Cisco Crosswork Workflow Manager 1.1 Administrator Guide

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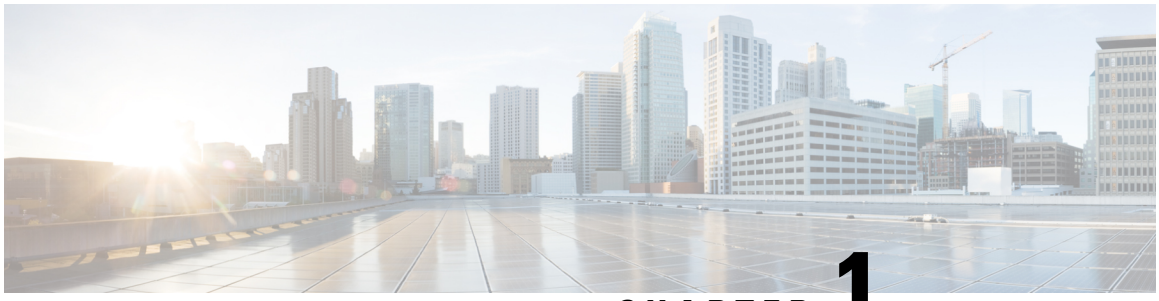


CHAPTER 1

Install CWM using OVA

This section contains the following topics:

Install CWM using OVA

The Crosswork Workflow Manager 1.1 is installed as a guest virtual machine by deploying an OVA image using the VMware vSphere 6.7 (and higher) virtualization platform.

Prerequisites

- An **ed25519** SSH public and private key pair.

System requirements

Minimum system requirements	
Server	**VMware vSphere 6.7+** account with an ESXi 6.7+ host
CPU	8 cores
Memory	64 GB
Storage	100 GB

Download the CWM package

To get the CWM 1.1 software package:

Step 1 Go to the Cisco Software Download service and in the search bar, type in '**Crosswork Workflow Manager**', then select it from the search list.

Step 2 From Select a software type, select **Crosswork Workflow Manager Software**.

Step 3 Download the Crosswork Workflow Manager software package for Linux.

Step 4 In a terminal, use the `sh` command to extract the downloaded **.signed.bin** file and verify the certificate. See example output below for reference:

```
sh cwm-1.1.signed.bin
Unpacking...
Verifying signature...
Retrieving CA certificate from http://www.cisco.com/security/pki/certs/crcam2.cer ...
Successfully retrieved and verified crcam2.cer.
Retrieving SubCA certificate from http://www.cisco.com/security/pki/certs/innerspace.cer ...
Successfully retrieved and verified innerspace.cer.
Successfully verified root, subca and end-entity certificate chain.
Successfully fetched a public key from tailf.cer.
Successfully verified the signature of cwm-1.1.tar.gz using tailf.cer
```

The `cwm-1.1.tar.gz` file and other files have been extracted and validated against the signature file.

Step 5 To extract the `cwm-1.1.tar.gz` file, double click on it (Mac users) or use gzip utility (Linux and Windows users). This will extract the CWM OVA file that will be used for installation.

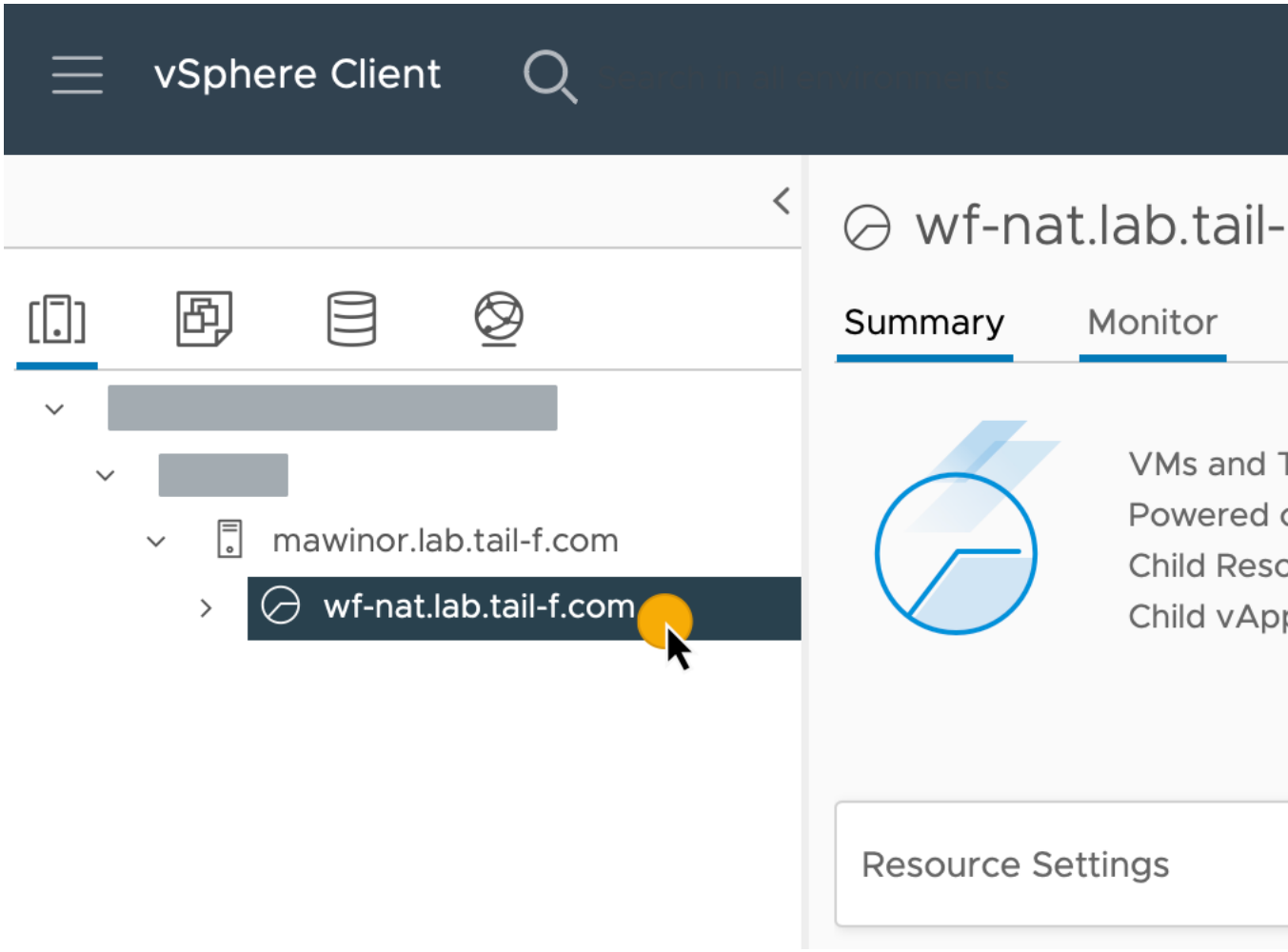
Deploy OVA and start VM

To create a virtual machine using the downloaded OVA image:

Step 1 Log in to your vSphere account.

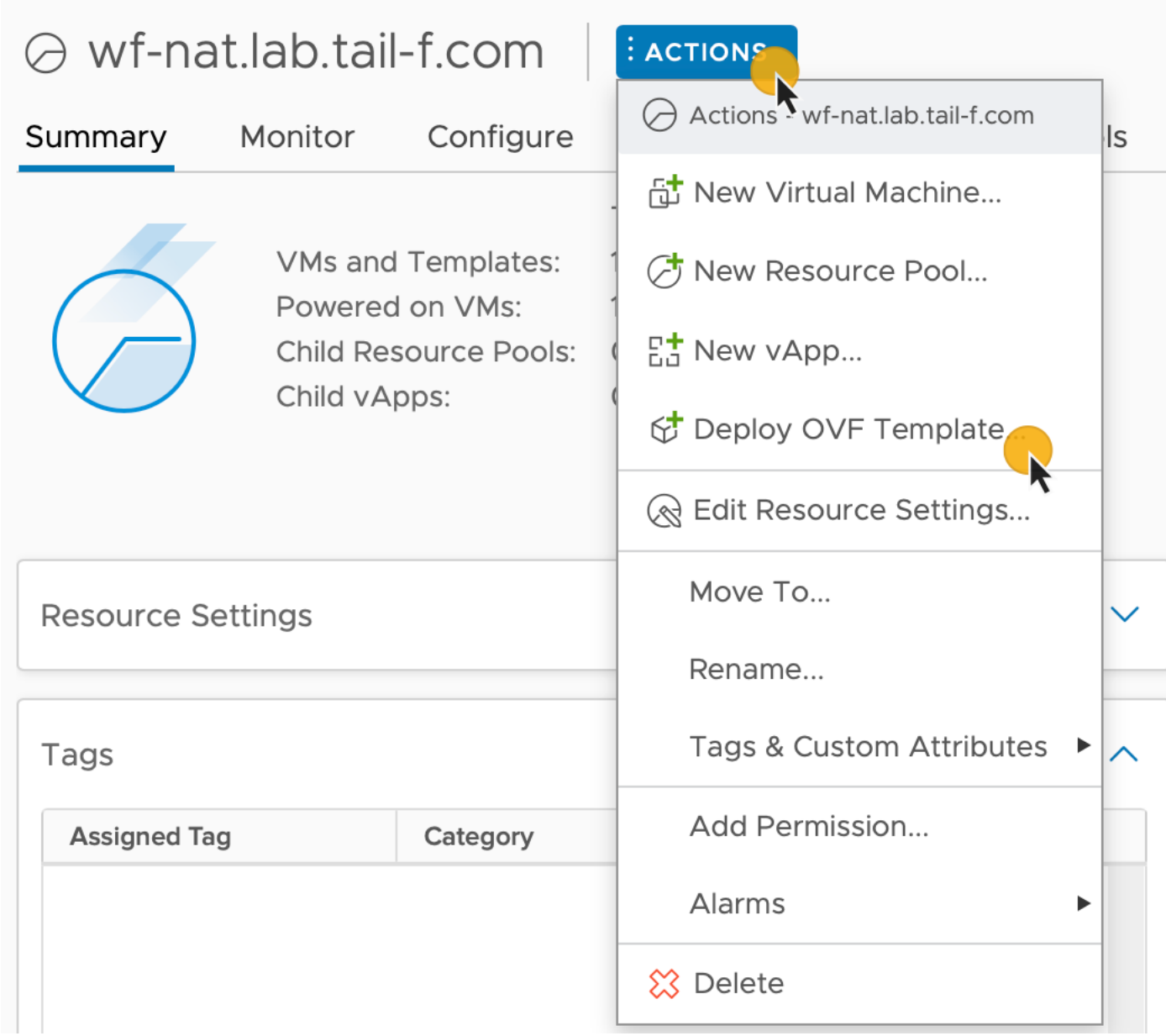
Step 2 In the **Hosts and Clusters** tab, expand your host and select your resource pool.

Figure 1:



Step 3 Click the **Actions** menu and select **Deploy OVF Template**.

Figure 2:



Step 4 In the **Select an OVF template** step, click **Local file**, **Select files**, and select the CWM OVA image. Click **Next**.

Step 5 In the **Select a name and folder** step, provide a name for your VM and select it's location. Click **Next**.

Step 6 In the **Select a compute resource** step, select your resource pool. Click **Next**.

Step 7 In the **Review details** step, click **Next**.

Step 8 In the **Select storage** step, set **Select virtual disk format** to **Thin provision** and select your storage, then click **Next**.

Step 9 In the **Select network** step, you need to select destination networks for the **Control Plane** and **Northbound**:

a) **Control Plane**: select **PrivateNetwork**. If not available, select **VM Network**.

Note Control plane settings are essential only in case of an HA cluster setup. For single-node setups, control plane settings need to be provided, but are not essential and should not conflict with any other devices connected to the control network.

b) **Northbound**: select **VM Network**.
c) Click **Next**.

