



Managing Apps

The Cisco Fog Director Apps pages provide information about Cisco IOx apps, and provide access to features for managing these apps and performing related operations.

When you log in to Cisco Fog Director, the Apps View page displays, If no apps have yet been added to Cisco Fog Director, this page displays “Welcome to Cisco Fog Director” and displays the **ADD NEW APP** button and the **IMPORT APPS** button.

If at least one app has been added, this page includes these areas:

- **Installed Apps area**—Lists apps that have been installed, are scheduled to be installed, or are in the process of being installed, through Cisco Fog Director on at least one device. Also provide information about these apps and devices, and access to other features and information for managing these apps. (An app that has been installed and then removed from a device appear in this area until you manually remove it from this area.)
- **Available Apps area**—Lists apps that have been published are so are available to be installed on one or more devices. Also provide information about these apps and devices, and access to other features and information for managing these apps.
- **Unpublished Apps area**—Lists apps that have been uploaded to Cisco Fog Director but that have not been published.

To access the Apps pages, log in to Cisco Fog Director as described in the “[Accessing Cisco Fog Director](#)” section on page 3-1, and then click the **APPS** tab. The Apps View page displays.

This chapter includes these sections:

- [Managing Installed Apps, page 4-2](#)
- [Managing Available Apps, page 4-4](#)
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- [Editing an App Icon, Description, and Release Notes, page 4-31](#)
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- [Backing Up and Restoring Apps, page 4-57](#)
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Managing Installed Apps

The Installed Apps area on the Apps View page lists each app that is installed through Cisco Fog Director on at least one device or that is scheduled to be installed, provides information about these apps, and provides access to related features.

For an app that is scheduled to be installed, this area displays the message “*App_name* is scheduled to install on # devices.” In this message, *App_name* is the name of the app and # is the number of devices on which the app is scheduled to be installed. You can click the number to display the Actions page, which provides detailed information about the scheduled installation and lets you perform related activities (see the “[Managing Outstanding and Expired Actions for Apps](#)” section on page 4-52). For information about scheduling app actions, see the “[Using Action Plans](#)” section on page 4-48.

For each installed app, this area includes the items that [Table 4-1](#) describes.

Table 4-1 **Installed Apps Area Items**

Item	Description
App name and icon	Displays the name and version of the app and an app for the app. Click an app icon to display more detailed information about the app and to access features for managing the app, as described in the “ Viewing Detailed Information about an Installed or Available App ” section on page 4-7.

Table 4-1 *Installed Apps Area Items (continued)*

Item	Description
App Status	<p>Displays text and a chart that provide information about the states of an app. App states can include the following:</p> <ul style="list-style-type: none"> • Running—App is running on a device • In Progress—App is in the process of installing on a device • Stopped—An app that was running has been stopped on a device • Failed—A start, stop, install, uninstall, upgrade, or configuration action that was performed on an app did not execute properly <p>The text that describes each state shows the number of devices on which the app in that state and the total number of devices on which the app is installed. For example, “8/12 Running” means that the app is installed on 12 devices and is running on 8 of them.</p> <p>The donut chart provides a visual representation of each state of an app as a percentage of the number of devices on which the app is installed. Hover your mouse pointer over any section of a chart to see what state that section represents and the percentage of devices on which the app is in that state. Click a chart to display monitoring information for the app, as described in the “Monitoring an App” section on page 4-58.</p>
Top 5 CPU Consumer	<p>Hostnames of up to five devices on which the app has consumed the most CPU resources during the past 24 hours.</p> <p>The percentage value next to a hostname indicates the average amount of CPU resources the app consumed on the device during the past 24 hours.</p> <p>Click a hostname to display device detailed information about the device. See the “Viewing Detailed Information about a Device” section on page 5-6 for more information.</p>
Top 5 Memory Consumer	<p>Hostnames of up to five devices on which the app has consumed the most RAM resources during the past 24 hours, and the amount of memory, in MG, consumed on each device.</p> <p>The percentage value next to a hostname indicates the average amount of RAM resources the app consumed on the device during the past 24 hours.</p> <p>Click a hostname to display device details information about the device. See the “Viewing Detailed Information about a Device” section on page 5-6 for more information.</p>
REMOVE button	<p>Appears if an app is not currently installed on any device. Click to remove the app from the Installed Apps area.</p>

Managing Available Apps

The Available Apps area on the Apps View page lists each app that has been published, provides information about these apps, and provides access to related features. An available app is ready to be installed on one or more devices.

You can display this area in either of these views:

- App Install view—Lists available apps and provide access to detailed information and related features for each app
- APP EDIT view—Lists available apps, provides options for unpublishing an app or removing it from a device, and provides access to related information and features for each app

The following sections provide more detailed information:

- [Available Apps Area: App Install View, page 4-4](#)
- [Available Apps Area: App Edit View, page 4-4](#)

Available Apps Area: App Install View

The Available Apps area displays in App Install view by default when you access the Apps View page. When this area is in the App Edit view, you can change to the App Install view by clicking the **SWITCH TO APP INSTALL VIEW** button or by clicking the **APPS** tab.

In App Install view, the Available Apps area includes the items that [Table 4-2](#) describes.

Table 4-2 Available Apps Area, App Install View Items

Item	Description
App name and icon	Displays the name, version, and icon of each available app. Click an app icon to display more detailed information about the app and to access features for managing the app, as described in the “ Viewing Detailed Information about an Installed or Available App ” section on page 4-7.
SWITCH TO APP EDIT VIEW button	Click to change the Available Apps area to App Edit view.

Available Apps Area: App Edit View



The Available Apps area displays in App Edit view when this area is in App Install view and you click the **SWITCH TO APP EDIT VIEW** button.

In App Edit view, the Available Apps area includes the items that [Table 4-3](#) describes.

Table 4-3 Available Apps Area, App Edit View Items

Item	Description
App name and icon	Displays the name, version, and icon of each available app. Click an app icon to display more detailed information about the app and to access features for administering the app.
IMPORT APPS button	See the “ Backing Up and Restoring Apps ” section on page 4-57.

Table 4-3 Available Apps Area, App Edit View Items (continued)


Item	Description
EXPORT APPS button	See the “Backing Up and Restoring Apps” section on page 4-57.
SWITCH TO APP INSTALL VIEW button	Click to change the Available Apps area to App Install view. See the “Available Apps Area: App Install View” section on page 4-4.
Unpublish button  for each app	See the “Unpublishing an App” section on page 4-13.
Remove button  for each app	See the “Removing an App” section on page 4-31.

When the Available Apps area is in App Edit view and you click an app icon, a configuration page displays. The items that this page displays vary depending on the type of the app, and can include the items that [Table 4-4](#) describes.

Table 4-4 Available Apps Area > Configuration Page Items

Item	Description
App icon	The icon that displays in Cisco Fog Director for the app. This icon comes from an image file that you specify. You can click Edit Icon to select an image file as described in the “Editing an App Icon, Description, and Release Notes” section on page 4-31.
Author	Entity that authored the app, as specified in the app metadata.
Resource Profile	Resource profile of the app, which specifies the amount of host system CPU and memory (RAM) resources that the app requires on a device. For information about assigning resource profiles to an app, see <i>Cisco IOx Local Manager Reference Guide</i> .
CPU	Number of CPU units that the app requires on a device.
Memory	Amount of RAM, in KB, that the app requires on a device.
Disk	Amount of disk space, in MB, that the app requires on a device.
App Type	Type of the app (PaaS , VM , or Docker)
Runtime	Runtime environment that the app requires on a device.
CPU Architecture	Type of device on which the app is supported.
App Links	Appears if you configured links for an app. Click a link to go to the configured resource. See the “Configuring App Links” section on page 4-40.
UPGRADE PKG button	Lets you upload a newer version of an app to Cisco Fog Director. See the “Upgrading an App” section on page 4-26.
PUBLISH button	Click to publish the app, which makes the app available for installation on devices. See the “Publishing an App” section on page 4-13.
SAVE button	Click to save updates that you make to the description or release notes for the app. See the “Editing an App Icon, Description, and Release Notes” section on page 4-31.

Table 4-4 Available Apps Area > Configuration Page Items (continued)



Item	Description
Description	Brief description of the app that displays when you view detailed information for the app. You can click Edit next to “Description” to enter description text as described in the “Editing an App Icon, Description, and Release Notes” section on page 4-31.
Release Notes	Notes for the app that appear when you view detailed information for the app. For example, notes might include a list and descriptions of features added in an updated app. You can click Edit next to “Release Notes” to enter release note text as described in the “Editing an App Icon, Description, and Release Notes” section on page 4-31.
Packaged Services	Appears only for an app that provides services and lists the service APIs that the includes. This type of app includes services that are defined in the service-bundle section in the package.yaml file for a the app. These services can be consumed by other apps.
App Links button 	Let you configure external links for an app. See the “Configuring App Links” section on page 4-40.

Managing Unpublished Apps

The Unpublished Apps area on the Apps View page on the Apps View page lists each app that has been uploaded to Cisco Fog Director and is not yet published. An unpublished app must be published before it can be installed on one or more devices.

The Unpublished Apps area includes the items that [Table 4-5](#) describes.

Table 4-5 Unpublished Apps Area Items

Item	Description
ADD NEW APP button	Lets you upload an app to Cisco Fog Director. See the “Adding an App” section on page 4-10.
App name and icon	Displays the name, version, and icon of each unpublished app. Click an icon to display additional information for the app. The page that displays is the same page that the “Available Apps Area: App Edit View” section on page 4-4 describes.
Publish button  for each app	Lets you publish an app, which makes it available for installation on a device. See the “Publishing an App” section on page 4-13.
Remove button  for each app	Removes this version of the app from Cisco Fog Director.

Viewing Detailed Information about an Installed or Available App

To view detailed information about an installed app or available, click its icon in the Installed Apps area or in the Available Apps area on the Apps View page. The App Configuration page displays.

This page includes information and features that apply to the app. The items that this page displays vary depending on the state of the app, and can include the items that [Table 4-6](#) describes.

Table 4-6 Detailed Information about an Installed or Available App Items

Item	Description
General information	The name of the app, its version, and the date and time it was last updated.
Author	Entity that authored the app, as specified in the app metadata.
CPU	Number of CPU units that the app requires on a device.
Memory	Amount of RAM, in KB, that the app requires on a device.
Disk	Amount of disk space, in MB, that the app requires on a device.
App Type	Type of the app (PaaS , VM , or Docker)
Runtime	Runtime environment that the app requires on a device.
CPU Architecture	Type of device on which the app is supported.
App Links	Appears if you configured links for an app. Click a link to go to the configured resource. See the “Configuring App Links” section on page 4-40.
INSTALL button	Lets you install an app on one or more devices. See the “Installing an App” section on page 4-13.
MONITOR APP button	Displays information about the operation of the app and its resource consumption on devices. See the “Monitoring an App” section on page 4-58.
UNINSTALL button	Lets you uninstall an app from one or more devices. See the “Uninstalling an App” section on page 4-22.
Installation Successful on display	Shows the number of devices on which the app has been successfully installed. The EDIT CONFIGURATION button under this display lets you update configuration parameters that apply to an app. These items may include configuration information, resource profile, networking, and port information. See the “Reconfiguring App Parameters” section on page 4-32 for more information.
Actions Failed on display	Shows the number of devices on which an installation, update, uninstall, or reconfiguration action failed for the app. Hover your mouse pointer over this area to see more detailed information about specific action failure types. You can click the RETRY NOW button retry an action. See the “Retrying a Failed Action for an App” section on page 4-44 for more information.

Table 4-6 Detailed Information about an Installed or Available App Items (continued)


Item	Description
Upgrade Required on display	After you add and publish a newer version of an already-published app, this field displays the app version number (in the left column) and the number of devices on which the corresponding app version should be upgraded to the newer version (in the right column). You can click the UPGRADE button to perform the upgrade. See the “Upgrading an App” section on page 4-26 for more information.
View Outstanding Actions link	Appears if an install, edit, upgrade, or uninstall action for the app is in Outstanding state or in Expired state as a result of an action plan. Click to display the Actions page, which provides options for managing actions that are in these states. See the “Managing Outstanding and Expired Actions for Apps” section on page 4-52 for more information.
Installing Display	<p>Displays information about the devices on which the app is installing. This information includes:</p> <ul style="list-style-type: none"> • One or more <i>device squares</i>. Each one represents a device on which you are installing the app and shows the status of the install operation on that device. You can hover your mouse pointer over a device square to display the Edit Resource Profile dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and the resource profile that has been assigned for the app on the device. You can click the hostname and IP address in the dialog box to exit the installation and display the Device Details page for the device. • The hostname of the device on which the app is installing and the status and progress of the installation operation on that device. Click the hostname to display detailed information about the device, as described in the “Viewing Detailed Information about a Device” section on page 5-6. • A search device field, which you can display by clicking the expand icon  next to Search Device. Enter the IP address or hostname of a device to see the status of the app installation process on that device.

Table 4-6 Detailed Information about an Installed or Available App Items (continued)

Item	Description
App State on installed devices display	<p>Includes a chart that provides a visual representation of the number of devices on which the app in a particular state.</p> <p>Hover your mouse pointer over any section of a chart to see what state that section represents and the number of devices on which the app is in that state.</p> <p>Click any section of the chart to display a table with detailed information about each device on which the app is in the state. This table includes the following:</p> <ul style="list-style-type: none"> <li>• App state and percentage—Name of the state, and the percentage of devices on which the app is installed that the app is in that state. <li>• Search Hostname, IP Address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. <li>• Host Name—Hostname of the device on which the app is in the state. Click a hostname to display detailed information about the device. See the “Viewing Detailed Information about a Device” section on page 5-6 for more information. <li>• IP address—IP address of the device on which the app is in the state. Click an IP address to display detailed information for the device. See the “Viewing Detailed Information about a Device” section on page 5-6 for more information. <li>• Health—Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information. <li>• Last Heard—How long ago Cisco Fog Director last communicated with the device, or a brief explanation of why the last attempt to communicate with the device was unsuccessful. <li>• Error Summary—For an app that is in the Failed state, provides information about the cause of the action that failed. <li>• Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. <li>• Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
Description	Brief description of the app. See the “Editing an App Icon, Description, and Release Notes” section on page 4-31 for related information.
Release Notes	Release notes for the app. See the “Editing an App Icon, Description, and Release Notes” section on page 4-31 for related information.

