Cisco Container Platform 1.1.0 User Guide

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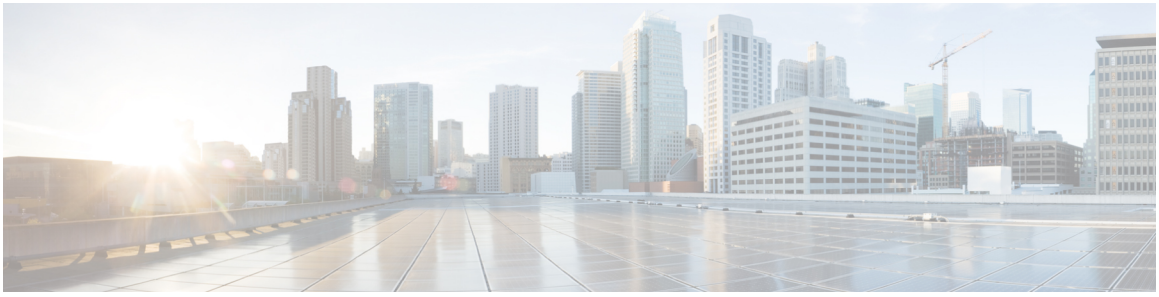


CONTENTS

CHAPTER 1

Cisco Container Platform 1

- Administrator Workflow 1
- User Workflow 2
- Accessing Cisco Container Platform Web Interface 3
- Setting Up Cisco Container Platform 3
- Configuring Cisco Smart Software Licensing 4
  - Workflow of Cisco Smart Software Licensing 5
  - Generating Registration Token 5
  - Configuring Transport Settings 6
  - Registering Cisco Container Platform License 7
  - Renewing Authorization 7
  - Reregistering Cisco Container Platform License 8
  - Deregistering Registration 8

CHAPTER 2

Managing Cisco Container Platform Infrastructure Configuration 9

- Managing Provider Profile 9
  - Adding Provider Profile 9
  - Modifying Provider Profile 10
  - Deleting Provider Profile 10
- Managing ACI Profile 10
  - Adding ACI Profile 10
  - Modifying ACI Profile 11
  - Deleting ACI Profile 11
- Managing Networks 11
  - Modifying Networks 12

Adding Subnets 12
Modifying Subnets 12
Adding VIP Pool 12
Modifying VIP Pool 13

CHAPTER 3 Administering Kubernetes Clusters 15
Creating Kubernetes Clusters 15
Upgrading Kubernetes Clusters 16
Scaling Kubernetes Clusters 16
Deleting Kubernetes Clusters 17
Managing Users and RBAC 17
Configuring Local Users 17
Changing Login Passphrase 17
Configuring AD Servers 18
Configuring AD Groups 18
Monitoring Health of Cluster Deployments 18
Monitoring Logs from Cluster Deployments 19
Viewing EFK Logs Using Kibana (Tenant Cluster) 20
Viewing EFK Logs Using Kibana (Control Plane Cluster) 20
Forwarding Logs to External Elasticsearch Server 21

CHAPTER 4 Managing Kubernetes Clusters 23
Setting up Kubernetes Dashboard 23

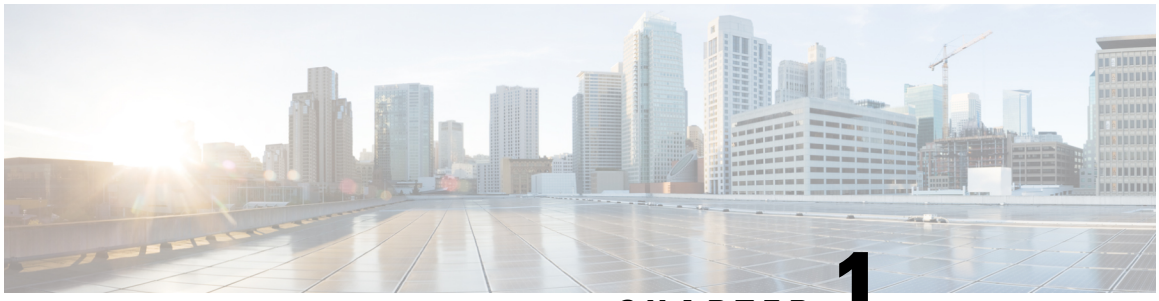
CHAPTER 5 Services and Networking 25
Load Balancing Kubernetes Services using NGINX 25
Types of Ingress 25
Network Policies 28

CHAPTER 6 Deploying Applications on Kubernetes Clusters 29
Workflow of Deploying Applications 29
Downloading Kubeconfig File 29
Sample Scenarios 30
Deploying a Pod with Persistent Volume 30

Deploying Cafe Application with Ingress 31

APPENDIX A **User Privileges on vSphere 35**

User Privileges on vSphere 35



CHAPTER 1

Cisco Container Platform

Cisco Container Platform is a turnkey, production grade, extensible platform to deploy and manage multiple Kubernetes clusters. It runs on 100% upstream Kubernetes. Cisco Container Platform offers seamless container networking, enterprise-grade persistent storage, built-in production-grade security, integrated logging, monitoring and load balancing.

Cisco Container Platform provides authentication and authorization, security, high availability, networking, load balancing, and operational capabilities to effectively operate and manage Kubernetes clusters. Cisco Container Platform also provides a validated configuration of Kubernetes and can integrate with underlying infrastructure components such as Cisco HyperFlex and Cisco ACI. The infrastructure provider for Cisco Container Platform is Hyperflex.

Using the Cisco Container Platform web interface, you can create Kubernetes clusters on which you can deploy containerized applications. The clusters are created on the infrastructure provider platform.

The two user personas in Cisco Container Platform are as follows:

- The **Administrator** persona, which is associated with the **Administrator** role.
- The **User** persona, which is associated with the **User** role.

This chapter contains the following topics:

- Administrator Workflow, on page 1
- User Workflow, on page 2
- Accessing Cisco Container Platform Web Interface, on page 3
- Setting Up Cisco Container Platform, on page 3
- Configuring Cisco Smart Software Licensing, on page 4

Administrator Workflow

The following table lists the workflow for Cisco Container Platform administrators.

Task	Related Section
Access the Cisco Container Platform web interface with *Administrator* credentials.	Accessing Cisco Container Platform Web Interface, on page 3
Set up the Cisco Container Platform infrastructure configuration.	Setting Up Cisco Container Platform, on page 3

Task	Related Section
Configure Cisco Smart Software Licensing for your Cisco Container Platform instance.	Configuring Cisco Smart Software Licensing, on page 4
Manage the Cisco Container Platform infrastructure configurations using which clusters are created.	Managing Cisco Container Platform Infrastructure Configuration, on page 9
Create Kubernetes clusters.	Creating Kubernetes Clusters, on page 15
Add users, assign appropriate roles, and associate the new users to the Kubernetes clusters that you have created.	Managing Users and RBAC, on page 17
Monitor Kubernetes clusters.	Monitoring Health of Cluster Deployments, on page 18 Viewing EFK Logs Using Kibana (Tenant Cluster), on page 20
Manage Kubernetes cluster using the Kubernetes Dashboard.	Managing Kubernetes Clusters, on page 23
Manage the lifecycle of Kubernetes clusters by scaling or upgrading the clusters.	Scaling Kubernetes Clusters, on page 16 Upgrading Kubernetes Clusters, on page 16

User Workflow

The following table lists the workflow for developers assigned with the *User* role.