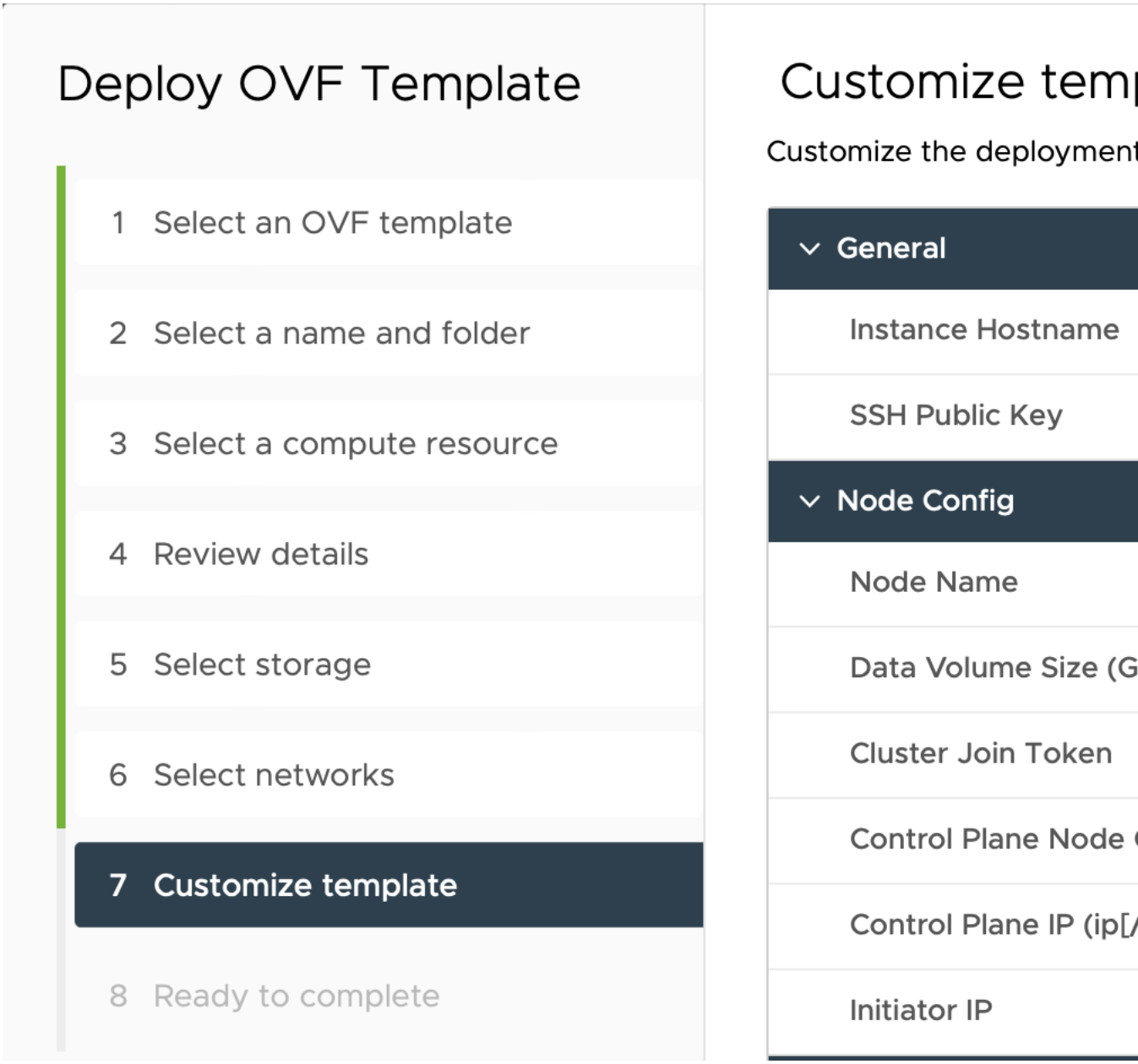
Step 10 In the **Customize template** step, provide the following selected properties:

a) **Instance Hostname**: type a name for your instance.
b) **SSH Public Key**: provide an **ed25519** SSH public key that will be used for command-line access to the VM.
c) **Node Name**: provide a name for installation node.

Note For single-node setups, it's not recommended to modify the node name. If you modify it, remember that it must match the **Zone-A Node Name** below.

d) **Control Plane Node Count**: change to more than 1 only in case of HA cluster setup. Not supported for CWM 1.1.
e) **Control Plane IP (ip subnet)**: provide a network address for the control plane. This address cannot conflict with any other devices in the control network, but is otherwise inessential in a single-node setup. Note that the default subnet mask is `/24`. You can add your custom subnet mask value if applicable for your network settings.
f) **Initiator IP**: set the initiator IP for the starter node. In a single-node setup, it is the same address as *Control Plane IP**.

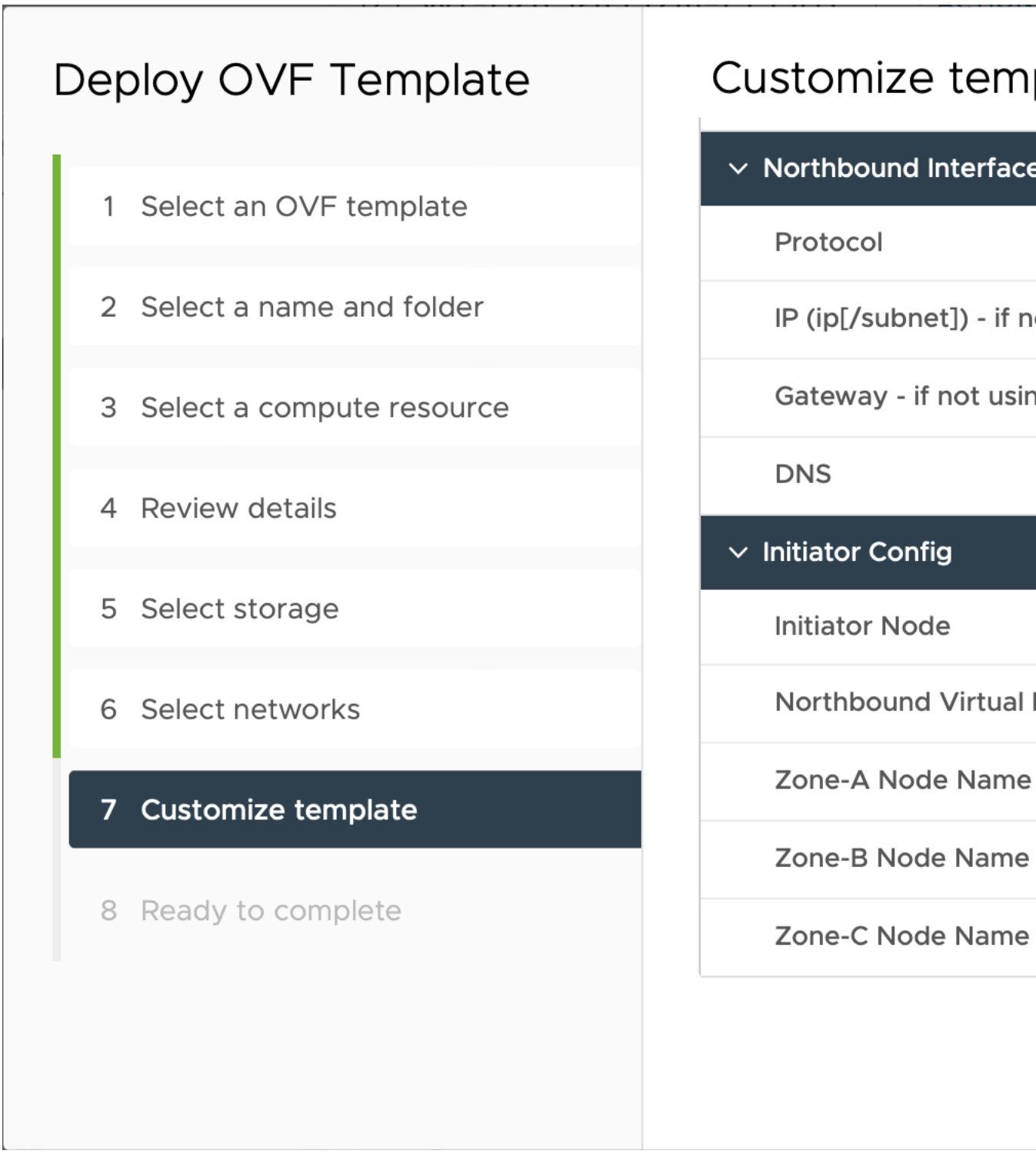
Figure 3:



g) **IP (ip subnet) - if not using DHCP**: provide the network address for the node. Note that the default subnet mask is `/24`. You can add your custom subnet mask value if applicable for your network settings.
h) **Gateway - if not using DHCP**: provide the gateway address. By default, it is `192.168.1.1`.
i) **DNS**: provide the address for the DNS. By default, it is `8.8.8.8`, or you can use your local DNS.
j) **Northbound Virtual IP**: provide the network address for the active cluster node. In a single-node setup this address is also required, as this is where the HTTP service is working.
k) **Zone-A Node Name**: provide the name of the Zone-A node. Note that it must match the **Node Name** above.
l) **Zone-B Node Name**: provide the name of the Zone-B node. For single-node setups, this is not essential and must not be modified.

m) **Zone-C Node Name (Arbitrator)**: provide the name of the Zone-C Arbitrator node. For single-node setups, this is not essential and must not be modified.
n) Click **Next**.

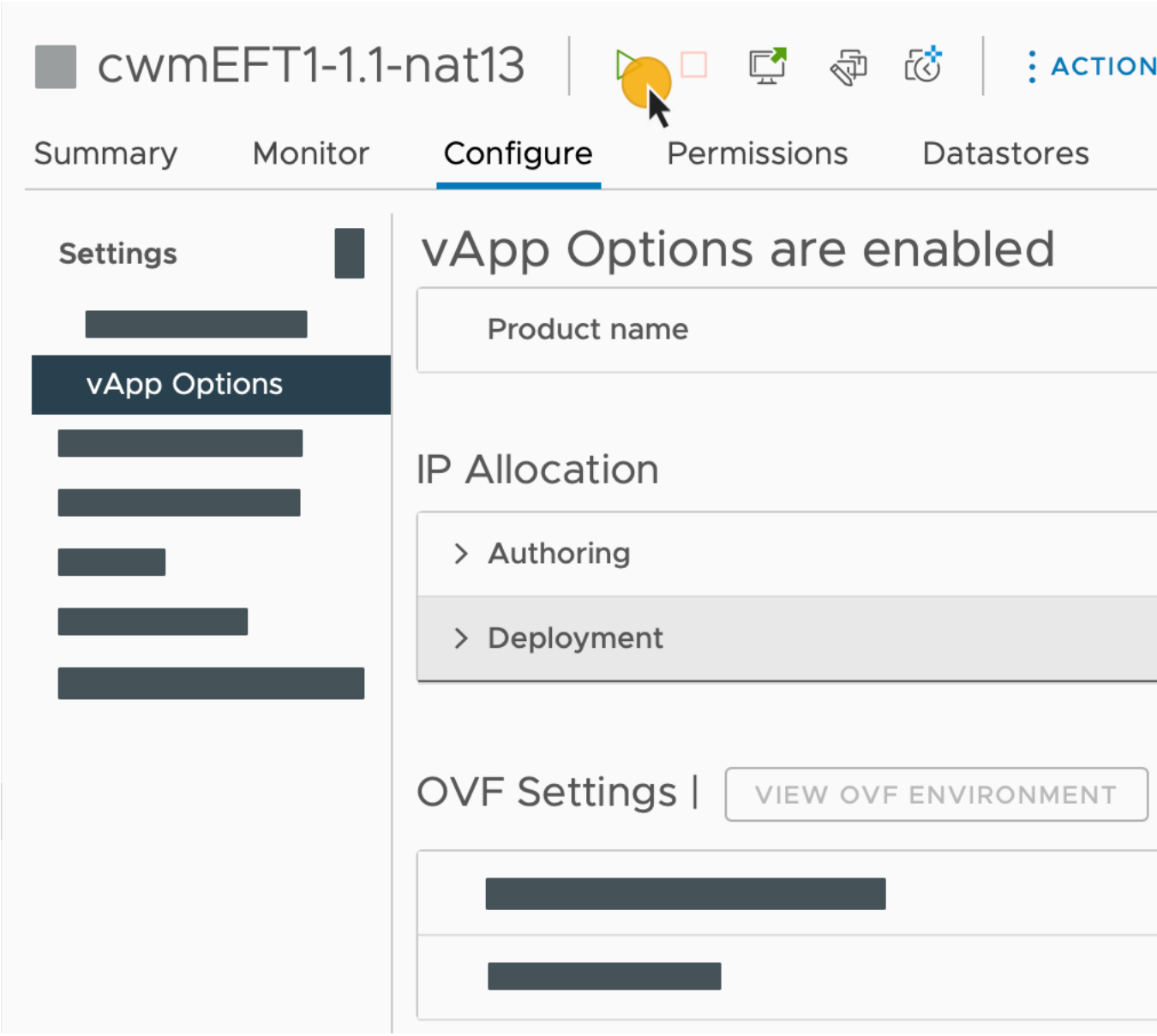
Figure 4:



Step 11 In the **Ready to complete**, click **Finish**. The deployment may take a few minutes.

Step 12 From the **Resource pool** list, select you newly created virtual machine and click the **Power on** icon.

Figure 5:



Note If the VM doesn't power on successfully, this might be due to an intermittent infrastructure error caused by NxF. As a workaround, remove the existing VM and redeploy the OVA on a new one.