Adding an App

Adding a Cisco IOx app uploads the app package for the app to Cisco Fog Director. When you add an app, it displays in the Unpublished area on the Apps View page and becomes available to be published.

When you add an app, you can choose to upload an app package that was created with the Cisco IOx SDK, or choose to have Cisco Fog Director create and upload an app package from a Docker image that is in the Cisco Docker registry or in a third party registry such as Docker Hub.

To add an app, perform the following steps.

Before You Begin

- If you are uploading an app package that was created with the Cisco IOx SDK, the app package must be on your local drive.
- If you are creating and uploading an app package from a Docker image, the app descriptor file (package.yaml), if used, and the configuration parameters file (package_config.ini) for the Docker image must be on your local drive. In addition, you must make the configuration update as described in the “[Docker Daemon Proxy Settings](#)” section on page 2-7. (If you do not use a package.yaml file for a Docker app, Cisco Fog Director generates metadata from the Docker image automatically.)


Procedure

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- Step 1** On the Apps View page, click the **ADD NEW APP** button.
- If other apps have already been added, this button displays In the Unpublished Apps area,
- Step 2** In the dialog box that displays, take either of these actions:
- To upload an app package that was created with the Cisco IOx SDK, click the **Upload from my computer radio** button, click the **Select App Package** button, and then follow the on-screen prompts to locate and select on your local drive the app that you want to add.
- The app is added to Cisco Fog Director and a page with the items that [Table 4-7 on page 4-11](#) displays. The items in this page depend on the type of app that you added.
- To create and upload an app package from a Docker image that is present in a Docker registry, click the **Create from Docker image** button, and then continue to [Step 3](#).
- Step 3** If you chose to have Cisco Fog Director create an app package from a Docker image, take these actions:
1. In the **Image name or ID** field, enter the name or ID of the Docker image.
 2. (Optional) In the **Image tag** field, enter a tag for the Docker image.
If you do not enter a tag name, Cisco Fog Directory uses the tag named “latest.”
 3. If the Docker image is in a Docker registry other than Docker Hub, enter either of the following in the **Docker Registry** field:
 - Hostname and optional port of the Docker registry, in the format *hostname[:port]*
 - IP address and optional port of the Docker registry, in the format *ip_address[:port]*
 If the Docker image is in Docker Hub, leave the **Docker Registry** field blank.
 4. (Optional) If the Docker registry requires authentication before you can pull an image from it, and if you did not instruct Cisco Fog Director to remember your credentials for this registry when you previously added or upgraded a Docker app, take these actions:
 - In the **Registry Username** field, enter the user name that authenticates you to the Docker Registry.

- In the **Registry Password** field, enter the password that authenticates you to the Docker Registry.
- Check the **Remember these credentials** check box if you want Cisco Fog Director to store the user name and password that you enter and automatically populate the **Username** and **Password** fields with this information the next time you add or upgrade a Docker app.

If you instructed Cisco Fog Director to remember your credentials for this registry when you previously added or upgraded a Docker app, the message “You have saved credentials (*username*). Use them?” displays below the **Image requires authentication to pull** check box. Click either of the following options that also appear:

- **Yes, use them**—Causes Cisco Fog Director to use the user name and password that have been stored.
 - **No, forget them**—Causes Cisco Fog Director to no longer store the user name and password for this Docker registry. In you choose this option, enter the user name and password that authenticate you to the Docker registry in the **User Name** and **Password** fields that appear. If you want Cisco Fog Director to remember these credentials, check the **Remember these credentials** check box.
5. Click the **Browse** button next to **Choose package.yaml and package_config.ini files** and then follow the on-screen prompts to locate and select on your local drive the following files that relate to the Docker image:
- package.yaml (optional)—App descriptor file
 - package_config.ini—Configuration parameters file

The files that you select are listed under the **Browse** button. To remove a file from this list, click the Remove icon  next to the file.

6. Click the **SUBMIT** button.

Cisco Fog Director creates an app by packaging the Docker image and related files and adds the app. A dialog box appear while the add process executes. This process can take some time.

When the app is added to Cisco Fog Director, a page with the items that [Table 4-7 on page 4-11](#) displays. The items in this page depend app that you added.

Table 4-7 **Added App Page Items**

Item	Description
Edit Icon	Click to add an icon for the app. See the “ Editing an App Icon, Description, and Release Notes ” section on page 4-31.

Table 4-7 Added App Page Items (continued)


Item	Description
App Information	Includes the following information <ul style="list-style-type: none"> • Name of the app • Latest version—Version of the app that you added • Last updated—Date and time that the app was last updated • Docker image name—Name or ID of the docker image, depending on the information that you entered, if Cisco Fog Director created the app from a Docker image • Docker Repository—Docker repository that you entered, if Cisco Fog Director created the app from a Docker image • Tag—Tag of the Docker image, if Cisco Fog Director created the app from a Docker image and you designated a tag
Author	Entity that authored the app, as specified in the app metadata.
Resource Profile	Resource profile of the app, which specifies the amount of host system CPU and memory (RAM) resources that the app requires on a device. For information about assigning resource profiles to an app, see <i>Cisco IOx Local Manager Reference Guide</i> .
CPU	Number of CPU units that the app requires on a device.
Memory	Amount of RAM, in KB, that the app requires on a device.
Disk	Amount of disk space, in MB, that the app requires on a device.
Services	Name of another app that provides services that the app requires.
App Type	Type of the app (PaaS , VM , LXC , or Docker)
Runtime	Runtime environment that the app requires on a device.
App Links button 	Let you configure external links for an app. See the “ Configuring App Links ” section on page 4-40.
UPGRADE PKG button	Lets you upload a newer version of an app to Cisco Fog Director. See the “ Upgrading an App ” section on page 4-26.
PUBLISH button	Click to publish the app, which makes the app available for installation on devices. See the “ Publishing an App ” section on page 4-13.
SAVE button	Click to save updates that you make to the description or release notes for the app. See the “ Editing an App Icon, Description, and Release Notes ” section on page 4-31.
Description	Brief description of the app that displays when you view detailed information for the app. You can click Edit next to “Description” to enter description text as described in the “ Editing an App Icon, Description, and Release Notes ” section on page 4-31.


Table 4-7 Added App Page Items (continued)

Item	Description
Release Notes	Notes for the app that appear when you view detailed information for the app. For example, notes might include a list and descriptions of features added in an updated app. You can click Edit next to “Release Notes” to enter release note text as described in the “Editing an App Icon, Description, and Release Notes” section on page 4-31.

Publishing an App

You can publish an app after it has been added to Cisco Fog Director. A published app becomes available to install on devices.

To publish an app, take any of these actions:

- In the Unpublished Apps area on the Apps View page, click the **Publish** button  that displays under the app that you want to publish
- In the page that displays when you add an app, click the **PUBLISH** button.
- In the Available Apps area, go to App Edit view, click the icon for the app that you want to publish, and then click the **PUBLISH** button in the page that displays


After you perform the Publish action, the app moves from the Unpublished Apps area to the Available Apps area on the Apps View page.

Unpublishing an App

Unpublishing an app moves the app to the unpublished area and makes it unavailable for installation on any device. Unpublishing an app does not remove it from devices on which it is installed already.

To unpublish an app, follow these steps:

Procedure

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- Step 1** In the Available Apps area on the Apps View page, click **SWITCH TO APP EDIT VIEW**.
- Step 2** Click the **Unpublish** button  under the icon for the app.
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Installing an App

You can install a published app on a device that has been added or imported to Cisco Fog Director.

The following sections provide additional information:

- [Install App Options, page 4-14](#)
- [Install App Procedure, page 4-15](#)

Install App Options


To view options for installing an app, click the **INSTALL** button on the App Configuration page for the app.

The Filter Devices page displays. This page includes the items that [Table 4-8](#) describes.

Table 4-8 Filter Devices Page Items

Item	Description
Installed Devices table	<p>Provides information about each device that has been added to Cisco Fog Director, and includes the following items:</p> <ul style="list-style-type: none"> • Search Hostname, IP address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. • Show field—Enter the name of a tag and then press the Enter key to display information for devices with a matching tag. You can choose a tag from a drop-down list of available tags by typing the first few letters of the tag and then clicking the tag that you want. • Check box—Check the check box for each device on which you want to install the app. You can click the check box in the title row of the table to quickly check all boxes in the table. • Host Name—Hostname of the device on which the app is to be installed. • IP Address—IP address of the device on which the app is to be installed. • Tags—Tags that are assigned to a device. • Installed Apps—Apps that are installed on the device • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
ADD SELECTED DEVICES button	Click to add devices with checked check boxes to the Selected Devices table.

Table 4-8 Filter Devices Page Items (continued)

Item	Description
Selected Devices table	<p>Provides information about each device on which you want to install the app. Devices appear in this table after you check their check boxes in the Installed Devices table and then click ADD SELECTED DEVICES. This table includes the following items:</p> <ul style="list-style-type: none"> • Selected Devices—Number of devices on which you want to install the app. • Search Hostname, IP Address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. • Host Name—Hostname of the device on which you want to install the app. • IP Address—IP address of the device on which you want to install the app. • Tags—Tags that are assigned to the device on which you want to install the app. • Health—Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information. • Last Heard—How long ago Cisco Fog Director last communicated with the device, or a brief explanation of why the last attempt to communicate with the device was unsuccessful. • Action—Click the x icon  to remove a device from the Selected Devices table. Clicking this icon does not affect the device. • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
Next button	Available if there is at least one device in the Selected Devices table. Click to continue an app install procedure.

Install App Procedure

To install an app on one or more devices, perform the following steps.

If you are installing an app on multiple devices and want to stop the installation procedure at any time, unpublish the app as described in the [“Unpublishing an App” section on page 4-13](#).

Cisco Fog Director associates an action plan with each app installation procedure that you perform. An action plan instructs Cisco Fog Director to retry an installation if the installation fails due to certain conditions, or to perform the installation within a designated maintenance window. By default, the action plan causes Cisco Fog Director to perform the installation immediately and to retry a failed installation up to 10 times at 2 minute intervals. You can change these parameters as needed when you perform the

app installation procedure. For more information, see the [“Using Action Plans”](#) section on page 4-48.

Before You Begin

- Add or import each device on which you are installing the app to Cisco Fog Director. See the [“Adding Devices”](#) section on page 5-13 or the [“Importing Devices”](#) section on page 5-14.
- Add the app to Cisco Fog Director. See the [“Adding an App”](#) section on page 4-10.
- Publish the app. See the [“Publishing an App”](#) section on page 4-13.
- If the app that you are installing requires services from an app that provides services, the app that provides the services must first be installed on the devices on which you are installing this app. Otherwise, this app install operation fails.

Procedure

-
- Step 1** Take either of these actions:
- If the device is installed on at least one device, in the Installed Apps area on the Apps View page, click the icon for the app that you want to install, and then click the **INSTALL** button.
 - If the device is not installed on any device, in the Available Apps area on the Apps View page, make sure that you are in App Install view, click the icon for the app that you want to install, and then click the **INSTALL** button.
- Step 2** In the Installed Devices table, check the check box for each device on which you want to install the app. For detailed information about this table and locating devices, see the [“Install App Options”](#) section on page 4-14.
- Step 3** Click the **ADD SELECTED DEVICES** button.
- The devices that you selected and on which the app can be installed are added to the Selected Devices table. The app will be installed on the devices that this table lists. For detailed information about this table and about removing devices from this table, see the [“Install App Options”](#) section on page 4-14.
- Step 4** Click the **Next** button near the bottom of the page.
- The Installation Summary page displays. This page lets you review and configure operations that are performed by Cisco Fog Director on the devices on which you are installing the app.
- Step 5** (Optional) In the Installation Summary page, expand **Selected Devices** (if it is not expanded already) to review the following information for each device that you selected:
- Host Name—Hostname of the device.
 - IP Address—IP address of the device.
 - Tags—Tags that are assigned to the device.
 - Health—Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information.
 - Last Heard—How long ago Cisco Fog Director last communicated with the device, or a brief explanation of why the last attempt to communicate with the device was unsuccessful.

You can click a pagination control to go to the first, next, last, previous, or specific page in the table. From the **Items per page** drop-down list you can choose the maximum number of devices that appear in each page of the table.

Step 6 In the Installation Summary page, take the following actions as needed:

- (Optional) To change the list of devices that you selected, click the **Back** button, update information in the Selected Devices table as described earlier in this procedure, and then click the **Next** button again.
- (Optional) To change the default tag that will be added to each device, type another tag name in the **Tag Selected Devices as** field.

By default, the system adds a tag with the app name to each device. You can change this name, or, if you do not want a tag to be added, delete all text in this field. See the [“Managing Tags for Devices” section on page 5-31](#) for related information.

- (Optional) To cause the app to start automatically after it installs, check the **Start app after installation** check box. Starting an app initiates its operation on a host device and puts the app in Running state. CPU and memory (RAM) resources that were reserved for the app become in use.
- (Optional) Click the **VIEW INCOMPATIBLE DEVICES** button (if this button is not dimmed) to see a table that provides information about devices that you selected but on which the app cannot be installed. This table includes the following items:
 - Host Name—Hostname of the device.
 - IP Address—IP address of the device.
 - Tags—Tags that are assigned to the device.
 - Health—Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information.
 - Incompatibility Cause—A brief description of why the app cannot be installed on the device.

You can click a pagination control to go to the first, next, last, previous, or specific page in the table. From the **Items per page** drop-down list you can choose the maximum number of devices that appear in each page of the table.

Step 7 (Optional) In the Installation Summary page, expand **Customize Configuration** to view and update configuration information for this app.

The configuration items that display are defined in the `package_config.ini` file for the app. The value that each field displays is the default value for that item as defined by the app. You can make updates in these fields as needed.

Step 8 (Optional) In the Installation Summary page, expand **Configure Resource Profile** to view and update the resource profiles that have been assigned for the app on each device.

You can update the resource profile for a specific device, some devices, or all devices.

The *device squares* in the box in the middle of the Configure Resource Profile area represent devices on which you are installing the app. You can hover your mouse pointer over a device square to display the Edit Resource Profile dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and the resource profile that has been assigned for the app on the device. You can click the hostname and IP address in the dialog box to exit the installation and display the Device Details page for the device.

