, recovery and witness sites) is able to communicate with all of the sites.

Pause your disaster recovery system

Information about pausing your disaster recovery system. You can pause your disaster recovery system to temporarily disable the replication of data from the active site to the standby site if you plan to break up your system for an extended period.

By pausing your main and recovery sites, you are effectively breaking up your disaster recovery system. The sites will no longer be connected and instead will act as standalone clusters. You would want to pause your system to temporarily disable the replication of data from the active site to the standby site if you plan to break up your system for an extended period of time. You would also pause the disaster recovery system to do one of these tasks:

- Complete any administrative tasks, such as upgrade the clusters or install additional packages.
- Replace the system or disaster recovery certificate.
- Perform maintenance on the main, recovery, or witness site clusters.
- Prepare for a planned network or power outage.

Place your system on pause

Instructions to pause your disaster recovery system.

To pause your disaster recovery system temporarily, which you would typically do before performing maintenance on a system component, complete this procedure:

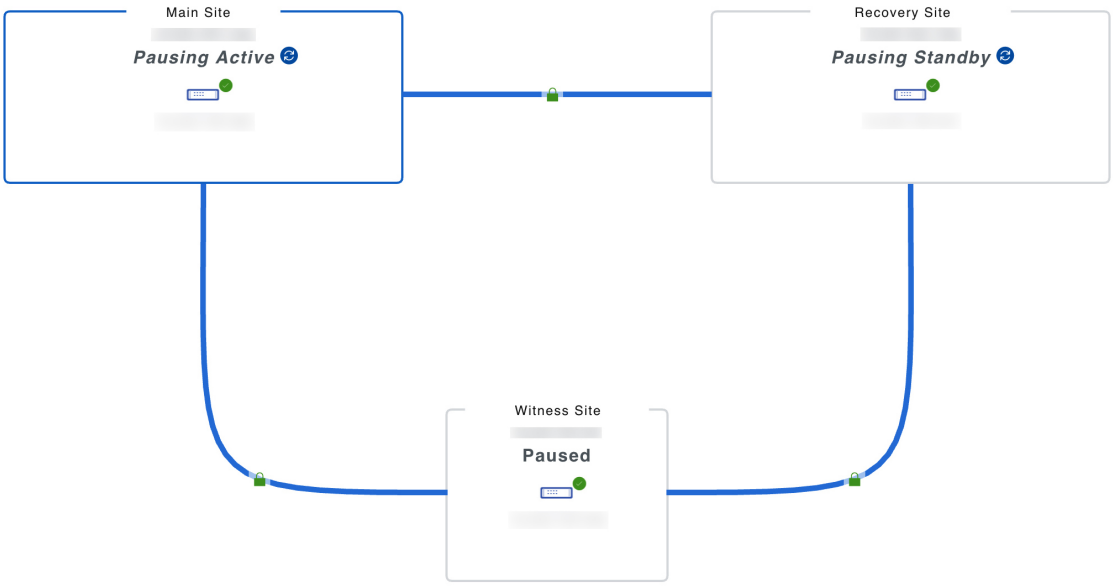
Procedure

1. From the main menu, choose **System** > **Disaster Recovery** to open the **Disaster Recovery** page.

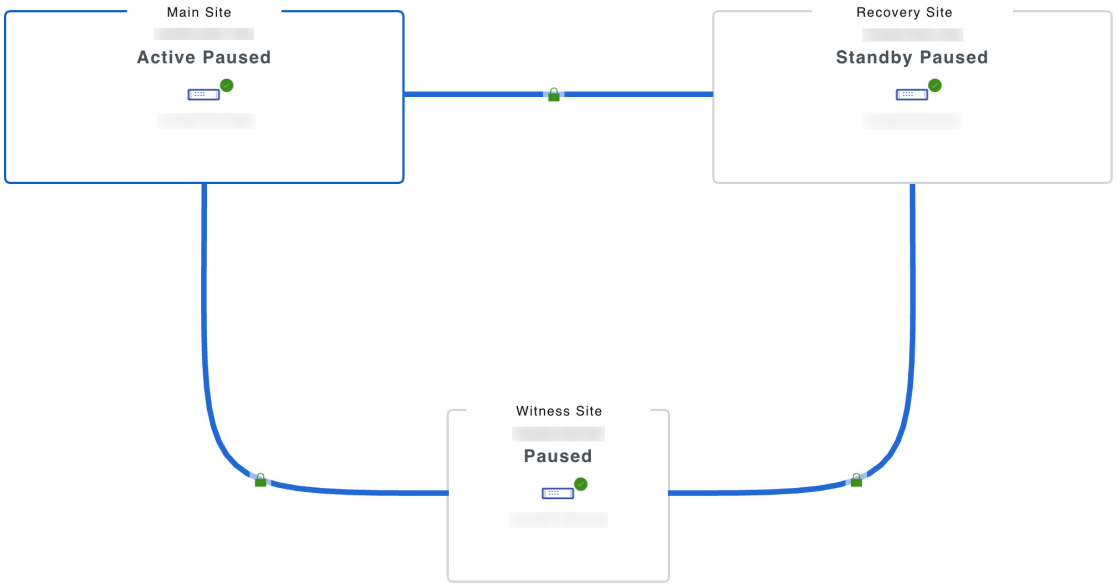
   The **Monitoring** tab is selected, by default, and displays your disaster recovery system's topology.

2. In the **Action** area, click  and then click **Pause**.
3. In the resulting dialog, click **Continue** to proceed.

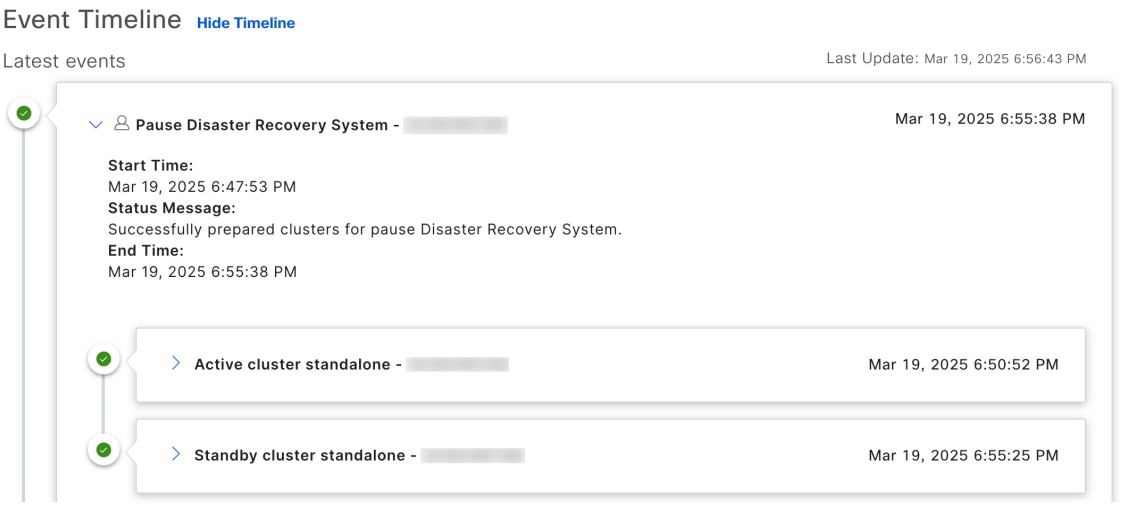
   A message is displayed in the bottom-right corner of the page, indicating that the process to pause your system has started. To pause your system, Catalyst Center disables data and service replication. It also reinstates the services that were suspended on your recovery site. As this is taking place, the status for your main and recovery sites is set to **Pausing** in the topology.



After Catalyst Center completes the necessary tasks, the topology updates and sets the status for your main, recovery, and witness sites as **Paused**.



4. Confirm that your disaster recovery system has been paused:
   a. Verify that your system's status is listed as **Paused** in the **Status** area.
   b. In the Event Timeline, verify that the **Pause Disaster Recovery System** task completed successfully.



Rejoin your system

Instructions to rejoin your disaster recovery system that is currently on pause.

Complete this procedure to restart a disaster recovery system that is currently on pause or has failed over.

Important

Before you perform this operation, verify that the current active site has all the data you expect (particularly recent changes). This operation will reset the standby site's databases.

Procedure

1. From the main menu, choose **System** > **Disaster Recovery** to open the **Disaster Recovery** page.

   The **Monitoring** tab is selected, by default, and displays your disaster recovery system topology.



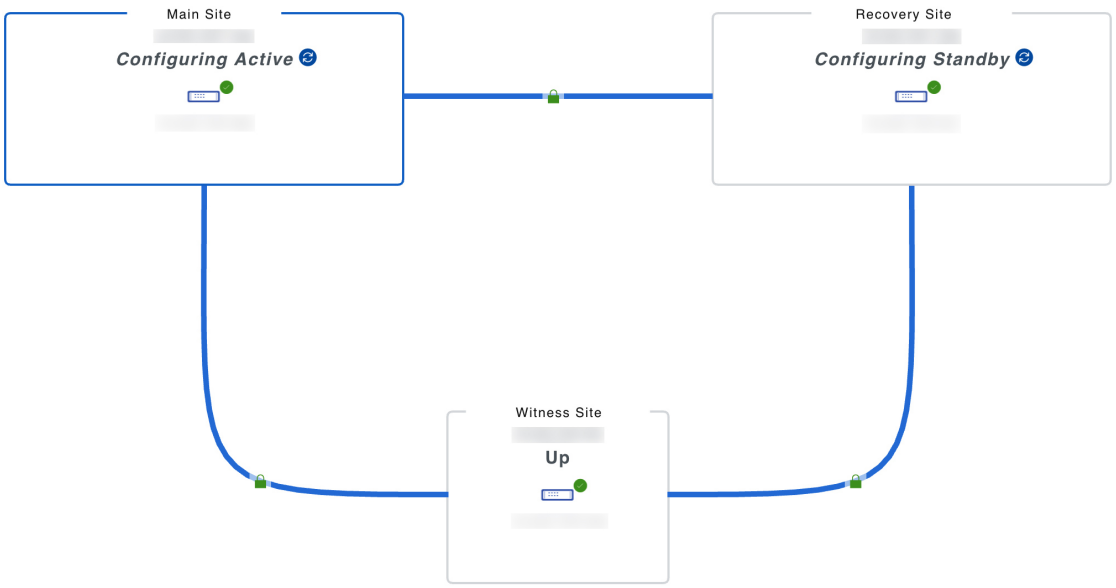
2. In the **Action** area, click **Rejoin**.

   A dialog opens, indicating that all the data on your standby site will be erased.

3. Click **Continue** to proceed.

   A message is displayed in the bottom-right corner of the page, indicating that the process to reconnect your main, recovery, and witness sites has started. As this is taking place, the status for your main and recovery sites is set to **Configuring** in the topology.

> **Note**
>
> The postgres database on the passive cluster is also reinitialized as the standby site for the active Catalyst Center cluster. During this transition, the **System Health** page may temporarily report that postgres is unhealthy. As long as postgres is not labeled unhealthy after the rejoin has completed, you can disregard this.



After Catalyst Center completes the necessary tasks, the topology updates the status for your main, recovery, and witness sites.



4. Confirm that your disaster recovery system is operational again by verifying that its status is listed as **Up and Running** in the **Status** area.

Failovers: an overview

An overview of failover when the standby site of your disaster recovery system becomes the new active site.

A failover takes place when your disaster recovery system's standby site takes over the responsibilities of the former active site and becomes the new active site. Catalyst Center supports two types of failover:

- System-triggered: Occurs when your system's active site experiences an issue that brings it offline (such as a hardware failure or network outage). When Catalyst Center recognizes that the active site has not been able to communicate with the rest of the Enterprise network (and the standby and witness sites) for seven minutes, it completes the tasks necessary for your standby site to assume its role so that network operations can continue without interruption.
- Manual: Occurs when a super-admin user instructs Catalyst Center to swap the roles that are currently held by your system's active and standby sites. You would typically do this before you update the Catalyst Center software that is installed on a site's appliances or perform routine site maintenance.

After either type of failover has taken place and the former active site has come back online, your disaster recovery system automatically moves the site to the **Standby Ready** state. To establish this site as the new standby site, click **Rejoin** in the **Action** area of the **Monitoring** tab.

Initiate a manual failover

Information about initiating a manual failover when the current active site is experiencing issues and you want to designate the standby site as the new active site.

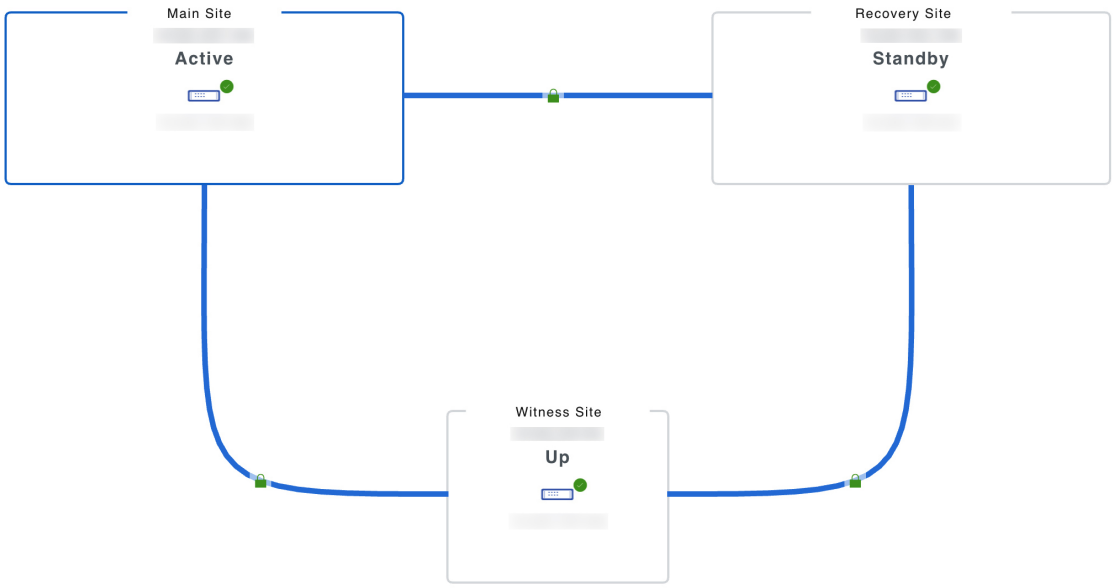
When you manually initiate a failover, you instruct Catalyst Center to swap the roles that are currently assigned to your disaster recovery system's main and recovery site. Manual failover is useful if you know that the current active site is experiencing issues and you want to proactively designate the standby site as the new active site. Complete this procedure to initiate a manual failover.

> **Note**
>
> You cannot initiate a manual failover from your witness site. You can only do so from the current active site.

