

# Pivotal Container Service (PKS)®

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## Pivotal Container Service (PKS)

Pivotal Container Service (PKS) enables operators to provision, operate, and manage enterprise-grade Kubernetes clusters on Pivotal Cloud Foundry (PCF).

### Overview

PKS uses the [On-Demand Broker](#) to deploy [Cloud Foundry Container Runtime](#), a BOSH release that offers a uniform way to instantiate, deploy, and manage highly available Kubernetes clusters on a cloud platform using BOSH.

After operators install the PKS tile on the Ops Manager Installation Dashboard, developers can provision Kubernetes clusters using the PKS Command Line Interface (PKS CLI), and run container-based workloads on the clusters with the Kubernetes CLI, [kubectl](#).

### Features

PKS has the following features:

- **Kubernetes Compatibility:** Constant compatibility with current stable release of Kubernetes
- **Production-ready:** Highly available from applications to infrastructure, with no single points of failure
- **BOSH advantages:** Built-in health checks, scaling, auto-healing and rolling upgrades
- **Fully automated operations:** Fully automated deploy, scale, patch, and upgrade experience
- **Multi-cloud:** Consistent operational experience across multiple clouds
- **GCP APIs access:** The Google Cloud Platform (GCP) Service Broker gives applications access to the Google Cloud APIs, and Google Container Engine (GKE) consistency enables the transfer of workloads from or to GCP

### PKS Components

The PKS Controller contains the following components:

- An [On-Demand Broker](#) that deploys [Cloud Foundry Container Runtime](#) (CFCR), an open-source project that provides a solution for deploying and managing [Kubernetes](#) clusters using [BOSH](#).
- A Service Adapter
- The PKS API

NSX-T and Harbor are optional integrations for vSphere.

The GCP Service Broker is under development.

### Installing PKS

To install PKS, you must have a GCP or vSphere environment with Ops Manager v2.0 deployed. If you are installing PKS to vSphere, you can also configure integration with NSX-T and Harbor.

Consult the following table:

IaaS	Ops Manager v2.0	NSX-T	Harbor
vSphere	Required	Available	Available
GCP	Required	Not Available	Not Available

For information about the requirements for installing PKS, see the topic that corresponds to your cloud provider:

- [GCP Prerequisites and Resource Requirements](#)
- [vSphere Prerequisites and Resource Requirements](#)

## Managing PKS

See [Managing PKS](#) for information about managing PKS.

## Using PKS

After installing PKS on [GCP](#) or [vSphere](#) PKS, you can use the PKS Command Line Interface (PKS CLI) commands to do the following:

- [Create](#) a Kubernetes cluster
- [Retrieve the credentials and configuration](#) for a Kubernetes cluster so that you can deploy application workloads to the cluster with `kubect1`, the Kubernetes CLI
- [View](#) the list of running Kubernetes clusters
- [View](#) details about a Kubernetes cluster
- [View](#) the list of available plans for deploying a Kubernetes cluster
- [Resize](#) the number of worker nodes in a Kubernetes cluster
- [Access](#) the Dashboard for a Kubernetes cluster
- [Deploy](#) and access basic workloads
- [Delete](#) a Kubernetes cluster


See [Using PKS](#) for information about using PKS.

## Diagnostics and Troubleshooting PKS

See [Diagnosing and Troubleshooting PKS](#) for information about diagnosing and troubleshooting issues installing or using Pivotal Container Service (PKS).

## Prerequisites

In addition to the prerequisites detailed in the installation and usage topics, Pivotal Container Service (PKS) requires the following:

- [Installing the PKS CLI](#)
- [Installing the Kubernetes CLI](#) 

## Installing the PKS CLI

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This topic describes how to install the Pivotal Container Service Command Line Interface (PKS CLI).

To install the PKS CLI, follow the procedures for your operating system to download the PKS CLI from [Pivotal Network](#). Binaries are only provided for 64-bit architectures.

- [Install PKS CLI for Mac OS X](#)
- [Install PKS CLI for Linux](#)
- [Install PKS CLI for Windows](#)

### Install PKS CLI for Mac OS X

1. On the command line, run the following command to download the Mac OS X binary:

```
$ curl -LO https://network.pivotal.io/api/v2/products/pivotal-container-service/releases/43085/product_files/75334/download
```

2. Run the following command to make the PKS binary executable:

```
$ chmod +x pks
```

3. Move the binary into your `PATH`. For example:

```
$ mv pks /usr/local/bin/pks
```

### Install PKS CLI for Linux

1. On the command line, run the following command to download the Linux binary:

```
$ curl -LO https://network.pivotal.io/api/v2/products/pivotal-container-service/releases/43085/product_files/75337/download
```

2. Run the following command to make the PKS binary executable:

```
$ chmod +x pks
```

3. Move the binary into your `PATH`. For example:

```
$ mv pks /usr/local/bin/pks
```

### Install PKS CLI for Windows

1. On the command line, run the following command to download the Windows executable file:

```
$ curl -LO https://network.pivotal.io/api/v2/products/pivotal-container-service/releases/43085/product_files/75343/download
```

2. Move the executable into your `PATH`.

## Installing PKS on vSphere

This topic outlines the steps for installing Pivotal Container Service (PKS) on vSphere. See the following sections:

- [vSphere Prerequisites and Resource Requirements](#)
- [Deploying BOSH and Ops Manager to vSphere](#)
- [Configuring Ops Manager on vSphere](#)
- [Installing and Configuring PKS on vSphere](#)
- [Installing and Configuring PKS with NSX-T](#)
- [Installing and Integrating VMware Harbor Registry with PKS](#) [↗](#)

## vSphere Prerequisites and Resource Requirements

This topic describes the prerequisites and resource requirements for installing Pivotal Container Service (PKS) on vSphere with or without NSX-T integration.

To install PKS on vSphere, you must have a vSphere environment with Ops Manager v2.0 deployed. You can also configure integration with NSX-T and Harbor.

Consult the following table for compatibility information:

IaaS	Ops Manager v2.0	NSX-T	Harbor
vSphere	Required	Available	Available
GCP	Required	Not Available	Not Available

## General PKS Prerequisites

- Ops Manager v2.0



**Note:** If you have Pivotal Application Service (PAS) installed, Pivotal recommends installing PKS on a separate instance of Ops Manager v2.0. This improves the security of your PAS deployment by ensuring that only PKS-related infrastructure credentials are stored in PKS. Running PKS on a separate instance of Ops Manager v2.0 helps protect your non-PKS infrastructure credentials and prevent their exposure through PKS. For more information about the infrastructure credentials specified in the PKS tile, see the [Kubernetes Cloud Provider](#) section of the *Installing and Configuring PKS* topic.

- [PKS CLI](#)
- [Kubernetes CLI](#) [↗](#)
- (Optional) An external TCP or HTTPS load balancer to access the PKS API
- An external TCP or HTTPS load balancer for each created cluster

## Component Version Requirements

PKS on vSphere supports the following vSphere component versions:

Versions	Editions
<ul style="list-style-type: none"> <li>VMware vSphere 6.5 GA</li> <li>VMware vSphere 6.5 U1</li> </ul>	<ul style="list-style-type: none"> <li>vSphere Enterprise Plus</li> <li>vSphere with Operations Management Enterprise Plus</li> </ul>

## NSX-T Integration Component Version Requirements

Deploying NSX-T requires the additional following component versions:

Component	Version
VMware NSX-T	2.1

## Resource Requirements

Installing PKS deploys the following two virtual machines (VMs):

VM	CPU	RAM	Storage
Pivotal Container Service	1	4 GB	20 GB
Pivotal Ops Manager	1	8 GB	160 GB

Each Kubernetes cluster provisioned through PKS deploys the VMs listed below. If you deploy more than one Kubernetes cluster, you must scale your



allocated resources appropriately.

VM Name	Number	CPU Cores	RAM	Ephemeral Disk	Persistent Disk
master	1	2	4 GB	8 GB	5 GB
worker	1	2	4 GB	8 GB	10 GB

## NSX-T Integration Resource Requirements

Deploying NSX-T requires the additional following resources from your vSphere environment:

NSX-T Component	Instance Count	Memory per Instance	vCPU per Instance	Disk Space per Instance
NSX Manager Appliance	1	16 GB	4	140 GB
NSX Controllers	1 or 3	16 GB	4	120 GB
NSX-T Edge	1 up to 8	16 GB	8	120 GB

## Installing PKS on vSphere

To install PKS on vSphere, follow the procedures below:

1. [Deploying BOSH and Ops Manager to vSphere](#)
2. [Configuring Ops Manager Director on vSphere](#)
3. Install and configure the PKS tile using one of the following topics:
  - If you are installing PKS **with** NSX-T integration, follow the procedures in [Installing and Configuring PKS with NSX-T Integration](#).
  - If you are installing PKS **without** NSX-T integration, follow the procedures in [Installing and Configuring PKS on vSphere](#).
4. (Optional) [Installing and Integrating VMware Harbor Registry with PKS](#) [↗](#)

## Deploying BOSH and Ops Manager to vSphere

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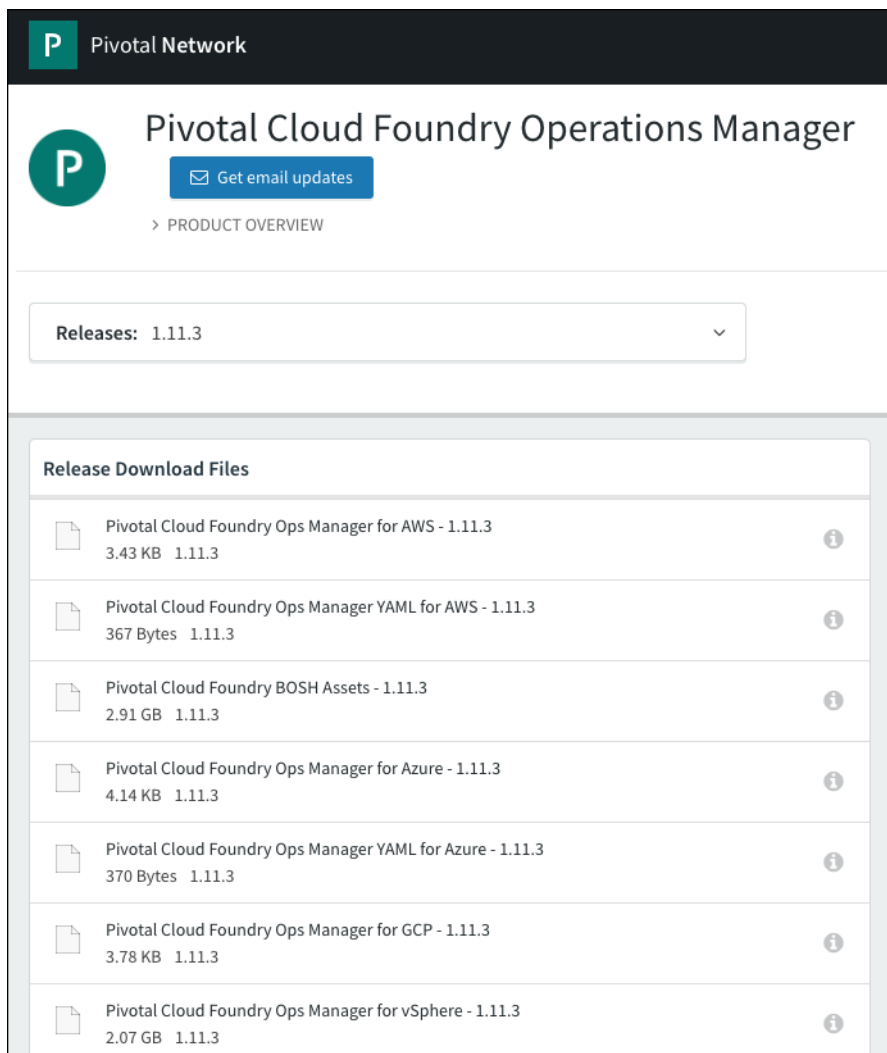
This topic provides instructions for deploying Ops Manager to VMware vSphere.

**Note:** With vSphere 6.5 and NSX-T 2.1, when initially deploying the Operations Manager OVF, you cannot connect directly to an NSX-T logical switch. You must first connect to a vSphere Standard (vSS) or vSphere Distributed Switch (vDS). A suggested approach is to connect to a VSS or VDS when deploying the OVF, but do not power the VM on. After the OVF deployment has completed, you can then connect the network interface to the appropriate NSX-T Logical switch and power the VM on to proceed with the install.

1. In order for Kubernetes to create load balancers and attach persistent disks to pods, you must create a service account in vCenter with sufficient permissions. You can apply the default [VMware Administrator System Role](#) to the service account to achieve the appropriate permission level.

For a full list of the permissions that BOSH requires in order to deploy Ops Manager, see [vSphere Service Account Requirements](#). Apply the permissions from this list if you require a service account with minimal privileges.

2. Refer to the [Known Issues](#) section of the *Ops Manager v2.0 Release Notes* topic before starting.
3. Download the [Pivotal Cloud Foundry](#) (PCF) Ops Manager .ova file at [Pivotal Network](#). Click the **Pivotal Cloud Foundry** region to access the PCF product page. Use the dropdown menu to select an Ops Manager release.

















**Pivotal Network**

**Pivotal Cloud Foundry Operations Manager**

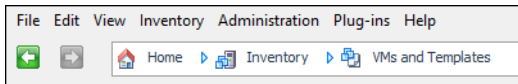
Get email updates

> PRODUCT OVERVIEW

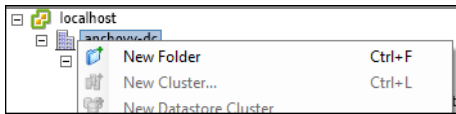
Releases: 1.11.3

Release Download Files		
	Pivotal Cloud Foundry Ops Manager for AWS - 1.11.3 3.43 KB 1.11.3	
	Pivotal Cloud Foundry Ops Manager YAML for AWS - 1.11.3 367 Bytes 1.11.3	
	Pivotal Cloud Foundry BOSH Assets - 1.11.3 2.91 GB 1.11.3	
	Pivotal Cloud Foundry Ops Manager for Azure - 1.11.3 4.14 KB 1.11.3	
	Pivotal Cloud Foundry Ops Manager YAML for Azure - 1.11.3 370 Bytes 1.11.3	
	Pivotal Cloud Foundry Ops Manager for GCP - 1.11.3 3.78 KB 1.11.3	
	Pivotal Cloud Foundry Ops Manager for vSphere - 1.11.3 2.07 GB 1.11.3	

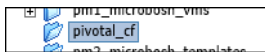
4. Log into vCenter.
5. Select the **VM and Templates** view.



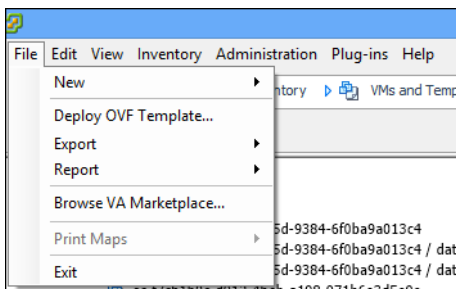
- Right click on your datacenter and select **New Folder**.



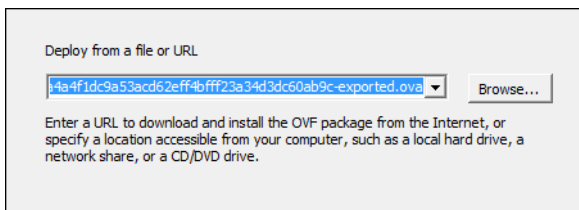
- Name the folder `pivotal_cf` and select it.



- Select **File > Deploy OVF Template**.



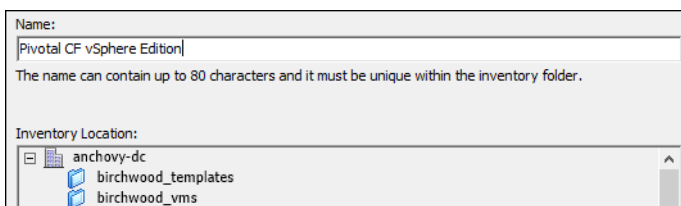
- Select the .ova file and click **Next**.



- Review the product details and click **Next**.

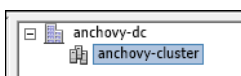
- Accept the license agreement and click **Next**.

- Name the virtual machine and click **Next**.



**Note:** The selected folder is the one you created.

- Select a vSphere cluster and click **Next**.



- If prompted, select a resource pool and click **Next**.

- If prompted, select a host and click **Next**.

**Note:** Hardware virtualization must be off if your vSphere host does not support VT-X/EPT. Refer to the [Installing Pivotal Cloud Foundry on vSphere](#) topic for more information.

Choose a specific host within the cluster.




On clusters that are configured with vSphere HA or Manual mode vSphere DRS, each virtual machine must be assigned to a specific host, even when powered off.

Select a host from the list below:

Host Name
172.16.64.2

16. Select a storage destination and click **Next**.

Select a destination storage for the virtual machine files:

VM Storage Profile: <input type="text"/> 						
Name	Drive Type	Capacity	Provisioned	Free	Type	Thin Provisioning
 anchovy-ds	Non-SSD	5.41 TB	1.62 TB	3.98 TB	VMFS5	Supported
 anchovy-ds-001	SSD	117.00 GB	215.56 GB	214.59 GB	VMFS5	Supported

17. Select a disk format and click **Next**. For information about disk formats, see [Provisioning a Virtual Disk](#).

**Warning:** Ops Manager v2.0 requires a Director VM with at least 8 GB memory.

Datstore: anchovy-ds

Available space (GB): 4076.0

☒ Thick Provision Lazy Zeroed  
☐ Thick Provision Eager Zeroed  
☐ Thin Provision

18. Select a network from the drop down list and click **Next**.

Source Networks	Destination Networks
Network 1	<div> <div>▼</div> <div> MattNetwork  VM Network  VM Network Private </div> </div>

19. Enter network information and passwords for the Ops Manager VM admin user.

Application properties - Ops Manager

Product: Ops Manager  
Version: 2.0-build.91  
Vendor: Pivotal

▼ Uncategorized 7 settings

IP Address: The IP address for the Ops Manager. Leave blank if DHCP is desired.  
10.85.53.16

Netmask: The netmask for the Ops Manager's network. Leave blank if DHCP is desired.  
255.255.255.0

Default Gateway: The default gateway address for the Ops Manager's network. Leave blank if DHCP is desired.  
10.85.53.1

DNS: The domain name servers for the Ops Manager (comma separated). Leave blank if DHCP is desired.  
10.87.8.10,10.87.8.11

NTP Servers: Comma-delimited list of NTP servers  
time1.stcf-app.com

Admin Password: This password is used to SSH into the Ops Manager. The username is 'ubuntu'.  
Enter password:   
Confirm password:

Custom Hostname: This will be set as the hostname on the VM. Default: 'pivotal-ops-manager'.

**Note:** Record this network information. The IP Address will be the location of the Ops Manager interface.


20. In the **Admin Password** field, enter a default password for the ubuntu user. If you do not enter a default password, your Ops Manager will not boot up.



Admin Password: This password is used to SSH into the Ops Manager. The username is 'ubuntu'.  
Enter password:   
Confirm password:

21. Click **Next**.

22. Check the **Power on after deployment** checkbox and click **Finish**. Once the VM boots, the interface is available at the IP address you specified.

**Note:** It is normal to experience a brief delay before the interface is accessible while the web server and VM start up.

23. Create a DNS entry for the IP address that you used for Ops Manager. You must use this fully qualified domain name when you log into Ops Manager in the [Installing Pivotal Cloud Foundry on vSphere](#)  topic.

 **Note:** Ops Manager security features require you to create a fully qualified domain name to access Ops Manager during the [initial configuration](#). 

## Next Steps

After you complete this procedure, follow the instructions in the [Configuring Ops Manager Director on vSphere](#) topic.