Check installation and create user

Before you create a platform user account for first login to the CWM UI, check if the installation is completed successfully and the system is up:

SUMMARY STEPS

1. Using a command-line terminal, log in to the NxF in your guest OS with SSH:
2. Check NxF boot logs:
3. Check if all the Kubernetes pods are up and running:

DETAILED STEPS

	Command or Action	Purpose

Step 1	Using a command-line terminal, log in to the NxF in your guest OS with SSH:	`ssh -o UserKnownHostsFile=/dev/null -p 22 nxf@<virtual_IP_address>`
		Note By default, the virtual IP address is the one you set in **IP (ip subnet) - if not using DHCP**. Depending on how vCenter is set up, this can be the resource pool address along with a specific port. Check this with your network administrator in case of doubt
		Optional: If you are logging in for the first time, provide the path name for your private key:
		`ssh -i <ed25519_ssh_private_key_name_and_location> nxf@<virtual_IP_address>`
		Note The default port for SSH is `22`, change it to your custom port if applicable.

Step 2	Check NxF boot logs:	`sudo journalctl -u nxf-boot` **Note** Note that it may take a few minutes for the installation to complete. At the bottom of the NxF logs that appear, look for the `NXF: Done setting up machine` message. If the logs report an issue, you might consider reinstalling CWM.

Step 3	Check if all the Kubernetes pods are up and running:	`kubectl get pods -A`
		This will display a list of pods accompanied by their status, which will resemble the following:
		`NAMESPACE NAME READY STATUS RESTARTS AGE`
		`kube-flannel kube-flannel-ds-vh4js 1/1 Running 0 7m35s`
		`kube-system coredns-9mnzv 1/1 Running 0 7m35s`
		`kube-system etcd-node1 1/1 Running 0 7m44s`
		`kube-system kube-apiserver-node1 1/1 Running 0 7m50s`
		`kube-system kube-controller-manager-node1`

	Command or Action	Purpose
		1/1 Running 0 7m50s kube-system kube-proxy-6hwg9 1/1 Running 0 7m35s kube-system kube-scheduler-node1 1/1 Running 0 7m42s local-path-storage local-path-provisioner-54c455f95-mbhc9 1/1 Running 0 7m34s nxf-system authenticator-f74c7c87f-m8p4x 2/2 Running 0 6m25s nxf-system controller-76686f8f5f-gpqvc 2/2 Running 0 6m27s nxf-system ingress-ports-node1-zchwz 1/1 Running 0 4m17s nxf-system ingress-proxy-bcb8c9fff-lzm9p 1/1 Running 0 6m23s nxf-system kafka-0 1/1 Running 0 7m34s nxf-system loki-0 3/3 Running 0 6m33s nxf-system metrics-5qnzb 2/2 Running 0 6m30s nxf-system minio-0 2/2 Running 0 7m34s nxf-system postgres-0 2/2 Running 0 6m59s nxf-system promtail-t7dp4 1/1 Running 0 6m33s nxf-system registry-5486f46b54-c6tf9 2/2 Running 0 7m2s nxf-system vip-node1 1/1 Running 0 6m12s zone-a cwm-api-service-67bd9db5c7-vfszs 2/2 Running 2 (3m37s ago) 4m16s zone-a cwm-dsl-service-7ffd6975ff-wlrwt 2/2 Running 4 (3m21s ago) 4m15s zone-a cwm-engine-frontend-6754445fc-67t5h 2/2 Running 2 (3m52s ago) 4m15s zone-a cwm-engine-history-c4dfffddd-t2fgv 2/2 Running 1 (2m35s ago) 4m14s zone-a cwm-engine-history-c4dfffddd-wr5v2 2/2 Running 2 (3m51s ago) 4m14s

	Command or Action	Purpose
		zone-a cwm-engine-history-c4dfffddd-zz74q 2/2 Running 4 (48s ago) 4m14s zone-a cwm-engine-matching-78dfdf858f-q8wg2 2/2 Running 2 (3m46s ago) 4m14s zone-a cwm-engine-ui-6b74755499-jwbld 2/2 Running 0 4m13s zone-a cwm-engine-worker-589b6bc88b-hs2ch 2/2 Running 0 4m13s zone-a cwm-event-manager-5b95bb49db-gw6g5 2/2 Running 0 4m12s zone-a cwm-plugin-manager-76f798446c-qgx27 2/2 Running 1 (2m29s ago) 4m12s zone-a cwm-ui-779bdb44-98d5v 2/2 Running 0 4m11s zone-a cwm-worker-manager-7bd8795b56-f4czp 2/2 Running 1 (112s ago) 4m10s zone-a logcli-5f8cc8c585-fq7wm 2/2 Running 0 4m10s **Note** Note that it may take a few minutes for the system to get all the pods running. If any of the pods stays in a status other than `Running`, consider using the `kubectl delete pod <pod_name> -n <namespace>` command to restart it.

Create user for UI login

You can create CWM platform user accounts using the command-line access to the VM. Here's how to do it:

Step 1 Using a command-line terminal, log in to the NxF in your guest OS with SSH:

```
ssh -o UserKnownHostsFile=/dev/null  -p 22  nxf@<virtual_IP_address>
```

Optional: If you are logging in for the first time, provide the path name for your private key:

```
ssh -i <ed25519_ssh_private_key_name_and_location> nxf@<virtual_IP_address>
```

Note The default port for SSH is `22`, change it to your custom port if applicable.

Step 2 To create a user with a password, run the following commands:

a) First, set minimum password complexity (default is `3`, `0` is complexity disabled):

```
sedo security password-policy set --min-complexity-score 1
```

b) Then create user account and a password:

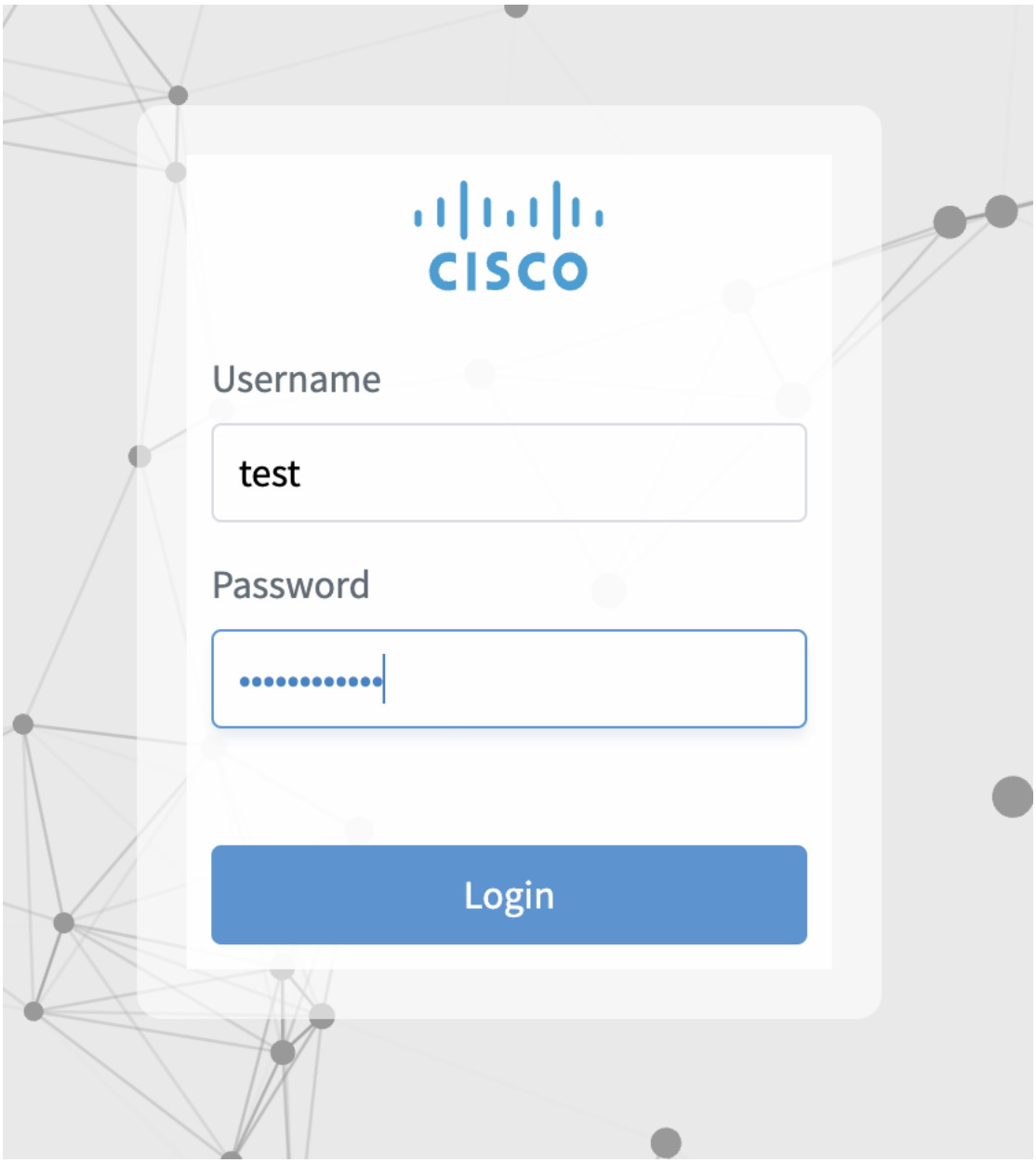
```
echo -en 'Password123!' | sedo security user add --password-stdin \
--access permission/admin --access permission/super-admin \
--access permission/user --display-name Tester test
```

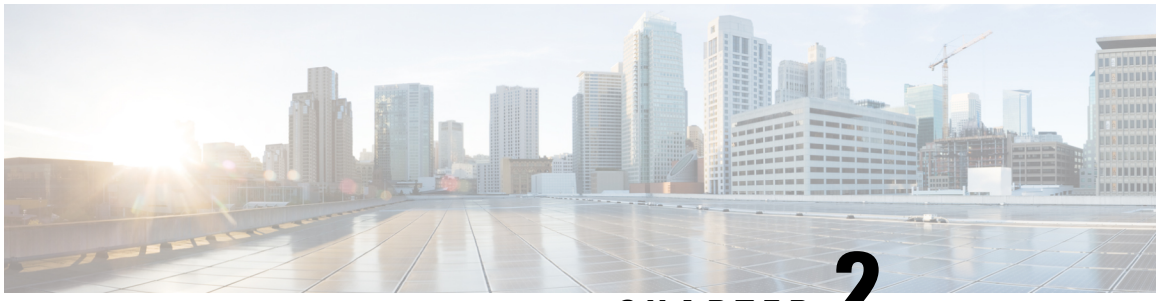
c) Optionally, disable the password change requirement for the test user:

```
sedo security user set test  --must-change-password=false
```

Step 3 To see the CWM UI, go to the address that you selected for Northbound IP and default port `8443`. For example, https://192.168.1.233:8443/.

Step 4 Log in using the `test` username and password.





CHAPTER 2

System

This section contains the following topics:

Architecture overview

The Crosswork Workflow Manager architecture is a microservice-based solution that operates on top of the Kubernetes container orchestration system. This section shows a diagram presenting its core architectural components along with short descriptions of each.

- **User Interface (UI)**: allows operators to add and instantiate workflows, enter workflow data, list running workflows, monitor job progress. The **Admin** section of the UI enables adding workers, managing worker processes and assigning activities from adapters to workers.
- **REST API**: includes all interaction with the CWM application: deploying adapters, publishing and instantiating workflows, managing workers, resources and secrets.
- **Control Server**: dispatches API requests to relevant microservices.
- **Workflow Engine**: it is the core component that conducts how workflows are handled; it interprets and manages the execution of workflow definitions.
- **Execution Engine (Workflow Worker)**: it is responsible for executing the workflow tasks. It receives the workflow tasks from the **Workflow Engine**, executes them in the correct order, and sends the results back to the **Workflow Engine**.
- **Adapter Workers**: they are processes responsible for executing the tasks defined in workflow definitions and adapter code. They receive the tasks from the **Workflow Worker**, execute them, and send the results back to the **Workflow Worker**. The Execution Workers are capable to load additional adapters as plugins, which allows them to work with different systems and technologies.
- **Adapters**: they interface and integrate with external systems, applications and technologies. Inside them, activities that can be consumed in a workflow are defined.
- **Adapter SDK**: a Software Development Kit that helps developers create new adapters to integrate with external systems.
- **Workflow Definitions**: workflow code written in the JSON format based on the Serverless Workflow specification.
- **K8s Infrastructure**: runtime platform for the CWM application. It is a collection of services that provide the necessary infrastructure to support the deployment and management of the application within a Kubernetes cluster.
- **PostgreSQL**: it is the database used by the system to store and manage its data.

Check health and logs

CWM is a microservice-based application that leverages Kubernetes cluster architecture as its runtime environment. The health of the CWM application can thus be checked using Kubernetes commands.

Note To see all the supported `kubectl` commands, log in to the OS on your VM and use `kubectl --help`.