Procedure

1. From the main menu, choose **System** > **Disaster Recovery** to open the **Disaster Recovery** page.

   The **Monitoring** tab is selected, by default, and displays your disaster recovery system's topology. In this example, the user is logged in to the current active site.



2. In the **Action** area, click **Manual Failover**.

   The **Disaster Recovery Manual Failover** dialog opens, indicating that the standby site will assume the **Active** role.

3. Click **Continue** to proceed.

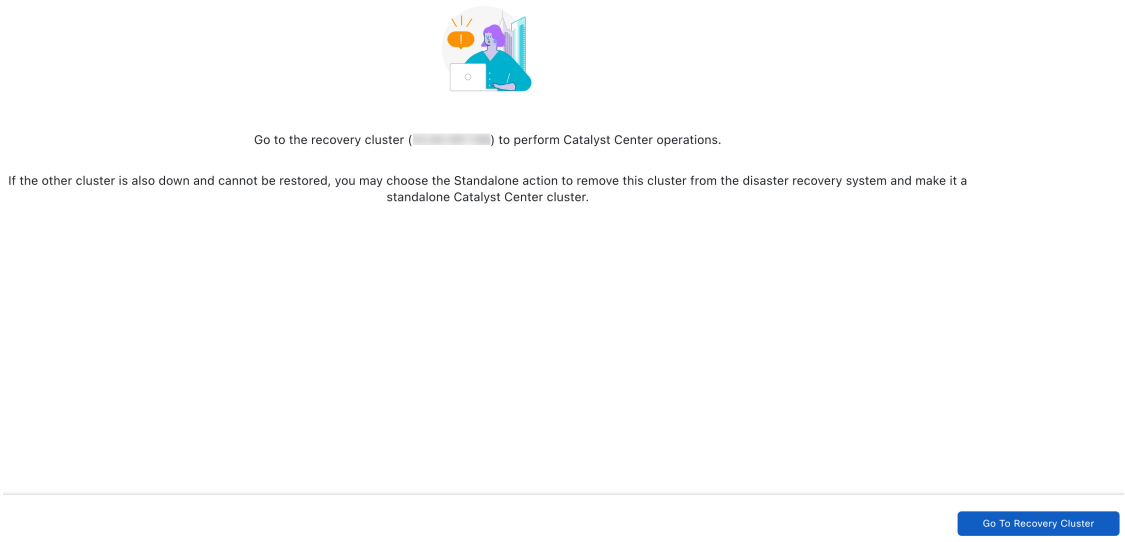
   A message is displayed in the bottom-right corner of the page, indicating that the failover process has started. The site previously acting as the active site is isolated from the system.

   At this point, the main and recovery sites are not connected and data replication is not taking place. If the former active site is experiencing issues, now is a good time to resolve those issues.

   A subsequent failover (initiated by either the system or a user) cannot take place until you add the former active site back to your disaster recovery system.

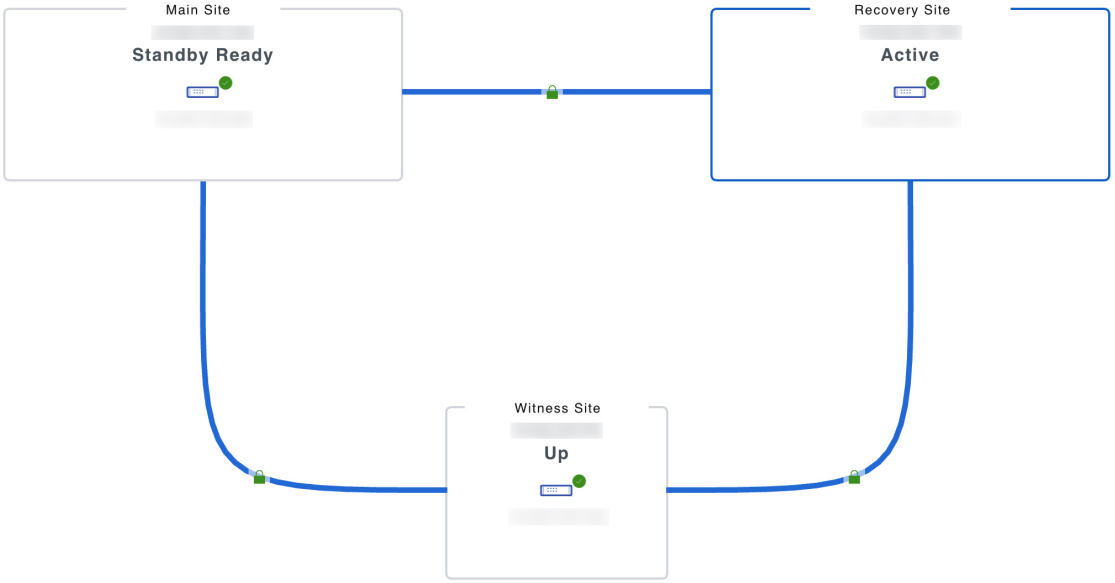
4. Reconnect the main and recovery sites and reconfigure your disaster recovery system:

   a. After the Catalyst Center window updates, click **Go To Recovery Cluster**.



b. Log in to your recovery site.

The site previously acting as the active site is isolated from the system and enters the **Standby Ready** state.

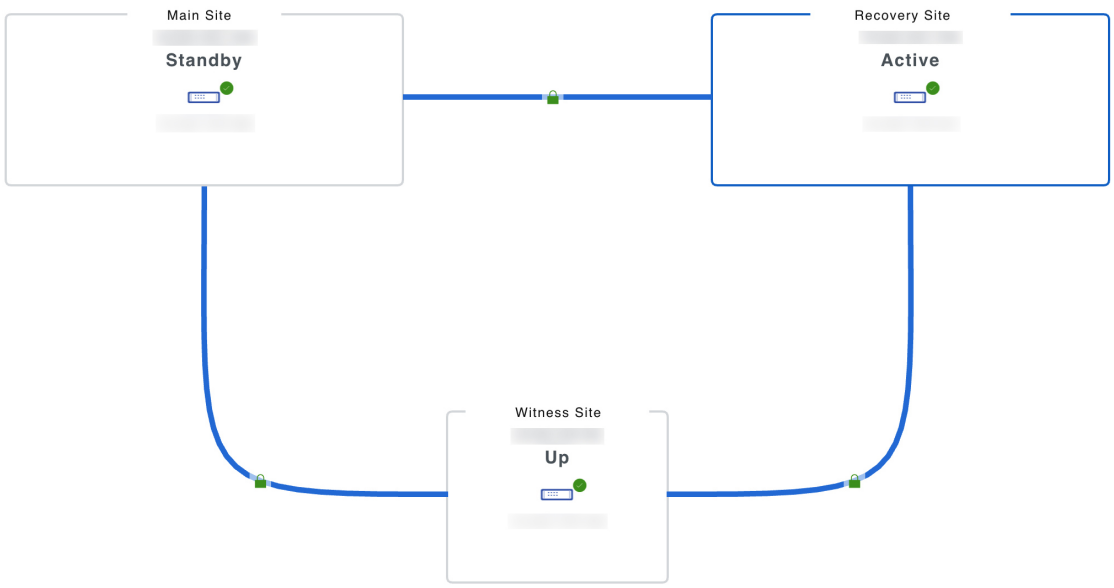


c. In the **Action** area, click **Rejoin**.

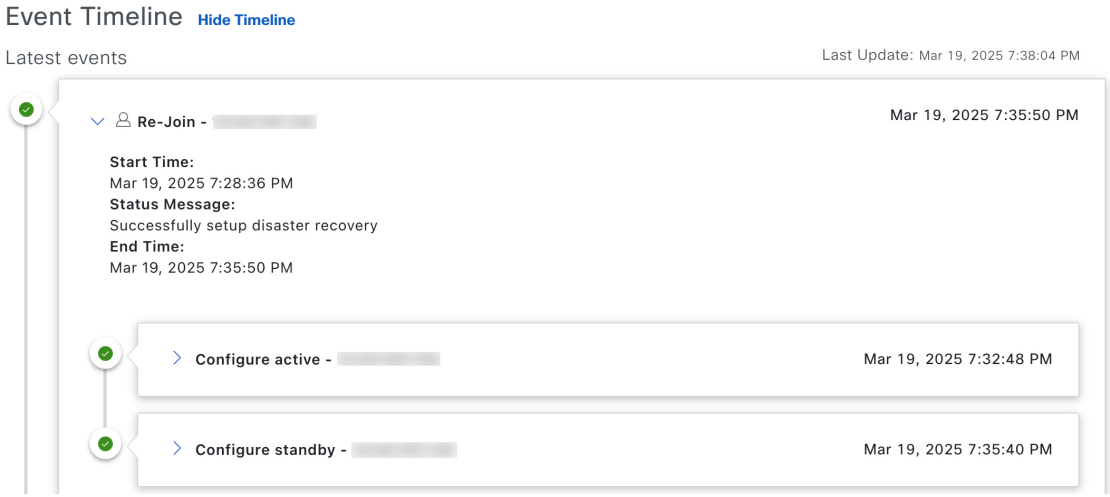
A dialog opens, indicating that data on the standby site will be erased.

5. Click **Continue** to proceed and restart data replication.

After Catalyst Center completes the relevant workflows, the manual failover completes. The main site, which was currently serving as the active site, is now the standby site.



6. Confirm that your disaster recovery system is operational again:
   a. In the top-right corner of the **Monitoring** tab, verify that its status is listed as **Up and Running**.
   b. In the Event Timeline, verify that the **Rejoin** task completed successfully.



Deregister your system

Information about deregistering your disaster recovery system. You may need to deregister to update the settings that you entered for a site.

After your disaster recovery system is activated, you may need to update the settings that you entered for a particular site. If you find yourself in this situation, complete this procedure.

> **Note**
>
> When you deregister your system, the settings that are currently set for all the sites in your system will be cleared.

Procedure

1. From the **Action** area, click **Pause** to suspend the operation of your system.

   For more information, see Place your system on pause on page 264.

2. From the **Action** area, click **Deregister**.

   Catalyst Center deletes all the settings that you configured previously for your system's sites.

3. Complete the tasks described in Set up disaster recovery on page 251 to enter the appropriate settings for your sites, reregister them, and reactivate your system.

Disaster recovery system considerations

Information about the considerations when managing your disaster recovery system.

This section describes things to be aware of when managing your disaster recovery system.

Backup and restore considerations

Information about backup and restore considerations for your disaster recovery system.

- A backup can only be scheduled from your system's active site.
- You cannot restore a backup file when disaster recovery is enabled. You must first pause your system temporarily. For more information, see Place your system on pause on page 264.
- You should only restore a backup file on the site that was the active site prior to pausing your system. After you restore the backup file, you then need to rejoin your system's sites. Doing so will reinstate disaster recovery and initiate the replication of the active site's data to the standby site. For more information, see Rejoin your system on page 266.
- You can only restore a backup file on cluster nodes that have the same Catalyst Center version installed as the other nodes in your system.
- After a failover takes place, your deployment's backup and restore settings and schedule are not replicated to the new active site. You will need to configure them again.
- If applicable to your deployment, we recommend that you upgrade the TLS version for incoming TLS connections to Catalyst Center. In the Catalyst Center Security Best Practices Guide, see the "Change the Minimum TLS Version and Enable RC4-SHA (Not Secure)" topic. If you have already upgraded your main site, we recommend that you also upgrade your recovery site (ideally before you activate your disaster recovery system or after a failover occurs).

Node or cluster replacement considerations

Information about node or cluster replacement considerations.

You cannot do either of these replacements without breaking your disaster recovery system's configuration:

- Replace one of the nodes in a 1+1+1 setup.
- Replace all of one site's nodes in a 3+3+1 setup.

If you need to do so, ensure that you then complete the steps described in Deregister your system on page 271 to get your system up and running again.

Reconfiguration considerations

Information about reconfiguration considerations for your disaster recovery system.

- Any data present on the appliances that reside at the recovery site will be deleted in these scenarios:
  - When setting up your disaster recovery system for the first time and you activate the system.
  - When the recovery site is the current active site, you pause your system, deregister it, and then reregister it as the recovery site.
- When you reconfigure an existing disaster recovery system, make sure you know which site is the current active site and register it as your system's main site. Alternatively, you can make a backup of the recovery site's data (if it's currently active) and restore this data on your system's main site prior to the system's reconfiguration.
- These changes cannot be made without reconfiguring your system:
  - Changing the IP addresses and static/default routes configured for your disaster recovery system's Enterprise and Management interfaces.
  - Changing the witness site's IP address.
  - Updating a site's **cluster_hostname** setting.
  - Changing your system's BGP settings.

  Complete the steps described in Deregister your system on page 271 to configure new IP addresses and routes. If you updated the **cluster_hostname** value, complete these same steps after doing so.

HA considerations

Information about HA considerations for your disaster recovery system.

You cannot convert the main and recovery sites from single-node clusters to HA clusters without breaking your disaster recovery system's configuration. If you need to do so:

1. Deregister your system on page 271.
2. Convert both sites to HA clusters.
3. Reregister and reactivate disaster recovery (see Set up disaster recovery on page 251).

Site failure considerations

Information about site failure considerations for your disaster recovery system.

By default, the disaster recovery system waits seven minutes before recognizing that a site has failed and taking one of these actions:

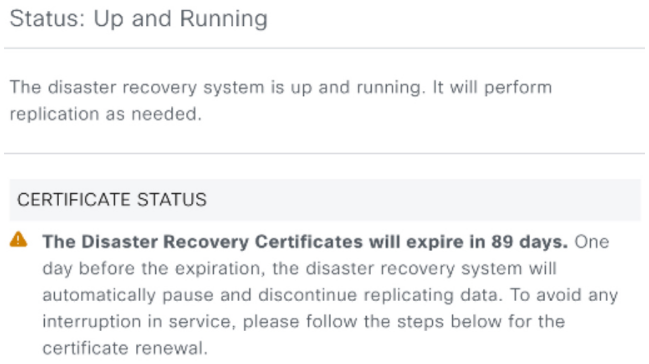
- When the active site goes down, it starts the failover process.
- When either the standby or witness site goes down, the system marks that site as down and disables the ability to start any tasks from the **Action** area.

If you try to initiate a task before the seven minutes have passed, the **Details** area will display a message that indicates why it cannot be completed.

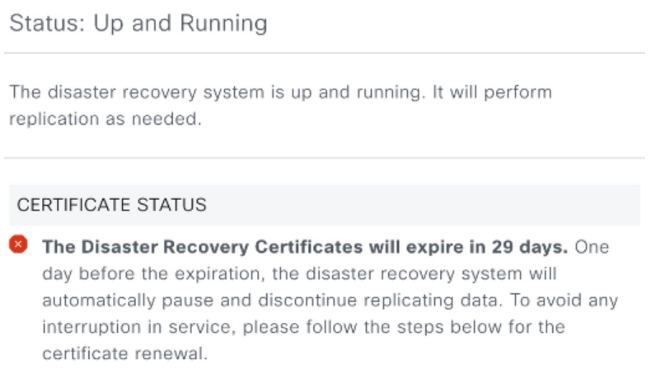
Certificate replacement considerations

Describes what happens when the certificate used by a disaster recovery system is about to expire.