## Configuring Ops Manager on vSphere

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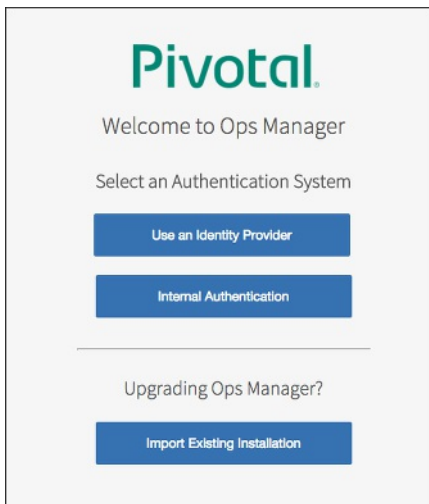
This topic describes how to configure the Ops Manager Director for VMware vSphere.

Before you begin this procedure, ensure that you have successfully completed all steps in the [Deploying BOSH and Ops Manager to vSphere](#) topic.

**Note:** You can also perform the procedures in this topic using the Ops Manager API. For more information, see the [Using the Ops Manager API](#) topic.

### Step 1: Set Up Ops Manager

1. Navigate to the fully qualified domain of your Ops Manager in a web browser.
2. The first time you start Ops Manager, you must choose one of the following:
  - [Use an Identity Provider](#): If you use an Identity Provider, an external identity server maintains your user database.
  - [Internal Authentication](#): If you use Internal Authentication, PCF maintains your user database.



### Use an Identity Provider

1. Log in to your IdP console and download the IdP metadata XML. Optionally, if your IdP supports metadata URL, you can copy the metadata URL instead of the XML.



2. Copy the IdP metadata XML or URL to the Ops Manager **Use an Identity Provider** log in page.

**Note:** The same IdP metadata URL or XML is applied for the BOSH Director. If you use a separate IdP for BOSH, copy the metadata XML or URL from that IdP and enter it into the BOSH IdP Metadata text box in the Ops Manager log in page.

3. Enter your **Decryption passphrase**. Read the **End User License Agreement**, and select the checkbox to accept the terms.

4. Your Ops Manager log in page appears. Enter your username and password. Click **Login**.

5. Download your SAML Service Provider metadata (SAML Relying Party metadata) by navigating to the following URLs:

- 5a. Ops Manager SAML service provider metadata: `https://OPS-MAN-FQDN:443/uaa/saml/metadata`
- 5b. BOSH Director SAML service provider metadata: `https://BOSH-IP-ADDRESS:8443/saml/metadata`

**Note:** To retrieve your `BOSH-IP-ADDRESS`, navigate to the **Ops Manager Director** tile > **Status** tab. Record the **Ops Manager Director** IP address.

6. Configure your IdP with your SAML Service Provider metadata. Import the Ops Manager SAML provider metadata from Step 5a above to your IdP. If your IdP does not support importing, provide the values below.

- Single sign on URL: `https://OPS-MAN-FQDN:443/uaa/saml/SSO/alias/OPS-MAN-FQDN`
- Audience URI (SP Entity ID): `https://OP-MAN-FQDN:443/uaa`
- Name ID: Email Address
- SAML authentication requests are always signed

7. Import the BOSH Director SAML provider metadata from Step 5b to your IdP. If the IdP does not support an import, provide the values below.

- Single sign on URL: `https://BOSH-IP:8443/saml/SSO/alias/BOSH-IP`
- Audience URI (SP Entity ID): `https://BOSH-IP:8443`
- Name ID: Email Address
- SAML authentication requests are always signed

8. Return to the **Ops Manager Director** tile, and continue with the configuration steps below.

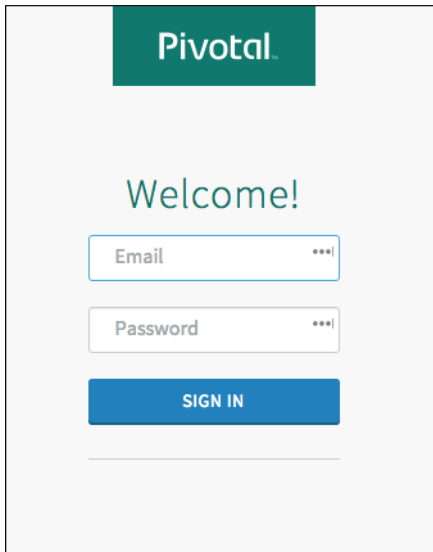
## Internal Authentication

1. When redirected to the **Internal Authentication** page, you must complete the following steps:

- Enter a **Username**, **Password**, and **Password confirmation** to create an Admin user.
- Enter a **Decryption passphrase** and the **Decryption passphrase confirmation**. This passphrase encrypts the Ops Manager datastore, and is not recoverable.
- If you are using an **HTTP proxy** or **HTTPS proxy**, follow the instructions in the [Configuring Proxy Settings for the BOSH CPI](#) topic.
- Read the **End User License Agreement**, and select the checkbox to accept the terms.

## Step 2: vCenter Config Page

1. Log in to Ops Manager with the Admin username and password you created in the previous step.



The image shows a login interface for Pivotal. At the top, there is a dark teal header with the word "Pivotal" in white. Below the header, the word "Welcome!" is displayed in a teal font. Underneath, there are two input fields: "Email" and "Password", both with placeholder text and a small "xxx|" icon on the right. Below these fields is a blue button labeled "SIGN IN". At the bottom, there is a thin horizontal line.

2. Click the **Ops Manager Director** tile.



3. Select **vCenter Config**.



[Installation Dashboard](#)

## Ops Manager Director

Settings Status Credentials

**vCenter Config**

☒ vCenter Config  
☒ Director Config  
☒ Create Availability Zones  
☒ Create Networks  
☒ Assign AZs and Networks  
☒ Security  
☒ Syslog  
☒ Resource Config

### vCenter Config

vCenter Host\*

vCenter Username\*

vCenter Password\*  
  
[Change](#)

Datacenter Name\*

Virtual Disk Type\*

Ephemeral Datastore Names (comma delimited)\*

NOTE: Removing an Ephemeral Datastore after an initial deploy can result in a system outage and/or data loss.

Persistent Datastore Names (comma delimited)\*

NOTE: Removing a Persistent Datastore after an initial deploy can result in a system outage and/or data loss.

☒ Standard vCenter Networking  
☐ NSX Networking

NSX Address\*

NSX Username\*

NSX Password\*

NSX CA Cert

Optional custom CA certificate(s)

VM Folder\*

Template Folder\*

Disk path Folder\*

[Save](#)

#### 4. Enter the following information:

- **vCenter Host:** The hostname of the vCenter that manages ESXi/vSphere.
- **vCenter Username:** A vCenter username with create and delete privileges for virtual machines (VMs) and folders.
- **vCenter Password:** The password for the vCenter user specified above.
- **Datacenter Name:** The name of the datacenter as it appears in vCenter.
- **Virtual Disk Type:** The Virtual Disk Type to provision for all VMs. For guidance on the virtual disk type to select, see [Provisioning a Virtual Disk in vSphere](#).
- **Ephemeral Datastore Names (comma delimited):** The names of the datastores that store ephemeral VM disks deployed by Ops Manager.
- **Persistent Datastore Names (comma delimited):** The names of the datastores that store persistent VM disks deployed by Ops Manager.
- **VM Folder:** The vSphere datacenter folder (default: `pcf_vms`) where Ops Manager places VMs.
- **Template Folder:** The vSphere datacenter folder (default: `pcf_templates`) where Ops Manager places VMs.
- **Disk path Folder:** The vSphere datastore folder (default: `pcf_disk`) where Ops Manager creates attached disk images. You must not nest this

folder.

5. Select a network configuration from one of the following:
  - **Standard vCenter Networking:** This is the default option when upgrading Ops Manager.
  - **NSX Networking:** Select this option to enable VMware NSX Network Virtualization.

6. Configure NSX networking by entering the following information:
  - **NSX Mode:** Select either **NSX-V** or **NSX-T**.
  - **NSX Address:** The address of the NSX Manager.
  - **NSX Username:** The username to connect to the NSX Manager.
  - **NSX Password:** The password for the username specified above.
  - **NSX CA Cert:** A CA certificate in PEM format that authenticates to the NSX server. Provide the fully qualified domain name if the NSX Manager uses a self-signed SSL certificate.

**Note:** To update NSX security group and load balancer information, see the [Updating NSX Security Group and Load Balancer Information](#) topic.

7. Click **Save**.

**Note:** After your initial deployment, you will not be able to edit the VM Folder, Template Folder, and Disk path Folder names.

## Step 3: Director Config Page

1. Select **Director Config**.

## Director Config

NTP Servers (comma delimited)\*

JMX Provider IP Address

Bosh HM Forwarder IP Address

☐ Enable VM Resurrector Plugin

☐ Enable Post Deploy Scripts

☐ Recreate all VMs


This will force BOSH to recreate all VMs on the next deploy. Persistent disk will be preserved

☐ Enable bosh deploy retries


This will attempt to re-deploy a failed deployment up to 5 times.

☐ Keep Unreachable Director VMs

- In the **NTP Servers (comma delimited)** field, enter your NTP server addresses.
- Leave the **JMX Provider IP Address** field blank.

 **Note:** Starting from PCF v2.0, BOSH-reported system metrics are available in the Loggregator Firehose by default. Therefore, if you continue to use PCF JMX Bridge for consuming them outside of the Firehose, you may receive duplicate data. To prevent this, leave the **JMX Provider IP Address** field blank.

- Leave the **Bosh HM Forwarder IP Address** field blank.

 **Note:** Starting from PCF v2.0, BOSH-reported system metrics are available in the Loggregator Firehose by default. Therefore, if you continue to use the BOSH HM Forwarder for consuming them, you may receive duplicate data. To prevent this, leave the **Bosh HM Forwarder IP Address** field blank.

- Select the **Enable VM Resurrector Plugin** to enable Ops Manager Resurrector functionality.
- Select **Enable Post Deploy Scripts** to run a post-deploy script after deployment. This script allows the job to execute additional commands against a deployment.
- Select **Recreate all VMs** to force BOSH to recreate all VMs on the next deploy. This process does not destroy any persistent disk data.
- Select **Enable bosh deploy retries** if you want Ops Manager to retry failed BOSH operations up to five times.
- Select **Keep Unreachable Director VMs** if you want to preserve Ops Manager Director VMs after a failed deployment for troubleshooting purposes.

10. Select **HM Pager Duty Plugin** to enable Health Monitor integration with PagerDuty.
- **Service Key:** Enter your API service key from PagerDuty.
  - **HTTP Proxy:** Enter an HTTP proxy for use with PagerDuty.

11. Select **HM Email Plugin** to enable Health Monitor integration with email.
- **Host:** Enter your email hostname.
  - **Port:** Enter your email port number.
  - **Domain:** Enter your domain.
  - **From:** Enter the address for the sender.
  - **Recipients:** Enter comma-separated addresses of intended recipients.
  - **Username:** Enter the username for your email server.
  - **Password:** Enter the password for your email server.
  - **Enable TLS:** Select this checkbox to enable Transport Layer Security.


12. Select a **Blobstore Location** to either configure the blobstore as an internal server or an external endpoint. Because the internal server is unscalable and less secure, Pivotal recommends you configure an external blobstore.

**Note:** After you deploy Ops Manager, you cannot change the blobstore location.

- **Internal:** Select this option to use an internal blobstore. Ops Manager creates a new VM for blob storage. No additional configuration is required.
- **S3 Compatible Blobstore:** Select this option to use an external S3-compatible endpoint. Follow the procedures in [Sign up for Amazon S3](#) and [Creating a Bucket](#) from the AWS documentation. When you have created an S3 bucket, complete the following steps:
  1. **S3 Endpoint:** Navigate to the [Regions and Endpoints](#) topic in the AWS documentation. Locate the endpoint for your region in the **Amazon Simple Storage Service (S3)** table and construct a URL using your region's endpoint. For example, if you are using the `us-west-2` region, the URL you create would be <https://s3-us-west-2.amazonaws.com>. Enter this URL into the **S3 Endpoint** field in

Ops Manager.

2. **Bucket Name:** Enter the name of the S3 bucket.
3. **Access Key** and **Secret Key:** Enter the keys you generated when creating your S3 bucket.
4. Select **V2 Signature** or **V4 Signature**. If you select **V4 Signature**, enter your **Region**.

 **Note:** AWS recommends using Signature Version 4. For more information about AWS S3 Signatures, see the [Authenticating Requests](#) documentation.

- **GCS Blobstore:** Select this option to use an external Google Cloud Storage (GCS) endpoint. To create a GCS bucket, you will need a GCS account. Then follow the procedures in [Creating Storage Buckets](#). When you have created a GCS bucket, complete the following steps:
  1. **Bucket Name:** Enter the name of your GCS bucket.
  2. **Storage Class:** Select the storage class for your GCS bucket. See [Storage Classes](#) in the GCP documentation for more information.
  3. **Service Account Key:** Follow the steps in the [Set Up an IAM Service Account](#) section to download a JSON file with a private key. Then enter the contents of the JSON file into the field.

Blobstore Location

☒ Internal
 ☐ S3 Compatible Blobstore

S3 Endpoint\*

Bucket Name\*

Access Key\*

Secret Key\*

☒ V2 Signature
 ☐ V4 Signature

Region\*

☐ GCS Blobstore

Bucket Name\*

Storage Class\*

Regional

Service Account Key\*

13. By default, PCF deploys and manages an **Internal** database for you. If you choose to use an **External MySQL Database**, complete the associated fields with information obtained from your external MySQL Database provider: **Host**, **Port**, **Username**, **Password**, and **Database**.

Database Location  
☒ Internal  
☐ External MySQL Database  
Host\*  
  
Port\*  
  
Username\*  
  
Password\*  
  
Database\*

14. (Optional) **Director Workers** sets the number of workers available to execute Director tasks. This field defaults to `5`.
15. (Optional) **Max Threads** sets the maximum number of threads that the Ops Manager Director can run simultaneously. For vSphere, the default value is `32`. Leave the field blank to use this default value. Pivotal recommends that you use the default value unless doing so results in rate limiting or errors on your IaaS.
16. (Optional) To add a custom URL for your Ops Manager Director, enter a valid hostname in **Director Hostname**. You can also use this field to configure [a load balancer in front of your Ops Manager Director](#).
17. Ensure the **Disable BOSH DNS server for troubleshooting purposes** checkbox is not selected.

**Note:** BOSH DNS must be enabled in all PKS deployments. If PAS and PKS are running on the same instance of Ops Manager, you cannot use the opt-out feature of BOSH DNS for your PAS without breaking PKS. If you want to opt out of BOSH DNS in your PAS deployment, install the tile on a separate instance of Ops Manager. For more information about opting out of BOSH DNS, see [this KB article](#) and [Ops Manager v2.0 Release Notes](#).

18. (Optional) To set a custom banner that users see when logging in to the Director using SSH, enter text in the **Custom SSH Banner** field.

☐ Disable BOSH DNS server for troubleshooting purposes  
Custom SSH Banner

19. Click **Save**.

**Note:** After your initial deployment, you will not be able to edit the Blobstore and Database locations.

## Step 4: Create Availability Zone Page

Ops Manager Availability Zones correspond to your vCenter clusters and resource pools. Multiple Availability Zones allow you to provide high-availability and load balancing to your applications. When you run more than one instance of an application, Ops Manager balances those instances across all of the Availability Zones assigned to the application. At least three availability zones are recommended for a highly available installation of your chosen runtime.

## 1. Select **Create Availability Zones**.

**Create Availability Zones**

Availability Zones  
Clusters and resource pools to which you will deploy Pivotal products

▼ first-az

Name\*

first-az

A unique name for this availability zone

Clusters

Cluster

hinterlands-1

Resource Pool

bulldog

Save

## 2. Use the following steps to create one or more Availability Zones for your applications to use:

- Click **Add**.
- Enter a unique **Name** for the Availability Zone.
- Enter the name of an existing vCenter **Cluster** to use as an Availability Zone.
- **(Optional)** Enter the name of a **Resource Pool** in the vCenter cluster that you specified above. The jobs running in this Availability Zone share the CPU and memory resources defined by the pool.
- **(Optional)** Click **Add Cluster** to create another set of **Cluster** and **Resource Pool** fields. You can add multiple clusters. Click the trash icon to delete a cluster. The first cluster cannot be deleted.



**Note:** For more information about using availability zones in vSphere, see the [Understanding Availability Zones in VMware Installations](#) topic.

## 3. Click **Save**.

## Step 5: Create Networks Page

### 1. Select **Create Networks**.

## Create Networks

Warning: Pivotal recommends keeping the IP settings throughout the life of your installation. Ops Manager may prevent you from changing them in the future. Contact Pivotal support for help completing such a change.

### Verification Settings

☐ Enable ICMP checks

### Networks

Add Network

One or many IP ranges upon which your products will be deployed

▼ Deadmines



Name\*

Deadmines



### Subnets

Add Subnet

vSphere Network Name\*

deadmines

CIDR\*

10.85.37.0/24

Reserved IP Ranges

10.85.37.1-10.85.37.10

Ops Manager will not deploy VMs to any IP in this range, e.g. '10.9.9.0-10.9.9.100, 10.9.9.200-10.9.9.255'

DNS\*

8.8.8.8

One or more Domain Name Servers used by VMs

Gateway\*

10.85.37.1

Availability Zones\*

☒ AZ1

Save


2. Select **Enable ICMP checks** to enable ICMP on your networks. Ops Manager uses ICMP checks to confirm that components within your network are reachable.

3. Use the following steps to create one or more Ops Manager networks:



- Click **Add Network**.
- Enter a unique **Name** for the network.
- Click **Add Subnet** to create one or more subnets for the network.
- Enter the full path and **vSphere Network Name** as it displays in vCenter. For example, enter `YOUR-DIRECTORY-NAME/YOUR-NETWORK-NAME`. If your vSphere Network Name contains a forward slash character, replace the forward slash with the URL-encoded forward slash character `%2F`.
- For **CIDR**, enter a valid CIDR block in which to deploy VMs. For example, enter `192.0.2.0/24`.
- For **Reserved IP Ranges**, enter any IP addresses from the **CIDR** that you want to blacklist from the installation. Ops Manager will not deploy VMs to any address in this range.
- Enter your **DNS** and **Gateway** IP addresses.
- Select which **Availability Zones** to use with the network.

4. Click **Save**.

 **Note:** Multiple networks allow you to place vCenter on a private network and the rest of your deployment on a public network. Isolating vCenter in this manner denies access to it from outside sources and reduces possible security vulnerabilities.

 **Note:** If you are using the Cisco Nexus 1000v Switch, refer to the [Using the Cisco Nexus 1000v Switch with Ops Manager](#) topic for more information.

## Step 6: Assign AZs and Networks Page

1. Select **Assign AZs and Networks**.

### Assign AZs and Networks

The Ops Manager Director is a single instance.

Choose the availability zone in which to place that instance. It is highly recommended that you backup this VM on a regular basis to preserve settings.

Singleton Availability Zone

AZ1

Network

Deadmines

Save

2. Use the drop-down menu to select a **Singleton Availability Zone**. The Ops Manager Director installs in this Availability Zone.

3. Use the drop-down menu to select a **Network** for your Ops Manager Director.

4. Click **Save**.

## Step 7: Security Page

1. Select **Security**.

# Security

## Trusted Certificates

-----BEGIN CERTIFICATE-----  
TH [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

These certificates enable BOSH-deployed components to trust a custom root certificate.

Generate VM passwords or use single password for all VMs

- ☒ Generate passwords
- ☐ Use default BOSH password

**Save**

2. In **Trusted Certificates**, enter a custom certificate authority (CA) certificate to insert into your organization's certificate trust chain. This feature enables all BOSH-deployed components in your deployment to trust a custom root certificate. If you want to use Docker Registries for running app instances in Docker containers, use this field to enter your certificate for your private Docker Registry. See the [Using Docker Registries](#) topic for more information.
3. Choose **Generate passwords** or **Use default BOSH password**. Pivotal recommends that you use the **Generate passwords** option for greater security.
4. Click **Save**. To view your saved Director password, click the **Credentials** tab.