Task	Related Section
Access the Cisco Container Platform web interface with user credentials.	Accessing Cisco Container Platform Web Interface, on page 3
Monitor Kubernetes clusters that are assigned to the user.	Monitoring Health of Cluster Deployments, on page 18 Viewing EFK Logs Using Kibana (Tenant Cluster), on page 20
Manage the assigned Kubernetes clusters using the Kubernetes Dashboard or CLI.	Managing Kubernetes Clusters, on page 23
Deploy applications on the assigned Kubernetes clusters.	Deploying Applications on Kubernetes Clusters, on page 29

Accessing Cisco Container Platform Web Interface

Before you begin

Ensure that you have configured the prerequisites for integrating ACI with Cisco Container Platform.

For more information, refer to the following documents:

- *ACI Integration Requirements* section of the *Cisco Container Platform Installation Guide*
- Planning and Prerequisites section of the Cisco ACI and Kubernetes Integration page

Ensure that you have powered on the Control Plane VMs on the infrastructure provider platform.

Step 1 Access the following URL using your web browser:

`https://<Cisco Container Platform IP Address>`

Note We recommend that you use the Chrome, Safari, or Firefox browser to access the URL.

Step 2 Log in to the web interface as an admin user using the passphrase given during the Cisco Container Platform installation.

Setting Up Cisco Container Platform

Note This topic is applicable only for an ACI environment. In a non-ACI environment, the IP address range of the default VIP pool must be expanded to include the additional VIPs for tenant clusters. For more information, see Managing Networks, on page 11.

When you log in to Cisco Container Platform for the first time, you need to configure the Cisco Container Platform initial setup using the **Cisco Container Platform Setup** wizard.

Step 1 On the **Welcome** page, click **START THE SETUP**.

Step 2 In the **ACI Credentials** screen, specify information such as IP address, username, and passphrase of the APIC instance, click **CONNECT**, and then click **NEXT**.

Step 3 In the **ACI Configuration** screen, perform these steps:

a) In the **NAMESERVERS** field, enter the IP address of all the DNS servers that the ACI fabric can access.
b) From the **VMM DOMAIN** drop-down list, choose the Virtual Machine Manager Domain (VMMD) that you want to use.
c) In the **INFRASTRUCTURE VLAN ID** field, enter the VLAN number for layer 2 networking.
d) From the **VRF** drop-down list, choose the Virtual Routing and Forwarding (VRF) IP address.
e) From the **L3OUT POLICY NAME** drop-down list, choose the ACI object for allowing external internet connectivity.
f) From the **L3OUT NETWORK NAME** drop-down list, choose the external network that is reachable through the L3OUT object.

g) From the **AAEP NAME** drop-down list, choose an Attachable Access Entity Profile (AAEP) name to associate the VMM domain with an AAEP.
h) In the **STARTING SUBNET FOR PODS** field, enter the starting IP address for the IP pool that is used to allocate IP addresses to the pods.
i) In the **STARTING SUBNET FOR SERVICE** field, enter the starting IP address for the IP pool that is used to allocate IP addresses to the service VLAN.
j) In the **CONTROL PLANE CONTRACT NAME** field, enter the name of the contract that allows traffic from the Control Plane cluster to the tenant cluster.
k) In the **NODE VLAN START ID** field, enter the starting IP address for the IP pool that is used to allocate IP addresses to the node VLAN.
l) In the **NODE VLAN END ID** field, enter the ending IP address for the IP pool that is used to allocate IP addresses to the node VLAN.
m) In the **OPFLEX MULTICAST RANGE** field, enter a range for the Opflex multicast.
n) Click **CONNECT**.

Step 4 In the **Summary** screen, verify the configuration, and then click **FINISH**.
For more information on adding, modifying, or deleting an ACI profile, see Managing ACI Profile, on page 10.

Configuring Cisco Smart Software Licensing

You need to configure Cisco Smart Software Licensing to easily procure, deploy, and manage licenses for your Cisco Container Platform instance. The number of licenses required depends on the number of VMs necessary for your deployment scenario.

A Cisco Container Platform instance is available for a 90-day evaluation period after which, you need to register with Cisco Smart Software Manager (Cisco SSM). Cisco SSM enables you to manage your Cisco Smart Software Licenses from one centralized website. With Cisco SSM, you can organize and view your licenses in groups called virtual accounts. You can also use Cisco SSM to transfer the licenses between virtual accounts as needed.

You can access Cisco SSM from the Cisco Software Central homepage at software.cisco.com, under the **Smart Licensing** area.

If you do not want to manage licenses using Cisco SSM, either for policy reasons or network availability reasons, you can choose to install Cisco SSM satellite at your premises. Cisco Container Platform registers and reports license consumption to the Cisco SSM satellite as it does to Cisco SSM.

Note Ensure that you use Cisco SSM Satellite version 5.0 or later. For more information on installing and configuring Cisco SSM satellite, refer to http://www.cisco.com/go/smartsatellite.

License Usage and Compliance

Once you register Cisco Container Platform with Cisco SSM, you will receive the **Cisco Container Platform License with Support** license.

Cisco SSM or Cisco SSM satellite totals the license requirements for all your Cisco Container Platform instances and compares the total license usage to the number of licenses purchased, on a daily basis. After the data synchronization, your Cisco Container Platform instance displays one of the following status indicators:

- **Authorized**, when the number of licenses purchased is sufficient
- **Out of Compliance**, when the number of licenses is insufficient
- **Authorization Expired**, when the product has not communicated with Cisco SSM or Cisco SSM satellite for a period of 90 days.

Workflow of Cisco Smart Software Licensing

The following table describes the workflow of Cisco Smart Software Licensing:

Task	Related Section
Generate a product instance registration token in your virtual account	Generating Registration Token, on page 5
Configure the transport settings using which Cisco Container Platform connects to Cisco SSM or Cisco SSM satellite	Configuring Transport Settings, on page 6
Register the Cisco Container Platform instance with Cisco SSM or Cisco SSM satellite	Registering Cisco Container Platform License, on page 7
Manage licenses	Renewing Authorization, on page 7 Reregistering Cisco Container Platform License, on page 8 Deregistering Registration, on page 8

Generating Registration Token

You need to generate a registration token from Cisco SSM or Cisco SSM satellite to register the Cisco Container Platform instance.

Before you begin

Ensure that you have set up a Smart Account and a Virtual account on Cisco SSM or Cisco SSM satellite.

Step 1 Log in to your Smart Account on Cisco SSM or Cisco SSM satellite.

Step 2 Navigate to the Virtual account using which you want to register the Cisco Container Platform instance.

Step 3 If you want to enable higher levels of encryption for the products registered using the registration token, check the **Allow export-controlled functionality on the products registered with this token** check box.

Note This option is available only if you are compliant with the Export-Controlled functionality.

Step 4 Click **New Token** to generate a registration token.

Step 5 Copy and save the token for using it when you register your Cisco Container Platform instance.

For more information on registering your Cisco Container Platform instance, see Registering Cisco Container Platform License, on page 7.

Configuring Transport Settings

By default, Cisco Container Platform directly communicates with the Cisco SSM. You can modify the mode of communication by configuring the transport settings.

Before you begin

Ensure that you have obtained the registration token for the Cisco Container Platform instance.

Step 1 Log in to the Cisco Container Platform web interface.

Step 2 From the left pane, click **Licensing**.

If you are running Cisco Container Platform in the Evaluation mode, a license notification is displayed on the **Smart Software Licensing** pane.