To update a resource profile on one or more devices, take these actions:

- a. If you want to limit the device squares displays to one or more specific devices, take either of these actions:
 - To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.
 - To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.

b. Take the desired action:

- To change the resource profile for a specific device, hover your mouse pointer over the device square for that device, and in the Edit Resource Profile dialog box, choose a resource profile from the **Select Profile** drop-down list.
- To change the resource profile for all devices for which a device square displayed, click the desired profile radio button and then click the **REASSIGN PROFILE** button:
 - **Exact matching profile**—Assigns the resource profile that is defined for the app in its metadata, if the resources are available on a device.
 - **Largest available profile**—Assigns the largest resource profile that is currently available on each device on which you are installing.
 - **Allocate all available resources**—Assigns all CPU and memory resources that are available on each device on which you are installing.
 - **Custom profile**—On each device on which you are installing, assigns the CPU and memory resources that you specify. After you click this radio button, the **CPU** and the **Memory** fields appear. Enter the CPU resources, in units, and memory resources, in MB, to assign on each device. The Max value under each field shows the maximum value that you can enter without exceeding the available corresponding resource on at least one device. If you enter a value that exceeds this maximum value, the **REASSIGN PROFILE** button is dimmed and cannot be used.

Step 9 (Optional) In the Installation Summary page, expand **Configure Networking** to view and update network information that relates to how the app obtains its IP address or addresses on each device.

The Configure Networking area is available only if its options apply to this installation.

You can update network information for a specific device, some of devices, or all devices. If network information is not configured for a device by default, you must configure it as described in this step.

The *device squares* in the box at the left of the Configure Networking area represent devices on which you are installing the app. You can hover your mouse pointer over a device square to display the Edit Network Details dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and network interface information for each network interface that is defined in the package_config.ini file for the app.

The Preferred Networks sub areas at the right of the Configure Networking area provide information for each network interface that is defined in the package_config.ini file for the app. You can expand a sub area to display and update options in it.

If you want to limit the device squares to one or more specific devices, take either of these actions:

- To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.
- To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.

To reassign network information for an app on one or more devices, take either of these actions:

- To change network information for a specific device, take these actions:
 - a. Hover your mouse pointer over the device square for that device, and in the Edit Network Details dialog box, choose a network for the corresponding network interface from the **Select Network** drop-down list. Network options are:
 - **iox-bridge#**—App obtains its IP address from a DHCP pool that is configured in Cisco IOS
 - **iox-nat#**—App obtains its IP address from an internal network address translator

- b. If you choose **iox-bridge#** and if you want to assign a static IP address from the DHCP pool for this network interface, check the **Static Mode** check box that displays. If you check this check box, the network interface uses IP addresses that are dynamically assigned from the DHCP pool.
 - c. If you check the **Static Mode** check box, configure the following fields that appear as needed:
 - **IPv# Address** and **Mask** fields—Enter the static address and subnet mask to use. If the IPv6required field is set to “true” in the app descriptor file (package.yaml) for an app, you must enter an IPv6 address. Otherwise, you can enter an IPv4 or an IPv6 address. If you enter an IPv6 address but a device on which you are installing the app does not support IPv6, the app installation will fail on that device.
 - **DNS** field—(Optional) Enter the IP address of the DNS server that the app uses for external communication.
 - **Default Gateway** field—(Optional) Enter the IP address of the default gateway that the app uses for external communication.
 - To update network information for all devices for which a device square is displayed, take these actions for each network interface that you want to configure:
 - a. Expand the Preferred networks sub area.
 - b. Choose a network from the **Select Network** drop-down list. Network options are:
 - **iox-bridge#**—App obtains its IP address from a DHCP pool that is configured in Cisco IOS
 - **iox-nat#**—App obtains its IP address from an internal network address translator
 - c. If you choose **iox-bridge#**, click one of the following radio buttons that appear:
 - **Static**— Click to assign a static IP address from the DHCP pool for this network interface
 - **Dynamic**—Click to use a dynamically assigned IP address from the DHCP pool for this network interface
 - d. If you click the **Static** radio button, configure the following fields that appear as needed:
 - **IPv# Address** and **Mask** fields—Enter the static address and subnet mask to use. If the IPv6required field is set to “true” in the app descriptor file (package.yaml) for an app, you must enter an IPv6 address. Otherwise, you can enter an IPv4 or an IPv6 address. If you enter an IPv6 address but a device on which you are installing the app does not support IPv6, the app installation will fail on that device.
 - **Default Gateway** field—(Optional) Enter the IP address of the default gateway that the app uses for external communication.
 - **DNS** field—(Optional) Enter the IP address of the DNS server that the app uses for external communication.
 - e. After you configure each network interface that you want, click the **REASSIGN NETWORKS** button.
- Step 10** (Optional) In the Installation Summary page, expand **Configure VNC Password** to set the VNC password that is required to access an app on devices via a VNC session.

The Configure VNC Password area is available only if the app requests a serial port.

The *device squares* in the box in the middle of the Configure VNC Password area represent devices on which you are installing the app. You can hover your mouse pointer over a device square to display the Edit VNC password dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and provides a field for entering the VNC password for the device.

To set the VNC password for an app on one or more devices, take these actions:

- a. If you want to limit the device squares to one or more specific devices, take either of these actions:

- To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.
- To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.

b. Take either of these actions:

- To set the VNC password for a specific device, hover your mouse pointer over the device square for that device, and in the Edit VNC Password dialog box, enter the password in the **VNC Password** field
- To set the VNC password for all devices for which a device square is displayed, enter the password in the **VNC Password** field that displays to the right of the device squares, and then click the **Assign** button.

Step 11 (Optional) In the Installation Summary page, expand **Configure VCPUs** to configure the number of virtual CPUs that the app requires on a device.

The Configure VCPUs area is available only if the app requests virtual CPUs.

The *device squares* in the box in the middle of the Configure VCPUs area represent devices on which you are installing the app. You can hover your mouse pointer over a device square to display the Edit VCPU Details dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and the number of virtual CPUs that have been assigned for the app on the device.

To configure the number of virtual CPUs that an app requires on one or more devices, take these actions:

a. If you want to limit the device squares to one or more specific devices, take either of these actions:

- To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.
- To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.

b. Take either of these actions:

- To configure the number of virtual CPUs for a specific device, hover your mouse pointer over the device square for that device, and in the Edit VCPU dialog box, type or use the up or down arrow buttons to enter the desired value.
- To configure the number of virtual CPUs for all devices for which a device square is displayed, in the **Select VCPU Value** field that displays to the right of the device square, type or use the up or down arrow buttons to enter the desired value, and then click the **REASSIGN VCPU** button. The text above the **Select VCPU Value** field indicates the number of virtual CPUs that the descriptor file for the app specifies and the maximum number of virtual CPUs that you can designate for the app on the devices that you selected.

Step 12 (Optional) In the Installation Summary page, expand **Configure Device Resource Ports** to view and update the serial port that an app uses on a device.

The Configure Device Resource Ports area is available only if the app requests a serial port.

The *device squares* in the box in the middle of the Configure Device Resource Ports area represent devices on which you are installing the app. You can hover your mouse pointer over a device square to display the Edit Serial Details dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and the serial port that has been assigned for the app on the device.

To update a serial port for an app on one or more devices, take these actions:

a. If you want to limit the device squares to one or more specific devices, take either of these actions:

- To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.

- To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.

- b. Hover your mouse pointer over the device square for the device that you want to update, and in the Edit Serial Details dialog box, choose a port from the **Select Serial Port** drop-down list.

Step 13 (Optional) In the Installation Summary page, expand **Configure Action Plan** to choose, view, modify or add an action plan.

The action plan designates how many times and at what interval Cisco Fog Director retries an action if the action fails on a device due to certain device reachability or network connectivity issues. If Cisco Fog Director cannot complete the app installation action after the number of retries that the action plan designates, the app installation does not complete.

When you expand **Configure Action Plan**, the **Selected Action Plan** field shows the name of the action plan that is in effect. The **Details** field describes the number of retries and time between retries that the selected action plan defines.

You can choose the action plan that you want from the Selected Action Plan drop-down list.

For information about modifying or adding action plans, see the [“Using Action Plans” section on page 4-48](#).

Step 14 (Optional) In the Installation Summary page, expand **Network Status** to view network, resource, and related information for apps and devices.

The Network Status area displays the following information:

- How many of the devices that you selected for installation of the app are reachable. (“Reachable” means that Cisco Fog Director can communicate with the device.) Hover your mouse pointer over a graph to see more detailed information.
- The *device squares* in the box in the middle of the area. Each box represents a device on which you are installing the app. You can hover your mouse pointer over a device square to display the following information:
 - **Cartridges**—Cisco cartridges that a PAAS app requires to run. These cartridges must already be uploaded to Cisco Fog Director (see [Chapter 7, “Managing Cartridges”](#)) and are installed automatically on the device as part of the app installation process.
 - **CPU Availability**—Number of free CPU units on the device.
 - **Memory Availability**—Amount of free RAM, in MB, on the device.
- How often the Cisco Fog Director updates the information in this area. You can choose a value from the **Collect resource usage at least every** drop-down list. Options are **Every 15 mins**, **Every 1 hour**, **Every 4 hour**, **Every 8 hour**, **Every 16 hour**, and **Never ever**.

Step 15 When you are satisfied with the information on the Installation Summary page, click the **DONE, LET’S GO** button.

The App Configuration page displays, as described in the [“Viewing Detailed Information about an Installed or Available App” section on page 4-7](#).

While the app is installing on a device, the status of the installation displays for that device. Click the device to see the progress of the installation. You can click the **ABORT** button under the status display to abort the installation action, as described in the [“Aborting an Action” section on page 4-41](#).

If the Actions Failed display on this page indicates that the installation failed on any device, you can take any of these actions:

- Click the **RETRY NOW** button to try the installation on these devices again. See the [“Retrying a Failed Action for an App” section on page 4-44](#).

- Click the **View Outstanding Actions** link to display the Actions page, which provides options for managing failed actions for which an action plan is in effect. See the “[Managing Outstanding and Expired Actions for Apps](#)” section on page 4-52 for more information.
 - Wait for Cisco Fog Director to retry the failed action according to an action plan that is in effect. See the “[Using Action Plans](#)” section on page 4-48.
-

Uninstalling an App

You can uninstall an app from any device on which it is running. Uninstalling an app removes it from the device and releases device CPU and memory (RAM) resources that were reserved for it.

You can uninstall an app that is in any state.

The following sections provide additional information:

- [Uninstall App Options, page 4-22](#)
- [Uninstall App Procedure, page 4-24](#)

Uninstall App Options


To view options for uninstalling an app, click the **UNINSTALL APP** button on the App Configuration page for the app.

A page displays that includes the items that [Table 4-9](#) describes.

Table 4-9 Uninstall App Items

Item	Description
Installed Devices table	<p>Provides information about each device on which the app is installed, and includes the following items:</p> <ul style="list-style-type: none"> • Search Hostname, IP Address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. • Show field—Enter the name of a tag and then press the Enter key to display information for devices with a matching tag. You can choose a tag from a drop-down list of available tags by typing the first few letters of the tag and then clicking the tag that you want. • Check box—Check the check box for each device from which you want to uninstall the app. You can click the check box in the title row of the table to quickly check all boxes in the table. • Host Name—Hostname of the device on which the app is installed. • IP Address—IP address of the device on which the app is installed. • Tags—Tags that are assigned to the device. • Installed Apps—Apps that are installed on the device. • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
ADD SELECTED DEVICES button	Click to add devices with checked check boxes to the Selected Devices table.

Table 4-9 Uninstall App Items (continued)

Item	Description
Selected Devices table	<p>Provides information about each device from which you want to uninstall the app. Devices appear in this table after you check their check boxes in the Installed Devices table and then click ADD SELECTED DEVICES. This table includes the following items:</p> <ul style="list-style-type: none"> • Selected Devices—Number of devices from which you want to remove the app. • Search Hostname, IP Address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. • Host Name—Hostname of the device from which you want to uninstall the app. • IP Address—IP address of the device from which you want to uninstall the app. • Tags—Tags that are assigned to the device from which you want to uninstall the app. • Health—Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information. • Last Heard—How long ago Cisco Fog Director last communicated with the device, or a brief explanation of why the last attempt to communicate with the device was unsuccessful. • Action—Click the x icon  to remove a device from the Selected Devices table. Clicking this icon does not affect the device and does not remove the app from the device. • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
DONE, LET'S GO button	Executes an uninstall operation.

Uninstall App Procedure

Uninstalling an app removes the installed app from one or more devices.

When you uninstall a Docker app, layers that are used by that app are not deleted automatically. If you want to delete these layers, see the [“Managing Layers” section on page 5-35](#). If you do not delete a layer, it is reused if you later install an app that requires it.

Cisco Fog Director associates an action plan with each app uninstallation procedure that you perform. An action plan instructs Cisco Fog Director to retry an uninstallation if the uninstallation fails due to certain conditions, or to perform the uninstallation within a designated maintenance window. By default, the action plan causes Cisco Fog Director to perform the uninstallation immediately and to retry a failed uninstallation up to 10 times at 2 minute intervals. You can change these parameters as needed when you

perform the app uninstallation procedure. For more information, see the [“Using Action Plans” section on page 4-48](#).