## Step 8: Syslog Page

1. Select **Syslog**.

## Syslog

Do you want to configure Syslog for Bosh Director?

☐ No
 ☒ Yes

Address\*

The address or host for the syslog server

Port\*

Transport Protocol\*

TCP

☐ Enable TLS

Permitted Peer\*

SSL Certificate\*

Save

- (Optional) To send BOSH Director system logs to a remote server, select **Yes**.
- In the **Address** field, enter the IP address or DNS name for the remote server.
- In the **Port** field, enter the port number that the remote server listens on.
- In the **Transport Protocol** dropdown menu, select **TCP**, **UDP**, or **REL**. This selection determines which transport protocol is used to send the logs to the remote server.
- (Optional) Mark the **Enable TLS** checkbox to use TLS encryption when sending logs to the remote server.
  - In the **Permitted Peer** field, enter either the name or SHA1 fingerprint of the remote peer.
  - In the **SSL Certificate** field, enter the SSL certificate for the remote server.
- Click **Save**.

## Step 9: Resource Config Page


- Select **Resource Config**.


Resource Config

JOB	INSTANCES	PERSISTENT DISK TYPE	VM TYPE
Ops Manager Director	Automatic: 1	Automatic: 50 GB	Automatic: medium.disk (cpu: 2, ram: 4 GB
Master Compilation Job	Automatic: 4	None	Automatic: large.cpu (cpu: 4, ram: 4 GB, di

Save

- Adjust any values as necessary for your deployment. Under the **Instances**, **Persistent Disk Type**, and **VM Type** fields, choose **Automatic** from the drop-down menu to allocate the recommended resources for the job. If the **Persistent Disk Type** field reads **None**, the job does not require persistent disk space.

 **Note:** Ops Manager requires a Director VM with at least 8 GB memory.

 **Note:** If you set a field to **Automatic** and the recommended resource allocation changes in a future version, Ops Manager automatically uses the updated recommended allocation.

- Click **Save**.

## Step 10: (Optional) Add Custom VM Extensions

Use the Ops Manager API to add custom properties to your VMs such as associated security groups and load balancers. For more information, see [Managing Custom VM Extensions](#).

## Step 11: Complete the Ops Manager Director Installation

- Click the **Installation Dashboard** link to return to the Installation Dashboard.
- Click **Apply Changes** on the right navigation.

## Next Steps

To install PKS on vSphere **with** NSX-T integration, perform the procedures in [Installing and Configuring PKS with NSX-T Integration](#).

To install PKS on vSphere **without** NSX-T integration, perform the procedures in [Installing and Configuring PKS](#).

To use Harbor to store and manage container images, see the VMware Harbor Registry [documentation](#).

## Installing and Configuring PKS on vSphere

Page last updated:

This topic describes how to install and configure Pivotal Container Service (PKS) on vSphere without NSX-T integration.

Before performing the procedures in this topic, consult the requirements in the \* [vSphere Prerequisites and Resource Requirements](#) topic.

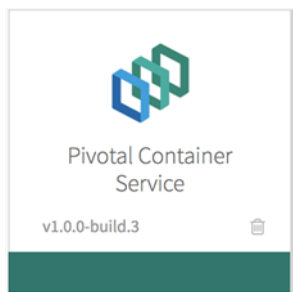
### Step 1: Install PKS

Perform the following steps to install PKS:

1. Download the product file from [Pivotal Network](#).
2. Navigate to `https://YOUR-OPS-MANAGER-FQDN/` in a browser to log in to the Ops Manager Installation Dashboard.
3. From the **Director Config** page, configure the following settings:
  - Select **Enable Post Deploy Scripts**.
  - Clear the **Disable BOSH DNS server for troubleshooting purposes** checkbox.
4. Click **Apply Changes**.
5. Click **Import a Product** to upload the product file.
6. Under **Pivotal Container Service** in the left column, click the plus sign to add this product to your staging area.

### Step 2: Configure PKS

Click the **Pivotal Container Service** tile to start the configuration process.



### Assign AZs and Networks

Perform the following steps:

1. Click **Assign AZs and Networks**.

Place singleton jobs in

☒ us-west-2a

☐ us-west-2b

☐ us-west-2c

Balance other jobs in

☐ us-west-2a

☒ us-west-2b

☐ us-west-2c

Network


pcf-management-network


Service Network

pcf-services-network

Save

2. Select an availability zone (AZ) for your singleton jobs and one or more AZs to balance other jobs in.

 **Note:** If you upgrade PKS, you must place singleton jobs in the AZ you selected when you first installed the PKS tile. You cannot move singleton jobs to another AZ.

 **Note:** In PKS, Pivotal Container Service is a singleton job. This broker VM enables the creation of PKS clusters through the PKS CLI.

3. Under **Network**, select a subnet for the PKS broker.
4. Under **Service Network**, select a subnet for the on-demand service instances created by the PKS broker.
5. Click **Save**.

## PKS API


Perform the following steps:

1. Click **PKS API**.
2. Under **Certificate**, provide your own certificate or have Ops Manager generate one. To generate a new certificate and key, enter a wildcard domain you own. For example, `*.pks.pcfvsphere.mydomain.com`.
3. Under **Generate RSA Certificate**, provide the domain names that you want your certificate to have. The domain names should contain the hostname you intend to use for accessing the PKS API service and UAA.
4. Click **Save**.

## Plans

To activate a plan, perform the following steps:

1. Click the **Plan 1**, **Plan 2**, or **Plan 3** tab.

 **Note:** A plan defines a set of resource types used for deploying clusters. You can configure up to three plans.

2. Select **Active** to activate the plan and make it available to developers deploying clusters.
3. Under **Name**, provide a unique name for the plan.
4. Under **Description**, edit the description as needed. The plan description appears in the Services Marketplace, which developers can access by using

PKS CLI.

5. Under **Default Cluster Authorization Mode**, select an authentication mode for the Kubernetes clusters. For more information, see the [RBAC Support in Kubernetes](#) blog post.
6. Under **AZ placement**, select an AZ for the Kubernetes clusters deployed by PKS.
7. Under **ETCD/Master VM Type**, select the type of VM to use for Kubernetes etcd and master nodes.
8. Under **Master Persistent Disk Type**, select the size of the persistent disk for the Kubernetes master VM.
9. Under **Worker VM Type**, select the type of VM to use for Kubernetes worker nodes.
10. Under **Worker Persistent Disk Type**, select the size of the persistent disk for the Kubernetes worker nodes.
11. Under **Worker Node Instances**, select the default number of Kubernetes worker nodes to provision for each cluster.
12. Under **Errand VM Type**, select the size of the VM where the errand will run. The smallest instance possible is sufficient, as the only errand running on this VM is the one that applies the **Default Cluster App** YAML configuration.
13. (Optional) Under **(Optional) Add-ons - Use with caution**, enter additional YAML configuration to [add custom workloads](#) to each cluster in this plan. You can specify multiple files using `---` as a separator.
14. If you want users to be able to create [pods with privileged containers](#), select the **Enable Privileged Containers - Use with caution** option.
15. Click **Save**.

To deactivate a plan, perform the following steps:

1. Click the **Plan 1**, **Plan 2**, or **Plan 3** tab.
2. Select **Plan Inactive**.
3. Click **Save**.

## Kubernetes Cloud Provider

Perform the following steps:

1. Click **Kubernetes Cloud Provider**.
2. Under **Choose your IaaS**, select vSphere.
3. Perform the steps specific to vSphere.
  - Ensure the values match those in the **vCenter Config** section of the **Ops Manager** tile:

Choose your IaaS\*

☐ GCP
 ☒ vSphere

vCenter Credentials \*

Username

Password

vCenter Host \*

Datacenter Name \*

Datastore Name \*

Stored VM Folder \*

1. Enter your **vCenter Credentials**.
2. Enter your **vCenter Host**, such as `vcenter.cf-example.com`.
3. Enter your **Datacenter Name**, such as `cf-example-dc`.
4. Enter your **Datastore Name**, such as `cf-example-ds`.
5. Enter the **Stored VM Folder** so that the persistent stores know where to find the VMs. To retrieve the name of the folder, navigate to your Ops Manager Director tile, click **vCenter Config**, and locate the value for **VM Folder**. The default folder name is `pcf_vms`.

4. Click **Save**.

## Networking


Perform the following steps:

1. Click **Networking**.
2. Under **Network**, select the Container Network Interface to use.
  - For **Flannel**, no additional fields are required.
  - For **NSX-T**, see [Installing and Configuring PKS with NSX-T Integration](#).
3. Click **Save**.

## UAA

Perform the following steps:

1. Click **UAA**.
2. Enter the URL you use to access UAA.

 **Note:** This must match the wildcard domain provided when generating the PKS API certificate in the [PKS API](#) section, or in the SAN for the certificate if you provided your own.

3. Enter the time (in seconds) for the PKS CLI access token lifetime.
4. Enter the time (in seconds) for the PKS CLI refresh token lifetime.



## (Optional) Syslog

You can designate an external syslog endpoint for PKS component and cluster log messages.

To specify the destination for PKS log messages, perform the following steps:

1. Click **Syslog**.
2. Select **Yes** to configure syslog forwarding.
3. Enter the destination syslog endpoint.
4. Enter the destination syslog port.
5. Select a transport protocol for log forwarding.
6. (Optional) If you select TLS to forward encrypted logs, perform the following steps:
  - a. Provide the accepted fingerprint (SHA1) or name of remote peer. For example, `*.YOUR-LOGGING-SYSTEM.com`.
  - b. Provide a TLS certificate for the destination syslog endpoint.



**Note:** You do not need to provide a new certificate if the TLS certificate for the destination syslog endpoint is signed by a Certificate Authority (CA) in your BOSH certificate store.

## Errands

Errands are scripts that run at designated points during an installation.

To configure when post-deploy and pre-delete errands for PKS are run, make a selection in the dropdown next to the errand. For a typical PKS deployment, Pivotal recommends that you leave the default settings.

For more information about errands and their configuration state, see [Managing Errands in Ops Manager](#).

## (Optional) Resource Config

To modify the resource usage of PKS, click **Resource Config** and edit the **PKS on-demand broker** job.

## (Optional) Stemcell

To edit the stemcell configuration, click **Stemcell**. Click **Import Stemcell** to import a new stemcell.

PKS uses floating stemcells. Floating stemcells allow upgrades to the minor versions of stemcells but not the major versions. For example, a stemcell can float from `1234.56` to `1234.99` but not from `1234.991` to `1235.0`. For more information on floating stemcells, see the [Understanding Floating Stemcells](#) topic.



**WARNING:** Because PKS uses floating stemcells, updating the PKS tile with a new stemcell triggers the rolling of every VM in each cluster. Also, updating other product tiles in your deployment with a new stemcell causes the PKS tile to roll VMs. This rolling is enabled by the **Upgrade all clusters errand**. Pivotal recommends that you keep this errand turned on because automatic rolling of VMs ensures that all deployed cluster VMs are patched. However, automatic rolling can cause downtime in your deployment.

## Step 3: Apply Changes

After configuring the tile, return to the Ops Manager Installation Dashboard and click **Apply Changes** to deploy the tile.

## Step 4: Retrieve PKS API Endpoint

You must share the PKS API endpoint to allow your organization to use the API to create, update, and delete clusters.

When an operator creates a cluster, they provide an IP address for the Kubernetes master host, then point the load balancer to the newly created cluster. If you use a load balancer as a service (LBaaS) tool, your LBaaS may manage cluster creation and configuration.

See [Using PKS](#) for more information.

Perform the following steps to retrieve the PKS API endpoint:

1. Navigate to the Ops Manager Installation Dashboard.
2. Click the PKS tile.
3. Click the **Status** tab and locate the IP address of the PKS API endpoint. This is the endpoint that developers use to create and manage clusters.

## Step 5: Configure External Load Balancer

Configure your external TCP or HTTPS load balancer to resolve to the domain name used in the certificate you provided during the [PKS API](#) section of the tile configuration. Your external load balancer forwards traffic to the PKS API endpoint on port 9021 and the UAA endpoint on port 8443.

The load balancer should be configured with:

- The IP address from [Step 4: Retrieve PKS API Endpoint](#)
- Ports 8443 and 9021
- The HTTPS or TCP protocol



## Step 1: Pre-allocate Network Subnets

Create and assign the following network CIDRs in the IPv4 address space according to the instructions in the [NSX-T documentation](#). Ensure that they are routable in your environment.


- **VTEP CIDR(s):** One or more of these networks will host your GENEVE Tunnel Endpoints on your NSX Transport Nodes. Size the network(s) to support all of your expected Host and Edge Transport Nodes. For example, a CIDR of `192.168.1.0/24` will provide 254 usable IPs. This will be used when creating the `ip-pool-vteps` in Step 3.
- **PKS MANAGEMENT CIDR:** This small network will be used for NAT access to PKS management components such as Ops Manager and the PKS Service VM. For example, a CIDR of `10.172.1.0/28` will provide 14 usable IPs.
- **PKS LB CIDR:** This network will provide your load balancing address space for each Kubernetes cluster created by PKS. The network will also provide IP addresses for Kubernetes API access and Kubernetes exposed services. For example, `10.172.2.0/25` will provide 126 usable IPs. This network will be used when creating the `ip-pool-vips` described in [Create NSX Network Objects](#).

Refer to the instructions in the [NSX-T documentation](#) to ensure that your network topology enables the following communications:

- vCenter, NSX-T components, and ESXi hosts must be able to communicate with each other.
- The Ops Manager Director VM must be able to communicate with vCenter and the NSX Manager.
- The Ops Manager Director VM must be able to communicate with all nodes in all Kubernetes clusters.
- Each Kubernetes cluster deployed by PKS will deploy a NCP pod that must be able to communicate with the NSX Manager.

## Step 2: Deploy NSX-T

Deploy NSX-T according to the instructions in the [NSX-T documentation](#).

 **Note:** In general, accept default settings unless instructed otherwise.

1. [Deploy](#) the NSX Manager.
2. [Deploy](#) NSX Controllers.
3. [Join](#) the NSX Controllers to the NSX Manager and [initialize](#) the Control Cluster.
4. [Add](#) your ESX host(s) to the NSX-T Fabric. Each host must have at least one **free nic/vmnic** not already used by other vSwitches on the ESX host for use with NSX Host Transport Nodes.
5. [Deploy](#) NSX Edge VMs (recommended at least two). Each deployed NSX Edge VM will require free resources in your vSphere Environment to provide 8 vCPU, 16 GB of RAM, and 120 GB of storage. When deploying, you must connect the vNICs of the NSX Edge VMs to an appropriate PortGroup for your environment by completing the following steps:
  - a. Connect the first Edge interface to your environment's PortGroup/VLAN where your Edge Management IP can route and communicate with the NSX Manager.
  - b. Connect the second Edge interface to your environment's PortGroup/VLAN where your T0 uplink interface will be located. Your **PKS MANAGEMENT CIDR** and **PKS LB CIDR** should be routable to this PortGroup.
  - c. Connect the third Edge interface to your environment's PortGroup/VLAN where your GENEVE VTEPs can route and communicate with each other. Your **VTEP CIDR** should be routable to this PortGroup.
  - d. [Join](#) the NSX Edge VMs to the NSX-T Fabric.

## Step 3: Create the NSX-T Objects Required for PKS


Create the NSX-T objects (network objects, logical switches, NSX Edge, and logical routers) needed for PKS deployment according to the instructions in the [NSX-T documentation](#).

### Create NSX Network Objects

1. [Create](#) two NSX IP pools:
  - One NSX IP pool for GENEVE Tunnel Endpoints `ip-pool-vteps`, within the usable range of the **VTEP CIDR** created in Step 1, to be used with NSX Transport Nodes that you create later in this section
  - One NSX IP pool for NSX Load Balancing VIPs `ip-pool-vips`, within the usable range of the **PKS LB CIDR** created in Step 1, to be used with

the T0 Logical Router that you create later in this section

2. [Create](#) two NSX Transport Zones (TZs):
  - One NSX TZ for PKS control plane Services and Kubernetes Cluster deployment overlay network(s) called `tz-overlay` and the associated N-VDS `hs-overlay` (select Standard)
  - One NSX TZ for NSX Edge uplinks (ingress/egress) for PKS Kubernetes cluster(s) called `tz-vlan` and the associated N-VDS `hs-vlan` (select Standard)
3. If the default uplink profile is not applicable in your deployment, [create](#) your own NSX uplink host profile.
4. [Create](#) NSX Host Transport Node(s)
  - For each host in the NSX-T Fabric, create a node named `tnode-host-NUMBER`. For example, if you have three hosts in the NSX-T Fabric, create three nodes named `tnode-host-1`, `tnode-host-2`, and `tnode-host-3`.
  - Add the `tz-overlay` NSX Transport Zone to each NSX Host Transport Node.

 **Note:** The Transport Nodes must be placed on free host NICs not already used by other vSwitches on the ESX host. Use the `ip-pool-vteps` IP pool that will allow them to route and communicate with each other, as well as other Edge Transport Nodes, to build GENEVE tunnels.
5. [Create](#) an NSX IP Block named `ip-block-pks-deployments`. The NSX-T Container Plug-in (NCP) and PKS will use this IP Block to assign address space to Kubernetes pods through the Container Networking Interface (CNI). Pivotal recommends using the CIDR block `172.16.0.0/16`.

## Create Logical Switches

1. [Create](#) the following NSX Logical Switches:
  - One for T0 ingress/egress uplink port `ls-pks-uplink`
  - One for the PKS Management Network `ls-pks-mgmt`
  - One for the PKS Service Network `ls-pks-service`
2. Attach your first NSX Logical Switch to the `tz-vlan` NSX Transport Zone.
3. Attach your second and third NSX Logical Switches to the `tz-overlay` NSX Transport Zone.

## Create NSX Edge Objects

1. [Create](#) NSX Edge Transport Node(s).
2. Add both `tz-vlan` and `tz-overlay` NSX Transport Zones to the NSX Edge Transport Node(s). Controller Connectivity and Manager Connectivity should be **UP**.
3. Refer to the MAC addresses of the Edge VM interfaces you deployed to deploy your virtual NSX Edge(s):
  - a. Connect the `hs-vlan` N-VDS to the vNIC (`fp-eth#`) that matches the MAC address of the second NIC from your deployed Edge VM.
  - b. Connect the `hs-overlay` N-VDS to the vNIC (`fp-eth#`) that matches the MAC address of the third NIC from your deployed Edge VM.
4. [Create](#) an NSX Edge cluster called `edge-cluster-pks`.
5. Add the NSX Edge Transport Node(s) to the cluster.

## Create Logical Routers

### Create T0 Logical Router for PKS

1. [Create](#) a Tier-0 (T0) logical router named `t0-pks`:
  - Select `edge-cluster-pks` for the cluster.
  - Set **High Availability Mode** to **Active-Standby**. NAT rules will be applied on T0 by NCP. If not set **Active-Standby**, the router will not support NAT rule configuration.
2. [Attach](#) the logical router to the `ls-pks-uplink` logical switch you created previously. Create a logical router port for `ls-pks-uplink` and assign an IP address and CIDR that your environment will use to route to all PKS assigned IP pools and IP blocks.

3. [Configure](#) T0 routing to the rest of your environment using the appropriate routing protocol for your environment or by using static routes. The CIDR used in `ip-pool-vips` must route to the IP you just assigned to your t0 uplink interface.

## Create T1 Logical Router for PKS Management VMs

1. [Create](#) a Tier-1 (T1) logical router for PKS management VMs named `t1-pks-mgmt` :
  - Link to the `t0-pks` logical router you created in a previous step.
  - Select `edge-cluster-pks` for the cluster.
2. [Create](#) a logical router port for `ls-pks-mgmt` and assign the following CIDR block: `172.31.0.1/24` .
3. [Configure](#) route advertisement on the T1 as follows:
  - Enable **Status**.
  - Enable **Advertise All NSX Connected Routes**.
  - Enable **Advertise All NAT Routes**.
  - Enable **Advertise All LB VIP Routes**.
4. Create an SNAT rule on the T1 to allow the PKS Management VMs to communicate with your vCenter and NSX Manager environments. Limit the Destination CIDR for the SNAT rules to the subnet(s) that contain your vCenter and NSX Manager IP addresses. Use the following settings:
  - **Opsman & BOSH Director -> DNS**
  - **Opsman & BOSH Director -> NTP**
  - **Opsman & BOSH Director -> vCenter**
  - **Opsman & BOSH Director -> ESXi**
  - **Opsman & BOSH Director -> NSX-T Manager**

For example, an SNAT rule that maps `172.31.0.0/24` to `10.172.1.1` , where `10.172.1.1` is a routable IP from your **PKS MANAGEMENT CIDR**. For more information, see [Configure Source NAT on a Tier-1 Router](#) in the VMware documentation.