Step 3 If a license notification is displayed, click the **edit the Smart Call Home Transport Settings** link.

Alternatively, click the **Licensing Status** tab, and then click the **View/Edit** link that appears under **Transport Settings**.

Step 4 In the **Transport Settings** dialog box, perform one of these steps:

- To configure Cisco Container Platform to send the license usage information to Cisco SSM using the Internet:
  1. Click the **DIRECT** radio button.
  2. Configure a DNS on Cisco Container Platform to resolve *tools.cisco.com*.

  This is the default setting.
- To configure Cisco Container Platform to send the license usage information to Cisco SSM using the Cisco SSM satellite:
  1. Click the **TRANSPORT GATEWAY** radio button.
  2. Enter the URL of the Cisco SSM satellite.
- To configure Cisco Container Platform to send the license usage information to Cisco SSM using a proxy server. For example, an off-the-shelf proxy, such as Cisco Transport Gateway or Apache:
  1. Click the **HTTP/HTTPS PROXY** radio button.
  2. Enter the IP address and port number of the proxy server.

Step 5 Click **SAVE**.

Registering Cisco Container Platform License

You need to register your Cisco Container Platform instance with Cisco SSM or Cisco SSM satellite before the 90-day evaluation period expires.

Before you begin

Ensure that you have configured the transport settings.

Step 1 Log in to the Cisco Container Platform web interface.

Step 2 From the left pane, click **Licensing**.

Step 3 In the license notification, click **Register**.
The **Smart Software Licensing Product Registration** dialog box appears.

Step 4 In the **Product Instance Registration Token** field, copy and paste the registration token that you generated using the Cisco SSM or Cisco SSM satellite.

For more information on generating a registration token, see Generating Registration Token, on page 5.

Step 5 Click **REGISTER** to complete the registration process.
Cisco Container Platform sends a request to Cisco SSM or Cisco SSM satellite to check the registration status and Cisco SSM or Cisco SSM satellite reports back the status to Cisco Container Platform, on a daily basis.

If registering the token fails, you can reregister the Cisco Container Platform instance using a new token.

For more information on reregistering Cisco Container Platform, see Reregistering Cisco Container Platform License, on page 8.

Renewing Authorization

By default, the authorization is automatically renewed every 30 days. However, Cisco Container Platform allows a user to manually initiate the authorization renew in case the automatic renewal process fails. The authorization expires if Cisco Container Platform is not connected to Cisco SSM or Cisco SSM satellite for 90 days and the licenses consumed by Cisco Container Platform are reclaimed and put back to the license pool.

Before you begin

Ensure that the Cisco Container Platform instance is registered with Cisco SSM or Cisco SSM satellite.

Step 1 Log in to the Cisco Container Platform web interface.

Step 2 From the left pane, click **Licensing**.

Step 3 From the **Actions** drop-down list, choose **Renew Authorization Now**.

Step 4 Click **OK** in the **Renew Authorization** dialog box.
Cisco Container Platform synchronizes with Cisco SSM or Cisco SSM satellite to check the license authorization status and Cisco SSM or Cisco SSM satellite reports back the status to Cisco Container Platform, on a daily basis.

Reregistering Cisco Container Platform License

You can reregister Cisco Container Platform with Cisco SSM or Cisco SSM satellite by deregistering it and registering it again, or by using a register force option.

Before you begin

Ensure that you have obtained a new registration token from Cisco SSM or Cisco SSM satellite.

Step 1 Log in to the Cisco Container Platform web interface.

Step 2 From the left pane, click **Licensing**.

Step 3 From the **Actions** drop-down list, choose **Reregister**.

Step 4 In the **Product Instance Registration Token** field of the **Smart Software Licensing Product Reregistration** dialog box, enter the registration token that you generated using Cisco SSM or Cisco SSM satellite.

For more information on generating a registration token, see Generating Registration Token, on page 5.

Step 5 Click **REGISTER** to complete the registration process.
Cisco Container Platform sends a request to Cisco SSM or Cisco SSM satellite to check the registration status and Cisco SSM or Cisco SSM satellite reports back the status to Cisco Container Platform, on a daily basis.

Deregistering Registration

You can deregister the Cisco Container Platform instance from Cisco SSM or Cisco SSM satellite to release all the licenses from the current Virtual account and the licenses are available for use by other products in the virtual account. Deregistering disconnects Cisco Container Platform from Cisco SSM or Cisco SSM satellite.

Before you begin

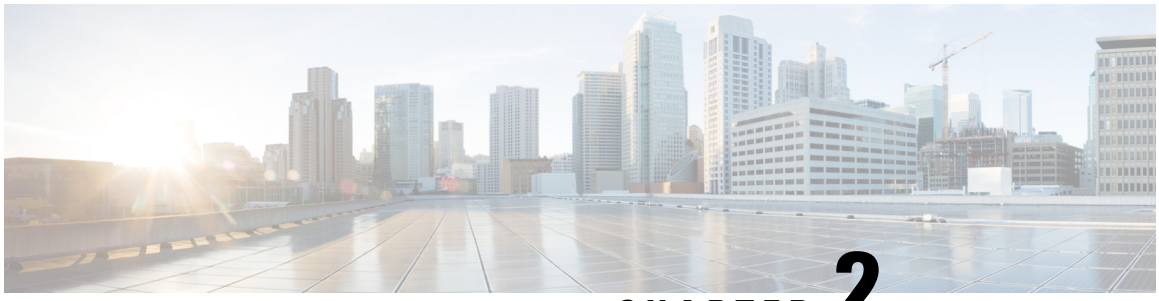
Ensure that the Cisco Container Platform instance is registered with Cisco SSM or Cisco SSM satellite.

Step 1 Log in to the Cisco Container Platform web interface.

Step 2 From the left pane, click **Licensing**.

Step 3 From the **Actions** drop-down list, choose **Deregister**.

Step 4 Click **DEREGISTER** in the confirmation dialog box.
Cisco Container Platform sends a request to Cisco SSM or Cisco SSM satellite to check the deregistration status and Cisco SSM or Cisco SSM satellite reports back the status to Cisco Container Platform, on a daily basis.



CHAPTER 2

Managing Cisco Container Platform Infrastructure Configuration

This chapter contains the following topics:

- Managing Provider Profile, on page 9
- Managing ACI Profile, on page 10
- Managing Networks, on page 11

Managing Provider Profile

Cisco Container Platform enables you to define the provider profile on which clusters can be created.

You can configure multiple provider profiles in an instance of Cisco Container Platform and use the same provider profile for multiple clusters.

Adding Provider Profile

Before you begin

Cisco Container Platform interacts with vSphere through the user that you configure when you add a provider profile. Hence, you need to ensure that this user has the necessary privileges.

For more information on the vSphere user privileges, see User Privileges on vSphere, on page 35.

Step 1 From the left pane, click **Infrastructure Providers**.

Step 2 Click **NEW PROVIDER** and specify information such as name and description of provider, IP address, port, username and passphrase of the provider profile.

Step 3 Click **SUBMIT**.

Modifying Provider Profile

Step 1 From the left pane, click **Infrastructure Providers**.

Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Edit** corresponding to the provider profile that you want to modify.

Step 3 Change the provider details as necessary and click **SUBMIT**.

Deleting Provider Profile

Step 1 From the left pane, click **Infrastructure Providers**.

Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Delete** corresponding to the provider profile that you want to delete.

Step 3 Click **DELETE** in the confirmation dialog box.