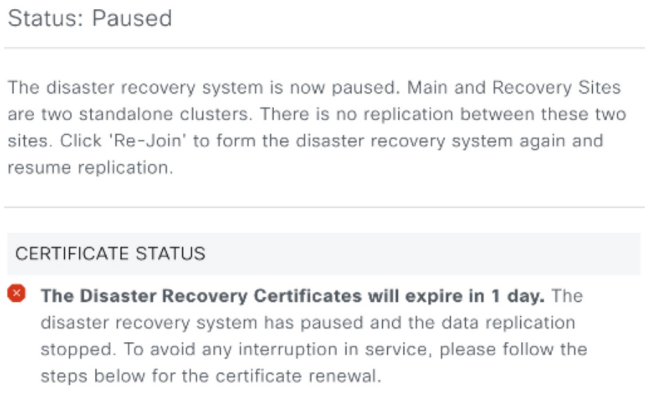
The **Status** area indicates when the certificate configured for your disaster recovery system is set to expire. If the certificate will expire within 90 days, a warning message is displayed:



If the certificate will expire in 30 days or less, an error message is displayed instead:



If the certificate is set to expire in a day, and the disaster recovery system is operational, Catalyst Center automatically pauses your system:



To configure a new certificate and restore the operation of your system, you'll need to do these tasks:

1. Place your disaster recovery system on pause (unless Catalyst Center has already done so).
2. Replace your system's certificate by completing the steps described in the Add the disaster recovery certificate on page 247 topic.
3. Rejoin your system to restart it.

VLAN mode considerations

Indicates that disaster recovery is not supported when VLAN mode is enabled for Catalyst Center.

- For a description of VLAN mode, see Steps 7 and 8 in the *Cisco Catalyst Center Installation Guide's* "Configure the Primary Node Using the Maglev Wizard" topic.
- VLAN mode:
  - Can only be enabled when you configure a Catalyst Center appliance using the Maglev Configuration wizard.
  - Can't be enabled using any of the browser-based configuration wizards.
  - Can't be disabled without reimaging the appliance.
- These items are not supported by Catalyst Center deployments that have VLAN mode enabled:
  - Catalyst Center in an ACI fabric
  - Disaster recovery

Administer your disaster recovery system

Describes how to complete common disaster recovery administration tasks.

This section describes how to complete the various tasks you may need to carry out while managing your deployment's disaster recovery system.

Replace the current witness site

Information about replacing your current witness site.

Complete this procedure to replace your disaster recovery system's current witness site with a new site.

Procedure

1. Log in to the current witness site:
   a) Open an SSH console to the witness site and run the **ssh -p 2222 maglev@***witness-site's-IP-address* command.
   b) Enter the default (maglev) user's password.

   Note

   Before you proceed to the next step, note the witness site's IP address. You'll need to configure the same address after you replace the witness site. Otherwise, the witness site won't work as expected.

2. Run the **witness reset** command.
3. Delete the current witness site's virtual machine.
4. Install the new witness site's virtual machine, as described in Install the witness site on page 249.
5. Log in to the new witness site:
   a) Open an SSH console to the witness site and run the **ssh -p 2222 maglev@***witness-site's-IP-address* command.
   b) Enter the default (maglev) user's password.

6. Run the **witness reconnect -w *witness-site's-IP-address* -m *main-site's-Enterprise-virtual-IP-address* -u *admin-username*** command.

   Note these points:

   - Regardless of the main site's current disaster recovery status, use the main site's Enterprise VIP when reconnecting the witness site.
   - To verify that the witness site is operational after running this command:
     a. From the Disaster Recovery Topology, click the **Show Detail Information** link to open the **Disaster Recovery System** slide-in pane.
     b. In the **Witness Site** section, confirm that the status for the witness site and configured IPSec links is `Up`.
   - To view all of the available options for this command, run the **witness reconnect --help** command.

Upgrade the current witness site

Complete this procedure to upgrade the witness site that's currently configured for your disaster recovery system.

> **Note**
>
> - You can upgrade the witness site only if Catalyst Center version 3.1.3 or later is installed.
> - Upgrading the witness site from Catalyst Center version 2.3.7.x to 3.1.3 or later is not supported.
>
> .

Procedure

1. Download the witness site upgrade bundle that's specific to the Catalyst Center version that the witness site is running:
   a) Open https://software.cisco.com/download/home/286316341/type.

   > **Note**
   >
   > You need a Cisco.com account to access this URL. See this page for a description of how to create an account: https://www.cisco.com/c/en/us/about/help/registration-benefits-help.html

   b) In the **Select a Software Type** area, click the Catalyst Center software link.

   The **Software Download** page updates, listing the software that's available for the latest Catalyst Center release.

   c) Do one of these tasks:

   - If the upgrade bundle you need is already listed (CatC-witness-3.1.6-75524.200-upgrade.tar.gz, for example) , click its icon.
   - Enter the relevant **Download** version number in the **Search** field, click its link in the navigation pane, and then click the **Download** icon for that version's upgrade bundle.

2. In an SCP client, copy the upgrade bundle from the host on which it was downloaded to the current witness site's virtual machine by running this command: **scp -P 2222** *upgrade-bundle-filename witness-site's-admin-username*

   Refer to this example:

```
$ scp -P 2222 CatC-witness-3.1.6-75524.200-upgrade.tar.gz
maglev@10.30.197.96:/tmp/CatC-witness-3.1.6-75524.200-upgrade.tar.gz
maglev@10.30.197.96's password:
CatC-witness-3.1.6-75524.200-upgrade.tar.gz     100%  242MB 138.4MB/s   00:01
```

3. In an SSH client, log in to the witness site's virtual machine and run the **witness upgrade** command, supplying values for these arguments:

   - **-p, --password** (TEXT): Admin password for the main system
   - **-u, --username** (TEXT): Admin username for the main system (required)
   - **-m, --main_ip** (IPV4_ADDRESS): Virtual IP address of the main system (required)
   - **-w, --witness_ip** (IPV4_ADDRESS): Witness site's IP address (required)
   - **-b, --upgrade-bundle** (TEXT): File system path to the upgrade bundle (required)

   Refer to this example of what you'll see during an upgrade:

> **Note**
>
> If you're viewing this example in a browser window, you may need to press the **Right Arrow** key a few times to view the entire example.

```
$ witness upgrade -b CatC-witness-3.1.6-75524.200-upgrade.tar.gz -m
10.30.199.53 -w 10.30.197.96 -u admin
password for admin:
Retrieving information from the Disaster Recovery service on 10.30.199.53...
Inspecting upgrade bundle CatC-witness-3.1.6-75524.200-upgrade.tar.gz...
Launching upgrade process in tmux session 'upgrade'...
Tailing the upgrade log /var/log/witness_upgrade.log...
upgrade_witness INFO witness upgrade process starting
[snip]
upgrade_witness INFO ***** Witness upgraded from version  2.1.734.370010 to
 2.1.734.370011 *****
upgrade_witness INFO ***** Please reboot the witness VM
($ sudo reboot) to insure all updates are applied *****
upgrade_witness INFO ***** Then use the 'witness reconnect' command to
re-establish witness connectivity *****
upgrade_witness INFO witness upgrade process completed successfully
Terminated
Witness upgrade invocation succeeded
```

4. Do one of these tasks:

   - If the upgrade completes successfully, reboot the witness site's virtual machine to pick up all of the updated packages that were applied by running the **sudo reboot** command.
   - If you get an error during the upgrade, retry the operation.

5. Log in to the new witness site:

a) Open an SSH console to the witness site and run the **ssh -p 2222 maglev@***witness-site's-IP-address* command.
b) Enter the default (maglev) user's password.

6. Run the **witness reconnect -w *witness-site's-IP-address* -m *main-site's-Enterprise-virtual-IP-address* -u *admin-username*** command.

   Note these points:

   - Regardless of the main site's current disaster recovery status, use the main site's Enterprise VIP when reconnecting the witness site.
   - To verify that the witness site is operational after running this command:
     a. From the Disaster Recovery Topology, click the **Show Detail Information** link to open the **Disaster Recovery System** slide-in pane.
     b. In the **Witness Site** section, confirm that the status for the witness site and configured IPSec links is `Up`.
   - To view all of the available options for this command, run the **witness reconnect --help** command.

Monitor the event timeline

Information about monitoring the event timeline.

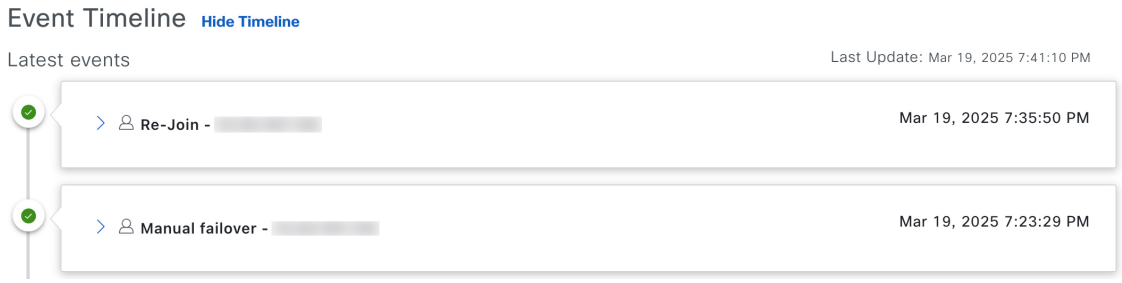
From the event timeline, you can track the progress of disaster recovery tasks that are currently running and confirm when these tasks have completed. To view the timeline:

1. From the main menu, choose **System** > **Disaster Recovery** to open the **Disaster Recovery** page.

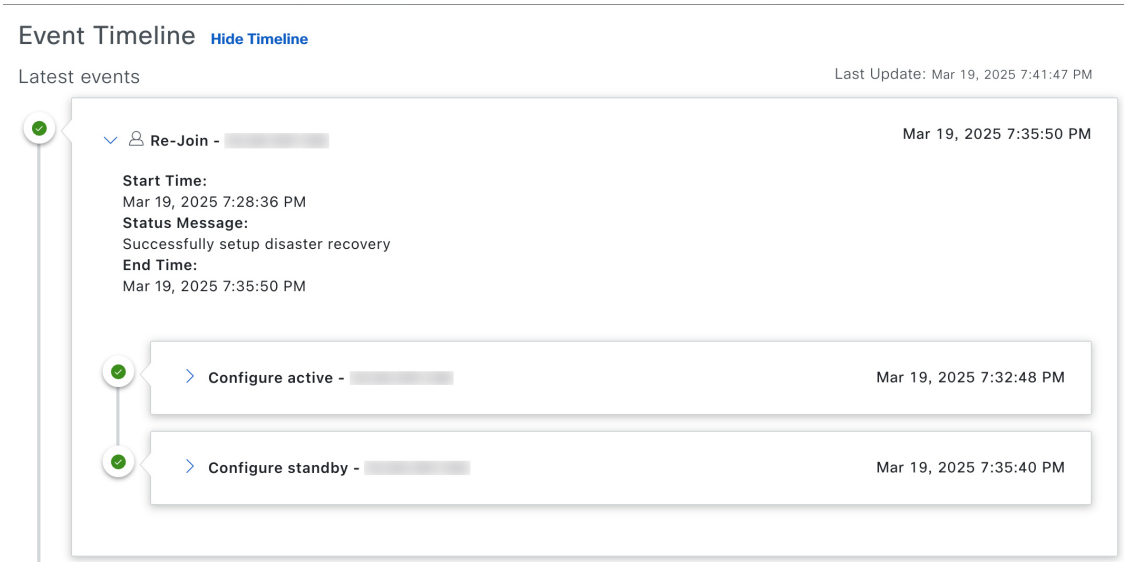
   The **Monitoring** tab is selected, by default.

2. Scroll to the bottom of the page.

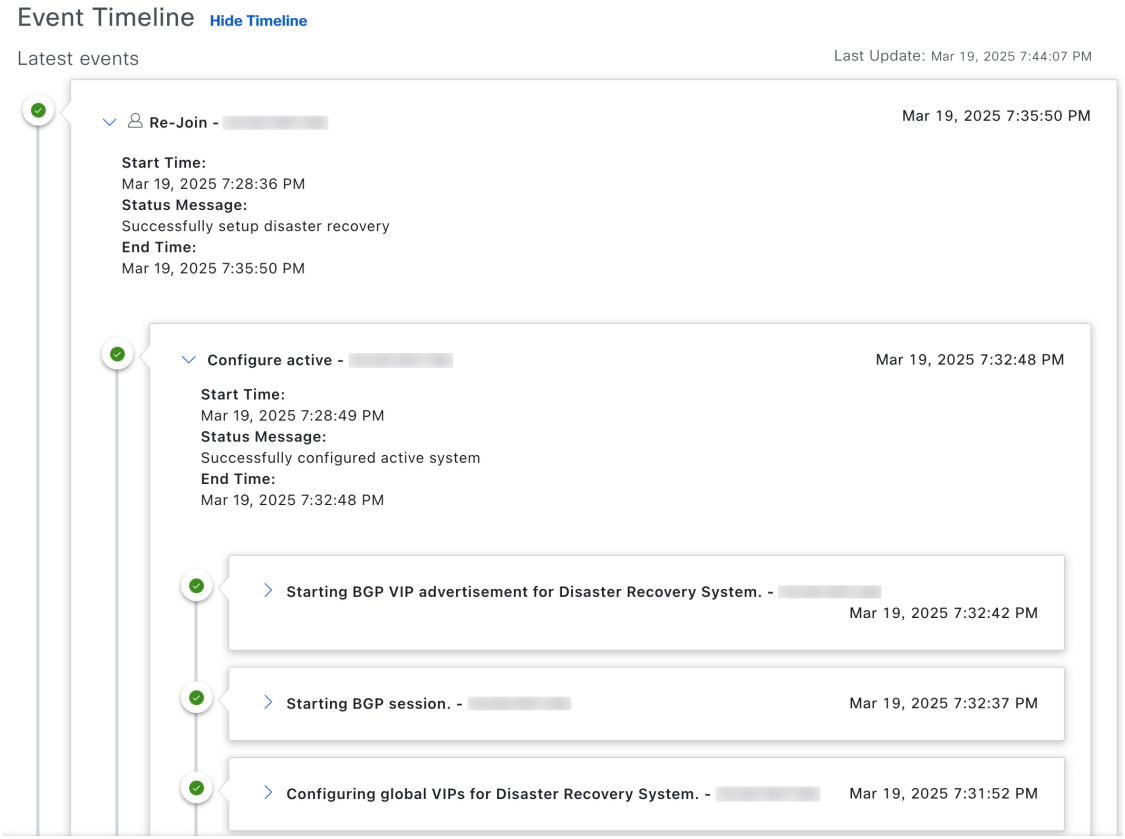
Every task that is in progress or has completed for your system is listed here (in descending order based on their completion timestamp), starting with the most recent task. Catalyst Center indicates whether each task was initiated by the system (⌨) or a user (👤).