5. Create a DNAT rule on the T1 to map an external IP from the **PKS MANAGEMENT CIDR** to the IP where you will deploy Ops Manager on the `ls-pks-mgmt` logical switch. Use the following settings:
  - **External -> Opsman**
  - **External -> Pivotal Container Service**


For example, a DNAT rule that maps `10.172.1.2` to `172.31.0.2` , where `172.31.0.2` is the IP address you assign to Ops Manager when connected to `ls-pks-mgmt` . For more information, see [Configure Destination NAT on a Tier-1 Router](#) in the VMware documentation.

Later you will create another DNAT rule to map an external IP from the **PKS MANAGEMENT CIDR** to the PKS endpoint.

## Create T1 Logical Router for PKS Service VMs

1. [Create](#) a Tier-1 (T1) Logical Router for PKS Service VMs `t1-pks-service` :
  - Link to the `t0-pks` logical switch you created in a previous step.
  - Select `edge-cluster-pks` for the cluster.
2. [Create](#) a logical router port for `ls-pks-service` and assign the following CIDR block: `172.31.2.1/23` .
3. [Configure](#) route advertisement on the T1 as follows:
  - Enable **Advertise All NSX Connected Routes**.
  - Enable **Advertise All NAT Routes**.
  - Enable **Advertise All LB VIP Routes**.
4. [Create](#) an SNAT rule on the T1 to allow the Kubernetes Cluster VMs to communicate with your environment's NSX Manager and allow the NCP pod on each cluster to communicate with your NSX Manager. Use the following settings:
  - **K8s Workers -> External Registries** (example: DockerHub)
  - **K8s Workers -> DNS**
  - **K8s Workers -> NTP**
  - **K8s Workers -> NSX-T Manager (NCP)**
  - **K8s Workers -> vCenter** (vSphere Cloud Provider)
  - **K8s Workers -> External Service Endpoints for Workloads**


For example, a SNAT rule that maps `172.31.2.0/23` to `10.172.1.3` , where `10.172.1.3` is a routable IP from your **PKS MANAGEMENT CIDR**.

 **Note:** Limit the Destination CIDR for the SNAT rules to the subnet(s) that contain your vCenter and NSX Manager IP addresses.


## Step 4: Configure Ops Manager

Perform the following steps to configure Ops Manager for the NSX logical switches:


1. Navigate to `https://YOUR-OPSMAN-FQDN` in a browser to log in to the Ops Manager Installation Dashboard.
2. Click the **Ops Manager Director** tile.
3. Complete the procedures in [Configuring Ops Manager on vSphere](#).

 **Note:** If you have Pivotal Application Service (PAS) installed, Pivotal recommends installing PKS on a separate instance of Ops Manager v2.0.

4. Verify the following Ops Manager settings:
  - On the **Director Config** page, select **Enable Post Deploy Scripts**. This setting enables post-deploy scripts for all tiles in your Ops Manager installation.
  - On the **Director Config** page, clear the **Disable BOSH DNS server for troubleshooting purposes** checkbox to ensure that BOSH DNS is enabled. If you disabled BOSH DNS, you must re-enable it and redeploy PCF.

 **Note:** BOSH DNS must be enabled in all PKS deployments. If PAS and PKS are running on the same instance of Ops Manager, you cannot use the opt-out feature of BOSH DNS for your PAS without breaking PKS. If you want to opt out of BOSH DNS in your PAS deployment, install the tile on a separate instance of Ops Manager. For more information about opting out of BOSH DNS, see [this KB article](#) and [Ops Manager v2.0 Release Notes](#).

- On the **vCenter Config** page, select **Standard vCenter Networking**. This configuration is utilized for PAS only. You configure NSX-T integration for PKS in a later step.
5. Click **Create Networks**.
  6. Create the following two networks:
    - A network for deploying the PKS control plane VM(s) that maps to the NSX logical switch named `ls-pks-mgmt` created for the PKS Management Network in [Step 3: Create Required Objects](#)
    - A service network for deploying PKS Kubernetes cluster nodes that maps to the NSX logical switch named `ls-pks-service` created for the PKS Service Network in [Step 3: Create Required Objects](#)


 **Note:** Using this NAT topology, you must have already deployed Ops Manager to the `ls-pks-mgmt` NSX logical switch by following [Step 3: Create Logical Router for PKS Management VMs](#) above. You will use the DNAT IP address to access Ops Manager.

7. Return to the Ops Manager Installation Dashboard and click **Apply Changes**.

## Step 5: Install and Configure PKS

Perform the following steps to install and configure PKS:

1. Perform the procedure in [Step 1: Install PKS](#) of *Installing and Configuring PKS on vSphere* to install the PKS tile.
2. Click the orange **Pivotal Container Service** tile to start the configuration process.

 **Note:** Configuration of NSX-T or Flannel **cannot** be changed after initial installation and configuration of PKS.

## Assign AZs and Networks

Perform the following steps:

1. Click **Assign AZs and Networks**.
2. Select an availability zone for your singleton jobs and one or more availability zones to balance other jobs in.



**Note:** In PKS, Pivotal Container Service is a singleton job. This broker VM enables the creation of PKS clusters through the PKS CLI.

3. Under **Network**, select the PKS Management Network linked to the `ls-pks-mgmt` NSX logical switch you created in [Step 4: Configure Ops Manager](#). This will provide network placement for the PKS broker.
4. Under **Service Network**, select the PKS Service Network linked to the `ls-pks-service` NSX logical switch you created in [Step 4: Configure Ops Manager](#). This will provide network placement for the on-demand Kubernetes cluster service instances created by the PKS broker.
5. Click **Save**.

## PKS API

Perform the procedure in the [PKS API](#) section of *Installing and Configuring PKS on vSphere*.

## Plans

Perform the procedures in the [Plans](#) section of *Installing and Configuring PKS on vSphere*.

## Kubernetes Cloud Provider

Perform the procedures in the [Kubernetes Cloud Provider](#) section of *Installing and Configuring PKS on vSphere*.

## Networking

Perform the following steps:

1. Click **Networking**.



Network\*

☐ Flannel
 ☒ NSX-T

NSX Manager hostname \*

NSX Manager credentials \*
 

Username
  Password

NSX Manager CA Cert

☐ Disable SSL certificate verification?

Cluster Name \*

T0 router ID \*

IP block ID \*
 


Please enter the IP block ID

Floating IP pool ID \*

Save

- Under **Network**, select **NSX-T** as the **Container Network Type** to use.
- For **NSX Manager hostname**, enter the NSX Manager hostname or IP address.
- For **NSX Manager credentials**, enter the credentials to connect to the NSX Manager.
- For **NSX Manager CA Cert**, optionally enter the custom CA certificate to be used to connect to the NSX Manager.
- The **Disable SSL certificate verification?** checkbox is **not** selected by default. In order to disable TLS verification, select the checkbox. You may want to disable TLS verification if you did not enter a CA certificate, or if your CA certificate is self-signed.
- For **vSphere Cluster Name**, enter the name of the vSphere cluster you used when creating the PKS broker in [Assign AZs and Networks](#).
- For **T0 Router ID**, enter the `t0-pks` T0 router UUID. This can be located in the NSX-T UI router overview.
- For **IP Block ID**, enter the `ip-block-pks-deployments` IP block UUID. This can also be located in the NSX-T UI.
- For **Floating IP pool ID**, enter the `ip-pool-vips` Floating IP pool ID that was created for load balancer VIPs.
- Click **Save**.

## Errands

 **WARNING:** You must enable the NSX-T Validation errand in order to verify and tag required NSX-T objects.

Perform the following steps:

- Click **Errands**.

2. For **Post Deploy Errands**, select **ON** for the **NSX-T Validation errand**. This errand will validate your NSX-T configuration and will tag the proper resources.
3. Click **Save**.

## (Optional) Resource Config and Stemcell

To modify the resource usage or stemcell configuration of PKS, see [\(Optional\) Resource Config](#) and [\(Optional\) Stemcell](#) in *Installing and Configuring PKS on vSphere*.

## Step 6: Apply Changes and Retrieve the PKS Endpoint

1. After configuring the tile, return to the Ops Manager Installation Dashboard and click **Apply Changes** to deploy the PKS tile.
2. When the installation is completed, retrieve the PKS endpoint by performing the following steps:
  - a. From the Ops Manager Installation Dashboard, click the **Pivotal Container Service** tile.
  - b. Click the **Status** tab and record the IP address assigned to the `Pivotal Container Service` job.
3. Create a DNAT rule on the `ts-pks-mgmt` T1 to map an external IP from the **PKS MANAGEMENT CIDR** to the PKS endpoint. For example, a DNAT rule that maps `10.172.1.4` to `172.31.0.4`, where `172.31.0.4` is PKS endpoint IP address on the `ts-pks-mgmt` NSX Logical Switch. For more information, see [Configure Destination NAT on a Tier-1 Router](#) in the VMware documentation.

**Note:** Ensure that you have no overlapping NAT rules. If your NAT rules overlap, you cannot reach Ops Manager from VMs in the vCenter network.

Developers should use the DNAT IP address when logging in with the PKS CLI. For more information, see [Using PKS](#).

**WARNING:** The PKS CLI is under active development and commands may change. To ensure you have installed the latest version, we recommend that you re-install the PKS CLI before you use it. See [Installing the PKS CLI](#).

## Step 7: Deploy a Cluster and Enable NAT Access

In the current version of PKS, NSX-T does not automatically configure a NAT for the master node of each Kubernetes cluster. As a result, you must perform the following procedure for each cluster to enable your developers to use `kubectl`:

1. Download the NSX scripts:

```
$ wget https://storage.googleapis.com/pks-releases/nsx-helper-pkg.tar.gz
```

2. Untar the `nsx-helper-pkg.tar.gz` file:

```
$ tar -xvzf nsx-helper-pkg.tar.gz
```

3. Install required packages:

```
$ sudo apt-get install git
$ sudo apt-get install -y httpie
```

4. One of the files from the tarball is `nsx-cli.sh`. Make the script executable:

```
$ chmod 755 nsx-cli.sh
```

5. Set your NSX Manager admin user, password, and IP address as environment variables named `NSX_MANAGER_USERNAME`, `NSX_MANAGER_PASSWORD`, and `NSX_MANAGER_IP`. For example:

```
$ export NSX_MANAGER_USERNAME="admin-user"
$ export NSX_MANAGER_PASSWORD="admin-password"
$ export NSX_MANAGER_IP="192.0.2.1"
```

- Execute the `nsx-cli` script with the following command:

```
$ ./nsx-cli.sh ipam allocate
```

Developers can use this IP address as the `--external-hostname` value to create a cluster via the PKS CLI. For more information, see [Using PKS](#).

- Collect the Cluster UUID after cluster has been successfully created.

```
$ pks clusters
```

- Use the `nsx-cli` script to create a NAT rule to allow access to the Kubernetes API for the cluster. Execute the following command:

```
$ ./nsx-cli.sh nat create-rule CLUSTER-UUID MASTER-IP NAT-IP
```

Where:

- `CLUSTER-UUID` is the ID of the cluster retrieved in the previous step.
- `MASTER-IP` is the IP address that BOSH has assigned to the master node of the cluster. To retrieve this value, use the [BOSH CLI v2](#) to log in to your BOSH Director and list all instances with `bosh -e YOUR-ENV instances`.
- `NAT-IP` is the NAT IP from the `ip-pool-vips` NSX IP pool retrieved above.

## Step 8: Clean NSX-T Objects After Deletion of a Cluster

In the current version of PKS, NSX-T does not automatically delete NSX-T objects created during the life of the product. After a cluster is deleted, you **must** perform the following task using the `nsx-cli.sh` script downloaded in [Step 7](#):

- [Delete](#) the Kubernetes Cluster using the PKS CLI.
- Execute the `nsx-cli` script with the following command:

```
$ ./nsx-cli.sh cleanup CLUSTER-UUID false
```

Where `CLUSTER-UUID` is the ID of the cluster you deleted.

## Installing PKS on GCP

This topic outlines the steps for installing Pivotal Container Service (PKS) on GCP. See the following sections:

- [GCP Prerequisites and Resource Requirements](#)
- [Preparing to Deploy PKS on GCP](#)
- [Deploying BOSH and Ops Manager to GCP](#)
- [Configuring Ops Manager Director on GCP](#)
- [Installing and Configuring PKS on GCP](#)

## GCP Prerequisites and Resource Requirements

This topic describes the prerequisites and resource requirements for installing Pivotal Container Service (PKS) on Google Cloud Platform (GCP).


To install PKS GCP, you must have a GCP environment with Ops Manager v2.0 deployed.


Consult the following table for compatibility information:

IaaS	Ops Manager v2.0	NSX-T	Harbor
vSphere	Required	Available	Available
GCP	Required	Not Available	Not Available

## General PKS Prerequisites

- Ops Manager v2.0

 **Note:** If you have Pivotal Application Service (PAS) installed, Pivotal recommends installing PKS on a separate instance of Ops Manager v2.0. This improves the security of your PAS deployment by ensuring that only PKS-related infrastructure credentials are stored in PKS. Running PKS on a separate instance of Ops Manager v2.0 helps protect your non-PKS infrastructure credentials and prevent their exposure through PKS. For more information about the infrastructure credentials specified in the PKS tile, see the [Kubernetes Cloud Provider](#) section of the *Installing and Configuring PKS* topic.

- [PKS CLI](#)
- [Kubernetes CLI](#) 
- (Optional) An external TCP or HTTPS load balancer to access the PKS API
- An external TCP or HTTPS load balancer for each created cluster

## Resource Requirements

Installing PKS deploys the following two virtual machines (VMs):

VM	CPU	RAM	Storage
Pivotal Container Service	1	4 GB	20 GB
Pivotal Ops Manager	1	8 GB	160 GB

Each Kubernetes cluster provisioned through PKS deploys the VMs listed below. If you deploy more than one Kubernetes cluster, you must scale your allocated resources appropriately.

VM Name	Number	CPU Cores	RAM	Ephemeral Disk	Persistent Disk
master	1	2	4 GB	8 GB	5 GB
worker	1	2	4 GB	8 GB	10 GB

## Installing PKS on GCP

To install PKS on GCP, follow the procedures below:

- [Preparing to Deploy PKS on GCP](#)
- [Deploying BOSH and Ops Manager to GCP](#)
- [Configuring Ops Manager Director on GCP](#)
- [Installing and Configuring PKS on GCP](#)



## Preparing to Deploy PKS on GCP

Page last updated:

This guide describes the preparation steps required to install Pivotal Container Service (PKS) on Google Cloud Platform (GCP).

In addition to fulfilling the prerequisites listed in the [GCP Prerequisites and Resource Requirements](#) topic, you must create resources in GCP such as a new network, firewall rules, load balancers, and a service account before deploying PKS. Follow these procedures to prepare your GCP environment.

### Step 1: Set up an IAM Service Account

In order for Kubernetes to create load balancers and attach persistent disks to pods, you must create a service account with sufficient permissions.

1. From the GCP Console, select **IAM & admin > Service accounts**
2. Click **Create Service Account**
3. Enter a name for the service account, and add the following roles:
  - `roles/compute.instanceAdmin` (Compute Engine > Compute Instance Admin)
  - `roles/compute.securityAdmin` (Compute Engine > Compute Security Admin)
  - `roles/compute.networkAdmin` (Compute Engine > Compute Network Admin)
  - `roles/compute.storageAdmin` (Compute Engine > Compute Storage Admin)
  - `roles/compute.viewer` (Compute Engine > Compute Viewer)
4. Select **Furnish a new private key** and select **JSON**.
5. Click **Create**. Your browser automatically downloads a JSON file with a private key for this account. Save this file in a secure location.

### Step 2: Enable Google Cloud APIs

Ops Manager manages GCP resources using the Google Compute Engine and Cloud Resource Manager APIs. To enable these APIs, perform the following steps:

1. Log in to the Google Developers console at <https://console.developers.google.com>.
2. In the console, navigate to the GCP project where you want to install PKS.
3. Select **API Manager > Library**.
4. Under **Google Cloud APIs**, select **Compute Engine API**.
5. On the **Google Compute Engine API** page, click **Enable**.
6. In the search field, enter `Google Cloud Resource Manager API`.
7. On the **Google Cloud Resource Manager API** page, click **Enable**.
8. To verify that the APIs have been enabled, perform the following steps:
  - a. Log in to GCP:

```
$ gcloud auth login
```

- b. List your projects:

```
$ gcloud projects list
PROJECT_ID  NAME               PROJECT_NUMBER
my-project-id  my-project-name  #####
```

This command lists the projects where you enabled Google Cloud APIs.

## Step 3: Create a GCP Network with Subnets

1. Log in to the [GCP Console](#).
2. Navigate to the GCP project where you want to install PKS.
3. Select **VPC network**, then **CREATE VPC NETWORK**.
4. In the **Name** field, enter `MY-PKS-virt-net`. `MY-PKS` is a prefix to help you identify resources for this PKS deployment in the GCP console.
  - a. Under **Subnets**, complete the form as follows to create an infrastructure subnet for Ops Manager and NAT instances:

<b>Name</b>	<code>MY-PKS-subnet-infrastructure-GCP-REGION</code>
<b>Region</b>	A region that supports three availability zones (AZs). For help selecting the correct region for your deployment, see the <a href="#">Google documentation on regions and zones</a> .
<b>IP address range</b>	A CIDR ending in <code>/26</code> Example: <code>192.168.101.0/26</code>

- b. Click **Add subnet** to add a second subnet for the BOSH Director, PKS API, and PKS broker with the following details:

<b>Name</b>	<code>MY-PKS-subnet-pks-GCP-REGION</code>
<b>Region</b>	The same region you selected for the infrastructure subnet
<b>IP address range</b>	A CIDR ending in <code>/22</code> Example: <code>192.168.16.0/22</code>

- c. Click **Add subnet** to add a third subnet for the Kubernetes clusters with the following details:

<b>Name</b>	<code>MY-PKS-subnet-services-GCP-REGION</code>
<b>Region</b>	The same region you selected for the previous subnets
<b>IP address range</b>	A CIDR in <code>/22</code> Example: <code>192.168.20.0/22</code>

5. Under **Dynamic routing mode**, leave **Regional** selected.
6. Click **Create**.

## Step 4: Create NAT Instances

Use NAT instances when you want to expose only a minimal number of public IP addresses.

1. In the console, navigate to **Compute Engine > VM instances**.
2. Click **CREATE INSTANCE**.
3. Complete the following fields:
  - o **Name**: Enter `MY-PKS-nat-gateway-pri`. This is the first, or primary, of three NAT instances you need. If you are using a single AZ, you need only one NAT instance.
  - o **Zone**: Select the first zone from your region. Example: For region `us-west1`, select zone `us-west1-a`.
  - o **Machine type**: Select `n1-standard-4`.
  - o **Boot disk**: Click **Change** and select `Ubuntu 14.04 LTS`.
4. Expand the additional configuration fields by clicking **Management, disks, networking, SSH keys**.
  - a. In the **Startup script** field under **Automation**, enter the following text:
 

```
#!/bin/bash
sudo sh -c 'echo 1 > /proc/sys/net/ipv4/ip_forward'
sudo iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
```
5. Click **Networking** to open additional network configuration fields:
  - a. In the **Network tags** field, add the following: `nat-traverse` and `MY-PKS-nat-instance`.
  - b. Click the pencil icon to edit the **Network interface**.