To uninstall an app, follow these steps:

Procedure

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- Step 1** Take either of these actions:
- In the Installed Apps area on the Apps View page, click the icon for the app that you want to uninstall, and then click the **UNINSTALL** button.
 - In the Available Apps area on the Apps View page, make sure that you are in App Install view, click the icon for the app that you want to uninstall, and then click the **UNINSTALL** button.
- Step 2** In the Installed Devices table, check the check box for each device from which you want to uninstall the app.
- For detailed information about this table and locating devices, see the [“Uninstall App Options” section on page 4-22](#).
- Step 3** Click the **ADD SELECTED DEVICES** button.
- The devices with checked check boxes are added to the Selected Devices table. The app will be uninstalled from devices that this table lists. For detailed information about this table and about removing devices from this table, see the [“Uninstall App Options” section on page 4-22](#).
- Step 4** (Optional) In the Installation Summary page, expand **Configure Action Plan** to choose, view, modify or add an action plan.
- The action plan designates how many times and at what interval Cisco Fog Director retries an action if the action fails on a device due to certain device reachability or network connectivity issues. If Cisco Fog Director cannot complete the app uninstallation action after the number of retries that the action plan designates, the app uninstallation does not complete.
- When you expand **Configure Action Plan**, the **Selected Action Plan** field shows the name of the action plan that is in effect. The **Details** field describes the number of retries and time between retries that the selected action plan defines.
- You can choose the action plan that you want from the Selected Action Plan drop-down list.
- For information about modifying or adding action plans, see the [“Using Action Plans” section on page 4-48](#).
- Step 5** Click the **DONE, LET’S GO** button.
- The App Configuration page displays, as described in the [“Viewing Detailed Information about an Installed or Available App” section on page 4-7](#).
- While the app is uninstalling on a device, the status of the uninstallation displays for that device. Click the device to see the progress of the uninstallation. You can click the **ABORT** button under the status display to abort the uninstallation action, as described in the [“Aborting an Action” section on page 4-41](#).
- If the Actions Failed display on this page indicates that the uninstallation failed on any device, you can take any of these actions:
- Click the **RETRY NOW** button to try the uninstallation on these devices again. See the [“Retrying a Failed Action for an App” section on page 4-44](#).
 - Click the **View Outstanding Actions** link to display the Actions page, which provides options for managing failed actions for which an action plan is in effect. See the [“Managing Outstanding and Expired Actions for Apps” section on page 4-52](#) for more information.

- Wait for Cisco Fog Director to retry the failed action according to an action plan that is in effect. See the [“Using Action Plans” section on page 4-48](#). While the uninstallation is in progress, you can click the **ABORT** button on the App Configuration page that displays, as described in the [“Aborting an Action” section on page 4-41](#).

Upgrading an App

When a new version of an installed app becomes available, you can upgrade the app. This process includes uploading the app package for the app to Cisco Fog Director and then upgrading devices with the new app version.

When you upgrade an app, you can choose to upload an app package that was created with the Cisco IOx SDK, or choose to have Cisco Fog Director create and upload an app package from a Docker image that is in the Cisco Docker registry or in a third party registry such as Docker Hub.

When you upgrade a Docker app, layers that are used by the previous version and the upgraded version of the app are reused automatically. Layers that are not used by the upgraded version are not deleted automatically. If you want to delete these layers, see the [“Managing Layers” section on page 5-35](#).

Cisco Fog Director associates an action plan with each app upgrade procedure that you perform. An action plan instructs Cisco Fog Director to retry an upgrade if the upgrade fails due to certain conditions, or to perform the upgrade within a designated maintenance window. By default, the action plan causes Cisco Fog Director to perform the upgrade immediately and to retry a failed upgrade up to 10 times at 2 minute intervals. You can change these parameters as needed when you perform the app upgrade procedure. For more information, see the [“Using Action Plans” section on page 4-48](#).

To upgrade an app, perform the following steps.

Before You Begin

If you are uploading an app package that was created with the Cisco IOx SDK, the app package must be on your local drive.

If you are creating and uploading an app package from a Docker image, the app descriptor file (package.yaml), if used, and the configuration parameters file (package_config.ini) for the Docker image must be on your local drive. In addition, you must make the configuration update as described in the [“Docker Daemon Proxy Settings” section on page 2-7](#). (If you do not use a package.yaml file for a Docker app, Cisco Fog Director generates metadata from the Docker image automatically.)

If you are upgrading an app that provides services, you must first uninstall other apps that uses the services that this app provides.

Procedure

-
- Step 1** If you are not viewing the page that displays when you add an app, take these actions:
- In the Available Apps area on the Apps View page, make sure that you are in App Edit view.
 - In this area, click the icon for the app for the app to upgrade.
- Step 2** Click the **UPGRADE PKG** button.
- Step 3** In the dialog box that displays, take either of these actions:

- To upload an app package that was created with the Cisco IOx SDK, click the **Upload from my computer radio** button, click the **Select App Package** button, and then follow the on-screen prompts to locate and select on your local drive the app that you want to add.
The app package that you select uploads to Cisco Fog Director. Skip to [Step 5](#).
- To create and upload an app package from a Docker image that is present in a Docker registry, click the **Create from Docker image** button, and then continue to [Step 4](#).

Step 4 If you chose to have Cisco Fog Director create an app package from a Docker image, take these actions:

1. In the **Image name or ID** field, enter the name or ID of the Docker image.
2. (Optional) In the **Image tag** field, enter a tag for the Docker image.
If you do not enter a tag name, Cisco Fog Directory uses the tag named “latest.”
3. If the Docker image is in a Docker registry other than Docker Hub, enter either of the following in the **Docker Registry** field:


- Hostname and optional port of the Docker registry, in the format *hostname[:port]*
- IP address and optional port of the Docker registry, in the format *ip_address[:port]*

If the Docker image is in Docker Hub, leave the **Docker Registry** field blank.

4. (Optional) If the Docker registry requires authentication before you can pull an image from it, and if you did not instruct Cisco Fog Director to remember your credentials for this registry when you previously added or upgraded a Docker app, take these actions:
 - In the **Registry Username** field, enter the user name that authenticates you to the Docker Registry.
 - In the **Registry Password** field, enter the password that authenticates you to the Docker Registry.
 - Check the **Remember these credentials** check box if you want Cisco Fog Director to store the user name and password that you enter and automatically populate the **Username** and **Password** fields with this information the next time you add or upgrade a Docker app.

If you instructed Cisco Fog Director to remember your credentials for this registry when you previously added or upgraded a Docker app, the message “You have saved credentials (*username*). Use them?” displays below the **Image requires authentication to pull** check box. Click either of the following options that also appear:

- **Yes, use them**—Causes Cisco Fog Director to use the user name and password that have been stored.
 - **No, forget them**—Causes Cisco Fog Director to no longer store the user name and password for this Docker registry. In you choose this option, enter the user name and password that authenticate you to the Docker registry in the **User Name** and **Password** fields that appear. If you want Cisco Fog Director to remember these credentials, check the **Remember these credentials** check box.
5. Click the **Browse** button next to **Choose package.yaml and package_config.ini files** and then follow the on-screen prompts to locate and select on your local drive the following files that relate to the Docker image:
 - package.yaml (optional)—App descriptor file
 - package_config.ini—Configuration parameters file

The files that you select are listed under the **Browse** button. To remove a file from this list, click the Remove icon  next to the file.

6. Click the **SUBMIT** button.

Cisco Fog Director creates an app by packaging the Docker image and related files and adds the app. A dialog box appears while the add process executes. This process can take some time.

Step 5 Click the **Publish** button on the Configuration page.

The app is published, which makes it available for upgrading, and the Apps View page displays.

Step 6 Take these actions to upgrade devices with the app that you uploaded:

- a. In the Installed Apps area on the Apps View page, click the icon for the app to upgrade.
- b. Click the **UPGRADE** button, which displays under the “Upgrade Required on” display.

The Filter Devices page displays. This page includes the items that [Table 4-8 on page 4-14](#) describes.

- c. In the table, check the check box for each device on which you want to upgrade the app, and then click the **ADD SELECTED DEVICES** button.
- d. Click the **Next** button.

The Upgrade Summary page displays.

- e. (Optional) To change the list of devices that you selected, click the **Back** button, update information in the Selected Devices table as described earlier in this procedure, and then click the **Next** button again.
- f. (Optional) In the Upgrade Summary page, check the **Retain App Data** check box cause the app upgrade process to retain existing information that the app has written to the device.

This information includes files and data that the app has written to the device, such as app log files and app property files, and that is stored in the /data directory for the app on the device.

If this check box is not checked, the app upgrade process deletes existing information that the app has written to the device.

This check box is checked by default.

- g. (Optional) In the Upgrade Summary page, expand **Selected Devices** (if it is not expanded already) to see a table that displays the following information for each device that you selected for the app upgrade:

- Host Name—Hostname of the device.
- IP Address—IP address of the device.
- Tags—Tags that are assigned to the device.
- Health—Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information.
- Last Heard—How long ago Cisco Fog Director last communicated with the device, or a brief explanation of why the last attempt to communicate with the device was unsuccessful.

You can take the following actions in the Selected Devices area:

- Use the pagination controls to go to the first, next, last, previous, or specific page in the table.
- From the **Items per page** drop-down list, choose the maximum number of devices that appear in each page of the table.
- Displays the tag that has been assigned to each device See the [“Managing Tags for Devices” section on page 5-31](#) for related information.
- Click the **VIEW INCOMPATIBLE DEVICES** button (if this button is not dimmed) to see a table that provides information about devices that you selected but on which the app cannot be upgraded. This table includes the following items:

- Host Name—Hostname of the device.
- IP Address—IP address of the device.
- Tags—Tags that are assigned to the device.
- Health—Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information.
- Incompatibility Cause—A brief description of why the app cannot be upgraded on the device.

You can click a pagination control to go to the first, next, last, previous, or specific page in the table. From the **Items per page** drop-down list you can choose the maximum number of devices that appear in each page of the table.

- h. (Optional) In the Upgrade Summary page, expand **Customize Configuration** to instruct Cisco Fog Director whether to retain or update existing configuration information for the app.

This area includes sub areas for each version of the app that currently is installed on a device. You can expand a sub area to display and update designated app configuration information for the corresponding app version. The information that displays is defined in the `package_config.ini` file for the app.

The fields that a sub area displays and the action that Cisco Fog Director takes when you upgrade the app depend on the status of the **Retain app configuration changes done on selected devices and merge configuration from this version** check box as follows:

- Checked—The fields that display are new configuration fields that are available in this version of the app. The value in each field is the default value for that item as defined by the app. You can make updates as needed in these fields. The upgrade process applies the configuration information in these fields but makes no changes to configuration information that exists for the current version of the app on a device.
- Unchecked—The fields that display are all configuration fields (both new in this version and existing) that are available in this version of the app. The value in each field is the default value for that item as defined by the app. You can make updates as needed in these fields. The upgrade process applies the configuration information in these fields and overwrites configuration information that exists for the current version of the app on a device.

This check box is checked by default.

- i. (Optional) In the Upgrade Summary page, expand **Configure Action Plan** to choose, view, modify or add an action plan.

The action plan designates how many times and at what interval Cisco Fog Director retries an action if the action fails on a device due to certain device reachability or network connectivity issues. If Cisco Fog Director cannot complete the app upgrade action on a device after the number of retries that the action plan designates, the app upgrade does not complete on the device.

When you expand **Configure Action Plan**, the **Selected Action Plan** field shows the name of the action plan that is in effect. The **Details** field describes the number of retries and time between retries that the selected action plan defines.

You can choose the action plan that you want from the Selected Action Plan drop-down list.

For information about modifying or adding action plans, see the [“Using Action Plans” section on page 4-48](#).

- j. (Optional) In the Upgrade Summary page, expand **Network Status** to view network, resource, and related information for apps and devices.

The Network Status area displays the following information:

- How many of the devices that you selected for installation of the app are reachable. (“Reachable” means that Cisco Fog Director can communicate with the device.) Hover your mouse pointer over a graph to see more detailed information.
 - The *device squares* in the box in the middle of the area. Each box represents a device on which you are installing the app. You can hover your mouse pointer over a device square to display the following information:
 - **Cartridges**—Cisco cartridges that a PAAS app requires to run. These cartridges must already be uploaded to Cisco Fog Director (see [Chapter 7, “Managing Cartridges”](#)) and are installed automatically on the device as part of the app installation process.
 - **CPU Availability**—Number of free CPU units on the device.
 - **Memory Availability**—Amount of free RAM, in MB, on the device.
 - How often the Cisco Fog Director updates the information in this area. You can choose a value from the **Collect resource usage at least every** drop-down list. Options are **Every 15 mins**, **Every 1 hour**, **Every 4 hour**, **Every 8 hour**, **Every 16 hour**, and **Never ever**.
- k. Click the **DONE, LET’S GO** button.

The App Configuration page displays, as described in the [“Viewing Detailed Information about an Installed or Available App”](#) section on page 4-7.

While the app is upgrading on a device, the status of the upgrade displays for that device. Click the device to see the progress of the upgrade. You can click the **ABORT** button under the status display to abort the upgrade action, as described in the [“Aborting an Action”](#) section on page 4-41.

If the Actions Failed display on this page indicates that the upgrade failed on any device, you can take any of these actions:

- Click the **RETRY NOW** button to try the upgrade on these devices again. See the [“Retrying a Failed Action for an App”](#) section on page 4-44.
- Click the **View Outstanding Actions** link to display the Actions page, which provides options for managing failed actions for which an action plan is in effect. See the [“Managing Outstanding and Expired Actions for Apps”](#) section on page 4-52 for more information.
- Wait for Cisco Fog Director to retry the failed action according to an action plan that is in effect. See the [“Using Action Plans”](#) section on page 4-48

Reverting to the Previous Version of an App

After you upgrade an app, you can revert to the most recent previously installed version of that app, if needed.

The following sections provide additional information:

- [Reverting to the Previous Version of a Published App, page 4-30](#)
- [Reverting to the Previous Version of an Unpublished App, page 4-31](#)

Reverting to the Previous Version of a Published App

If you have upgraded an app and then published the upgraded version, you can revert to the previous version of the app.

To revert to the previous version of a published app, follow these steps:

Procedure

-
- Step 1** Uninstall the app from each device on which it is installed, as described in the [“Uninstalling an App” section on page 4-22](#).
- Step 2** Unpublish the app, as described in the [“Unpublishing an App” section on page 4-13](#).
The previous version of the app displays in the Published area on the Apps View page.
-

Reverting to the Previous Version of an Unpublished App

If you have upgraded an app but not published the upgraded version, you can revert to the previous version of the app.



To revert to the previous version of an unpublished app, remove the app as described in the [“Removing an App” section on page 4-31](#). The previous version of the app displays in the Unpublished area on the Apps View page.

Removing an App

Removing an app removes it from Cisco Fog Director.