Managing ACI Profile

Cisco Container Platform enables you to define ACI profiles using which tenant clusters can be created.

You can define multiple ACI profiles and use the same profile for multiple clusters.

Adding ACI Profile

Step 1 From the left pane, click **ACI Profiles**.

Step 2 Click **Add New ACI Profile** and perform these steps:

a) Specify information such as profile name, IP address, username, and passphrase of the ACI instance.

Note If there is more than one host, use a comma-separated host list in the **APIC IP ADDRESSES** field.

b) In the **NAMESERVERS** field, enter the IP address of all the DNS servers that the ACI fabric can access.

c) From the **VMM DOMAIN** drop-down list, choose the Virtual Machine Manager Domain (VMMD) that you want to use.

d) In the **INFRASTRUCTURE VLAN ID** field, enter the VLAN number for layer 2 networking.

e) From the **VRF** drop-down list, choose the Virtual Routing and Forwarding (VRF) IP address.

f) From the **L3OUT POLICY NAME** drop-down list, choose the ACI object for allowing external internet connectivity.

g) From the **L3OUT NETWORK NAME** drop-down list, choose the external network that is reachable through the L3OUT object.

h) From the **AAEP NAME** drop-down list, choose an Attachable Access Entity Profile (AAEP) name to associate the VMM domain with an AAEP.

i) In the **STARTING SUBNET FOR PODS** field, enter the starting IP address for the IP pool that is used to allocate IP addresses to the pods.

j) In the **STARTING SUBNET FOR SERVICE** field, enter the starting IP address for the IP pool that is used to allocate IP addresses to the service VLAN.
k) In the **CONTROL PLANE CONTRACT NAME** field, enter the name of the contract that allows traffic from the Control Plane cluster to the tenant cluster.
l) In the **NODE VLAN START ID** field, enter the starting IP address for the IP pool that is used to allocate IP addresses to the node VLAN.
m) In the **NODE VLAN END ID** field, enter the ending IP address for the IP pool that is used to allocate IP addresses to the node VLAN.
n) In the **OPFLEX MULTICAST RANGE** field, enter a range for the Opflex multicast.

Step 3 Click **SUBMIT**.

Modifying ACI Profile

Step 1 From the left pane, click **ACI Configuration**.
Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Edit** for the ACI profile that you want to modify.
Step 3 Change the ACI profile details as necessary and click **SUBMIT**.

Deleting ACI Profile

Step 1 From the left pane, click **ACI Configuration**.
Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Delete** for the ACI profile that you want to delete.
Step 3 Click **DELETE** in the confirmation dialog box.

Managing Networks

Note This section is applicable only for a non-ACI environment.

Cisco Container Platform enables you to select an existing network, create a subnet in that network, and then create a Cisco Container Platform Virtual IP Address (VIP) pool within that subnet.

VIP pools are reserved ranges of IP addresses that are assigned as virtual IP addresses within the Cisco Container Platform clusters. For example, the master VIPs of tenant clusters or the external IP addresses of Ingress controllers are assigned from the VIP pool. The range of IP addresses in the VIP pools must be outside of the IP addresses that are assigned by DHCP.

Modifying Networks

Step 1 From the left pane, click **Networks**.
The **Networks** page displays the list of available networks.

Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Edit** for the network that you want to modify.
Alternatively, click the **SUBNETS** tab or the **POOLS** tab, and then click **EDIT** from the right pane to view the **Edit** dialog box.

Step 3 Modify the network name or the network VRID ranges as necessary, and then click **SUBMIT**.

Adding Subnets

If you want to allocate VIP from a different subnet CIDR you need to add the subnet.

Step 1 From the left pane, click **Networks**, and then click the network to which you want to add a subnet.

Step 2 From the right pane, click **NEW SUBNET**.

Step 3 Enter a name and CIDR for the subnet.

Step 4 Click **SUBMIT**.

Modifying Subnets

Step 1 From the left pane, click **Networks**, and then click the network that contains the subnet you want to modify.

Step 2 Click the **SUBNETS** tab.

Step 3 From the drop-down list displayed under the **ACTIONS** column, choose **Edit** for the subnet that you want to modify.

Step 4 Modify the subnet name and CIDR as necessary, and then click **SUBMIT**.

Adding VIP Pool

Step 1 From the left pane, click **Networks**, and then click the network to which you want to add a VIP pool.

Step 2 From the right pane, click **NEW POOL**.

Step 3 Specify a name, subnet and IP address range for the VIP pool.

Step 4 Click **SUBMIT**.

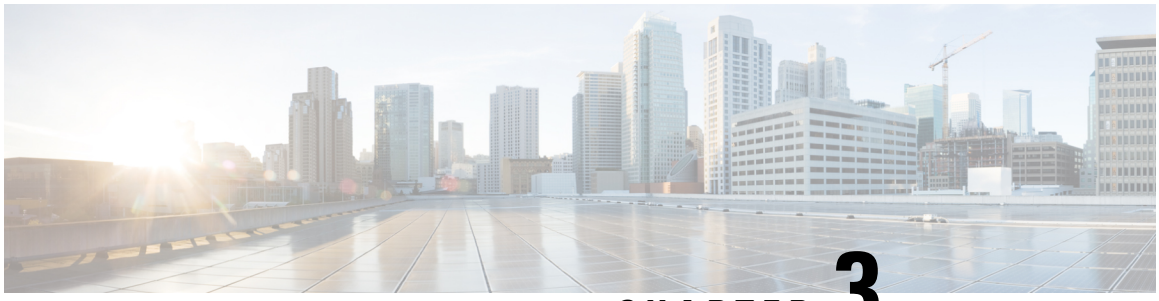
Modifying VIP Pool

Step 1 From the left pane, click **Networks**, and then click the network that contains the VIP pool you want to modify.

Step 2 Click the **POOLS** tab.

Step 3 From the drop-down list displayed under the **ACTIONS** column, choose **Edit** for the VIP pool that you want to modify.

Step 4 Change the pool name and the IP address as necessary, and then click **SUBMIT**.



CHAPTER 3

Administering Kubernetes Clusters

You can create, modify, or delete Kubernetes clusters using the Cisco Container Platform web interface.

This chapter contains the following topics:

- Creating Kubernetes Clusters, on page 15
- Upgrading Kubernetes Clusters, on page 16
- Scaling Kubernetes Clusters, on page 16
- Deleting Kubernetes Clusters, on page 17
- Managing Users and RBAC, on page 17
- Monitoring Health of Cluster Deployments, on page 18
- Monitoring Logs from Cluster Deployments, on page 19

Creating Kubernetes Clusters

Step 1 From the left pane, click **Clusters**, and then click **NEW CLUSTER**.

Step 2 In the **Basic Information** screen, specify the following information, and then click **NEXT**:

- The infrastructure provider where the cluster needs to be created.

  For more information, see Adding Provider Profile, on page 9.

- The name, version of Kubernetes, SSH public key, and description to be used for creating the cluster.
- If you are using ACI, specify the ACI profile, see Adding ACI Profile, on page 10.

Step 3 In the **Provider Settings** screen, specify the data center, cluster, resource pool, network, HyperFlex local network, datastore, and VM template that you have configured on vSphere, and then click **NEXT**.

Note
- Ensure that DRA and HA are enabled on the cluster that you choose in this step. For more information on enabling DRS and HA on clusters, refer to the *Cisco Container Platform Installation Guide*.
- Ensure that the datastore that you choose in this step is accessible to the hosts in the cluster.