- c. For **Network**, select `MY-PKS-virt-net`. You created this network in [Step 1: Create a GCP Network with Subnets](#).
- d. For **Subnetwork**, select `MY-PKS-subnet-infrastructure-GCP-REGION`.
- e. For **Primary internal IP**, select `Ephemeral (Custom)`.
- f. Enter an IP address in the **Custom ephemeral IP address** field. Example: `192.168.101.2`. The IP address must meet the following requirements:
  - The IP address must exist in the CIDR range you set for the `MY-PKS-subnet-infrastructure-GCP-REGION` subnet.
  - The IP address must exist in a reserved IP range set later in Ops Manager Director. The reserved range is typically the first `.1` through `.9` addresses in the CIDR range you set for the `MY-PKS-subnet-infrastructure-GCP-REGION` subnet.
  - The IP address cannot be the same as the Gateway IP address set later in Ops Manager. The Gateway IP address is typically the first `.1` address in the CIDR range you set for the `MY-PKS-subnet-infrastructure-GCP-REGION` subnet.
- g. For **External IP**, select `Ephemeral`.
- h. Set **IP forwarding** to `On`.
- i. Click **Done**.

6. Click **Create** to finish creating the NAT instance.

7. To create additional NAT instances, repeat steps 2-6 using the names and zones specified in the table below.

Instance 2	Name	<code>MY-PKS-nat-gateway-sec</code>
	Zone	Select the second zone from your region. Example: For region <code>us-west1</code> , select zone <code>us-west1-b</code> .
	Internal IP	Select <code>Custom</code> and enter an IP address in the <b>Internal IP address</b> field. Example: <code>192.168.101.3</code> .  As described above, this address must in the CIDR range you set for the <code>MY-PKS-subnet-infrastructure-GCP-REGION</code> subnet, must exist in a reserved IP range set later in Ops Manager Director, and cannot be the same as the Gateway IP address set later in Ops Manager.
Instance 3	Name	<code>MY-PKS-nat-gateway-ter</code>
	Zone	Select the third zone from your region. Example: For region <code>us-west1</code> , select zone <code>us-west1-c</code> .
	Internal IP	Select <code>Custom</code> and enter an IP address in the <b>Internal IP address</b> field. Example: <code>192.168.101.4</code> .  As described above, this address must in the CIDR range you set for the <code>MY-PKS-subnet-infrastructure-GCP-REGION</code> subnet, must exist in a reserved IP range set later in Ops Manager Director, and cannot be the same as the Gateway IP address set later in Ops Manager.

## Create Routes for NAT Instances


1. In the GCP console, navigate to **VPC Networks > Routes**.
2. Click **CREATE ROUTE**.
3. Complete the form as follows:
  - o **Name:** `MY-PKS-nat-pri`
  - o **Network:** `MY-PKS-virt-net`
  - o **Destination IP range:** `0.0.0.0/0`
  - o **Priority:** `800`
  - o **Instance tags:** `MY-PKS`
  - o **Next hop:** `Specify an instance`
  - o **Next hop instance:** `MY-PKS-nat-gateway-pri`
4. Click **Create** to finish creating the route.
5. Repeat steps 2-4 to create two additional routes with the names and next hop instances specified in the table below. The rest of the configuration remains the same.

Route 2	Name: <code>MY-PKS-nat-sec</code> Next hop instance: <code>MY-PKS-nat-gateway-sec</code>
Route 3	Name: <code>MY-PKS-nat-ter</code> Next hop instance: <code>MY-PKS-nat-gateway-ter</code>

## Step 5: Create Firewall Rules for the Network

GCP lets you assign [tags](#) to virtual machine (VM) instances and create firewall rules that apply to VMs based on their tags. This step assigns tags and firewall rules to Ops Manager components and VMs that handle incoming traffic.

1. In the **Networking** pane, select **Firewall rules**.
2. Create firewall rules according to the table below:

 **Note:** If you want your firewalls rules to only allow traffic within your private network, modify the **Source IP Ranges** from the table accordingly.

Firewall Rules	
Rule 1	<p>This rule allows SSH from public networks.</p> <p>Name: MY-PKS-allow-ssh</p> <p>Network: MY-PKS-virt-net</p> <p>Allowed protocols and ports: tcp:22</p> <p>Source filter: IP ranges</p> <p>Source IP ranges: 0.0.0.0/0</p> <p>Target tags: allow-ssh</p>
Rule 2	<p>This rule allows HTTP from public networks.</p> <p>Name: MY-PKS-allow-http</p> <p>Network: MY-PKS-virt-net</p> <p>Allowed protocols and ports: tcp:80</p> <p>Source filter: IP ranges</p> <p>Source IP ranges: 0.0.0.0/0</p> <p>Target tags: allow-http, router</p>
Rule 3	<p>This rule allows HTTPS from public networks.</p> <p>Name: MY-PKS-allow-https</p> <p>Network: MY-PKS-virt-net</p> <p>Allowed protocols and ports: tcp:443</p> <p>Source filter: IP ranges</p> <p>Source IP ranges: 0.0.0.0/0</p> <p>Target tags: allow-https, router</p>
Rule 4	<p>This rule allows communication between BOSH-deployed jobs.</p> <p>Name: MY-PKS-allow-pks-all</p> <p>Network: MY-PKS-virt-net</p> <p>Allowed protocols and ports: tcp;udp;icmp</p> <p>Source filter: Source tags</p> <p>Target tags: MY-PKS, MY-PKS-opsman, nat-traverse</p> <p>Source tags: MY-PKS, MY-PKS-opsman, nat-traverse</p>

3. If you are only using your GCP project to deploy PKS, then you can delete the following default firewall rules:
  - default-allow-http
  - default-allow-https
  - default-allow-icmp
  - default-allow-internal
  - default-allow-rdp
  - default-allow-ssh

## Next Steps

To install PKS on GCP, follow the procedures in [Deploying BOSH and Ops Manager to GCP](#).



## Deploying BOSH and Ops Manager to GCP

Page last updated:

This topic describes how to deploy Ops Manager Director for Pivotal Container Service (PKS) on Google Cloud Platform (GCP).

After you complete this procedure, follow the instructions in the [Configuring Ops Manager Director on GCP](#) and [Configuring PKS on GCP](#) topics.

### Step 1: Locate the Pivotal Ops Manager Installation File

1. Log in to the [Pivotal Network](#), and click on **Pivotal Cloud Foundry Operations Manager**.
2. From the **Releases** drop-down, select the release to install.
3. Select one of the following download files:
  - **Pivotal Cloud Foundry Ops Manager for GCP**
  - **Pivotal Cloud Foundry Ops Manager YAML for GCP**

When you click on the download link, your browser downloads or opens the `OpsManager_version_onGCP.pdf` or `OpsManager_version_onGCP.yml` file.

These documents provide the GCP location of the Ops Manager `.tar.gz` installation file based on the geographic location of your installation.

4. Copy the filepath string of the Ops Manager image based on your deployment location.

### Step 2: Create a Private VM Image

1. Log in to the [GCP Console](#).
2. In the left navigation panel, click **Compute Engine**, and select **Images**.
3. Click **Create Image**.
4. Complete the following fields:
  - **Name:** Enter a name. For example, `opsman-pcf-gcp-2-0`.
  - **Encryption:** Leave **Automatic (recommended)** selected.
  - **Source:** Choose **Cloud Storage file**.
  - **Cloud Storage file:** Paste in the Google Cloud Storage filepath you copied from the PDF file in the [previous step](#).
5. Click **Create**. The file may take a few minutes to import.

### Step 3: Create the Ops Manager VM Instance

1. Select the checkbox for the image that you created above.
2. Click **Create Instance**.
3. In the **Create an instance form**, complete the following fields:
  - **Name:** Enter a name that matches the naming conventions of your deployment.
  - **Zone:** Choose a zone from the region in which you created your network.
  - **Machine type:** Choose `n1-standard-2`.
  - Click **Customize** to manually configure the vCPU and memory. An Ops Manager VM instance requires the following minimum specifications:

Machine Spec	Minimum Value
CPU	2 vCPUs
Memory	8 GB

- **Boot disk:** Click **Change**, then perform the following steps:
  - Click **Custom images** if it is not already selected.
  - Select the **Boot disk type**. If you have an Ops Manager environment with high performance needs, select **SSD**. As an example, environments used to [develop PCF tiles](#) may benefit from a higher performing Ops Manager VM boot disk. For most environments,

however, you can select **Standard**.

- Set the **Size (GB)** of the boot disk to the minimum or higher.


Machine Spec	Minimum Value
Boot disk	100 GB

- Select the Ops Manager image you created in the previous step if it is not already selected.
- Click **Select** to save.

- Under **Identity and API access**, choose the **Service account** you created when preparing your environment during the step [Set up an IAM Service Account](#).
- **Allow HTTP traffic**: Leave this checkbox unselected.
- **Allow HTTPS traffic**: Leave this checkbox unselected.
- **Networking**: Select the **Networking** tab, and perform the following steps:
  - Under **Network interfaces**, perform the following steps:
    - Remove the `default` network interface if this interface still exists.
    - Select the network (for example, `MY-PKS-virt-network`) you created when preparing your environment in the [Create a GCP Network with Subnet](#) section of the *Preparing to Deploy PKS on GCP* topic.
    - Under **Subnetwork**, select the `MY-PKS-subnet-infrastructure-MY-GCP-REGION` subnet that you created when preparing your environment in the [Create a GCP Network with Subnet](#) section of the *Preparing to Deploy PKS on GCP* topic.
    - For **Primary internal IP**, select **Ephemeral (Custom)**. Enter an IP address (for example, `192.168.101.5`) in the **Custom ephemeral IP address** field. Specify the next available internal IP address located within the reserved IP range that you will [configure in Ops Manager Director](#). Do not use the **Gateway IP**, for example `192.168.101.1`.
    - For **External IP**, select **Create IP address**. In the next form, enter a name for the static IP. For example, `om-public-ip`. Click **Reserve**. In the **External IP** drop-down, select the static IP address you just reserved.
    - For **Network tags**, enter `MY-PKS-opsman` and `allow-https`. These tags tag apply the firewall rules you created in [Create Firewall Rules for the Network](#) to the Ops Manager VM.

4. Click **Create** to deploy the new Ops Manager VM. This may take a few moments.

5. Navigate to your DNS provider, and create an entry that points a fully qualified domain name (FQDN) `opsman.MY-DOMAIN` to the `MY-PKS-opsman` static IP address of Ops Manager that you created in a previous step.

 **Note:** In order to set up Ops Manager authentication correctly, Pivotal recommends using a Fully Qualified Domain Name (FQDN) to access Ops Manager. Using an ephemeral IP address to access Ops Manager can cause authentication errors upon subsequent access.


## Next Steps

After you complete this procedure, follow the instructions in the [Configuring Ops Manager Director on GCP](#) topic.

## Configuring Ops Manager Director on GCP


Page last updated:

This topic describes how to configure the Ops Manager Director for Pivotal Container Service (PKS) on Google Cloud Platform (GCP).

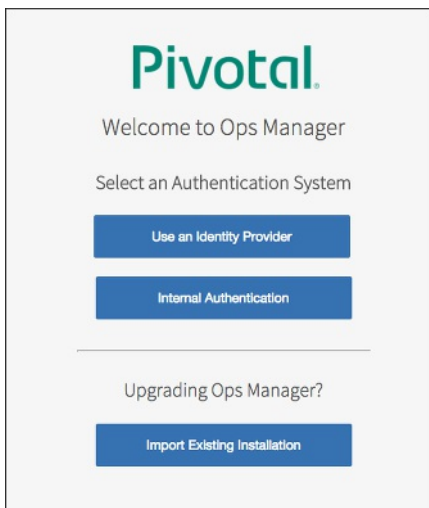
 **Note:** You can also perform the procedures in this topic using the Ops Manager API. For more information, see the [Using the Ops Manager API](#) topic.

### Step 1: Access Ops Manager

1. In a web browser, navigate to the fully qualified domain name (FQDN) of Ops Manager that you set up in [Launching an Ops Manager Director Instance on GCP](#).

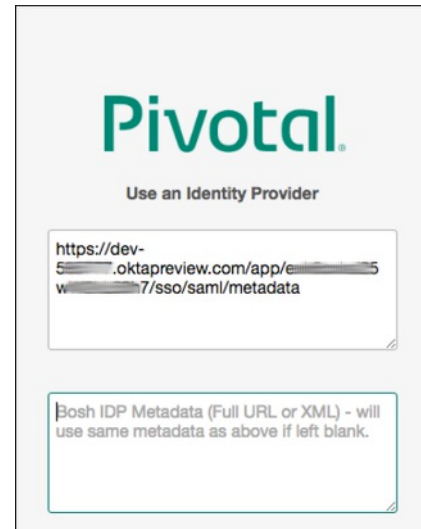
 **Note:** In order to set up Ops Manager authentication correctly, Pivotal recommends using a Fully Qualified Domain Name (FQDN) to access Ops Manager. Using an ephemeral IP address to access Ops Manager can cause authentication errors upon subsequent access.

2. When Ops Manager starts for the first time, you must choose one of the following:
  - [Use an Identity Provider](#): If you use an Identity Provider, an external identity server maintains your user database.
  - [Internal Authentication](#): If you use Internal Authentication, PCF maintains your user database.



### Use an Identity Provider (IdP)

1. Log in to your IdP console and download the IdP metadata XML. Optionally, if your IdP supports metadata URL, you can copy the metadata URL instead of the XML.



2. Copy the IdP metadata XML or URL to the Ops Manager **Use an Identity Provider** log in page.



**Note:** The same IdP metadata URL or XML is applied for the BOSH Director. If you use a separate IdP for BOSH, copy the metadata XML or URL from that IdP and enter it into the BOSH IdP Metadata text box in the Ops Manager log in page.

3. Enter your **Decryption passphrase**. Read the **End User License Agreement**, and select the checkbox to accept the terms.

4. Your Ops Manager log in page appears. Enter your username and password. Click **Login**.

5. Download your SAML Service Provider metadata (SAML Relying Party metadata) by navigating to the following URLs:

- **5a.** Ops Manager SAML service provider metadata: `https://OPS-MAN-FQDN:443/uaa/saml/metadata`
- **5b.** BOSH Director SAML service provider metadata: `https://BOSH-IP-ADDRESS:8443/saml/metadata`



**Note:** To retrieve your `BOSH-IP-ADDRESS`, navigate to the **Ops Manager Director** tile > **Status** tab. Record the **Ops Manager Director** IP address.

6. Configure your IdP with your SAML Service Provider metadata. Import the Ops Manager SAML provider metadata from Step 5a above to your IdP. If your IdP does not support importing, provide the values below.

- **Single sign on URL:** `https://OPS-MAN-FQDN:443/uaa/saml/SSO/alias/OPS-MAN-FQDN`
- **Audience URI (SP Entity ID):** `https://OP-MAN-FQDN:443/uaa`
- **Name ID:** Email Address
- SAML authentication requests are always signed

7. Import the BOSH Director SAML provider metadata from Step 5b to your IdP. If the IdP does not support an import, provide the values below.

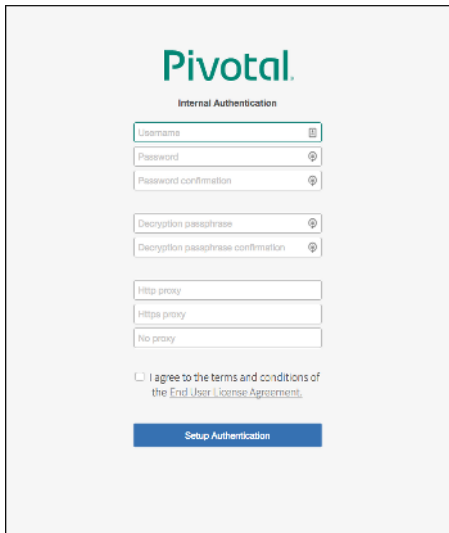
- **Single sign on URL:** `https://BOSH-IP:8443/saml/SSO/alias/BOSH-IP`
- **Audience URI (SP Entity ID):** `https://BOSH-IP:8443`
- **Name ID:** Email Address
- SAML authentication requests are always signed

8. Return to the **Ops Manager Director** tile, and continue with the configuration steps below.

## Internal Authentication

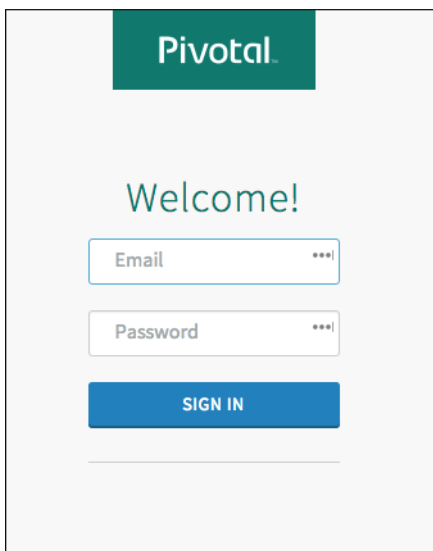
1. When redirected to the **Internal Authentication** page, you must complete the following steps:

- Enter a **Username**, **Password**, and **Password confirmation** to create an Admin user.
- Enter a **Decryption passphrase** and the **Decryption passphrase confirmation**. This passphrase encrypts the Ops Manager datastore, and is not recoverable if lost.
- If you are using an **HTTP proxy** or **HTTPS proxy**, follow the instructions in the [Configuring Proxy Settings for the BOSH CPI](#) topic.
- Read the **End User License Agreement**, and select the checkbox to accept the terms.
- Click **Setup Authentication**.



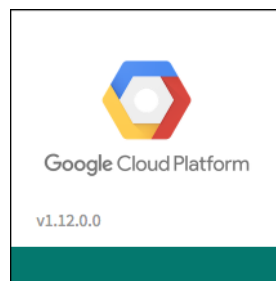
The image shows the 'Pivotal Internal Authentication' form. It includes fields for Username, Password, Password confirmation, Decryption passphrase, and Decryption passphrase confirmation. There are also fields for Http proxy, Https proxy, and No proxy. A checkbox for 'I agree to the terms and conditions of the End User License Agreement' is present, followed by a 'Setup Authentication' button.

2. Log in to Ops Manager with the Admin username and password that you created in the previous step.



The image shows the 'Pivotal Welcome!' login form. It features a 'Pivotal' logo at the top, followed by 'Welcome!'. Below this are input fields for 'Email' and 'Password', both with masked characters (\*\*\*). A blue 'SIGN IN' button is at the bottom.

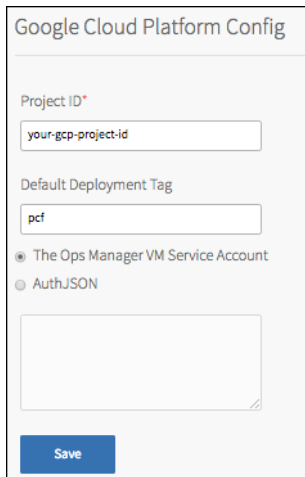
## Step 2: Google Cloud Platform Config



1. Click the **Google Cloud Platform** tile within the **Installation Dashboard**.
2. Select **Google Config**. Complete the following fields:
  - **Project ID**: Enter your GCP project ID in all lower case, such as: `your-gcp-project-id`.
  - **Default Deployment Tag**: Enter the `MY-PKS` prefix that you used when creating the GCP resources for this PCF installation.
  - Select **AuthJSON** and in the field below enter the contents of the JSON file that you downloaded in the [Set up an IAM Service Account](#) section of the *Preparing to Deploy PKS on GCP* topic.

**Note:** As an alternative, you can select **The Ops Manager VM Service Account** option to use the service account automatically created by GCP for the Ops Manager VM. To use this option, the project-wide service account that you set up in [Set up an IAM Service Account](#) must be assigned the **Service Account Actor** role.