To remove an app, follow these steps:

Procedure

-
- Step 1** Uninstall the app as described in the [“Uninstalling an App” section on page 4-22](#).
The app moves to the Available Apps area on the Apps View page.
- Step 2** In the Available Apps area, click **SWITCH TO APP EDIT VIEW**.
- Step 3** Click the **Remove** button  under the icon for the app.
The app moves to the Unpublished Apps area on the Apps View page.
- Step 4** In the Unpublished Apps area, click the **Remove** button  under the icon for the app.
-

Editing an App Icon, Description, and Release Notes

You can add or update the following items for an app:

- **Icon**—The icon that displays in Cisco Fog Director for the app.

This icon comes from an image file that you specify. The image size should be 250 x 250 pixels. The system accepts images that are other sizes, but those images are scaled and may not appear as desired. The image file can be in any of these formats: ai, bmp, drw, gif, ico, jpe, jpeg, jpg, pct, png, psd, psp, raw, scf, svg, svgz, tif, or tiff.

- **Description**—Brief description of the app that displays when you view detailed information for the app.
- **Release Notes (optional)**—Notes for the app that appear when you view detailed information for the app. For example, notes might include a list and descriptions of features added in an updated app.

To add or update an icon, description, or release notes for an app, follow these steps:

Procedure

- Step 1** If you are not viewing the page that displays when you add an app, take these actions:
- In the Available Apps area on the Apps View page, make sure that you are in App Edit view.
 - In this area, click the icon for the app for which you want to add or update the icon, description, or release notes.
- Step 2** To add or update an icon, take these actions:
- Click **Edit Icon**.
 - Follow the on-screen prompts to locate and select the image file for the icon that you want.
- Step 3** To add or update a description, take these actions:
- Click **Edit** next to “Description.”
 - In the edit area that displays, type the description. You can use the formatting tools at the top of the Edit area to format the text and perform related operations.
 - Click **Apply**.
 - Click the **SAVE** button.
- Step 4** To add or update release notes, take these actions:
- Click **Edit next to** “Release Notes.”
 - In the edit area that displays, type the notes. You can use the formatting tools at the top of the Edit area to format the text and perform related operations.
 - Click **Apply**.
 - Click the **SAVE** button.
-

Reconfiguring App Parameters

You can reconfigure a variety of items that apply to an app. Depending on the app, items that you can reconfigure include:

- **Configuration information**—Configuration items that are defined in the `package_config.ini` file for the app
- **Resource profile**—Amount of host system CPU and memory (RAM) resources that the app requires on a device.
- **Networking**—Network from which the app obtains its IP address or addresses.
- **Resource port**—Serial port that the app uses on a device.

- Action plan—The number of times and at what intervals Cisco Fog director retries an install, reconfigure, upgrade, or uninstall action that fails due to certain device reachability or network connectivity issues.

The following sections provide additional information:

- [Reconfigure App Options, page 4-33](#)
- [Reconfigure App Procedure, page 4-34](#)

Reconfigure App Options

To view options for reconfiguring an app, take either of these actions:


- Click the **EDIT CONFIGURATION** button on the App Configuration page for the app
- From the Devices tab, choose a device, and then click **EDIT CONFIGURATION** near the bottom of the page that displays for the device

If you clicked **Edit Configuration** from the App Configuration page, the Reconfigure App page displays, which displays that includes the items that [Table 4-10](#) describes.

Table 4-10 *Reconfigure App Page Items*

Item	Description
Installed Devices table	<p>Provides information about each device on which the app is installed, and includes the following items:</p> <ul style="list-style-type: none"> • Search Hostname, IP Address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. • Show field—Enter the name of a tag and then press the Enter key to display information for devices with a matching tag. You can choose a tag from a drop-down list of available tags by typing the first few letters of the tag and then clicking the tag that you want. • Check box—Check the check box for each device on which you want to reconfigure the app. You can click the check box in the title row of the table to quickly check all boxes in the table. • Host Name—Hostname of the device on which the app is installed. • IP Address—IP address of the device on which the app is installed. • Tags—Tags that are assigned to the device on which the app is installed. • Installed Apps—Apps that are installed on the device. • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.

Table 4-10 Reconfigure App Page Items (continued)

Item	Description
ADD SELECTED DEVICES button	Click to add devices with checked check boxes to the Selected Devices table.
Selected Devices table	<p>Provides information about each device on which you want to reconfigure the app. Devices appear in this table after you check their check boxes in the Installed Devices table and then click ADD SELECTED DEVICES. This table includes the following items:</p> <ul style="list-style-type: none"> • Selected Devices—Number of devices on which you want to reconfigure the app. • Search Hostname, IP Address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. • Host Name—Hostname of the device on which you want to reconfigure the app. • IP Address—IP address of the device on which you want to reconfigure the app. • Tags—Tags that are assigned to the device on which you want to reconfigure the app. • Health—Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information. • Last Heard—How long ago Cisco Fog Director last communicated with the device, or a brief explanation of why the last attempt to communicate with the device was unsuccessful. • Action—Click the x icon  to remove a device from the Selected Devices table. Clicking this icon does not affect the device and does not remove the app from the device. • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
Customize Resources	Expand this area to access the items that you can reconfigure.

Reconfigure App Procedure

You can reconfigure an app from the Apps View page or the Devices View page, as described in the following sections:

- [Reconfiguring an App from the Apps View Page, page 4-35](#)
- [Reconfiguring an App from the Devices View Page, page 4-39](#)

If you are reconfiguring an app that provides services, you must first uninstall other apps that uses the services that this app provides.

Reconfiguring an App from the Apps View Page

Reconfiguring an app from the Apps View page is useful if you want to apply the reconfiguration to multiple devices.


Cisco Fog Director associates an action plan with each app reconfiguration procedure that you perform. An action plan instructs Cisco Fog Director to retry a reconfiguration if the reconfiguration fails due to certain conditions, or to perform the reconfiguration within a designated maintenance window. By default, the action plan causes Cisco Fog Director to perform the reconfiguration immediately and to retry a failed reconfiguration up to 10 times at 2 minute intervals. You can change these parameters as needed when you perform the app reconfiguration procedure. For more information, see the [“Using Action Plans” section on page 4-48](#).

To reconfigure an app from the Apps View page, perform the following steps. The items that you can reconfigure depend on the app, so some configuration options that the following procedure includes may not be available for some apps.

Before You Begin

Make sure that the app is installed as described in the [“Installing an App” section on page 4-13](#).

Procedure

-
- Step 1** Take one of these actions:
- In the Installed Apps area on the Apps View page, click the icon for the app that you want to reconfigure, and then click the **EDIT CONFIGURATION** button on the App Configuration page.
 - In the Available Apps area on the Apps View page, make sure that you are in App Install view, click the icon for the app that you want to reconfigure, and then click the **EDIT CONFIGURATION** button on the App Configuration page.
- Step 2** In the Installed Devices table, check the check box for each device on which you want to reconfigure the app.
- For detailed information about this table and locating devices, see the [“Reconfigure App Options” section on page 4-33](#).
- Step 3** Click the **ADD SELECTED DEVICES** button.
- The devices with checked check boxes are added to the Selected Devices table. The app can be reconfigured on devices that this table list. For detailed information about this table and about removing devices from this table, see the [“Reconfigure App Options” section on page 4-33](#).
- Step 4** To to change configuration information for this app, take these actions:
- a. Click the Expand icon  next to **Customize Configuration**.
The configuration items that display are defined in the package_config.ini file for the app.
 - b. Make updates as needed in the fields that appear.
The value that each field displays is the default value for that item as defined by the app. To see the current value of an item on a particular device, from the Devices tab, choose a device, and then click **EDIT CONFIGURATION** near the bottom of the page that displays for the device.
 - c. (Optional) **Check the Restart app** after configuration check box if you want the app to restart after you save the configuration updates. Some apps require a restart after a configuration change.
 - d. Click the **DONE, LET’S GO** button to complete the changes to configuration information.

Step 5 To reconfigure resource profiles that have been assigned for the app, take these actions:

- a. Click the Expand icon  next to **Customize Resources**, if this area is not expanded already.
- b. Click the Expand icon  next to **Configure Resource Profiles**.

You can update the resource profile for a specific device, some devices, or all devices.

The *device squares* in the box in the middle of the Configure Resource Profile area represent devices on which the app is installed. You can hover your mouse pointer over a device square to display the Edit Resource Profile dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and the resource profile that has been assigned for the app on the device. You can click the hostname and IP address in the dialog box to exit the reconfigure procedure and display the Device Details page for the device.

- c. If you want to limit the device squares displays to one or more specific devices, take either of these actions:
 - To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.
 - To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.
- d. Take the desired action:
 - To change the resource profile for a specific device, hover your mouse pointer over the device square for that device, and in the Edit Resource Profile dialog box, choose a resource profile from the **Select Profile** drop-down list.
 - To change the resource profile for all devices for which a device square displayed, click the desired profile radio button and then click the **Reassign Profile** button:
 - **Exact matching profile**—Assigns the resource profile that is defined for the app in its metadata, if the resources are available on a device.
 - **Largest available profile**—Assigns the largest resource profile that is currently available on a device.
 - **Allocate all available resources**—Assigns all CPU and memory resources that are available on each device on which you are installing.
 - **Custom profile**—On each device on which you are installing, assigns the CPU and memory resources that you specify. After you click this radio button, the **CPU** and the **Memory** fields appear. Enter the CPU resources, in units, and memory resources, in MB, to assign on each device. The Max value under each field shows the maximum value that you can enter without exceeding the available corresponding resource on at least one device. If you enter a value that exceeds this maximum value, the **REASSIGN PROFILE** button is dimmed and cannot be used.
- e. If you are finished reconfiguring the app, click the **EDIT RESOURCES** button. Otherwise, continue to the following step.

Step 6 To reconfigure network information that relates to how the app obtains its IP address or addresses on each device, take these actions:

- a. Click the Expand icon  next to **Customize Resources**, if this area is not expanded already.
- b. Click the Expand icon  next to **Configure Networking**.

You can update the network for a specific device, some devices, or all devices.

The *device squares* in the box at the left of the Configure Networking area represent devices on which the app is installed. You can hover your mouse pointer over a device square to display the Edit Network Details dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and network interface information for each network interface that is defined in the `package_config.ini` file for the app.

The Preferred Networks sub areas at the right of the Configure Networking area provide information for each network interface that is defined in the `package_config.ini` file for the app. You can expand a sub area to display and update options in it.

If you want to limit the device squares to one or more specific devices, take either of these actions:



- To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.
- To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.

To update network information for an app on one or more devices, take either of these actions:

- To change network information for a specific device, take these actions:
 - a. Hover your mouse pointer over the device square for that device, and in the Edit Network Details dialog box, choose a network for the corresponding network interface from the **Select Network** drop-down list. Network options are:
 - **iox-bridge#**—App obtains its IP address from a DHCP pool that is configured in Cisco IOS
 - **iox-nat#**—App obtains its IP address from an internal network address translator
 - b. If you choose **iox-bridge#** and if you want to assign a static IP address from the DHCP pool for this network interface, check the **Static Mode** check box that displays. If you check this check box, the network interface uses IP addresses that are dynamically assigned from the DHCP pool.
 - c. If you check the **Static Mode** check box, configure the following fields that appear as needed:
 - **IPv# Address** and **Mask** fields—Enter the static address and subnet mask to use. If the IPv6required field is set to “true” in the app descriptor file (`package.yaml`) for an app, you must enter an IPv6 address. Otherwise, you can enter an IPv4 or an IPv6 address. If you enter an IPv6 address but a device on which you are installing the app does not support IPv6, the edit configuration operation will fail on that device.
 - **DNS** field—(Optional) Enter the IP address of the DNS server that the app uses for external communication.
 - **Default Gateway** field—(Optional) Enter the IP address of the default gateway that the app uses for external communication.
- To update network information for all devices for which a device square is displayed, take these actions for each network interface that you want to configure:
 - a. Expand the Preferred networks sub area.
 - b. Choose a network from the **Select Network** drop-down list. Network options are:
 - **iox-bridge#**—App obtains its IP address from a DHCP pool that is configured in Cisco IOS
 - **iox-nat#**—App obtains its IP address from an internal network address translator
 - c. If you choose **iox-bridge#**, click one of the following radio buttons that appear:
 - **Static**— Click to assign a static IP address from the DHCP pool for this network interface
 - **Dynamic**—Click to use a dynamically assigned IP address from the DHCP pool for this network interface

- d. If you click the **Static** radio button, configure the following fields that appear as needed:
 - **IPv# Address** and **Mask** fields—Enter the static address and subnet mask to use. If the IPv6required field is set to “true” in the app descriptor file (package.yaml) for an app, you must enter an IPv6 address. Otherwise, you can enter an IPv4 or an IPv6 address. If you enter an IPv6 address but a device on which you are installing the app does not support IPv6, the edit configuration operation will fail on that device.
 - **Default Gateway** field—(Optional) Enter the IP address of the default gateway that the app uses for external communication.
 - **DNS** field—(Optional) Enter the IP address of the DNS server that the app uses for external communication.
- e. After you configure each network interface that you want, click the **REASSIGN NETWORKS** button.



Step 7 To reconfigure a VNC password that is required to access an app on devices via a VNC session, take these actions:

- a. Click the Expand icon  next to **Customize Resources**, if this area is not expanded already.
- b. Click the Expand icon  next to **Configure VNC Password**.

The *device squares* in the box in the middle of the Configure VNC Password area represent devices on which you are installing the app. You can hover your mouse pointer over a device square to display the Edit VNC password dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and provides a field for entering the VNC password for the device.

- c. If you want to limit the device squares to one or more specific devices, take either of these actions:
 - To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.
 - To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.
- d. Take either of these actions:
 - To set the VNC password for a specific device, hover your mouse pointer over the device square for that device, and in the Edit VNC Password dialog box, enter the password in the **VNC Password** field
 - To set the VNC password for all devices for which a device square is displayed, enter the password in the **VNC Password** field that displays to the right of the device squares, and then click the **Assign** button.

Step 8 To reconfigure the number of virtual CPUs that the app requires on a device:

- a. Click the Expand icon  next to **Customize Resources**, if this area is not expanded already.
- b. Click the Expand icon  next to **Configure VCPUs**.

The *device squares* in the box in the middle of the Configure VCPUs area represent devices on which you are installing the app. You can hover your mouse pointer over a device square to display the Edit VCPU Details dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and the number of virtual CPUs that have been assigned for the app on the device.

- a. If you want to limit the device squares to one or more specific devices, take either of these actions:
 - To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.