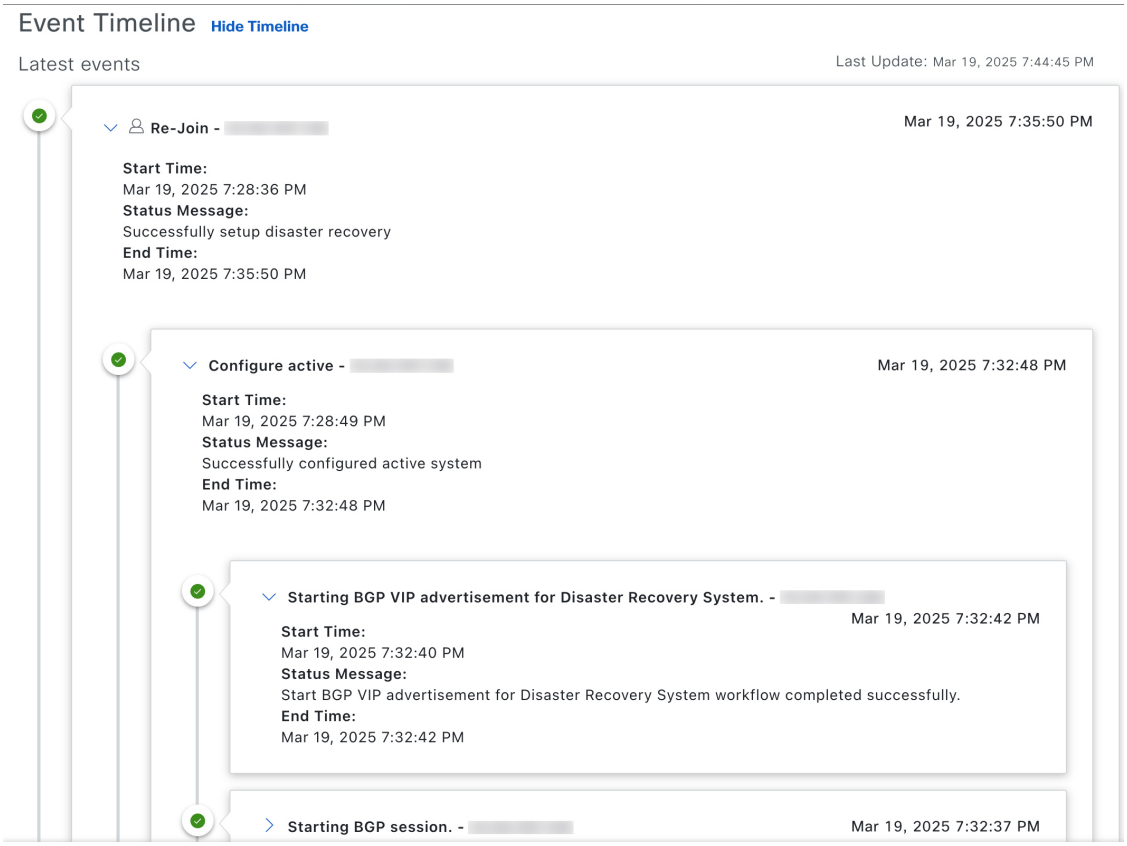
Say you want to monitor the restoration of your system after it was paused. Catalyst Center updates the Event Timeline as each task in the restoration process is started and then completed. To view a summary of what took place during a particular task, click **>**.



Catalyst Center lists the relevant subtasks that were completed.



As with tasks, you can click **>** to view summary information for a particular subtask.



See Troubleshoot your disaster recovery system on page 286 for a description of the issues that you may encounter while monitoring the event timeline and how to remedy them.

Monitor managed services replication

Describes the managed services that are monitored when replicated and the four possible status messages.

After you activate your disaster recovery system, Catalyst Center begins monitoring the data replication status of the GlusterFS, MongoDB, and Postgres services. Whenever the replication of these services is taking place, the **Status** area displays one of these four messages:

- Replication is completing as expected.

  ONGOING DATA REPLICATION

  Ongoing data replication is proceeding within the normal range of latency.

- Replication is completing, but the data sync lag between your system's main and recovery site is currently 20 minutes or more.

  ONGOING DATA REPLICATION

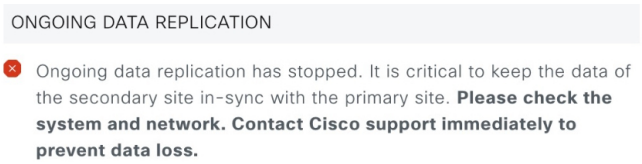
  Ongoing data replication is slowing down. You may want to be on the lookout for the status of network and/or system.

- Replication is completing, but the data sync lag between your system's main and recovery site is 30 minutes or more.

  ONGOING DATA REPLICATION

  Ongoing data replication is slowing down significantly. **Please check the system and network. Contact Cisco support if the issue persists.**

- Replication has stopped.



These messages allow you to keep tabs on the replication of managed services, pointing out when network or system issues are impacting the sync of these services' data between your system's sites.

System and site states

Information about the current state of your disaster recovery system.

In the disaster recovery GUI, the **Status** area indicates the current state of your system. This tables explain the various states that you may see for the individual sites in your system Topology.

Table 14: Active site states

State	Description
Unregistered	Newly installed site. Disaster recovery information is not available yet.
Initializing	The site is preparing to transmit the data required by the other sites in order to set up the disaster recovery cluster during the registration process.
Initialized	The site has successfully prepared the data that it will transmit to the other sites in order to set up the disaster recovery cluster during the registration process.
Failed to Initialize	The site encountered an error while preparing to transmit the data required by the other sites in order to set up the disaster recovery cluster during the registration process.
Connecting Recovery	The main site is contacting the recovery site to retrieve the initialized data required to set up secure communication with the main site.
Connecting Witness	The main site is contacting the witness site to retrieve the initialized data required to set up secure communication with the main site.
Recovery Site Connected	The main site successfully established secure communication with the recovery site.
Failed to Connect Recovery	The main site encountered an error while establishing a secure channel with the recovery site.
Failed to Connect Witness	The main site encountered an error while establishing a secure channel with the witness site.
Registered	The active site successfully established secure communication with the other two sites.
Deregistering	Removing the current disaster recovery configuration from the system.
Deregister Failed	An error occurred while removing the current disaster recovery configuration from the system.
Validating	Validating the state of the system before starting the disaster recovery configuration.
Validated	Successfully validated the state of the system before starting the disaster recovery configuration.

State	Description
Validation Failed	An error occurred while validating the state of the system before starting the disaster recovery configuration.
Configuring Active	Executing the workflows to establish this site as the active site.
Failed to Configure	An error occurred while running the workflows to enable disaster recovery on this site.
Syncing Config Data	Syncing the data required from the other sites to set up the disaster recovery system.
Config Data Synced	Successfully synced the data required from the other sites to set up the disaster recovery system.
Active Sync Failed	An error occurred while the pending active site was syncing the data required from the other sites to set up the disaster recovery system.
Waiting Standby Configuration	Successfully completed the workflows to establish this site as the active site; waiting for the standby site's workflows to complete.
Active	The site is successfully managing the network as the active site.
Failed to Configure	The site failed to execute some of the workflows that would enable itself as the active site in the disaster recovery cluster.
Isolating	The site is executing the workflows to isolate itself because it either lost connectivity with the other two sites or is preparing to become standby-ready (as part of a manual failover).
Isolated	The site has successfully executed the workflows to isolate itself because it either lost connectivity with the other two sites or is preparing to become standby-ready (as part of a manual failover).
Failed to Isolate	The site encountered an error while executing the workflows to isolate itself because it either lost connectivity with the other two sites or is preparing to become standby-ready (as part of a manual failover).
Configuring Active	Configuring a previous standby site as the active site (as part of a system-triggered or manual failover).
Failed during Failover	An error occurred while executing the workflows to establish this site as the active site (as part of a failover or recovery from a two-system failure).
Pausing Active	Executing the workflows that disable disaster recovery operations on the active site (in order to prepare for an administrative operation or a planned outage).
Active Paused	Successfully disabled disaster recovery operations on the active site.
Failed to Pause Active	An error occurred while disabling disaster recovery operations on the active site.
Active Stand Alone	Executing the workflows to establish a previous active site that lost connectivity with the other two sites as an independent system by removing all disaster recovery configurations.
Down	The active site has lost connectivity with the other two sites.

Table 15: Standby site states

State	Description
Unregistered	Newly installed site. Disaster recovery information is not available yet.
Initializing	The site is preparing to transmit the data required by the other sites in order to set up the disaster recovery cluster during the registration process.
Initialized	The site has successfully prepared the data that it will transmit to the other sites in order to set up the disaster recovery cluster during the registration process.
Failed to Initialize	The site encountered an error while preparing to transmit the data required by the other sites in order to set up the disaster recovery cluster during the registration process.
Connecting Main	The recovery site is contacting the main site to retrieve the initialized data required to set up secure communication with the main site.
Connecting Witness	The recovery site is contacting the witness site to retrieve the initialized data required to set up secure communication with the main site.
Main Site Connected	The recovery site successfully established secure communication with the main site.
Failed to Connect Main	The recovery site encountered an error while establishing a secure channel with the main site.
Failed to Connect Witness	The recovery site encountered an error while establishing a secure channel with the witness site.
Registered	The standby site successfully established secure communication with the other two sites.
Deregistering	Removing the current disaster recovery configuration from the system.
Deregister Failed	An error occurred while removing the current disaster recovery configuration from the system.
Validating	Validating the state of the system before starting the disaster recovery configuration.
Validated	Successfully validated the state of the system before starting the disaster recovery configuration.
Validation Failed	An error occurred while validating the state of the system before starting the disaster recovery configuration.
Configuring Standby	Executing the workflows to establish this site as the standby site.
Failed to Configure	An error occurred while running the workflows to enable disaster recovery on this site.
Syncing Config Data	Syncing the data required from the other sites to set up the disaster recovery system.
Config Data Synced	Successfully synced the data required from the other sites to set up the disaster recovery system.
Standby Sync Failed	An error occurred while the pending standby site was syncing the data required from the other sites to set up the disaster recovery system.
Waiting Active Configuration	Successfully completed the workflows to establish this site as the standby site; waiting for the active site's workflows to complete.

State	Description
Standby	The site is successfully configured as the standby site in the disaster recovery cluster.
Failed to Configure	The site failed to execute some of the workflows that would enable itself as the standby site in the disaster recovery cluster.
Isolating	The site is executing the workflows to isolate itself because it lost connectivity with the other two sites.
Isolated	The site has successfully executed the workflows to isolate itself because it lost connectivity with the other two sites.
Failed to Isolate	The site encountered an error while executing the workflows to isolate itself because it lost connectivity with the other two sites.
Configuring Standby	Configuring a previous active site as the standby-ready site (as part of a manual failover).
Standby Ready	A previous active system is ready to be configured as a standby system (as a result of a failover).
Pausing Standby	Executing the workflows that disable disaster recovery operations on the standby site (in order to prepare for an administrative operation or a planned outage).
Standby Paused	Successfully disabled disaster recovery operations on the standby site.
Failed to Pause Standby	An error occurred while disabling disaster recovery operations on the standby site.
Standby Stand Alone	Executing the workflows to establish a previous standby site that lost connectivity with the other two sites as an independent system by removing all disaster recovery configurations.
Down	The site has lost connectivity with the other two sites.

Table 16: Witness site states

State	Description
Unregistered	Newly installed site. Disaster recovery information is not available yet.
Registered	This site has been designated as the witness site and the validation checks have completed successfully.
Up	Configuration of the witness site has completed successfully.
Down	The site has lost connectivity with the other two sites.

Disaster recovery event notifications

Information about disaster recovery event notifications.

You can configure Catalyst Center to send a notification whenever a disaster recovery event takes place. See the "Work with Event Notifications" topic in the *Cisco Catalyst Center Platform User Guide* for a description of how to configure and subscribe to these notifications. When completing this procedure, ensure that you select and subscribe to the SYSTEM-DISASTER-RECOVERY-v2 event in the **Platform** > **Developer Toolkit** > **Events** table.

Important

Disaster recovery supports IPsec up/down notifications on a best-effort basis. When network disruptions prevent writing to the distributed store, some up/down notifications may be dropped. Event notifications resume after network communication is restored.

After you subscribe, Catalyst Center sends a notification indicating that the IPsec session is down because the system's certificate has expired. To update this certificate:

1. Place your system on pause on page 264.
2. On both your main and recovery site, replace the current system certificate. From the main menu, choose **System** > **Settings** > **Certificates** > **System Certificates**.
3. Rejoin your system on page 266.

Supported events

Lists the disaster recovery events for which Catalyst Center generates notifications.

This table lists the disaster recovery events that Catalyst Center generates notifications for when they take place.

System health status	Event	Notification
OK	The disaster recovery system is operational.	`Activate DR (Disaster Recovery Setup Successful)`
OK	Failover to either the main or recovery site has completed successfully.	`Failover Successful`
OK	Registration of the main site has completed successfully.	`Successfully Registered Main Site`
OK	Registration of the recovery site has completed successfully.	`Successfully Registered Recovery Site`
OK	Registration of the witness site has completed successfully.	`Successfully Registered Witness Site`
OK	The disaster recovery system has been paused successfully.	`DR Pause Success`
OK	The standby site is operational.	`Standby Site Up`
OK	The witness site is operational.	`Witness Site Up`
OK	The disaster recovery system has been unregistered successfully.	`Unregister Success`
Degraded	Failover to either the main or recovery site has failed.	`Failover Failed`
Degraded	Automated failover is not available because the standby site is currently down.	`Standby Cluster Down`
Degraded	Automated failover is not available because the witness site is currently down.	`Witness Cluster Down`

System health status	Event	Notification
Degraded	Unable to place the disaster recovery system on pause.	`Pause Failure`
Degraded	BGP route advertisement failed.	`BGP Failure`
Degraded	The IPsec tunnel connecting your system's sites is operational.	`IPsec Up`
Degraded	The IPsec tunnel connecting your system's sites is currently down.	`IPsec Down`
NotOk	Disaster recovery system configuration failed.	`Activate DR Failure`
NotOk	The site that is currently in the **Standby Ready** state is unable to rejoin the disaster recovery system.	`Activate DR Failure`
NotOk	Unregistration of the disaster recovery system failed.	`Unregistration Failed`
NotOk	Registration of the main site failed.	`Main Registration Failed`
NotOk	Registration of the recovery site failed.	`Recovery Registration Failed`
NotOk	Registration of the witness site failed.	`Witness Registration Failed`

Troubleshoot your disaster recovery system

Information about troubleshooting your disaster recovery system.