Google Cloud Platform Config

Project ID\*

your-gcp-project-id

Default Deployment Tag

pcf

☒ The Ops Manager VM Service Account

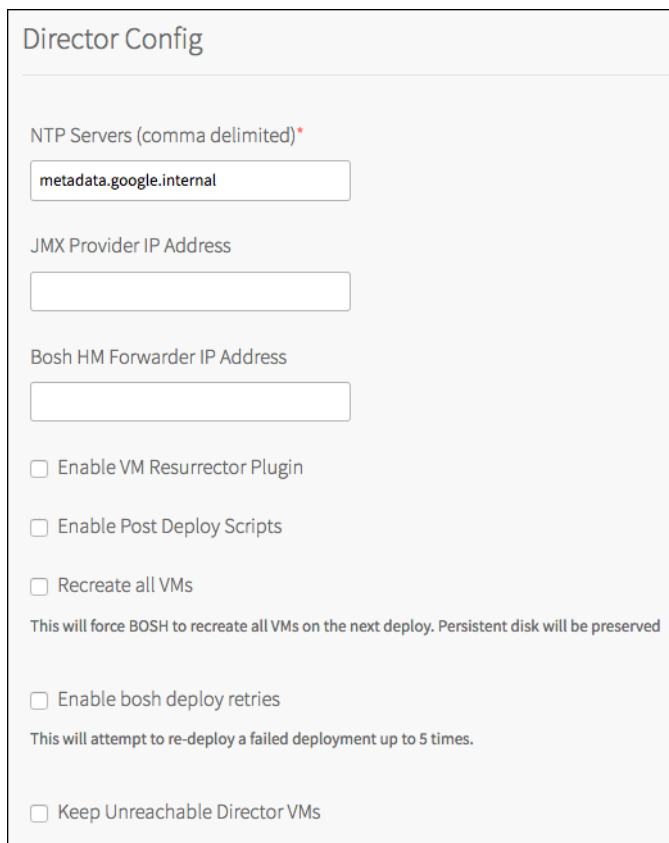
☐ AuthJSON

Save

3. Click **Save**.

## Step 3: Director Config Page

1. Select **Director Config** to open the **Director Config** page.



Director Config

NTP Servers (comma delimited)\*

metadata.google.internal

JMX Provider IP Address

Bosh HM Forwarder IP Address

☐ Enable VM Resurrector Plugin

☐ Enable Post Deploy Scripts

☐ Recreate all VMs

This will force BOSH to recreate all VMs on the next deploy. Persistent disk will be preserved

☐ Enable bosh deploy retries

This will attempt to re-deploy a failed deployment up to 5 times.

☐ Keep Unreachable Director VMs

2. In the **NTP Servers (comma delimited)** field, enter `metadata.google.internal`.
3. Leave the **JMX Provider IP Address** field blank.
4. Leave the **Bosh HM Forwarder IP Address** field blank.
5. Select the **Enable VM Resurrector Plugin** checkbox to enable the Ops Manager Resurrector functionality and increase runtime availability.
6. Select **Enable Post Deploy Scripts** to run a post-deploy script after deployment. This script allows the job to execute additional commands against a deployment.

7. (Optional) Select **Recreate all VMs** to force BOSH to recreate all VMs on the next deploy. This process does not destroy any persistent disk data.
8. Select **Enable bosh deploy retries** for Ops Manager to retry failed BOSH operations up to five times.
9. (Optional) Select **Keep Unreachable Director VMs** if you want to preserve Ops Manager Director VMs after a failed deployment for troubleshooting purposes.
10. (Optional) Select **HM Pager Duty Plugin** to enable Health Monitor integration with PagerDuty.

☒ HM Pager Duty Plugin
 

Service Key\*

HTTP Proxy

- **Service Key:** Enter your API service key from PagerDuty.
- **HTTP Proxy:** Enter an HTTP proxy for use with PagerDuty.

☒ HM Email Plugin
 

Host\*

Port\*

Domain\*

From\*


Recipients\*

Username

Password


☒ Enable TLS

11. (Optional) Select **HM Email Plugin** to enable Health Monitor integration with email.
  - **Host:** Enter your email hostname.
  - **Port:** Enter your email port number.
  - **Domain:** Enter your domain.
  - **From:** Enter the address for the sender.
  - **Recipients:** Enter comma-separated addresses of intended recipients.
  - **Username:** Enter the username for your email server.
  - **Password:** Enter the password password for your email server.
  - **Enable TLS:** Select this checkbox to enable Transport Layer Security.
12. Select a **Blobstore Location** to either configure the blobstore as an internal server or an external endpoint. Because the internal server is unscalable and less secure, Pivotal recommends you configure an external blobstore.

 **Note:** After you deploy Ops Manager, you cannot change the blobstore location.

- **Internal:** Select this option to use an internal blobstore. Ops Manager creates a new VM for blob storage. No additional configuration is required.
- **S3 Compatible Blobstore:** Select this option to use an external S3-compatible endpoint. Follow the procedures in [Sign up for Amazon S3](#) and [Creating a Bucket](#) from the AWS documentation. When you have created an S3 bucket, complete the following steps:

1. **S3 Endpoint:** Navigate to the [Regions and Endpoints](#) topic in the AWS documentation. Locate the endpoint for your region in the **Amazon Simple Storage Service (S3)** table and construct a URL using your region's endpoint. For example, if you are using the `us-west-2` region, the URL you create would be <https://s3-us-west-2.amazonaws.com>. Enter this URL into the **S3 Endpoint** field in Ops Manager.
2. **Bucket Name:** Enter the name of the S3 bucket.
3. **Access Key** and **Secret Key:** Enter the keys you generated when creating your S3 bucket.
4. Select **V2 Signature** or **V4 Signature**. If you select **V4 Signature**, enter your **Region**.

 **Note:** AWS recommends using Signature Version 4. For more information about AWS S3 Signatures, see the [Authenticating Requests](#) documentation.

- **GCS Blobstore:** Select this option to use an external Google Cloud Storage (GCS) endpoint. To create a GCS bucket, follow the procedures in [Creating Storage Buckets](#). When you have created a GCS bucket, complete the following steps:
1. **Bucket Name:** Enter the name of your GCS bucket.
  2. **Storage Class:** Select the storage class for your GCS bucket. See [Storage Classes](#) in the GCP documentation for more information.
  3. **Service Account Key:** Enter the contents of the JSON file that you downloaded in the [Set Up an IAM Service Account](#) section of the

Blobstore Location

☒ Internal
 ☐ S3 Compatible Blobstore

S3 Endpoint\*

Bucket Name\*

Access Key\*

Secret Key\*

☒ V2 Signature
 ☐ V4 Signature

Region\*

☐ GCS Blobstore

Bucket Name\*

Storage Class\*

Regional

Service Account Key\*

Preparing to Deploy PKS on GCPtopic.

13. For **Database Location**, select **Internal**.
14. (Optional) Modify the **Director Workers** value, which sets the number of workers available to execute Director tasks. This field defaults to `5`.
15. (Optional) **Max Threads** sets the maximum number of threads that the Ops Manager Director can run simultaneously. Pivotal recommends that you leave the field blank to use the default value, unless doing so results in rate limiting or errors on your IaaS.
16. (Optional) To add a custom URL for your Ops Manager Director, enter a valid hostname in **Director Hostname**. You can also use this field to configure [a load balancer in front of your Ops Manager Director](#).



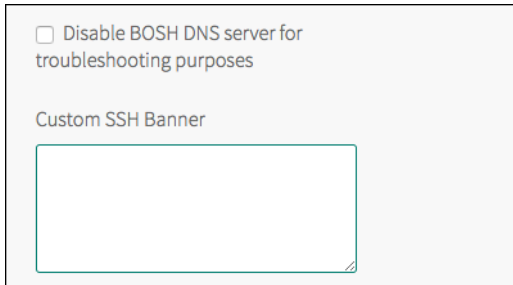
The screenshot shows a configuration form with three sections:

- Director Workers:** A text input field containing the value `5`.
- Max Threads:** An empty text input field.
- Director Hostname:** A text input field containing the value `opsdirector.example.com`.

17. Ensure the **Disable BOSH DNS server for troubleshooting purposes** checkbox is not selected.

**Note:** BOSH DNS must be enabled in all PKS deployments. If PAS and PKS are running on the same instance of Ops Manager, you cannot use the opt-out feature of BOSH DNS for your PAS without breaking PKS. If you want to opt out of BOSH DNS in your PAS deployment, install the tile on a separate instance of Ops Manager. For more information about opting out of BOSH DNS, see [this KB article](#) and [Ops Manager v2.0 Release Notes](#).

18. (Optional) To set a custom banner that users see when logging in to the Director using SSH, enter text in the **Custom SSH Banner** field.



The screenshot shows a configuration form with two sections:

- Disable BOSH DNS server for troubleshooting purposes:** An unchecked checkbox.
- Custom SSH Banner:** A large, empty text area for entering a custom banner.

19. Click **Save**.

## Step 4: Create Availability Zones Page

1. Select **Create Availability Zones**.
2. Click **Add**.
3. For **Google Availability Zone**:
  - o Enter one of the zones that you associated to the NAT instances. For example, if you are using the `us-central1` region and selected `us-central1-a` as one of the zones for your NAT instances, enter `us-central1-a`.
  - o Click **Add**
  - o Repeat the above step for all the availability zones that you associated to instances in [Preparing to Deploy PKS on GCP](#).

## Create Availability Zones

Availability Zones

Add

▶ us-central1-b

▼ us-central1-a

Google Availability Zone\*

us-central1-a

The Google Availability Zone name

▶ us-central1-c

Save

- Click **Save**.

- Repeat the above step for all the availability zones you are using in your deployment. When you are done, click **Save**.

## Step 5: Create Networks Page

- Select **Create Networks**.
- Make sure **Enable ICMP checks** is not selected. GCP routers do not respond to ICMP pings.
- Use the **Add Network** button to create the following three networks:

**Note:** To use a shared VPC network, enter the shared VPC host project name before the network name in the format `VPC-PROJECT-NAME/NETWORK-NAME/SUBNET-NAME/REGION-NAME`. For example, `vpc-project/opsmgr/central/us-central1`. For more information, see [Configuring a Shared VPC on GCP](#).

**Note:** Pivotal recommends using the gateway IP as your default DNS server only if the IP is reachable by all deployed VMs and apps. If you configure Application Security Groups (ASGs) that do not allow apps to reach the gateway IP, for example, your applications will fail to resolve any DNS entries. In this case, consider using other Google-provided DNS servers such as `169.254.169.254` or `8.8.8.8`, as long as these IPs are whitelisted in your configured ASGs.

- Create the following networks:

	Field	Configuration
Main Network	Name	pks-main
	Google Network Name	MY-PKS-virt-net/MY-PKS-subnet-pks-GCP-REGION/GCP-REGION
	CIDR	192.168.16.0/22
	Reserved IP Ranges	192.168.16.1-192.168.16.9
	DNS	169.254.169.254
	Gateway	192.168.16.1
Infrastructure Network	Field	Configuration
	Name	infrastructure
	Google Network Name	MY-PKS-virt-net/MY-PKS-subnet-infrastructure-GCP-REGION/GCP-REGION
	CIDR	192.168.101.0/26
	Reserved IP Ranges	192.168.101.1-192.168.101.9
	DNS	169.254.169.254
	Gateway	192.168.101.1
	Field	Configuration

Service Network	Name	pks-services
	Google Network Name	MY-PKS-virt-net/MY-PKS-subnet-services-GCP-REGION/GCP-REGION
	CIDR	192.168.20.0/22
	Reserved IP Ranges	192.168.20.1-192.168.20.9
	DNS	169.254.169.254
	Gateway	192.168.20.1

## Step 6: Assign AZs and Networks Page

1. Select **Assign AZs and Networks**.
2. Use the drop-down menu to select a **Singleton Availability Zone**. The Ops Manager Director installs in this Availability Zone.
3. Under **Network**, select the **infrastructure** network for your Ops Manager Director.
4. Click **Save**.

## Step 7: Security Page

1. Select **Security**.

### Security

---

Trusted Certificates

-----BEGIN CERTIFICATE-----

TH

-----END CERTIFICATE-----

These certificates enable BOSH-deployed components to trust a custom root certificate.

Generate VM passwords or use single password for all VMs

☒ Generate passwords
 ☐ Use default BOSH password

Save

2. In **Trusted Certificates**, enter a custom certificate authority (CA) certificate to insert into your organization's certificate trust chain. This feature enables all BOSH-deployed components in your deployment to trust a custom root certificate.
  - You do not need to enter anything in this field if you are using self-signed certificates.
  - If you want to use Docker Registries for running app instances in Docker containers, enter the certificate for your private Docker Registry in this field. See the [Using Docker Registries](#) topic for more information.
3. Choose **Generate passwords** or **Use default BOSH password**. Pivotal recommends that you use the **Generate passwords** option for greater security.
4. Click **Save**. To view your saved Director password, click the **Credentials** tab.

## Step 8: Syslog Page

## 1. Select Syslog.

### Syslog

Do you want to configure Syslog for Bosh Director?

☐ No
 ☒ Yes

Address\*

The address or host for the syslog server

Port\*

Transport Protocol\*

TCP

⌵

☐ Enable TLS

Permitted Peer\*

SSL Certificate\*

Save

- (Optional) To send BOSH Director system logs to a remote server, select **Yes**.
- In the **Address** field, enter the IP address or DNS name for the remote server.
- In the **Port** field, enter the port number that the remote server listens on.
- In the **Transport Protocol** dropdown menu, select **TCP**, **UDP**, or **REL**P. This selection determines which transport protocol is used to send the logs to the remote server.
- (Optional) Mark the **Enable TLS** checkbox to use TLS encryption when sending logs to the remote server.
  - In the **Permitted Peer** field, enter either the name or SHA1 fingerprint of the remote peer.
  - In the **SSL Certificate** field, enter the SSL certificate for the remote server.
- Click **Save**.

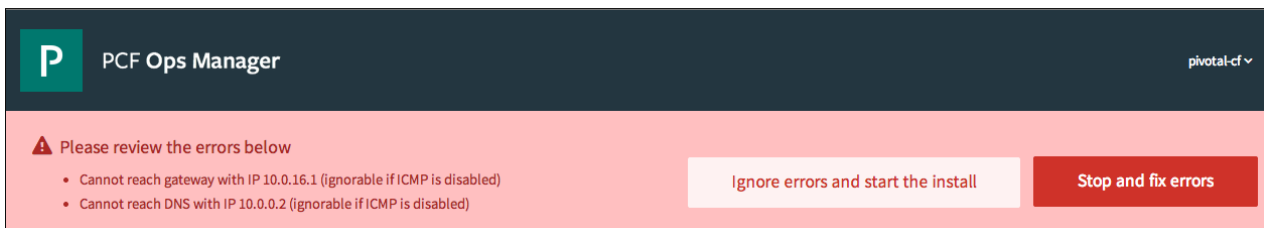
## Step 9: Resource Config Page

- Select **Resource Config**.
- Ensure that the **Internet Connected** checkboxes are not selected for any jobs. The checkbox gives VMs a public IP address that enables outbound

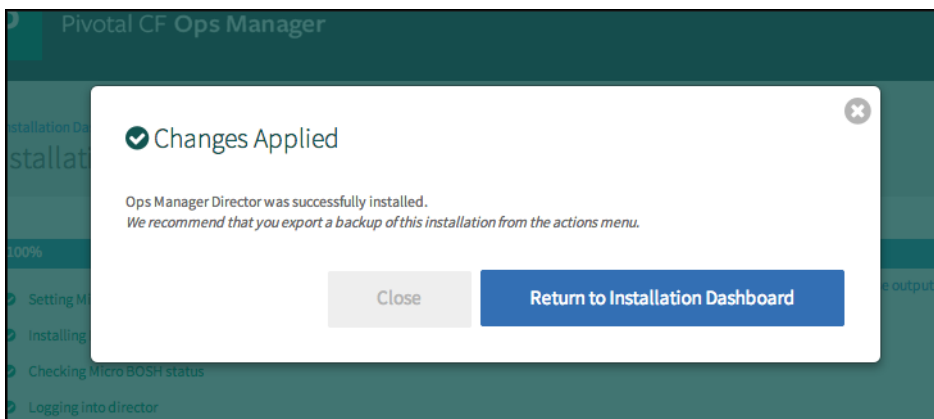
Internet access. In [Preparing to Deploy PKS on GCP](#), you provisioned a Network Address Translation (NAT) box to provide Internet connectivity to your VMs. For more information about using NAT in GCP, see the [GCP documentation](#).

## Step 10: Complete the Ops Manager Director Installation

1. Click the **Installation Dashboard** link to return to the Installation Dashboard.
2. Click **Apply Changes**. If the following ICMP error message appears, return to the [Network Config](#) screen, and make sure you have deselected the **Enable ICMP Checks** box. Then click **Apply Changes** again.



3. Ops Manager Director installs. This may take a few moments. When the installation process successfully completes, the **Changes Applied** window appears.



## Next Steps

After you complete this procedure, follow the instructions in [Installing PKS](#) to deploy PKS.



## Installing and Configuring PKS on GCP

Page last updated:

This topic describes how to install and configure Pivotal Container Service (PKS) on Google Cloud Platform (GCP).

Before performing the procedures in this topic, consult the [GCP Prerequisites and Resource Requirements](#) topic.

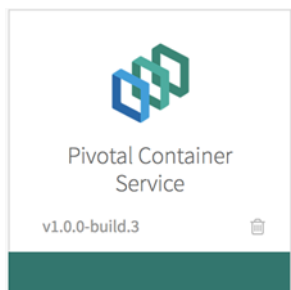
### Step 1: Install PKS

Perform the following steps to install PKS:

1. Download the product file from [Pivotal Network](#).
2. Navigate to `https://YOUR-OPS-MANAGER-FQDN/` in a browser to log in to the Ops Manager Installation Dashboard.
3. From the **Director Config** page, configure the following settings:
  - Select **Enable Post Deploy Scripts**.
  - Clear the **Disable BOSH DNS server for troubleshooting purposes** checkbox.
4. Click **Apply Changes**.
5. Click **Import a Product** to upload the product file.
6. Under **Pivotal Container Service** in the left column, click the plus sign to add this product to your staging area.

### Step 2: Configure PKS

Click the orange **Pivotal Container Service** tile to start the configuration process.



### Assign AZs and Networks

Perform the following steps:

1. Click **Assign AZs and Networks**.

Place singleton jobs in

☒ us-west-2a
 ☐ us-west-2b
 ☐ us-west-2c

Balance other jobs in

☐ us-west-2a
 ☒ us-west-2b
 ☐ us-west-2c

Network


pcf-management-network


Service Network

pcf-services-network

Save

2. Select an availability zone (AZ) for your singleton jobs and one or more AZs to balance other jobs in.

 **Note:** If you upgrade PKS, you must place singleton jobs in the AZ you selected when you first installed the PKS tile. You cannot move singleton jobs to another AZ.

 **Note:** In PKS, Pivotal Container Service is a singleton job. This broker VM enables the creation of PKS clusters through the PKS CLI.

3. Under **Network**, select a subnet for the PKS broker.
4. Under **Service Network**, select a subnet for the on-demand service instances created by the PKS broker.
5. Click **Save**.

## PKS API


Perform the following steps:

1. Click **PKS API**.
2. Under **Certificate**, provide your own certificate or have Ops Manager generate one. To generate a new certificate and key, enter a wildcard domain you own. For example, `*.pks.pcfhcp.mydomain.com`.
3. Under **Generate RSA Certificate**, provide the domain names that you want your certificate to have. The domain names should contain the hostname you intend to use for accessing the PKS API service and UAA.
4. Click **Save**.

## Plans

To activate a plan, perform the following steps:

1. Click the **Plan 1**, **Plan 2**, or **Plan 3** tab.

 **Note:** A plan defines a set of resource types used for deploying clusters. You can configure up to three plans.

2. Select **Active** to activate the plan and make it available to developers deploying clusters.
3. Under **Name**, provide a unique name for the plan.
4. Under **Description**, edit the description as needed. The plan description appears in the Services Marketplace, which developers can access by using

PKS CLI.