- To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.
- b. Take either of these actions:
 - To configure the number of virtual CPUs for a specific device, hover your mouse pointer over the device square for that device, and in the Edit VCPU dialog box, type or use the up or down arrow buttons to enter the desired value.
 - To configure the number of virtual CPUs for all devices for which a device square is displayed, in the **Select VCPU Value** field that displays to the right of the device square, type or use the up or down arrow buttons to enter the desired value, and then click the **REASSIGN VCPU** button. The text above the **Select VCPU Value** field indicates the number of virtual CPUs that the descriptor file for the app specifies and the maximum number of virtual CPUs that you can designate for the app on the devices that you selected.

Step 9 To reconfigure the serial port that the app uses on a device, take these actions:

- a. Click the Expand icon  next to **Customize Resources**, if this area is not expanded already.
- b. Click the Expand icon  next to **Configure Device Resource Ports**.

The *device squares* in the box in the middle of the Configure Device Resource Ports area represent devices on which the app is installed. You can hover your mouse pointer over a device square to display the Edit Serial Details dialog box. This dialog box shows the hostname and IP address of the device, tags assigned to the device, and the serial port that has been assigned for the app on the device.

- a. If you want to limit the device squares to one or more specific devices, take either of these actions:
 - To limit the device display to a specific device based on its hostname or IP address, enter all or part of the hostname or IP address in the **Search Hostname, IP Address** field.
 - To limit the device display to specific devices based on a tag, choose a tag from the **Show** drop-down list.
- b. Hover your mouse pointer over the device square for the device that you want to update, and in the Edit Serial Details dialog box, choose a port from the **Select Serial Port** drop-down list.
- c. When you are finished reconfiguring resources, click the **EDIT RESOURCES** button.

Step 10 (Optional) To choose, view, modify or add an action plan, click the Expand icon  next to **Configure Action Plan**.

The action plan designates how many times and at what interval Cisco Fog Director retries an action if the action fails on a device due to certain device reachability or network connectivity issues. If Cisco Fog Director cannot complete the app reconfiguration action after the number of retries that the action plan designates, the app reconfiguration does not complete.

When you expand **Configure Action Plan**, the **Selected Action Plan** field shows the name of the action plan that is in effect. The **Details** field describes the number of retries and time between retries that the selected action plan defines.

You can choose the action plan that you want from the Selected Action Plan drop-down list.

For information about modifying or adding action plans, see the [“Using Action Plans” section on page 4-48](#).

Reconfiguring an App from the Devices View Page

Reconfiguring an app from the Devices View page applies the reconfiguration to a specified device.

To reconfigure an app from the Devices View page, follow these steps:

Before You Begin

Make sure that the app is installed as described in the [“Installing an App”](#) section on page 4-13.

Procedure

-
- Step 1** On the Devices page, choose the device on which you want to reconfigure the app.
- Step 2** Click **Edit Configuration** under the app that you want to reconfigure.
The configuration items that display are defined in the package_config.ini file for the app.
- Step 3** Make updates as needed in the fields that appear.
The value that each field displays is the value for that item on the device that you chose.
- Step 4** (Optional) **Check the Restart app** after configuration check box if you want the app to restart after you save the configuration updates. Some apps require a restart after a configuration change.
- Step 5** Click the **RECONFIGURE APP** button.
-

Configuring App Links

You can use app links to associate links to external resources with an app. For example, you could include a link to a web site or document that provides information about an app, or you could include a link to a reference guide or configuration guide for an app. You can associate as many links as needed with an app.

After you configure a link for an app, the link displays under App Links on the App Configuration page, and in the Apps area on the Device Details page. Click a link to go to the configured resource.


The following sections describe how add, update, or delete app links.

- [Adding an App Link, page 4-40](#)
- [Updating or Deleting an App Link, page 4-41](#)



Adding an App Link

To configure and app link, follow these steps:

Procedure

-
- Step 1** If you are not viewing the page that displays when you add an app, take these actions:
- In the Available Apps area on the Apps View page, make sure that you are in App Edit view.
 - In this area, click the icon for the app for which you want to add links.
- Step 2** Click the **App Links** button  .
Three fields appear.
- Step 3** In the first field, enter a name for the link.





For example, enter the name of the web page or a document that the link references.

- Step 4** In the second field, enter the URL of the link.
- Step 5** In the third field, enter a brief description of the linked resource.
- Step 6** Take either of these actions:
- To save your changes, click the Check icon .
 - To close the fields without saving your changes, click the X icon .
-

Updating or Deleting an App Link

To update or delete an app link, follow these steps:

Procedure

-
- Step 1** If you are not viewing the page that displays when you add an app, take these actions:
- a. In the Available Apps area on the Apps View page, make sure that you are in App Edit view.
 - b. In this area, click the icon for the app for which you want to add links.
- Step 2** Take either of these actions
- To delete the link, click the Delete icon .
 - To update the link, click the Delete icon  and continue to [Step 3](#).
- Step 3** In the fields that display, update the name a name of the link, the URL of the link, or the description of the link as needed.
- Step 4** Take either of these actions:
- To save your changes, click the Check icon .
 - To close the fields without saving your changes, click the X icon .
-

Aborting an Action

Cisco Fog Director provides the ability to abort a variety of actions after you start them. This feature is useful if you start an action that is to take place on several devices and you want to stop the action before it completes on all devices.

To use this feature, you select the devices on which to abort the action. Cisco Fog Director then does not perform the action on any selected device on which the action has not yet started. The action might continue on devices on which it has started already, but Cisco Fog Director stops monitoring and displaying status information about the action on those devices.

You can abort the following actions:

- Installing an app

- Uninstalling an app
- Upgrading an app
- Reconfiguring app parameters from the Apps View page
- Retrying failed actions for an app

The following sections provide additional information:

- [Table 4-10 Abort Ongoing Actions Options, page 4-42](#)
- [Aborting an Action on Selected Devices, page 4-43](#)

Abort Ongoing Actions Options


Options for aborting actions appear in the Abort Ongoing Actions page. This page displays when you click the ABORT button on a page that displays after you start an action.

The Abort Ongoing Actions page displays. This page includes the items that [Table 4-11](#) describes.

Table 4-11 *Abort Ongoing Actions Page Items*

Item	Description
Devices table	<p>Provides information about each device on which you specified that the action be performed:</p> <ul style="list-style-type: none"> • Search Hostname, IP address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. • Show field—Enter the name of a tag and then press the Enter key to display information for devices with a matching tag. You can choose a tag from a drop-down list of available tags by typing the first few letters of the tag and then clicking the tag that you want. • Check box—Check the check box for each device on which you want to abort the action. You can click the check box in the title row of the table to quickly check all boxes in the table. • Host Name—Hostname of the device on which you specified that the action be performed. • IP Address—IP address of the device on which you specified that the action be performed. • Tags—Tags that are assigned to a device. • Installed Apps—Apps that are installed on the device • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
ADD SELECTED DEVICES button	Click to add devices with checked check boxes to the Selected Devices table.

Table 4-11 Abort Ongoing Actions Page Items (continued)

Item	Description
Selected Devices table	<p>Provides information about each device for which you want to abort the action. Devices appear in this table after you check their check boxes in the Devices table and then click ADD SELECTED DEVICES. This table includes the following items:</p> <ul style="list-style-type: none"> • Selected Devices—Number of devices on which you want to abort the action. • Search Hostname, IP Address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. • Host Name—Hostname of the device on which you want to abort the action. • IP Address—IP address of the device on which you want to abort the action. • Tags—Tags that are assigned to the device on which you want to abort the action. • Health—Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information. • Last Heard—How long ago Cisco Fog Director last communicated with the device, or a brief explanation of why the last attempt to communicate with the device was unsuccessful. • Action—Click the x icon  to remove a device from the Selected Devices table. Clicking this icon does not affect the device. • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
SUBMIT button	Appears when one or more devices appear in the Selected Devices table. Click to abort the action on the devices in the Selected Devices table.

Aborting an Action on Selected Devices

To abort an action, follow these steps:

Procedure

-
- Step 1** In the page that displays after you start the action, click the **ABORT** button. The Abort Ongoing Actions page displays.

- Step 2** In the Installed Devices table, check the check box for each device for which you want to abort the action.
- For detailed information about this table and locating devices, see the [“Abort Ongoing Actions Options” section on page 4-42](#).
- Step 3** Click the **ADD SELECTED DEVICES** button.
- The devices that you selected are added to the Selected Devices table. The action will be aborted on the devices that this table lists. For detailed information about this table and about removing devices from this table, see the [“Abort Ongoing Actions Options” section on page 4-42](#).
- Step 4** Click the **SUBMIT** button.
- The action aborts on the devices that you selected. If the action has started on a device, the action might continue on that device, but Cisco Fog Director stops monitoring and displaying status information about the action on that device.
-

Retrying a Failed Action for an App

If any of the following actions fails on one or more devices, you can use the **RETRY NOW** button on the App Configuration page to retry the action:

- Installing an app
- Reconfiguring app parameters
- Upgrading an app
- Uninstalling an app
- Editing app resources



Note

If a failed action has an associated action plan that instructs Cisco Fog Director to retry an app, you also can manually retry the action by using the **RETRY NOW** button on the Actions page as described in the [“Outstanding and Expired Actions Management Procedure” procedure on page 4-55](#).

For detailed information about action plans, see the [“Using Action Plans” procedure on page 4-48](#).

The following sections provide additional information:

- [Retry Failed Action Options, page 4-44](#)
- [Retry Failed Action Procedure, page 4-47](#)

Retry Failed Action Options

To view options for retrying a failed action, click the **RETRY NOW** button on the App Configuration page for the app.

The Select Retry Actions page displays. This page includes the items that [Table 4-12](#) describes.

Table 4-12 Select Retry Actions Page Items

Item	Description
Redeploy app on devices where it failed installation area	
Redeploy button	Click to retry the failed installation operation on the devices that you select in the Devices table in this area.
REMOVE FOREVER button	Click to delete information about the action that failed on the devices that you select in the Devices table in this area and to clear the error from the system.
VIEW DEPLOY ACTION HISTORY button	Click to display the Actions History window for the devices that you select in the Devices table in this area. For a description of this window, see Table 4-13 on page 4-46 .
Devices table	<p>Provides information about each device on which an installation action failed, and includes the following items:</p> <ul style="list-style-type: none"> • Search Hostname, IP address field—Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type. • Show field—Enter the name of a tag and then press the Enter key to display information for devices with a matching tag. You can choose a tag from a drop-down list of available tags by typing the first few letters of the tag and then clicking the tag that you want. • Check box—Check the check box for each device on which you want to perform an action. You can click the check box in the title row of the table to quickly check all boxes in the table. • Host Name—Hostname of the device on which the action is to be performed. • IP Address—IP address of the device on which action is to be performed. • Tags—Tags that are assigned to a device. • Installed Apps—Apps that are installed on the device • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
Edit configuration on devices where configuration failed area	
EDIT CONFIGURATION button	Click to retry the failed configuration operation on the devices that you select in the Devices table in this area.
VIEW EDIT CONFIGURATION ACTION HISTORY button	Click to display the Actions History window for the devices that you select in the Devices table in this area. For a description of this window, see Table 4-13 on page 4-46 .
Devices table	Provides information about each device on which an edit configuration action failed. This table contains the information that the Devices table row in this table describes.

Table 4-12 *Select Retry Actions Page Items (continued)*

Item	Description
Restart app after configuration check box	Check this check box if you want the app to restart after the configuration operation completes. Some apps require a restart after a configuration change.
Customize configuration fields	Displays configuration items that are defined in the package_config.ini file for the app. You can make updates in these fields as needed.
Upgrade app on devices where upgrade failed area	
Upgrade button	Click to retry the failed upgrade operation on the devices that you select in the Devices table in this area.
VIEW UPGRADE ACTION HISTORY button	Click to display the Actions History window for the devices that you select in the Devices table in this area. For a description of this window, see Table 4-13 on page 4-46 .
Devices table	Provides information about each device on which an upgrade action failed. This table contains the information that the Devices table row in this table describes.
Uninstall app from devices where uninstall failed area	
Uninstall button	Click to retry the failed uninstall operation on the devices that you select in the Devices table in this area.
VIEW UNINSTALL ACTION HISTORY button	Click to display the Actions History window for the devices that you select in the Devices table in this area. For a description of this window, see Table 4-13 on page 4-46 .
Devices table	Provides information about each device on which an uninstall action failed. This table contains the information that the Devices table row in this table describes.
Allocate resource for app on devices where resource allocation failed area	
EDIT RESOURCES button	Click to retry the failed resource allocation operation on the devices that you select in the Devices table in this area.
VIEW EDIT RESOURCES ACTION HISTORY button	Click to display the Actions History window for the devices that you select in the Devices table in this area. For a description of this window, see Table 4-13 on page 4-46 .
Devices table	Provides information about each device on which a resource allocation action failed. This table contains the information that the Devices table row in this table describes.

The Action History window displays when you click a **VIEW TYPE ACTION HISTORY** button for a failed action in the Select Retry Actions page. This window includes the items that [Table 4-13](#) describes.

Table 4-13 *Action History Window Items*

Item	Description
Outstanding tab	Click to display devices on which the action is in Outstanding state.
Expired tab	Click to display devices on which the action is in Expired state.

Table 4-13 Action History Window Items (continued)

Item	Description
Host Name field	Hostname of a device on which the action is in Outstanding state or Expired state. You can click a hostname to display the Device Details page for the corresponding device.
IP Address field	IP address of a device on which the action is in Outstanding state or Expired state. You can click an IP address to display the Device Details page for the corresponding device.
Last Attempted field	Date and time that Cisco Fog Director last attempted to perform the action on a device.
Message	Brief description of why the action last failed on the device.
Next attempt	Date and time that Cisco Fog Director will next attempt to perform the action on the device, according to the action plan that is in effect for this action.
Action Type	Type of the outstanding action (Install, Uninstall, Upgrade, Edit Configuration, or Edit Resources).
Pending attempts	For a device with actions in Outstanding state, displays the maximum number of additional times that Cisco Fog Director will attempt to perform the action on the device, according to the action plan that is in effect for this action. For a device that you moved to Expired state by manually canceling future retries, displays the maximum number of retries that were pending when you canceled the retries.