Check pod status

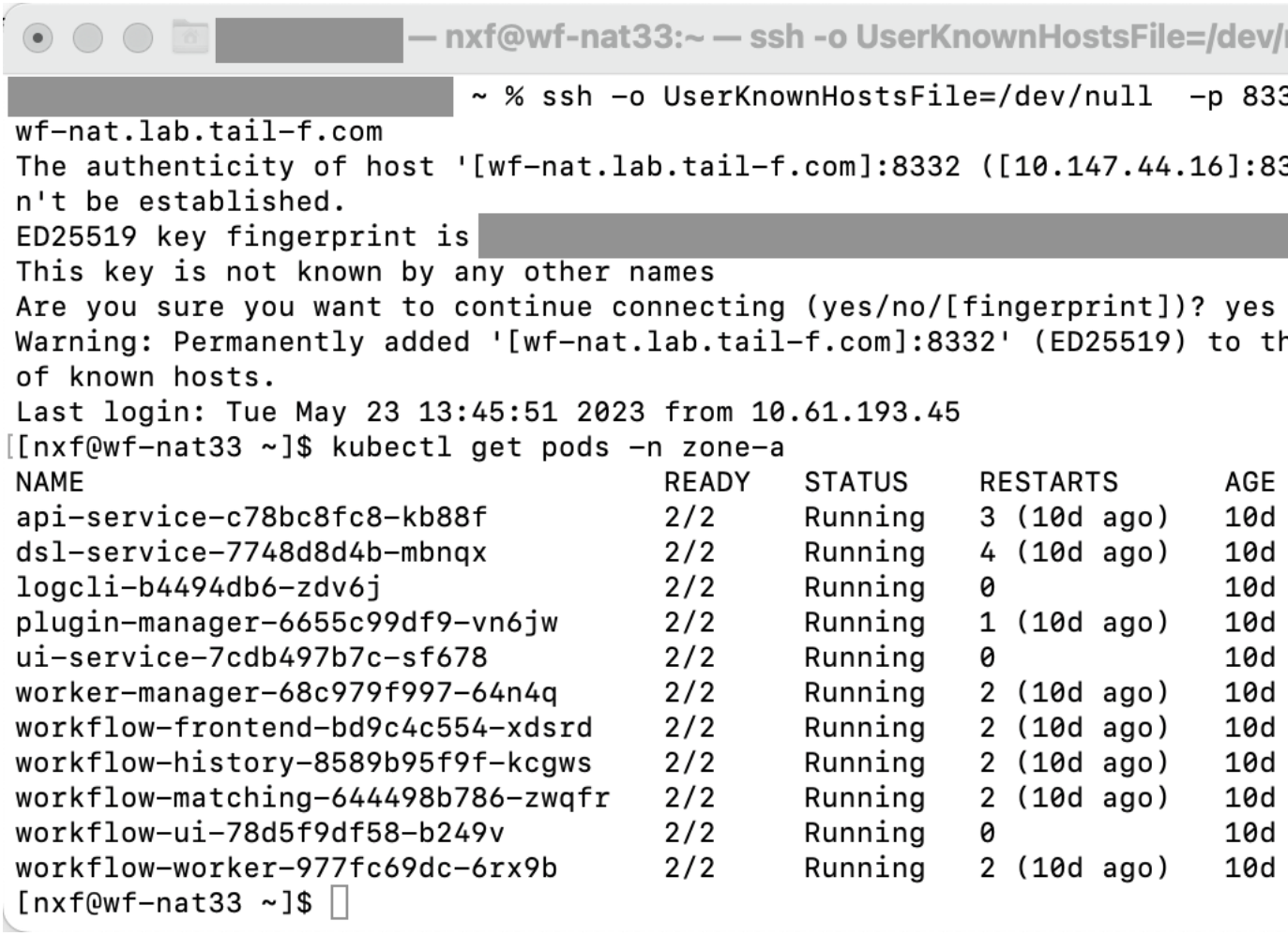
Step 1 Using a command-line terminal, log in to the OS on your virtual machine with SSH:

```
ssh -o UserKnownHostsFile=/dev/null  -p 22  nxf@<your_resource_pool_address>
```

Step 2 To check status of pods for namespace `zone-a` (this is the default namespace for pods contaning CWM microservices), run the following command:

```
kubectl get pods -n zone-a
```

Step 3 A list of pods will appear:



Step 4 If a pod has a status different from `Running`, you can 'restart' it using the following command:

```
kubectl delete pod <pod_name> -n zone-a
```

The pod will be deleted, but as Kubernetes configuration is declarative, it will effectively recreate the deleted pod and rerun it.

Check and collect logs

Application logs can be checked with **Loki logCLI** command-line interface. To gather logs from the CWM platform, follow these steps:

Step 1 Using a command-line terminal, connect to the system using SSH client:

```
ssh  -pSSH_PORT nxf@ip_address_of_deployment
```

Note Adjust `SSH_PORT` and `ip_address_of_deployment` accordingly.

Step 2 After successful login, use the command below to list all running pods:

```
kubectl get pods -A
```

Example result:

```
[nxf@wf-nat-08 ~]$ kubectl get pods -A
NAMESPACE            NAME                                      READY   STATUS      RESTARTS
AGE
kube-flannel         kube-flannel-ds-trr95                     1/1     Running     0
103m
kube-system          coredns-htg9j                             1/1     Running     0
103m
kube-system          etcd-wf-nat-08                            1/1     Running     0
103m
kube-system          kube-apiserver-wf-nat-08                  1/1     Running     0
103m
kube-system          kube-controller-manager-wf-nat-08         1/1     Running     0
103m
kube-system          kube-proxy-c25f5                          1/1     Running     0
103m
kube-system          kube-scheduler-wf-nat-08                  1/1     Running     0
103m
local-path-storage   local-path-provisioner-6fb6f599c7-ckcjc   1/1     Running     0
103m
nxf-system           authenticator-5db8885675-qlrmg            2/2     Running     0
102m
nxf-system           controller-cbd87f8c5-6tg6f                2/2     Running     1 (102m ago)
102m
nxf-system           ingress-proxy-56f7c9899d-6st6j            1/1     Running     0
102m
nxf-system           kafka-0                                   1/1     Running     0
102m
nxf-system           loki-7c994678f8-fnrs9                     3/3     Running     0
102m
nxf-system           minio-0                                   2/2     Running     0
103m
nxf-system           postgres-0                                2/2     Running     0
102m
nxf-system           promtail-v6tb4                            1/1     Running     0
102m
nxf-system           registry-7dd84db44f-n5q7h                 2/2     Running     0
102m
nxf-system           vip-wf-nat-08-28131000-772k5              0/1     Completed   0
3m42s
zone-a               api-service-745759bffc-v6r25              2/2     Running     2 (100m ago)
100m
zone-a               dsl-service-77d5fc96cc-5nv42              2/2     Running     3 (100m ago)
100m
zone-a               logcli-5c7ddbc95d-mkpcc                   2/2     Running     0
100m
zone-a               plugin-manager-665b7bbd4d-jvqdk           2/2     Running     1 (100m ago)
100m
zone-a               ui-service-57cf6d6bcc-smmvt               2/2     Running     0
100m
zone-a               worker-manager-6d6b445d46-r6nzk           2/2     Running     1 (99m ago)
100m
```

```
zone-a               workflow-frontend-77bc897549-kcz5k        2/2     Running     1 (99m ago)
100m
zone-a               workflow-history-58bdb85b8d-88t25         2/2     Running     1 (99m ago)
100m
zone-a               workflow-history-58bdb85b8d-h22bd         2/2     Running     1 (99m ago)
100m
zone-a               workflow-history-58bdb85b8d-ph5fh         2/2     Running     1 (99m ago)
100m
zone-a               workflow-matching-86cfc5577c-4mxhb        2/2     Running     1 (99m ago)
100m
zone-a               workflow-ui-68f857645-9mq9v               2/2     Running     0
100m
zone-a               workflow-worker-8496898f7b-wcrqs          2/2     Running     1 (99m ago)
100m
```

Step 3 Identify the logcli tool available in the `zone-a` namespace. In this example, it is the pod named `logcli-5c7ddbc95d-mkpcc`.

Step 4 Connect to the correct pod and list the available log labels for filtering:

```
kubectl exec --namespace=zone-a -ti logcli-5c7ddbc95d-mkpcc -- logcli labels
app
container
filename
level
namespace
node_name
pod
stream
```

Step 5 Gather logs from all applications running in the "zone-a" namespace and save them to a single file. Make sure to adjust the `--since` option to collect logs from the relevant time period when the troubleshooting event occurred:

```
kubectl exec --namespace=zone-a -ti logcli-5c7ddbc95d-mkpcc -- logcli query '{namespace="zone-a"}'
--since 60m > zone-a.log
```

Step 6 Similarly, collect logs from other namespaces, using different files for convenience:

```
kubectl exec --namespace=zone-a -ti logcli-5c7ddbc95d-mkpcc -- logcli query '{namespace="nxf-system"}'
 --since 60m > nxf-system.log
```

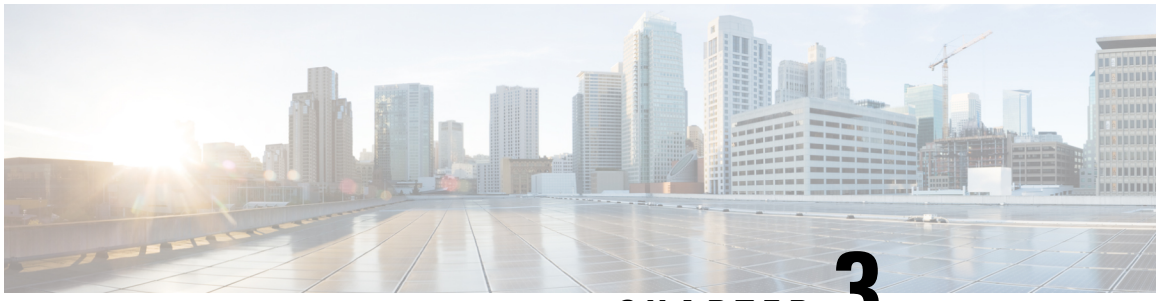
```
kubectl exec --namespace=zone-a -ti logcli-5c7ddbc95d-mkpcc -- logcli query '{namespace="kube-system"}'
 --since 60m > kube-system.log
```

Step 7 Use the SCP tool to copy the log files from the system to your desktop:

```
scp -P SSH_PORT nxf@ip_address_of_deployment:"*.log".
```

Step 8 Finally, you can send the logs to support and provide a detailed description of the issue you are experiencing.

Note For more details on the logCLI commands and usage, refer to logCLI Grafana documentation.



CHAPTER 3

API

This section contains the following topics:

CWM API Overview

The CWM API was developed according to the Representational State Transfer (REST) design principles. The API is accessed using HTTP with JSON data format. The success or failure of the request is indicated by the relevant HTTP response code. Data retrieval methods require a GET request, while methods for adding, changing, or deleting data require POST, PUT, PATCH, or DELETE methods. Errors will be returned if the request is sent with the wrong request type.

How to use CWM API?

You can consume CWM API in two ways:

- via Swagger interface, or
- via Postman collection.

Built directly into the product is a Swagger interface accessed from the CWM UI, but for ease of use, a Postman collection with example requests is also provided.

All tutorials under *Manage via API* section assume the use of Swagger.

Use Swagger

To access CWM Swagger API, from the navigation menu on the left, click the **swagger** icon.

Use CWM Postman collection

Prerequisites

- Postman Web app account or Postman Desktop installed.

Download JSON collection file

Download the Postman collection in JSON format by clicking this link. Unpack the zip archive.

Import collection and set environment

Step 1 Open Postman and go to **Collections**.

Step 2 Click **Import**, select **folders** from the **Drop anywhere to import** screen and point to the folder that you have unpacked from the zip archive.

Step 3 Go to **Environments** and select the newly imported **test** environment.

Step 4 Provide current values for the **baseUrl** and **port** variables to fit your CWM IP address and port and save the changes.

Now you're set up and ready to use the collection.

Manage adapters

To interact with external target systems, CWM requires adapters. You can manage them in the CWM UI as described in the **Operator** guide, or using the CWM API. The following API endpoints are available for handling adapters:

- `GET/adapter`: gets a list of adapters existing in the CWM application.
- `POST/adapter`: uploads an adapter **.tar** file to CWM storage.
- `GET/adapter/{adapterId}`: gets the details of a specific adapter existing in the CWM application. Among others, it lists all the activities available in the adapter.
- `PUT/adapter/{adapterId}`: updates an existing adapter file with a new adapter version.
- `DELETE/adapter/{adapterId}`: deletes an adapter from the CWM application.
- `POST/adapter/{adapterId}/deploy`: deploys an adapter in the system based on the uploaded adapter file.
- `PATCH/adapter/{adapterId}`: updates the default status of the adapter.