Step 4 In the **Node Configuration** screen, specify the following information, and then click **NEXT**:

- The number of worker and master nodes, and their VCPU and memory configurations.

- The VM username that you want to use as the login for the VM.
- The VIP pool that you want to use for this cluster.
- The IP addresses in CIDR notation that you want to use as the pod subnet.

Step 5 In the **Summary** screen, verify the configuration, and then click **FINISH**.

The cluster deployment takes few minutes to complete. The newly created cluster is displayed on the **Clusters** page.

For more information on deploying applications on clusters, see Deploying Applications on Kubernetes Clusters, on page 29.

Upgrading Kubernetes Clusters

Before you begin

Ensure that you have imported the latest tenant cluster OVA to the vSphere environment.

For more information on importing the tenant cluster OVA, refer to the *Cisco Container Platform Installation Guide*.

Step 1 From the left pane, click **Clusters**.

Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Upgrade**.

Step 3 In the **Upgrade Cluster** dialog box, enter a Kubernetes version, choose a new template for the VM, and then click **Submit**. It may take a few minutes for the Kuberenetes cluster upgrade to complete.

Scaling Kubernetes Clusters

You can scale clusters by adding or removing nodes to them based on the demands of the workloads you want to run.

Step 1 From the left pane, click **Clusters**.

Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Edit** and modify the number of worker nodes, and then click **UPDATE**.

Alternatively, follow these steps to scale the cluster:

a) Click the name of the cluster that you want to scale.
b) Click the **Nodes** tab.
c) From the right pane, click **EDIT**, modify the number of worker nodes, and then click **UPDATE**.

Deleting Kubernetes Clusters

Before you begin

Ensure that the cluster you want to delete is not currently in use, as deleting a cluster removes the containers and data associated with it.

Step 1 From the left pane, click **Clusters**.

Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Delete** for the cluster that you want to delete.

Step 3 Click **DELETE** in the confirmation dialog box.

Managing Users and RBAC

Cisco Container Platform provides Role-based Access Control (RBAC) through built-in static roles, namely the *Administrator* and *User* roles. Role-based access allows you to use local accounts and LDAP for authentication and authorization.

Configuring Local Users

Cisco Container Platform allows you to manage local users. An administrator can add a user, and assign an appropriate role and cluster(s) to the user.

Step 1 From the left pane, click **User Management**, and then click the **Users** tab.

Step 2 Click **NEW USER**.

Step 3 Specify information such as first name, last name, username, passphrase, and role for the user.

Step 4 Click **SUBMIT**.
The new user is displayed on the **User Management** page.

Note You can edit or delete a user by using the options available under the **ACTIONS** column.

Changing Login Passphrase

Step 1 From the left pane, click **User Management**, and then click the **Users** tab.

Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Edit** corresponding to your name.

Note Administrators can change passphrase and role for other users as well.

Step 3 Change the passphrase and role assigned as necessary, and click **SUBMIT**.

Configuring AD Servers

LDAP authentication is performed using a service account that can access the LDAP database and query for user accounts. You will need to configure the AD server and service account in Cisco Container Platform.

Step 1 From the left pane, click **User Management**, click the **Active Directory** tab, and then click **EDIT**.
Step 2 In the **SERVER IP ADDRESS** field, type the IP address of the AD server.
Step 3 In the **PORT** field, type the port number for the AD server.
Step 4 For improved security, we recommend that you check **STARTTLS**.
Step 5 In the **BASE DN** field, specify the domain name of the AD server for all the accounts that you have.
Step 6 In the **ACCOUNT USERNAME** field, specify the service account name that is used for accessing the LDAP server.
Step 7 In the **PASSPHRASE** field, type the passphrase of the AD account.
Step 8 Click **SUBMIT**.

Configuring AD Groups

Cisco Container Platform allows you to manage users using AD groups. An administrator can add users to AD groups, and then assign appropriate roles and clusters to the groups.

Before you begin

Ensure that you have configured the AD server that you want to use.

For more information on configuring AD servers, see Configuring AD Servers, on page 18.

Step 1 From the left pane, click **User Management**, and then click the **Groups** tab.
Step 2 Click **ADD GROUP**.
Step 3 Specify information such as the name of the AD group and the role you want to assign to the group.

Note If the AD group is associated with the *Administrator* role, by default, access is provided to all clusters. But, if the AD group is associated with the *User* role, you need to assign a cluster.

Step 4 From the **CLUSTERS** drop-down list, choose the names of the cluster that you want to assign to the AD group.
Step 5 Click **SUBMIT**.

Monitoring Health of Cluster Deployments

It is recommended to continuously monitor the health of your cluster deployment to improve the probability of early detection of failures and avoid any significant impact from a cluster failure.

Cisco Container Platform is deployed with Prometheus and Grafana configured to start monitoring and logging services automatically when a Kubernetes cluster is created.

Prometheus is an open-source systems monitoring and alerting toolkit and Grafana is an open source metric analytics and visualization suite.

Prometheus collects the data from the cluster deployment, and Grafana provides a general purpose dashboard for displaying the collected data. Grafana offers a highly customizable and user-friendly dashboard for monitoring purposes.

Note A user with *Administrator* role can view all the cluster deployments, but a user with *User* role can view only those clusters for which the user has permission to view.

Step 1 Access the Kubernetes cluster master node using ssh.

```
ssh -l <username> <IP address of master node>
```

Note Once you create a Kubernetes cluster, it may take a few minutes for the necessary services to start. If ssh to a cluster fails, we recommend that you try again after a few minutes.

Step 2 Obtain the password for Grafana, which is stored as a Kubernetes secret.

```
kubectl get secrets ccp-addons-grafana -o yaml | grep grafana-admin-password | awk '{print $2}' |
base64 --decode
```

Step 3 Access the Grafana UI using a web browser.

```
https://<VIP>/grafana
```

Where <*VIP*> is the Virtual IP address of the control or tenant cluster as the case may be. In case of a tenant cluster, <*VIP*> is the Virtual IP address that is used by the cluster Ingress as described in Services and Networking, on page 25.

Step 4 Log in to the Grafana UI of your Kubernetes cluster using your username, and the password that you obtained in Step 2.

Note It is important to either change or retain the original login credentials since the secret that was used to initialize the Grafana login may be lost or changed with future upgrades.

Step 5 Add Prometheus as the data source and configure the Grafana dashboard to monitor the health of your cluster deployments.

Monitoring Logs from Cluster Deployments

The Elasticsearch, Fluentd, and Kibana (EFK) stack enables you to collect and monitor log data from containerized applications for troubleshooting or compliance purposes. These components are automatically installed when you install Cisco Container Platform.

Fluentd is an open source data collector. It works at the backend to collect and forward the log data to Elasticsearch.

Kibana is an open source analytics and visualization platform designed to work with Elasticsearch. It allows you to create rich visualizations and dashboards with the aggregated data.

Note A user with the *Administrator* role can view all logs, but a user with *User* role can view logs for only those clusters for which the user has permission to view.

Viewing EFK Logs Using Kibana (Tenant Cluster)

Step 1 Download the Kubeconfig file of the cluster whose logs you want to view, see Downloading Kubeconfig File, on page 29.