This table describes issues that your disaster recovery system may present and ways to address them.

Note

If a disaster recovery operation fails or times out, click **Retry** to repeat the operation. If the problem persists and its solution is not provided in this table, contact Cisco TAC for assistance.

Table 17: Disaster recovery system issues

Error Code	Message	Solution
SODR10007	`Token does not match.`	The token provided during recovery site registration does not match the token generated during main site registration. From the main site's **Disaster Recovery** > **Configuration** tab, click **Copy Token** to ensure that you copy the correct token.

Error Code	Message	Solution
SODR10048	`Packages (package names) are mandatory and not installed on the main site.`	Install the listed packages before registering the system.
SODR10056	`Invalid credentials.`	Confirm that you entered the correct credentials for the main site during recovery and witness site registration.
SODR10062	`() site is trying to () with invalid IP address. Expected is (); actual is ().`	The main site IP address provided during recovery and witness site registration is different from the IP address that was provided during main site registration.
SODR10067	`Unable to connect to (recovery or witness site).`	Verify that the main site is up.
SODR10072	`All the nodes are not up for (main or recovery site).`	Check whether all three of the site's nodes are up.
SODR10076	`High availability should be enabled on (main or recovery) site cluster.`	Enable high availability (HA): 1. Log in to the site you need to enable HA on. 2. From the main menu, choose **System** > **Settings** > **System Configuration** > **High Availability**. 3. Click **Activate High Availability**.
SODR10100	`(Main or recovery) site has no third party certificate.`	Replace the default certificate that Catalyst Center is currently using with a third-party certificate. See Update the Catalyst Center server certificate on page 27 for more information.
SODR10113	`Save cluster metadata failed.`	Contact Cisco TAC for help with completing the appropriate recovery procedure.
SODR10118	`Appliance mismatch between main () and recovery ().`	The main and recovery sites use different appliances. To successfully register disaster recovery, both sites must use the same 56 or 112 core appliance.
SODR10121	`Failed to advertise BGP. Reason: ().`	See Troubleshoot BGP route advertisement issues on page 292 for more information.
SODR10122	`Failed to stop BGP advertisement. Reason: ().`	See Troubleshoot BGP route advertisement issues on page 292 for more information.
SODR10123	`Failed to establish secure connection between main () and ()().`	No solution is available for this issue. Contact Cisco TAC for assistance.
SODR10124	`Cannot ping VIP: (main, recovery, or witness site's VIP or IP address).`	Perform these actions: • Verify that the address specified is correct. • Check whether the address is reachable from the other addresses.

Error Code	Message	Solution
SODR10129	`Unable to reach main site. ()`	Check whether the Enterprise virtual IP address configured for the main site is reachable from the recovery and witness sites.
SODR10132	`Unable to check IP addresses are on the same interface. Retry the operation. ()`	Retry the operation you just attempted.
SODR10133	`The disaster recovery enterprise VIP () and the IP addresses () are not configured or reachable via the same interface. Check the gateway or static routes configuration.`	The disaster recovery system's sites communicate over the Enterprise network. The main and recovery site's Enterprise virtual IP address and the witness site's IP address must be reachable through the Enterprise interface. This error means that at least one site configures its IP address or virtual IP address with an interface other than the Enterprise interface.
SODR10134	`The disaster recovery management VIP (`*`VIP address`*`) and the IPs (`*`IP addresses`*`) are configured/reachable via same interface. It should be configured/reachable via management interface. Check the gateway or static routes' configuration.`	Configure the disaster recovery system's management virtual IP address on the management interface. This error means the virtual IP address is currently set on an interface that does not have the management cluster's virtual IP address. Add a /32 static route to the management virtual IP address configured on the management interface.
SODR10136	`Certificates required to establish IPsec session not found.`	From the **System Certificate** page (**System** > **Settings** > **Certificates** > **System Certificates**), try uploading the third-party certificate again and then retry registration. If the problem persists, contact Cisco TAC for assistance.
SODR10138	`Self-signed certificate is not allowed. Upload a third-party certificate and retry.`	–

Error Code	Message	Solution
SODR10139	`Disaster recovery requires first non-wildcard DNS name to be same in main and recovery. {} in {} site certificate is not same as {} in {} site certificate.`	The third-party certificate installed on your main and recovery sites has different DNS names specified for your disaster recovery system. Generate a third-party certificate that specifies a DNS name for your system and upload this certificate to both sites. **Note** Ensure that the DNS name does *not* use a wildcard.
SODR10140	`Disaster recovery requires at least one non-wildcard DNS name. No DNS name found in certificate.`	The third-party certificate installed on your main and recovery sites does not specify a DNS name for your disaster recovery system. Catalyst Center uses this name to configure the IPsec tunnel that connects your system's sites. Generate a third-party certificate that specifies a DNS name for your system and upload this certificate to both sites. **Note** Ensure that the DNS name does *not* use a wildcard.
–	–	When all three of your system's sites are not connected due to network partitioning or another condition, Catalyst Center sets the status of the sites to **Isolated**. Contact Cisco TAC for help with completing the appropriate recovery procedure.
–	`External postgres services does not exists to check service endpoints.`	Perform these actions: 1. Log in to the site that the error occurred on. 2. Run the following commands: • **Kubectl get sep -A** • **kubectl get svc -A | grep external** 3. In the resulting output, search for `external-postgres`. 4. If present, run the following command: **kubectl delete sep external-postgres -n fusion** 5. Retry the operation that failed previously.

Error Code	Message	Solution
–	`Success with errors.`	If you see this message after initiating a failover or pausing your disaster recovery system, it indicates that the operation completed successfully even though one or multiple services encountered minor errors. You can go ahead and click **Rejoin** to restart your system. These errors will be resolved after you do so.
–	`Failed.`	This message indicates that a disaster recovery operation failed because one or multiple services encountered a critical error. To troubleshoot the failure, we recommend that you view the Event Timeline and drill down to the relevant error. When you see this message, click **Retry** to perform the operation again.
–	`Cannot ping VIP: (`*`VIP address`*`).`	Verify that the Enterprise VIP address configured for your system is reachable.
–	`VIP drop-down list is empty.`	Confirm that your system's VIP addresses and intracluster link are configured properly.
–	`Cannot perform (`*`disaster recovery operation`*`) due to ongoing workflow: BACKUP. Please try again at a later time.`	A disaster recovery operation was triggered while a scheduled backup was running. Retry the operation after the backup finishes.
–	`The GUI indicates that the standby site is still down after it has come back online.`	If the standby site goes down and Catalyst Center's first attempt to isolate it from your disaster recovery system fails, it may not automatically initiate a second attempt. When this happens, the GUI will indicate that the site is down, even if it is operational again. In addition, you cannot restart your system as the standby site is stuck in maintenance mode. To restore the standby site, do the following: **1.** In an SSH client, log in to the standby site. **2.** Run the **maglev maintenance disable** command to take the site out of maintenance mode. **3.** Log in to Catalyst Center. **4.** From the main menu, choose **System** > **Disaster Recovery**. The **Monitoring** tab is selected by default. **5.** In the **Action** area, click **Rejoin** in order to restart your disaster recovery system.

Error Code	Message	Solution
–	`Multiple services exists for MongoDB to check node-port label.`	For debugging, the MongoDB node port is exposed as a service. Run the following commands to identify this port and hide it: • **kubectl get svc --all-namespaces | grep mongodb** • **magctl service unexpose mongodb** <*port-number*>
–	`Multiple services exist for Postgres to check node-port label.`	For debugging, the Postgres node port is exposed as a service. Run the following commands to identify this port and hide it: • **kubectl get svc --all-namespaces | grep postgres** • **magctl service unexpose postgres** <*port-number*>

Two-site failure scenarios

List the two-site failure scenarios.

A two-site failure occurs when at least two of your disaster recovery system's three sites go down at the same time, or the sites have been partitioned. Try your best to restore the failed sites. If you're able to do so, disaster recovery will automatically reactivate, but will require a manual rejoin. If the system is not recoverable, refer to this table for a description of how Catalyst Center responds to the various failure scenarios and any user actions that need to be taken.

Failure scenario	System and user response
Scenario 1: Two or more sites go down and come back online about the same time.	1. The system isolates the active and standby sites. 2. The system restores the active site and the standby site enters the **Standby Ready** state. 3. You are notified that the system has recovered from a two-system failure. For confirmation, refer to the Event Timeline. 4. Reactivate your disaster recovery system by clicking **Rejoin** in the **Action** area.
Scenario 2: The active, standby, and witness sites go down. The active and standby sites come back online while the witness site remains offline.	1. The system isolates the active and standby sites. 2. The system restores the active site and the standby site enters the **Standby Ready** state. 3. You are notified that the system has recovered from a two-system failure. For confirmation, refer to the Event Timeline. 4. Replace the current witness site on page 275. 5. In the **Action** area, click **Rejoin**.

Failure scenario	System and user response
Scenario 3: The active, standby, and witness sites go down. The active and witness sites come back online while the standby site remains offline.	1. The system isolates and then restores the active site. 2. You are notified that the system has recovered from a two-system failure. For confirmation, refer to the Event Timeline. 3. After the former active site comes back online and reactivates. If you've determined that you need to replace the nodes at the standby site, instead: a. Log in to the witness site and run the **witness reset** command. b. Log in to the active site, click **Standalone**, and then click **Continue**. c. Replace the nodes at the standby site. d. Set up disaster recovery on page 251.
Scenario 4: The active, standby, and witness sites go down. The standby and witness sites come back online while the active site remains offline.	1. The system isolates the standby site and then establishes it as the new active site. 2. You are notified that the system has recovered from a two-system failure. For confirmation, refer to the Event Timeline. 3. After the former active site comes back online and enters the **Standby Ready** state, click **Rejoin** in the **Action** area. If you've determined that you need to replace the nodes at the former active site, instead: a. Log in to the witness site and run the **witness reset** command. b. Log in to the active site, click **Standalone**, and then click **Continue**. c. Replace the nodes at the former active site. d. Set up disaster recovery on page 251.

Troubleshoot BGP route advertisement issues

Information about troubleshooting BGP route advertisement issues.

Complete this procedure to troubleshoot the cause of a BGP route advertisement error.

Procedure

1. Validate the BGP session's status on the Catalyst Center cluster:
   a) In the Event Timeline, confirm that the **Starting BGP VIP advertisement** task completed successfully (**Activate Disaster Recovery System** > **View Details** > **Configure active** > **View Details**).
   If the task failed, do the these task before going to Step 1b:
   1. Check whether the neighbor router that the error message indicates is up.
   2. Confirm that the neighbor router has connectivity with Catalyst Center. If it doesn't, restore connectivity. Then retry activating the new disaster recovery system or restarting a paused existing system.

b) In the Catalyst Center GUI, view the disaster recovery system's Logical Topology and determine whether the neighbor router is currently active.

If it's down, check whether the Catalyst Center cluster is configured as a BGP neighbor from the router's perspective. If it's not, configure the cluster as a neighbor. Then retry activating the new disaster recovery system or restarting a paused existing system.

c) View the bgpd and bgpmanager log files by running these commands:

- **sudo vim /var/log/quagga/bgpd.log**
- **magctl service logs -rf bgpmanager | lql**

When viewing the log files, look for error messages. If you can't find any, this indicates that the BGP session is functioning properly.

d) Check the status of the BGP session between Catalyst Center and its neighbor router by running the **echo** *admin-password***| sudo VTYSH_PAGER=more -S -i vtysh -c 'show ip bgp summary'** command.

In the command output, look for the neighbor router's IP address. At the end of the same line, confirm that the output lists the router's connection state as **0**. If so, this indicates that the BGP session is active and functioning properly.

2. Validate the BGP session's status on the neighbor router indicated in the error message:

a) Run the **show ip bgp summary** command.

b) In the command output, look for the Catalyst Center cluster's virtual IP address. At the end of the same line, confirm that the output lists the cluster's connection state as **0**. If so, this indicates that the BGP session is active and functioning properly.

c) Run the **show ip route** command.

d) View the command's output and confirm whether Catalyst Center is advertising the disaster recovery system's Enterprise virtual IP address.

For example, say your system's Enterprise virtual IP address is 10.30.50.101. If this is the first IP address that you see in the output, this confirms that Catalyst Center is advertising it.

Upgrade Catalyst Center disaster recovery deployment

This section describes the workflow for upgrading a Catalyst Center deployment with disaster recovery enabled. It explains how to minimize monitoring downtime by upgrading sites in sequence and transitioning the VIP.

To upgrade a Catalyst Center deployment with disaster recovery enabled, follow this workflow The workflow reduces the monitoring downtime window from hours to less than 15 minutes.

While you follow this workflow, Catalyst Center upgrades the active and standby sites of your disaster recovery system in sequence. When Catalyst Center upgrades the active site, it moves the disaster recovery VIP and BGP to the standby site This allows the standby site to temporarily act as the active site, enabling it to continue processing and forwarding events..

> **Note**
>
> Do not perform provisioning activities while the standby site temporarily acts as the active site. Database changes made to the standby site during this period are not retained after the VIP returns to the active site..

Before you begin

Make sure you can access Catalyst Center's **Disaster Recovery** and **Software Management** pages.

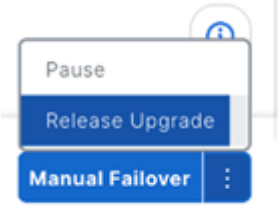
Procedure

1. From the active site, choose **System** > **Disaster Recovery** from the main menu.

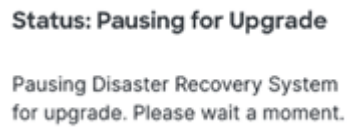
   By default, **Monitoring** is selected and displays your disaster recovery system's topology.



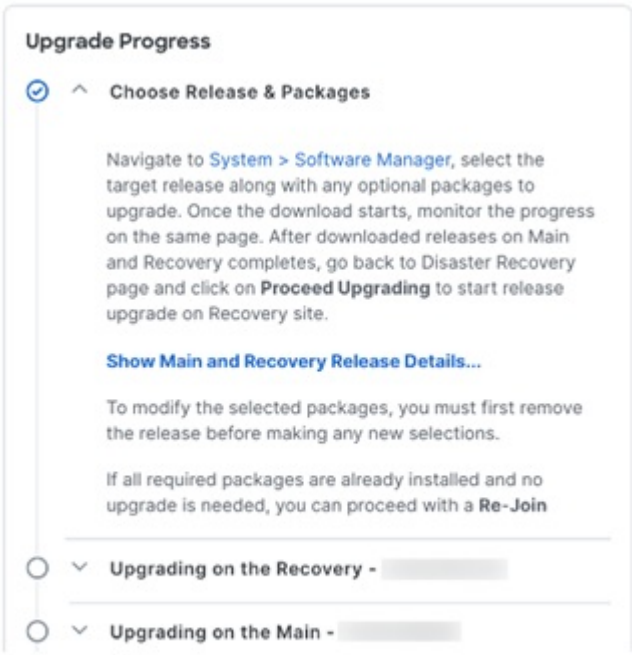
2. In the **Action** area, select  **> Release Upgrade**.