Install adapter

CWM adapters come in **.tar** installation files. Before they can be used in a workflow, they need to be uploaded to storage and deployed in the system. Here's how to do it.

Upload adapter file

Before you deploy an adapter, you need to upload the adapter **.tar** file to CWM storage:

Step 1 Get a latest adapter installation file or create your own adapter.

Step 2 Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.

Step 3 In the **adapters** section, click the `POST/adapter` endpoint to expand it. Inside the endpoint, click **Try it out**.

Step 4 In the subsection that appears, click **Choose File**, select the adapter **.tar** installation file and click **Upload**, then click **Execute**.

If the server response code is `201`, the adapter file is successfully uploaded into the CWM database.

Deploy adapter

Step 1 In the CWM API **adapters** section, click the `GET/adapter` endpoint to expand it. Inside the endpoint, click **Try it out** and **Execute**.

Step 2 From the server response body, copy the value of the `id` field for your uploaded adapter.

Step 3 In the CWM API **adapters** section, click the `POST/adapter/{adapterId}/deploy` endpoint to expand it.

Step 4 Inside the endpoint, click **Try it out**. Paste the adapter id into the **Adapter ID** field.

Step 5 In the **createWorker** field, you may set the `createWorker` parameter to `true`. This will create a worker with the same name as the adapter id.

Step 6 Click **Execute**.

If the server response code is `201`, the adapter plugin is successfully installed and you're good to proceed.

Delete adapter

To delete an adapter permanently from storage and uninstall it:

Step 1 In the CWM API **adapters** section, click the `GET/adapter` endpoint to expand it. Inside the endpoint, click **Try it out** and **Execute**.

Step 2 From the server response body, copy the value of the `id` field for your uploaded adapter.

Step 3 In the CWM API **adapters** section, click the `DELETE/adapter/{adapterId}` endpoint to expand it.

Step 4 Inside the endpoint, click **Try it out**. Paste the adapter id into the **Adapter ID** field.

Step 5 Click **Execute**.

Manage workers

Workers are processes that execute actions defined in workflow definitions and adapter code. You can manage them using the CWM UI as described in the **Operator** guide, or with the CWM API, as described below.

The following actions for managing workers are available:

- `GET/worker`: gets a list of workers existing in the CWM application.
- `POST/worker`: creates a new worker in the CWM application.
- `GET/worker/{workerName}`: gets the details of a specific worker existing in the CWM application.
- `PUT/worker/{workerName}`: updates an existing worker with new parameter values.
- `DELETE/worker/{workerName}`: deletes a worker from the CWM application.
- `POST/worker/{workerName}/start`: activates a worker created in the application.
- `POST/worker/{workerName}/stop`: deactivates a worker created in the application.

Create worker

Step 1 Log in to CWM and from the navigation menu on the left, click the **swagger** icon.

Step 2 In the CWM API **workers** section, click the `POST/worker` endpoint to expand it. Inside the endpoint, click **Try it out**.

Step 3 In the **Worker data** field, provide the required values:

a) "activities": paste the ID of your deployed adapter or specific adapter activity.
b) "startWorker": set to `true`.
c) "workerName": provide a name for your worker.

Step 4 Click **Execute**.

Start a worker

Step 1 In the CWM API **workers** section, click the `POST/{workerName}/start` endpoint to expand it. Inside the endpoint, click **Try it out**.

Step 2 In the **parameters** fields, provide the required values:

a) "Name of a worker to start": paste the name the worker to be started.
b) "forceReload": set to `true` if you want to force the worker to start.

Step 3 Click **Execute**.

Stop a worker

Step 1 In the CWM API **workers** section, click the `POST/{workerName}/stop` endpoint to expand it. Inside the endpoint, click **Try it out**.

Step 2 In the **parameters** fields, provide the required values:

a) "Name of a worker to stop": paste the name the worker to be stopped.

b) "forceStop": set to `true` if you want to force the worker to stop.

Step 3 Click **Execute**.

Manage workflows

Workflow definitions can be managed both in the CWM UI as described in the **Operator** guide, or using the CWM API:

- `GET/workflow`: gets a list of workflow definitions existing in the CWM application.
- `POST/workflow`: creates a new workflow definition in the CWM application.
- `GET/workflow/{workflowId}`: gets the details of a specific workflow existing in the CWM application.
- `PUT/workflow/{workflowId}`: updates an existing workflow definition in the CWM application.
- `DELETE/workflow/{workflowId}`: deletes a selected workflow definition from the CWM application.
- `GET/workflowExport`: exports workflow definitions based on a given array of workflow definition IDs.
- `POST/workflowImport`: imports in bulk workflow definitions to the CWM application.

Note The recommended method for managing workflows is through CWM UI. For details, refer to the **Operator** guide.

Manage resources and secrets

Overview

For CWM, adapters define activities that enable to execute actions in external entities, such as other systems or applications. These entities are, in most cases, integrated via APIs which usually require connection and authentication data. CWM provides a framework where when an activity is consumed in a workflow, the details of a connection endpoint and authentication data can be passed at runtime. Thus, the operator who runs a workflow may not know any details of these systems (resources) such as IP addresses, ports or usernames and passwords.

CWM provides a framework for secure handling of resources and secrets in the database and identifying them by their respective IDs. When running a workflow, just the resource ID needs to be passed, with the rest of the data sent to the adapter by the Resource Manager without any intervention from the Operator or additional development from Adapter developer. You can manage secrets and resources in the CWM UI as described in the **Operator** guide, or using the CWM API.

Resource and secret types

You can think of resource and secret types are buckets used to organize resources and secrets created by users by their type. Types are defined inside a given adapter and are added to the system automatically upon installing the adapter. You can list secrets belonging to a specific type using the `GET/secretType/{secretTypeId}` API endpoint.

Secrets API endpoints

The following actions for managing secrets are available:

- `GET/secret`: gets a list of secrets existing in the CWM application.
- `POST/secret`: creates a new secret in the CWM application.
- `GET/secretType/{secretTypeId}`: lists secrets existing in the CWM application that belong to a specific type.
- `GET/secretType`: gets a list of secret types existing in the CWM application.
- `GET/secret/{secretId}`: gets details of an existing secret.
- `DELETE/secret/{secretId}`: deletes a secret from the CWM application.
- `PATCH/secret/{secretId}`: updates a secret existing in the CWM application with new parameter values.

Resources API endpoints

The following actions for managing resources are available:

- `GET/resource`: gets a list of resources existing in the CWM application.
- `POST/resource`: creates a new resource in the CWM application.
- `GET/resource/{resourceId}`: gets the details of a specific resource existing in the CWM application.
- `PATCH/resource/{resourceId}`: updates an existing resource with new parameter values.
- `DELETE/resource/{resourceId}`: deletes a resource from the CWM application.
- `GET/resourceType`: gets a list of resource types existing in the CWM application.
- `GET/resourceType/{resourceTypeId}`: gets the details of an existing resource type.

Create secret

Step 1 Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.

Step 2 In the CWM API **secrets** section, click the `POST /secret` endpoint to expand it.

Step 3 Inside the endpoint, click **Try it out**, and provide your data into the **Secret input** field. Example input can look like this:

```
{
"secret": {
"username": "admin",
"password": "admin"
},
"secretId": "NSOSecret",
"secretType": "basicAuth"
}
```

Step 4 Click **Execute**.

If the server response code is `201`, the secret is successfully created and you can start creating a resource to associate the secret with.

Create resource

SUMMARY STEPS

1. In the CWM API **resources** section, click the `POST /resource` endpoint to expand it.
2. Inside the endpoint, click **Try it out**, and provide your data into the **Resource input** field. Example input can look like this:
3. Click **Execute**.

DETAILED STEPS

	Command or Action	Purpose
Step 1	In the CWM API **resources** section, click the `POST /resource` endpoint to expand it.	
Step 2	Inside the endpoint, click **Try it out**, and provide your data into the **Resource input** field. Example input can look like this:	`{ "resource": { "scheme": "http", "host": "127.0.0.1", "port": 8080 }, "resourceId": "NSOLocal", "resourceType": "cisco.nso.resource.v1.0.0", "secretId": "NSOSecret" }`
Step 3	Click **Execute**.	If the server response code is `201`, the resource is successfully created.

Manage Schedules

To automate recurring operations or settle them on a specific date and time in the future, you can create a schedule. In CWM, there are two types of schedules:

- One-time: define at what time and date a single job will be executed

- Recurring: define rules (based on the interval, calendar or cron expression) when the job run repeats

CWM scheduler API allows you to create, update and pause/unpause schedules. While creating a basic schedule (along with other operations like deleting a schedule) in {{ version.CWM }} is possible via UI, defining advanced schedules using more functionalities of the scheduler is available only via API.

The following API endpoints are available for handling schedules:

- `GET/schedule`: gets a list of schedules existing in the CWM application.
- `POST/schedule`: creates a new schedule in the CWM application.
- `GET/schedule/{scheduleId}`: gets the details of a specific schedule existing in the CWM application.
- `PATCH/schedule/{scheduleId}`: updates an existing schedule with new detail(s).
- `DELETE/schedule/{scheduleId}`: deletes a schedule from the CWM application.

Create a schedule

To create a schedule, follow the steps below:

SUMMARY STEPS

1. Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.
2. In the CWM API **scheduler** section, click the `POST/schedule` endpoint to expand it.
3. Inside the endpoint, click **Try it out** and in the **Schedule request** provide the chosen values.
4. Click **Execute**. If the server response code is `201`, the schedule has been successfully created.

DETAILED STEPS

	Command or Action	Purpose
Step 1	Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.	
Step 2	In the CWM API **scheduler** section, click the `POST/schedule` endpoint to expand it.	
Step 3	Inside the endpoint, click **Try it out** and in the **Schedule request** provide the chosen values.	
Step 4	Click **Execute**. If the server response code is `201`, the schedule has been successfully created.	

Update a schedule

To edit a schedule, follow the steps below:

Step 1 Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.

Step 2 In the CWM API **scheduler** section, click the `PATCH/schedule` endpoint to expand it.

Step 3 Inside the endpoint, click **Try it out**, provide the *Schedule ID* and in the **Schedule update request** edit the chosen values.

Step 4 Click **Execute**. If the server response code is `200`, the schedule has been successfully updated.

Updating a schedule replaces the entire configuration. It means that if you want to change only one existing value, you still need to pass all of the details again, even if they will be the same.

Pause a schedule

You can pause a schedule for a chosen time, for example, for a maintenance window. When the schedule is paused, the runs that are supposed to be executed are skipped. To pause a schedule, follow the steps below:

Step 1 Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.

Step 2 In the CWM API **scheduler** section, click the `PATCH/schedule` endpoint to expand it.

Step 3 Inside the endpoint, click **Try it out**, provide the *Schedule ID* and in the **Schedule update request** set the value of the field "paused" to `true`.

Step 4 Click **Execute**. If the server response code is `200`, the schedule has been successfully paused.

The schedule remains paused as long as you resume it with the next request.

Unpause a schedule

To resume a schedule, follow the steps below:

Step 1 Log in to CWM and from the navigation menu on the left, click the swagger icon.

Step 2 In the CWM API **scheduler** section, click the `PATCH/schedule` endpoint to expand it.

Step 3 Inside the endpoint, click **Try it out**, provide the *Schedule ID* and in the **Schedule update request** set the value of the field "paused" to `false`.

Step 4 Click **Execute**. If the server response code is `200`, the schedule has been successfully resumed.

Pause on failure

If you set `pauseOnFailure` field to `true`, the schedule will be automatically paused after any of its job fails. It gives a chance to address the issue, for example, when the workflow definition associated with the schedule will be deleted. To change the pause on failure value, follow the general steps in **Update a schedule**.

Change the overlap policy

Overlap policy controls what happens when the next job should be started by a schedule at the same time that a previous run is still being executed. The default policy is **Skip** (with the "overlap" field value set to `1`), which means that when the previous job is still running, the next scheduled run won't start and it will be skipped. When the existing run completes, only the next scheduled run after that time will be considered. To change the overlap policy, follow the general steps in **Update a schedule**.

Possible policies:

Policy type	`overlap` field value	Description
Skip	1	This is the default policy that prevents overlapping runs. While the previous run from a schedule is still running when the next one should be executed, the next run will be skipped.
Buffer One	2	Starts the next run as soon as the current one completes. Only one run will be buffered. If they are more runs that are supposed to happen when the current job is running, they are skipped, and only the first one in the queue will be executed after the running job finishes.
Buffer All	3	Buffers all runs that are supposed to happen when the current job is running. All buffered runs will be executed sequentially, directly after the running job completes.
Cancel Other	4	Cancels the running job and starts the new one after the cancellation of the old one is completed.
Terminate Other	5	Terminates running job and starts the new one immediately.
Allow All	6	Starts any number of concurrent runs.

Manage Jobs

Jobs can be managed both in the CWM UI as described in the Operator guide or using the CWM API.

!!! note "Important" Some functionalities, for example, querying the jobs based on multiple tags, for {{ version.CWM }} are available only via API.