Step 2 Copy the contents of the downloaded Kubeconfig file to:

- Your local host `~/.kube/config`
- A local file and export KUBECONFIG=<*Downloaded Kubeconfig file*>

Step 3 Create a port-forward using kubectl to access Kibana from outside a cluster.

a) Determine the pod.

```
kubectl -n kube-system get pods
```

For example, `kibana-logging-7db596d7f6-g9pxv`

b) Open a port-forward.

```
kubectl port-forward -n kube-system
```

For example, `kibana-logging-7db596d7f6-g9pxv 5601:5601`

Step 4 Access the Kibana UI and view the data from the target tenant cluster using a web browser.

http://localhost:5601/app/kibana

For more information on customizing the Kibana UI, refer to the latest Kibana documentation.

Viewing EFK Logs Using Kibana (Control Plane Cluster)

Step 1 Access the Kubernetes cluster master node using ssh.

```
ssh ccpuser@control plane master node
sudo cat /etc/kubernetes/admin.conf
```

Step 2 Copy the contents of the downloaded Kubeconfig file to:

- Your local host `~/.kube/config`
- A local file and export KUBECONFIG=<*Full path of the Kubeconfig local file*>

For more information on setting Kubeconfig, see Configure Access to Multiple Clusters.

Step 3 Create a port-forward using kubectl to access Kibana from outside a cluster.

a) Determine the pod.

```
kubectl -n kube-system get pods
```

For example, `kibana-logging-7db596d7f6-g9pxv`

b) Open a port-forward.

```
kubectl port-forward -n kube-system
```

For example, `kibana-logging-7db596d7f6-g9pxv 5601:5601`

Step 4 Access the Kibana UI and view the data from the target tenant cluster using a web browser.
http://localhost:5601/app/kibana
For more information on customizing the Kibana UI, refer to the latest Kibana documentation.

Step 5

What to do next

Forwarding Logs to External Elasticsearch Server

Use the following Curl commands to configure forwarding of logs to an external Elasticsearch server:

Step 1 Open a terminal that has a curl client installed.

Step 2 Configure Cisco Container Platform login credentials.

```
export MGMT_HOST=https://<Cisco Container Platform IP address>:<Port>
export CCP_USER=<Username>
export CCP_PASSPHRASE=<Passphrase>
```

Step 3 Login to Cisco Container Platform and save the session cookie for future requests into the cookies.txt local file.

```
curl -k -j -c cookies.txt -X POST -H "Content-Type:application/x-www-form-urlencoded" -d
"username=$CCP_USER&password=$CCP_PASSWORD" $MGMT_HOST/2/system/login/
```

Step 4 Get the list of cluster names.

```
curl -s -k -b cookies.txt -H "Content-Type: application/json"
$MGMT_HOST/2/clusters/ | jq -r '.[].name'
```

Step 5 Set the CLUSTER_NAME environment variable to the cluster that you are working on.

```
export CLUSTER_NAME="<A cluster name from Step 2>"
```

Step 6 Configure the cluster UUID.

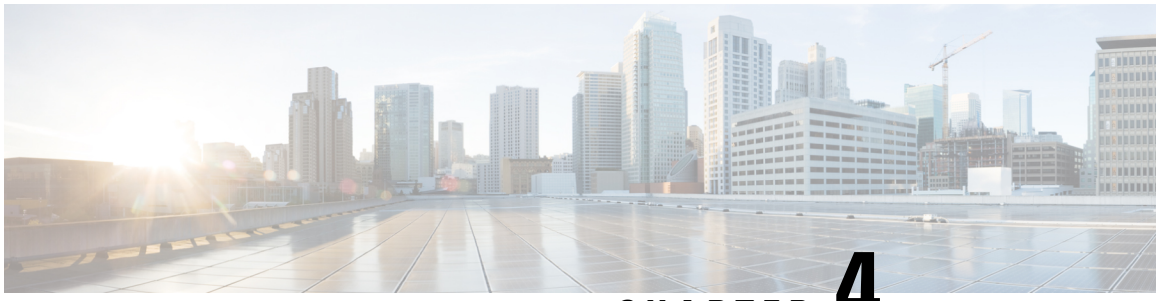
```
export CLUSTER_UUID=$(curl -s -k -b cookies.txt -H "Content-Type: application/json"
$MGMT_HOST/2/clusters/$CLUSTER_NAME | jq -r '.uuid')
```

Step 7 Configure the Elasticsearch server IP address and port number.

```
export EFK_SERVER=<IP address of Elasticsearch server>
export EFK_PORT=<Port number of Elasticsearch server>
```

Step 8 Install the helm chart to configure the custom Elasticsearch server.

```
curl -s -k -b cookies.txt -X POST --header 'Content-Type: application/json' --header 'Accept:
application/json' -d '{"chart_url": "/opt/ccp/charts/ccp-agent.tgz", "name": "ccpagent", "options":

"ccp-efk.localLogForwarding.enabled=False,ccp-efk.localLogForwarding.elasticsearchHost='$EFK_SERVER',ccp-efk.localLogForwarding.elasticsearchPort='EFK_PORT'"}'
 $MGMT_HOST/2/clusters/$CLUSTER_UUID/helmcharts
```



CHAPTER 4

Managing Kubernetes Clusters

The Cisco Container Platform web interface allows you to manage Kubernetes clusters by using the **Kubernetes Dashboard**. Once you set up the **Kubernetes Dashboard**, you can deploy applications on the authorized Kubernetes clusters, and manage the application and the cluster itself.

This chapter contains the following topic:

- Setting up Kubernetes Dashboard, on page 23

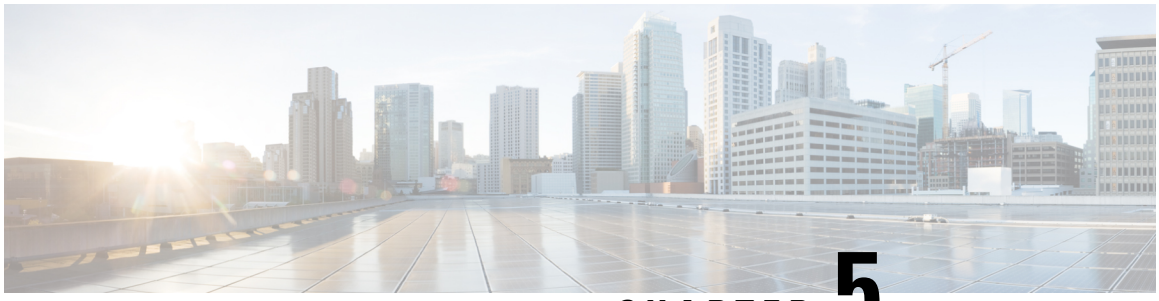
Setting up Kubernetes Dashboard

Step 1 From the left pane, click **Clusters**.

Step 2 From the drop-down list displayed under the **ACTIONS** column, choose **Kubernetes Dashboard** for the cluster that you want to access using the Kubernetes Dashboard.

Step 3 Click the **Download** icon of the cluster environment to get the Kubernetes configuration (Kubeconfig) file.

Step 4 Use the Kubeconfig file from Step 3 to login to the Kubernetes Dashboard.



CHAPTER 5

Services and Networking

This chapter contains the following topics:

- Load Balancing Kubernetes Services using NGINX, on page 25
- Network Policies, on page 28

Load Balancing Kubernetes Services using NGINX

Cisco Container Platform uses NGINX to offer advanced layer 7 load balancing solutions. NGINX can handle a large number of requests and at the same time, it can be run on Kubernetes containers.

The NGINX load balancer is automatically provisioned as part of Kubernetes cluster creation. Each Kubernetes cluster is provisioned with a single L7 NGINX load balancer. You can access the load balancer using its virtual IP address, which can be found by running the command `kubectl get svc`.