5. Under **Default Cluster Authorization Mode**, select an authentication mode for the Kubernetes clusters. For more information, see the [RBAC Support in Kubernetes](#) blog post.
6. Under **AZ placement**, select an AZ for the Kubernetes clusters deployed by PKS.
7. Under **ETCD/Master VM Type**, select the type of VM to use for Kubernetes etcd and master nodes.
8. Under **Master Persistent Disk Type**, select the size of the persistent disk for the Kubernetes master VM.
9. Under **Worker VM Type**, select the type of VM to use for Kubernetes worker nodes.
10. Under **Worker Persistent Disk Type**, select the size of the persistent disk for the Kubernetes worker nodes.
11. Under **Worker Node Instances**, select the default number of Kubernetes worker nodes to provision for each cluster.
12. Under **Errand VM Type**, select the size of the VM where the errand will run. The smallest instance possible is sufficient, as the only errand running on this VM is the one that applies the **Default Cluster App** YAML configuration.
13. (Optional) Under **(Optional) Add-ons - Use with caution**, enter additional YAML configuration to [add custom workloads](#) to each cluster in this plan. You can specify multiple files using `---` as a separator.
14. If you want users to be able to create [pods with privileged containers](#), select the **Enable Privileged Containers - Use with caution** option.
15. Click **Save**.

To deactivate a plan, perform the following steps:

1. Click the **Plan 1**, **Plan 2**, or **Plan 3** tab.
2. Select **Plan Inactive**.
3. Click **Save**.

## Kubernetes Cloud Provider

Perform the following steps:

1. Click **Kubernetes Cloud Provider**.
2. Under **Choose your IaaS**, select **GCP**.
3. Perform the steps specific to GCP.
  - Ensure the values match those in the **Google Config** section of the **Ops Manager** tile:
    1. Enter your **GCP Project Id**, which is the name of the deployment in your Ops Manager environment.
    2. Enter your **VPC Network**, which is the VPC network name for your Ops Manager environment.
    3. Enter your **GCP Service Key**, which you created using [the instructions from the GCP prerequisites](#).
4. Click **Save**.

## Networking

Perform the following steps:

1. Click **Networking**.
2. Under **Network**, select the Container Network Interface to use.
  - For **Flannel**, no additional fields are required.
  - For **NSX-T**, see [Installing and Configuring PKS with NSX-T Integration](#).
3. Click **Save**.

## UAA

Perform the following steps:

1. Click **UAA**.
2. Enter the URL you use to access UAA.



**Note:** This must match the wildcard domain provided when generating the PKS API certificate in the [PKS API](#) section, or in the SAN for the certificate if you provided your own.

3. Enter the time (in seconds) for the PKS CLI access token lifetime.
4. Enter the time (in seconds) for the PKS CLI refresh token lifetime.

## (Optional) Syslog

You can designate an external syslog endpoint for PKS component and cluster log messages.

To specify the destination for PKS log messages, perform the following steps:

1. Click **Syslog**.
2. Select **Yes** to configure syslog forwarding.
3. Enter the destination syslog endpoint.
4. Enter the destination syslog port.
5. Select a transport protocol for log forwarding.
6. (Optional) If you select TLS to forward encrypted logs, perform the following steps:
  - a. Provide the accepted fingerprint (SHA1) or name of remote peer. For example, `*.YOUR-LOGGING-SYSTEM.com`.
  - b. Provide a TLS certificate for the destination syslog endpoint.



**Note:** You do not need to provide a new certificate if the TLS certificate for the destination syslog endpoint is signed by a Certificate Authority (CA) in your BOSH certificate store.

## Errands

Errands are scripts that run at designated points during an installation.

To configure when post-deploy and pre-delete errands for PKS are run, make a selection in the dropdown next to the errand. For a typical PKS deployment, Pivotal recommends that you leave the default settings.

For more information about errands and their configuration state, see [Managing Errands in Ops Manager](#).

## (Optional) Resource Config

To modify the resource usage of PKS, click **Resource Config** and edit the **PKS on-demand broker** job.

## (Optional) Stemcell

To edit the stemcell configuration, click **Stemcell**. Click **Import Stemcell** to import a new stemcell.

PKS uses floating stemcells. Floating stemcells allow upgrades to the minor versions of stemcells but not the major versions. For example, a stemcell can float from `1234.56` to `1234.99` but not from `1234.991` to `1235.0`. For more information on floating stemcells, see the [Understanding Floating Stemcells](#) topic.

**⚠ WARNING:** Because PKS uses floating stemcells, updating the PKS tile with a new stemcell triggers the rolling of every VM in each cluster. Also, updating other product tiles in your deployment with a new stemcell causes the PKS tile to roll VMs. This rolling is enabled by the **Upgrade all clusters errand**. Pivotal recommends that you keep this errand turned on because automatic rolling of VMs ensures that all deployed cluster VMs are patched. However, automatic rolling can cause downtime in your deployment.

## Step 3: Apply Changes

After configuring the tile, return to the Ops Manager Installation Dashboard and click **Apply Changes** to deploy the tile.

## Step 4: Retrieve PKS API Endpoint

You must share the PKS API endpoint to allow your organization to use the API to create, update, and delete clusters.

When an operator creates a cluster, they provide an IP address for the Kubernetes master host, then point the load balancer to the newly created cluster. If you use a load balancer as a service (LBaaS) tool, your LBaaS may manage cluster creation and configuration.

See [Using PKS](#) for more information.

Perform the following steps to retrieve the PKS API endpoint:

1. Navigate to the Ops Manager Installation Dashboard.
2. Click the PKS tile.
3. Click the **Status** tab and locate the IP address of the PKS API endpoint. This is the endpoint that developers use to create and manage clusters.

## Step 5: Configure External Load Balancer

Configure your external TCP or HTTPS load balancer to resolve to the domain name used in the certificate you provided during the [PKS API](#) section of the tile configuration. Your external load balancer forwards traffic to the PKS API endpoint on port 9021 and the UAA endpoint on port 8443.

The load balancer should be configured with:

- The IP address from [Step 4: Retrieve PKS API Endpoint](#)
- Ports 8443 and 9021
- The HTTPS or TCP protocol

## Managing PKS

Page last updated:

This topic describes how to manage Pivotal Container Service (PKS). See the following sections:

- [Configure PKS API Access](#)
- [Manage Users in UAA](#)
- [Manage PKS Deployments with BOSH](#)
- [Add Custom Workloads](#)
- [Download Cluster Logs](#)
- [Prepare Workloads for an Upgrade](#)
- [Delete PKS](#)

## Configure PKS API Access

Page last updated:

To configure access to the PKS API, perform the following steps:

1. Configure an external load balancer to forward traffic to the PKS API endpoint. For more information, see the Configure External Load Balancer section of *Installing and Configuring PKS on [GCP](#) or [vSphere](#)*.



**Note:** If your PKS installation is integrated with NSX-T, map the external load balancer to the DNAT IP address assigned in the [Apply Changes and Retrieve the PKS Endpoint](#) section of *Installing and Configuring PKS with NSX-T Integration*.

2. Configure a DNS entry that points to the load balancer and uses the domain configured in the PKS API section of *Installing and Configuring PKS on [GCP](#) or [vSphere](#)*.

## Manage Users in UAA

Page last updated:

Create and manage users in UAA with the [UAA Command Line Interface \(UAAC\)](#).

### Retrieve UAA Admin Credentials

To retrieve the UAA admin client secret, perform the following steps:

1. In a web browser, navigate to the fully qualified domain name (FQDN) of Ops Manager and click the **Pivotal Container Service** tile.
2. Click **Credentials**.
3. To view the UAA admin client credentials, click **Uaa Admin Secret**.

### Grant Cluster Access to a User

To allow a user to access clusters in PKS, perform the following steps using UAAC:

1. Target your PKS API endpoint using `uaac target https://YOUR-PKS-API:8443`. Replace `YOUR-PKS-API` with your PKS API endpoint URL. For example:

```
$ uaac target https://pks-api.example.com:8443
```

2. Authenticate with UAA using the secret you retrieved in the previous section. Run the following command, replacing `UAA-ADMIN-SECRET` with your UAA admin secret:

```
uaac token client get admin -s UAA-ADMIN-SECRET
```

3. Create a user by running `uaac user add USERNAME --emails USER-EMAIL -p USER-PASSWORD`. For example:

```
$ uaac user add alana --emails alana@example.com -p password
```

4. Assign a scope to the user to allow them to access Kubernetes clusters. Run `uaac member add UAA-SCOPE USERNAME`, replacing `UAA-SCOPE` with one of the following UAA scopes:
  - `pks.clusters.admin`: Users with this scope have full access to all clusters.
  - `pks.clusters.manage`: Users with this scope can only access clusters they create.

For example:

```
$ uaac member add pks.clusters.admin alana
```



## Manage PKS Deployments with BOSH

Page last updated:

To manage your PKS deployment with BOSH, perform the following steps:

1. Gather credential and IP address information for your BOSH Director and SSH into the Ops Manager VM. See [Advanced Troubleshooting with the BOSH CLI](#) for more information.

2. Create a BOSH alias for your PKS environment. For example:

```
$ bosh alias-env pks -e 10.0.0.3 --ca-cert /var/tempest/workspaces/default/root_ca_certificate
```

3. Log in to the BOSH Director.

```
$ bosh -e pks log-in
```

4. Follow the procedures in the [Use the BOSH CLI for Troubleshooting](#) topic to manage your PKS deployment with BOSH.

## Add Custom Workloads

Page last updated:

To apply custom Kubernetes workloads to every cluster created on a plan, add YAML to the tile config under **Default Cluster Apps**. Use this configuration to define what a cluster includes out of the box. For example, use custom workloads to configure metrics or logging.

## Download Cluster Logs

To download cluster logs, perform the following steps:

1. Gather credential and IP address information for your BOSH Director, SSH into the Ops Manager VM, and use the BOSH CLI v2 to log in to the BOSH Director from the Ops Manager VM. For more information, see [Advanced Troubleshooting with the BOSH CLI](#).

2. After logging in to the BOSH Director, identify the name of your PKS deployment. For example:

```
$ bosh -e pks deployments
```

Your PKS deployment name begins with `pivotal-container-service` and includes a BOSH-generated hash.

3. Identify the names of the VMs you want to retrieve logs from by listing all VMs in your deployment. For example:

```
$ bosh -e pks -d pivotal-container-service-aa1234567bc8de9f0a1c vms
```

4. Download the logs from the VM. For example:

```
$ bosh -e pks -d pivotal-container-service-aa1234567bc8de9f0a1c logs pks/0
```

See [Diagnosing and Troubleshooting PKS](#) for information about using cluster logs to diagnose issues in your PKS deployment.

## Prepare Workloads for an Upgrade

To prevent workload downtime during a PKS upgrade, define the following settings in the deployment manifest:

- Increase the number of worker nodes by editing the `spec.replicas` value.
- Schedule pod replicas to run on separate workers by defining a `podAntiAffinity` rule.

For example:

```
kind: Deployment
metadata:
  # ...
spec:
  replicas: 3
  template:
    metadata:
      labels:
        app: APP-NAME
    spec:
      containers:
        - name: MY-APP
          image: MY-IMAGE
          ports:
            - containerPort: 12345
      affinity:
        podAntiAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
            - labelSelector:
                matchExpressions:
                  - key: "app"
                    operator: In
                    values:
                      - APP-NAME
              topologyKey: "kubernetes.io/hostname"
```

See the following table for descriptions of the values you must edit in the deployment manifest:

Key-Value Pair	Description
<code>spec:</code> <code>replicas: 3</code>	Set this value to at least 2 to increase the number of worker nodes. If you are unsure of your worker capacity, begin by increasing the value by 1.
<code>app: APP-NAME</code>	Use this app name when you define the anti-affinity rule later in the spec.
<code>matchExpressions:</code> <code>- key: "app"</code>	This value matches <code>spec.template.metadata.labels.app</code> .
<code>values:</code> <code>- APP-NAME</code>	This value matches the <code>APP-NAME</code> you defined earlier in the spec.

## Delete PKS


To delete PKS, perform the following steps:

1. Navigate to the Ops Manager Installation Dashboard.
2. Click the trash icon on the PKS tile.
3. Click **Confirm** in the dialog box that appears.
4. By default, deleting the PKS tile will also delete all the clusters created by PKS. To preserve the clusters, click the **Delete all clusters** errand under **Pending Changes** and select **Off**.
5. Click **Apply Changes**.

## Using PKS

Page last updated:

This topic describes how to use Pivotal Container Service (PKS).

 **Note:** Because PKS does not currently support the Kubernetes Service Catalog or the GCP Service Broker, binding clusters to Kubernetes services is not supported.


See the following sections:

- [Prerequisites](#)
- [Create a Cluster](#)
- [Retrieve Cluster Credentials and Configuration](#)
- [View Cluster List](#)
- [View Cluster Details](#)
- [View Cluster Plans](#)
- [Using Dynamic Persistent Volumes](#)
- [Scale Existing Clusters](#)
- [Access the Dashboard](#)
- [Deploy and Access Basic Workloads](#)
- [Delete a Cluster](#)
- [Log Out of the PKS Environment](#)


## Prerequisites for Using PKS

The procedures for using PKS have the following prerequisites:

- You must have a Pivotal Cloud Foundry (PCF) deployment with Ops Manager v2.0 or later and PKS installed.
- You must have the [PKS CLI](#) installed.

 **WARNING:** The PKS CLI is under active development and commands may change. To ensure you have installed the latest version, we recommend that you re-install the PKS CLI before you use it. To install the PKS CLI, see [Installing the PKS CLI](#).

- You must have `kubectl`, the Kubernetes CLI, installed. To download and install `kubectl`, see the [Install and Set Up kubectl](#) topic in the Kubernetes documentation. For more information about using `kubectl`, see the [kubectl documentation](#).
- You must have an external TCP or HTTPS load balancer configured to forward traffic to the PKS API endpoint. For more information, see the Configure External Load Balancer section of *Installing and Configuring PKS on GCP or vSphere*.
- You must have your PKS API endpoint and your UAA credentials. To retrieve these values, perform the following steps:
  1. Navigate to the **Pivotal Container Service** tile in the Ops Manager Installation Dashboard.
  2. Click **Credentials**.
  3. To retrieve the UAA credentials, click **Uaa Admin Secret**.
  4. Click the **Status** tab.
  5. Retrieve the PKS API IP under **IPs**.

 **Note:** If your PKS installation is integrated with NSX-T, use the DNAT IP address assigned in the [Apply Changes and Retrieve the PKS Endpoint](#) section of *Installing and Configuring PKS with NSX-T Integration*.

## Create a Cluster

Follow the steps below to create a Kubernetes cluster using the PKS CLI.

1. Locate the external hostname for accessing the Kubernetes API. Use one of the following methods, depending on your PKS installation:
  - If your PKS installation is **integrated with NSX-T**, use the NAT IP from the `ip-pool-vips` NSX IP pool. For more information, see [Enable NAT Access](#) in *Installing and Configuring PKS with NSX-T Integration*.
  - If your PKS installation is **not integrated with NSX-T**, [create an external load balancer](#) and record its IP address or hostname. Each new cluster requires its own TCP or HTTPS load balancer to allow external access. When you provide the external hostname later in this procedure, you can either use the load balancer IP address or a hostname from the domain you specified for the PKS API. For more information, see the PKS API section of *Installing and Configuring PKS on GCP or vSphere*.

2. On the command line, run the following command to log in:

```
pkcs login -a PKS_API -u USERNAME -p PASSWORD
```

Replace the placeholder values in the command as follows:

- `PKS_API` is your PKS API hostname. For example, `10.85.102.12`. The PKS CLI uses port 9021 by default.
- `USERNAME` is your PKS API username.
- `PASSWORD` is your PKS API password.

3. Run the following command to create a cluster:

```
pkcs create-cluster CLUSTER-NAME --external-hostname HOSTNAME --plan PLAN-NAME [--num-nodes WORKER-NODES]
```

Replace the placeholder values in the command as follows:

- `CLUSTER-NAME` is a unique name for your cluster.
- `HOSTNAME` is the external hostname for accessing the Kubernetes API. Use the hostname you located earlier in this procedure.
- `PLAN-NAME` is the name of the plan you want to use to create the cluster.
- `WORKER-NODES` is the number of worker nodes for the cluster. For high availability, Pivotal recommends creating clusters with at least 3 worker nodes. The maximum value is 50. This flag is optional.

For example:

```
$ pkcs create-cluster my-cluster --external-hostname 10.0.0.1 --plan large --num-nodes 3
```

4. Track the cluster creation process by running `pkcs cluster CLUSTER-NAME`. Replace `CLUSTER-NAME` with the unique name for your cluster. For example:

```
$ pkcs cluster my-cluster
```

The cluster status appears in the **Last Action State** column. If the last action state is `error`, troubleshoot cluster creation by logging in to the BOSH Director and running `bosh tasks`. See [Advanced Troubleshooting with the BOSH CLI](#) for more information.

5. When cluster creation is complete, configure the external hostname.
  - a. Run `pkcs cluster CLUSTER-NAME` to view cluster details. Replace `CLUSTER-NAME` with the unique name for your cluster. For example:

```
$ pkcs cluster my-cluster
```

- b. Locate the master IP address for the cluster in the `kubernetes_master_ips` row.
- c. Configure your external TCP or HTTPS load balancer to point to the master IP address.

6. To access your cluster, run `pkcs get-credentials CLUSTER-NAME`. This command creates a local `kubeconfig` that allows you to manage the cluster. See [Retrieve Cluster Credentials and Configuration](#) for more information.
7. Run `kubectl cluster-info` to confirm you can access your cluster using the Kubernetes CLI.

See [Managing PKS](#) for information about checking cluster health and viewing cluster logs.



## Retrieve Cluster Credentials and Configuration

Follow the steps below to retrieve the cluster credentials and configuration using the PKS CLI.

1. On the command line, run the following command to log in:

```
pkc login -a PKS_API -u USERNAME -p PASSWORD
```

Replace the placeholder values in the command as follows:

- `PKS_API` is your PKS API hostname. For example, `10.85.102.12`. The PKS CLI uses port 9021 by default.
- `USERNAME` is your PKS API username.
- `PASSWORD` is your PKS API password.

2. Run the following command to retrieve the cluster credentials and configuration:

```
pkc get-credentials CLUSTER-NAME
```

Replace `CLUSTER-NAME` with the unique name for your cluster. For example:

```
$ pkc get-credentials my-cluster
```

You can use the `pkc get-credentials` command to perform the following actions:

- Fetch the cluster's `kubeconfig`
- Add the cluster's `kubeconfig` to the existing `kubeconfig`
- Create a new `kubeconfig`, if none exists
- Switch the context to the `CLUSTER-NAME` provided

The `kubeconfig` file path works the same way as `kubectl`. If you do not set the file path, the default path is `$HOME/.kube/config`. Use the `KUBECONFIG` environment variable to change the `kubeconfig` file path.

You can use the credentials and the `kubeconfig` to deploy application workloads to your cluster with `kubectl`. For more information about accessing your cluster, see the [Kubernetes documentation](#).

## View Cluster List

Follow the steps below to view the list of deployed Kubernetes cluster with the PKS CLI.

1. On the command line, run the following command to log in:

```
pkc login -a PKS_API -u USERNAME -p PASSWORD
```

Replace the placeholder values in the command as follows:

- `PKS_API` is your PKS API hostname. For example, `10.85.102.12`. The PKS CLI uses port 9021 by default.
- `USERNAME` is your PKS API username.
- `PASSWORD` is your PKS API password.

2. Run the following command to view the list of deployed clusters, including cluster names and status:

```
pkc clusters
```

## View Cluster Details

Follow the steps below to view the details of an individual cluster using the PKS CLI.

1. On the command line, run the following command to log in:

```
pkcs login -a PKS_API -u USERNAME -p PASSWORD
```

Replace the placeholder values in the command as follows:

- `PKS_API` is your PKS API hostname. For example, `10.85.102.12`. The PKS CLI uses port 9021 by default.
- `USERNAME` is your PKS API username.
- `PASSWORD` is your PKS API password.