The following actions for managing jobs are available:

- `GET/job`: gets a list of jobs existing in the CWM application.
- `POST/job`: creates a new job run in the CWM application based on given parameters.
- `GET/job/{jobId}/runs/{runId}`: returns the details of a specific job existing in the CWM application.
- `POST/job/{jobId}/runs/{runId}/cancel`: cancels the execution of a running job, after the workflow worker completes the ongoing task execution from the workflow definition.
- `GET/job/{jobId}/runs/{runId}/events`: returns the event history for a specific job.
- `POST/job/{jobId}/runs/{runId}/terminate`: immediately terminates the execution of a running job.

Execute a job

To run a job, follow the steps below:

Step 1 Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.

Step 2 In the CWM API **jobs** section, click the `POST/job` endpoint to expand it.

Step 3 Inside the endpoint, click **Try it out** and in the **Job Execution Request** provide the chosen values, for example:

```
{
"data": {},
"jobName": "test API job",
"tags": [
    "test", "API"
],
"workflowName": "Test cisco workflow",
"workflowVersion": "1.1"
}
```

Note Job tags are optional but may ease filtering specific jobs in the future.

Step 4 Click **Execute**.

If the job run has been successfully created, you should get a server response with a code `200` and the job ID and run ID returned.

Filter jobs by multiple tags

You can get a list of jobs existing in CWM filtered by specific queries, for example, by associated tags. To get a list, follow the steps below:

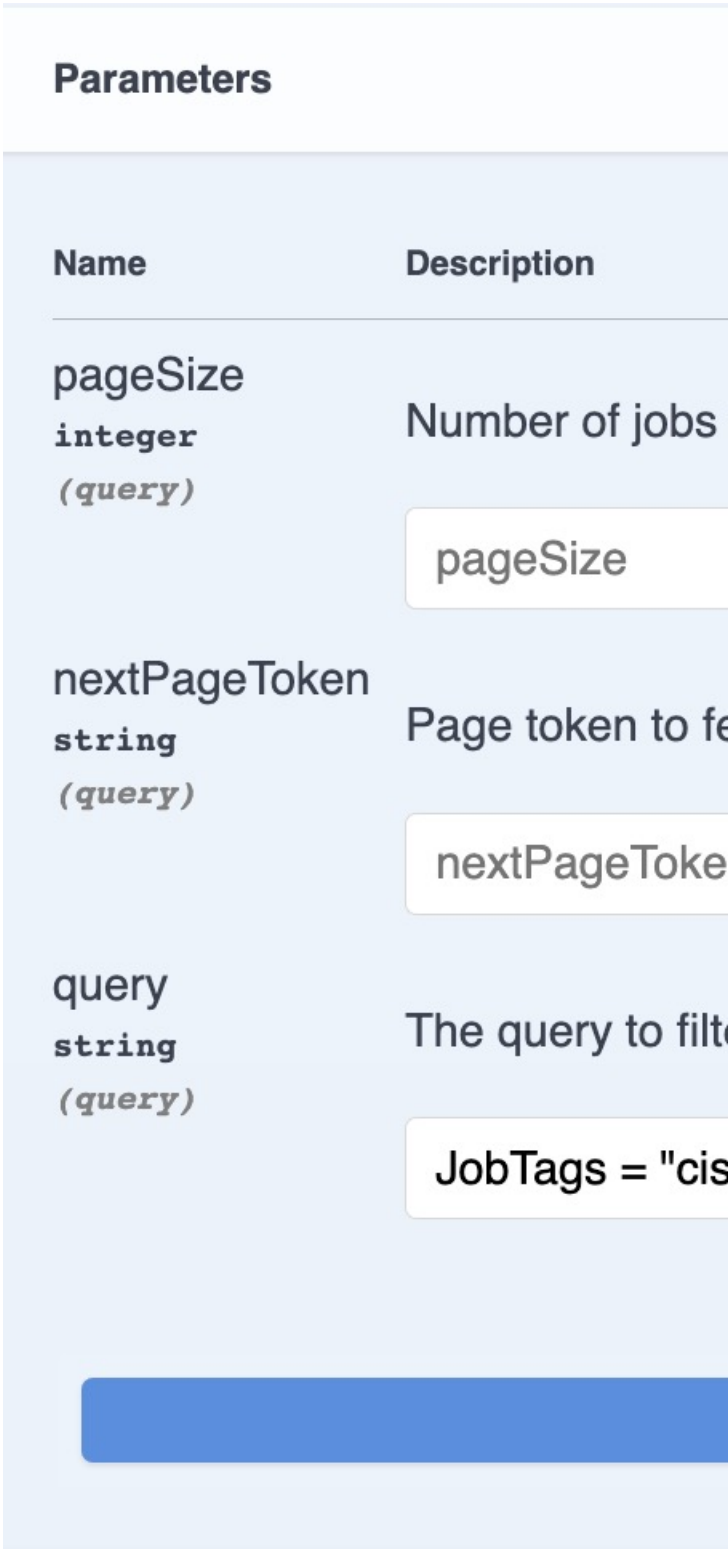
SUMMARY STEPS

1. Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.
2. In the CWM API **jobs** section, click the `GET/job/{jobId}/runs/{runId}` endpoint to expand it.
3. Inside the endpoint, click **Try it out** and in the `query` parameter, specify the tags by which you want to filter the jobs, following the schema: `JobTags = "tag_name1" and JobTags = "tag_name2"`, as in the example below:
4. Click **Execute**.

DETAILED STEPS

	Command or Action	Purpose
Step 1	Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.	
Step 2	In the CWM API **jobs** section, click the `GET/job/{jobId}/runs/{runId}` endpoint to expand it.	

	Command or Action	Purpose
Step 3	Inside the endpoint, click **Try it out** and in the `query` parameter, specify the tags by which you want to filter the jobs, following the schema: `JobTags = "tag_name1" and JobTags = "tag_name2"`, as in the example below:	***Figure 6: Job Event Log***

	Command or Action	Purpose
		

	Command or Action	Purpose
Step 4	Click **Execute**.	You should receive a server response with a `200` status code, along with the filtered jobs details. **Known issue**: In the response body with the job details, the field named `workflowId` is actually a Job ID, not a Workflow definition ID.

Get event history

To get a list of event history (all or filtered) for a given job, follow the steps below:

Step 1 Log in to CWM and from the navigation menu on the left, click the **swagger** icon.

Step 2 In the CWM API **jobs** section, click the `GET/job/{jobId}/runs/{runId}/events` endpoint to expand it.

Step 3 Inside the endpoint, click **Try it out** and provide the Run ID and Job ID of the job for which you want to get the event history.

Step 4 Optionally, you can set `isLongPoll` parameter to `true` if you are querying the currently running job. Then, the connection will be open until the execution of a given job finishes, and you will get the response after the job execution is completed. If you set it to `false`, you will receive a history of events immediately after sending the request, consisting of events completed up to the moment of request.

Step 5 Optionally, you can set `filterType` parameter to the chosen value (`all` or `close_event`).

Note The `close_event` value filters only for the closing event of an already finished job, for example `WorkflowExecutionFailed` or `WorkflowExecutionCompleted`. If you picked the `close_event` as a filter, and your job is currently running, you will receive a `400` error.

Step 6 Click **Execute**.

You should receive a server response with a `200` status code, along with the filtered events.

Manage policies

The CWM policy API allows you to manage policies that define rules for user access as part of the RBAC functionality in CWM. You can define policies only through the API.

!!! note When you define a policy, at the same time you create a new CWM user role (or update an existing role). Therefore, a `roleId` (where role ID is the `role_name` from the schema `permission/role_name`, without the "permission/" prefix) is required when defining a policy. If the role already exists, the new policy will be matched to it. If you create a new role, you will need to add it to a user in CWM afterwards. For a detailed instruction, see the **Manage access policy for users** section.

The following API endpoints are available for handling policies:

- `GET/policy/{roleId}`: gets the details of a specific policy existing in CWM.
- `PUT/policy/{roleId}`: updates a specific policy existing in CWM.

- `POST/policy/{roleId}`: creates a new policy in CWM.

Create a policy

To create a policy, follow the steps below:

Step 1 Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.

Step 2 In the CWM API **policy** section, click the `POST/policy/{roleId}` endpoint to expand it.

Step 3 Inside the endpoint, click **Try it out** and in the **roleId**, provide the CWM role name.

Step 4 Click **Execute**. If the server response code is `200`, the policy has been successfully created.

Note Note that by default, the policy has all the permissions set to `false`. To modify the permissions, you need to update the policy.

Update a policy

To modify user permissions in a policy, follow the steps below:

Step 1 In the CWM API, click the `GET/policy/{roleId}` endpoint to expand it. Inside the endpoint, click **Try it out**.

Step 2 Type the role name inside the **roleId** field and click **Execute**.

Step 3 In the API response, you'll get a JSON array. Copy the response body, edit it to reflect your needs regarding specific permissions, and copy the modified content.

Step 4 In the CWM API, click the `PUT/policy/{roleId}` API endpoint to expand it, then click **Try it out**.

Step 5 In **roleId**, type the role name.

Step 6 In **Policy to update**, paste the copied policy JSON array inside the `"policy": {}` brackets.

Step 7 Click **Execute**. Your policy will be updated. To see if it works as intended, log in as a user to which the role is assigned.

Note If the server response code is `200`, the policy has been successfully updated.

Manage Event types

Event types are categories of signals either received or produced by CWM and referred to in workflow definitions. You can manage them using the CWM UI as described in the **Operator** guide, or with the CWM API, as described below.

The following actions for managing Event types are available:

- `GET/eventType`: gets a list of Event types existing in the CWM application.
- `POST/eventType`: creates a new Event type in the CWM application.

- `GET/eventType/{name}`: gets the details of a specific Event type existing in the CWM application.
- `PUT/eventType/{name}`: updates an existing Event type with new parameter values.
- `DELETE/eventType/{name}`: deletes a Event type from the CWM application.
- `POST/eventType/{name}/start`: starts or stops an event listener.

Create Event type

Step 1 Log in to CWM and from the navigation menu on the left, click the :simple-swagger: icon.

Step 2 In the CWM API **eventType** section, click the `POST/eventType` endpoint to expand it. Inside the endpoint, click **Try it out**.

Step 3 In the **eventType data** field, modify the required values:

```
    {
"correlation": [
    {
    "contextAttributeName": "string",
    "contextAttributeValue": "string"
    }
],
"createWorkflow": false,
"dataOnly": true,
"endpoint": "string",
"kind": "string",
"name": "string",
"resourceId": "string",
"source": "string",
"type": "string",
"workflowName": "string",
"workflowVersion": "string"
}
```

Step 4 Click **Execute**.

Start/stop an Event type listener

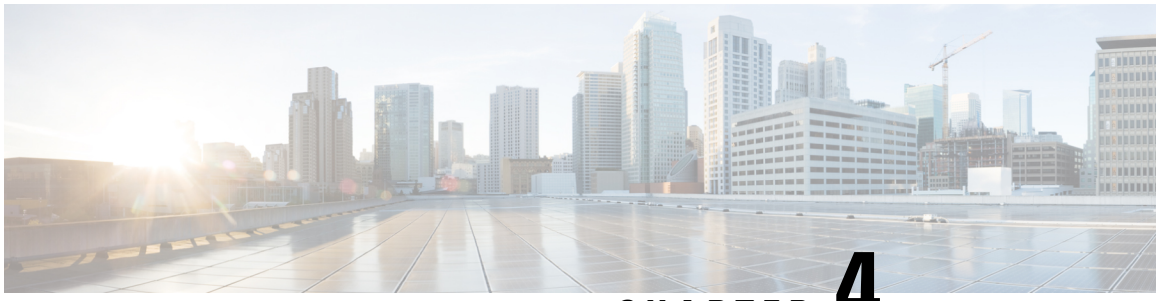
Step 1 In the CWM API **eventType** section, click the `POST/{name}/{action}` endpoint to expand it. Inside the endpoint, click **Try it out**.

Step 2 In the **parameters** fields, provide the required values:

a) "Name": paste the name the Event type for which a listener needs to be started/stopped.

b) "action": set to `start` if you want to start a listener, or `stop` if you want to stop a running listener.

Step 3 Click **Execute**.



CHAPTER 4

Users

This section contains the following topics:

Manage user access

In CWM, you can manage user access and permissions via the Role-Based Access Control functionality. Additionally, NxF adds a layer of security and works as a Single Authentication Agent, thus sharing local, LDAP, and SAML users.

NxF functionality in CWM

NxF functionality is available for admin users from the **Settings** tab in the CWM UI. To access NxF functionality in CWM:

Step 1 In CWM, go to the outermost navigation menu on the left.

Step 2 Click the **Settings** icon.