Retry Failed Action Procedure

To retry a failed action, follow these steps:

Procedure

-
- Step 1** From the App Configuration page for the app, click the **RETRY NOW** button. This button is available only if an action failed.
- The Select Retry Actions page displays, as described in [Table 4-12 on page 4-45](#). This page includes areas that relate to the following failed actions types:
- App install action
 - App reconfigure action
 - App upgrade action
 - App uninstall action
 - App resource allocation action
- Step 2** (Optional) To view a history of failed actions on one or more devices, take these actions:
- a. In the Devices table in the area for the type of failed action for which you want to view history, check the check box for each device for which you want to see information.
 - b. **VIEW TYPE ACTION HISTORY** button in the same area.

Step 3 Take the desired actions:

- To retry an install action, take these actions in the **Redeploy app on devices where it failed installation** area:
 - a. In the devices table, check the check box for each device on which you want to retry the action.
 - b. Click the **REDEPLOY** button to retry the installation operation on the devices that you selected, or click the **REMOVE FOREVER** button delete information about the action that failed on the devices that you select and to clear the error from the system.
- To retry an edit configuration action, take these actions in the **Edit Configuration on devices where configuration failed** area:
 - a. In the devices table, check the check box for each device on which you want to retry the action.
 - b. If needed, edit information that displays the Customize Configuration fields. These fields display configuration items that are defined in the package_config.ini file for the app.
 - c. Check the **Restart app after configuration** check if you want the app to restart after the edit configuration operation completes. Some apps require a restart after a configuration change.
 - d. Click the **EDIT CONFIGURATION** button to retry the edit configuration operation on the devices that you selected.
- To retry an upgrade action, take these actions in the **Upgrade app on devices where upgrade failed** area:
 - a. In the devices table, check the check box for each device on which you want to retry the action.
 - b. Click the **UPGRADE** button to retry the upgrade operation on the devices that you selected.
- To retry an uninstall action, take these actions in the **Uninstall app on devices where uninstall failed** area:
 - a. In the devices table, check the check box for each device on which you want to retry the action.
 - b. Click the **UNINSTALL** button to retry the uninstall operation on the devices that you selected.
- To retry a resource allocation action, take these actions in the **Allocate resource for app on devices where resource allocation failed** area:
 - a. In the devices table, check the check box for each device on which you want to retry the action.
 - b. Click the **EDIT RESOURCES** button to retry the resource allocation operation on the devices that you selected.

The App Configuration page displays, as described in the [“Viewing Detailed Information about an Installed or Available App”](#) section on page 4-7.

While the system is retrying an action on a device, the status of the retry operation displays for that device. Click the device to see the progress of the operation. You can click the **ABORT** button under the status display to abort the operation, as described in the [“Aborting an Action”](#) section on page 4-41.

Using Action Plans

An *action plan* is a Cisco Fog Director policy that instructs Cisco Fog Director to retry an app installation, configuration, upgrade, or uninstallation action if the action fails due to certain conditions, or to perform the action within a designated maintenance window.

Cisco Fog Director automatically associates an action plan with each app installation, configuration, upgrade, or uninstallation that you perform. By default, the action plan causes Cisco Fog Director to perform the action immediately and to retry a failed action up to 10 times at 2 minute intervals. You can change these parameters as needed when you perform an app installation, configuration, upgrade, or uninstallation procedure.

If you perform an action that has an action plan that instructs Cisco Fog Director to retry the action and the action does not complete successfully when you execute it, or if the action plan instructs Cisco Fog to perform the action in a designated maintenance window, the action will be in one of these states:

- **Outstanding**—The action will be retried or executed in a maintenance window according to the action plan that is associated with the action
- **Expired**—The action did not complete successfully but will no longer be retried because the maximum number of retries that the associated action plan specifies, the maintenance window or windows that were scheduled for the action no longer exist, you manually canceled future retries of the action, or the failure is not related to certain device reachability or network connectivity issues

For more information about these states and how to manage actions that are in these states, including information about manually retrying or canceling future retries of an action, see the [“Managing Outstanding and Expired Actions for Apps” procedure on page 4-52](#).

- The following sections provide more detailed information about action plans:
- [Action Plan Guidelines, page 4-49](#)
- [Managing Action Plans, page 4-50](#)

Action Plan Guidelines

The following guidelines apply to action plans:

- Cisco Fog Director associates an action plan with every app installation, configuration, upgrade, and uninstallation procedure that you perform.
- Cisco Fog Director includes the action plan named `FogDirectorDefaultPolicy`. By default, this action plan designates that an action that fails be retried up to 10 times at 2 minute intervals. The system uses this action plan unless you specify that it use another one.
- You can modify or create an action plan when you perform an app installation, configuration, upgrade, or uninstallation procedure. If you do so, Cisco Fog Director saves the modifications or creation when you complete the procedure. If you exit the procedure without completing it, your action plan changes are not saved.
- For each action plan, you can designate that it take effect immediately or within a maintenance window, the number of times and at what interval it causes an action to be retried, and whether it is the default action plan.
- After action plan modifications or creations are saved, the updates that you made are available and used for all future app installation, configuration, upgrade, or uninstallation actions.
- If you delete an action plan, it is removed from Cisco Fog Director immediately. You do not need to complete the app installation, configuration, upgrade, or uninstallation procedure to save the deletion.
- The action plan that is currently designated as the default cannot be deleted from Cisco Fog Director.
- When you make an action plan the default, any actions that are pending under an action plan that was the previous default are not affected.

- If you do not want Cisco Fog Director to automatically retry a failed action, you can set the existing default action plan to 0 retries, or create a new default action plan that designates 0 retries.
- If Cisco Fog Director cannot complete an action after the number of retries that the action plan designates, the action does not complete.



Managing Action Plans

This section describes how to manage action plans. Action plan management tasks include:

- Modifying the number of times and at what interval an action plan causes Cisco Fog Director to retry a failed action
- Configuring (scheduling) an action plan to execute or retry actions only during one or more designated time periods, called *maintenance windows*
- Setting an action plan as the default action plan
- Creating a new action plan, called a *custom action plan*
- Deleting an action plan that is not the current default action plan or in use










To manage an action plan, follow these steps:

Procedure

-
- Step 1** When performing an app installation, configuration, upgrade, or uninstallation procedure, expand **Configure Action Plan** when this option becomes available during the procedure.
- Step 2** Take one of these actions:
- To create a new custom action plan, from the **Selected Action Plan** drop-down list, choose **[Define a new plan...]**. Continue to [Step 3](#).
 - To modify an custom action plan, from the **Selected Action Plan** drop-down list, choose the name of the plan, and click the Edit Action Plan icon  next to the action plan name. Skip to [Step 4](#).
You cannot modify an action plan when an action is in Outstanding state according to the plan. In this situation, the Edit Action Plan icon is dimmed.
 - To delete an action plan, from the **Selected Action Plan** drop-down list, choose the name of the plan, and click the Delete icon  next to the name.
The action plan is removed from Cisco Fog Director immediately and no further steps are needed, although you can complete the app installation, configuration, upgrade, or uninstallation procedure.
You cannot delete an action plan that is the current default or when an action is in Outstanding state according to the plan. In these situations, the delete icon is dimmed.
- Step 3** In the **Plan Name** field, enter a descriptive name for the new action plan.
- Step 4** (Optional) Check the **Make this plan the default** check box to make this action plan the default action plan.
Cisco Fog Director uses the default action plan if you do not choose another one when performing an action.
This check box does not appear if this action plan is the current default.
- Step 5** Choose one of the following **Action Type** radio buttons (*Action* identifies the type of procedure that you are performing when you access this option):

- **Now**—Causes the action plan to take effect as soon as you complete the app installation, configuration, upgrade, or uninstallation procedure. In this situation, if an action that is associated with this action plan fails, Cisco Fog Director immediately begins to retry the action according to this action plan. Skip to [Step 7](#).
- **In a maintenance window**—Causes the action plan to be in effect according to the schedule (called a *maintenance window*) that you specify. In this situation, an action that is associated with this action plan does not execute until the beginning of the maintenance window, and if the action fails, Cisco Fog Director retries the action according to this action plan only within the maintenance window. Continue to [Step 6](#).

Step 6 From the **Maintenance window type** drop-down list, choose one of the following options to define the schedule for this action plan:

- **Once**—Causes the action plan to be in effect for the designated time period on the designated date. If you choose this option, enter information in the **Maintenance window date and time** fields that appear as follows:
 - **Date** field—Click the calendar icon  and then choose the date on which the action plan should be in effect.
 - **From** field—Click the clock icon  and then choose the time on the selected date at which the action plan should begin to take effect.
 - **To** field—Click the clock icon  and then the time on the selected date after which the action plan should no longer be in effect.
 - **Time zone** field—Specifies the time zone for the times in the **From** and **To** fields. By default, this field displays the time zone of your PC. We recommend that you use the time zone of the server on which Cisco Fog Director is running. To change the time zone that displays in this field, click this field, click its delete icon , and then start typing the time zone that you want. You can choose a time zone from the list that displays.
- **Every day**—Causes the action plan to be in effect for the designated time period every day or until the action goes to Expired state. If you choose this option, enter information in the **Maintenance window** fields that appear as follows:
 - **From** field—Click the clock icon  and then choose the time on the selected date at which the action plan should begin to take effect.
 - **To** field—Click the clock icon  and then the time on the selected date after which the action plan should no longer be in effect.
 - **Time zone** field—Specifies the time zone for the times in the **From** and **To** fields. By default, this field displays the time zone of your PC. We recommend that you use the time zone of the server on which Cisco Fog Director is running. To change the time zone that displays in this field, click this field, click its delete icon , and then start typing the time zone that you want. You can choose a time zone from the list that displays.
- **On selected days of the week**—Causes the action plan to be in effect for the designated time period on each day that you choose or until the action goes to Expired state. If you choose this option, enter information in **Maintenance days** and **Maintenance window** fields that appear:
 - **Maintenance days** field—Check the check box for each day on which the action plan should be in effect.
 - **From** field—Click the clock icon  and then choose the time on each day at which the action plan should begin to take effect.
 - **To** field—Click the clock icon  and then the time on the selected date after which the action plan should no longer be in effect.

- **Time zone** field—Specifies the time zone for the times in the **From** and **To** fields. By default, this field displays the time zone of your PC. We recommend that you use the time zone of the server on which Cisco Fog Director is running. To change the time zone that displays in this field, click this field, click its delete icon **X**, and then start typing the time zone that you want. You can choose a time zone from the list that displays.
- **On a cron schedule**—Causes the action plan to be in effect for a time period that begins according to a cron schedule that you designate and lasts for the amount of time that you specify. If you choose this option, enter information in the **Cron Expression** and **Maintenance window duration** fields that appear:
 - **Cron expression** field—Enter a cron expression that defines date and time that the action plan should start. The expression should be in the format *MinuteHourDateMonthDayYear*, where:
 - *Minute*—Minutes after the hour. Valid values are 1 through 59.
 - *Hour*—Hour of the day, in 24-hour format. Valid values are 0 through 23.
 - *Date*—Date of the month. Valid values are 1 through 31.
 - *Month*—Month of the year. Valid values are 1 (January) through 12 (December).
 - *Day*—Day of the week. Valid values are 1 (Sunday) through 7 (Saturday).
 - *Year*—Four-digit year.
 - **Maintenance window duration** field—Enter the number of minutes that the action plan should be in effect from the time that it starts.

Step 7 In the **Number of times to retry failed installs** field, enter the number of times that Cisco Fog Director retries a failed action.

If you do not want Cisco Fog Director to retry a failed action, enter **0** in this field.

Step 8 In the **Minimum duration between retries** field, enter the minimum number of minutes that Cisco Fog Director waits from the time that an action last failed before retrying the action.

In some situations, internal system factors can cause the system to wait for a time that is longer than the minimum.

Step 9 Complete the app installation, configuration, upgrade, or uninstallation procedure to save modifications that you made to this custom action plan.

You do not need to complete the procedure if you deleted this action plan.

Managing Outstanding and Expired Actions for Apps

If an action does not complete successfully when you execute it and it has an action plan that instructs Cisco Fog Director to retry a failed action, or if an action has an action plan that instructs Cisco Fog to perform the action in a designated maintenance window, the action will be in one of these states:

- **Outstanding**—The action will be retried or executed in a maintenance window according to the action plan that is associated with the action
- **Expired**—The action did not complete successfully but will no longer be retried due to any of the following situations:
 - The maximum number of retries that an action plan specifies for the action has been reached
 - The maintenance window or windows that were scheduled for the action no longer exist

- You manually cancel future retries of the action
- The failure is not related to certain device reachability or network connectivity issues

You can manage actions that are in these states by using information and options on the Actions page.

The following sections provide additional information:

- [Outstanding and Expired Actions Management Options, page 4-53](#)
- [Outstanding and Expired Actions Management Procedure, page 4-55](#)

Outstanding and Expired Actions Management Options

To view options for outstanding actions, click the **View outstanding actions** link on the App Configuration page. This link displays if one or more app actions are in Outstanding state. The following information displays:

- **Install**—Number of devices on which an app install action is in Outstanding state
- **Edit**—Number of devices on which an app configuration action is in Outstanding state
- **Upgrade**—Number of devices on which an app upgrade action is in Outstanding state
- **Uninstall**—Number of devices on which an app uninstall action is in Outstanding state

To see detailed information about the install, edit, upgrade, or uninstall action that are in Outstanding state or Expired state, click the display for the action type that you want. The Actions page displays. This page includes the items that [Table 4-14](#) describes.

Table 4-14 *Actions Page Items*

Item	Description
Search box	Type all or part of a hostname or IP address to display information for devices with matching information. The table display updates as you type.
Show drop-down list	Choose an option to designate the devices that display in the Devices table: <ul style="list-style-type: none"> • All—Displays devices on which one or more app install, configuration, upgrade, or uninstall action is in Outstanding state or Expired state • Install—Displays devices on which one or more app install action is in Outstanding state or Expired state • Edit—Displays devices on which one or more app configuration action is in Outstanding state or Expired state • Upgrade—Displays devices on which one or more app upgrade action is in Outstanding state or Expired state • Uninstall—Displays devices on which one or more app uninstall action is in Outstanding state or Expired state
Outstanding button	Click to displays devices for which actions are in Outstanding state.
Expired button	Click to displays devices for which actions are in Expired state.