2. Run the following command to view the details of an individual cluster:

```
pkcs cluster CLUSTER-NAME
```

Replace `CLUSTER-NAME` with the unique name for your cluster. For example:

```
$ pkcs cluster my-cluster
```

## View Cluster Plans

Follow the steps below to view information about the available plans for deploying a cluster using the PKS CLI.

1. On the command line, run the following command to log in:

```
pkcs login -a PKS_API -u USERNAME -p PASSWORD
```

Replace the placeholder values in the command as follows:

- `PKS_API` is your PKS API hostname. For example, `10.85.102.12`. The PKS CLI uses port 9021 by default.
- `USERNAME` is your PKS API username.
- `PASSWORD` is your PKS API password.

2. Run the following command to view information about the available plans for deploying a cluster:

```
$ pks plans
```

The response lists details about the available plans, including plan names and descriptions:

Name	ID	Description
default		Default plan for K8s cluster

## Using Dynamic Persistent Volumes

When using PKS, you can choose to pre-provision persistent storage or create on-demand persistent storage volumes. Refer to the [Kubernetes documentation](#) for more information about storage management.

Perform the steps in this section to define a `PersistentVolumeClaim` that you can apply to newly-created pods.

1. Download the `StorageClass` spec for your cloud provider.
  - GCP:

```
$ wget https://raw.githubusercontent.com/cloudfoundry-incubator/kubo-ci/master/specs/storage-class-gcp.yml
```

- vSphere:

```
$ wget https://raw.githubusercontent.com/cloudfoundry-incubator/kubo-ci/master/specs/storage-class-vsphere.yml
```

2. Apply the spec by running `kubectl create -f STORAGE-CLASS-SPEC.yml`. Replace `STORAGE-CLASS-SPEC` with the name of the file you downloaded in the previous step. For example:

```
$ kubectl create -f storage-class-gcp.yml
```

3. Run the following command to download the example `PersistentVolumeClaim`:

```
$ wget https://raw.githubusercontent.com/cloudfoundry-incubator/kubo-ci/master/specs/persistent-volume-claim.yml
```

4. Run the following command to apply the `PersistentVolumeClaim`:

```
$ kubectl create -f persistent-volume-claim.yml
```


- To confirm you applied the `PersistentVolumeClaim`, run the following command:

```
$ kubectl get pvc -o wide
```

5. To use the dynamic persistent volume, create a pod that uses the `PersistentVolumeClaim`. See the [pv-guestbook.yml configuration file](#) as an example.

## Scale Existing Clusters

Follow the steps below to scale up an existing cluster using the PKS CLI.

 **Note:** You cannot scale the number of worker nodes down. You can only scale the number of worker nodes up.


1. On the command line, run the following command to log in:

```
pks login -a PKS_API -u USERNAME -p PASSWORD
```

Replace the placeholder values in the command as follows:

- `PKS_API` is your PKS API hostname. For example, `10.85.102.12`. The PKS CLI uses port 9021 by default.
- `USERNAME` is your PKS API username.
- `PASSWORD` is your PKS API password.

2. Run the following command below to scale up your cluster. You cannot scale the number of worker nodes down.

 **Note:** This command may roll additional VMs in the cluster, affecting workloads if the worker nodes are at capacity. This issue will be resolved in a future release of PKS.

```
pks resize CLUSTER-NAME --num-nodes WORKER-NODES
```

Replace the placeholder values in the command as follows:

- `CLUSTER-NAME` is the name of your cluster.
- `WORKER-NODES` is the number of worker nodes for the cluster. The maximum number of worker nodes is 50. For example:

```
$ pks resize my-cluster --num-nodes 5
```

## Access the Dashboard

*Dashboard* is a web-based Kubernetes user interface. You can use Dashboard to deploy containerized applications to a Kubernetes cluster, troubleshoot containerized applications, and manage the cluster and its resources. Dashboard also provides information about the state of Kubernetes resources in the cluster.

You must have `kubectl` credentials to access Dashboard. This requirement prevents unauthorized admin access to the Kubernetes cluster through a browser.

Follow the steps below to access the Dashboard for a Kubernetes cluster.

1. As a PKS operator or developer, you may already have access to `kubectl` credentials. If you do not, follow the instructions in the [Retrieve Cluster Credentials and Configuration](#) section of this topic to retrieve these credentials.
2. After retrieving `kubectl` credentials, run `kubectl proxy` on a command line. Do not exit or close the terminal.
3. In a web browser, browse to `http://localhost:8001/ui` to access the Dashboard.

## Deploy and Access Basic Workloads


You can deploy and access workloads in a number of ways. This PKS release focuses on `routing_mode: external` and does not include a bundled load balancing component. Select an option based on your PKS deployment:

- [No Load Balancer Abstraction Configured / vSphere without NSX-T](#)
- [Load Balancer Abstraction Configured / GCP or vSphere with NSX-T](#)
- [External Load Balancer](#)

### No Load Balancer Abstraction Configured / vSphere without NSX-T

If you use vSphere without NSX-T or configuring a load balancer abstraction, follow the steps below to deploy and access basic workloads.

1. Expose the workload using a Service with `type: NodePort`.
2. Download the spec for a basic NGINX app from the [pivotal-cf-experimental/kubo-ci](#) GitHub repository.
3. Run `kubectl create -f nginx.yml` to deploy the basic NGINX app. This command creates three pods (replicas) that span three worker nodes.
4. Retrieve the IP address for a worker node with a running NGINX pod.


 **Note:** If you deployed more than four worker nodes, some worker nodes may not contain a running NGINX pod. Select a worker node that contains a running NGINX pod.

You can retrieve the IP address for a worker node with a running NGINX pod in one of the following ways:

- On the command line, run `kubectl get nodes`. Select a node name, then locate the node name in the vCenter or GCP Console to find the IP address.
  - On the Ops Manager command line, run `bosh vms` to find the IP address.
5. On the command line, run `kubectl get svc nginx`. Find the node port number in the `3XXXX` range.
  6. On the command line of a server with network connectivity and visibility to the IP address of the worker node, run `curl http://NODE-IP:NODE-PORT` to access the app. Replace `NODE-IP` with the IP address of the worker node, and `NODE-PORT` with the node port number.

### Load Balancer Abstraction Configured / GCP or vSphere with NSX-T

If you use GCP or vSphere with NSX-T, follow the steps below to deploy and access basic workloads.


 **Note:** This approach creates a dedicated load balancer for each workload. This may be an inefficient use of resources in clusters with many apps.

1. Expose the workload using a Service with `type: LoadBalancer`.
2. Download the spec for a basic NGINX app from the [cloudfoundry-incubator/kubo-ci](#) GitHub repository.
3. Run `kubectl create -f nginx.yml` to deploy the basic NGINX app. This command creates three pods (replicas) that span three worker nodes.
4. Wait until the GCP CloudProvider interacts with GCP to create a dedicated load balancer and connects it to the worker nodes on a specific port.
5. Run `kubectl get svc nginx` and retrieve the load balancer IP address and port number.
6. On the command line of a server with network connectivity and visibility to the IP address of the worker node, run `curl http://EXTERNAL-IP:PORT` to access the app. Replace `EXTERNAL-IP:PORT` with the IP address of the load balancer, and `PORT` with the port number.

### External Load Balancer

All deployments can use an external load balancer. To use an external load balancer, follow the steps below to deploy and access basic workloads.



 **Note:** All external load balancers in your deployment must use TCP or HTTPS. Using an HTTP load balancer causes `kubectl` operations to fail.

1. Expose every workload and app using a Service with `type: NodePort`.
2. Map each node port exposed in the worker nodes that you need to an external port in your external load balancer. The process to map these ports depends on your load balancer. See your external load balancer documentation for more information.
3. For each app, run `curl http://LOAD-BALANCER-IP:EXTERNAL-PORT`. Replace `LOAD-BALANCER-IP` with the IP address of your external load balancer and `EXTERNAL-PORT` with the external port number.

## Delete a Cluster

Follow the steps below to delete a cluster using the PKS CLI.

1. On the command line, run `pkcs login -a PKS_API -u USERNAME -p PASSWORD` to log in. Replace the placeholder values in the command as follows:
  - `PKS_API` is your PKS API hostname. For example, `10.85.102.12`. The PKS CLI uses port 9021 by default.
  - `USERNAME` is your PKS API username.
  - `PASSWORD` is your PKS API password.
2. Run `pkcs delete-cluster CLUSTER-NAME` to delete a cluster. Replace `CLUSTER-NAME` with the unique name for your cluster. For example:

```
$ pkcs delete-cluster my-cluster
```

## Log Out of the PKS Environment

On the command line, run `pkcs logout` to log out of your PKS environment.

After logging out, you must run `pkcs login` before you can run any other `pkcs` commands.

## Using Helm with PKS

Page last updated:

This topic describes how you can use the package manager [Helm](#) for your Kubernetes apps running on Pivotal Container Service (PKS).

Helm includes of the following components:

Component	Role	Location
<code>helm</code>	Client	Runs on your local workstation
<code>tiller</code>	Server	Runs inside your Kubernetes cluster

Helm packages are called [charts](#). Here are some examples of charts you can use:

- [Concourse](#) for CI/CD pipelines
- [Datadog](#) for monitoring
- [MySQL](#) for storage

This topic includes a procedure for installing [Concourse](#) using Helm. For more charts, see the Kubernetes [charts repository](#) on GitHub.

If you want to to use Helm with PKS, see the following sections:

- [Configure Tiller](#)
- [Install Concourse Using Helm](#)

## Configure Tiller

Tiller runs inside the Kubernetes cluster and requires access to the Kubernetes API. If you use role-based access control (RBAC) in PKS, perform the steps in this section to grant Tiller permission to access the API.

1. Create a service account for Tiller by running the following command:

```
$ kubectl create serviceaccount tiller --namespace kube-system
```

2. Bind the service account to the `cluster-admin` role by adding the following section to `rbac-config.yaml`:

```
apiVersion: v1
kind: ServiceAccount
metadata:
  name: tiller
  namespace: kube-system
---
apiVersion: rbac.authorization.k8s.io/v1beta1
kind: ClusterRoleBinding
metadata:
  name: tiller
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: cluster-admin
subjects:
- kind: ServiceAccount
  name: tiller
  namespace: kube-system
```

3. Apply the role by running the following command:

```
$ kubectl create -f rbac-config.yaml
```

4. Deploy Helm using the service account by running the following command:

```
$ helm init --service-account tiller
```

5. Run `helm ls` to verify that the permissions are configured.

To apply more granular permissions to the Tiller service account, see the [Helm](#) documentation.

## Install Concourse Using Helm

Perform the steps in this section to install Concourse using Helm.

1. Download the StorageClass spec for your cloud provider.

- **GCP:**

```
$ wget https://raw.githubusercontent.com/cloudfoundry-incubator/kubo-ci/master/specs/storage-class-gcp.yml
```

- **vSphere:**

```
$ wget https://raw.githubusercontent.com/cloudfoundry-incubator/kubo-ci/master/specs/storage-class-vsphere.yml
```

2. Apply the spec by running `kubectl create -f STORAGE-CLASS-SPEC.yml`. Replace `STORAGE-CLASS-SPEC` with the name of the file you downloaded in the previous step. For example:

```
$ kubectl create -f storage-class-gcp.yml
```

3. Install the Concourse Helm chart by running `helm install stable/concourse` with the following options:
  - `--name APP-NAME` : (Optional) Replace `APP-NAME` with a name you provide for the installed chart.
  - `--set persistence.worker.storageClass=STORAGE-CLASS` : Replace `STORAGE-CLASS` with your StorageClass to apply the spec to the Concourse worker persistent volumes.
  - `--set postgresql.persistence.storageClass=STORAGE-CLASS` : Replace `STORAGE-CLASS` with your StorageClass to apply the spec to the PostgreSQL database persistent volumes.

For example:

```
$ helm install --name my-concourse --set persistence.worker.storageClass=ci-storage,postgresql.persistence.storageClass=ci-storage stable/concourse
```

4. Forward the port number so that you can access Concourse from localhost. By default, the Concourse chart does not expose services outside the cluster.

- a. Export the pod name as an environment variable. For example:

```
$ export POD_NAME=$(kubectl get pods --namespace default -l "app=concourse-web" -o jsonpath="{.items[0].metadata.name}")
```

- b. Forward the port number by running the following command:

```
$ kubectl port-forward --namespace default $POD_NAME 8080:8080
```

5. Navigate to `http://127.0.0.1:8080` in your browser to access Concourse. Use the default credentials to log in.
6. Log in to your Concourse instance from the command line by running `fly -t MY-CONCOURSE login -c http://127.0.0.1:8080`. For example:

```
$ fly -t ci-helm login -c http://127.0.0.1:8080
```

For more configuration options, see the [Concourse Helm chart](#) documentation.

## Diagnosing and Troubleshooting PKS

This topic is intended to provide assistance when diagnosing and troubleshooting issues installing or using Pivotal Container Service (PKS).

See the following sections:

- [Diagnostic Tools](#)
- [Troubleshooting](#)

## Diagnostic Tools

### Verify PKS CLI Version

The Pivotal Container Service (PKS) CLI interacts with your PKS deployment through the PKS API endpoint. You create, manage, and delete Kubernetes clusters on your PKS deployment by entering commands in the PKS CLI. The PKS CLI is under active development and commands may change between versions.

Run `pkcs --version` to determine the version of PKS CLI installed locally. For example:

```
$ pkcs --version
PKS CLI version: 0.7.1-build.6
```

### View Logs Files

Log files contain error messages and other information you can use to diagnose issues with your PKS deployment. Follow the steps below to access PKS log files.

1. Gather credential and IP address information for your BOSH Director, SSH into the Ops Manager VM, and use the BOSH CLI v2 to log in to the BOSH Director from the Ops Manager VM. For more information, see [Advanced Troubleshooting with the BOSH CLI](#).
2. After logging in to the BOSH Director, identify the name of your PKS deployment. For example:

```
$ bosh -e pkcs deployments
```

Your PKS deployment name begins with `pivotal-container-service` and includes a BOSH-generated hash.

3. On a command line, run `bosh -e pkcs -d YOUR-DEPLOYMENT-NAME vms` to list the virtual machines (VMs) in your PKS deployment. For example:

```
$ bosh -e pkcs -d pivotal-container-service-aa1234567bc8de9f0a1c vms
```

4. Run `bosh -e pkcs -d YOUR-DEPLOYMENT-NAME ssh VM-NAME/GUID` to ssh into a PKS VM.
  - To access logs on the master VM, replace `VM-NAME/GUID` with the name of the PKS master VM, and `GUID` with the GUID of the master VM.
  - To access logs on a worker VM, replace `VM-NAME/GUID` with the name of a PKS worker VM, and `GUID` with the GUID of the same worker VM.
5. Run `sudo su` to act as super user on the PKS VM.
6. Navigate to `/var/vcap/sys/log` on the PKS VM:

```
$ cd /var/vcap/sys/log
```

7. Examine the following file:
  - On the PKS master VM, examine the `kubernetes-api` log file.
  - On a PKS worker VM, examine the `kubelet` log file.



## Troubleshooting Issues

### Cannot Access Add-On Features or Functions

#### Symptom

You cannot access a feature or function provided by a Kubernetes add-on.

Examples include the following:

- You cannot access the [Kubernetes Dashboard](#) in a browser or using the `kubectl` command-line tool.
- [Heapster](#) does not start.
- Pods cannot resolve DNS names, and error messages report the service `kube-dns` is invalid. If `kube-dns` is not deployed, the cluster typically fails to start.

#### Explanation

The Kubernetes features and functions listed above are provided by the following PKS add-ons:

- **Kubernetes Dashboard** `kubernetes-dashboard`
- **Heapster:** `heapster`
- **DNS Resolution:** `kube-dns`

To enable these add-ons, Ops Manager must run scripts after deploying PKS. You must configure Ops Manager to automatically run these post-deploy scripts.

#### Solution

Perform the following steps to configure Ops Manager to run post-deploy scripts to deploy the missing add-ons to your cluster.

1. Navigate to `https://YOUR-OPS-MANAGER-FQDN/` in a browser to log in to the Ops Manager Installation Dashboard.
2. Click the Ops Manager v2.0 tile.
3. Select **Director Config**.
4. Select **Enable Post Deploy Scripts**.



**Note:** This setting enables post-deploy scripts for all tiles in your Ops Manager installation.

5. Click **Save**.
6. Click the **Installation Dashboard** link to return to the Installation Dashboard.
7. Click **Apply Changes**.
8. After Ops Manager finishes applying changes, enter `pkcs delete-cluster` on the command line to delete the cluster. For more information, see the [Delete Cluster](#) section of *Using PKS*.
9. On the command line, enter `pkcs create-cluster` to recreate the cluster. For more information, see the [Create Cluster](#) section of the *Using PKS*.

### Error: Failed Jobs

#### Symptom

In stdout or log files, you see an error message referencing `post-start scripts failed` or `Failed Jobs`.

#### Explanation

After deploying PKS, Ops Manager runs scripts to start a number of jobs. You must configure Ops Manager to automatically run these post-deploy scripts.

## Solution

Perform the following steps to configure Ops Manager to run post-deploy scripts.

1. Navigate to `https://YOUR-OPS-MANAGER-FQDN/` in a browser to log in to the Ops Manager Installation Dashboard.
2. Click the Ops Manager v2.0 tile.
3. Select **Director Config**.
4. Select **Enable Post Deploy Scripts**.



**Note:** This setting enables post-deploy scripts for all tiles in your Ops Manager installation.

5. Click **Save**.
6. Click the **Installation Dashboard** link to return to the Installation Dashboard.
7. Click **Apply Changes**.
8. After Ops Manager finishes applying changes, enter `pkcs delete-cluster` on the command line to delete the cluster. For more information, see the [Delete Cluster](#) section of *Using PKS*.
9. On the command line, enter `pkcs create-cluster` to recreate the cluster. For more information, see the [Create Cluster](#) section of the *Using PKS*.

---

## Error: No Such Host

### Symptom

In stdout or log files, you see an error message that includes `lookup vm-WORKER-NODE-GUID on IP-ADDRESS: no such host`.

### Explanation

This error occurs on GCP when the Ops Manager Director tile uses 8.8.8.8 as the DNS server. When this IP range is in use, the master node cannot locate the route to the worker nodes.

### Solution

Use the Google internal DNS range, 169.254.169.254, as the DNS server.

## PKS Release Notes

PKS (Pivotal Container Service) is used to create and manage on-demand Kubernetes clusters via the PKS CLI.

### v1.0.0

**Release Date:** February 8, 2018

PKS v1.0.0 uses the following component versions:

Component	Version
Stemcell	3468.21
PKS CLI	1.0.0
<i>* Components marked with an asterisk have been patched to resolve security vulnerabilities or fix component behavior.</i>	

### Features

- Create, resize, delete, list, and show clusters through the PKS CLI
- Native support for NSX-T and Flannel
- Easily obtain kubeconfigs to use each cluster
- Use kubectl to view the Kubernetes dashboard
- Define plans that pre-configure VM size, authentication, default number of workers, and addons when creating Kubernetes clusters
- User/Admin configurations for access to PKS API
- Centralized logging through syslog

### Known Issues

#### Special Characters

In vCenter, special characters, such as, `(`, `#`, `&`, `:`, `"`, `'`, `^`, `\`, Space `( )`, `!`, and `%` cannot be used with PKS.

#### Stemcell Updates Cause Automatic VM Rolling

Enabling the **Upgrade all clusters** errand allows automatic rolling for VMs in your deployment. Pivotal recommends enabling this errand to ensure that all deployed cluster VMs are patched.

When you enable the **Upgrade all clusters** errand, the following actions can cause downtime:

- Updating the PKS tile with a new stemcell triggers the rolling of each VM in each cluster.
- Updating other tiles in your deployment with new stemcells causes the rolling of the PKS tile.

#### Upgrade Errand Fails with Failed Deployments

The **Upgrade all clusters** errand fails if any deployments are in a failed state.

To work around this issue, [delete the failed cluster](#) using the PKS CLI or [redploy the failed cluster](#) with the BOSH CLI to ensure the cluster is in a successful state.