Figure 7: NxF Settings

Step 3 In the expanded drawer, you can find the following:

Figure 8: NxF Drawer Settings

a) A) **System Info** section with information about the latest versions of NxF and CWM microservices.
b) B) **Security** section for access management:
   - **Local Users**: where you can display, create and edit local users via UI.
   - **LDAP**: where you can set LDAP settings for user authentication.
   - **SAML SSO**: where you can set SAML Single-Sign-On settings for user authentication.
   - **Permission Mapping**: where you can handle permission management via Cisco Policy Management Tool.

Add local user

Step 1 In CWM, go to the outermost navigation menu on the left.

Step 2 Navigate to **CWM** (Cisco icon) -> **Local Users** tab.

Step 3 Click **Add...**

Step 4 In the Add User panel, fill in the mandatory fields (marked with an asterisk): Username (used to log in to the CWM), Password, Confirm Password and Access Permissions (enter `permission/user`). The Description and Display Name (visible next to the username in CWM) are optional fields.

Figure 9: NxF Add User

Step 5 Use radio buttons to set the user status. You can make both radio buttons disabled or enabled at the same time.

a) **Active enabled**: allows the user to log in to the CWM.
b) **Active disabled**: forbids the user to log in to the CWM.
c) **Locked enabled**: prevents deleting the user.
d) **Locked disabled**: allows removal of the user.

Step 6 Click **Save**.

Role-Based Access Control

Overview

The Role-Based Access Control (RBAC) is a mechanism that allows you to grant or revoke user access to specific resources in the CWM application. As an administrator, by defining a policy in the policy API endpoint and associating it with a user role, you can manage access to all the available CWM API endpoints for users assigned to a given permission set.

Default `permission/admin` role

Then you install a CWM instance, the user which you create is associated by default with a pre-defined access permission: `permission/admin` role.

The `permission/admin` role has full access to the CWM and all of its functionalities; `admin` can control user access and permissions. All local users with admin permissions can create new users if needed.

To restrict user access to CWM functionalities, create an RBAC policy, assign it to a user role and update the default policy permissions.

Manage access policy for users

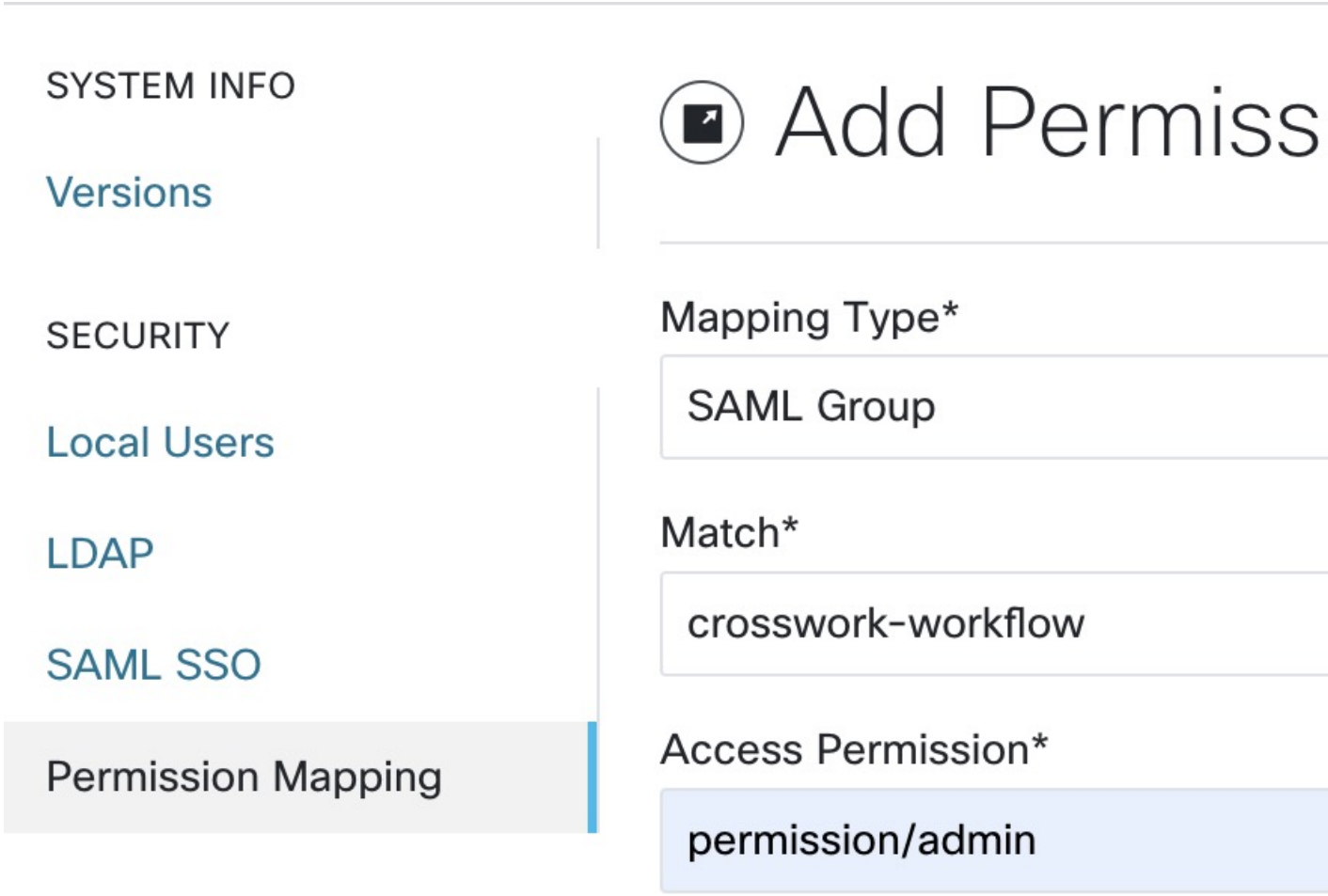
A **policy** is a set of permissions that grants or revokes access to specific CWM API endpoints and their methods (which can be seen roughly as specific application functionalities). In order to work correctly, a **policy** needs to be matched with a corresponding NxF user role which can be created in the CWM UI, either before or after adding the policy in the CWM API. Here are the steps for the management of an RBAC policy:

Add user role

Step 1 In CWM, go to the outermost navigation menu on the left.

Step 2 Click the **Settings** icon.

Figure 10: NxF Settings



Step 3 In the expanded drawer, select **Local Users** and find a user for whom you want to add a role and create a policy.

Step 4 In **Access Permissions**, add a role following the `permission/role_name` format, or copy an existing role. We'll use `permission/user` as an example.

Note **Known issue**: Note that only the role which comes first in the list is the one which applies. If you add any more roles to a user, their assigned policies won't apply.

Create new policy

Step 1 In CWM, go to the outermost navigation menu on the left, and click the :simple-swagger: icon.

Step 2 In the Swagger **policy** section, click the `POST/policy{roleId}` endpoint to expand it. Inside the endpoint, click **Try it out**.

Step 3 In the **Role Name**, paste the role name that matches a user role added in NxF, for example, `permission/user`.

Note The policy name must match a role name assigned to a user. If you don't have a user role, you can first define the policy, and then create a new role that matches the policy name.

Step 4 Click **Execute**.

Modify default policy permissions

Now that you have created a policy that matches a user role, you need to modify its permission set to reflect your needs.

Step 1 In the CWM API, click the `GET/policy/{roleId}` endpoint to expand it. Inside the endpoint, click **Try it out**.

Step 2 Type the role name inside the **roleId** field and click **Execute**.

Step 3 In the API response, you'll get a JSON array. Copy the response body, edit it to reflect your needs regarding specific permissions, and copy the modified content.

Note By default, a newly created policy has all the permissions set to `false`.

Step 4 In the CWM API, click the `PUT/policy/{roleId}` API endpoint to expand it, then click **Try it out**.

Step 5 In **roleId**, type the role name.

Step 6 In **Policy to update**, paste the copied policy JSON array inside the `"policy": {}` brackets.

Step 7 Click **Execute**. Your policy will be updated. To see if it works as intended, log in as a user to which the role is assigned.

Set up authentication via LDAP

Besides supporting local users, CWM allows adding LDAP users through integration with LDAP (Lightweight Directory Access Protocol) servers.

Step 1 In CWM, go to the outermost navigation menu on the left.

Step 2 Navigate to **CWM** (Cisco icon) -> **LDAP** tab.

Step 3 Click the **Enabled** radio button.

Step 4 Fill in the mandatory fields (marked with an asterisk): LDAP Server Address, Bind DN, Bind Credentials and Search Filter. Search Base and Root CAs are optional.

Figure 11: NxF LDAP

Step 5 Click **Save**.

Set up authentication via SAML SSO

CWM offers SAML SSO feature that supports both LDAP and non-LDAP users to gain single sign-on access based on the protocol SAML (Security Assertion Markup Language). You can enable SAML SSO for CWM along with LDAP or without it.

Step 1 In CWM, go to the outermost navigation menu on the left.

Step 2 Navigate to **CWM** (Cisco icon) -> **SAML SSO** tab.

Step 3 Click the **Enabled** radio button.

Step 4 Fill in the mandatory fields: Login URL, Entity ID, Base URL, Signing Certificate and Groups Attribute Name.

Figure 12: NxF SAMLSSO

Step 5 Click **Save**.

Set up permission mapping

You can give specific permissions to a group of users via Cisco Policy Management Tool (PMT).

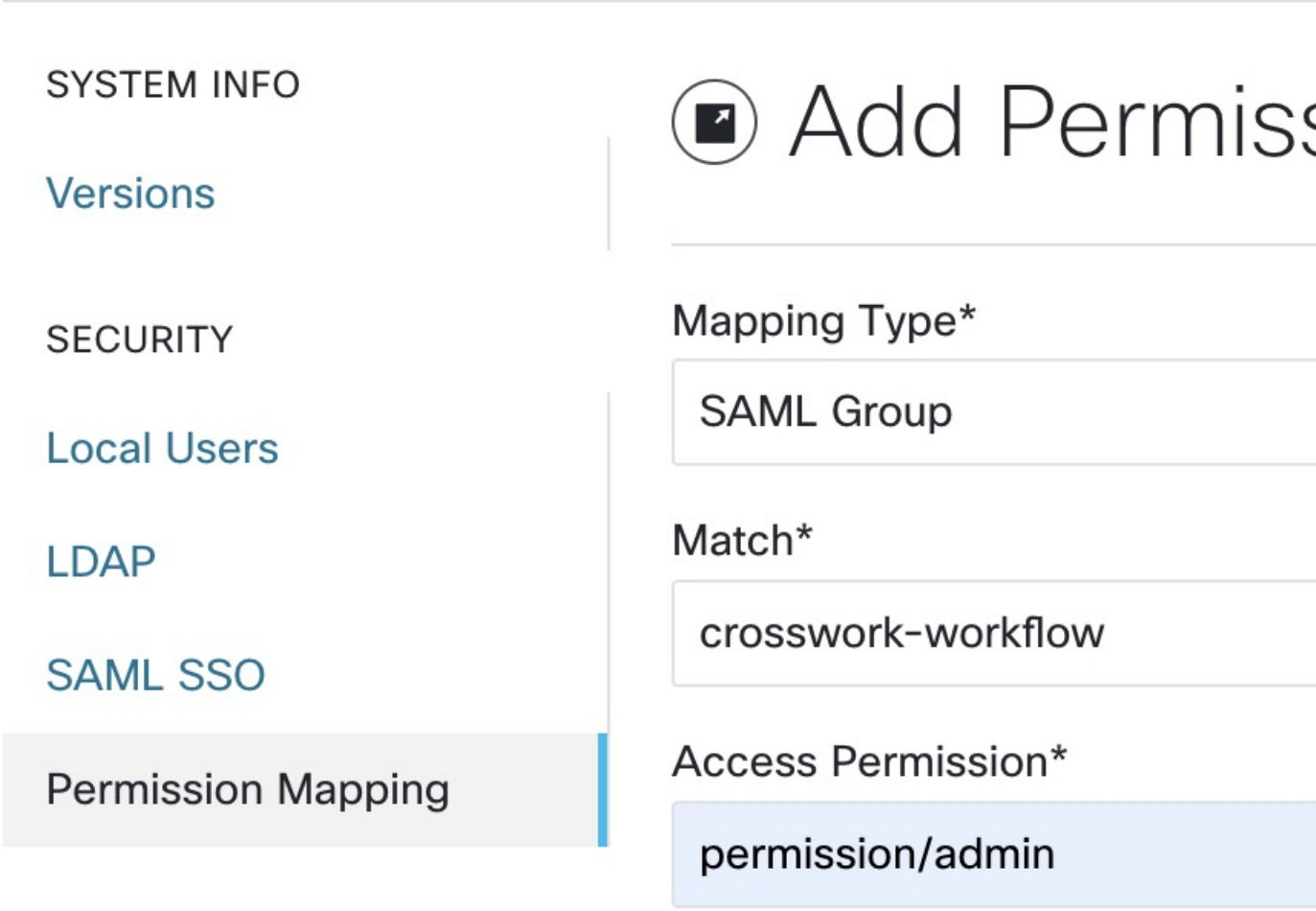
Step 1 In CWM, go to the outermost navigation menu on the left.