To use the NGINX load balancer, you must create an Ingress resource. Ingress is a Kubernetes object that allows you to define HTTP load balancing rules to allow inbound connections to reach the cluster services. You can configure Ingress to create external URLs for services, load balance traffic, terminate SSL, offer name-based virtual hosting, and so on.

Types of Ingress

Cisco Container Platform supports the following types of Ingresses:

- **Simple fanout**

  It enables you to access the website using http.

  For example:

```
cafe.test.com ->   10.1.1.1  ->  / tea      tea-svc:80
                                 / coffee   coffee-svc:80
```

  For this type of Ingress, you need to create a yaml file that defines the Ingress rules.

Figure 1: Sample yaml file

```
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: cafe-ingress
spec:
  rules:
  - host: cafe.test.com
    http:
      paths:
      - path: /tea
        backend:
          serviceName: tea-svc
          servicePort: 80
      - path: /coffee
        backend:
          serviceName: coffee-svc
          servicePort: 80
```

- **Simple fanout with SSL termination**

  It enables you to access the website using https.

  For example:

```
https://cafe.test.com ->    10.1.1.1   -> / tea       tea-svc:80
                                          / coffee    coffee-svc:80
```

  For this type of Ingress, you need to create the following yaml files:

  - A yaml file that defines the Secret

    Figure 2: Sample yaml file

```
apiVersion: v1
kind: Secret
metadata:
  name: cafe-secret
type: Opaque
data:
  tls.crt:  base64 encoded cert
  tls.key: base64 encoded key
```

  - A yaml file that defines the Ingress rules

Figure 3: Sample yaml file

```
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: cafe-ingress
spec:
  tls:
  - hosts:
    - cafe.test.com
    secretName: cafe-secret
  rules:
  - host: cafe.example.com
    http:
      paths:
      - path: /tea
        backend:
          serviceName: tea-svc
          servicePort: 80
      - path: /coffee
        backend:
          serviceName: coffee-svc
          servicePort: 80
```

- **Name based virtual hosting**

  It enables you to access the website using multiple host names.

  For example:

```
tea.test.com      --|              |-> tea.test.com       s1:80
                    | 10.1.1.1     |
coffee.test.com   --|              |-> coffee.test.com    s2:80
```

  For this type of Ingress, you need to create a yaml file that defines the Ingress rules.

Figure 4: Sample yaml file

```
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: cafe-ingress
spec:
  rules:
  - host: tea.test.com
    http:
      paths:
      - path: /tea
        backend:
          serviceName: tea-svc
          servicePort: 80
  - host: coffee.test.com
    http:
      paths:
      - path: /coffee
        backend:
          serviceName: coffee-svc
          servicePort: 80
```

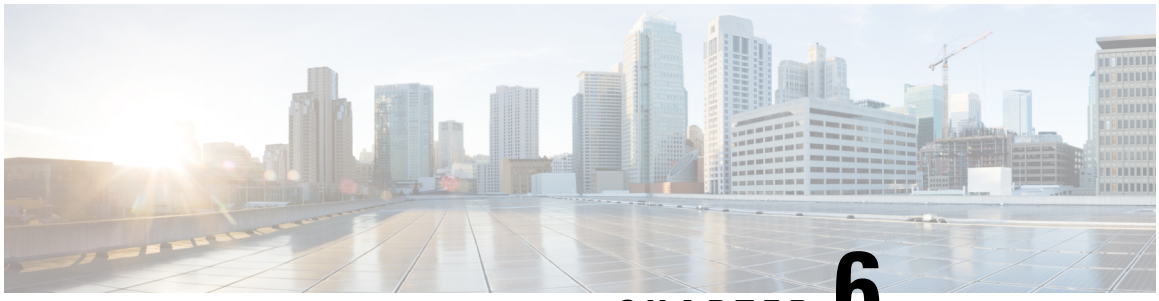
Note You can download the yaml files that are shown in this topic from the following link:

https://github.com/nginxinc/kubernetes-ingress/tree/master/examples/complete-example

For more information on a sample scenario of implementing Ingress, see Deploying Cafe Application with Ingress, on page 31.

Network Policies

Cisco Container Platform supports Kubernetes NetworkPolicies. The NetworkPolicies are independent of the underlying container network plugin.



CHAPTER 6

Deploying Applications on Kubernetes Clusters

Once you have created Kubernetes cluster using the Cisco Container Platform web interface, you can deploy containerized applications on top of it.

This chapter contains the following topics:

- Workflow of Deploying Applications, on page 29
- Downloading Kubeconfig File, on page 29
- Sample Scenarios, on page 30

Workflow of Deploying Applications

Task	Related Section
Create Kubernetes clusters using the Cisco Container Platform web interface.	Creating Kubernetes Clusters, on page 15
Download the kubeconfig file that contains the cluster information and the certificates required to access clusters.	Downloading Kubeconfig File, on page 29
Use the kubectl utility to deploy the application and test the scenario.	Sample Scenarios, on page 30

Downloading Kubeconfig File

You must download the cluster environment to access the Kubernetes clusters using command line tools such as `kubectl` or using APIs.

Step 1 From the left pane, click **Clusters**.

Step 2 Click the **Download** icon corresponding to the cluster environment that you want to download.

The `kubeconfig` file that contains the cluster information and the certificates required to access clusters is downloaded to your local system.

Sample Scenarios

This topic contains a few sample scenarios of deploying applications.

Deploying a Pod with Persistent Volume

This scenario describes deploying and configuring a pod with persistent volume.

Step 1 Go to the following URL:
https://github.com/kubernetes/examples/tree/master/staging/volumes/vsphere

Step 2 Download the following yaml files:

- vsphere-volume-sc-fast.yaml
- vsphere-volume-pvcsc.yaml
- vsphere-volume-pvcscpod.yaml

Step 3 Open the **kubectl** utility.

Step 4 Configure the Kubernetes cluster.

```
export KUBECONFIG=<Path to kubeconfig file>
```

Step 5 Create the storage class.

```
$ kubectl create -f vsphere-volume-sc-fast.yaml
```

Step 6 Verify if the storage cluster is created.

```
$ kubectl describe storageclass fast
```

```
Name: fast
IsDefaultClass: No
Annotations: <none>
Provisioner: kubernetes.io/vsphere-volume
Parameters: diskformat=zeroedthick,fstype=ext3
No events.```
```

Step 7 Create the persistent volume claim to request for storage.

```
$ kubectl create -f vsphere-volume-pvcsc.yaml
```

Step 8 Verify if the persistent volume claim (pvc) is created.

```
$ kubectl describe pvc pvcsc001
```

```
Name: pvcsc001
Namespace: default
StorageClass: fast
Status: Bound
Volume: pvc-83295256-f8e0-11e6-8263-005056b2349c
Labels: <none>
Capacity: 2Gi
Access Modes: RWO
Events:```
FirstSeen LastSeen Count From            SubObjectPath Type   Reason     Message
1m        1m       1     persistentvolume              Normal Provisioning Successfully provisioned
```

```
                                -controller                                Succeeded    volume pvc-83295256-f8e0
                                                                                        -11e6-8263-005056b2349c
                                                                                          using
kubernetes.io/vsphere-volume
```

Persistent Volume is automatically created and is bounded to this pvc.