Table 4-14 Actions Page Items (continued)

Item	Description
Devices table	<p>Provides information about each device on which actions are in Outstanding state or Expired state:</p> <ul style="list-style-type: none"> • Check box—Check the check box for each device on which you want to manually retry the action or cancel additional retries of an action. You can click the check box in the title row of the table to quickly check all boxes in the table. • Host Name field—Hostname of a device on which the action is in Outstanding state or Expired state. • IP Address field—IP address of a device on which the action is in Outstanding state or Expired state. • Last Attempted field—Date and time that Cisco Fog Director last attempted to perform the action on the device. • Message—Brief description of why the action last failed on the device. • Next attempt—Date and time that Cisco Fog Director will next attempt to perform the action on the device, according to the action plan that is in effect for this action. • Action Type—Type of the outstanding action (Install, Uninstall, Upgrade, Edit Configuration, or Edit Resources). • Pending attempts—For a device with actions in Outstanding state, displays the maximum number of additional times that Cisco Fog Director will attempt to perform the action on the device, according to the action plan that is in effect for this action. For a device that you moved to Expired state by manually canceling future retries, displays the maximum number of retries that were pending when you canceled the retries. • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table. • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table.
ADD SELECTED DEVICES button	Click to add devices with checked check boxes to the Selected Devices table.

Table 4-14 *Actions Page Items (continued)*

Item	Description
Selected Devices table	<p>Provides information about each device on which you want to manually retry an action or cancel additional retries of an action. Devices appear in this table after you check their check boxes in the Installed Devices table and then click ADD SELECTED DEVICES. This table includes the following items:</p> <ul style="list-style-type: none"> • Host Name field—Hostname of a device on which to manually retry or cancel future retries of an action • IP Address field—IP address of a device on which to manually retry or cancel future retries of an action • Message—Can display the following information: <ul style="list-style-type: none"> – Brief description of why the action last failed on the device – “Scheduled”—Indicates that the action is scheduled to run in an a future maintenance window – “Expired because no future maintenance window exists”—Indicates that the action is in Expired state • Action Type—Type of the outstanding action (Install, Uninstall, Upgrade, Edit Configuration, or Edit Resources) • Action—Click the x icon x to remove a device from the Selected Devices table • Pagination controls—Click a control to go to the first, next, last, previous, or specific page in the table • Items per page drop-down list—Choose the maximum number of devices that appear in each page of the table
RETRY NOW button	Click to immediately execute on the devices that are listed in the Selected Devices table an action that is in Outstanding device.
CANCEL OUTSTANDING button	Click to stop Cisco Fog Director from retrying the action on the devices that are listed in the Selected Devices table. Choosing this option cancels the action plan that is in effect for the action on this device and moves the action on this device to Expired state.

Outstanding and Expired Actions Management Procedure

This section describes how to manage actions that are in Outstanding state or Expired state. Management tasks include:

- Viewing information about actions.
- Manually retrying actions. You can manually retry actions that are in Outstanding state or in Expired state.
- Canceling future retries of actions.

You also can manually retry an action as described in the [“Retrying a Failed Action for an App”](#) section on page 4-44, and cancel future retries for outstanding actions on a device as described in the [“Device Details Area”](#) section on page 5-7.

To view information about, manually retry, or cancel future retries of actions in Outstanding state or Expired state, follow these steps:

Procedure

-
- Step 1** On the App Configuration page, click the **View outstanding actions** link, and then click the Action display (**Install**, **Edit**, **Upgrade**, or **Uninstall**) for the action type that you want.
- The Actions page displays. By default, this page shows devices on which the action that you chose is in Outstanding state. For descriptions of the items on this page, see [Table 4-14 on page 4-53](#).
- Step 2** (Optional) To display information in the Devices table for devices that have actions of a specific type or in a specific state, take these actions:
- To display information for devices that have outstanding actions of a particular type, choose one of the following options from the **Show** drop-down list:
 - **All**—Displays devices on which one or more app install, configuration, upgrade, or uninstall actions are in Outstanding state or Expired state
 - **Install**—Displays devices on which one or more app install actions are in Outstanding state or Expired state
 - **Edit**—Displays devices on which one or more app configuration action is in Outstanding state or Expired state
 - **Upgrade**—Displays devices on which one or more app upgrade actions are in Outstanding state or Expired state
 - **Uninstall**—Displays devices on which one or more app uninstall actions are in Outstanding state or Expired state
 - To display devices on which an action type is in Expired state, click the **Expired** button.
 - To display devices on which an action type is in Outstanding state, click the **Outstanding** button.
- Step 3** To manually retry an action or cancel future retries of an action, take these actions:
- a. In the Installed Devices table, check the check box for each device on which you want to manually retry an action or cancel future retries of an action.

For detailed information about this table and locating devices, see the [“Outstanding and Expired Actions Management Options”](#) section on page 4-53.
 - b. Click the **ADD SELECTED DEVICES** button.

The devices with checked check boxes are added to the Selected Devices table. Actions will be retried or canceled on the devices that this table lists. For detailed information about this table and about removing devices from this table, see the [“Outstanding and Expired Actions Management Options”](#) section on page 4-53.
 - c. Click the desired button:
 - **RETRY NOW**—Click to immediately retry the actions on the devices that are listed in the Selected Devices table.
 - **CANCEL OUTSTANDING**—Click to stop Cisco Fog Director from retrying the action on the devices that are listed in the Selected Devices table.

Choosing this option cancels the action plan that is in effect for the action on this device and moves the action on this device to Expired state. In his situation, Cisco Fog Director no longer retries the action or runs it a future maintenance window.
-

Backing Up and Restoring Apps

The Cisco Fog Director export and import features let you back up and restore apps. These features can be useful for creating an archive of apps or for importing apps to another Cisco Fog Director.

The export feature saves all apps that appear in the Available and the Unpublished areas on the Apps View page to a zip file outside of Cisco Fog Director. The import feature restores apps that have been exported to a zip file.

The following sections describe these features in detail:

- [Exporting Apps, page 4-57](#)
- [Importing Apps, page 4-57](#)

Exporting Apps

Exporting apps lets you save apps in an export file, which is a zip file named exportedApps.zip that is stored outside of Cisco Fog Director. This action affects all apps that appear in the Available and the Unpublished areas on the Apps View.

To export an app, follow these steps:

Procedure

- Step 1** In the Available Apps area on the Apps View page, make sure that you are in App Edit view, and then click the **EXPORT APPS** button.
- Step 2** Follow the on-screen prompts to save the app in the location of your choice.
The file is named exportedApps.zip.
-

Importing Apps

When you import apps that you exported as described in the “[Exporting Apps](#)” section on page 4-57, the apps are added to Cisco Fog Director. If an app already exists in the Cisco Fog Director to which you are importing, the app is not restored.

To import an app, follow these steps:

Procedure

- Step 1** On the Apps View page, take either of these actions:
- If no apps have yet been added, click the **IMPORT APPS** button
 - If other apps have already been added, in the Available Apps area, make sure that you are in App Edit view, and then click the **IMPORT APPS** button
- Step 2** In the Import Apps dialog box that displays, click the **Select Apps Archive** button.

- Step 3** Follow the on-screen prompts to locate and select the exportedApps.zip export file that you want to import.

When the import process completes, the Import Apps Dialog box confirms the completion. It also provides information about any apps that could not be imported (you might need to scroll down in the dialog box to see this information).

Monitoring an App

Monitoring an app provides information about the operation of an app across all devices on which it is installed. This information can be useful for evaluating the operation of the app or for troubleshooting. The following sections describe the app monitoring features:

- [Viewing General Monitoring Information, page 4-58](#)
- [Viewing Detailed Monitoring Information, page 4-61](#)

Viewing General Monitoring Information

To view general monitoring information about an installed app, take any of these actions:

- In the Installed Apps area on the Apps View page, click the App Status donut chart for the app
- In the Available Apps area on the Apps View page, make sure that you are in App Install view, click the icon for the app that you want to monitor, and then click the **MONITOR APP** button
- Click the **MONITOR APP** button when you are viewing detailed information about the app

The App Monitoring page displays. This page includes information and features that apply to the app, and includes some or all of the items that [Table 4-15](#) describes.

Table 4-15 App Monitoring Page Items

Item	Description
Installed-on information	Shows the number of devices on which the app has been successfully installed.
Configuration View link	Click to display detailed information about the app, as described in the “Viewing Detailed Information about an Installed or Available App” section on page 4-7.
APP DOWNTIME	Shows the number of devices on which the app has been in Running state or in Stopped state during the designated time period. Hover your mouse pointer over any part of the chart to see detailed information about a data point. You can click Day , Week , or Month above this graph to designate the time period for the information.

Table 4-15 App Monitoring Page Items (continued)

Item	Description
Status charts	<p>Show information about devices on which an app is running and on which an app is stopped. For each state, a chart shows the name of the state, and the number of devices on which the app is in that state, and the percentage of devices on which the app is installed that the app is in that state.</p> <p>You can click the following buttons under a status chart:</p> <ul style="list-style-type: none"> • STOP—Appears under the Running chart. Click to stop the app, which shuts down its operation on the host devices on which it is running and puts it in Stopped state on these devices. • START—Appears under the Stopped chart. Click to start the app, which initiates its operation on the host devices on which it is stopped and puts it in Running state on these devices. • VIEW DETAIL—Appears under each chart and provides access to information that can be useful for troubleshooting. See the “Viewing Detailed Monitoring Information” section on page 4-61. <p>Note You also can start and stop an app from the Devices View page as described in the “Starting or Stopping an App on a Device” section on page 5-32.</p> <p>You cannot stop an app that provides services if the services that it provides are being used by one or more other apps that are in Running state. To stop an app that provides services, first stop each app that uses the services that it provides.</p>

Table 4-15 App Monitoring Page Items (continued)

Item	Description
Status charts	<p>Show information about devices on which an app is running and on which an app is stopped. For each state, a chart shows the name of the state, and the number of devices on which the app is in that state, and the percentage of devices on which the app is installed that the app is in that state.</p> <p>You can click the following buttons under a status chart:</p> <ul style="list-style-type: none"> • STOP—Appears under the Running chart. Click to stop the app, which shuts down its operation on the host devices on which it is running and puts it in Stopped state on these devices. • START—Appears under the Stopped chart. Click to start the app, which initiates its operation on the host devices on which it is stopped and puts it in Running state on these devices. • VIEW DETAIL—Appears under each chart and provides access to information that can be useful for troubleshooting. See the “Viewing Detailed Monitoring Information” section on page 4-61. <p>Note You also can start and stop an app from the Devices View page as described in the “Starting or Stopping an App on a Device” section on page 5-32.</p> <p>You cannot stop an app that provides services if the services that it provides are being used by one or more other apps that are in Running state. To stop an app that provides services, first stop each app that uses the services that it provides.</p>

Table 4-15 App Monitoring Page Items (continued)

Item	Description
App Consumption	<p>Displays the following charts, which provide information about device resources that the app consumes:</p> <ul style="list-style-type: none"> • Mean CPU Consumption—Average (mean) CPU resources that the app used on devices on which it ran during the designated time period. • Mean Disk Consumption—Average (mean) hard disk space that the app used on devices on which it ran during the designated time period. • Mean Memory Consumption—Average (mean) RAM resources that the app used on devices on which it ran during the designated time period. • Mean Network Consumption—Average (mean) network bandwidth that the devices on which the app ran used for the app during the designated time period. <p>You can click Day, Week, or Month above these charts to designate the time period for the information that the charts display.</p> <p>Hover your mouse pointer over any part of a chart to see detailed information about a data point.</p> <p>Click a chart to display a table with detailed information about the corresponding resource consumption for individual devices. The tables include the following items:</p> <ul style="list-style-type: none"> • Host Name—The hostname of the device on which the resource is consumed. Click a hostname to display device details information for the device. See the “Viewing Detailed Information about a Device” section on page 5-6. • IP Address—The IP Address of the device on which the resource is consumed. Click an IP address to display device details information for the device. See the “Viewing Detailed Information about a Device” section on page 5-6. • Tags—Tags that have been assigned to the device. See the “Managing Tags for Devices” section on page 5-31. • CPU Consumption, Disk Consumption, Memory Consumption, or Network Consumption (depending on the chart that you clicked)—Shows the average (mean) resource consumption of the app on the device during the designated time period.

Viewing Detailed Monitoring Information

To view general monitoring information about an installed app, click either of these buttons on the App Monitoring page:

- **VIEW DETAIL** under the Running Devices chart—Displays a table for the devices on which the app is in Running state. This table includes the **Running Devices** tab and the **Error** tab.

This button is dimmed if the app is not in the Running state on at least one device.

- **VIEW DETAIL** under the Stopped Devices chart—Displays a table for the devices on which the app is in Stopped state. This table includes the **Stopped Devices** tab and the **Error** tab.

This button is dimmed if the app is not in the Stopped state on at least one device.

The **Running Devices** or **Stopped devices** tab in the table provide information for devices on which the app is in the corresponding state. The **Error** tab provides information about devices on which the app is in an error state of some kind.

This table includes the items that [Table 4-5](#) describes.

Table 4-16 Detailed Monitoring Information for an App

Item	Description
Search Hostname, IP Address field	Type all or part of a hostname or IP address of a device to display information for devices with matching information. The table display updates as you type.
Host Name	Hostname of the device on which the app is in the state. Click a hostname to display device details information for the device. See the “Viewing Detailed Information about a Device” section on page 5-6.
IP Address	IP Address of the device on which the app is in the state. Click an IP address to display device details information for the device. See the “Viewing Detailed Information about a Device” section on page 5-6.
Tags (on Running Devices or Stopped Devices tab only)	Tags that have been assigned to the device. See the “Managing Tags for Devices” section on page 5-31.
Health	Icons that represent information about CPU use or memory use on the device. Hover your mouse pointer over an icon to see more detailed information.
View App Log button (on Running Devices or Stopped Devices tab only)	Click to display log information that is generated by the app on a device.
Error Summary (on Error tab only)	Brief description of the error that occurred.
Pagination controls	Click a control to go to the first, next, last, previous, or specific page in the table. From the Items per page drop-down list, choose the maximum number of devices that appear in each page of the table.