Step 2 Navigate to **CWM** (Cisco icon) -> **Permission Mapping** tab.

Step 3 Click **Add...**.

Step 4 In the Add Permission Mapping panel, choose one **Mapping Type** from the dropdown menu: SAML User, SAML Group, LDAP User, or LDAP Group.

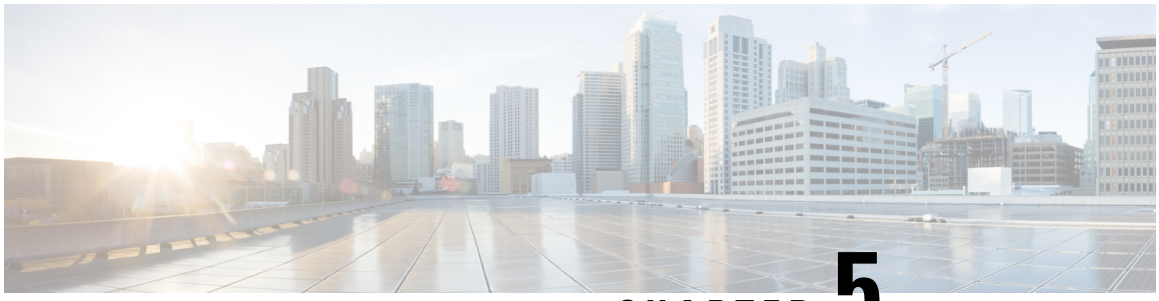
Figure 13: NxF Permission Mapping



Step 5 Fill in the Match field with the entry from the Cisco Policy Management Tool. You can find the match in PMT UI -> **OAuth Clients** tab -> Client ID Column.

Step 6 Enter appropriate permission (for example `permission/admin`) in the Access Permission field.

Step 7 Click **Save**.



CHAPTER 5

Adapters

This section contains the following topics:

Use `generic-email` adapter

The **Email Adapter** (`generic-email`) adds an element of reporting into your workflows by providing basic functionality to send emails using an SMTP server. For the 1.0.0 adapter version, you can use the `Send` activity to send an email with a message defined inside the workflow definition.

Get `generic-email` adapter

Download the CWM 1.1 Software package. The `cwm.v1.1.generic.email.v1.0.0.tar.gz` file is included inside the package.

Install adapter

To install the adapter, follow the instructions on how to install an adapter in the Operator guide.

Create SMTP resource and secret

Before going into the details of defining your email message inside a workflow, you need to add a resource and a secret to CWM. You will later need to reference them inside your workflow.

Add secret

Step 1 In CWM, navigate to the **Admin** -> **Secrets** tab.

Step 2 Click **Add Secret**.

Step 3 In the **New secret** view, specify the following:

a) Secret ID: name your secret. You'll need to reference this secret ID later in the resource and inside the workflow. E.g. `emailSecret`.

b) Secret type: select `basicAuth`.

Step 4 After selecting the secret type, a set of additional fields is displayed under the Secret type details section. Fill in the fields with the following:

a) password: provide password to your sender email address.

b) username: provide the address you will send the email from in the format `sender@address.com`.

Step 5 Click **Create Secret**.

Add resource

Step 1 In CWM, navigate to the **Admin** -> **Resources** tab.

Step 2 Click **Add Resource**.

Step 3 In the **New resource** window, specify the following:

a) Resource name: name your resource. You'll need to provide the resource ID later inside the workflow as a reference. E.g. `emailResource`.

b) Resource type: select `generic.email.resource.v1.0.0`.

c) Secret ID: provide the ID of the secret you've just added.

d) Connection:

- Host: provide the address of the SMTP server to be used.
- Port: provide the SMTP port. The standard SMTP ports for encrypted email transmissions are either `587` or `25`.
- Scheme: this field is not required.
- Timeout: this field is not required.
- Allow Insecure: select `true`.

Step 4 Click **Create resource**.

Define the `Send` activity in workflow

Learn how to use the adapter `Send` activity in a workflow.

Set activity reference

In CWM, the adapter `Send` activity is referred to as `generic.email.smtp.Send`. When defining a workflow, you need to specify it as the value of the `operations` parameter under `functions`:

```
"functions": [
  {
    "name": "smtp.send",
    "operation": "generic.email.v1.0.0.smtp.Send"
  }
]
```

Note Inside the `name` parameter, provide an activity name that you will later refer to in the `refName` parameter while defining the action.

Define email message in `actions`

Now you can define an action in which an email will be sent as part of a workflow state.

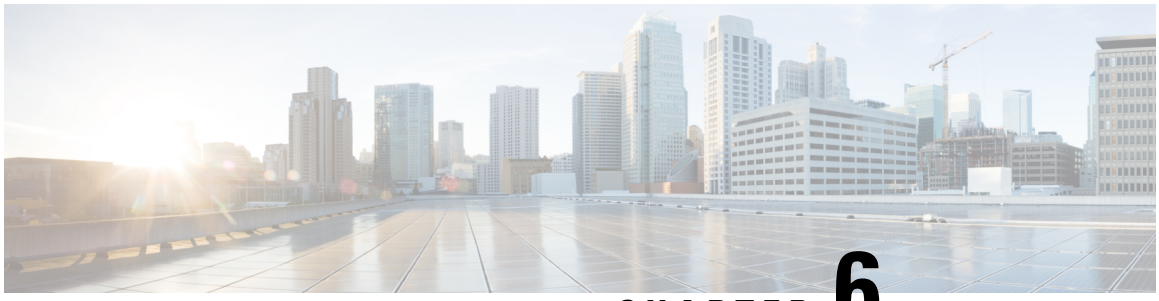
The available input parameters for the action are:

Field	Type	Label	Description
from	string		Sender email address
to	string	repeated	List of recipient email addresses
cc	string	repeated	List of recipient cc email addresses
bcc	string	repeated	List of recipient bcc email addresses
subject	string		Email title
text	string		Email body as text
html	string		Email body as html

Use the available fields as the `input` key/value pairs within the `arguments` that define the `SendEmail` example action as shown below:

```
"states":[
  {
    "name":"EmailState",
    "type":"operation",
    "end": true,
    "actions": [
      {
        "name": "SendEmail",
        "functionRef": {
          "refName": "smtp.send",
          "arguments": {
            "input": {
              "to": ["recipient1@address.com", "recipient2@address.com"],
              "from": "sender@address.com",
              "text": "Hello, this is some placeholder email text.",
              "subject": "A test email from CWM"
            },
            "config": {
              "resourceId": "emailResource"
            }
          }
        }
      }
    ]
  }
]
```

If you want to trigger the email action based on a condition, you can use the Switch state and define the `dataConditions` parameter inside it. For details, check out the Serverless Workflow Specification documentation for the Switch state.



CHAPTER 6

Events

This section contains the following topics:

Define a Kafka event

Event handling overview

The event handling mechanism enables interaction with an external Kafka (or other) broker for handling external events. Thus, workflows can act as either consumers or producers of events which can be used to initiate a new workflow, or signal an existing workflow. The Kafka side of communication (or other service, like RabbitMQ) needs to be set up and configured beforehand to send produced events to CWM or forward events produced by CWM to other systems.

Note **Known issue**: For CWM 1.1, events can be either consumed or produced. Both consuming and producing the same event type is not yet supported.

Prerequisites

- A set-up Kafka service (or RabbitMQ with AMQP 1.0 plugin in case of AMQP, or any HTTP Client).
- CWM 1.1 installed using OVA.

Step 1: Create Kafka secret and resource

To enable a secure connection to the Kafka service, you need to create a secret with Kafka credentials and a resource with connection details. Here's how to do it:

Create secret

SUMMARY STEPS

1. In CWM, navigate to the **Admin** -> **Secrets** tab.
2. Click **Add Secret**.
3. In the **New secret** view, specify the following:
4. After selecting the secret type, a set of additional fields is displayed under the Secret type details section. Fill in the fields:
5. Click **Create Secret**.

DETAILED STEPS

	Command or Action	Purpose
Step 1	In CWM, navigate to the **Admin** -> **Secrets** tab.	
Step 2	Click **Add Secret**.	
Step 3	In the **New secret** view, specify the following:	
Step 4	After selecting the secret type, a set of additional fields is displayed under the Secret type details section. Fill in the fields:	
Step 5	Click **Create Secret**.	

Create resource

Step 1 In CWM, navigate to the **Admin** -> **Resources** tab.

Step 2 Click **Add Resource**.

Step 3 In the **New resource** window, specify the following:

a) Resource name: `KafkaResource`

b) Resource type: `cisco.cwm.kafka.v1.0.0` (or `cisco.cwm.amqp.v1.0.0` or `cisco.cwm.http.v1.0.0` if you use these protocols instead)

c) Secret ID: `KafkaSecret`

d) Connection:

- **KafkaVersion**: provide your Kafka version. The standard way to check this is to run `bin/kafka-topics.sh --version` in a terminal.
- **Brokers**: provide your Kafka broker address in the following format: `["localhost:9092"]`.
- **OtherSettings**: an editable list with default Kafka setting values. You can modify the values if needed.

Note Connection setting differ in case of **AMQP** and **HTTP** resource types:

- For AMQP, provide the **ServerDNS** in the following format: `amqp://localhost:5723`. - For HTTP, provide the **URL** and additional **headers** (for example, Client-ID header name and value). Note that URL needs to be your host address but without the URL path. This you will specify as **End point** when configuring the resource type.

Step 4 Click **Create resource**.

Step 2: Add event type to CWM

When you have the secret and resource in place, it's time to specify the type of event that will be consumed or produced by CWM.

Step 1 In the CWM UI, select the **Admin** tile from the navigation menu on the left.

Step 2 In the **Event system** panel, click **Add event type**.

Step 3 In the **New event type** modal, provide the required input:

a) **Event type name**: provide name for your event type. You will later refer to it inside the workflow definition.

b) **Resource**: from the list, select `KafkaResource`.

c) **Event source**: define your event source. It's fully user-defined and will be referenced in the workflow definition. Required for `produce` event kind.

d) **End point**: for Kafka, provide your Kafka topic (event stream). For AMQP, provide endpoint (terminus). For HTTP, provide URL (Host) path.

e) **Select kind**: from the list, select `consume`.

Note Use `Produce` to define an event to be produced by a workflow and consumed by another system. In this case, the remaining **Step 2** settings presented below this point won't apply. The `both` option is not yet supported for CWM 1.1.

f) **Start listener**: click it to start listening for the defined event type.

g) **Run job**: tick this checkbox if you want to trigger a workflow upon receiving the event. Then select the desired workflow from the list.

h) **Correlation context attributes**: optionally, you can set context attributes for your event. They apply only to the `consume` event kind and are used to trigger workflows selectively. You can view them as a kind of custom filter that refines the inbound event data and triggers actions defined inside a "listening" workflow on the basis of your context attributes.

i) Click **Add attribute** and provide attribute name and value (fully user-defined).

Step 4 Click **Create Event type**.

Step 3: Define event in a workflow

Now that we have the event type added, we can create a workflow that registers for this event type and executes an action when the event is received by CWM. For this purpose, we'll need to define the event using an Event definition and specify the Event state and define actions to be taken when the event occurs. For example purposes, let's take a scenario where a router overheating alarm (inbound event) triggers the workflow event state and two remediation actions are executed:

```
{
  "id": "HighRouterTempWorkflow",
  "name": "Router Overheating Alarm Workflow",
  "start": "RemediateHighTemp",
  "events": [
    {
      "kind": "consumed",
      "name": "HighRouterTemp",
      "type": "HighRouterTemp",
```

```
      "source": "monitoring.app"
    }
  ],
  "states": [
    {
      "end": {
        "terminate": true
      },
      "name": "RemediateHighTemp",
      "type": "event",
      "onEvents": [
        {
          "actions": [
            {
              "functionRef": {
                "refName": "DispatchTech",
                "contextAttributes": {
                  "RouterIP": "${ .RouterIP }"
                },
                "resultEventTimeout": "PT30M"
              }
            },
          ],
          "eventRefs": ["HighRouterTemp"],
           },
           {
           "actions": [
            {
              "functionRef": {
                "refName": "MoveTraffic",
                "contextAttributes": {
                  "RouterIP": "${ .RouterIP }"
                },
                "resultEventTimeout": "PT30M"
              }
            }
          ],
          "timeouts": {
            "actionExecTimeout": "PT60M"
          }
        }
      ]
    }
  ],
  "version": "1.0.0",
  "description": "Remediate router overheating",
  "specVersion": "0.8"
}
```

Note Note that the example is not a complete workflow. It presents a sample of how you can define an event inside a workflow and act on it.