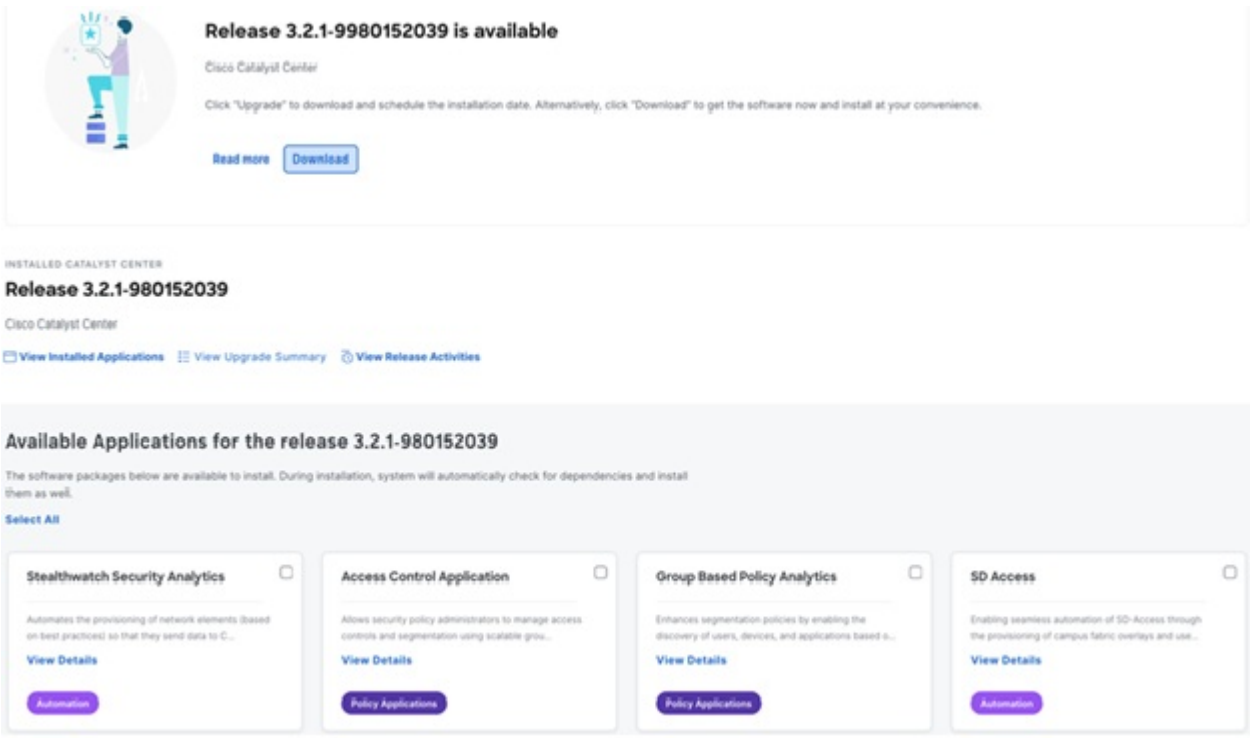
   Catalyst Center pauses your system to prepare for the upgrade.



After this operation completes, the **Upgrade Progress** page opens and guides you through the upgrade.



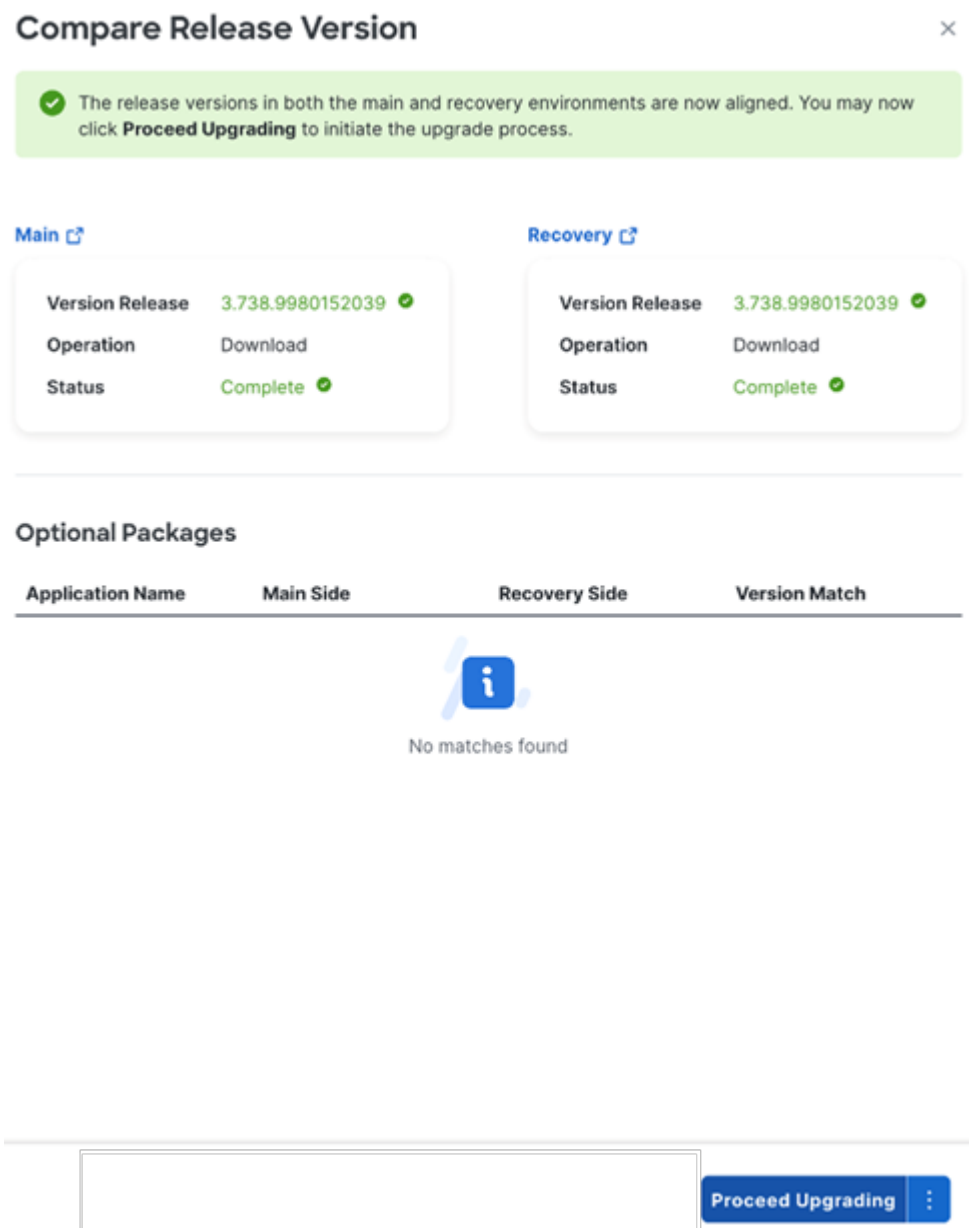
3. From the main menu, choose **System** > **Software Management**.
4. In the **Available Applications for the release** *release-number* area, choose the optional software packages to install with the target Catalyst Center release.



5. Select **Download**.

   After Catalyst Center downloads the target release to the active site, it automatically downloads the same release to the standby site.

6. After you have confirmed that Catalyst Center has downloaded the target release to both the active and standby sites, select **Proceed Upgrading**.



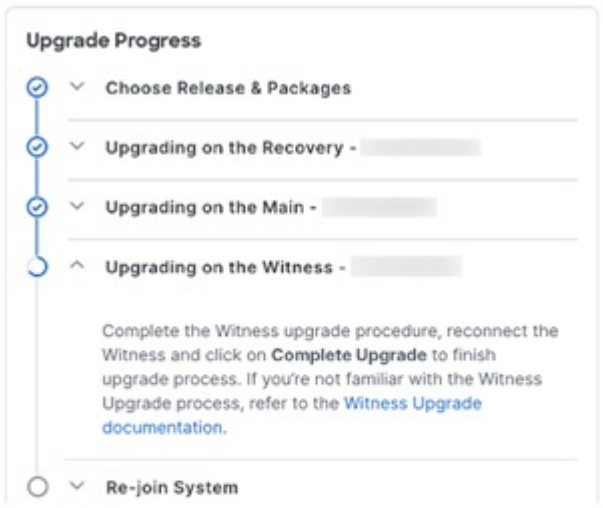
The upgrade of the standby site begins.

7. After this upgrade completes, select **Proceed Upgrading** again.

   Catalyst Center first moves the disaster recovery VIP to the standby site. Then it starts upgrading the active site.

8. After this upgrade completes, select **Proceed Upgrading**again.

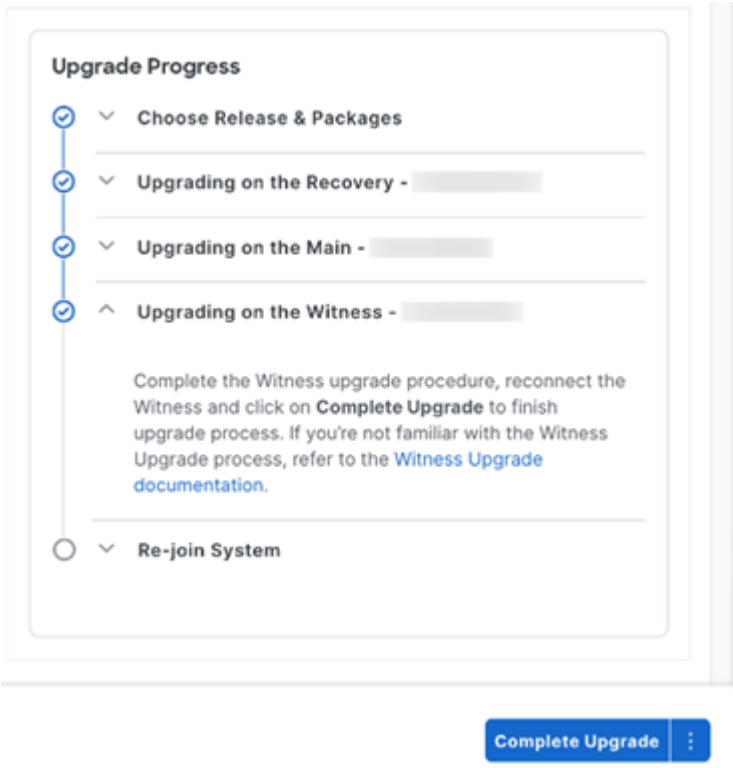
   Catalyst Center moves the disaster recovery VIP back to the active site.



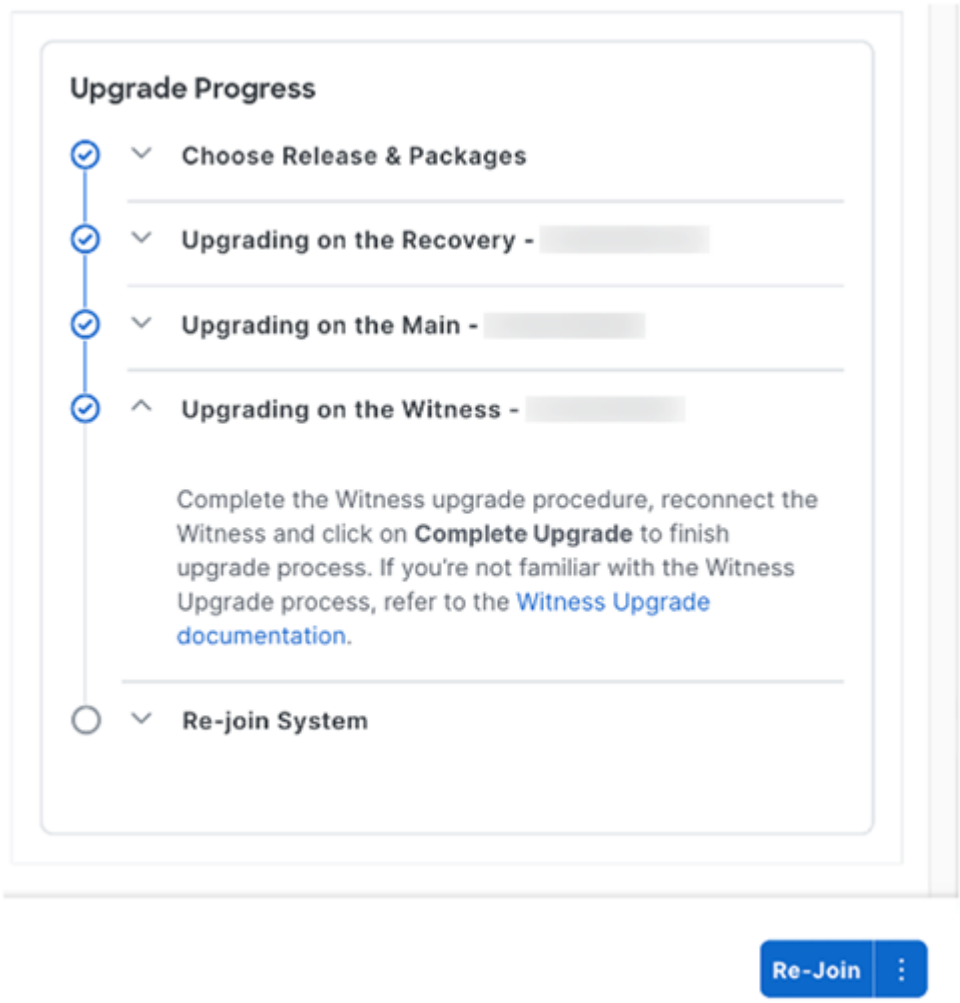
9. Upgrade your system's witness site.

   Refer to Upgrade the current witness site on page 276

10. After this upgrade completes, select **Complete Upgrade**.



11. Select **Re-Join** to reactivate your disaster recovery system.



Upgrade an airgapped deployment

Explains the upgrade process for airgapped Catalyst Center deployments, highlighting the requirements for manual binary image placement and the execution of scan and preload actions on both sites.

Airgapped Catalyst Center deployments are fully supported. The upgrade flow is almost identical to that for cloud-connected deployments, with the following differences:

- Manually place the binary image on both the active and standby sites.
- On your system's active site, open the main menu and select **System** > **Software Management**. Run both the **Scan** and **Preload** actions. Catalyst Center scans and preloads the same release on the standby site.