Step 9 Verify if the persistent volume claim is created:

```
$ kubectl describe pv pvc-83295256-f8e0-11e6-8263-005056b2349c
```

```
Name: pvc-83295256-f8e0-11e6-8263-005056b2349c
Labels: <none>
StorageClass: fast
Status: Bound
Claim: default/pvcsc001
Reclaim Policy: Delete
Access Modes: RWO
Capacity: 2Gi
Message:
Source:
Type: vSphereVolume (a Persistent Disk resource in vSphere)
VolumePath: [datastore1] kubevols/kubernetes-dynamic-pvc-83295256-f8e0-11e6-8263-005056b2349c.vmdk
FSType: ext3
No events.
```

Note VMDK is created inside the *kubevols* folder in the datastore, which is specified in the `vSphere cloudprovider config` file that is created during the setup of Kubernetes cluster on vSphere.

Step 10 Create a pod that uses persistent volume claim with storage class.

```
$ kubectl create -f vsphere-volume-pvcscpod.yaml
```

Step 11 Verify if the pod is up and running.

```
$ kubectl get pod pvpod
```

```
NAME      READY     STATUS    RESTARTS    AGE
pvpod     1/1       Running   0           48m
```

Step 12 While the pod is starting, access vCenter and view the dynamically provisioned VMDKs of the pod.

Deploying Cafe Application with Ingress

This scenario describes deploying and configuring the *Cafe application* with Ingress rules to manage incoming HTTP requests. It uses a **Simple fanout with SSL termination Ingress**.

For more information on Ingress, see Load Balancing Kubernetes Services using NGINX, on page 25.

Step 1 Go to the following URL:

https://github.com/nginxinc/kubernetes-ingress/tree/master/examples/complete-example

Step 2 Download the following yaml files:

- `tea-rc.yaml`
- `tea-svc.yaml`

- coffee-rc.yaml
- coffee-svc.yaml
- cafe-secret.yaml
- cafe-ingress.yaml

Step 3 Open the **kubectl** utility.

Step 4 Obtain the IP address of the L7 NGINX load balancer that Cisco Container Platform automatically installs:

```
$ kubectl get pods --all-namespaces -l app=ingress-nginx -o wide

NAMESPACE     NAME            READY  STATUS  RESTARTS AGE  IP            NODE
ingressnginx  nginx-           1/1   Running  0       3d   10.10.45.235  test-clusterwc5729f9ce2
              ingresscontroller
              -66974b775-jnmpl
```

Step 5 Deploy the Cafe application.

a) Create the coffee and the tea services and replication controllers:

```
kubectl create -f tea-rc.yaml<br>
kubectl create -f tea-svc.yaml<br>
kubectl create -f coffee-rc.yaml<br>
kubectl create -f coffee-svc.yaml
```

Step 6 Configure load balancing.

a) Create a Secret with an SSL certificate and a key:

```
kubectl create -f cafe-secret.yaml
```

b) Create an Ingress Resource:

```
kubectl create -f cafe-ingress.yaml
```

Step 7 Verify that the Cafe application is deployed.

```
$ kubectl get pods -o wide

NAMESPACE       READY STATUS     RESTARTS  AGE   IP                NODE
coffee-rc-jb9sx 1/1   Running    0         3d    192.168.151.134   test-cluster-wb3d42afeff
coffee-rc-tjwgj 1/1   Running    0         3d    192.168.44.133    test-cluster-wc5729f9ce2
tea-rc-6qmvm    1/1   Running    0         3d    192.168.44.132    test-cluster-wc5729f9ce2
tea-rc-ms46j    1/1   Running    0         3d    192.168.151.132   test-cluster-wb3d42afeff
tea-rc-tnftv    1/1   Running    0         3d    192.168.151.133   test-cluster-wb3d42afeff
```

Step 8 Verify if the coffee and tea services are deployed.

```
$ kubectl get svc

NAME         TYPE        CLUSTER-IP    EXTERNAL-IP     PORT(S)     AGE
coffee-svc   ClusterIP   10.105.139.1  80/TCP          3d
kubernetes   ClusterIP   10.96.0.1     443/TCP         4d
tea-svc      ClusterIP   10.109.34.129 80/TCP          3d
```

Step 9 Verify if the Ingress is deployed.

```
$ kubectl describe ing

Name: cafe-ingress
Namespace: default
Address:
Default backend: default-http-backend:80 (<none>)
```

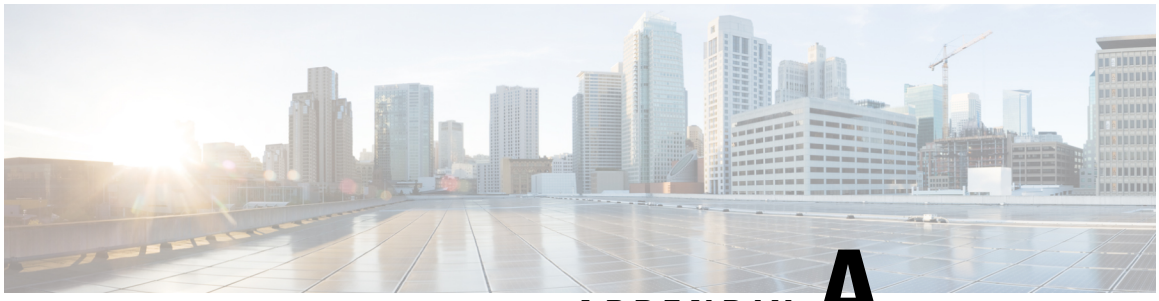
```
TLS: cafe-secret terminates cafe.example.com
Rules:

Host               Path       Backends
cafe.example.com
                   /tea       tea-svc:80 (<none>)
                   /coffee    coffee-svc:80 (<none>)

Annotations:
Events: <none>
```

Step 10 Test the application.

a) Access the load balancer IP address `10.10.45.235`, which is obtained in Step2.

b) Test if the Ingress controller is load balancing as expected.

```
$ curl --resolve cafe.example.com:443:10.10.45.235 https://cafe.example.com/coffee --insecure
<!DOCTYPE html>
...
<p><span>Server address:</span> <span>192.168.151.134:80</span></p>
...
$ curl --resolve cafe.example.com:443:10.10.45.235 https://cafe.example.com/coffee --insecure
<!DOCTYPE html>
...
<p><span>Server address:</span> <span>192.168.44.133:80</span></p>
...
```



APPENDIX A

User Privileges on vSphere

This appendix contains the following topic:

- User Privileges on vSphere, on page 35

User Privileges on vSphere

The following table provides the minimal set of privileges that are required by the vSphere user to execute the relevant operations in vCenter.

Roles	Privileges	Entities	Propagate to Children
manage-k8s-node-vms	Resource.AssignVMToPool System.Anonymous System.Read System.View VirtualMachine.Config.AddExistingDisk VirtualMachine.Config.AddNewDisk VirtualMachine.Config.AddRemoveDevice VirtualMachine.Config.RemoveDisk VirtualMachine.Inventory.Create VirtualMachine.Inventory.Delete	Cluster, Hosts, VM Folder	Yes
manage-k8s-volumes	Datastore.AllocateSpace Datastore.FileManagement System.Anonymous System.Read System.View	Datastore	No

Roles	Privileges	Entities	Propagate to Children
k8s-system-read-and-spbmprofile-view	StorageProfile.View System.Anonymous System.Read System.View	vCenter	No
ReadOnly	System.Anonymous System.Read System.View	Datacenter, Datastore Cluster, Datastore Storage Folder	Yes
ccp-register-extension	Extension.Register Extension.Unregister Extension.Update	vCenter	No

For more information on adding a provider profile, see Adding Provider Profile, on page 9.