Troubleshooting upgrade failures in disaster recovery

Details troubleshooting procedures for disaster recovery upgrades, including monitoring the Event Timeline, addressing errors reported in the Disaster Recovery page, and using the Software Management page to remediate and resume failed upgrades.

When performing an upgrade in a disaster recovery environment, follow these steps to manage potential issues:

- Observe the **Event Timeline** in Catalyst Center. This interface logs all upgrade-related actions, providing a granular view of success or failure messages for individual services.

- If SMO (what does this stand for?) reports an error during the upgrade process on either the active or standby site, Catalyst Center relays that error in the **Disaster Recovery** page.
- Debug and remediate upgrade issues in the **Software Management** page.
- After an upgrade issue has been resolved, select **Retry** to resume the upgrade.

Frequently asked questions

Addresses common questions regarding disaster recovery upgrades, specifically clarifying data loss risks during VIP transitions and the mandatory requirement to upgrade the witness site before system reactivation.

Q: Are database changes made to the standby site synced back to the active site after an upgrade?

A: No. These changes are lost when you perform the **Rejoin** operation. During an upgrade, moving the disaster recovery VIP to the standby site and then returning it to the active site reduces the monitoring downtime window. However, this action does not remove the period during which data loss can occur while the active site is being upgraded.

Q: Can I upgrade my disaster recovery system without first updating the witness site?

A: No. Catalyst Center does not allow you to reactivate your system until the witness site has been upgraded to the proper Catalyst Center version.

15 Integrate Multiple Catalyst Center Clusters with a Single Cisco ISE System

Topics:

- Overview of a Multiple Catalyst Center deployment
- Author Node cluster
- Reader Node cluster
- Multiple Catalyst Center policy management
- Upgrade recommendations for Multiple Catalyst Center
- Multiple Catalyst Center deployments
- Enable Multiple Catalyst Center
- Integrate multiple Catalyst Centers with a single Cisco ISE
- Integrate other Catalyst Center clusters with Cisco ISE as Reader Nodes
- Delete a virtual network
- Delete a security group
- Promote a Reader Node to an Author Role
- Promote a Reader Node gracefully
- Promote a Reader Node forcibly

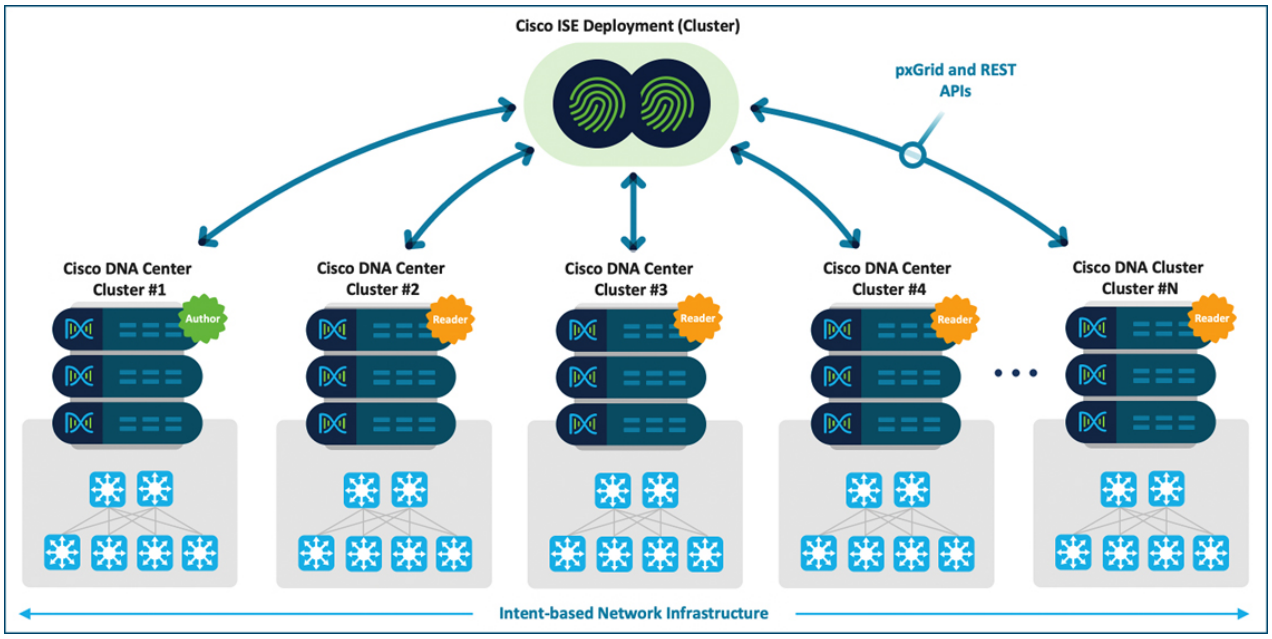
Overview of a Multiple Catalyst Center deployment

This is an overview of a Multiple Catalyst Center deployment.

When you integrate more than one Catalyst Center cluster with a single Cisco ISE system, each Catalyst Center cluster is independent. No information is shared among the clusters. In this scenario, when you deploy Cisco Software-Defined Access (SD-Access) on Catalyst Center, the set of virtual networks (VNs) and all other SD-Access is local to each cluster.

Catalyst Center provides a mechanism to coordinate SD-Access and Group-Based Policy (GBP) elements across multiple Catalyst Center clusters integrated with a single Cisco ISE system. To enable global administration of SD-Access across multiple Catalyst Center clusters with a consistent set of VNs, the Multiple Catalyst Center feature leverages the existing secure connection with Cisco ISE to propagate VNs, security group tags (SGTs), Access Contracts, and Group-Based Access Control (GBAC) Policy from one cluster to another cluster. Cisco ISE takes the information learned from one cluster (known as the Author Node) and propagates it to the other clusters (known as the Reader Nodes).

The Multiple Catalyst Center feature is available when you integrate it with Cisco ISE Release 3.2 or later.



Note

- The Multiple Catalyst Center operation is disabled by default. To use this feature, select the **Enable Multiple Catalyst Center operation** (under **Advanced Settings**) when integrating Catalyst Center with Cisco ISE. You can enable this feature during the initial configuration or at a later time (after Cisco ISE is already integrated). After this functionality is enabled, only deleting the Cisco ISE integration can disable the functionality.
- If you are using earlier releases of Cisco ISE, contact your account team to submit a request to the Cisco SDA Design Council for inclusion in the Limited Availability program. A Multiple Catalyst Center Limited Availability package is provided to allow access to the limited availability (LA) version of this functionality. For more information, see the Multiple Cisco DNA Center to Single Cisco ISE Prescriptive Deployment Guide.

The Multiple Catalyst Center feature has specific role designations for the clusters:

- Author Node cluster
- Reader Node cluster

Author Node cluster

This topic explains the Author Node cluster in a Multiple Catalyst Center deployment.

The Author Node role is assigned to the first cluster with the **Multiple Catalyst Center** option enabled that integrates with the Cisco ISE deployment, or the first cluster which enables the **Multiple Catalyst Center** option. The Author Node cluster is the administration point for the Group-Based Policy (GBP) and for Cisco SD-Access global data. The Author Node cluster manages VNs, SGTs, Access Contracts, and GBAC Policy. You can create, modify, or delete VNs and GBP components only on the Author Node cluster.

The Author Node cluster pushes VN and GBP information to Cisco ISE via ERS (REST) APIs, allowing Cisco ISE to use this information and publish to all other Cisco Catalyst Center Clusters in the Reader Node role through Cisco ISE pxGrid.

Only one cluster can be designated as the Author Node. It's the only node where GBP and user-defined global SDA data (such as VNs or extranet policy) can be managed.

If SGTs or VNs are operational on the Author Node, it is not possible to delete them.

Reader Node cluster

This topic explains Reader Node cluster in a Multiple Catalyst Center Deployment.

All other Catalyst Center clusters which have the Multiple Catalyst Center feature enabled are assigned the role of Reader Node cluster. Reader Node clusters have a read-only view of VNs and SGTs.

Even though Reader Node clusters consume and persist the same VNs, SGTs, Access Contracts, and GBAC Policies that are defined on the Author Node cluster, a Reader Node cluster does not display Access Contracts or policies.

You can create VNs only on the Author Node cluster. After creating VNs, they propagate to Reader Node clusters for use in fabric provisioning operations. The Reader Node clusters configure the associated network attributes such as Virtual Network Identifiers (VNID), Route Targets (RT), and Route Distinguishers (RD) which are local to that cluster.

Except for the VN and GBP features, each Reader Node cluster is an independent cluster that manages its own network infrastructure.

The Multiple Catalyst Center feature enables global policy administration across multiple Cisco Catalyst Center clusters integrated to a single Cisco ISE. This capability doesn't change the underlying limitations of managing virtual networks and fabrics on multiple Cisco Catalyst Center clusters. A VN may have the same name across multiple Cisco Catalyst Center clusters, which allows it to support consistent security group-VN associations across multiple clusters. But at the individual cluster level, the actual network attributes to associate with a VN (VRF, route target, route distinguisher, and so on) aren't identical across clusters. This is the same as when operating independent Catalyst Center clusters.

You can add up to four Catalyst Center clusters as Reader Node clusters. Before adding a Catalyst Center node as a Reader, you must remove all admin-created Cisco SD-Access global data on the Reader Node cluster for Catalyst Center to integrate with Cisco ISE. This includes nondefault VNs (any VNs other than "DEFAULT_VN" and "INFRA_VN", Extranet Policy, and so on). In the event there's any nondefault GBP data (SGTs, Access Contracts, GBP), the user has the option to automatically clean up (delete) all nondefault GBP data, or to merge any GBP data not already present in Cisco ISE.

Note

- You can integrate only five Catalyst Center clusters with a single Cisco ISE deployment. This includes one Author Node cluster and up to four Reader Node clusters.
- It is possible to delete SGTs or VNs on the Author Node even when they are in use on Reader Nodes. In that event, you must delete the stale SGTs or VNs manually on the Reader Nodes (after removing any references).

Multiple Catalyst Center policy management

This topic explains the policy management in Multiple Catalyst Center.

After integrating Catalyst Center with Cisco ISE and performing GBP synchronization policy information is synchronized between Catalyst Center and Cisco ISE. The policy authoring privileges reside within Catalyst Center. The Cisco ISE windows for management of SGTs, Security Group ACLs (SGACLs), and Egress Policy become read-only.

You can manage group-based policy (Security Groups, Access Contracts, and GBAC Policy) in Cisco ISE instead of in Catalyst Center.

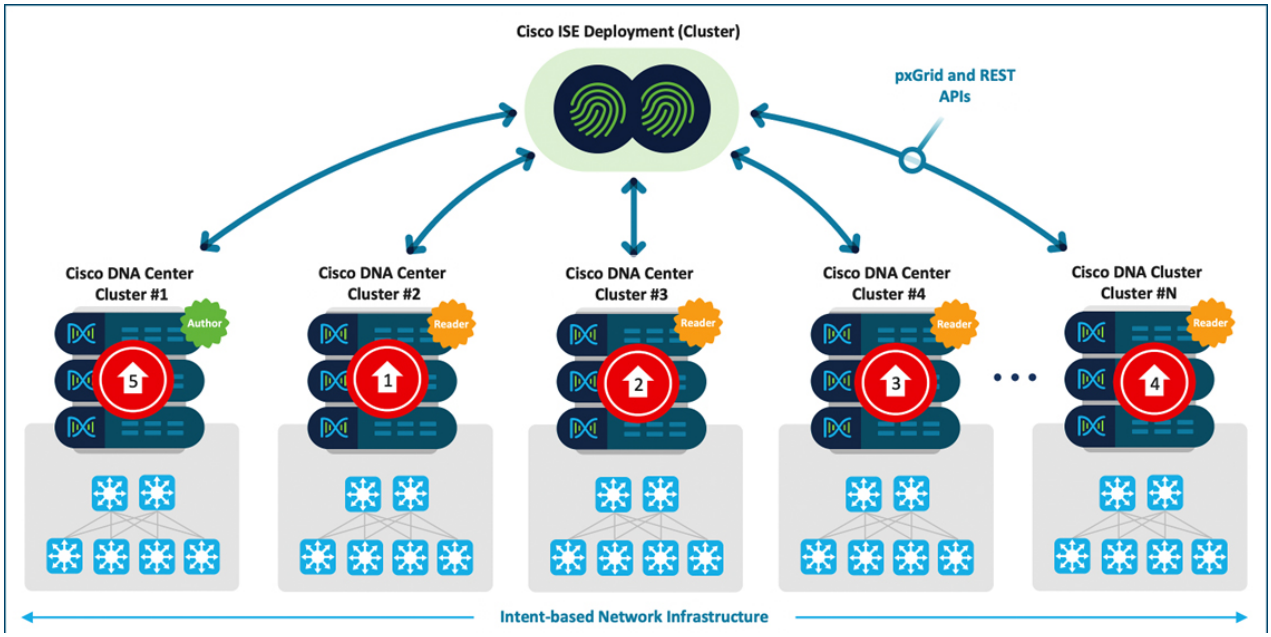
In the Catalyst Center GUI, click the menu icon and choose **Policy** > **Group-Based Access Control** > **Policies** > **GBAC Configuration** > **Manage Group-Based Access Control in Cisco ISE**.

Upgrade recommendations for Multiple Catalyst Center

This topic explains the upgrade recommendations for Multiple Catalyst Center deployment.

In a multiple Catalyst Center environment, we recommend to run the **same Catalyst Center software version across all Author and Reader Node clusters**, except during the process of cluster upgrades. Upgrade all Reader Node clusters before upgrading the Author Node cluster to avoid feature disparity and feature incompatibility across software versions. Avoid the promotion of a Reader Node cluster to the Author Node role in the middle of an upgrade cycle. All Catalyst Center clusters should be upgraded and run the same software version before promoting a Reader Node cluster.

Figure 1: Upgrade recommendations for Multiple Catalyst Center



Note

The basic functionality of the Multiple Catalyst Center feature does not require the same software version in all the participating Author and Reader Node clusters. However, using mismatched code versions may result in a difference in fixes, capabilities, and features between the clusters. The same Catalyst Center software version is recommended across all Author and Reader Node clusters.

Multiple Catalyst Center deployments

This topic explains the multiple Catalyst Center deployment scenarios.

There are two options for deployment of multiple Catalyst Center.

- A new deployment of multiple Catalyst Center clusters that are not currently integrated with Cisco ISE.
- An existing Catalyst Center cluster that is integrated with Cisco ISE and new additional Catalyst Center clusters without Cisco ISE Integration.

Enable Multiple Catalyst Center

This task takes you through the workflow of enabling the Multiple Catalyst Center feature.

The Multiple Catalyst Center cluster functionality is disabled by default. It can be enabled during or after integration with Cisco ISE. After the Multiple Catalyst Center functionality is enabled, you can disable it only by removing the Cisco ISE integration completely.

> **Note**
>
> The Multiple Catalyst Center operation requires pxGrid functionality. You can't disable pxGrid after enabling Multiple Catalyst Center.

Procedure

1. In the Catalyst Center GUI, click the menu icon and choose **System** > **Settings** > **Authentication and Policy Servers**.
2. Add **Cisco ISE**.
3. Enter the required Cisco ISE information. For information, refer to Catalyst Center and Cisco ISE integration on page 71.
4. Choose **System** > **Settings** > **Authentication and Policy Servers** > **Add** > **ISE** > **Advanced Settings**.

   The **Advanced Settings** switch exposes various advanced options, including the switch to enable the **Multiple Catalyst Center** operation.
5. Enable the **Multiple Catalyst Center Operation** option.
6. (Optional) If you are editing an existing Cisco ISE integration, re-enter the Cisco ISE admin password.
7. Click **Add**.

Integrate multiple Catalyst Centers with a single Cisco ISE

This task explains the workflow for integrating multiple Catalyst Center devices with a single Cisco ISE.

There are prerequisites for integrating Catalyst Center and Cisco ISE for the first time. For information, see Catalyst Center and Cisco ISE integration on page 71.

Before you begin

When Catalyst Center is already integrated with Cisco ISE, complete the following steps to reintegrate Catalyst Center and Cisco ISE after enabling the **Multiple Catalyst Center** operation. This allows Catalyst Center to negotiate the Author or Reader Node cluster role based on whether it's a first node or subsequent node joining Cisco ISE with the Multiple Catalyst Center feature enabled.

Procedure

1. In the Catalyst Center GUI, click the menu icon and choose **System** > **Settings** > **Authentication and Policy Servers**.
2. In the **Actions** column, hover your cursor over the ellipsis icon (***) and choose **Edit**.
3. Choose **System** > **Settings** > **Authentication and Policy Servers** > **Add** > **ISE** > **Advanced Settings**.
4. Enable the **Multiple Catalyst Center Operation** option.
5. Enter the Cisco ISE Admin password again.
6. Click **Add**. Catalyst Center negotiates the Author Node role with Cisco ISE.
   - If the status of the configured Cisco ISE server displays 'FAILED' because of a password change, click **Retry** and update the password to resynchronize the Cisco ISE connectivity.

- Check the integration status in the slide-in pane. Ensure that the integration **Status** displays as **Active** in the **Authentication and Policy Server** window.

7. To verify the negotiated role of the cluster as the Author Node, choose **System** > **Settings** > **System Configuration** > **Multiple Catalyst Center Settings**.

Integrate other Catalyst Center clusters with Cisco ISE as Reader Nodes

This task explains how to integrate the other Catalyst Center clusters with Cisco ISE in the form of Reader Nodes.

To integrate the subsequent Catalyst Center clusters with the same Cisco ISE that has Multiple Catalyst Center enabled, the Catalyst Center cluster must not contain any nondefault VNs (any VNs other than “DEFAULT_VN” and “INFRA_VN”).

Before you begin

Verify that the cluster that you want to integrate includes only the default VNs under **Policy** > **Virtual Network**.

Procedure

1. In the Catalyst Center GUI, click the menu icon and choose **System** > **Settings** > **Authentication and Policy Servers**.
2. Click **Add** and choose **ISE**.
3. Enter the required Cisco ISE information. See Catalyst Center and Cisco ISE integration on page 71.
4. Choose **System** > **Settings** > **Authentication and Policy Servers** > **Add** > **ISE** > **Advanced Settings**.
5. Enable the **Multiple Catalyst Center Operation** option.
6. Click **Add**.
7. (Optional) When integrating the cluster with Cisco ISE for the first time, click **Accept** in the slide-in pane for Catalyst Center to accept the certificate pushed by Cisco ISE. Close the slide-in pane.
8. In the **Authentication and Policy Server** window, verify that the status of the integration displays as **Active**.
9. To verify the Author and Reader Nodes, choose **System** > **Settings** > **System Configuration** > **Multiple CiscoCatalyst CenterSettings**.

Delete a virtual network

This topic explains how to delete a virtual network in a Multiple Catalyst Center deployment.

The Author Node cluster does not know of Virtual Network (VN) usage on the Reader Node cluster. You must remove all references to a VN on all the Reader Node clusters before attempting to delete that VN on the Author Node cluster. If you delete a VN on the Author Node cluster, the VN is deleted on the Author node and on the Reader Node clusters which do not have references to it. But if one of the Reader Nodes is using that VN, the status of such a VN then displays as **Out of sync with Author**. You must remove all the references (for example, VN Addition in Host Onboarding Section or static port assignment) of the VN on the Reader Node cluster and then proceed to delete that VN on the Reader Node cluster.

Delete a security group

This topic explains how to delete a security group in a Multiple Catalyst Center deployment.

The Author Node cluster is not aware of security group usage on a Reader Node cluster. You must remove all references to the security group on all the Reader Node clusters before attempting to delete that security group on the Author Node cluster. If you delete a security group on the Author Node cluster, that security group is deleted on the Author Node cluster, Cisco ISE, and on the Reader Node cluster if there are no references to it. If one of the Reader Node clusters is using that security group, the status of such a security group then displays as **Out of sync with Author**. You must remove all the references of the security group on the Reader Node cluster and then proceed to delete that security group on the Reader Node cluster.

Promote a Reader Node to an Author Role

This topic explains how to promote reader nodes to the author role when needed.

The Multiple Catalyst Center solution architecture has multiple Catalyst Center clusters and only one cluster can be the policy Author. There may be instances where the Administrator needs to promote a Reader Node cluster to take over the role of the Author Node cluster. This promotion should only be done when:

- You are taking the Author Node cluster out of service or making it unavailable for an extended period of time.
- The Author Node cluster is permanently unavailable or unresponsive for an extended period of time and policy changes are required during that time.

This promotion of a Reader Node to an Author Node can be done in two ways:

1. Graceful Promotion of a Reader Node to the Author role.
2. Force Promotion of a Reader Node to the Author role.

Promote a Reader Node gracefully

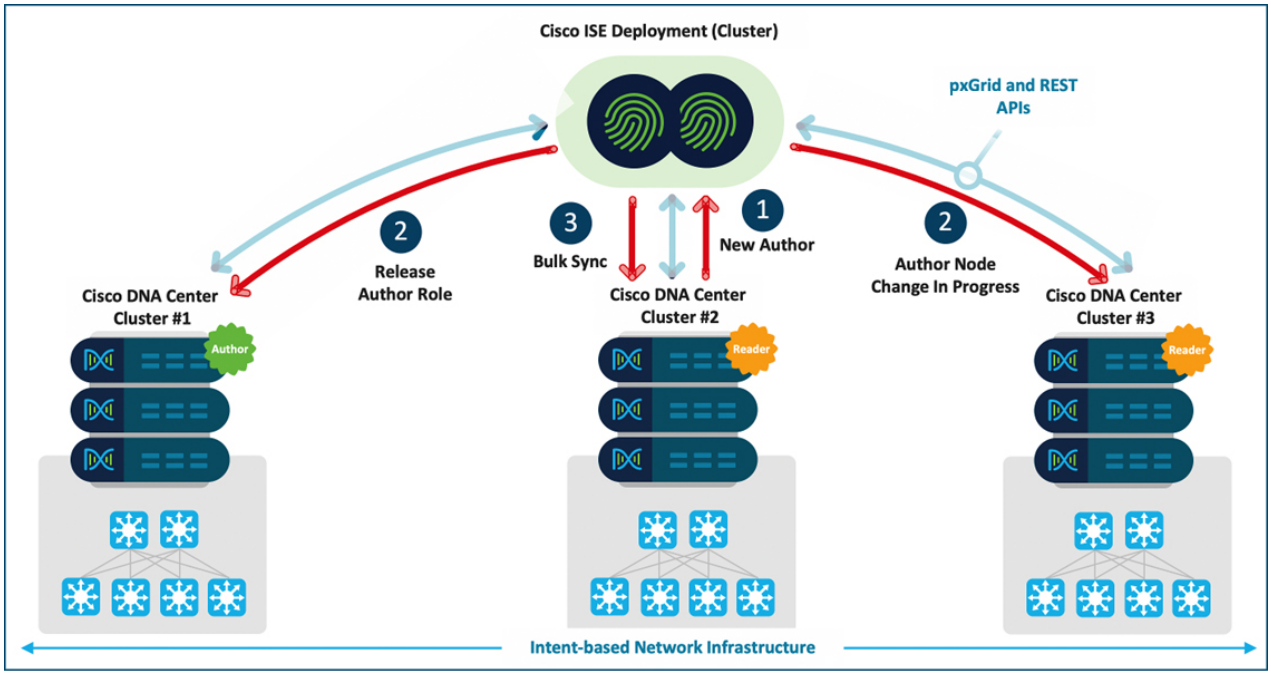
This task explains how you can gracefully promote a Reader Node to the Author Role.

You can manually promote a Reader Catalyst Center cluster to the Author Role if necessary in the Multiple Catalyst Center deployment. All the Reader Node clusters have a **Promote to Author** button. You can promote a Reader Node cluster to an Author Node while your current Author Node cluster is still in operation. However, do not start the promotion operation while the existing Author Node cluster is in the middle of a group-based policy authoring activity (for example, while synchronizing policies with Cisco ISE). If the Author Node cluster is busy, the promotion operation is staggered until the Author Node completes its current processing.

Note

- Upon graceful promotion of a Reader Node cluster to the Author Role, the Reader Node cluster initiates a request to Cisco ISE for a role change (Reader to Author).
- When Cisco ISE receives the role change request, it requests the current Author Node to release the role of policy Author. The current Author node then releases the role of policy Author (if no sync in progress) and takes over the role of the Reader Node cluster.
- The current Reader Node that selected for promotion assumes the role of the Author Node. Upon the Author and Reader Role change, Cisco ISE updates the other Reader Node clusters about the new Author Node through a configuration update.

Figure 2: Graceful promotion of a Reader Node to the Author Role



Procedure

1. On the Reader Node cluster, choose **System** > **Settings** > > **System Configuration** > **Multiple Cisco Catalyst Center Settings** and verify the Author and Reader Nodes.
2. Click the **Promote to Author** button.
3. Click **Continue** to promote the node to the Author Role.

   The transition process may take a few minutes.

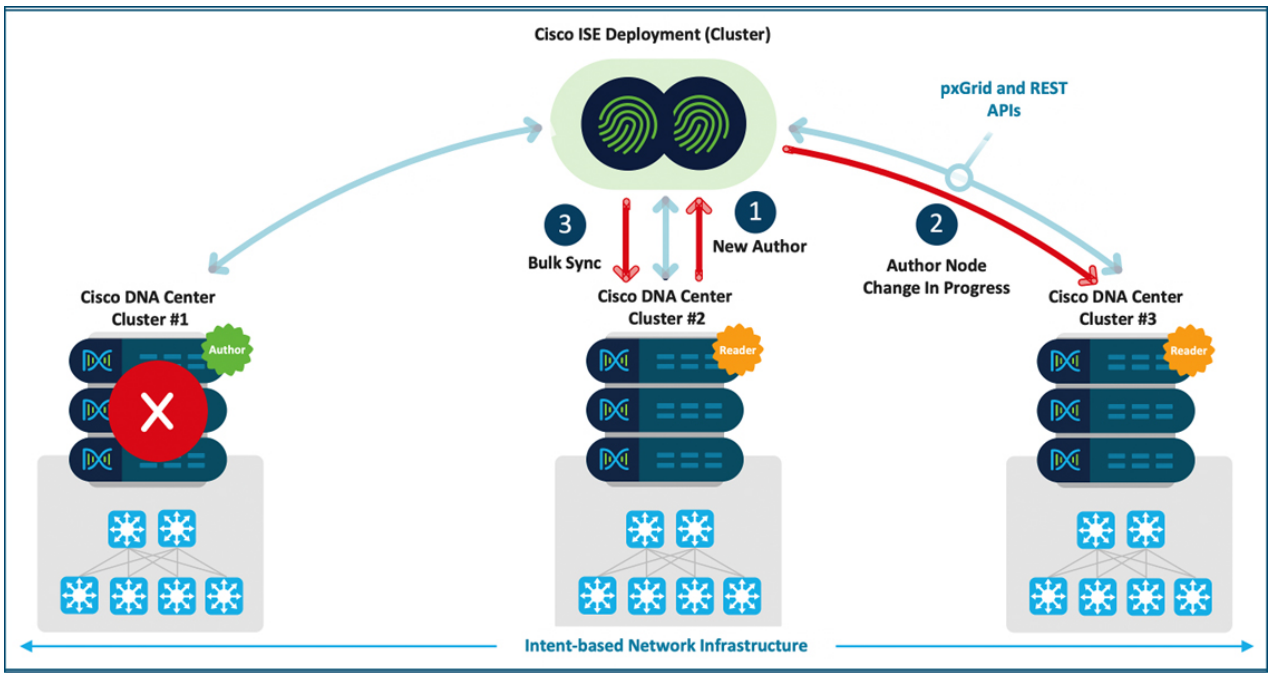
Promote a Reader Node forcibly

This topic explains the force promotion of a Reader Node to the Author Role.

Force promotion is a manual process designed specifically to promote the current Reader Node cluster to the Author Node role in the following situations:

- The current Author Node cluster is out of service.
- The current Author Node cluster is non-responsive.
- The graceful promotion of a Reader Node to the Author Role is taking more than five minutes.

Figure 3: Force promotion of a Reader Node to the Author Role



Do not use the force promotion option while the existing Author Node cluster is in service with a GBP authoring activity, as this may result in data loss and the Author Node cluster going out of sync with Cisco ISE. Force promotion is only recommended if you must restore service immediately and you are willing to risk losing data. After the forced promotion, the promoted Reader Node cluster will become the new Author Node cluster for the deployment. When the former Author Node cluster becomes available, it will transition to a reader role and download the latest configuration data from Cisco ISE.

When you initiate the promotion of a Reader Node cluster, the Reader Node cluster initiates a request to Cisco ISE for a Role change (in other words, Reader to Author). When Cisco ISE receives the role change request, it requests the current Author Node to release the role of policy Author. If the current Author Node is unresponsive and if the administrator selects **Force Promotion**, the Reader Node cluster ACA initiates a request to force the change of the Reader Node cluster to the Author Role and vice versa immediately in Cisco ISE. This configuration update message is sent to all the nodes.

The steps to force promote a Reader Node cluster to Author Node cluster are exactly the same as explained in the graceful promotion of a Reader Node to the Author Role. There is an additional step at the end to initiate the **Force Promotion** function.